

A 45-Year History:
Metro Wastewater Reclamation District

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Designed by Melissa Ogilvie Rosner.



Boris Stanley Voukovitch
July 18, 1923-March 4, 2009

This history of the first 45 years of the Metro Wastewater Reclamation District is dedicated to the memory of Boris Stanley Voukovitch (July 18, 1923-March 4, 2009), who served on the Metro District's Board of Directors from 1962-1964 and from 1970 until his passing in 2009. The 1951 graduate of the Colorado School of Mines was also employee number three at the then-fledgling Metro District—a fact he was proud to share. When Colorado developed a licensing program for wastewater operators, he earned license number 44 and helped teach wastewater operations to countless others. From 1964 until his resignation in 1969, he served as chief engineer and owner's representative while what is now the Metro District's North Plant (and at the time the District's only plant) was being built and put into service. During his tenure on the Metro District's Board, he mentored many Board members and guided all five district managers. Boris' dedication to water and to the water profession, the Metro District, and his own Alameda Water and Sanitation District made the State of Colorado and metropolitan Denver a better place for people to live.



When I set out to produce this book, I thought it would be relatively easy. I thought I would just pull a couple of hundred photos that looked interesting, write captions, and put them in a book. When I got into the project, it turned out to be much more than that.

I had to understand what happened. Not just dates and dry events, but the story that tied the events together. Then I needed to understand what it all meant over the 45 years the book covers.

I hope you find reading this book half as interesting as I found writing it to be. My primary sources were the official Metro District histories for the years covered as well as board meeting minutes, resolutions, newspaper stories, and first person accounts. Unless otherwise noted, photographs are from the Metro Wastewater Reclamation District collection. If there are errors, they are mine.

No work of this nature can be created without the help of many people, and I wish to thank them here. First, my thanks goes to District Manager Bob Hite, who passed away about 15 months before the book was finished. Without his belief that the project was worth doing, I would not have been able to spend the time it took to do it. His successor, Cathy Gerali, also supported the project and continued funding it, and I thank her as well.

Other people were also exceedingly valuable in this endeavor: José Padilla, Ed Sturgeon, Jim Carabajal, Leroy Gonzales, Steve Pearlman, Glen Jones, Steve Walker, Bob Thomas, Donna Hull, Arne Holst (now retired), and Boris Voukovitch, to whom this book is dedicated. They explained things and identified people in photos long stored away. Thanks also go to Dan Schuler, Steve Rogowski, Mitch Costanzo, and Bill Brennan for their help. Several others, including Kathy Jeffrey, Kelley Merrit, and Wendy Hall also provided help.

José Padilla, who has now been at the Metro District more than 40 years, was absolutely invaluable in identifying people he has known and worked with over his years as a plant operator and in human resources. He told me about things that had been tried, things that worked, and things that didn't. Many of the stories made it into the book. Some still aren't ready for prime time.

Arne Holst, who retired after 38 years at Metro, patiently identified for me from old photos—sometimes several times—various pieces of equipment, how they worked, and how they were supposed to work.

Finally, I thank my wife, Dian, who put up with my dragging pictures and documents home to research them and try to understand them. She put up with me and my nonsense, and here we are.

In the end, writing this book became a labor of love. I hope you enjoy it.

Stephan D. Frank, APR

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THE BEGINNING, 1840-1963

Early Events

The seeds that eventually grew to become the Metro Wastewater Reclamation District were planted long before May 15, 1961, the date the Metro District was officially organized. Originally called the Metropolitan Denver Sewage Disposal District No. 1, it operated under that name until it was changed to Metro Wastewater Reclamation District in 1990. In this book, Metro District, District, and Metro will refer to both organizations.

No history begins with one certain event. There are antecedents. For the Metro District, a host of events took place that helped set the stage for its arrival in 1961. Many of the most important early events in the District's history revolve around the South Platte River. In later years, development in the South Platte River Valley, growth in Denver, and intergovernmental cooperation increasingly impacted the direction and the operation of the District.

Before 1860, the hand of man exerted little influence on the South Platte River. Francis Parkman, an early explorer, said of the South Platte in 1846:

On the fifth day...we saw, late in the afternoon, what we supposed to be a considerable stream, but on approaching it, we found to our mortification nothing but a dry bed of sand, into which the water had sank and disappeared.¹

Facing page: An encampment by the South Platte River. Source: unknown.

In that pre-1860s period, the South Platte River was a seasonal, intermittent river. It depended primarily on snowmelt and rainfall for its existence. The influence of man had scarcely been felt. Only a few trappers and traders depended upon the river as a resource, and the only real settlement was Fort St. Vrain, about 40 miles north of present day Denver.

With its headwaters near Fairplay, Colorado, the South Platte was formed about 100 million years ago during the Mesozoic Era of geologic time. After rising in the mountains of central Colorado, it is a fast-running, cold-water stream that drops through relatively narrow channels in the mountains until it arrives at Littleton, Colorado. There it begins to transition into a warm water stream that flows north through Denver and then begins to meander northeastward toward Nebraska at about the point where the Metro District now contributes about 140 million gallons of treated wastewater a day into it.

Water has always been important in Colorado. Before European settlers came—before the 1860s—melting snow often flooded the South Platte in the spring and early summer. By midsummer, the snowmelt flows had generally slowed to a trickle. Thunderstorms that can drop an inch of water or more in an hour, however, made for flash floods that could change the course of the river in an afternoon. In the dry months of the fall and winter, the river's flows would diminish to almost nothing, leading to the description given above by Francis Parkman.

The coming of settlers, however, changed the South Platte River. Settlements in the region came first in the form of miners who arrived in 1859, followed by farmers, food processors, manufacturers, merchants, and the railroads. Big irrigation projects brought return flows from irrigation, and water storage projects changed the river from an intermittent stream to a perennial one. By the late 1800s, transmountain projects were bringing water to the Front Range, while complex water legislation grew up around the need to manage this precious resource. The now-famous “first in time, first in right” doctrine, established in California in 1855,² became the principal doctrine by which water was appropriated. This doctrine was imbedded in the Colorado Constitution in 1876, the year the state joined the Union.³



Confluence of Cherry Creek and the South Platte River. Source: unknown.

Water quality becomes a concern

Water quantity was not the only water issue. Water quality was beginning to become an issue as well. In the 1860s, French scientist Louis Pasteur showed that microorganisms did not spontaneously generate themselves from nothing, thus disproving a popular theory of that era.⁴ As early as 1854, English physician John Snow had tied multiple cholera deaths to a single water pump and, in 1884, German microbiologist Robert Koch proved the relationship between polluted water and disease after isolating *Vibrio cholera* from the Elbe River.⁵

Many scientists and others during the late 1800s did not make the connection between sickness and things in the water that were too small to see. Nevertheless, civic-minded people could see filth and refuse, and smell sewage and other odors. Many early sewerage (sewage treatment infrastructure) projects were begun simply as a way to deal with odors, and Denver began such a project some time after 1872.⁶

As early as 1874, the Denver Board of Water Commissioners submitted a report at a Denver City Council meeting that showed wells near the South Platte River to have “...one to twenty grains of ‘putrid matter per gallon of water.’”⁷ A grain per gallon is equal to 17.1 milligrams per liter. Dr. William R. Whitehead, who was chair of the Denver Board of Water Commissioners Health Committee, warned the assembled council members that “...in the course of a few years, we may be made to drink from the Platte River, diluted with excremental filth and foul drainage of the most populous parts of Denver.”⁸

Health problems related to water pollution took time to recognize. The textbook American Sewerage Practice: Vol. III, Disposal of Sewage, published in 1916 by Leonard Metcalf and Harrison Eddy, includes a table that lists typhoid fever death rates per 100,000 population in various American cities. The table on page 119 shows that, for Denver, the typhoid death rate averaged 40 a year from 1900-1912. This volume (p. 123) also states: “The contamination of municipal water supplies by sewage is likely to result in typhoid epidemics because of the large number of persons exposed to the danger of infection.” The number of people who might have looked at a textbook like American Sewerage Practice then was extremely small, so it would have taken a long time for the general public to understand what physicians and sanitary engineers were beginning to see.

A 1934 report entitled “Your Municipal Water System” said 287 deaths per 100,000 had been reported from typhoid fever. It also noted:

When mechanical filters were installed at drinking water treatment plants in 1893, the deaths fell to approximately 58. Further attempts to treat the water with hypochlorite dropped the deaths to 21 in 1911, and between 1923 and 1932, deaths fell to two when chlorine was added.⁹

It would be roughly the beginning of the 20th Century before public health officials across the nation firmly linked disease and polluted water. Sewer historian Jon Schladweiler said,

In 1875+, not one of the U.S. cities with a population of 100,000 or more used any kind of formal treatment

for its sewage. By 1900, only two of those same cities (Worchester, MA, and Reading, PA) had installed formal designed treatment facilities. (sic)

Schladweiler’s history also noted:

During the previous 50 years (1875-1925), the “state-of-the-art” for sewage disposal had advanced considerably more than that for sewage conveyance. Cities and towns had the benefit of knowing the actual connection between sewage and the sources of drinking water (*i.e.*, the adverse potential impact on their health/welfare). That knowledge



Early photo from the Metro District's files showing dead fish.

resulted in great strides being made in collecting and conveying sewage from/away from people's homes, and in treating the sewage prior to its discharge either into their source of potable water or at a point near their source.

Ordinary people could see some of the effects of pollution, too, as this report in 1898 from the *Denver Times* shows:

A most curious phenomenon was visible...on the north side [of the Platte] in the vicinity of Zang's Brewery... fishes by the thousands jumped from the shallow Platte and endeavored to reach the shore. The peculiar whitish hue that the river assumed terrified some of the men employed at Zang's. They argued that the fish could not be persuaded to leave the river unless there was something in the water that would exterminate them... it [a milky substance] is supposed to have come from the paper mills near Overland Park, some five miles away.¹⁰

In 1902, the *Denver Times* reported that residents in the nearby towns of Globeville and Elyria protested Denver's sewers emptying into the South Platte River upstream of their towns.¹¹ Downstream, the polluted waters of the South Platte were being used to irrigate crops in the South Platte valley. This untreated wastewater caused "an increase of typhoid fever, amebic dysentery and infectious diarrhea, deadly to infants, whenever the vegetables were consumed."¹²

A 1932 report by the Colorado Department of Health concluded Denver was the cause not only of pollution but also of typhoid fever and dysentery downstream. It



Sewer crew: Two men pull a coworker from an alley sewer manhole. Denver, Colorado. The man in the hole wears a mask while other men observe. Photo dated between 1920 and 1940. Photographer: Harry Mellon Rhoads, 1880 or 81-1975. Source: Western History/Genealogy Department, Denver Public Library.

"recommended a sewage treatment plant; scientists and citizens agreed," and voters passed a \$3 million bond issue.¹³

Denver opens a treatment plant

Denver stopped discharging raw sewage into the South Platte River when it opened and began operating a sewage treatment plant on Nov. 29, 1937. The then-new North Side Treatment Plant (now a park at 51st and Franklin in Denver), built at a



Building a sewer in north Denver, summer 1921. Source: unknown; found in Metro District files.

cost of \$1.148 million, provided primary treatment of Denver's sewage and was thought by many to be one of the most modern treatment plants in existence at that time. On the day before the plant began operating, *The Rocky Mountain News* said the plant would be responsible for "transforming germ-bearing refuse into soil-vitalizing fertilizers for use of local farmers."¹⁴

Yet, even as late as 1945, the North Side Treatment Plant and several other so-called modern plants along the South Platte and its tributaries weren't helping the water pollution situation much. The Colorado Board of Health cited 76 cities that year for sewage disposal that was "unsatisfactory and should be corrected."¹⁵

By 1947, the American Sanitation Foundation had branded Denver's sewage system as highly inadequate and a menace to public health.¹⁶

Things didn't change much over the next three years. *The Rocky Mountain News*, in an editorial on October 9, 1950, spoke out on the cause of pollution to the South Platte River, stating, "Denver should be held strictly accountable for its own transgressions. At the moment, the Platte (sic) is a river of disease."¹⁷

Oddly enough, a few days later, Dana E. Kepner, chairman of the state Board of Health's Stream Pollution Advisory Committee, appeared to contradict the *News* when he said, "Placing entrails, blood and other slaughterhouse refuse in the river is against health regulation, but is not a source of disease."¹⁸

Adding to the concern, the *Rocky Mountain News* less than a week later reported that chlorination facilities at the Denver North Side Plant were shut down for several weeks while an addition was being built. Raw sewage was bypassed into the South Platte River during that time.¹⁹

Whether based on the statement made by Kepner or on their own volition, two meat packing plants, using an unauthorized connection, were caught months later in January 1951 dumping "filth and butchering waste through it into the (South) Platte River for more than eight months."²⁰

In 1956, Denver hired the engineering firm Black & Veatch to complete a report after Denver was ordered by the state Board of Health to begin "absolute abatement of violations" and establish secondary treatment facilities.



This photo shows a hand-laid 60-inch diameter brick sewer being built in north Denver in the summer of 1921 (source: City Hall).

The \$20,000 report advised expanding Denver's current sewage treatment facilities at a cost of \$14.65 million. The four major points of the eight-month study were to (1) construct a new south plant, (2) construct secondary treatment facilities at the North Side Plant, (3) abandon the East Side Plant and construct new sewer lines in east Denver, and (4) install relief lines to suburban areas serviced by Denver.²¹

Raoul Maes, a long-time Metro District board member who worked for the engineering firm HDR in the 1960s, said:

All these little treatment plants that were dumping their effluent into all these various creeks...cried out for a Metro District because most of these little sewage treatment plants were primary [treatment] plants. So the treatment wasn't as adequate as it should have been. Many of these little plants had upsets where they discharged raw sewage into the receiving stream. It was very definitely a great health hazard at that time for the metropolitan area.²²

Boris Voukovitch, another long-time Metro District board member and the third employee hired by the District, commented:

The best answer I could come up with is [that] people on the whole knew nothing about it [wastewater treatment]. They weren't concerned with anything about it. The best example that the population as a whole had was Denver's North Side Plant, which was a sewage treatment plant. They did not know the distinction between a primary plant and a secondary plant. So there was a plant that was treating the sewage, and you had the delusion that everything was fine.

On the other hand, for a few of us in the engineering field who knew something about sewage treatment, we were flabbergasted that a metropolitan area could grow here without secondary treatment.²³

According to Gail H. "Doc" Gilbert, an Arvada veterinarian who served as that city's mayor from 1948-1950 and again from 1957-1963:

Denver could have enlarged their sewage capacity, but it would have been an enormous job and it would be very,

very costly for Denver to do it alone. And, it would have excluded all the rest of us who also needed it, too.²⁴

In response to the deteriorating conditions of the state's waterways, a Colorado House Legislative Health Committee held hearings all over the state during the summer of 1954 to get information on the condition of sewage treatment in Colorado.

Robert Wham, a Denver attorney who served as the Metro District Board's first secretary from 1961-1964, said the most amazing thing to him was that, as he traveled the state in 1954 holding hearings, there was only rudimentary or non-existent sewage treatment by municipalities in those days. Many municipalities had some semblance of treatment, but some had none at all.²⁵

As a result of the hearings, Sewage and Trade Wastes Effluent Regulations were adopted by the Colorado Department of Health on January 14, 1957.²⁶

Black & Veatch later noted in its Report on Metropolitan Denver Sewerage Study for the Inter-County Regional Planning Commission that:

...45 separate sanitation authorities and 27 overloaded sewage treatment facilities [were] providing various degrees of treatment.²⁷

Many of the plants in the Denver area are not satisfactorily operated and produce poor effluents. The resulting improperly treated sewage has, in various places, caused nuisances, and imposed a public health hazard on municipal water supplies.²⁸

Special district plan emerges

The 1957 report recommended integrating all sewerage facilities in the area covered by the report into either one large Metropolitan Sanitary Authority or into a group of smaller authorities:²⁹

Substantial savings are obtained by replacing numerous small plants with one large, well-designed and operated plant. In addition to monetary savings, nuisances and health hazards would be removed and stream pollution abated by the proposed unification. Continuation of the present practice of building numerous small plants will aggravate existing grave sewerage problems now troubling the area.³⁰

Two years later, in 1959, and based on Black & Veatch's 1957 study, the Colorado Legislature approved a \$10,000-\$15,000 study for the formation of a consolidated secondary sewage treatment plant at the confluence of Clear Creek and the South Platte River.³¹

H.M. Shulenburg, chairman of the Inter-County Regional Planning Commission, hailed the study as the first step toward creation of a metropolitan sewer district:

At present in the Denver basin there are nine sewerage (sic) treatment plants. All are overloaded. A serious problem of water contamination exists in the Denver basin for lack of secondary sewage treatment. It has all the bad effects of stream pollution on irrigation, stench and local infection hazards.³²

Denver as well as several metropolitan sewage districts, Coors Brewery, and some suburban communities were to participate in the study. A special committee of representatives from sanitation

districts in the Clear Creek and Denver tributary basins was to be formed.³³

“A Report on the Feasibility of a Metropolitan Consolidated Sewage Treatment System” was prepared by the Inter-County Regional Planning Commission; Joint Sanitation Commission; special consultants Phillips-Carter-Osborn Inc., Engineers; Hatfield Chilson, Legal Counsel; Colorado Department of Health; Tri-County District Health Department; and Jefferson County Health Department in November 1959.

The report and plans were laid out to:

...provide for an efficient consolidation of the sewage collection and treatment facilities for the Denver Metropolitan Area... feasible from the standpoint of health, engineering, economy and legal aspects.³⁴

The report recommended immediately introducing enabling consolidation legislation. If such was not passed, most municipalities and sanitation districts in the area would be required to repair, expand, or complete new sewage treatment facilities to conform to state law regarding sewage treatment and stream pollution.³⁵

The report’s preferred plan was for interceptors (main trunk lines) for Clear Creek and Sand Creek Basins, and a consolidated treatment plant near the confluence of Sand Creek and the South Platte River. The new plant would provide complete sewage treatment for flows from Clear Creek and Sand Creek Basins and secondary treatment for flows from the Denver North Side Plant.³⁶

The report optimistically said the effluent from the new treatment plant would be “clear, sparkling, odorless water easily meeting state standards for sewage effluent.” It stated the new plant would be economical and less expensive for Denver because it would not be necessary to construct secondary treatment facilities at the North Side Plant.³⁷

The preferred plan provided alternatives to the usual response of creating new sanitation districts and building small treatment plants to handle population growth. The report described the current method as “inefficient and expensive in comparison to large consolidated plants.”³⁸

When the report was written, ten treatment plants were discharging effluent into Clear Creek.³⁹

Water rights were an important part of the early considerations. The report recognized the need for providing replacement water to users downstream whose irrigation and water supplies would be affected by the diversion of the sewage effluent from Clear Creek.⁴⁰

The plan called for “a ‘special district’ for sewage treatment, comprising the total area of participating local sanitation authorities, and leaving them intact to perform their local functions.” The authorities would have the option to divert all or part of their sewage into the interceptors (major sewers that would carry sewage from the point of connection to the point of treatment).⁴¹ The primary factor for the formation of a special district was the “unprecedented population growth taking place in the area.”⁴²



Governor Steve McNichols

Why was a new special district act needed? According to the report, it would not interfere with existing governments. The then-current state Sanitation District Act did not allow one district to impose on another existing district. Under the proposed legislation, existing entities would have to agree to be included in the service area. The proposed legislation would also be flexible enough to extend its service area if necessary and provide for inclusion and exclusion of participants. It would also provide a broad financial base for projects, be allowed financial and other powers necessary to achieve its objectives, and provide equitable representation of all participants on its board.⁴³

The last paragraph of the report recommended a special district be formed as the best and most flexible means to carry out the plan. The recommendation included drafting enabling legislation and submitting it to the Colorado Legislature to create this type of special district.⁴⁴

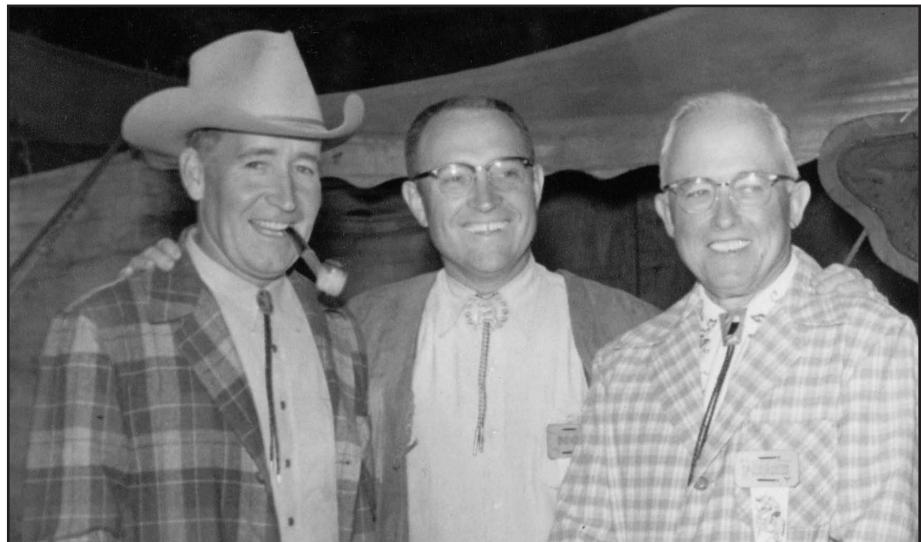
In November 1959, Hatfield Chilson, attorney and water rights expert for the Joint Sanitation Commission, made a preliminary report on a metropolitan sewage district to Governor Steve McNichols. The new district was to include all of Denver and portions of Jefferson and Adams counties. McNichols endorsed the preliminary report.⁴⁵

The governor said he would include consideration of enabling legislation in January if affected cities and districts expressed approval of plan. To that end, George Nez, director of the Regional Planning Commission, said “My agency will do the ‘leg work’ in selling the plan to the 26 sewer districts in the area.”⁴⁶

According to the preliminary report, the enabling legislation would specify the district would serve political entities, not individual families; have no power to invade territory; and would have power to condemn private property for public use, levy taxes, and issue bonds.⁴⁷

Robert Wham, the Metro District’s first secretary, was elated, saying:

Everybody was on board, believing something had to be done, not only because it was required but because it was right. And so there was some good thinking that went in [to the District’s formation] and what steps to take.⁴⁸



At a Grand Lake camp: Pete Smythe, Doc Gilbert (center), and Frank Johns. Arvada's Gail H. "Doc" Gilbert was instrumental in getting Arvada to pass an ordinance calling for creating the Metro District.

The enabling legislation was adopted in 1959. The first step was taken to create the Metropolitan Denver Sewage Disposal District No. 1 the first week of May 1959, when the Wheat Ridge Sanitation District adopted a resolution favoring the district.⁴⁹

In June 1960, Denver, Arvada, Westminster, North Washington, Denver-Altura, Bellaire and the South Adams County Sanitation Districts agreed at a meeting of the Joint Sanitation Commission to form a Metropolitan Denver Sewage Disposal District. The system they envisioned would cost \$24 million and include "giant sewage collection lines and treatment plant facilities to serve 1.5 million persons."⁵⁰

Carl Jacobson, president of the Joint Sanitation Commission, described this action as the "first tangible

step in a metropolitan program which can unite several governmental functions common to Denver and suburban areas for more efficient and economical operation."⁵¹

Enabling legislation to form the district had been passed in 1959. The original plan to finance the district was to have been a mill levy: three-quarters of a mill spread over five years for an engineering study and planning, with revenue bonds planned to finance the \$24 million cost to build it.⁵²

Arvada's "Doc" Gilbert was a proponent of urban area cooperation. He knew that, under the new law, a city had to take the lead and pass an ordinance for the District to be officially created. Gilbert had spoken to Aurora's mayor and city manager and thought he had a commitment from Aurora to pass an ordinance in favor of the creation of a Metropolitan Denver Sewage Disposal District. But Aurora declined. Gilbert describes what happened:

In the meantime, my family and I went up to Estes Park for a little vacation. And the next morning I picked up the paper because the night before Aurora was going to have the council meeting and pass this ordinance. And the paper said they didn't do it. I just absolutely blew my stack. They had promised to do it, and time was of the essence. They had promised to get this district started by just the mere act of doing a very simple thing: just pass this ordinance.⁵³

Gilbert said he called Bill Miller, a reporter who was then writing for the *Denver Post* and who later became manager of Denver Water.

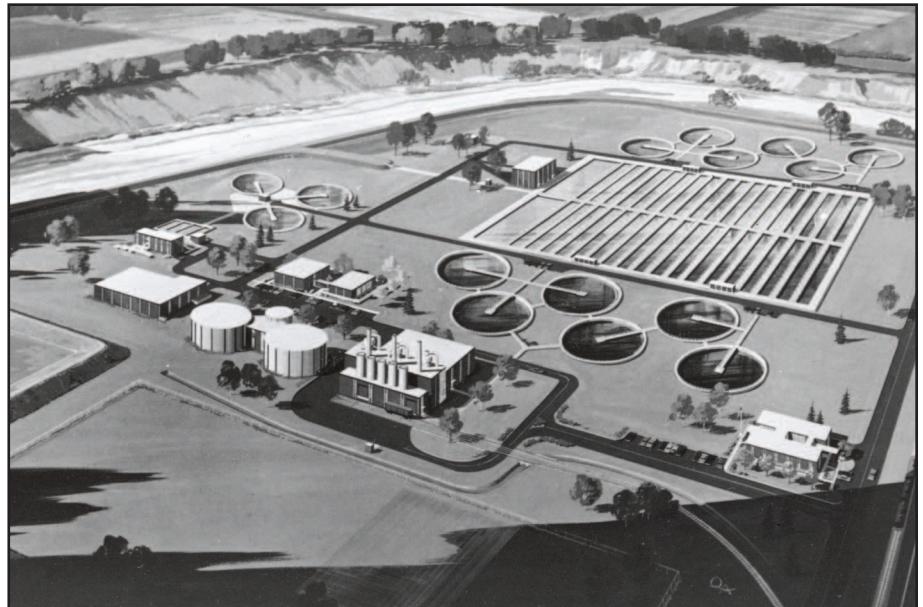
I called up Bill from Estes Park, and I have to admit I blew my stack. I was so mad. And so I told Bill, "I'm up

here on vacation in Estes Park and I see what happened." And he said, "What are you going to do, Doc?" And I said, "I'm going to leave here and go down to Arvada call a special meeting of our council, and tonight we will pass an ordinance." Because, for one thing, time was of the essence. We had to get this going. So I did. I left Estes Park and went back down to Arvada and I called a special session of the city council and we...passed the ordinance which began the creation of the metropolitan sanitation district.⁵⁴

Arvada became the first city to pass an ordinance calling for the creation of a metropolitan sewage district.

In October of 1960, the Joint Sanitation Commission was adjourned so a new sanitation committee could be formed. It would be made up of representatives from Denver, Arvada, Westminster, Wheat Ridge, and the Altura, North Washington and East Lakewood sanitation districts. The next steps would include the election of permanent officers and preparation of an application for a \$300,000 loan from the U.S. Housing and Home Finance Agency to fund engineering studies for the District. The *Denver Post* quoted L.M. Cooley, Denver's manager of public works, as saying "the action was 'the first real evidence of metropolitan cooperation,' and said Denver is '1000 percent behind this.'"⁵⁵

On May 12, 1961, a meeting was held to organize the board of directors, consider admission of other cities or districts, and other business. Arvada was required to call the meeting because it was the first city to pass the ordinance.⁵⁶



This artist's concept, prior to construction, shows the Metro District's plant as originally conceived. Note that only three primary clarifiers are depicted, indicating the early conception that the Metro District plant would be mostly a secondary treatment facility for metropolitan Denver.

Metro District formed

On May 15, 1961, the civic leaders of 13 cities and sanitation districts in the metropolitan Denver area signed the historic agreement that created the Metropolitan Denver Sewage Disposal District No. 1.

The Metropolitan Denver Sewage Disposal District No. 1 was organized on June 2, 1961. Jerrold Park, a councilman representing the City of Arvada, was elected chairman. W.J. "Joe" Shoemaker, Denver's public works manager, was elected chairman pro-tem. Robert Wham, deputy city attorney for Denver, was elected secretary. Carl Jacobson, representing

the City of Westminster, was elected treasurer. Jacobson had headed the Joint Sanitation Commission that drafted the enabling legislation. All were elected unanimously.⁵⁷

During the meeting at the Colorado Department of Health, a committee was formed to determine the location of the new plant. One potential site, at the confluence of Clear Creek and the South Platte River, had resulted in protests by some of the local truck farmers, who had asked the North Washington board members to try to influence the District to choose another site farther downstream. The site that was eventually chosen is just upstream of the confluence of Sand Creek with the South Platte River.

Single treatment plant

Plans called for a single treatment plant and several collector sewers. Metro Engineers, Inc., a firm created from three engineering companies for this project, was busy drawing up plans for the plant and had examined potential plant sites.⁵⁸

Moving quickly, the Metro District secured offices at the Majestic Building in Denver and held its meetings at the Colorado Department of Health.⁵⁹

At its October 1961 meeting, the Metro District authorized the board of directors to borrow \$100,000 from The First National Bank of Denver after Colorado National Bank was unwilling to make a loan without formal steps being taken to impose a tax levy that would be effective in 1962. In addition, the board agreed to have two bank accounts at The First National Bank of Denver: a general account and a planning account. At that meeting, the board determined it was not feasible to

offer service to the City of Glendale. The third Tuesday of the month was established for board meetings. The third Tuesday remains to this day the day for board meetings.⁶⁰

At a special board meeting the following week, the board accepted Highland Park Sanitation District and the Baker, Bancroft, and Berkeley Water and Sanitation Districts into membership. It also accepted the Pre-Design Report of Metro Engineers and the Review of Pre-Design Report of M.H. Klegerman of Alexander Potter Associates, a recognized New York engineering firm.⁶¹

Five months into his appointment, Jerrold Park of Arvada resigned from his post as chairman of the board.⁶²



The property where Metro's current Administration Building stands was once owned by the Lammers family. (Photo, taken in the 1970s, is courtesy of Fred and Charlene Lammers.)

At a special board meeting on November 14, 1961, Metro Engineers was chosen to draw up plans and supervise the construction. The contract fee was approximately four percent of construction costs. It was estimated it would take one year to prepare plans and one to two years to build the plant. The board hired M.H. Klegerman to serve as consultant on the project.⁶³

At its regular November meeting, the board approved Alternate Site No. 1 at the confluence of Sand Creek and the South Platte River for the location of the new regional treatment facility and decided technical changes were needed to the Metropolitan Sewage Disposal Districts Act to market bonds at a reasonable rate. W.J. "Joe" Shoemaker replaced Jerrold Park as chairman of the board, and Robert Warner of the Wheat Ridge Sanitation District replaced Shoemaker as chairman pro tem.⁶⁴

At its January 1962 meeting, the board accepted the contracts with Metro Engineers and with M.H. Klegerman as consulting engineer. Of the original loan of \$5,000, only \$34.86 remained. A resolution was passed to borrow a second \$5,000.⁶⁵

Four months into his term, Chairman Joe Shoemaker resigned. At the Metro District's March 1962 board meeting, James Small of Denver acted as chairman. March 1962 also brought the first resolution for the death of a board member because Robert Warner, who had been elected to serve as chairman pro tem in November, had died. Bylaws were adopted.⁶⁶

At its April 1962 meeting, Emerson Ellett of Denver was elected as the third chairman of the board in less than a year, and Charles E. Rhyne of Arvada was elected as the third chairman pro tem to fill Warner's unexpired term. The U.S. Housing and Home Finance

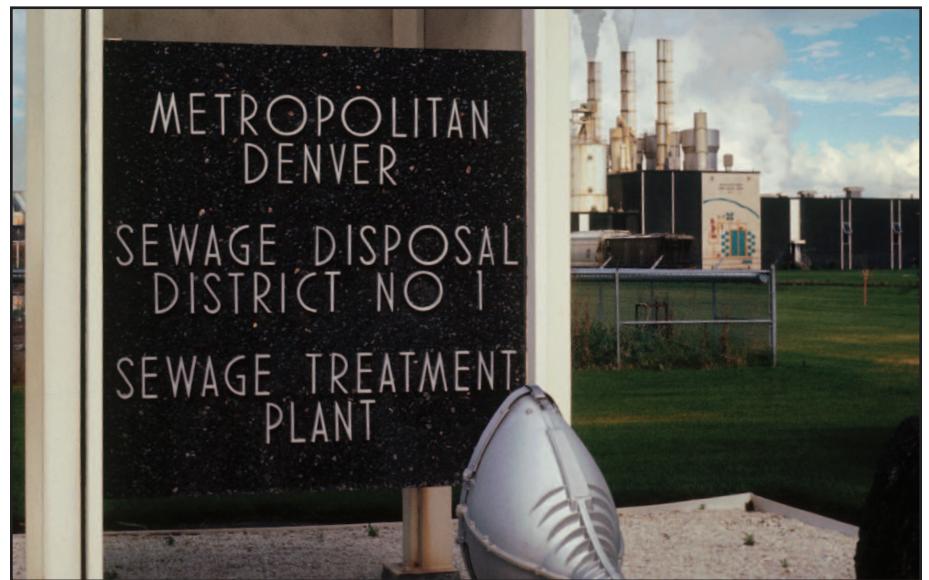
Agency granted an increase to an overall amount of \$400,000 for further planning work. Although the directors refused compensation for their services, they approved reimbursement of travel at eight cents a mile and other expenses. They also agreed to borrow an additional \$25,000 in \$5,000 increments.⁶⁷

Service charges

The board clarified the original concept at its May meeting that no member would pay more for services from the Metro District than if it had to solve its problems separately.⁶⁸

At a special meeting in August, service charges were adopted. The service charges or rates were to be

...practicable, equitable, and reasonable... [and] uniform throughout the district (sic) for the same type, class and amount



This sign (circa 1967) noted the entrance to the plant from Commerce City.

of use or service of the sewage disposal system, based upon sewage flow, with a minimum charge for availability of service....⁶⁹

At the same meeting, the board retained Dunham, Stephenson & Associates as accountants for the District. James Small resigned due to his future association with Ken White & Associates, one of the firms that made up Metro Engineers.⁷⁰

Even with all the progress being made toward a metropolitan Denver sanitation district, the expectations for a faster resolution were apparent in portions of a February 20, 1962, letter from the Colorado Department of Health. A *Rocky Mountain News* article in August 1962 quoted the letter, which stated:

At the present time the standard of quality of sewage effluent required in Colorado Revised Statutes... is being violated by all but one member of the Metropolitan Denver Sewage Disposal District.

There is very urgent need for better sewage treatment in the Denver metropolitan area, not only because present treatment is inadequate to comply with legal standards, but because the effect of inadequately treated sewage is felt throughout the entire main stem of the South Platt (sic) River. Further, inadequately treated sewage constitutes a serious public health problem that can only grow worse until corrected.⁷¹

The *News* also reported that Arvada officials were aware of the stench coming from raw sewage being dumped into Ralston Creek, which connects to Clear Creek. The raw sewage was being dumped because Arvada lacked the facilities to treat it at its plant.⁷²

According to "Doc" Gilbert, Arvada's sewage treatment facility was terribly undersized. He said it had been designed for a community of about 4,000-5,000 but was handling the sewage for 60,000 people. Sewage was basically flowing through the plant untreated. All they could do to treat it was to install a machine—probably some sort of grinder such as is commonly used in headworks and lift stations—to chew up the sewage detritus so it did not look so obviously like sewage.⁷³

With state-wide elections coming in the fall, the board decided in August 1962 that the earliest bond elections that could be held without conflicting or interfering with state elections would be December 11, 1962.

When the board began strategizing about the special election, two basic ideas came into conflict. The less favored was to hold a special election in conjunction with a general election when it would benefit from maximum voter turnout. The prevailing wisdom, however, was to hold it separately so only those who were invested in the issue would turn out. The Metro District chose the latter strategy with its first bond election.

"An issue must stand on its own feet such as this bond proposal, and not meet failure by the outcome of the heat and passion of a political election or the constitutional issues on the ballot," said Carl Jacobson, secretary-treasurer of the Westminster Sanitation District and Metro District Board Election Committee Chairman.⁷⁴

Early in the Metro District's existence, the board struggled to make sure charges were equitable to all. A September 14, 1962, *Denver Post* article stated that



Denver's North Side Treatment Plant can be seen in this 1966 photo. The plant remained in operation until 1987.

...the board of directors is determined that the cost of sewage disposal to each member municipality of the district shall not exceed the cost of providing the same service by each on its own.⁷⁵

For the Metro District's bonds to be valid, the District would have to comply with the state statute requirement that "rates must be uniform for the same class and amount of use or service throughout the district," said a *Denver Post* article. Other factors in determining the charges included Denver's primary treatment at the North Side Plant and payments for water loss in streams and ditches caused by diverting the treated water further downstream from where it had once been discharged.⁷⁶

However, the *Post* article said, "the inherent feeling on the part of at least some of the district members (is) that big Denver is trying to get something good at the expense of smaller surrounding communities."⁷⁷

The issue was the amount and quality of each member's sewage the new regional facility was to treat. Denver and several of the original Metro District member municipalities already owned and operated primary treatment plants, which they planned to connect via sewers to the District's treatment plant. Thus, they would be discharging sewage that had already been partially treated. Other municipalities had aging or virtually nonexistent facilities and needed both the primary as well as the secondary treatment the Metro District's new treatment plant would provide.

Equity arguments took the following form: If member X discharges only this amount of sewage with this loading of pollutants to the Metro plant, but member Y discharges a smaller but more heavily loaded (polluted) amount of sewage, how should they be charged for the service so each pays only for the amount of treatment service it uses? A loadings-related variant was: What if one municipality discharges sewage that has undergone primary treatment and another does no primary treatment at all?

The solution was a system of charges based on both flows (amount of water) and loadings (amount of pollutants in the water). The latter-day descendant of that charge system, based on both flows and loadings, provides the basis for equitable charges to all connectors today.

The same September 14, 1962, *Denver Post* article that discussed the equity of charges also provided information on anticipated costs: plant costs—\$15.2 million, trunk and connector lines—\$7.2 million, miscellaneous expenses including interest and organization expenses—\$5 million. The total was \$27.4 million.⁷⁸

In September, because of a Westminster water problem related to pollution in Clear Creek, the board approved the City of Arvada's request for Metro Engineers' plans and specifications to build a trunk sewer line from the Arvada plant to east of the Kershaw ditch headgate and to reimburse Arvada for the cost if the bond election passed.⁷⁹

At its regular November meeting, the board approved the budget for 1963.⁸⁰

Just five days before the December 1962 bond election, the *Rocky Mountain News* provided coverage on the need for a new treatment plant, saying:

The people of Adams County have had to live for many years with filth and stench of the Denver area's raw, untreated sewage which is being dumped into the South Platte River. Barr Lake, north of Denver and in Adams County, has been used as a cesspool for Denver's primary-treated sewage. The Metropolitan Mile High City never has had a secondary treatment plant....Odors rising from the foul waters carry for miles, blanketing Brighton, Irondale, Dupont and other communities.⁸¹

In an editorial the same day, the *Rocky Mountain News* voiced its support for the sewage bond-issue election. The editorial spoke



Contract signing May 27, 1965. Seated, left to right, Cyrus L. Colburn, Jr., Secretary; and Charles E. Rhyne, Chairman, Metro; Jack Cook, Tiago Construction Co. Standing: Edwin Vandervort, Tiago Construction Co.

of the unified sewage treatment systems as vital to "protecting the health of the community from the scourge of epidemics."⁸²

Bond issue passes

On December 11, 1962, the 13 communities that made up the Metro District voted "by an overwhelming margin of more than 9 to 1" in favor of \$32.5 million in revenue bonds for construction of a new sewage system. In some communities, the vote was unanimous. The vote was 25,101 for and 2,756 against.⁸³ With approval of the sewer bond issue, the *Denver Post* reported construction of the system would start in 60 days.⁸⁴

Charles Rhyne, Metro District Board member from Arvada, was quoted as saying:

The first work will be construction of sewer lines in the lower portion of Clear Creek to the new treatment plant...

We are overwhelmed by the vote. This will furnish the means for Arvada and our neighbors to eliminate a serious problem. It could mean great things for the metropolitan approach to common problems.⁸⁵

“This demonstrates that people are willing to work together to solve mutual problems,” said Emerson Ellett, deputy manager of public works for Denver and chairman of the District’s board.⁸⁶

“I will predict tremendous health advantages for the Denver area and the entire state as a result of Tuesday’s vote,” said Dr. Ralph Stuck of Englewood, former chairman of the legislature’s water pollution control committee.⁸⁷

The estimated project cost was \$27.4 million. The 110-acre plant “will be built at the confluence of Sand Creek, Clear Creek, and the South Platte River.”⁸⁸ This location was then identified as being about two miles north of Denver.⁸⁹

The U.S. Housing and Home Finance administrator granted an increase of up to \$600,000 for further planning work.⁹⁰

The Metro District board approved authorization for the City of Arvada to begin construction of the Arvada segment of the Clear Creek Interceptor in January 1963.⁹¹ Further action by the Metro District board named The First National Bank of Denver as “lead bank” in arranging the \$7 million in interim financing.⁹²

In 1963, the Metro District board approved a plan for \$7 million in bond anticipation notes to allow early financing of construction.

Part of the early funding was to be used for the construction of the Clear Creek Interceptor extending from Arvada.⁹³

Also in 1963, at a meeting to discuss the Metro District’s revenue bond sale and \$7 million in bond anticipation notes, board members learned that Denver area banks oversubscribed the \$7 million for a total of \$7,757,000 after hearing that several suburban banks had already sent in bids.⁹⁴

As the formation phase of the Metro District’s history came to a close in 1963, the District board unanimously decided that its executive secretary would be called executive director and the position would have career status. An ad hoc committee was created to further spell out the job responsibilities for the position, which would pay between \$12,000 and \$18,000 annually.

The committee further agreed that the person selected should be between 30 and 55 years of age and that there were sufficient monies available to cover expenses for at least three applicants from outside Denver. It was also agreed the “committee should publish the availability of the position in at least two publications which are generally read by men qualified in this field of endeavor.”

ENDNOTES

¹ Camp, Dresser & McKee. South Platte River Segment 15 Water Quality: A Historical Perspective. 1994. Metro Wastewater Reclamation District, Denver, CO. p. iv.

² 5 California 140, 63 Am December 11, 1855.

³ Camp, Dresser & McKee. South Platte River Segment 15 Water Quality: A Historical Perspective. 1994. Metro Wastewater Reclamation District, Denver, CO. p. xix.

- ⁴ "Microbiology." Encyclopedia Britannica. 2006. Encyclopedia Britannica Online. June 9, 2006 <http://www.search.eb.com/eb/article-216161>.
- ⁵ Jesperson, Kathryn. "A History Lesson: Contaminated Water Makes a Deadly Drink." On Tap. [n.d.] June 6, 2006 http://www.nesc.wvu.edu/ndwc/ndwc_DWH_2.html.
- ⁶ Camp, Dresser & McKee. South Platte River Segment 15 Water Quality: A Historical Perspective. 1994. Metro Wastewater Reclamation District, Denver, CO. p. xxii.
- ⁷ *Ibid.*
- ⁸ *Ibid.*
- ⁹ *Ibid*, p. xxiii.
- ¹⁰ *Ibid*, p. xxii
- ¹¹ "Want Sewer Extended." *Denver Times*, September 19, 1902, p. 7.
- ¹² Camp, Dresser & McKee. South Platte River Segment 15 Water Quality: A Historical Perspective. 1994. Metro Wastewater Reclamation District, Denver, CO. p. xxiii.
- ¹³ *Ibid.*
- ¹⁴ "Sewage Plant at Work Tomorrow." *Rocky Mountain News*, November 28, 1937, p. 8.
- ¹⁵ "Other Cities Must Change Sewage Plants." *Denver Post*, August 26, 1945, p. 6.
- ¹⁶ "Sewage System, Garbage Pickup Branded Menace." *Denver Post*, August 10, 1947, p. 1.
- ¹⁷ "River of Disease." Editorial, *Rocky Mountain News*, October 9, 1950, p. 26.
- ¹⁸ "Seven Denver Firms Dump Raw Sewage into Platte." *Denver Post*, October 11, 1950, p. 1
- ¹⁹ "City's Tests Show Platte Is Polluted Far Beyond Limit." *Rocky Mountain News*, October 14, 1950, p. 5.
- ²⁰ "Packers' Illicit Use of Denver Sewers Bared." *Rocky Mountain News*, January 5, 1951, p. 26.
- ²¹ "Sewage Expansion Advised for Denver." *Rocky Mountain News*, May 14, 1957, p. 9.
- ²² Maes, Raoul. Interview, January 10, 2006.
- ²³ Voukovitch, Boris. Interview, November 8, 2005.
- ²⁴ Gilbert, Gail H. "Doc." Interview, February 2, 2006.
- ²⁵ Wham, Robert. Interview, February 6, 2006.
- ²⁶ Report on Metropolitan Denver Sewerage Study for the Inter-County Regional Planning Commission, Black & Veatch, May 14, 1957, p. 2.
- ²⁷ *Ibid.*, p. b.
- ²⁸ *Ibid.*, p. 67.
- ²⁹ *Ibid.*, p. a.
- ³⁰ *Ibid.*, p. c.
- ³¹ "Metropolitan Sewer Study Gets Backing." *Rocky Mountain News*, April 16, 1959, p.14.
- ³² *Ibid.*
- ³³ *Ibid.*
- ³⁴ A Report on the Feasibility of a Metropolitan Consolidated Sewage Treatment System. Inter-County Regional Planning Commission, Joint Sanitation Commission and special consultants: Phillips-Carter-Osborn Inc., Engineers; Hatfield Chilson, Legal Counsel; Colorado Department of Public Health; Tri-County District Health Department; and Jefferson County Health Department. Denver, Colorado, November 1959.
- ³⁵ *Ibid.*, p. ii.
- ³⁶ *Ibid.*, p. 1 (summary).
- ³⁷ *Ibid.*, p. 3 (summary).
- ³⁸ *Ibid.*, p. 4 (summary).
- ³⁹ A Report on the Feasibility of a Metropolitan Consolidated Sewage Treatment System. p. 14.
- ⁴⁰ A Report on the Feasibility of a Metropolitan Consolidated Sewage Treatment System, pp. 4, 5 (summary).
- ⁴¹ *Ibid.*, pp. 5, 6 (summary).
- ⁴² *Ibid.*, p. 7 (summary).
- ⁴³ *Ibid.*, pp. 62-63.
- ⁴⁴ *Ibid.*, p. 64.
- ⁴⁵ "Metro Sewer Plan Wins Support of Gov. McNichols," *Rocky Mountain News*, November 13, 1959, p. 5.

- ⁴⁶ "Denver Sewer District Pledged Aid by State," *Denver Post*, November 13, 1959, p. 21.
- ⁴⁷ "Metro Sewer Plan Wins Support of Gov. McNichols," *Rocky Mountain News*, November 13, 1959, p. 5.
- ⁴⁸ Wham, Robert. Interview, 6 February 2006.
- ⁴⁹ "Metro Sewer Group to Serve 22 Municipalities, Districts," *Denver Post*, May 9, 1961, p.16.
- ⁵⁰ "Denver, Suburbs Okay Metro Sewage Unit." *Rocky Mountain News*, June 24, 1960, p. 26.
- ⁵¹ *Ibid.*
- ⁵² Gilbert, Gail H. "Doc" Interview, February 2, 2006.
- ⁵³ *Ibid.*
- ⁵⁴ Imeda, Jim. "Sanitation Unit Reorganized To Gain Loan," *Denver Post*, 6 October 1960, p. 3.
- ⁵⁵ "Metro Sewer Group to Serve 22 Municipalities, Districts," *Denver Post*, May 9, 1961, p. 16.
- ⁵⁶ Miller, Bill. "'Impossible accomplished': Metropolitan Denver District Organized." *Denver Post*, June 2, 1961, p. 3.
- ⁵⁷ *Ibid.*
- ⁵⁸ Board Minutes, Notice for October 3, 1961 meeting.
- ⁵⁹ Board Minutes, October 3, 1961, pp. 1, 2, 6.
- ⁶⁰ Board Minutes, October 10, 1961, pp. 5, 6.
- ⁶¹ Board Minutes, November 14, 1961, p. 7.
- ⁶² *Ibid.* and "Metro Engineers Hired for Sewer," *Denver Post*, November 15, 1961, p. 2.
- ⁶³ Board Minutes, November 21, 1961, pp. 1, 3, 5.
- ⁶⁴ Board Minutes, January 16, 1962, p. 3, 4, 8.
- ⁶⁵ Board Minutes, March 20, 1962, p. 2, 3, 5.
- ⁶⁶ Board Minutes, April 17, 1962, p. . 2, 4, 5, 7, 8.
- ⁶⁷ Board Minutes, May 15, 1962, p. 6.
- ⁶⁸ Board Minutes, August 9, 1962, p. 4, 7.
- ⁶⁹ *Ibid.*
- ⁷⁰ "Health Dept. Prods Denver on Sewage," *Rocky Mountain News*, August 19, 1962, p. 27.
- ⁷¹ *Ibid.*
- ⁷² Gilbert, Gail H. "Doc". Interview, February 2, 2006.
- ⁷³ "\$32.5 Million Bond Issue for Metro Sewage Proposed." *Rocky Mountain News*, August 22, 1962, p. 8.
- ⁷⁴ "Requirements Complicating Sewage Unit." *Denver Post*, September 14, 1962, p. 56.
- ⁷⁵ *Ibid.*
- ⁷⁶ *Ibid.*
- ⁷⁷ "Requirements Complicating Sewage Unit." *Denver Post*, September 14, 1962, p. 56.
- ⁷⁸ Board Minutes, September 18, 1962, p. 3.
- ⁷⁹ Board Minutes, November 20, 1962, pp. 3, 6.
- ⁸⁰ "Adams County Hurt by Denver Sewage," *Rocky Mountain News*, December 6, 1962, p. 38.
- ⁸¹ "Sewage Bond Issue Is Clear." *Rocky Mountain News*, December 6, 1962, p. 66.
- ⁸² "Sewage Bonds Approved 9-1." *Denver Post*, December 12, 1962, p. 1.
- ⁸³ "Construction to Start in 60 Days on \$32 Million Metro Sewer." *Denver Post*, December 12, 1962, p. 34.
- ⁸⁴ *Ibid.*
- ⁸⁵ "Voters Approve Sewage Plan By Overwhelming 9-1 Margin." *Rocky Mountain News*, December 12, 1962, p. 5.
- ⁸⁶ *Ibid.*
- ⁸⁷ *Ibid.*
- ⁸⁸ Board Minutes, December 18, 1962, p. 6.
- ⁸⁹ Board Minutes, January 15, 1963, p. 4.
- ⁹⁰ Board Minutes, January 15, 1963, p. 5.
- ⁹¹ "Metro Sewer Officials OK \$7 Million Advance" *Rocky Mountain News*, January 16, 1963, p. 70
- ⁹² "\$7 Million Is Voted to Start Metro Sewer" *Rocky Mountain News*, January 31, 1963, p..54.
- ⁹³ Board Minutes, January 15, 1963, p. 6 and 7.



GROUNDBREAKING TO STRIKE, 1964-1970

A mission, a mandate, and money

Metropolitan Denver Sewage Disposal District No. 1 began in 1964 with a mission, a mandate, and the money to carry them out. Its mission was to solve huge metropolitan public health and environmental problems by constructing and operating metro-wide wastewater treatment facilities. The mandate was the convincing margin by which voters approved immediate action to address these concerns. The money was the \$32.5 million bond issue the voters approved in December 1962.

The governing authority then, as now, was the board of directors. In 1964, it was a 24-man board. Supplied with preliminary engineering reports and the invaluable findings of earlier pollution control and abatement studies, the board set out to decide what facilities would be needed, the amount of money required, and the contractual arrangements Metro would need to develop with the member municipalities.

With adequate financing assured, Metro began constructing components of its interceptor sewers—the collection system. It also began recruiting nationwide for a manager to form the foundation of its administrative staff. The board hired J. D. (Jerry) Wingeart as Metro's first manager in 1964.

The Metropolitan Denver Sewage Disposal District No. 1 treatment plant was sited at the confluence of Sand Creek and the South Platte River. The top of this view is to the southwest. Seen to the left is the Burlington Ditch, and the bend in the South Platte is at the right, top. Note greenhouses in lower portion of photo near the ditch.

The board also began working on the service agreement between Metro and its member municipalities. By March 30, 1964, all the necessary approvals had been executed to commit Metro to providing direct and indirect service to 13 municipalities comprising approximately 70 percent of the metropolitan Denver population.

Collection facilities

The board and its advisors saw in 1964 that Metro needed a system of interceptor sewers to connect the existing facilities of member municipalities to Metro's treatment plant. At each connection point, measuring and sampling stations would be needed to quantify the sewage disposal problem Metro had assumed.

Plans further called for appropriate charges to then be billed to the connecting municipalities. These connectors, in turn, would put in place separate arrangements with what were then called “associate municipalities” and “non-member municipalities” that would together comprise the entire system Metro would serve.

Treatment facilities

The original operating concept was for most of the sewage from Metro's collection system to receive primary treatment at the Denver North Side Treatment Plant or the primary treatment plants of other member municipalities. The partially treated sewage would be sent for secondary treatment at Metro's treatment plant. The North Side Plant and Metro would operate for the



Jerry Wingate (standing), the Metro District's first manager.

most part as a combined system. The North Side Plant was modified and enlarged for this job. It was initially envisioned to provide primary treatment for all the upper South Platte Basin.

Some people began referring to the plant as the “gigantic new Metro plant.” It was envisioned as providing not only primary treatment for the Sand Creek and Clear Creek Basins, but also all secondary treatment for the entire metropolitan drainage basin under contract. This allowed connectors with primary treatment facilities to take advantage of having those facilities.

A 90-inch line connected the North Side and the Metro District plants. Metro’s secondary treatment plant was designed to treat an average flow of 117 million gallons per day (mgd).

The originally-envisioned service population was equivalent to about 1.5 million people. Early planners made provisions for subsequent expansion of facilities to allow an ultimate capacity of 270 mgd, adequate for a population equivalent of 3.5 million.

Financing

Metropolitan Denver’s determination to handle its water pollution problem attracted investors. In April 1963, after voter approval of the \$32.5 million bond issue, local banks raised \$7 million to provide interim financing for the Metro District. These funds allowed Metro to build or buy the required interceptors and acquire a plant site. Actual preparations of the bond sale itself took more than a year.

Bond counsel Dawson, Nagel, Sherman & Howard executed the initial phase by carefully developing the status of the obligations assumed by Metro. After the bond counsel was able to show that the Metro District had adequate measures to retire debt, financial consultants headed by B. J. Van Ingen & Co. presented the metropolitan venture to prospective bond buyers in July 1964. The sale was made at the very favorable average interest rate of 3.4127 percent.

Additional funds from the federal government for constructing water pollution control facilities were a significant part of Metro’s overall early financing. In 1964, Metro received almost \$1 million in federal aid.

Until funds were needed for construction or other related purposes, Metro invested its funds in federal securities to reduce its net interest expense. A series of controls was put

in place to ensure that each disbursement furthered Metro's mission to bring about a healthier, more sanitary environment.

First interceptor projects completed

The Sand Creek, Platte River I, and Clear Creek II Interceptors were the first projects the Metro District built entirely on its own. Begun in 1963, they were completed in 1964. During the same period, the Metro District bought part of the Weir Gulch Interceptor and built the remainder of it. These projects, together with buying the Sanderson Gulch Interceptor in June 1964, completed the first stage of interceptor acquisition.

In addition, easements for much of the Clear Creek I Interceptor and the effluent pipeline from the Denver North Side Plant were obtained, thus enabling construction of these projects in early 1965.

Modifications to the North Side Plant were necessary to adapt this major primary treatment facility to substantially enlarge its capacity. The first stages of cleaning the water were to take place at the North Side Plant for much of the nearly 100 million gallons a day used by the people of metropolitan Denver.

Under a \$1,265,354 contract with Weaver Construction Company, the work of modifying and enlarging Denver's North Side Plant began in August 1964 with the construction of the first of two immense clarifiers. By December 31, one-fourth of the Denver North Side Plant project had been completed.

The Metro plant

In April 1964, the Metro District asked for bids from construction companies to build its metropolitan facility at the confluence of Sand Creek with the South Platte River: the new Metro plant.



The 90-inch reinforced concrete sewer line that connected Denver's North Side Treatment Plant to Metro's plant is emplaced in this October 1964 photo.

Contractors from coast to coast competed to build the huge, new mechanical plant that would be a résumé-builder for the winner. Denver-based Mead & Mount Construction Company won the job with a low bid of \$17.3 million. They were well known for their many successful undertakings in the Colorado construction market.

Groundbreaking ceremonies for the \$17.3 million treatment plant were held on the 92-acre site at 1:30 p.m. on Saturday, Sept. 12, 1964.

According to an article in the *Rocky Mountain News*,

A sprawling network of connector sewer lines, some five feet in diameter, will extend along the South Platte River, Clear Creek, Sand Creek, Bear Creek, Sanderson, Weir and Lakewood Gulches to be linked to the main treatment plant. The system will serve a present population of 700,000 and ultimately a population of 1.25 million.¹

The article quoted Roger Mead, secretary-treasurer of Mead & Mount Construction Co., as saying "the first phases of the work would be the building of some stronger bridges to carry heavy equipment to the site, sinking well points and pumps to lower the water table for installation of casements, and piling and leveling work by scrapers and bulldozers."²

That wasn't all that was happening.

"Before the bids were called for in the early part of—I think—'64, I resigned from the board and became employee number three," said Boris Voukovitch, who later rejoined the board and lived through much of Metro's history. "I think the original title in the minutes when I was hired was superintendent of maintenance, but I don't know why, because we had nothing to maintain. And then, through evolution someplace, I became chief engineer. But the practical matter is that I was charged as the owner's rep in the construction of the plant."³

Following the groundbreaking ceremonies, work on the plant proceeded at the rate of \$500,000 a month. Huge earthmovers reshaped the entire site. Skilled workmen built the plant's big peripheral effluent conduit and started foundations for other



Sections of reinforced concrete pipe that would become the Clear Creek Interceptor are lined up for installation in this October 1965 photo.

units. By year's end, tons and tons of steel and concrete formed the beginning structure of the facility that would serve the people and industries of the Denver metropolitan community.

From plans to operations: a series of precautions

To ensure effective use of the \$32.5 million the voters had made available to the Metro District, the board took comprehensive measures. The goal was to enhance functional characteristics and prevent structural weaknesses in the facilities, carefully calculated to permit the best possible operations at the least possible cost for years to come.

Metro Engineers, a joint venture composed of Phillips-Carter-Osborn, Inc., Ken R. White Consulting Engineers,



Members of the board line up to take a shovelful of earth at the September 12, 1964, groundbreaking ceremony for the plant.

Inc., and Henningson Durham Richards, Inc. (now known as HDR), had participated in the planning from the very beginning. Metro Engineers got the nod to design the sewage collection and treatment system. Under its direction, reams of field information had been gathered to determine the physical requirements for each element of each facility.

During construction, inspectors and independent testing laboratories ensured the quality of both the materials being put in place and the workmanship performed on each project. In addition to the continued oversight maintained by Metro's staff, the consulting engineering firm of Alexander Potter Associates further assured against inadequacies in the final outcome by reviewing all designs and making periodic tours of inspection.

Voukovitch recalled that the Metro District had an office on the corner of East 16th Avenue and Lincoln Street

...in an insurance company building. The northeast corner of that intersection....In the same building were (legal counsel) Inman Flynn and Coffey....We operated out of that office. The plant was completed in the allotted time—actually, it was completed almost two months ahead of schedule. And then we closed that office and moved to the Administration Building on the plant site.⁴

The monthly Manager's Progress Report was expanded in 1964 to become the Manager's Progress and Projection Report. The projection portion was to cover anything coming up in the 30 days following a board meeting. Jerry Wingeart, the first manager, reported he had hired Joseph Woodley as office manager, approved payment for construction of a spur railroad track by Denver and Rio Grande Western Railroad Company, and approved an additional fourth primary clarifier to be built along with the three clarifiers initially approved for construction.⁵ Wingeart also said Lewis D. Kifer had been hired as plant superintendent.

In other business, the suburb of Bel Aire asked to join the Metro District, but its request to be included in Metro was deemed infeasible.⁶

As construction on the plant continued, the builders found that dewatering on the plant site resulted in insufficient water for nearby carnation growers. According to Voukovitch:

When we started the excavation on the site here, the ground water table was very close to the surface. So what we did,

or the contractor did, was to put a string of dewatering wells around the plant itself to lower the water table and pump that water into the Platte River. Lowering the water table also lowered their (the growers') wells. That's how I got to know all the farmers. It was a legitimate complaint. But the moment we stopped pumping, the water table came right back up where it had been. So it wasn't permanent damage, but it was damage at the time. If we hadn't done anything, we would have heard about it because those greenhouses depended on having water in those wells. We did pump some of the water from our dewatering into their wells or we pumped it to them so they could use it. So all three families—Spanos, Amatos, and Elliots—were satisfied.⁷

Robert Chase was hired Dec. 1, 1964, as field clerk to assist Kifer, the plant superintendent. Joe Woodley was charged with



The peripheral effluent conduit for what is now the North Aeration Basin complex is being laid down in this photo.

producing the Metro District's first annual report. As 1964 drew to a close, the Metro District appropriated funds for the 1965 budget, amended the 1964 annual budget, and agreed to the North Pecos Water & Sanitation District becoming a member.⁸

Said Voukovitch:

We had difficulty in finding qualified plant operators. Back in '66 when we took over the plant from the contractor, the certification (system) that we have today was in its very early stages. As a matter of fact, I carry Class A operator certificate number 44 in Colorado. Now it's in the thousands. But mine is 44. We had few real operators; the rest were just learners.⁹

1965—Construction continues

The plant and interceptors were slated for completion in late 1966. The plant was to be able to provide secondary treatment for an average flow of 117 million gallons a day for a population of 1.5 million people. It would provide primary treatment for 27 mgd from Clear Creek and Sand Creek valleys and secondary treatment for flows from the Denver North Side Plant.

A *Denver Post* progress report article on Jan. 21, 1965, said:

Good weather this winter has permitted the prime contractor, Mead & Mount Construction Co. of Denver, to proceed swiftly with initial work on four primary sedimentation tanks, 12 secondary tanks, a 400,000 square-foot aeration basin, four sludge holding tanks, several building complexes, a mile or so of enclosed effluent channels big enough to drive a car in, and a chlorination basin. The effluent dumped in the Platte River will be as clean as modern sewage treatment methods can make it.¹⁰

The flood

In mid-June of 1965, the plant was under construction and everything seemed to be humming along. And then the rains came.

According to a December 1999 article in the *Rocky Mountain News*:

The flood of 1965 left six people dead, caused about \$530 million in damage in 1998 dollars, and spurred construction of the Chatfield Dam to control flows in the South Platte....Almost 1,400 families sought disaster relief. The flood damaged 1,270 structures, including 600 homes in Denver alone. It inundated factories along the South Platte and knocked out so many bridges that thousands of workers were kept from their jobs for days.¹¹

Voukovitch remembered the day.

We did not have any concrete poured yet. We were still in the excavation stage. We had the ground level water reduction wells, well points around, and we had a great big hole excavated for the North Secondary Plant basins. We had the levee along the Platte River both on the west and north side of the bend. And the afternoon of the flood on June 15, I came down to the plant site.¹²

He said he believes he parked his car near where the Warehouse and Mechanical & Electrical Shops Building now stands.

And I started walking because I saw pieces of equipment scattered all over the place, and I was wet and muddy. But I walked up to the equipment and ordered the



The South Platte in flood. (Source unknown; photo found in Metro District files.)

people just to park their equipment on the highest piece of ground they could find and get out.

It was already dusk, and I saw where the 90-degree bend is—that would be the northwest corner—a backhoe was still digging. I don't know why I missed him before, and I was close to where the bridge across the Burlington ditch is, so I walked all the way back and I climbed into (the cab with) the guy and said, "Look, fella, quit. You're going to lose your life." He said, "What am I going to do with my machine?" I said, "Leave it. This is the highest point."

At that point, the water was already lapping at the road on the levee. It was there that he got out and I got out, and that was the highest level. The water never breached that levee. If you had gotten two more inches, we

would close the site. But the site was not damaged. So we didn't have really any damage. The biggest damage the contractor had was the lost time. But physically, we didn't have any damage. So that part was alright.¹³

Arne Holst, a Metro engineer who had 38 years on the job when he retired, talked about less visible effects.

In 1965, the construction of the plant was going on... and (the flood) pretty well wiped out a swath that went through downtown...and the area of 6th Ave and...

Bryant Street, I think it is. That got flooded.¹⁴

Holst said the flood destroyed all the electrical drawings, which were in an office on Bryant Street.

A concrete supplier strike in 1965 threatened to affect the construction schedule, but later developments showed the schedule was not impacted. With construction well underway, the design capacity in 1965 was thought to be sufficient to handle growth through 1982. Primary treatment capacity was slated to be 27 mgd, and secondary capacity was to be 117 mgd. Sludge processing would consist of dissolved air flotation thickening followed by vacuum filtration and then incineration or drying. The groundwater table was 11 feet below ground level, requiring a perimeter of well points, pumps, spot dewatering, and sumping, plus 5,000 uplift piles to anchor all deep structures. Fourteen buildings were planned for the plant.¹⁵

1966—First flows

By early 1966, construction was about 85 percent complete. Plans were underway for the site to be landscaped.¹⁶



60th Ave bridge looking west prior to beginning construction. This bridge carried workers and materials onto the plant site.

Metro studied installing an interceptor along East 56th Avenue. It would join the Sand Creek interceptor near Vasquez Boulevard. The Sand Creek line ran from Denver's East Side Treatment Plant northwest of Smith Road and Yosemite Street to the Metro District treatment plant.

The City of Thornton and the North Pecos Water and Sanitation District became new members in 1966.¹⁷

By the end of March, the plant was 94 percent completed and was expected to be ready in October of that year. Both the Pleasant View and the Applewood Sanitation Districts were seeking membership. More than 80 percent of the 350-square-mile Denver metropolitan area was expected to be served.

"The Platte River Interceptor Sewer, which will pass under the heart of Denver, should link Littleton and Englewood



Secondary clarifier under construction, July 20, 1966. View is to the south.

to the metropolitan facility in 1972 or 1973," said an April 1966 *Rocky Mountain News* article. Arvada's probable annexation of Fruitdale and Clear Creek Valley would allow those districts to come into the Metro system.

The effluent would be "so pure it could be used for drinking," District Manager Jerry Wingeart effused to a newspaper reporter. "Hundreds of electric- and gas-powered motors are in rooms and galleries beneath the huge sedimentation and aeration basins. So are miles of pipe, metering control devices, switches, power control panels, pumps, heaters, blowers, and a maze of wiring."

The number of employees was about 80. Operations was to have 15-20 men per shift.¹⁸

"John Puntenney was hired as chemist, and I reported to him on April 8, 1966," said Baird Smith, a retiree who worked

in the Metro District's laboratory. "We worked out of the Westminster sewage treatment plant lab as the Metro lab was under construction. The Westminster plant was our headquarters for several months during the summer of 1966. John started the Metro lab with a staff of three."¹⁹

Smith remembered May 15, 1966, the fifth anniversary of Metro's creation.

The plant site was full of bulldozers, and Joe Woodley and his staff were working out of a downtown high rise...I believe my job title was lab tech. We scoured Denver area army surplus stores for any lab equipment we could use in the sampling program.²⁰

They ended up buying insulated blood boxes, baskets, and bottles, plus a brand new 1966 Ford van.

Smith continued:

We must have sampled most of the existing treatment plants from Thornton to Englewood. We tested biochemical oxygen demand, suspended solids clarity, etc., to give us some idea of what kind of volumes and strengths we could expect when the main plant went on line. John Puntenney purchased rain gauges we mounted in our backyards at home. We wanted to find how much runoff contributed to the plant loading.

Smith said his employment interview was held downtown with Joe Woodley and a second one by John Puntenney. He also took a written test. "John wouldn't tell me how I did on the test, but they hired me anyway," Smith said.²¹

Another now-retired long-time laboratory employee, Carl Calkins, said liquid flows began coming into the plant in late 1966. “There were only trials on the furnaces and filters for processing sludge. No flow into the plant, no liquid flow. They did a lot of charge sampling for connectors,” he said, explaining the initial rate-setting work.²²

“John Puttenney was the director of Lab Services, plus we had Baird Smith, Tony Tostin, myself, and I think we had Dave Devaney within the year. So four lab people before the lab was functional,” Calkins said.

The Metro District board increased Jerry Wingeart’s salary from \$18,000 to \$19,000 in 1966. Westridge was added as a member municipality, increasing the number of directors to 30 (one new one for Westridge plus one additional member for Denver). The issue of the number of members on the board would come back to concern Metro’s board many more times.

Construction was nearly six months ahead of schedule despite the June 1965 flood and carpenter and concrete strikes. Sludge processing facility testing was set to begin July 5, with other parts of the plant scheduled to follow. Estimates were that the plant would begin operations in September or October.²³

By May 1966, 30 directors governed the District: 15 from Denver and 15 from the other municipalities. The statute limited Denver to no more than 50 percent of the director seats and provided for one director per 25,000 population or portion thereof. Fifty-four directors were either serving or had served on the board, and



Laboratory Technician Carl Calkins circa 1967.

two of these had already died. Board members met as often as a dozen nights a month during the formative and planning stages.²⁴

The board also approved “a maximum of \$25,000 for installing a 42-inch sewer main, the North Washington Street Water & Sanitation District and the Thornton Sanitation District interceptor lines, across the Interstate 80 S (sic) route in Adams County before highway construction is completed.”²⁵

Metro was constantly planning. In May, the East Denver Plant at Smith Road and Wabash Street was forecast to be

abandoned when the Metro District plant came on line. The East Side Plant's 2-mgd flows would be sent on to Metro for primary and secondary treatment. Manager Jerry Wingeart also predicted that Denver would abandon its North Side Plant within 10 years (this did not occur until 1987) and all flows that then went there would go to the Metro District. Denver's Sanitation Engineer, Horace Smith, expressed his doubts.²⁶

Some people believe that hiring and keeping good employees is an issue for every organization. It wasn't for the Metro District. Voukovitch remembered that

There was a turnover, but it was not a great turnover because our statute said we have to pay a prevailing wage. Ours were high, and it was a better wage than most anybody paid, so that's something this district has never had a problem with. People don't leave.

On the plant site, Voukovitch noted that

My duties included (keeping up with) constant changes and additions that had to be made. One of the big problems we had from the very get-go was air diffusers for the secondary treatment plant, both maintenance on the ones we had and making sure the operators made sure they did the job they were designed for. In the beginning, we had all kinds of minor problems with pumps to get the right kind of pump for the right function.²⁷

The board approved the 1967 budget in 1966, the first budget to include money for operations and maintenance. That budget was \$5,490,142.²⁸

An August 1966 *Denver Post* editorial recommended that Aurora join the Metro District.²⁹

The U.S. Department of Housing and Urban Development and the U.S. Bureau of Public Roads reiterated 1965 laws in 1966 that required regional planning for sewer systems, water systems, parks, and open spaces and comprehensive, continuing cooperative planning for transit systems in order to qualify for federal aid.³⁰ The Metro District was aware of these requirements.

Robert Dougan Construction Co. of Boulder won a contract in 1966 for a pumping (lift) station west of York Street on Clear Creek. A contract was awarded to Southway Construction for four miles of pipeline that would connect with the existing Sand Creek Interceptor and serve areas north and east of Aurora, including Montbello. The board also agreed to purchase a 24-inch line from the North Washington Water & Sanitation District for \$20,000.³¹

By October 1966, the Aurora City Council had unanimously approved the city joining the Metro District. The agreement was set to go into effect at the end of December, pending a public hearing and final approval. The agreement required Metro to treat all of Aurora's sewage and that of the Altura Sanitation District (which had been taken over by Aurora in 1962) for the next 45 years.

The contract required Aurora to continue operating its Sand Creek Treatment Plant until 1986 and allowed Metro to purchase the plant in 20 installments for \$5 million. Aurora would also abandon its Westerly Creek Plant by the end of 1976. The Westerly Creek flows were to be directed to the Sand Creek



Boris Voukovitch (center) was the Metro District's first chief engineer. On his immediate left is Joe Woodley, who was hired as office manager and retired as director of administrative services. He also served as acting manager when the District was between managers.

Plant. For Metro, the contract required it to build two additional interceptors. Both Aurora and Metro were required to apply for federal construction grants to cover 30 percent of the cost. According to Chuck Wemlinger, director of utilities for Aurora, Aurora's eligibility for the funding required it to join Metro.^{32,33}

Boris Voukovitch played a part in getting Aurora to join Metro.

After the (Metro) plant went on stream in '67, Metro had a study done by R.W. Beck and Associates on the feasibility of Aurora joining Metro. Jerry Wingert gave me the job to be the go-between for Metro and Aurora. (I) couldn't stand those days. I practically lived for awhile in the

Aurora City Hall. And, of course, at the time I knew all the staff and all the city councilmen. And convinced them very easily and quickly to join Metro. And they did.³⁴

Voukovitch recalled that after he got back on the board, Metro was talking with the cities of Thornton and Golden. Both joined. Later, Metro had discussions with Westminster, which got a new wastewater treatment plant for its northern half and wanted to have some territory excluded.

"I spent most of my time after our plant went on stream in dealing with the members or future members or potential members all up and down Clear Creek. Some people I convinced to join, and others I couldn't," Voukovitch said.³⁵

The Metro District board approved a contract in 1966 to build the 3.5 mile Thornton-North Washington Interceptor sewer and force main line. The interceptor would pick up Thornton-area effluent at the old Thornton sewage treatment plant at 88th Avenue near the South Platte River and carry it to the North Washington Water & Sanitation District at 72nd Avenue. It was then to be pumped from there to Metro's Clear Creek Interceptor at 64th Avenue and York Street, where it would flow to the plant.³⁶

1967-The plant comes to life

Early in 1967, Aurora became the sixteenth member of the Metro District. Preliminary action was taken to allow the Applewood Sanitation District and the Pleasant View Water and Sanitation District to join Metro on the Clear Creek Interceptor.³⁷

State Sen. John Bermingham of Denver proposed a bill in 1967 that would expand the powers of the Metro District to include

solid waste and junk autos disposal in order to make Metro a total waste disposal operation.³⁸ It was thought that combining sewage sludge and solid waste disposal could potentially cut costs.

A *Denver Post* article noted that Denver would face a solids handling-and-disposal crisis in two years and asked the state to expand the Metro District's authority to handle trash. E.R. Bennit, an assistant professor of civil engineering at the University of Colorado, was quoted as saying that in 1967 "the average person produced four pounds of trash a day and four pounds of raw sludge, and that refuse disposal costs ranged from \$1 to \$6 per ton." The articles went on to say that composting costs were estimated then to be \$6 to \$10 a ton, but a market was needed and compost was generally not competitive with other types of mulching. Adding sewage sludge to trash was thought to aid in decomposition, but it would take four to six weeks. Care would also be needed so landfill sites did not pollute ground and surface water.³⁹

The movement to add solid waste disposal to Metro's mission eventually died.

Metro officially accepted the treatment plant from Mead & Mount Construction Company on March 21, 1967. The Metro District's 17 members then included 4 cities and 13 sanitation districts. Three more sanitation districts were expressing interest in joining: Pleasant View, Applewood, and South Adams. The board had 38 members; the newest included Mary O'Dell (the first woman), Harry LaBonde, and Julio Zamagni.⁴⁰

Two months later, on May 21, 1967, the Central Plant was dedicated. Ceremonies included a flag-raising by Boy Scouts, an invocation, and presentation of a plaque and key.



Primary Clarifier filling for first time on January 24, 1967.

About the time of the turnover from the contractor, the full compliance by the Central Plant with water pollution standards was thought to be probably three months away. The operational shakedown took longer than expected, however, and adjustments and replacements were still going on even though the plant was accepted from the contractor on March 21. District Manager Jerry Wingeart answered complaints from the Colorado Water Pollution Control Commission that raw sewage was being bypassed into the South Platte River by saying it was "not necessarily raw sewage" since nearly all the influent had undergone primary treatment.⁴¹

The plant had attained a satisfactory performance level by the time the dedication took place on May 21.⁴² Some 800

invitations to the dedication ceremony were sent to federal, state, and municipal leaders and area civic leaders. An open house followed the ceremonies.⁴³ An article in Empire Magazine (then published on Sundays in the *Denver Post*) said:

The administration building of the new plant just north of Denver was a modern blend of glass, steel and pre-cast aggregate. Contemporary design carries through on the inside, where there's a glass-enclosed center court graced with metal sculpture....Pretty secretaries and executives in business suits add to the atmosphere of quiet efficiency. Altogether, the picture isn't what one expects to find at a sewage plant. But this is no ordinary sewage plant.⁴⁴

The article went on to say the plant sat on 50 acres and cleaned 75 million gallons of water a day "enough to be used again." It described the plant as "something of a showplace," having already hosted more than 500 visitors.

At a cost of \$20 million, it was a four-county effort to bring sewage treatment up to state standards. It was at that time the biggest step in rehabilitating a part of the South Platte River that had been a cesspool on the move since Denver's earliest days.

The magazine pointed out that the 38-member board was "a little cumbersome, but democratic."⁴⁵

The staff included Plant Superintendent Lewis Kifer, his assistant Arnold Gibson, Chief Chemist John Puntenney, Chief Engineer Boris Voukovich, and Administrative Assistant Joe Woodley. There were 30 major concrete structures, more than 100 pumps and machines, and miles of lines. However, some of the pumps and furnaces had already exhibited problems, the article noted.



Mary O'Dell of Aurora became the first woman to serve on Metro's board and the first woman to serve as the chair of Metro's board.

The plant had an operating staff of 65 employees and 25 employees for administration and maintenance. The article said the service area, with a population served of slightly more than 1 million, was 250 square miles. The plant was said to be capable of handling 120 million gallons a day for 1.5 million people, and capacity could be doubled with on-site expansion.⁴⁶

The board delayed action on the 1968 annual budget in 1967 to allow for more plant operating time for better cost estimates. The reported problems included excessive grease accumulation. Operating costs were \$1,831,110 in 1967 and were slated to increase to \$2,158,670 in 1968.⁴⁷ Later, the board approved a \$4.1 million budget for 1968. Operating and maintenance costs were projected to be higher because of loads that were higher than anticipated.⁴⁸

Whether Applewood, Fruitdale, and Clear Creek would become members continued to be discussed. If membership occurred, some thought stream pollution problems would be eliminated. Applewood joined on August 15, 1967.^{49,50}

By December 1967, Metro had begun to make a difference in the environment of the area. People in Brighton, downstream of metropolitan Denver and long a recipient of Denver's sewage, began to notice the effects of a cleaner South Platte River. "Yes, the sewage smells of the South Platte River, the ditches, and the 1,400-acre area of Barr Lake are gone, and for this I am thankful and so is my community," said Charles A. Taylor, a Brighton resident, in a *Denver Post* article.⁵¹

1967 operating results

Operating capabilities were developed and improved during the year as plant staff increased their knowledge and skills to realize the plant's potential. Water flowing over the white-tiled final effluent weir (colloquially called the "banana weir" because of its shape) in 1967 approached the clarity planned when the Metropolitan Denver Sewage Disposal District No. 1 was established, according to the 1967 annual report. Gone were the tons of offensive waste

previously entrained in the water discharged to the South Platte River. As much as 100 million gallons of water a day were being recovered and made available to Colorado by the public investment made in Metropolitan Denver Sewage Disposal District No. 1.

Early in 1967, following the startup and testing period, the new Metro plant showed it could meet Colorado water quality standards. Difficulties encountered later in the year in the elaborate metering and control systems resulted in considerable loss of operating data until September. Between September and December, when data were continuously available, the data showed the plant was actually removing more than 88 percent of the suspended solids and more than 90 percent of the biochemical oxygen demand (BOD).



Members of the board as seen at a July 16, 1968, meeting.

During the year, member municipalities discharged 30,649 million gallons of wastewater to the Metro plant. This flow contained 28,088 tons of suspended solids and 28,712 tons of BOD. When compared to budget estimates, the flow estimate was very close to the actual flow received at the plant, but suspended solids and BOD far exceeded the budget estimates.

Metro's staff paid close attention to routine operations throughout the year, but they also examined operating capability limitations carefully. In most new plants, design capacities in the operation of all the many pieces of equipment are not ordinarily attained at startup. This held true at Metro. In almost all instances, minor modifications or equipment replacements were made, and the difficulties were eliminated.

The ratios of different sludges processed at the plant proved to be significantly different than had been expected. These differences caused dewatering difficulties. In addition, because primary treatment capacity was small relative to the secondary treatment capacity, using the primaries for occasional recirculation was found to be inadequate. To overcome these problems, plant modifications were being considered and additional studies were planned for 1968 and 1969.

When Metro had a year of experience under its belt, staff found that keeping the plant in operation 24 hours a day, 7 days a week required 60 operators plus 9 supervisory and administrative employees.⁵²

Maintenance

Maintaining the plant proved to be a huge job. The mechanical and electrical equipment required continuous

surveillance, precise adjustment, and even overhauls. The large size of the treatment and disposal facilities also presented maintenance crews a sizable housekeeping problem.

The plant was covered by a construction warranty until March 1968. Thereafter, the Metro District had to pay all repair expenses. As with all equipment, maintenance costs were expected to rise as more and more operating hours accumulated.

Maintenance work was normally done on an 8-hour, day-shift basis, with call-outs at other hours for emergencies. The maintenance crew consisted of 17 men in building and ground maintenance, 3 electrician-instrument technicians, 4 mechanics, and 3 supervisory and administrative employees.⁵³

Laboratory

The laboratory performed about 30,000 analyses in support of plant operations during the year. It also began research projects to control the processes better. Among the more promising investigations were those on oxygen uptake rates to determine the optimum air supply for microorganisms used in treating the waste; oxidation-reduction potential to provide a guide for maintaining proper food supply for the microorganisms; dye dilution studies to calibrate in-plant flow measuring devices; rate of oxidation of carbohydrates, proteins and fats in wastes treated to determine desired detention times; toxic levels to monitor amounts of toxic substances intercepted; and chemical conditioning studies to determine the effectiveness of polymers in sludge processing.

To substantiate the District's annual charges, samples were taken and analyzed to determine the suspended solids and BOD in



A 1968 laboratory photo shot though a microscope shows some of the microorganisms present.

the flow from each connecting municipality. Sampling staff took samples every 15 minutes for 7 consecutive days and nights.

In addition to the sampling crew, the laboratory staff included two chemists and four laboratory technicians.

More members joined

The District had 9 municipalities when it was organized in 1961. It grew to 13 by 1964, and by 1967 had increased to 16. During 1967, three new members joined the District: the City of Aurora on January 18; the Applewood Sanitation District on August 15; and the Pleasant View Water and Sanitation District on October 17.

Of the 19 member municipalities, 13 were connecting municipalities (which meant they received service directly from the Metro District) and 4 were associate municipalities, which received service through one of the connecting municipalities. In addition, approximately 40 other municipalities had contracts with one of the District's connecting municipalities and were being served indirectly as non-members by the District.

Representing the 19 member municipalities, the board of directors consisted of 42 members. They established policies and guided the growth of the Metro District.⁵⁴

More services added

Construction contracts completed and accepted during 1967 totaled \$19,031,983, including the Metro plant costing \$17,383,734. Metro began constructing an interceptor at a cost of \$741,167 and a 29 mgd lift station and force main at a cost of \$388,997 for Thornton and North Washington. For the part of northeastern Denver known as Montbello, the East 56th Avenue Interceptor was built at a cost of \$482,423. For the nearby paper plant owned by Packaging Corporation of America, an 8-inch force main was installed at a cost of \$35,662.

To serve the city of Aurora, which then had a population of approximately 67,000 people and undeveloped land to the east that could potentially house many more, the board of directors approved acquiring the necessary easements and securing bids for an interceptor system that would be constructed as the Sand Creek II Interceptor and the Sand Creek-Toll Gate Interceptor. Design work and construction of the connections to Aurora were on track and were expected to be completed in early 1969.⁵⁵



This photo shows the Sludge Processing Building as it appeared on May 13, 1966.

1968-New year, new problems

As North Vietnam launched the Tet offensive in South Vietnam in January 1968, the Metro District began the year having tasted the heady wine of success and recognition. At the end of 1967, Metro had treated the region's sewage for a full year. Employees were learning how to operate and maintain the new plant north of Denver, and people who were affected by it were seeing results. Then reality set in.

Amidst a growing movement across the country to allow unions to organize employees of local governments, the board voted in January to support Senate Bill 5. This was a no-strike bill that would have removed Metro from the provisions of the Colorado Labor Peace Act and prevented Metro workers from being represented by a labor union. Metro was the only political subdivision of the state that fell under the provisions of the

Colorado Labor Peace Act, which required "forced collective bargaining," according to comments recorded in board minutes.⁵⁶

In February, the Colorado Industrial Commission ruled the Metro District fell under the Colorado Labor Peace Act. District Manager Wingeart and legal counsels Robert Inman and John Flynn thought the Metro District was the only political subdivision of the state that was in that position under the Act. The board had opposed requests by unions representing municipal employees and operating engineers to have representation elections at the plant.⁵⁷

"It's my opinion that a person working for a district such as this should not be allowed to strike," said board member Bill McNichols, then Denver's public works manager and later its mayor. But Ralph A. Diltz, business manager of Operating Engineers Local No. 1, said, "We're not organizing it just to strike it." Fifty-eight employees had signed a petition asking Metro to drop its appeal and allow a union representation election to be held, said an article in the *Denver Post* on February 19, 1968.

After Senate Bill 5 passed in the Senate, it was introduced into the Colorado House of Representatives. A proposed change to the bill would have allowed workers to strike if they first notified the Colorado Industrial Commission of any intent to do so. The March 19 minutes of the Metro District board meeting said the House Rules Committee had killed the bill.⁵⁸

The board voted in April not to withdraw its appeal of the Colorado Industrial Commission ruling that had been pending in district court since December 28, 1967. The board's legislative committee presented a majority report at the April

meeting signed by Denver Directors Roy Romer, Charles Dosh, and William Bradley. The report recommended ending all legal and legislative attempts to exclude the District from the Colorado Labor Peace Act and that the District's employees be allowed to join a union. All other political subdivisions in the state except Metro were exempt from this provision.

The board instead accepted the committee's minority report from Ed Hoskinson of Arvada and Mary O'Dell of Aurora. This report recommended pursuing court appeals and working on state legislation that would allow employees to unionize and bargain collectively for wages, hours, and working conditions but prohibit them from striking, boycotting, or picketing.⁵⁹

In February 1969, however, the board elected not to appeal a district court decision permitting Metro District employees to join a union and negotiate for a contract. The board's vote followed Romer's announcement of a letter signed by all of the Metro District's more than 70 potential bargaining unit workers accepting a no-strike clause in any contract they negotiated with the Metro District. The regional director of the International Union of Operating Engineers, AFL-CIO, W.E. Magruder, said he was "in complete agreement" with the no-strike proposal.⁶⁰

Mary O'Dell Thurber, a director representing Aurora and the first woman to serve on the Metro District's board, said she was concerned about having a union because her father had been in a union. She was concerned with the cost and the inability to provide wastewater treatment if the union struck. She spoke strongly and adamantly against the union. But Roy Romer and Herrick S. Roth (representing the Colorado Labor Council, AFL-CIO)

wanted the Metro District to be organized, and their position eventually prevailed at the February 1969 Board meeting.^{61,62}

Issues: Capacity, sludge, water rights

At the May 1968 board meeting, Director James Stone of Westridge asked whether Metro was "approaching its full capacity," and inquired whether any planning had been done in this matter. He was advised that this problem would be handled as it came.⁶³

What to do with the sludge—the mostly organic solid precipitate that results from wastewater treatment—was increasingly becoming a problem in 1968. With its furnaces operating to dry the material, Metro gave samples of dried sludge to the City of Denver for test application by its Parks and Recreation Department. The tests were successful, and Metro arranged with Denver for its Parks Department to begin hauling dried sludge in August.⁶⁴



Roy Romer (standing) addresses members during 1968 board meeting.

Oyer G. Leary, a judge in the 17th Judicial District, entered a final judgment for the Metro District to pay costs to return the South Platte River flow that was interrupted when the plant went on-line in 1967. The Metro District would have to pump water and effluent into Adams County. Farmers Reservoir and Irrigation Co., the Burlington Ditch, Reservoir and Land Co., and the Henrylyn Irrigation District claimed over \$25 million in damages due to the water loss.

Judge Leary ruled that the Metro District had unlawfully interfered with the discharge returning to the river. The Metro District had constructed a pumping facility to deliver flow from the plant to the headgates. Another pending lawsuit from Denver Water Board and Adolph Coors Co. against ten ditch companies maintained Denver Water had a right to a succession of uses of water it derived from the Colorado River across the Continental Divide.⁶⁵



This photo shows Board Chair Bill McNichols (left), John Flynn (Metro's legal counsel), and Bonnie Evans, the secretary who took notes at board meetings.

Construction firms were chosen for Aurora's hookup to the Metro District. Burks & Co., Inc. and the M.J. Bober Co. were the low bidders. The project was scheduled for completion the following June. The first line was to connect with Aurora's Sand Creek Plant and pick up existing overflows. The Sand Creek Plant was to continue to operate after the hookup was completed. The second line would parallel the Sand Creek Interceptor. A branch line would result in Aurora's Hoffman Heights pump station being discontinued. The fourth line was to cross Stapleton International Airport and would result in Aurora's sewage treatment plant near the Montview Shopping Center being decommissioned.⁶⁶

In late 1968, sludge processing and incineration problems resulted from the disintegration of two large fans in the incinerator units. Replacements were not available and had to be custom built. Sludge was being processed at a rate of 121 tons per day. The raw sludge was diverted into large lagoons that were built for drying and temporary storage. The odors prompted complaints from neighbors and local public officials. The lagoons were closed within six months.⁶⁷

1969—Peace, love, long hair, and sludge woes

In mid-January 1969, expanded Vietnam peace talks were set to begin in Paris.

Sludge handling continued to be a huge issue in 1969. Voukovitch said the sludge drying furnaces operated "some of the time" and were considered by some people to be "mostly experimental." The furnaces also were expensive to run and used "an awful lot of gas."⁶⁸ Voukovitch continued:

Bill Martin (who later became the first head of Resource Recovery and Reuse at Metro) lived for those furnaces. He was the head operator, head honcho on furnaces.

First, the furnaces could not handle all of the sludge we had to burn. Second, it was extremely expensive. Third, we had baggers to bag the sludge.

The furnaces (were designed) to dry (sludge) but not the total production of it, so (it) became obvious that furnaces were not the answer to sludge treatment. We had to find something else.

To find some other (solution), we made a sludge lagoon on the plant site in the area where our South Plant is now. And somehow, even though the decision was made by the engineering committee, which we had in those days instead of future programs (committee), that lagoon became Boris's baby. After we filled the lagoon, it became painfully obvious the sludge would not dry. And then we ended up with the problem of having to take it out.

And that's when we hired the contractor...to load it and haul it out. Plus, these types of lagoons created an odor that was horrible, and we spent a lot of time and a lot of money in trying to mask the odor chemically. Oh yes, all kinds of attempts, and I don't think any of them eliminated the smell. They helped.

On a good day it wasn't bad, but on a high humidity day, the lagoons smelled to high heaven. We had complaints from neighbors, but it really was very few considering the enormity of the problem. You see, nobody lived anywhere



Plant Operator Ralph Trujillo works his shift in the Control Room, early 1990s.

close, and across the river we had the rendering plants, which had smelled long before we came into existence. So when wind conditions and atmospheric conditions were right and the smell drifted beyond (our fence line), the people couldn't tell where it was coming from, the rendering plant or us or both or what. And, in my opinion, not many complaints against us were legitimate complaints, but we knew we had a problem. That was the end result. The furnaces could work but they could not take care of all of the sludge, and it was so expensive that we couldn't afford it. But the lagoons definitely did not work.⁶⁹

Ralph Trujillo, a retired plant operator, said there was no safety committee in those early days as there is now:

When we used to clean the furnaces, we used to come from the top floor, and we used to have fill up these 55-gallon barrels with sludge. And we used to have to bring the barrels down flights of stairs from the top. They didn't have a hoist or anything like that, so we would drag the barrels down, step by step, and a number of us got hurt. It was hot, it was very hot.⁷⁰

Other scary jobs included cleaning the inside of the sludge furnaces and cleaning the clarifiers, Trujillo said. "We usually had to get into the clarifiers while they were in service and step on the channel and clean the sides and the floor with a deck brush," he said.⁷¹

"That job was very hard. People would come and they would work for an hour or two and then quit. Nobody liked it. The turnover was so unbelievable...They would work for an hour or two, and they didn't like getting dirty with the ash or the water or like that."⁷²

"It was hard to get people then because the work was hard," said Employment & Retirement Plan Administrator José I. Padilla,⁷³ who was then a plant operator. "Joe Woodley hired anyone who qualified. He didn't discriminate against anyone. He had to keep enough people on the payroll to get the work done."

Arne Holst, a retired engineer who started at Metro in 1969, said the way the furnaces were designed required moving a lot of sludge.

We moved the sludge from the basement to the top of the furnace and back down through the furnace and then took some of that dried product and made it go around again in a circle. It moved at a high velocity in a stream of hot air from the furnaces. Dried sludge was very abrasive, and so the pipes



This construction photo dated April 22, 1966, shows the sludge furnaces that were installed in the Process Building.

just wore themselves out. I needed to find a way to cut out the worn pieces and put back in new pieces. These weren't straight pipes. They had lots of elbows and bends. We made drawings to have the replacement pieces constructed and flanged together so we could do it again next time. The pipes were 10- to 12-inches in diameter. They were fairly lightweight construction compared to water lines. The only problem was the furnaces were not capable of burning all the sludge because it was too wet. There was too much moisture left in it by the time it went through the vacuum filter process.⁷⁴

State health officials would not permit the Metro District to dump the sludge into the river. The incinerators were eventually

restored to partial use, and sludge had to be trucked away to the old Lowry Bombing Range 28 miles away. Some sludge was used on Denver city parks. The daily costs for sludge hauling was \$1,200 until all three furnaces were modified.

The board approved a lawsuit against Metro Engineers, the joint venture of Phillips-Carter-Osborn, Inc., Ken R. White Consulting Engineers, Inc., and Henningson Durham Richards, Inc. (now HDR), over the furnace design. The firms contended the moisture content of the sludge caused the failure. It required running the equipment at higher capacity and resulted in higher maintenance and down-time for cleaning and repairs. The Metro District thought otherwise. The Colorado Air Pollution Control Board took the Metro District to task.

Metro applied for and received a conditional variance until the necessary equipment was installed in 1971. Despite these problems, Metro was treating more than 100 million gallons of wastewater a day. The state stream standards required 80 percent removal of biochemical oxygen demand (BOD) and suspended solids (SS), and Metro was averaging 92 percent of the BOD. Metro was also removing more than 88 percent of SS.⁷⁵

During its monthly board meeting in September 1969, former board chairman Charles M. Dosh asked the board to conduct an investigation of Metro's operations for irregularities in personnel practices. He threatened to request a congressional probe if it did not. Dosh, an attorney, had conducted his own 30-day investigation and interviewed 20 employees. In his 12-page report, which he provided to the press and the board, Dosh stated: "Most of the personnel at the plant are disillusioned, discouraged.

Some are angry and resentful. Many are quietly seeking other employment in similar lines of endeavor; this is not easy. Almost all of the men are extremely critical of management. This includes the manager, his chief assistants and other supervisory personnel." Dosh added that the employees "are not treated as rational human beings." He cited numerous problems with the plant and management's attitude toward employees.⁷⁶

Jerry Wingeart resigned as manager of the Metro District after a closed-door executive session lasting more than 90-minutes during the September 1969 board meeting. The resignation was announced at 12:10 a.m. and was effective immediately. Dosh had tried to get Wingeart fired at the August board meeting, but the motion failed in a tie vote. Dosh resigned from the executive committee when the motion failed. At the September meeting, Dosh blamed plant management for poor employee morale, lack of safety programs, and equipment breakdowns and failures. Dosh attacked management's handling of sludge disposal. At one point, Chairman H.C. "Doc" Webber of Arvada asked Dosh if he wanted to go into the matter at that time. Eventually, the board went into executive session to "discuss the position of the manager."⁷⁷

In October 1969, a *Denver Post* article by Dick Johnston, who later came to work for Metro as public information and intergovernmental officer, said, "The District has been in a state of continual crisis for the past year." The article recapped the resignation of District Manager Jerry Wingeart in September and said that Ernest J. Capaldo, the district engineer for the Colorado Department of Health, had tried to contact Metro regarding its inability to handle its business.⁷⁸



Chief Construction Engineer Arne Holst receives an award in 2000 for finding \$80,000 in overbilled electrical charges. Presenting the award was District Manager Bob Hite (left). To Holst's right are Director of Engineering Colin McKenna and Director of Operations and Maintenance Mary Ann Tavery.

Johnston's article said Capaldo had sent Metro a letter saying, "This department is becoming quite concerned with the procrastination of the District in resolving its problems. The District apparently admits that it has an emergency situation, yet from month to month has postponed taking any positive steps to remedy the situation." Johnston noted that Capaldo's letter had taken into account that the Metro, under Wingeart, had made arrangements to truck its sludge to the former Lowry Bombing Range, but took Metro to task because the "sludge incinerators at the plant are violating state and local clean air standards." Capaldo's letter said he had tried to contact Boris Voukovitch, who was

functioning as chief engineer, but Voukovitch said he no longer had any authority to make any decisions about the plant.⁷⁹

Following Wingeart's forced resignation in September, Voukovitch said he saw the handwriting on the wall and resigned at the board meeting in October.⁸⁰

Engineer Arne Holst said:

In 1969, we had our next 100-year flood. Actually, I think that was a little bit less than the other two. The plant was running and it was running well at that time, but we got enough flooding coming down there that we had high water in all of the vessels around the plant site. You have to remember that, at that time, we only had the North plant, and it was reaching 117 mgd (full capacity at that time), and it was up to the top of the walls in most places.⁸¹

1970-Beginning of the decade of the environment

The world celebrated the first Earth Day in April 1970 as the Metro District continued to struggle with its overloaded plant and how to manage its sludge.

The Colorado Water Pollution Control Commission began the year by criticizing the Metro District's lagging attempts to rectify problems at its overloaded plant. Tom Ten Eyck, the commission chairman, said, "We're not at all impressed they're making any progress at all." Ernest Capaldo, a Colorado Health Department district engineer, said, "I can't really say the plant is not polluting the (South Platte) river when it is overloaded." According to Frank Rozich, the commission's technical secretary, the effluent was meeting water standards

at the time. Commissioner Howard V. Lewis disagreed with Capaldo's report, stating, "They're working on it. You just can't push a button in a big plant and expect something to happen."⁸²

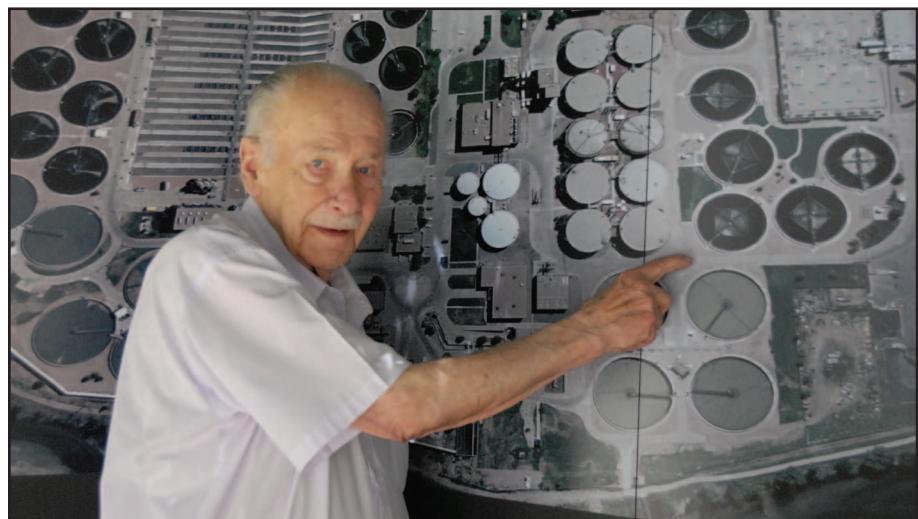
Of the sludge problem, Holst said:

After firing all the management, the board of directors was in a lot of turmoil, and there was some political pressure. An engineering company was hired to fix the furnaces. That was the Cross Brothers. They came up with some good pollution fixes. I got involved in executing construction on the fixes. They were the ones who designed it all. None of it was enough volume to do any good, though, so we moved to trucking the sludge out to the Lowry Bombing Range. That was in...the early part of 1970, and we had to get the sludge out of the process building. We would put it in a minor pump and pump it through a tube and then we could move it to trucks. That worked, but with a price. We ate up most of the stators for that size pump that were available in all of the United States in the winter time.⁸³

With sludge handling continuing to be a serious problem, an Adams County Grand Jury recommended the Metro District employ epidemiologists to ensure semi-treated sludge from the plant did not create a health hazard. Metro was trucking the sludge to the old Lowry Bombing Range. The burning sludge at the Treatment Plant violated state air pollution standards by not meeting the Ringlemann 2 test. The Colorado Grand Jury recommended changes to the Colorado statute that created the District to make the function of the directors and District management clearer. It also recommended reducing the size of



In 1969, the Metro District built two lagoons in which to try to solar dry its sludge. The experiment failed. The sludge would not dry.



Boris Voukovitch points to a photo showing where the lagoons were.



Sludge is disposed of by applying it to the land where the South Aeration Basin now sits.

the board from 42 to a more manageable number. The Grand Jury investigation found there were no adequate lunchrooms and that many employees ate on the job, a possible health hazard. Employees reported no job security, no formal training, no preventative maintenance, and no stockpile of spare parts.⁸⁴

By March, the Metro District was hauling 500-700 wet tons of sludge to the former Lowry Bombing Range each day at a cost of about \$2,000 a day. There was a proposal to dump it at the Rocky Mountain Arsenal instead by Metro, which would have cut the drive distance in half. Problems, it was said, had plagued Metro since it began operations in 1967. Until stopped by the Colorado Department of Health, sludge was being dumped into the South Platte River. Next, lagoons were used until area residents complained about odors.⁸⁵

The Colorado Public Expenditures Council, a watchdog group, complained about the unwieldy management, something that could not, according to state statute, be changed until 1971. Heavy incinerator smoke violated air pollution laws.

Joe Woodley, who had served as acting manager since September 1969, had taken some positive steps to break the plant's apparent "jinx," including hiring more maintenance employees, reconditioning equipment, varying treatment processes, modifying furnaces, and adding polymer. A newspaper article talked of the possible addition of a thermal conditioning process called the "Porteous Process" (which was demonstrated at Metro in 1969⁸⁶) for the sludge. Metro's problem was compared to that of a plugged toilet. "Anybody knows you either stop using the toilet or get it fixed," a Metro District director said. "We can't stop using the plant, and fixing it takes a long time. In the meantime, we've got a mess—a very expensive mess."⁸⁷

Carl Calkins, who then worked in the lab, said the lagoons smelled like "unkept cat boxes." He said Metro put up 8- or 10-inch manifolds with holes in them around the plant, and lab personnel conducted odor testing. "The best masking odor was Feeler's bubblegum odor, the sweet, fruity thing. So, we had this fetid cat box bubblegum odor that we hit our neighbors with. It was a real gagger," Calkins said.⁸⁸ He continued:

The concentrator couldn't process the waste-activated sludge. The furnaces couldn't filter and burn the waste-activated sludge. The reason we had these lagoons was they couldn't concentrate it because the pumps we got with



In this 2007 photo, three 40-year employees got together to talk about the changes they had seen. Left to right: Jim Carabajal, Ray Montez, and Steve Trujillo.

it weren't good for pumping thick, viscous material, and it was very, very difficult and expensive in chemicals used to filter and mix sludge with waste-activated sludge. So it went to the lagoons and it went to the river through the weir. It was all measured, you know. No midnight dumping here. But I think our discharge permit at the time allowed us something like 40 mg per liter of suspended solids. And we would come up with 38, 36, 39. So to the extent that solids could (legally) go into the river, they went in the river legally. That was one reason I left. That really irked my environmental soul. Not that you could do much about it.⁸⁹

"The major problem was the air pollution," said the late Allen Jones, a long-time board member who represented Baker Sanitation District for years and then later represented

Westminster. "You know what a Ringelmann (visible pollution) scale is? That's going back. Maybe nobody in the whole world remembers that anymore. The air emissions just never met standards. And I tell you the truth, I don't remember what all we got involved with to alleviate those problems. But eventually we worked them out."⁹⁰

The Metro District received a \$17,056 contract from the U.S. Labor Department for a waste treatment plant operator training program. The program was to provide skilled workers "for the fight against water pollution, provide better paying skills for trainees, and new employment opportunities for about 90 new workers." The contract, part of a \$1,031,000 nationwide program, was to provide training for 24 plant operators in Colorado.⁹¹

"I was one of those who were trained under that contract," said José Padilla, who began work at Metro on September 30, 1968. "Al Jacobs was my supervisor."⁹²

At the August 1970 board meeting, the executive committee changed the board's structure, eliminating some 15 small committees and substituting three main committees responsible to the executive committee: operation and maintenance, budget, and legislative. The new structure also required the manager and legal counsel to report to the executive committee. William E. Korbitz, a civil engineer, was introduced as the new District manager. He told the board the first correspondence he had received as district manager was the 10-day notice from the International Union of Operating Engineers (IUOE), Local No. 1, that its members intended to strike on September 1 at 12:01 a.m.⁹³

True to its word and in contrast to the no-strike promise executed when the union was being organized, IUOE, Local No. 1, bargaining unit employees struck Metro at 12:01 a.m. on September 1. Plant operations (TSS removal, BOD removal, and total treatment) were reported as “excellent” at the September 15 board meeting, which was about the midway point in the 35-day strike.⁹⁴

An undated newspaper article (most likely from the Sept. 5 *Denver Post*) provided by Assistant Maintenance Superintendent Jim Carabajal said the plant was “operating Friday better than it has in the past despite a four-day strike by 90 operations and maintenance workers.”⁹⁵

A *Denver Post* editorial during the strike criticized the General Assembly because there was not a no-strike law in place. The editorial emphasized the essential public health nature of Metro’s task.⁹⁶

Carabajal, who had joined Metro on February 16, 1967, said he was a member of the bargaining unit at the time of the strike and a member of the union negotiating team. In the early days, there were 20-25 operators a shift, two electricians, two mechanics, and one oiler. He said he clearly remembers the strike vote. Although it came out about 4-to-3 to strike, he said some union members were forced to vote for the strike, but he believes most members would rather not have struck. He said he thought it was frivolous and the union couldn’t win.⁹⁷

Retired Maintenance Superintendent Jerry Lee was also a union member then. He started at Metro on May 6, 1968, and retired

in 2005. He was working as an operator at the time of the strike. He said he was forced to go on strike and didn’t support it.⁹⁸

The Tri-County District Health Department became concerned that, during the strike, Metro would not be able to operate the plant in compliance with Colorado Health Department water quality standards. The Tri-County District Health Department’s concerns had prompted Adams County District Judge Oyer G. Leary to issue a court order prohibiting Metro from dumping raw or improperly treated sewage into the South Platte River.⁹⁹

Governor John Love, responding to fears expressed by many citizens, said he would call out the National Guard if necessary to operate the Metro treatment facility. A *Denver Post* editorial on



In this September 1970 photo, District Manager Korbitz mows the grass during the strike.

September 4 said that the governor's call-out-the-guard plan was "silly" because the only kind of plant the guardsmen knew how to operate was a very small facility such as the one that served the Buckley Air National Guard Base (now Buckley Air Force Base).¹⁰⁰ A *Rocky Mountain News* article a couple of days later said the plant was operating at about 10 percent above the standards.¹⁰¹

Union representatives told the newspapers that the reason for the strike was Metro's refusal to bargain over a union-prepared manpower chart that sought to establish specific quotas for the number of employees needed for each type of bargaining unit job. Metro Board Chairman Ed Hoskinson of Arvada said Metro would discuss such a chart—called a manning chart—but was not required to accept the union's proposed chart.¹⁰²

Bill Korbitz, who had begun in August as the new district manager, said some of the board wanted to force the strikers to come back. Korbitz advised them not to, and the Mountain States Employers Council agreed.¹⁰³

During the strike, 28 supervisory, administrative, and laboratory personnel operated the plant. They worked 12-on, 12-off shifts, seven days a week. Calkins remembers getting off once to get a haircut: "I took two hours off to get a haircut. It felt like a holiday in Spain."¹⁰⁴

The supervisory, administrative, and laboratory personnel did the work of running the plant. Korbitz was only allowed to mow the lawn during the strike. He said the strike was a good way to break into his job. He learned more about the people at Metro in a few weeks than he would have in years under other

circumstances. Korbitz said the union-proposed manning table would have required a minimum number of people per shift. "It means, in effect, that every time management wanted to change its operations, it would be a negotiable item. It would actually take management out of the hands of management." He believes he was vindicated in this position because, after the strike, about a third of the union positions were eliminated.¹⁰⁵

During the strike, Leroy Gonzales' job (for the union) was to make sure Metro was not bypassing untreated sewage to the river. "My job when picketing was to watch the bypass," said Gonzales, now a supervisor in the Transmission Division. "I made sure the District wasn't bypassing. If it was, the union would use that information. I saw no bypassing in the time of the strike," he said.¹⁰⁶

Metro benefited later on from the experience gained by those who kept the plant running during the strike. Calkins said his work as an operator then helped him later on.

As a "lab scab," I got to work as a plant operator, and that I think gave me an excellent feel for plant operations. I worked in the primaries. We pumped sludge, pumped grease, and I worked in the concentrator so I could see the hassle of concentrating this stuff. I also got to work in the secondaries. I think that's what helped me the most in the last part of my career. Because I knew what the place was about.¹⁰⁷

Retired engineer Holst said the strike

...changed our knowledge of what needed to be done on the plant site. The numbers of operators kept changing downward and numbers of maintenance people and mechanics like

craftsmen and laborers went upward. Those proportions still exist. (The strike) made all of the staff know a whole lot more about the plant. I got to change a bearing on a furnace, and I had never done anything like that before. I also got to run the DAF building. We were on 12-hour days, seven days a week.¹⁰⁸

Metro's board met in special session September 29, 1970, to approve the District's final offer to the union and to invite striking employees back to work. The highest rate of pay was for a master mechanic, which paid \$5.59 an hour. The lowest was janitor at \$2.88 an hour.¹⁰⁹

Bargaining unit employees who had been on strike returned to work on October 5, 1970.¹¹⁰ Board Resolution 1170-7d in the November board minutes commended the 28 "administrative, supervisory and laboratory personnel" who operated the plant during the strike and directed that a copy of the commendation be put in their personnel records. The resolution said the strike lasted from September 1 to October 3.¹¹¹

After the strike, Korbitz said management held a number of meetings with bargaining unit employees. He also allowed a touch football game to be played between management and union employees. Calkins said the grudge match became known among employees as the Sludge Bowl.¹¹²

Korbitz said he went too far out for a pass during the game and fell. Something snapped and he cracked a rib. No matter what his injuries were, however, he felt he had to come to work the next day even though he would have given anyone else permission to be off with such an injury. He felt it was a "must-do" situation for him.¹¹³



Dave Devanney was one of the first lab technicians hired at the Metro District and quarterback of the management team during the famed Sludge Bowl.

Calkins said he doesn't remember who won the grudge match, but that some of the feelings were intense, as was the play on the field. "It was played...where the east blower building is now. It was tag football, but...there was some pretty intense blocking going on. Dave Devanney was our quarterback. He was pretty good."

Calkins said the word was out among the non-union participants that, no matter how banged up they felt, they needed to show up at work the next day. He said he was very sore, and "to drive to work, I had to use my arm to lift my leg so I could use the clutch."¹¹⁴

The union never struck again.

Koritz, a civil engineer by training, said the problems Metro was experiencing with sludge management were already present when he was hired. The decision to dispose of sludge by using drying furnaces to dry it into a material that Denver communities could put on parks had been made. Precedent existed for this both in Denver and in other cities, but Metro's furnaces were drying furnaces, not incinerators, and they were a constant problem to maintain. Corrosion was pervasive. If it was to have been burned, the sludge should have been incinerated in open hearth furnaces, not drying furnaces. The furnaces were forced to do something they weren't designed for. Koritz said he was proud of having helped lead Metro toward a solution to its sludge management problem during his 10-year tenure as manager.¹¹⁵

At the end of 1970, Metro's board excluded an area in northern Westminster's Big Dry Creek drainage. That area was to be served by a 1-mgd facility that Westminster wanted to build. Metro allowed the exclusion because it was economically infeasible for Metro to serve at that time.

Ushering in a new era of environmental control, the U.S. Environmental Protection Agency opened its doors in Washington, D.C., on December 2, 1970.

ENDNOTES

¹ "\$17.3 Million Metro Sewer Plant Groundbreaking Set." *Rocky Mountain News*, September 9, 1964, pg. 4.

² *Ibid.*

³ Boris Voukovitch, Interview, November 8, 2005.

⁴ Boris Voukovitch, Interview, November 8, 2005.

⁵ Board Minutes, October 20, 1964, pp 2, 5, 7.

⁶ Board Minutes, November 17, 1964, pgs 2, 3, 4, 7.

⁷ Boris Voukovitch Interview, November 8, 2005.

⁸ Metropolitan Sewage Disposal District No. 1, Minutes of December 15, 1964, Meeting of the Board of Directors, pp 6, 7, 15, 16, 20.

⁹ Boris Voukovitch Interview, November 8, 2005.

¹⁰ "Sewage Treatment Plant Under Way on South Platte." *Denver Post*, January 21, 1965, p. 46.

¹¹ Sprengelmeyer, M.E., "1965 flood left deep scars along South Platte." *Rocky Mountain News*, Dec. 14, 1999. Downloaded June 23, 2007, <http://denver.rockymountainnews.com/millennium/1214mile.shtml>.

¹² Boris Voukovitch, Interview, November 8, 2005.

¹³ Arne Holst, Interview, March 17, 2005.

¹⁴ Arne Holst, Interview, March 17, 2005.

¹⁵ *Civil Engineering*, December 1965, p. 64-66.

¹⁶ *Denver Post*, January 30, 1966, p 57.

¹⁷ *Denver Post*, March 27, 1966, p 76.

¹⁸ "Metro Sewage Plant Near Finish." *Rocky Mountain News*, April 3, 1966, p. 10.

¹⁹ Baird Smith, E-Mail Interviews January 10 & 18, 2005.

²⁰ *Ibid.*

²¹ *Ibid.*

²² Carl Calkins, Interview, October 28, 2004.

²³ "\$3.3 Million Proposed, Action Delayed on Sewer Budget." *Denver Post*, June 22, 1966.

²⁴ "Officials Plan Tour of New Sewage Plant." *Rocky Mountain News*, May 13, 1966.

²⁵ "More Study Asked: Area Sewer Budget Delayed." *Denver Post*, May 18, 1966.

²⁶ "Sewage Switchover Forecast in 10 Years," *Denver Post*, May 22, 1966, p. 35.

²⁷ Boris Voukovitch, Interview, November 8, 2005.

- ²⁸ "Operation Starts in Fall, Sewage District Budgets \$5,490,142," *Denver Post*, July 20, 1966, p. 51.
- ²⁹ "Metro, Aurora Need Each Other," *Denver Post*, August 10, 1966.
- ³⁰ "Federal Funds Cutoff, Water-Sewer Deadline '68," *Denver Post*, August 17, 1966.
- ³¹ "Sewer Line Contracts Awarded." *Denver Post*, October 19, 1966.
- ³² "Aurora Will Join Sewage Disposal Dist. 1." *Denver Post*, October 27, 1966.
- ³³ "Sewer Unit Tie-In Okd By Aurora." *Denver Post*, November 24, 1966, p. 40.
- ³⁴ Boris Voukovitch, Interview, November 8, 2005.
- ³⁵ *Ibid.*
- ³⁶ "Bid Accepted On Sewer Line." *Denver Post*, November 16, 1966.
- ³⁷ "Two More Members—Sewage District Expanding." *Denver Post*, January 18, 1967, p. 25.
- ³⁸ "Bill Would Expand Sewage Dist. Powers." *Denver Post*, February 14, 1967.
- ³⁹ "Combination Waste Disposal Suggested." *Denver Post*, February 14, 1967.
- ⁴⁰ "Metro Sewage Plant Dedication Slated." *Denver Post*, March 22, 1967.
- ⁴¹ "Sewage Troubles Analyzed," *Denver Post*, April 14, 1967, p 20.
- ⁴² "Dedication is Sunday for \$17 Million Plant Facilities of Metro Sanitation District," *Westminster & District 50 Journal*, May 18, 1967, p 2.
- ⁴³ "Sewage Plant to Be Dedicated," *Denver Post*, May 19, 1967.
- ⁴⁴ "The factory that cleans water," Empire Magazine, *Denver Post*, May 21, 1967, pp 38-42.
- ⁴⁵ *Ibid.*
- ⁴⁶ *Ibid.*
- ⁴⁷ "Board Meeting: Metro Sewage Budget Offered," *Denver Post*, May 24, 1967.
- ⁴⁸ "Metro Board Votes Budget of \$4.1 Million," *Denver Post*, July 1967.
- ⁴⁹ "Metro Sewage Dist. Picks Chief," *Denver Post*, August 2, 1967.
- ⁵⁰ Metropolitan Sewage Disposal District No. 1, 1967 Annual Report, n.p.
- ⁵¹ "Brightonites Give Thanks," *Denver Post*, December 2, 1967.
- ⁵² Metropolitan Sewage Disposal District No. 1, 1967 Annual Report, n.p.
- ⁵³ Metropolitan Sewage Disposal District No. 1, 1967 Annual Report, n.p.
- ⁵⁴ Metropolitan Sewage Disposal District No. 1, 1967 Annual Report, n.p.
- ⁵⁵ Metropolitan Sewage Disposal District No. 1, 1967 Annual Report, n.p.
- ⁵⁶ Metropolitan Sewage Disposal District No. 1, Minutes of January 16, 1968, Meeting of the Board of Directors, p 8. "Bill Need Told in Metro Sewage Case," *Denver Post*, February 21, 1968.
- ⁵⁸ Metropolitan Sewage Disposal District No. 1, Minutes of the March 19, 1968, Meeting of the Board of Directors, p 2.
- ⁵⁹ Metropolitan Sewage Disposal District No. 1, Minutes of the April 16, 1968, Meeting of the Board of Directors, p 16.
- ⁶⁰ "Sewage Board Accepts Union." *Denver Post*, February 19, 1969.
- ⁶¹ Mary O'Dell Thurber, Interview, January 12, 2006.
- ⁶² Metropolitan Denver Sewage Disposal District No. 1, Minutes of the February 18, 1969, Meeting of the Board of Directors, n.p.
- ⁶³ Metropolitan Sewage Disposal District No. 1, Minutes of the May 21, 1968, Meeting of the Board of Directors, p 8.
- ⁶⁴ Metropolitan Sewage Disposal District No. 1, Minutes of the August 20, 1968, Meeting of the Board of Directors, p 3.
- ⁶⁵ "Ruling on Water Use its Sewage District," *Denver Post*, August 30, 1968.
- ⁶⁶ "Work Started on Aurora Sewer Line Hookup." *Denver Post*, September 17, 1968.
- ⁶⁷ "Sewage disposal fees based on content of user flow and volume," *Syracuse Herald-Journal*, August 26, 1970.
- ⁶⁸ Boris Voukovitch, Interview, November 8, 2005.

- ⁶⁹ *Ibid.*
- ⁷⁰ Ralph Trujillo, Interview, Summer 2005.
- ⁷¹ *Ibid.*
- ⁷² *Ibid.*
- ⁷³ *Ibid.*
- ⁷⁴ Arne Holst, Interview, March 17, 2005.
- ⁷⁵ "Sewage disposal fees based on content of user flow and volume," *Syracuse Herald-Journal*, August 26, 1970.
- ⁷⁶ "Attorney Charles Dosh: Sewage District Board Member Asks Operation Probe," *Denver Post*, September 17, 1969.
- ⁷⁷ "Sewage Manager Quits After Board Uproar," *Denver Post*, September 17, 1969.
- ⁷⁸ "Sewage group: Bid for probe to be studied," *Denver Post*, October 21, 1969.
- ⁷⁹ *Ibid.*
- ⁸⁰ Boris Voukovitch, Interview, November 8, 2005.
- ⁸¹ Arne Holst Interview, March 17, 2005
- ⁸² "Plant Overload: Sewage Dist. Under Attack," *Denver Post*, January 1970.
- ⁸³ Arne Holst Interview, March 17, 2005.
- ⁸⁴ "Health Hazard Feared: Jury Blasts Adams Sludge." *Denver Post*, January 1970.
- ⁸⁵ "Arsenal Land Eyed for Sewage Dump," *Denver Post*, March 8, 1970.
- ⁸⁶ Arne Holst Interview, July 6, 2007.
- ⁸⁷ "Arsenal Land Eyed for Sewage Dump," *Denver Post*, March 8, 1970.
- ⁸⁸ Carl Calkins, Interview, October 28, 2004.
- ⁸⁹ Carl Calkins, Interview, October 28, 2004.
- ⁹⁰ Allen Jones, Interview, January 4, 2006.
- ⁹¹ "Metro Sewage District Gets Training Grant," Cervis, February, 1970.
- ⁹² José Padilla, Interview, February 4, 2008.
- ⁹³ Metropolitan Sewage Disposal District No. 1, Minutes of the Aug. 20, 1968, Meeting of the Board of Directors, p 5.
- ⁹⁴ Metropolitan Sewage Disposal District No. 1, Minutes of the September 15, 1968, Meeting of the Board of Directors, p 2.
- ⁹⁵ Undated newspaper articles from the time of the September 1970 strike provided by Jim Carabajal.
- ⁹⁶ "Why No Sewage Plant Strike Law?" Editorial, *Denver Post*, Sept. 4, 1970.
- ⁹⁷ Jim Carabajal, Interview, March 10, 2005.
- ⁹⁸ Jerry Lee, Interview, April 7, 2005.
- ⁹⁹ "Court prohibits dumping sewage into South Platte," *Rocky Mountain News*, September 5, 1970.
- ¹⁰⁰ "Why No Sewage Plant Strike Law?" Editorial, *Denver Post*, September 4, 1970.
- ¹⁰¹ Undated newspaper articles from the time of the September 1970 strike provided by Jim Carabajal.
- ¹⁰² Undated newspaper articles from the time of the September 1970 strike provided by Jim Carabajal.
- ¹⁰³ William E. Korbitz, Interview, January 11, 2006.
- ¹⁰⁴ Carl Calkins, Interview, October 28, 2004.
- ¹⁰⁵ William E. Korbitz, Interview, January 11, 2006.
- ¹⁰⁶ Leroy Gonzales, Interview, December 2, 2004
- ¹⁰⁷ Carl Calkins, Interview, October 28, 2004.
- ¹⁰⁸ Arne Holst, Interview, March 17, 2005.
- ¹⁰⁹ Metropolitan Sewage Disposal District No. 1, Minutes of the September 29, 1970, Special Session of the Board of Directors.
- ¹¹⁰ Metropolitan Sewage Disposal District No. 1, Minutes of the October 20, 1970, Meeting of the Board of Directors, n.p.
- ¹¹¹ Metropolitan Sewage Disposal District No. 1, Minutes of the November 1970, Meeting of the Board of Directors, n.p.
- ¹¹² Carl Calkins, Interview, October 28, 2004.
- ¹¹³ William E. Korbitz, Interview, January 11, 2006.
- ¹¹⁴ Carl Calkins, Interview, October 28, 2004.
- ¹¹⁵ William E. Korbitz, Interview, January 11, 2006.



OVERFLOWS TO SOUTH PLANT START-UP, 1971-1977

1971-Helter Skelter Dominates the News

Helter Skelter murderer Charles Manson and three of his followers were convicted and sent to jail in 1971, and huge anti-Vietnam war protests were staged in Washington, D.C. and San Francisco. The average person also began to express concerns about the environment.

With the 35-day strike by the International Union of Operating Engineers behind it, Metro focused again on how to do its job. The total annual flows of the primary and secondary treatment facilities had reached more than 90 percent of design capacity, and flows during peak two-week periods reached 115.9 percent of primary design capacity and 108.9 percent of secondary design capacity. From May through September, the hydraulic capacity of both primary and secondary treatment facilities was exceeded during peak flow periods. Metro's ability to remove solids had decreased because of increased growth of the Denver metro area. Growth, however, continued unabated. The overcapacity problem would get worse before it got better.

In this northeast-to-southwest photo of the Metropolitan Denver Sewage Disposal District No. 1 treatment plant as it appeared in 1971, smoke can be seen rising from the sludge drying furnaces in the sludge processing building south of the secondary clarifiers, and empty fields can be seen further to the south. Also note the greenhouses at the left side of the photo.

Notwithstanding the diminished plant capacities, Metro operations met or beat the state standard of removing at least 80 percent of the biochemical oxygen demand (BOD) more than 80 percent of the time in 1971. But during the peak flow hours of weekdays, the BOD removal requirement was not met. The Metro and Denver North Side primary treatment facilities combined with the Metro secondary treatment facilities attained an overall BOD removal in 1971 of 84.6 percent.

Metro's 1971 annual report said the earliest possible date additional treatment facilities could be built and put into operation was 1975. Flows by then were expected to grow to approximately 122 percent of the design capacity of the original treatment works. The continuing growth seen in the future led the District to retain an engineering consulting firm in 1971 to prepare a feasibility study of means to satisfy future demands.

From the time the Treatment Plant first began serving Metro's member municipalities in 1967 until August 1971, the main way sludge had been disposed of was through incineration, although that part of Metro's system was nearing its end. Early in the year, only sludge that could not be burned was dewatered to 16 percent solids and trucked to the old Lowry Bombing Range where it was incorporated into the soil.

Inadequate capacity, stringent state air pollution standards, and numerous, continuing mechanical problems prompted the District to abandon the incinerators. The need to shut down the incinerator/drier units in 1971 because of increasingly stringent Colorado air pollution standards meant that, beginning in August 1971, all sludge produced at the Metro and Denver North Side Treatment Plants would be trucked to the Lowry site where it would be recycled into the land.

In June 1971, Metro received notice from the Rocky Mountain Arsenal that the Army had denied its request to experiment with disposing of dewatered sludge at the Arsenal. The Army refused because detoxification procedures at the Arsenal were due to begin soon thereafter.¹

The search for better methods

The Metro District staff began three research projects in 1971. These projects would help to reduce operating costs and determine the feasibility of applying certain developing pollution control technologies to the Denver area and to the Metro facilities in particular.

In a joint effort with the Martin Marietta Corporation, Metro tested the use of pure oxygen rather than conventional air in secondary wastewater treatment. This research indicated that pure oxygen might be used as an interim measure to extend the capabilities of the District's existing secondary treatment facilities. It looked promising enough to influence the design of additional facilities needed at the Metro plant.

Colorado State University faculty members directed the Metro staff in research on beneficially recycling liquid

sewage sludge and sludge cake beginning in June 1971 near Watkins, Colo. The early results were promising. They showed that recycling sludge to land as a soil amendment would eventually be the most economical and environmentally beneficial method for the metropolitan Denver area.

Planning for the future

The Metro District began to establish a comprehensive preventive maintenance program in 1971. This new system stressed servicing equipment on a routine, scheduled basis. The result was minimal equipment breakdown and operational disruption.

Retired Maintenance Superintendent Jerry Lee, who began work at Metro in May 1968 as a general industrial maintenance worker, said Metro's facility was fairly new when he came to work and that Metro had no established maintenance program. "There was just a guy who did inspections and minor things," Lee said.²

"The Metro District had to establish a maintenance program," Lee continued. "The theory was that the plant was new and there was no need for maintenance. A few years later, we needed a maintenance program."³

In 1971, Lee was a supervisor in operations. He and a few other supervisors moved into maintenance when the program was established. He says they were sent to a couple of schools to help get them ready for their new duties. "We needed to get to a certain level then," Lee said. He spent the rest of his Metro career in maintenance.

Growth and ever-increasing flows were pushing Metro to move to build additional facilities as soon as possible. The



Retired Maintenance Supervisor Jerry Lee started at the Metro District in 1968 as a general industrial maintenance worker.

District hired Cornell, Howland, Hayes & Merryfield, Inc. (now known as CH2M Hill) in September 1971 to project the District's needs out to 1985 and develop preliminary layouts and cost estimates of the additional facilities needed.

In July 1971, the special counsel Metro had hired to pursue a possible cause of action against Metro Engineers for the sludge disposal design quit. Metro's board decided not to pursue any "cause of action against potential defendants in matters arising out of the construction of the main sewage plant."⁴

Metro also began playing a major role in the development of the Denver Regional Water Quality Management Plan. This plan provided Denver area officials a good perspective on future needs for wastewater treatment facilities and proposed use of capital and operating resources to meet these needs. Metro independently prepared a long-range (30-year) master plan and provided a detailed five-year budget program that began in 1971.

Robert W. Hite joined the Metro District board in 1971 as a representative of Denver. He became chairman of the board in the early 1980s and District manager in 1988, serving until his death in December 2007.

Metro exceeds its capacity in 1972

In October 1972, then-President Richard Nixon signed the Clean Water Act. This new law changed everything about how wastewater treatment agencies would do business from then on and began to impact the Metro District soon thereafter.

The Metro District's flows exceeded the treatment system's capacity in 1972, with average primary flows of 32 mgd and average secondary flows of 116 mgd. Consulting engineers CH2M re-rated the District's secondary average design capacity, reducing it from 117 mgd to 98 mgd because of historical secondary clarifier performance.

Metro exceeded the hydraulic capacity of its primary treatment facilities for the first time. It exceeded the hydraulic capacity of the secondary treatment facilities more than ever before. Both primary and secondary facilities saw hydraulic capacity exceeded by more than 16 percent, and the organic loadings were at 98.6 percent

of the design capacity. Metro determined that the total results of treatment were still good on a daily basis even though they did not meet Colorado water quality requirements during the peak four hours of most days. Long-range planning forecasts showed the growth trend for primary flows would continue unabated until about 1980 when the primary flow was projected to level off.⁵

The District also reported that both biochemical oxygen demand (BOD) and suspended solids (SS) removal performance had decreased since 1969. Flows in excess of design capacity and inadequate sludge processing capabilities contributed jointly to this gradual decline in solids removals.⁶

District Manager Bill Korbitz told board members that although Metro's facilities continued to be taxed over-capacity, efforts to provide adequate planning, facilities construction, and facilities operation and maintenance had resulted in substantial progress in these areas.

The board prepared for a \$25 million bond election in 1973. Its passage would be a major step toward alleviating the over-capacity operation conditions. The bond money would finance the local portion of the total cost.

The board also approved a six-year construction program, including \$96.6 million of construction. Predesign work for what would eventually become the South Plant proceeded on schedule during 1972. CH2M presented the engineering predesign report for plant expansion in May, and Metro hoped the first advertisement for bids on the construction contract would go out by the end of September 1973.



Alfalfa yields resulting from tests of land-applied liquid sludge in eastern Colorado.

Metro continued to expand and solidify its comprehensive preventive maintenance program in 1972 after more than a year of preparation. Manager Bill Korbitz said, "Early results are encouraging and indicate that major breakdowns can probably be eliminated, and down time of equipment due to lack of maintenance can be virtually eliminated."

The workload for maintenance personnel stabilized after the program's implementation, and the amount of overtime and call-in time was appreciably reduced. There were no major shutdowns of plant processes in 1972 due to inadequate maintenance or unexpected breakdowns.⁷

Sludge handling research

The District continued to pursue a vigorous research program as well, including using sludge as a soil amendment. The agricultural research included greenhouse studies, developing a two-acre research project, and using approximately 100 acres of full-scale dryland wheat research. The pure oxygen research looked into its use for aerobic digestion of waste-activated sludge and for biological treatment of wastewaters. Increased emphasis was placed on upgrading biological treatment process control in order to achieve a high degree of performance.

The District implemented a new five-year program budget in 1972 in preparing for the 1973 budget. Metro's hope was that the five-year program budget would let the board adopt each annual budget while understanding the implications of that budget in connection with the required expenditures for the next four years.

Metro also advanced its Long-Range Planning Study in 1972 to a point at which the first annual report to the board of directors was

scheduled for early 1973. Additionally, Metro contributed to the Denver Regional Council of Governments' Regional Water Quality Management Plan, both in terms of money and in-kind services.

The City of Golden was admitted as a new member on August 15, 1972, bringing the number of directors on the board to 50. Fruitdale Sanitation District was also being processed for full membership in the District.⁸

Metro's unit costs, 1967–1972

By 1972, costs per million gallons processed had increased by 22 percent since 1967. This increase compared to a 25 percent consumer price index increase in the Denver area over the same time interval. The major cost increase during the previous five years was in sludge processing. Costs there rose from \$27 per million gallons in 1967 (when not all sludge was vacuum filtered and incinerated) to a high of \$45 per million gallons in 1970. In 1972, sludge disposal unit cost declined to \$40, because the sludge was not incinerated but was trucked and incorporated into the soil. There was some sludge volume reduction through aerobic digestion of waste-activated sludge.

In the lab, the workload continued to increase as 14 analysts made 81,500 analytical determinations performed in extremely cramped laboratory spaces. The lab began to investigate a 4-day, 10-hour-per-day work week for its people to help alleviate the overcrowding. The initial results looked promising. Meanwhile, samplers collected 18 samples per 24-hour period for 7 consecutive days once a month for each connector. They used a specially equipped mobile unit allowing them to sample six different locations during each sampling period. Lab work also included

analyzing the samples from the samplers to set the annual charges for each connector. Major equipment additions included both a gas chromatography system that helped Metro manage organic industrial wastes and a specific ion meter with ammonia probe to increase the efficiency of nitrogen measurements.

Over-capacity condition continues in 1973

The big news stories for most Americans in 1973 were the cease-fire in Vietnam and the Watergate scandal in Washington. For Metro, it was more wastewater flowing into the District's Central Plant than it was designed to take. Flows exceeded design capacity by 39 percent. As a result, the final effluent into the South Platte River failed to achieve Colorado Water Quality Standards (30 mg/L BOD and 30 mg/L SS).

The year passed with Metro experiencing several regulatory, technical, and legal delays on the CH2M predesign study report, despite the board's approval and inclination to move forward. Despite setbacks, District Manager Bill Korbitz's letter to the board in the 1973 annual report began:

The District had a successful year in 1973! The \$25 million bond issue won voter approval; federal and state grant monies were committed to the Central Plant expansion project; the treatment performance was optimized by process upgrading, even though wastewater flows increased by 17 percent; a budget surplus of approximately \$119,000 was realized; and employee productivity remained consistently high.

Inflation slammed the Metro District that year as it did everyone else in the country. Its effects and the higher prices increased the

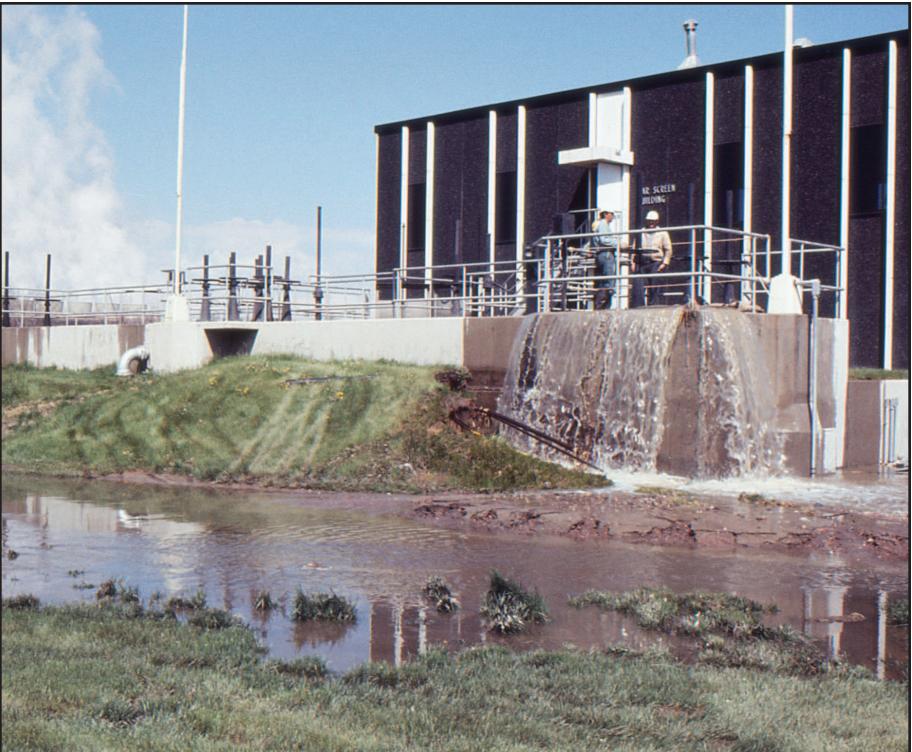
amount Metro had to pay for supplies, materials, electrical power, chemicals, labor, and contract services. Metro also encountered shortages of chlorine, ferric chloride, and stators for pumps. Metro (and most other institutions) worried about the extent to which the rising cost and diminishing availability of these and other critical materials might affect its operational capability the following year.

A May 6 flood of the South Platte River caused extensive damage to Metro's facilities, and Metro had to spend nearly \$302,000 for repairs. On November 5, a major blower failed. This created periodic oxygen sags in the biological treatment process. Six months elapsed before Metro could get and install a replacement.

In 1973, Fruitdale was admitted as a new member, bringing to 54 the number of directors on the district board. The board was also considering admitting approximately an 8-5/8ths section of land in Adams County into the District. Plans for developing this area, which lies east of the Rocky Mountain Arsenal, were being reviewed and considered by the Adams County Board of County Commissioners.

Operational performance

The average daily flows to Metro's treatment facility increased dramatically in 1973. Wastewater flow to the primary treatment facilities increased 25 percent, from 32 mgd daily average to 40 mgd. Flow to the secondary treatment facilities jumped from an average of 116 mgd to 136 mgd, representing a 17 percent increase. This large increase was partially due to the May 6 flood and partially to the continued growth of the metropolitan Denver area. The 1973 daily average primary flows exceeded the design capacity (28 mgd) of the primary treatment facilities by



A flood on May 6, 1973, caused the headworks to overflow.

43 percent, and the secondary flows exceeded design capacity (98 mgd) by 29 percent. The impact of this high hydraulic loading was reflected in treatment process performance.

Although high flows helped cause treatment performance to fall off. Treatment processes improved in 1973, effluent quality continued to get worse because of the extraordinary increase in flows. The 1973 final effluent averaged 40 milligrams per liter (mg/L) of biochemical oxygen demand (BOD) and 57 mg/L of suspended solids (SS), as compared to 36 mg/L BOD and 56 mg/L SS in 1972.

Until January 1973, the Colorado effluent quality standard required 80 percent BOD removal, a level of performance the District exceeded during 1967-1972. New 1973 Colorado standards required that the final effluent not exceed 30 mg/L BOD or 30 mg/L SS. Metro estimated it would not reach this level of performance until it completed the planned expansion in 1976.

In 1973, the cost per million gallons of wastewater treated was \$117. This cost was about one percent less than the unit cost in 1972 and only four percent greater than the unit cost in 1969. The Denver metropolitan area consumer price index increased 22 percent during the same time period, so the small increase in the wastewater treatment unit cost was a bargain—but with a down side. The stability of unit costs between 1969 and 1973 was, to a large extent, a direct result of the dramatic flow increase. Some costs, such as chemicals and electrical power, increased in proportion to wastewater flow increases. Other costs, such as capital investment and grounds work, remained relatively constant. The large increases in flows over design capacity decreased the attainable level of treatment. The lower effluent quality was not easily transferable to monetary terms and was not reflected in the unit costs.

District member costs

Since 1969, the District's annual charges to member municipalities had increased from \$4,023,857 to \$5,774,452, an increase of 43.5 percent. This amounted to an average increase of 8.7 percent per year. The yearly increases in annual charges partially reflected the increases in wastewater flows as well as strength loadings, and partially reflected the increases in the cost of materials,

supplies, and wages, which were part of the general inflationary trend. To the homeowner, however, it is difficult to understand the actual costs of wastewater treatment whether they were expressed in terms of millions of gallons or millions of dollars.

Annual charges for sampling went up in 1973, with the number of sampling locations increasing from 18 to 24. Each station was sampled 18 times per 24-hour period for seven consecutive days at a frequency of approximately once per month. Mobile units let a single Metro crew cover five to seven stations at any one time. The laboratory also performed almost 98,000 analyses, a 20 percent increase from 1972. New laboratory programs initiated included a laboratory quality control system, computerizing calculations for the connector charges, and

laboratory support for compliance with new federal requirements regarding the proposed effluent discharge permit. Lab personnel looked forward to the money from the bond election to help get them more space during the coming plant expansion.

\$25 million bond issue passes

On April 3, 1973, voters of the Metro District approved a \$25 million bond issue by more than a 3-to-1 margin. Although the voter turnout was only about five percent of the eligible electorate, the official final tally showed 24,910 persons voting for and 7,228 against issuing the bonds to pay the local share of a six-year, \$96.6 million improvement and expansion program.

1974-New federal water quality requirements

In news around the rest of the country in January 1974, Patty Hearst, newspaper magnate William Randolph Hearst's granddaughter, was kidnapped by radicals, and Richard Nixon resigned as president in August, making Vice President Gerald Ford the nation's president. Meanwhile, oil prices shot through the roof.

In the Denver metro area, voters approved the \$25 million April 1973 bond issue, and the District's six-year, \$96.6 million construction program finally commenced on April 29, 1974, when Metro District officers and Mead & Mount Construction Company officials signed the central plant expansion contract. Construction of what is now the South Plant began on May 1, 1974. The bond money was needed to finance an ambitious construction program for Metro to catch up with the sharply increased wastewater flows to the District, eliminate raw sewage bypasses, and build the facilities needed for the future. The



In 1972, pot tests were conducted to assess the viability of sludge application to farm land to increase yields.

construction program, initially estimated to cost \$96 million, increased over 100 percent to \$207 million because of changes in regulatory requirements and inflated construction costs.

The first phase of the construction program was to build a 70 mgd expansion for a new plant next to Metro's original plant. The \$25 million contract for this facility was awarded in May 1974 after several delays due to Environmental Impact Statement requirements and a dispute as to which construction firm had submitted the lowest bid. By June 1975, the project was at 50 percent complete and good progress was being made, but the work was slightly behind the expected schedule. During June 1975, the District received and accepted two grant offers for two more high priority projects: anaerobic digesters and the first phase of the Platte River II Interceptor. Metro scheduled construction on these projects to begin in the fall of 1975.

Chlorine leak

In other major Metro events in 1974, the Metro District experienced a serious leak in the Chlorine Building on June 20. District Manager Bill Korbitz said it "scared us."⁹

A large amount of chlorine was released and a number of employees in the plant on the afternoon shift were very scared. The leak also killed carnations in a neighboring greenhouse. Metro ended up paying for the carnations.

Something went wrong during a maintenance procedure on an evaporator, causing the leak. A slug of chlorine with water entrained in it was released. Chlorine gas got into what is now the Technical Services Building through the ventilation system.



Engineer Bill Page checks a flow recorder.

A number of employees responded to the leak, taking precautions and performing actions to prevent injuries and damage to property. Employees and other people in the area were warned so they could vacate the area. There were some injuries. Korbitz praised Bill Martin, who later became the first head of the Resource Recovery and Reuse Department, for taking it upon himself to shut off the valve and stop the leak. Martin then spent the night in a hospital.¹⁰

In addition to Martin, the board also recognized Arne Holst, John Nelson, John Puntenney, George White, and Albert Pothoff for their actions in a resolution dated July 16, 1974.¹¹

Assistant Maintenance Superintendent Jim Carabajal said the gas cloud was substantial. Although it wasn't huge, Carabajal said, people could smell chlorine in the Admin/Lab Building. Air intakes at that time were not designed to be shut down. Over the succeeding years, evacuation plans have been developed. Looking back, Carabajal said, a lot of people were at risk because there were no evacuation or intake shutdown procedures in place.¹²

Compliance schedule

The District also was put on a compliance schedule that was tied to completing the new plant. The effluent quality requirements of the new permit were quite restrictive and were integrated with the District's plant expansion schedule. By August 1, 1976, the permit required that the effluent contain no more than 20 mg/L each of BOD and SS. If the plant expansion was completed by that time, compliance was expected.

District Manager Bill Korbitz characterized 1974 as "a period of efforts and frustrations, progress and delay. The year was filled with successes, but only after overcoming significant problems and challenges. The year was one of change and beginnings."¹³

The flow of wastewater to the District's plant had increased 35 percent in the preceding five years. Korbitz noted that the District had received a federal discharge permit, and the first phase of the District construction program to build the South Plant had begun. The impact of federal wastewater planning

regulations, however, was being felt, and the nation's economy adversely affected District operations and expenses.¹⁴

A secondary treatment system blower that failed in late 1973 hurt effluent quality during the first five months of 1974. It took six months to get the new blower fan, and that delayed the repair. Effluent quality during the first five months averaged 49 mg/L BOD and 49 mg/L SS, almost 50 percent higher than the state standards of 30/30 mg/L. After repairing the blower in June, the District achieved much-improved effluent quality for the rest of the year.¹⁵

The EPA issued the District a discharge permit in August. It was designed to ensure that Metro's effluent quality would not deteriorate. This permit prohibited the District from exceeding certain limits in the effluent. Specific limits were placed upon biochemical oxygen demand, suspended solids, fecal coliform, flow, and several other parameters. If the District violated this permit, several unappealing options were open to the regulatory agencies, including fines and a moratorium on new taps. The experience during the latter part of 1974 showed that, barring major mechanical problems or flow increases, the District would be able to comply with the discharge permit until the new facilities were completed in 1976.

Building the South Plant

Metro began construction on the first phase of its central plant expansion (now called the South Plant) in 1974. By the end of the year, the new plant was 28 percent complete. This project was expected to be completed and operational in the fall of 1976.

It was also expected that construction of anaerobic digesters and the portion of the Platte River II Interceptor between the Central Plant and the Denver North Side Treatment Plant would begin in the fall of 1975. As a result of research done in cooperation with design engineers CH2M, the District began preparations to implement an advanced digital process control system to control the 70 mgd UNOX process and 42 mgd primary process that were to become operational in 1976.

Despite these encouraging steps, progress on accomplishing the goals of the construction program was slow and painful. EPA planning requirements were instituted after Metro had undertaken a number of studies. Developing facilities to serve the Lower South Platte, Clear Creek, and Sand Creek Service Areas, and to recycle sludge as an agricultural product were all delayed pending completion of additional federal requirements and review by the Denver Regional Council of Governments Wastewater Planning Agency.

Long range planning

The District's "1974 Long Range Planning Study" and the CH2M report "Water Quality, Clear Creek and Sand Creek Service Areas" were both completed during 1974. These reports addressed a fundamental and important question concerning sewage treatment: should it be centralized into one treatment complex or should there be one satellite treatment facility in the Clear Creek Basin and another in the Sand Creek Basin? Both reports showed the centralized treatment philosophy to be less costly, and both reports raised questions concerning environmental benefits that might be attainable with satellite plants. Stream flow augmentation could



Construction of what is now the South Plant began in May 1974, and this June 1974 photo shows the early phase of the construction.



The South Outfall, shown here, was built in 1975 as part of the South Plant construction project.

be a benefit in Clear Creek, but there was considerable doubt whether a suitable location for a facility existed. The Sand Creek Service Area had a suitable location for a facility, but the benefits of stream flow augmentation in a shifting sand bed stream were extremely doubtful. On January 21, 1975, the board of directors passed a resolution directing the District to pursue centralization of treatment unless some agency was willing to help pay the approximately 20 percent higher costs of satellite facilities.

The board's decision to provide centralized treatment for the Clear Creek and Sand Creek Basins was a significant step toward resolving issues that had come up earlier as to

whether centralization was the strategy Metro would follow. By letting Metro begin design and construction without further delays, the board allowed it to proceed with the program to build facilities to cost-effectively abate water pollution.

A bad year for the economy

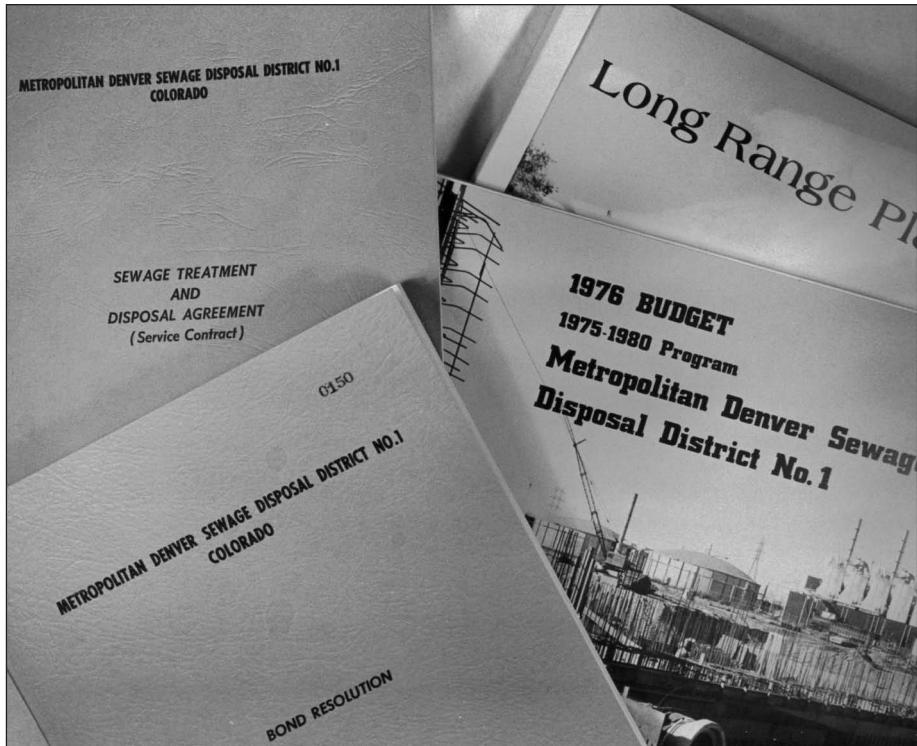
Throughout the United States, 1974 was a bad year economically. The national trauma was reflected in difficulties affecting the District. Chemical supplies were scarce, and costs rose rapidly. Other problems included increasing power rates, difficulty in finding replacement parts, extraordinary increases in construction costs, and the all-pervasive inflation, which was considerably more than had been anticipated when preparing the 1974 budget.

Yet, District employees exceeded budgeted projections by less than 10 percent. District Manager Korbitz told the board: "District employees deserve special commendation for their hard work and diligence in minimizing the adverse effects of the nation's economy on District operations."¹⁶

Korbitz told the board not to expect the years to come to be any less stressful. Federal requirements and metropolitan Denver's needs were moving on different timetables, he said, and the economy was still unstable. But Metro would pull through.

Plans try to glimpse the future

Every year, District staff met with all the member municipalities and gathered up-to-date information concerning factors influencing flow increases. Such subjects as new developments planned, rezonings, interceptor repair work, new service contracts, and general flow trends were discussed with all



Long range plans, budgets, and other planning documents help keep the Metro District on track.

members and analyzed by the District. Projections of flows and loadings to the District were developed from these visits and were used to verify and prepare a base for the District's long-range planning. The 1974 Long Range Planning Study, released in May, developed projections of wastewater flow through the year 2003 and compared a number of alternative methods of meeting the projected sewage treatment needs.

The District's plans for the future were based on estimates made by the member municipalities, other metropolitan Denver agencies, and on the basis of regional population trends.

The District's planning philosophy was to avoid future water pollution problems. This philosophy meant the District had to make reasonable projections of the growth that would occur in the metropolitan Denver area and construct facilities to match those needs. The District believed that to knowingly plan for a population lower than the projected population would only result in pollution of rivers and poorly planned growth.

Meanwhile, the City of Aurora's interest in the reuse of treated wastewater for irrigation and other beneficial purposes introduced another factor into the analysis of centralized vs. satellite treatment facilities. The District and Aurora undertook a review of the needs of each agency to reach a sensible and effective solution. Eventually, Aurora configured its Sand Creek Plant so non-potable reuse water could be extracted from the water treated there.

In a note of historical interest, Aurora's Mary B. O'Dell made history in 1974 and 1975 as the first woman to serve as chair of the Metro board of directors.

1975—Almost there

The increase in the number of Metro District directors from 54 to 62 in 1975 demonstrated the continued increase in the number of people served by the Metro District. District activities and costs also increased.

Inflation again strained the District budget that year, although staff's efforts reduced the anticipated \$800,000 budget deficit by about 90 percent.

Metro continued to operate its over-capacity facilities in 1975 as effectively as it could and had no significant violations of its discharge permit.

Construction progressed well despite delays caused by regulations and guidelines mandated by federal law. The major treatment plant construction on the South Plant that began in 1974 progressed slowly. By 1975, it was expected to be completed in early 1977.

The anaerobic digester project and the first section of the Platte River II Interceptor project began in 1975. They were expected to be completed in early 1977 and mid-1976, respectively. Construction of the final four sections of the Platte River II Interceptor was scheduled to start in early 1976 and be completed in late 1977. A sludge reuse facility project, urgently needed for its health, environmental, energy savings, and economic benefits, continued to be delayed for political and legal reasons that are explained later.

The solids management problems Korbitz inherited continued to plague Metro. Solids recycling remained a major part of the District's costs, efforts, and concerns. Major progress was made in 1975 in developing a market for sludge, designing the future drying basin facilities, and carrying out research projects.

District employees also labored with the Industrial Cost Recovery and User Charge requirements of the Federal Water Pollution Control Act in 1975. In early 1976, the Industrial Cost Recovery System was adopted by the board and about half the District's members. The work on the required user charge systems continued.

Operations

The Metro District met the required level of performance specified in its interim discharge permit in 1975. Operations continued



Maintenance workers install instrumentation in the North chlorine contact chamber in the mid-1970s.

smoothly, and staff worked hard to reduce costs. A National Pollutant Discharge Elimination System Interim Discharge Permit was issued to the District in late 1974. District facilities were still receiving flows in excess of design capacity and could not produce effluent quality that met state effluent requirements. The interim discharge permit recognized the limitations of the treatment facility and specified an effluent quality the District could and must meet while awaiting the new plant. Metro's effort to meet discharge permit limitations during 1975 resulted in a few minor violations that did not have a discernible effect on the quality of the South Platte River; otherwise, Metro met the permit limits.

For the third straight year, Metro's staff tried to keep expenditures down. The 1975 budget was adopted July 16, 1974, almost six months before the budget year began. After it was adopted, several events threatened the District's ability to prevent a budget deficit. The discharge permit was received after the budget was set. The permit contained stricter standards than had been anticipated. In meeting the new discharge permit standards, Metro spent considerable additional money to process the additional solids.

In addition, the final wage determinations for 1975 were almost six percent higher than had been anticipated. This became another force pushing the District budget toward a deficit. The cost of chemicals climbed precipitously during mid- and late-1974, and bids from chemical manufacturers were taken in late 1974. Imagined inflationary pressures on these companies and real cost increases to them pushed their prices up. Many of the companies did not seek any new business and were reluctant to supply the District at any price. Metro was able to secure chemical supplies, but only by paying more than had been budgeted.

By early 1975, the numbers told the story: there would likely be an overrun in the Operations & Maintenance Fund of more than \$800,000. Staff worked to reduce this projected deficit, and all departments helped. Studies and efforts to reduce chemical use, power consumption, and manpower had begun before 1975, but with the extra need for spending reductions, the efforts were accelerated and expanded.

The original air diffusion system in the secondary treatment process had used a diffuser employees called a "Saran wrap diffuser." It

was difficult to clean and had low air transfer efficiency. The board approved converting the entire secondary process to Flexofuser diffusers, which allowed air to be diffused at a lower pressure and consumed less electricity. Conversion was completed during 1975, and the full benefits of this more efficient diffuser were fully realized. Total electrical power use was cut by 19.5 percent from the budget projections. In spite of a unit power cost increase of 15.2 percent during 1975, the District was able to achieve net dollar savings of \$47,000, or 7.1 percent in electrical power cost.

Another problem area was chemical expenses. A major portion of Metro's total chemical expense was associated with vacuum filtering sludge. Vacuum filtering expenditures were only budgeted to be \$509,000, but because of inflation, \$880,000 was spent (a 73 percent budget overrun). The amount would have been significantly higher if staff had not reduced chemical use by closely monitoring chemical feed rates and chemical demand. Similar efforts to control chlorine dosage enabled a chlorine cost savings of 34 percent (\$27,000), despite a 67 percent increase in its cost.

The total personnel costs were \$1,895,516, which was \$41,654–2 percent under budget. This reduction was achieved despite the six percent higher-than-predicted prevailing wage rate increases. Savings were accomplished in several ways. Facilities were modified to reduce the number of people needed, process control strategies were revised to improve distribution of operators, and certain non-critical work was deferred. These efforts enabled the District to leave vacant positions unfilled and delay hiring for most positions that had to be filled.



Construction of the South Plant spanned May 1974 through late 1976. These are secondary clarifiers.

Flows and loadings up to 10 percent less than expected provided additional relief. This probably resulted from less infiltration than in the 20 months following the May 6, 1973, flood that damaged some District facilities. Additional relief also resulted from the City and County of Denver Parks Department hauling dewatered, anaerobically digested sludge for their own use. Cost reduction efforts by staff, lower loadings, and higher interest earnings combined to offset the cost consequences of the stricter effluent standards and the steep rate of inflation. Overspending by a projected \$800,000 was reduced to an actual overspend of only \$77,000, while Metro met the Interim discharge permit standards with a hydraulically overloaded facility.

Construction

During the early 1970s, the District saw that an expansion program would be needed to provide increased treatment capacity for the rapidly increasing volume of wastewater flow from the metropolitan Denver area. In April 1973, District voters approved a \$25 million bond issue to pay for an expansion program that would provide additional capacity for existing interceptor and treatment facilities and add new facilities to the system.

Central Plant expansion

Expanding the Central Plant was the most urgent of the projects included in the overall program because the primary and secondary treatment facilities were significantly overloaded. Three construction contracts were awarded for this work. The first was to Mead & Mount Construction Company to expand the primary and secondary treatment facilities, construct a new laboratory, and modify the existing Administration Building. It was thought this expansion would provide sufficient treatment capacity to last until approximately 1985. The construction contract was awarded in May 1974 and was originally scheduled for completion in April 1976. The major portion of the construction work was completed in 1975, with construction approximately 88 percent complete by the end of the year. Equipment delivery problems delayed the project, however, and it appeared in 1975 that it would not be completed until January 1977.

The second plant expansion contract was to build a new access road to the Central Plant, including a bridge across the South Platte River. The new road and bridge would provide access to the District-owned property on the north side of the South Platte

River and also provide a second and more convenient access to the existing plant facilities. This contract was awarded to Peter Kiewit Sons Company in November 1974 and was completed in December 1975.

The third plant expansion contract was to build support facilities: a new warehouse and shop facilities, vehicle storage facilities and an addition to the existing Administration Building. A contract went to Haselden-Langley Constructors, Inc. in October 1975. It was scheduled for completion in May 1976.

Solids Stabilization and Reuse System

The District's temporary solids handling program in 1975 was to haul filtered sludge cake to the former Lowry Bombing Range and incorporate into the soil. Metro hoped a proposed system would provide for stabilizing the sludge through anaerobic digestion and then transporting it via pipeline to a 2,000-acre site about 25 miles east of the Central Treatment Plant where it would be air dried and marketed to farmers.

A contract was awarded to Frank Briscoe Company in October 1975 to build eight anaerobic digesters at the Central Plant. This project was scheduled to take 18 months for completion. Approximately six percent of the project had been completed by the end of 1975.

The portion of the Solids Stabilization and Reuse System in which sludge would be air dried in Eastern Colorado was under design by the District's consultants, CH2M. The EPA had begun preparing an Environmental Impact Statement (EIS) on the proposed project, and this statement had to be satisfactorily completed before a grant could be offered and



From November 1974 through the end of 1975, a bridge was built across the South Platte River so the plant could be accessed from York Street.

construction started. The District had no control over the timing of the preparation of the EIS. Although the process began in 1975, it was not expected to be completed until late 1976.

Platte River II Interceptor

The Platte River II Interceptor was part of the District's original interceptor system design, but excess capacity in the City and County of Denver system was used until the additional capacity was needed. The need for this capacity

became apparent in about 1970 when final design began. Because of a shortage of federal funds, construction was delayed on this important 9-mile link in the system.

In August 1975, Martin K. Eby Construction Company was awarded a contract to build the 1.4-mile portion of the Platte River II Interceptor from the District's Central Plant to the Denver North Side Treatment Plant. Construction proceeded well during the remainder of 1975 and was more than 10 percent ahead of schedule by the end of the year. In November 1975, the EPA made a construction grant available for the remainder of the interceptor, and it was anticipated that construction would be started in early 1976 and be completed in 1977.

Lower South Platte, Sand Creek, and Clear Creek Service Areas

District interceptor sewer facilities in the Lower South Platte, Sand Creek, and Clear Creek Basins were nearing their capacities, and Metro began planning to develop facilities to meet the increasing demands. The planning efforts stalled in 1975 while the District, the Denver Regional Council of Governments, and several local governments worked to resolve issues. No resolution was reached concerning proposed facilities, but parts of the completed planning work would be revised and updated to meet new EPA standards. Considerable time was spent clarifying the required work with the EPA and negotiating a contract with the consultants to perform the work. Work actually began near the end of 1975 on facility plans written according to the new requirements.



Pipe for the Platte River II interceptor is readied for installation on Platte Street in 1979.

1976-The South Plant comes on line

A major facilities-related event equal in impact in the history of Metropolitan Denver Sewage Disposal District No. 1 to construction of the original North Plant came in December 1976. Flows were directed into the new South Complex of the Central Plant for the first time, and the Metro District's facilities were not overloaded as they had been since 1971.

Although minor problems accompanied operations start-up, the treatment facilities began performing in a generally satisfactory manner from the time wastewater first entered the facilities.

Achieving the goal of meeting performance requirements was attributed, in part, to a new electronic data processing system that Metro had begun using. It provided operations management information on a more timely basis to assure adequate process control, and it put the Metro District on the road to automation.

Building the South Plant involved enlarging the existing facility from an average capacity of 98 mgd to 170 mgd as well as additions and enlargements to the support facilities. Portions of these facilities were placed in operation in late 1976, and final completion was scheduled for 1977. The new secondary treatment facilities used pure oxygen in the activated sludge process.

As the Metro District was preparing to start and run the new South Plant, senior management had to deal with how to staff the new facility. The plan that was eventually implemented called for hiring six new control system operators (CSOs) because the control room for the new plant was to be digital. In other words, it was controlled by computers, which was a brand new wrinkle in the world of wastewater treatment in 1976 and 1977. Additional plant operators were also hired before the new plant came on line to give them time to train and be ready.

The original plan was for the CSOs to be trained to work in the control room and alert plant operators when something needed attention in the plant.

“Their concerns centered on the computer side of things, but it didn’t work out well because they (CSOs) didn’t know how the plant operated,” said José I. Padilla, a former plant operator who now works in human resources.



One of the six control systems operators hired to run the new South Plant was Floyd Bolen, seen here in the control room in 1977. Bolen was a 30-year man who retired in 2006.

“The equipment vendors and manufacturers trained the most senior plant operators on each shift on how to run the new cryogenic system. The senior operators then trained the more junior people on their shifts,” Padilla said in an interview.

“The cryogenic system was the most significant new thing in the South Plant. Clarifiers were still clarifiers and the aeration basin was still an aeration basin,” Padilla continued.¹⁷

Having separate classifications for CSOs and plant operators did not work out in practice. The Metro District later combined both classifications into the plant operator classification, Padilla recalled.



A contract to build eight anaerobic digesters was awarded in October 1975, and by year-end the digester project was six percent complete. This photo was made in 1977.

All training for the start-up was done by operations staff, assisted by equipment manufacturers. Many of the plant operators also took advantage of continuing education through enrollment in a two-year Water and Wastewater Technology Program at the Community College of Denver.

Meanwhile, the Metro District's facilities provided good treatment during 1976, with no major violations of the discharge permit conditions (although there were a few minor violations). Metro achieved this feat even though flow and loadings to the Central Plant exceeded average hydraulic design capacity by 40 percent.

In addition to maintaining a high level of treatment, the Metro District ended 1976 with a substantial budget surplus. Continued austerity efforts by District employees and stabilized costs for chemicals, utilities, and materials were the reason. The year-end surplus let the Metro District meet the bond reserve requirements for 1977 and 1978 and permitted additional funds to be transferred into the General Reserve Fund and the Platte River II Fund.

The Metro District's National Pollutant Discharge Elimination System discharge permit expired at the end of 1976. Late that year, District staff worked with regulatory officials at the Colorado Department of Health to help develop the conditions of a new permit.

Construction of the eight anaerobic sludge digesters had reached 90 percent completion by the end of the year, and the final portion of the Platte River II Interceptor construction reached 34 percent completion. The digester project was expected to be completed in 1977, and the Platte River II Interceptor was expected to be completed in late 1977.

Solids processing and recycling continued to be the major cost drivers and problems for the Metro District. The hoped-for new sludge drying and distribution center project continued to be delayed by the federally required Environmental Impact Survey (EIS) procedure, and District employees began looking for additional ways to recycle sludge while waiting for the sludge drying and distribution center to be constructed.

Meanwhile, in preparing for the anaerobic digester start-up scheduled for 1977, Metro initiated a full-scale study in cooperation with Denver Wastewater Management. This study involved the use of one of the Denver North Side Treatment Plant's anaerobic digesters to digest different blends of the District's sludges and to determine operational performance for use in projecting costs and performance for the District's new anaerobic digesters.

Metro also continued to conduct research on the agricultural reuse of sludge. It established agricultural plots at the Northern Colorado Research and Demonstration Center to evaluate nutrient and heavy metals uptake into crop tissues. Metro also grazed cattle at the Lowry Bombing Range on winter wheat grown in sludge-amended soil, and Metro applied dried, anaerobically digested sewage sludge to reclaim mine-tailing wastes at the Urad molybdenum mine.

In October, the new UNOX cryogenic oxygen production facility was started in a trial mode and evaluated in preparation for full start up of the new secondary treatment facilities. In November, the new South primary and secondary treatment facilities were placed in operation. Operational problems resulted from construction activities and new facilities start-up, and it was expected that continued construction and anaerobic digester start-up during 1977 would present ongoing challenges for the operations and maintenance staff.

In September, the board occupied the new board room in the Administration Building, and in November, the Metro District Central Plant had a new main entrance and a new address as a result of the new entrance: 6450 York Street, Denver, rather than the old Commerce City address.

No progress was made in developing acceptable user charges by member municipalities, mainly because it was hoped that Congress would revise the Federal Water Pollution Control Act to permit the use of ad valorem taxes in some cases rather than user charges for operations and maintenance expenses.

Facility planning commenced in 1976 for the Clear Creek, Sand Creek, and the Lower South Platte Service Areas. When the facility planning was completed for these service areas and approved by appropriate agencies, design for the necessary construction was to have commenced.

Orientation sessions for new directors were developed and attended by more than a dozen directors. These sessions were four hours long and proved to have significant value to new directors as well as to directors who had served the District for a number of years.

The interest and attitude of the directors toward District activities was reflected in the outstanding attendance at meetings of the board of directors. An average of 49 directors attended each board meeting, representing 80 percent of directors in attendance at each board meeting.

At year end, District Manager Bill Korbitz said, "The directors and employees of the Metro District can properly feel proud of the results of their efforts during 1976 in protecting the environment, public health and the total interests of the 1.1 million citizens served by the Metro District."¹⁷

1977—Discos and digesters

Disco music was in vogue, Americans watched waves of new Vietnamese immigrants arrive in the U.S. in 1977, Elvis Presley died, and then-President Jimmy Carter called upon people to make personal sacrifices to solve the energy crisis. Meanwhile, the people of metropolitan Denver celebrated a successful addition to their regional wastewater treatment facility that roughly doubled its capacity.

The South Plant was fully operational. For years it was visited by wastewater treatment professionals as though it were the eighth wonder of the world. Using pure oxygen in wastewater treatment plus the automation incorporated in the plant's design made it a "must see" highlight of any trip to Denver by a water quality person.

The first eight of what are now twelve 244,000-cubic-foot anaerobic digesters were completed in mid-1977 to digest Metro's sludge. Digestion decomposes and stabilizes the sludge, kills pathogens, reduces the volume, and relieves Metro of the need to treat it with lime. Digesting the sludge also helped Metro grapple with the problem of what to do with it—a problem that had persisted from Metro's earliest days.

The Project Action Request (PAR) system was activated in 1977 after the Metro District's transmission and treatment facilities had been in operation for a decade.

Before the PAR system was instituted, there were instances in which projects were designed before proper project approval or project funding had been received. Plant modifications appeared without the benefit of engineering design. There

were no clear-cut guidelines regarding when a project should go through the Engineering Department and when it could simply be performed by maintenance personnel. The PAR system helped bring order out of this chaos.

The PAR system represented a formal system for managing the increasing number of engineering projects by imposing a process for doing projects. The first PAR was entitled "RPC Force Main—Vault Fan (construction phase)." Gary Flesner, an engineer who retired in December 2004, was the district project manager. The project cost was about \$4,200.

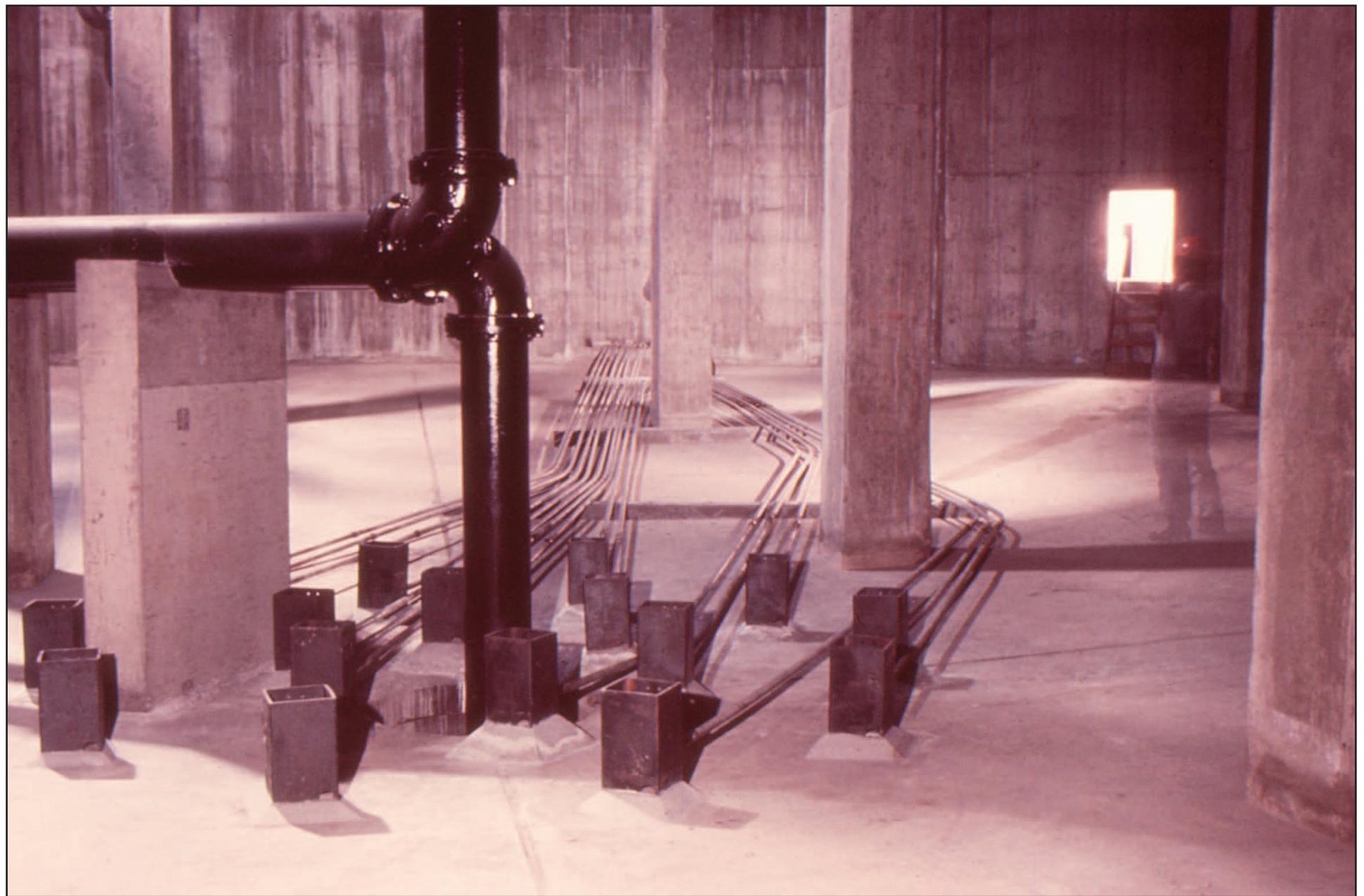
South Plant dedicated

The *Rocky Mountain News* covered the dedication of the new South Plant on Sunday, May 22, 1977, in a short, page 16 article on May 23 headlined "Expansion hailed at sewage facility." The article said a \$37 million expansion of Metro's treatment facilities had occurred.

The expansion included the \$29.6 million South Plant, which included both primary and secondary treatment, and eight anaerobic digesters which, though not completed at the time of the ceremony, were then under construction at a cost of \$7.5 million.

The article said 25 percent of the project cost had been financed by bonds that voters approved in 1973. The remaining 75 percent of the cost was covered by federal and state grants.

Ron Linton, executive director of the Association of Metropolitan Sewerage Agencies (now called the National Association of Clean Water Agencies) delivered the dedication address, the article said.



This 1977 photo shows what the inside of one of the eight anaerobic digesters looked like before sludge was added and the digestion process started.

Sludge disposal still a problem

On July 17, 1977, the *Rocky Mountain News* ran a lengthy article by Andrew Schlesinger tied to the start-up of the eight new anaerobic digesters. It said sludge handling remained the Metro District's biggest problem.

The article noted that the cleaner the Metro District made its effluent, the more sludge it generated for disposal. It included a quote from Marshall Fisher, a U.S. EPA sanitary engineer, saying, "Sludge is the biggest burden of a plant. It takes more money disposing of it than treating sewage." (The rule of thumb today is that the final disposition of a facility's solids represents about half its operating costs.)



District Manager Bill Korbitz speaks at the 1977 dedication of the new South Plant on May 22, 1977.

The article described how Metro then was spending more than \$8,000 a day disposing of its daily production of some 700 wet tons of sludge by trucking it out to the old Lowry Bombing Range and plowing it into the ground. Although Metro took in a few dollars by leasing the grazing land, the expense was significant. The article also noted that the 2,000 acres of rolling farm land at Lowry was getting "between 20 to 30 dry tons of sludge an acre a year, far more than would be applied by a farmer."

The article also discussed new 20 mg/L biochemical oxygen demand (BOD) limit and 20 mg/L suspended solids (SS) permit limits the state and the EPA intended to impose on Metro via a stream classification hearing then scheduled for October that year. The current permit limits were then 30 mg/L for BOD and 30 mg/L for SS.

District Manager Bill Korbitz was quoted as saying the new limits would cost Metro some \$150,000 a year more to handle the sludge produced and "the environment would not be affected in any way."

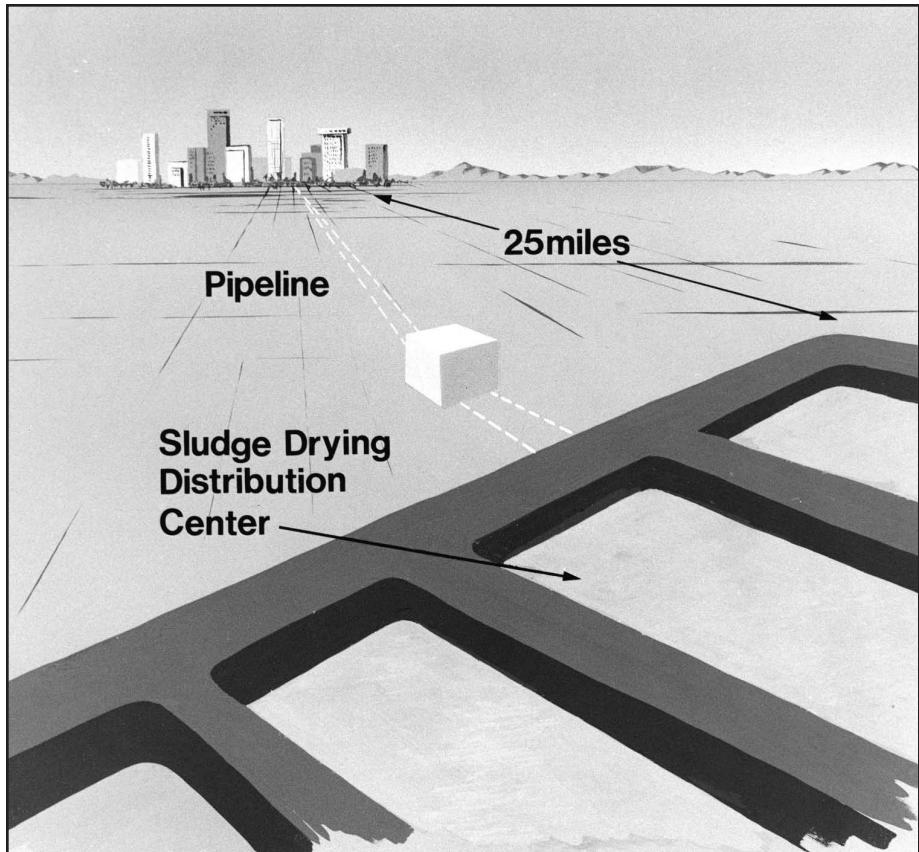
The article went on to say: "Korbitz also said the EPA has told the district to start planning for ammonia removal from the effluents in the river." Such a step, Korbitz said, would add another \$3 million a year to the operating budget. "The purpose would be to protect fish," he added. "We think that's ridiculous."

Time would prove Korbitz wrong.

In addition to talking about possible new stream limits, the article discussed Metro's hoped-for sludge handling solution involving a 10- and a 12-inch pipeline to transport wet sludge about 22 miles out into the countryside to a 2,000-acre site "in a remote area of Adams County north of Watkins."

There, the article said, the sludge would be sun-dried on 600 acres of unlined basins and sold to local farmers.

Bill Martin, director of Resource Recovery and Reuse, described the dried sludge product as “a virtually nuisance-free product.” The newspaper noted, however, that “Adams County officials and residents have let it be known they are not enthralled by the opportunity of having a waste recycling plant in their back yards.”



Artist's concept from the late 1970s shows the sludge drying distribution center the Metro District hoped to build near where Denver International Airport now stands.

ENDNOTES

- ¹ Minutes of the Board of Directors Meeting, Metropolitan Denver Sewage Disposal District No. 1, June 9, 1971, Commerce City, CO, pp. 2-3.
- ² Jerry Lee, Interview, April 7, 2005.
- ³ *Ibid.*
- ⁴ Metropolitan Denver Sewage Disposal District No. 1, Minutes of the Board of Directors Meeting, July 20, 1971, Commerce City, CO, p. 7.
- ⁵ Annual Report for 1972. Metropolitan Sewage Disposal District No. 1, Commerce City, CO.
- ⁶ *Ibid.*
- ⁷ *Ibid.*
- ⁸ *Ibid.*
- ⁹ Interview, William Korbitz, January 11, 2006.
- ¹⁰ *Ibid.*
- ¹¹ Metropolitan Denver Sewage Disposal District No. 1, Minutes of the monthly meeting of the Board of Directors, July 16, 1974.
- ¹² Jim Carabajal, Interview, March 10, 2005, and Leroy Gonzales, Interview, December 2, 2004.
- ¹³ Annual Report for 1974. Metropolitan Sewage Disposal District No. 1, Commerce City, CO.
- ¹⁴ *Ibid.*
- ¹⁵ *Ibid.*
- ¹⁶ Annual Report for 1974. Metropolitan Denver Sewage Disposal District No. 1, Commerce City, CO.
- ¹⁷ Annual Report for 1976, Metropolitan Denver Sewage Disposal District No. 1, Commerce City, CO.



CONOCO EXPLOSION TO THE COMMON SYSTEM, 1978-1984

1978-Basic obligations met

Hundreds of people died in a mass murder-suicide at Jonestown commune in Guyana, U.S. president Jimmy Carter took emergency steps to rescue the plunging dollar, and the first so-called “test-tube baby” was born in Britain in 1978. Meanwhile, Metro met its daily obligation to treat the wastewater from 1.1 million people in the metropolitan Denver area. This success was met despite continuing problems with the final disposition of its sludge. The utility ended the year hoping it could comply with several regulatory agencies’ requirements and begin construction on its Sludge Reuse Project the following year.

Metro hoped to be recycling all of its sludge as a beneficial product rather than waste by 1983, making it a widely-distributed and valuable fertilizer product. Project plans called for fully stabilized, anaerobically digested liquid sludge to be pumped eastward in dual pipelines from the Central Plant for 22.5 miles to a solar drying center. After drying for up to a year in lagoons, the solids were to be stockpiled and distributed widely as a fertilizer and soil conditioner. Metro thought this solution would provide multiple environmental and cost benefits.

When the Conoco explosion occurred in 1978, it destroyed the plant schematic mosaic that had graced the east wall of the Process Building since the plant was built.

Implementing the project would save Metro at least \$1.6 million annually in operating costs. Metro was experiencing lengthy delays in permission from regulatory agencies to proceed with what was believed to be a carefully researched sludge drying and distribution project. It was proving costly.

Savings predicted

Analysis showed that Metro’s capacity to process and dispose of solids would have to keep up with increased loadings, or the sludge would back up into the wastewater treatment process and could pollute the South Platte River.

During 1978, Metro’s members, which included 6 cities and 15 sanitation districts, discharged an average of 116.5 million gallons of wastewater a day into its transmission and treatment system. The treatment process also extracted an average of 700 wet tons of sludge a day, which Metro trucked to the former Lowry Bombing Range and plowed into the ground.

The treated water, with 95 percent of the pollutants removed, was discharged into the river in compliance with a permit issued under state and federal water quality control laws. Metro performed this service at a total cost of slightly over \$10 million, with increases in costs over 1977 being roughly equivalent to the Denver area rate of inflation.

Five years of planning to prevent interceptor sewers from becoming overloaded culminated in 1978 and early 1979 with the board of directors approving facility plans for the Sand Creek and Clear Creek Basins. New facilities called for in the plans could then proceed to design and construction, unless the U.S. Environmental Protection Agency (EPA) required environmental impact statements. One 1978 interceptor system milestone was completing an \$11.3 million section of the Platte River Interceptor.

Regulatory pressure builds

By 1978, Metro was feeling increasing pressure from state and federal agency controls and regulations as well as some local governments.

- The Colorado Water Quality Control Commission was unable to revise state water quality standards and reclassify streams receiving effluent, which complicated Metro's planning and budgeting.
- The EPA issued its Denver Regional Environmental Impact Statement. It listed broad requirements for planned wastewater facilities. Metro believed these requirements went far beyond the basic questions of cost-effective and environmentally sound water pollution control.
- The EPA also issued its long-awaited Environmental Impact Statement—three years in the making—for the Sludge Reuse Project. The agency approved the project but imposed some costly conditions.

State and federal laws placed several basic mandates on Metro. Additionally, much of the EPA's involvement dealt with Metro's

eligibility for 75 to 85 percent federal financing for roughly \$100 million worth of capital improvements constructed or planned between 1975 and 1985. The EPA and state officials controlled Colorado's allocation of grant money from annual congressional appropriations. Metro's management often felt frustrated by delays.

Metro maintained extensive cooperative relationships with other agencies, especially the Denver Regional Council of Governments regarding regional planning and the Denver Water Department, the major supplier of drinking water for the Denver region.

The board adopted a “risk” budget for Metro's operating expenses in 1978 that resulted in a \$780,000 unfavorable variance at year end. Healthy reserves plus income from selling Aurora's Sand Creek Treatment Plant back to Aurora covered the overrun. The budget anticipated that all sludge would be digested in 1978, sharply reducing the weight and volume of sludge that had to be transported to and disposed of at the old Lowry Bombing Range.

Processing, transporting, and disposing of sludge continued to be Metro's most serious operational problem in 1978, although Metro made significant progress toward a permanent solution to hold down costs and provide for beneficial use.

As Metro accumulated operating experience with the new digesters, unforeseen problems arose. Not being able to integrate digestion with the hoped-for sludge pipeline and solar drying center caused part of the problem. In addition, solids processing, transport, and disposition costs exceeded the budget. Actual operating costs for 1978 were 11 percent higher than actual costs in 1977.

Beneficial reuse researched

The board adopted a resolution in February 1978 that was to have a far-reaching effect. The Biosolids Recycling/Reuse Policy was Resolution 1178-5.a, which basically said the Metro District preferred to recycle and reuse the sludge it generated beneficially rather than to dispose of it by landfilling it, incinerating it, or otherwise “wasting” a valuable resource. This resolution was modified in July 2004—Resolution 0704-6.f—which recognized changes in the regulations that had taken place since 1978 but still expressed a preference for beneficial reuse.¹

Metro extended a federally-funded research project that had begun in 1975 to examine sludge effects on forages and cattle in relation to the fate and transport of contaminants into the food chain. Cost of this work through 1978 totaled \$129,157, of which \$112,605 was subcontracted to Colorado State University. Soils, forages, and cattle grazing at the Lowry Bombing Range sludge disposal site were examined for trace metals and refractory organics. Cattle were grazed at Lowry and were fed varying rations of sludge. These cattle were compared with cattle having no exposure to sludge. None of the Lowry animals showed ill effects.

Another study, 75 percent funded by the EPA and completed in 1978, showed that pathogens (bacteria, viruses, and parasitic organisms) die off to below detection limits as anaerobically digested sludge is thoroughly dried in basins such as those Metro hoped to use at its sludge drying center. Metro and the U.S. Agricultural Research Service carried out the \$28,000 project.

One four-year demonstration project at the Northern Colorado Research and Demonstration Center at Greeley

showed no significant differences in yields of corn, pinto bean, and sugar beet crops grown with varying applications of dried, anaerobically digested sludge when compared to chemically fertilized control plots.

A second study by the center examined the extent of heavy metals uptake into crops at various sludge application rates and the soil factors that affect the metals uptake. Results indicated that soil pH (acidity/alkalinity) was the major factor involved. Tentative conclusions were that heavy metals in sewage sludge applied to calcareous soils, typical of Colorado,



Field experiments with the beneficial reuse of sludge as a fertilizer product dated back to this 1972 application trial.

would become less available for plant uptake after a period of years. Those two studies cost \$35,000 in 1978.

Construction project mop-up

Metro mopped up major construction projects it had previously begun. Initial plans were completed for constructing additional interceptors in the Sand Creek and Clear Creek Basins as soon as funding became available. Metro made final payments on the \$24.7 million South Complex treatment facilities and the \$6.5 million anaerobic digester system. Numerous major and minor improvements were made to existing facilities.

The Engineering Department monitored metered flows at metering and sampling stations in 1978. These stations were at points where member cities and sanitation districts discharged their wastewater into the interceptor network. Metro appropriated \$110,000 to purchase and install automatic sampling equipment at 21 connection points to replace manual sampling. The project was estimated to save \$184,000 in five years and was extended in 1979.

Laboratory Services performed 50,900 analyses to determine loadings from Metro members in 1978 compared to 43,100 in 1977. These analyses included an industrial wastes monitoring program so Metro could know what kinds of deleterious or hazardous wastes—if any—(such as acids, flammable materials, and chemicals) were being discharged into the system.

Leadership in national organizations

Metro staff members began working in leadership roles in the Association of Metropolitan Sewerage Agencies (later the National Association of Clean Water Agencies), the Water

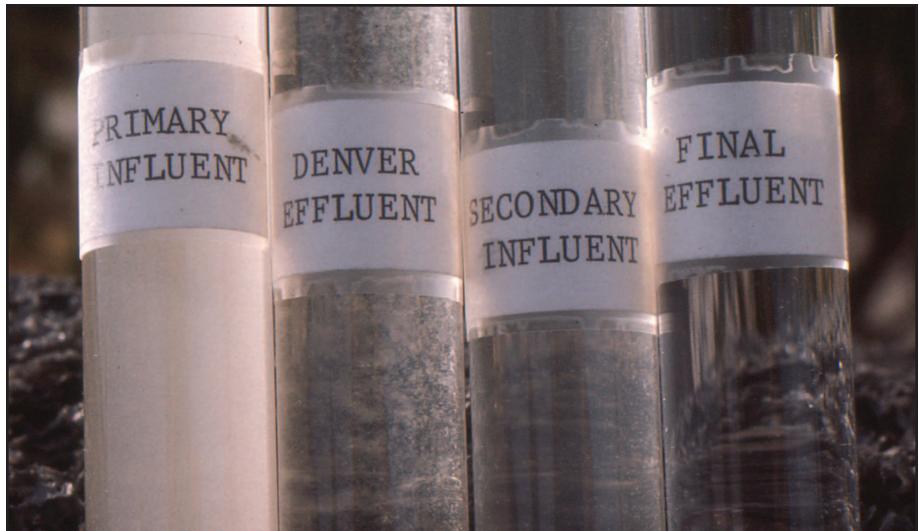


In 1973, the Metro District conducted these early, side-by-side plant growth experiments. No sludge was applied to the soil in which the wheat on the left was grown, and sludge was applied to the soil in which the wheat on the right was grown.

Pollution Control Federation (later the Water Environment Federation), and other technical and professional organizations.

Sixty-two public-spirited citizens representing member connectors served on Metro's board of directors. Their attendance at the monthly board meeting and the meetings of its six standing committees was 80 percent.

The staff and some directors attempted to update the 14-year-old service contract between Metro and its members. Board-proposed amendments were aimed at a more equitable formula for members' charges and at providing some flexibility for future amendments to the annual charges formula. However, Metro could not get the unanimous consent required for the changes from the governing bodies of all the members.



These four test tubes contain effluents from Metro's primary clarifiers, the Denver North Side Plant, Metro's secondary clarifiers, and the outfalls taking the water to the South Platte River.

Efforts continued throughout the year to have member agencies comply with a federal requirement (tied to Metro eligibility for grants) that their charges to their sewer systems' users be equitable.

Under Metro's Bond Issue Resolution, a consulting engineer was required to inspect system operations annually and review the budget to help protect bondholders' interests. Culp/Wesner/Culp, a nationally recognized consultant in wastewater systems, performed this function. It commented in its April 1978 inspection report:

Problems arise continually in a wastewater facility, and the criteria for judging an operation is not by the number of problems, but how the problems are handled. We feel the (Metro) District Operations and Maintenance program is among the best in the country.²

Conoco explosion

Most employees who were on the payroll in October 1978 remember the explosion at the Continental Oil Company (Conoco) refinery on October 3 on the southeast corner of the Metro plant. The damage was estimated at roughly \$500,000. Metro buildings were damaged, but no Metro employees were injured, largely because the blast occurred at 6:30 a.m.

Assistant Maintenance Superintendent Jim Carabajal remembered the morning. He was in the electrical shop in the southeast corner of the old Shops and Warehouse Building. "I was in the middle of giving instructions," he said, recalling windows shattering and feeling the blast.

"You could say it was an interesting time. There was a point where everyone had to evacuate. Windows on the east side of the lab building shattered," Carabajal said.³

Tim King, a retired computer programmer who was an electrical instrument technician at that time, was in Carabajal's briefing.

"It was a huge, huge blast. I ran out. There was a blaze to the southeast. We could feel it. We knew something bad had happened. We saw broken windows and dislodged panels at Metro. At Conoco, it kept burning and burning. We were eventually told to evacuate and were called back in later," he said.⁴

Mechanical Maintenance Supervisor Ray Montez said he was on light duty when the blast hit. "I was in the shower at home and felt the windows shake," he said. His wife turned on the television and found out there had been an

explosion at Conoco. He came in to work and spent most of his time that day working the telephone, he said.

"There was a lot of glass damage," Montez said. "The big mural of the North plant (on the east wall of the Sludge Processing Building) was destroyed. Pieces fell off and we never replaced it."⁵

Engineer Ray McNeill was at home taking a shower when the Conoco explosion occurred. "It was dumb luck that all the plant people were inside at the shift change getting briefed when the explosion hit," he said.

"My office was in the interior of the (Administration) building, and there wasn't much damage," he said.⁶

Carl Calkins, who worked in the lab, was also at home when the explosion hit. "My kids were delivering newspapers and came running in the house to wake me up because they thought we had been nuked," he said. "That's what they had been told about in school and they saw a mushroom cloud, so that's what they thought."⁷

At year end, work toward repairing the damage and getting Conoco's insurance company to pay for it was ongoing. This effort was expected to continue through 1979. The Administration Building, where office windows shattered over some desks, was largely unoccupied when the blast hit.⁸

Personnel actions

In personnel actions:

- The board negotiated a new three-year labor contract that included an annual wage reopeners clause with the

International Union of Operating Engineers (IUOE) in the fall of 1978. IUOE represented Metro operations and maintenance bargaining unit personnel. A new contract was also negotiated with the Oil, Chemical and Atomic Workers (OCAW) Union, which represented Metro laboratory personnel. The average salary/wage increase for all Metro employees, as approved by the board in December, was 7.6 percent plus a 4.2 percent increase in fringe benefits.

- As a major part of the increase in fringe benefits, requirements were liberalized for participation in the employee retirement plan, which was converted from an employer/employee co-pay plan to a defined benefit plan totally funded by the Metro District.
- Twelve employees were honored for 10 years of service. Bonnie Evans, a secretary, was honored for 15 years of service, the longest tenure among Metro's 180 employees.

Highland Park Sanitation District dissolves

Directors of the Highland Park Sanitation District (one of the original associate members of Metro in 1961) decided in November to dissolve that district and place its operation under the Lakewood Board of Water and Sewer Commissioners. The dissolution and merger occurred in January 1979. The Lakewood Board took over the Highland Park membership in the Metro District. This was the first change in Metro members since the Fruitdale Sanitation District's status changed in 1973, and it was the first consolidation of a special district into a city government since the City of Westminster took over the Westminster Sanitation District in 1970.



The plant schematic mosaic on the east wall of the Sludge Processing Building was destroyed by the pressure from the explosion at Conoco in October 1978.



Mary Ann Tavery, the first woman to become a department head at Metro, is seen here in a metering cabinet in 1977.

Proposed amendments to service contract

In May 1978, after several years of intensive study, the Metro board approved a proposal for major amendments to the service contract between Metro and its members. The agreement, in effect since 1964, included a formula for annual charges to be paid by members based on the wastewater flows and pollutant loadings contributed by each member to the Metro system.

The proposed amendments would:

- Add an element to the charges formula under which members would pay for capital construction based on their relative needs for “reserved capacity” at Metro facilities and based on a philosophy that “growth should pay its own way.”
- Alter the formula to more accurately reflect the current operating costs of Metro. The change would reduce charges for volume of wastewater flow and increased charges for extracting pollutants—suspended solids and organic materials.
- Allow the charges formula to be amended in the future by a two-thirds vote of the governing bodies of members. The previous agreement allowed amendments to be proposed by a simple majority vote of the board of directors but required unanimous approval by all Metro members.

Member governing bodies received briefings and extensive information about the proposed amendments in the fall of 1978, but several members voted against the changes and they did not pass.

Under a requirement for federal grants, Metro members were also asked in 1978 to prove that charges to its sewer system users were equitable. By the end of the year, all but four members had complied with the requirement. However, \$5.2 million in federal grants that Metro anticipated receiving could not be released until all members complied. As a result, Metro was losing about \$300,000 a year in interest earnings on the withheld grants. One result of the lost interest

was to inhibit Metro's ability to fund capital improvements listed for the bond issue approved by voters in 1973.

1979-Interceptor crisis looms

In 1979, the Shah of Iran was overthrown, an accident at the Three Mile Island nuclear plant in Pennsylvania led to a near meltdown, Iranians seized the U.S. embassy in Teheran and took 52 hostages, and the Soviet Union invaded Afghanistan. Meanwhile, actions in 1978 and 1979 by the Denver Regional Office of the EPA caused the district manager to tell Metro's board that 1980 could be a year of unusually difficult fiscal decision-making.

Diminishing interceptor capacity in the Denver area became increasingly critical through 1979. Progress on financing additional interceptors bogged down in intergovernmental disputes over which Metro had no control and in EPA regulations for federal grants for 75 percent of costs.

At issue was whether Metro could (or should) continue to seek federal grants or whether Metro should try to obtain 100 percent local financing for capital improvements.

The stakes were high in both economic and public health consequences for the Metro District and the 1.1 million citizens it served in the Denver metropolitan area.

Funding delays would increase construction costs and, more importantly, increase the probability of raw sewage overflows from overloaded interceptor sewers. Overflows are a public health hazard and could have resulted in moratoria on real estate development.

In the meantime, Metro's management and staff did their best to keep existing facilities, especially interceptors, operating without violating state and federal anti-pollution laws.



Pipe sections for the Sand Creek Interceptor coming into the plant.

In 1978, the EPA issued a “final action” report on an Environmental Impact Statement setting forth policies it would follow in considering federal grants for ten wastewater facilities in the Denver region. In 1979, the EPA began applying those policies as complex and specific requirements for grants awards, based on federal laws and executive orders.

The EPA offered Metro a grant to design an additional interceptor to serve the Sand Creek Basin on the east side of the metropolitan area. However, for Metro to be eligible later

for a \$6 million construction grant, the EPA said that Aurora, Denver, Arapahoe County, and Adams County had to agree to adopt a series of policies on land use and growth management.

Metro said it was a special district that provided contract wastewater transmission and treatment services to its 7 member cities and 14 member sanitation districts. It said further it had no power over local government land use and development policies, and it could only ask for cooperation in complying with the EPA conditions that would apply to other Metro projects as well as the Sand Creek Interceptor.

Additional concerns about continued pursuit of federal grants arose from the EPA's slow progress on grant applications plus the increasing unpredictability of the federal appropriation and grant allocation process.

The most obvious alternative available to Metro for a substitute for federal grants was to ask voters in Metro's service area to approve a bond issue. Bond proceeds would be used to finance the needed projects in the next few years. The bond debt would be paid off by increases in charges for wastewater service.

'Pay-as-you-go' financing

Another possibility was "pay-as-you-go" financing. Annual charges paid to Metro by its members could be increased by 20 to 30 percent above normal budget requirements. This would build up a capital improvements fund. The cost would be passed along by Metro member cities and sanitation districts in the form of slightly higher wastewater charges to their property owners and customers.



Two workmen help install a sewer manhole in this 1982 photo.

The Metro District's services were comparatively low cost. Its actual expenditures in 1979 totaled \$10,701,785, which represented an annual cost of \$9.75 per person or about \$35 per household.

Adding to the difficulty of capital funding choices were the annual increases in Metro's operating budget. The increases were fueled by inflation, rising volumes of wastewater, and delays in the Metro program to beneficially recycle sludge as a fertilizer instead of disposing of it as a waste product.

"Risk" budgets in 1978 and 1979 resulted in cost overruns despite severe belt-tightening in operations and maintenance. Cost reductions and environmental benefits from digesting all the sludge failed to materialize. Reserve funds had to be used to bridge the gap between expenses and revenues. A balanced budget was adopted for 1980.

Costly adjustments had to be made in sludge processing and disposal facilities. These were mainly the result of delays in regulatory agencies' approvals of Metro's planned sludge drying and fertilizer distribution system.

Planning studies in 1979 concentrated on the future of the Central Plant as it would be affected by revised state water quality standards and the state's reclassification of the South Platte River. Metro hoped the complex process of revising Colorado water quality regulations would be completed in 1980 so it could plan for plant improvements.

Northside Plant purchase discussed

The dynamic nature of the Metro District as an intergovernmental service agency in a fast-growing metropolis was reflected in 1979

in reapportionment of the board of directors and in changes in the status of member jurisdictions. Consideration of possible purchase by Metro of the City and County of Denver's Northside Treatment Plant was revived, with discussions extending into 1980. Metro and Denver officials thought consolidated management of the two plants could produce significant savings.

Despite the concerns about funding and burdensome regulations, the most important single aspect of 1979 was that the Metro District provided cost-effective treatment of almost 133 million gallons of wastewater every day. The quality of treatment improved steadily, enhancing the public health, economic, and physical environments of the people who paid the Metro District's bills.

Operations

The amount of wastewater Metro treated rose to an average of 132.6 mgd, up from 116.6 mgd in 1978, and effluent quality improved steadily as well. During the rainy June of 1979, new records for flow were set: An average of 173 mgd for the month and a one-day peak of 236 million gallons.

The Metro plant operated under a National Pollutant Discharge Elimination System permit issued by the Colorado Department of Health, Division of Water Quality Control. It limited the amount of pollution that could remain in effluent after treatment. The two major parameters measured were suspended solids (SS) and biochemical oxygen demand (BOD), which is a measure of organic pollutants.

In 1979, the permit limitations for Metro effluent were 25 milligrams of SS per liter of water (25 mg/L, equivalent to 25

parts per million) and 25 mg/L of BOD as monthly averages. Metro plant operations improved to produce an effluent that averaged 20 mg/L of SS and 19 mg/L of BOD. This assured Metro's ability to meet discharge limits of 20 mg/L each for SS and BOD consistently in 1980. The so-called "20-20" limit was originally scheduled to be effective September 1, 1979, but was postponed by state officials until February 1, 1980.

Metro discharged most of the effluent to the South Platte River, but some water was discharged into the Burlington Ditch under an arrangement with the Denver Water Department and Farmers Reservoir and Irrigation Company.

South Plant performs well

Metro's highly-automated (for its time) three-year-old South Plant handled an average flow of 90 mgd in 1979. Its secondary-treated effluent averaged 18 mg/L for both SS and BOD. Since the South Plant was generally more efficient than the older North Plant, maximizing its use kept treatment costs low.

Several major elements of operating costs increased even beyond the rate of inflation. For example, Metro's electricity bill for 1979 was \$1,311,841, compared with \$1,114,410 in 1978. So, despite a 3 percent reduction in power consumption, the cost of electricity rose 18 percent.

A \$79,900 engineering study began in 1979 on how to conserve energy—especially electricity—at the treatment plant, and on possible improvements in using the methane gas produced in digesters. A federal grant helped with 75 percent of the study cost.

Computerized control of waste activated sludge in the North Complex secondary treatment facilities was completed in 1979 at a cost of \$280,850. The new control system replaced obsolete, high-maintenance equipment. The automatic controls were planned to save an estimated \$21,000 a year in electricity and personnel costs.

Repair of damage to the Central Plant caused by the explosion at the nearby Conoco refinery on October 3, 1978, was largely completed early in 1980. The cost was \$475,000, and Metro anticipated recovering most of the costs from Conoco's insurance company.

Metro conducted 40 tours of the Central Plant for approximately 800 people in 1979. The tours included visitors from around the world.

Maintenance

Effective preventive maintenance and the capability to make fast repairs are essential for Metro. Most of the facilities operate around the clock, often at or above rated capacities.

Making maximum use of the South Complex allowed the entire North Complex primary treatment system and part of the North secondary facilities to be shut down in 1979-80. This let Metro repair and rehabilitate these facilities before reactivating them in the 1980s. The work included cleaning, repainting, and joint resealing in aeration basins and clarifiers. Phased work to replace insulation on air piping and to replace air diffusers in the North secondary also continued.

Major unscheduled corrective maintenance in 1979 included cleaning sludge foam out of the gas system in the digesters,

replacing chlorination equipment and piping because of corrosion, and frequent work on filtrate pipelines.

Maintenance employees installed a \$145,000 automated polymer feed system in the vacuum filters that dewatered sludge.

Electricians also installed automatic wastewater samplers at 22 stations in Metro's interceptor network. Significant improvements were made in processing and reporting maintenance data.

Planning for treatment

The first phase of a planning study on the future of the Metro plant was completed in August 1979, and citizen viewpoints were solicited on four possible alternatives for expanded treatment of wastewater. However, progress toward completing the study was slowed by a delay in the revision of state water quality regulations.



Laboratory Analyst Nancy Gurgilio prepares the manual hot plate digestion for total phosphates analysis in this 1975 photo.

The Colorado Water Quality Control Commission adopted new state water quality standards in 1978, but the complex process of applying the standards to waterways continued through 1980. Until Metro District officials knew what water quality would be required for the South Platte River, they could not complete plans for modifying the treatment plant to meet limits on the effluent discharged to the river. Cost estimates for plant improvements over the next 20 years ranged from \$14-\$60 million, depending on the level of treatment required. The major factor involved whether changes in or removal of nitrogen compounds from the wastewater would be required.

Cooperation between the Denver Water Department and the Metro District grew in 1979, as Denver Water proceeded with designing a \$22 million water reuse demonstration project just south of the Metro plant. Plans called for a demonstration plant that could recycle one million gallons of Metro effluent daily into potable water. John L. Puntenney, Metro's director of operations and maintenance, was appointed to Denver Water's advisory committee along with other regional and national experts.

Industrial pretreatment

To comply with regulations governing federal grants and discharge permits, the Metro District had to develop and implement an industrial pretreatment (source control) program in cooperation with its members. The pretreatment program would prevent or control the discharge of toxic pollutants from industries into the publicly-owned wastewater system. Metro began program development in 1979 and extended it into 1980.



John Puntenney (right) briefs officials on plant improvements.

The initial task was to identify establishments that discharged one or more of 129 toxic substances listed by the EPA by industrial categories. Such establishments, if over a certain size, would eventually be required to pretreat their wastewater to remove the toxic materials.

In May 1979, Metro filed an application with the EPA for a \$522,000 grant to help finance program development and provide the sophisticated laboratory facilities needed for monitoring many of the toxic pollutants. By early 1980, the EPA had not acted on the grant application.

Metro's Laboratory Services Department collected 10,700 samples and made 84,930 analyses in 1979.

Solids processing and reuse

In 1979, Metro faced what it hoped would be the last steps before beginning the Sludge Reuse Project. These steps were approvals by Adams County and the Colorado Department of Health of the planned sludge drying and fertilizer distribution center 22.5 miles east of the Metro District Central Plant. The long-term, cost-effective, environmentally safe solution to the final disposition of its sludge continued to elude the Metro District in 1979. However, the five-year role of regulatory agencies in reviewing the proposed solution was definitely scheduled to end in 1980, clearing the way for construction or court action.

In the meantime, applied research and development programs prevented a crisis in sludge dewatering capabilities and moved Metro closer to its goal of stabilizing all sludge through anaerobic digestion.

In 1979, the Metro plant handled an average of 115 dry tons of sludge per day, compared with an average of 111 tons in 1978. Because the sludge was trucked away from the plant as a mud-like cake composed of approximately 14 percent solids and 86 percent water, each dry ton of sludge represented 7 wet tons for transportation. The sludge came from extracting pollutants in the form of settleable solids from primary treatment of wastewater at both the Metro and Denver Northside plants and from secondary treatment at the Metro plant.

The original Metro treatment plant, designed in the early 1960s, treated sludge with lime and ferric chloride and dewatered it using vacuum filtration and incineration. Metro

had stopped incinerating sludge in 1971 because of air pollution laws, fuel availability problems, and breakdowns.

During the 1970s, all sludge (in the form of sludge cake) was disposed of by plowing it into soil. Disposing of the sludge as a waste product was costly and difficult, especially in severe winter weather. Additionally, Metro could not continue this type of disposal indefinitely for environmental reasons, especially with chemically treated sludge. Each dry ton of raw sludge had to be treated with 600 pounds of ferric chloride and lime.

Sludge digestion planned

In 1972, Metro began planning to recycle sludge as a soil conditioner and fertilizer by switching to anaerobic (without oxygen) digestion, in which sludge is biologically decomposed without chemicals in digesters.

This energy-efficient digestion process kills up to 97 percent of pathogens such as bacteria and larvae and reduces the raw sludge volume by about 40 percent. Metro believed it had virtually eliminated odor, though some residents living near application sites disagreed with this assessment. Digestion produced water, methane gas, and a stabilized sludge that, when dried, resembles humus.

The first phase of the plan was building the eight digesters that were placed in operation in 1977. The design capacity was 140 dry tons of sludge a day.

Metro had trouble operating the digesters at full capacity in 1978-79 because foam unexpectedly formed on the sludge in the tanks. Some experiments and a national survey of other major wastewater agencies that digest waste-activated

sludge under similar circumstances showed no solution to the foam problem. Early in 1980, Metro operations staff found that operating the tanks at about 120 degrees Fahrenheit rather than 95 degrees greatly reduced the foam.

Operating the digesters at the higher temperature meant Metro needed additional boiler capacity to heat the digesters in winter fueled by methane gas generated from the digestion process. Experience also showed the need to be able to flare excess methane gas in summer and the likely need for improved sludge mixing. Work on those problems began immediately.

The second phase of the sludge-as-fertilizer plan called for a sludge drying and distribution center on 1,920 acres located 22.5 miles east of the Metro plant. Digested liquid sludge would be pumped in dual, underground pipes to 600 acres of basins at the site for solar drying. The basins would have a special lining to prevent groundwater pollution. Surrounding the basins would be 1,320 acres for agricultural demonstrations with sludge and for stockpiling dried sludge fertilizer.

Sludge processing center delayed

Building a sludge processing center was delayed from 1975 to 1978 by an EPA Environmental Impact Study. It was further delayed through 1979 by a Colorado Health Department review. EPA and state approval cleared the way for the Adams County Commissioners to act in 1980 on a Metro application for county approval of the site. Meanwhile, estimated costs of the project tripled to \$40 million. Although the project was eligible for an 85 percent federal grant, the delay hurt Metro's position in the

state/EPA system of allocating grant funds. Metro feared the full amount of the grant would not be available when needed.

The delay also cost Metro an estimated \$1-2 million in extra sludge processing expenditures each year. The anaerobic digestion system was designed to have pumps and pipelines carry liquid sludge from the plant to the sludge reuse center. Without the pipeline and distribution center, the digested sludge had to be dewatered by vacuum filtration and transported as cake to the former Lowry Bombing Range. Digested sludge is difficult to dewater, and the capacity of the vacuum filters was being exceeded. If sludge could not be removed at the plant, it could end up as pollution in the South Platte River in violation of Metro's discharge permit.



Methane flares seen in this 1983 photo were part of the methane gas management system. Excess methane could not be stored and had to be flared if it was not being used to heat digesters.

Metro also faced a steady reduction in land available for sludge disposal at Lowry from 1,800 acres in 1970 to about 700 usable acres in 1980. This increased pressures to place only digested sludge there rather than chemically treated sludge.

The Metro staff and board did cost-benefit analyses of alternative solutions and began implementing a program to transport liquid digested sludge to the old Lowry Bombing Range in tanker trucks. The board appropriated \$390,000 to buy three truck tractors and four 7,000-gallon tank trailers plus a \$92,000 sludge applicator that could apply liquid sludge to farm land as a soil conditioner/fertilizer. A loading dock for filling the tankers was built, and liquid sludge hauling began in November 1979.

Other major improvement projects for solids processing during the year included:

- A start on a \$119,200 project to improve storage of polymer, an organic chemical used in the dissolved air flotation process for thickening sludge. The process used about 550 tons of polymer yearly.
- Completing a \$145,600 project for batching and feeding polymer into the vacuum filters that dewater the thickened solids to sludge cake for truck transportation.
- Installing pumps and piping costing \$146,800 to increase the capacity to transfer sludge from holding to digester tanks.

In cooperation with state and national organizations, Metro continued to experiment with agricultural reuse of sludge. Tests confirmed that Metro's sludge was safe for

many kinds of crops when properly applied. It was found to be roughly comparable to manure as a soil conditioner/fertilizer. The Colorado Health Department in 1979 adopted guidelines for using digested sludge in agriculture.

Personnel

IUOE union contract wage reopener negotiations resulted in an overall average wage increase of 8.5 percent for Metro District employees for the year starting December 1, 1979. The fringe benefits package was amended to provide one additional holiday per year. State law required Metro to provide employee compensation comparable to the prevailing rate in the Denver area.

The average pay raise by categories of Metro employees was 9 percent for operations and maintenance employees covered by an IUOE contract, 8.3 percent for laboratory employees covered by an OCAW Union contract, and 7.7 percent for administrative employees.

Member activities

Two lawsuits affecting the relationships with Metro District members were filed in 1979. One case resulted in a District Court order to reapportion the Metro board of directors. It was appealed to higher courts in 1980. The second case involved defining “connecting” and “associate” members of Metro and was scheduled for trial in September 1980.

The 1960 state law that enabled creation of the Metro District said the board must be reapportioned in May of odd-numbered years to reflect population changes among the Metro member municipalities. At the beginning of 1979, the Metro board consisted

of 62 directors—31 representing the City and County of Denver and 31 representing 20 suburban cities and sanitation districts—in accordance with complex apportionment formulas in the state law.

Early in 1979, the Lakewood Board of Water and Sewer Commissioners absorbed the Highland Park Sanitation District and assumed that district’s membership in Metro. The Lakewood Board provided sewer service for some areas within the city of Lakewood, while other areas were served by sanitation districts, including four that were members of Metro. During reapportionment talks, a dispute arose over which areas of Lakewood’s population should be counted as population for the Metro District.

Board reapportioned

In June, the Metro board, by a majority vote, adopted a reapportionment that listed a total Metro District population of 1,004,535, warranting a total of 66 directors. Included were a “served” population of 21,053 for Lakewood warranting one director, and a population of 510,747 for Denver warranting 33 directors. Under the law, each Metro member was entitled to one director for each 25,000 population or fraction thereof. However, a municipality having 50 percent or more of the total District population was entitled to 50 percent of the directorships. Crestview Water and Sanitation District and the Lakewood board filed a lawsuit in Adams County District Court challenging the reapportionment.

In August, District Judge Dorothy Binder ruled that the Metro board had to reapportion itself by using a larger population for Lakewood. In compliance with the court order, the board approved a reapportionment, effective

November 1, that listed a Metro District population of 1,068,134, warranting 57 directors. Included was a population of 84,652 for Lakewood, represented by four Metro directors. The Denver population of 510,747 was not changed.

Under the state law, however, Denver no longer had at least 50 percent of the directorships, so its representation had to be based solely on its population, which warranted 21 directors compared to 36 for all other Metro members. Denver was appealing Judge Binder's order as 1979 drew to a close.

The second lawsuit was set for trial in Adams County District Court in September 1980. It was filed against the Metro District by two members, the Bancroft-Clover and Alameda Water and Sanitation Districts. The City and County of Denver entered the case to oppose claims of the plaintiffs.

Bancroft-Clover and Alameda contended their wastewater systems were directly connected to Metro facilities via a section of the Platte River Interceptor that was completed late in 1978. As associate members, their wastewater had flowed through Denver facilities, and Denver had charged the two districts for wastewater services. The two districts said they preferred to deal directly with Metro. Similar issues were also involved in a lawsuit that Denver filed in Denver District Court against the Metro District and its members.

Efforts continued unsuccessfully in 1979 to have all Metro members prove that their systems of charges to their sewer system users were equitable in accordance with federal law and regulations. The EPA required such documentation before the last 20 percent



In 1980, the executive committee of the board included: (standing, from left) Harold Cook, Boris Voukovitch, Mary O'Dell, Alan Canter, (seated) Dean Lund, Bob Hite, Don Allard, and Richard Beckfeld.

of federal grants would be released. In 1978 and 1979, the EPA withheld \$5.2 million in grant funds due Metro. This resulted in a loss of more than \$300,000 a year in interest earnings to Metro.

Early in 1979, the Metro Board adopted goals and policies to:

- Provide service to newly developed areas and wastewater agencies through present member municipalities rather than accept new members.
- Encourage and assist in consolidating present member municipalities to reduce costs,

increase water reuse opportunities, and provide flexibility in reserved capacity allocations.

1980—Year of changes

In April of 1980, thousands of Cuban refugees began arriving in Florida in what became known as the Mariel Boatlift. In the same month, the U.S. announced it would boycott the Olympic Games that summer to protest the Soviet Union's invasion of Afghanistan, Mount St. Helens erupted in Washington State in May, and Ronald Reagan beat Jimmy Carter in November following the dismal failure of the attempt to rescue the U.S. hostages in Iran in April.

Situations that would affect the Metro District for years to come hit the utility in 1980. Interceptors were full to overflowing and Metro was headed for a confrontation with the federal government over problems related to grants. In addition, District Manager William Korbitz resigned, and Robert W. Hite, a director representing Denver, was elected to the first term of an unprecedented three terms as chairman.

Interceptors that delivered wastewater to the Central Plant were reaching their ultimate capacity during 1979 and 1980. Meanwhile, the federal government and local governments in the metropolitan area, including the District's member municipalities, continued their long dispute over the federal government's exercise of regulatory controls that, in theory, would improve wastewater facilities and operations.

Weir Gulch overflow

A 1980 incident highlighted the interceptor capacity problem. Heavy rains in the spring brought on a 10-

day spill in the south branch of Metro's Weir Gulch Interceptor near South Sheridan Blvd. and West Alameda Ave. The overflow spurred a Colorado Department of Health order prohibiting new sewer taps in the Weir Gulch drainage basin until a relief interceptor could be built.

The Weir Gulch overflow highlighted the board's rising concern over financing for badly needed additional interceptors in the fast-growing Denver area. These problems had to be solved, with or without federal aid.

It soon became clear that the Metro District would likely not qualify for federal grants for 75 percent of the cost of new interceptors.

The director of the Colorado Water Quality Division of the Colorado Health Department attended a Metro board meeting in August to stress prevention of illegal sewage discharges. The governing bodies of several of Metro's members passed resolutions urging Metro to develop a financial plan for new interceptors.

Federal grants, however, carried use limitations. They were an unacceptable financial incentive to the District's member municipalities. Meanwhile, Metro's board was increasingly leaning toward 100 percent local funding of capital construction projects through a bond issue as the only practical alternative.

The board and staff worked on a plan they felt voters could accept. Much of the preliminary design work for needed projects had been completed. Thus, if voters approved a bond issue, much of the financing and construction planning would already have been completed and implementation could move ahead rapidly.

Treatment quality improves

The District improved its effluent quality by 20 percent in 1980 in compliance with state requirements. The improvement met Metro's National Pollutant Discharge Elimination System permit limits.

The Colorado Water Quality Control Division had issued the discharge permit under federal guidelines. It limited the pollutants that could remain in the effluent; the two major parameters were suspended solids (SS) and biochemical oxygen demand (BOD), a measure of organic pollutants.

In 1980, Metro's effluent could contain only 20 parts per million (ppm) of SS and 20 ppm of BOD, compared with limits of 25 ppm of BOD and 25 ppm of SS in 1979.



Retired Regulatory Officer Duane Humble (left) and retired Director of Laboratory Services Shian Kung conduct experiments in the lab in 1981 using bench-scale anaerobic digester.

The operations and maintenance staff achieved the higher treatment level without increasing costs and in the face of growing wastewater flows. Flows into Metro's facilities averaged 139.9 mgd in 1980, up from 132.6 mgd in 1979. A peak flow of 188 mgd came in May 1980. The typical diurnal (daily) fluctuation was a low of 75 mgd at 6-7 a.m. and a high of 185 mgd at about noon.

Most of the effluent was discharged to the South Platte River, but up to 60 mgd, depending on demand, was pumped into the Burlington Ditch under an arrangement with the Denver Water Department and Farmers Reservoir and Irrigation Co.

Primary treatment facilities in the Central Plant's 15-year-old North Complex remained shut down in 1980. All primary treatment was handled in the highly-automated, four-year-old South Complex. It had a design capacity of 42 mgd for primary treatment but processed an average of 57.7 mgd in 1980. This resulted in a savings of \$170,000 for the year.

For secondary treatment, the South Complex handled an average flow of 85 mgd. The North Complex secondary treatment facilities averaged 55 mgd during the year.

A demonstration project to test new equipment to improve removal of settleable solids began in 1980 in one of the North Complex secondary clarifiers. Testing continued into 1981. The Board appropriated \$172,550 for the equipment and installation.

Sludge processing and disposal continued to be major cost elements, and attempts to find an economical way to recycle digested sludge into a fertilizer/soil conditioner continued. Metro staff found cost-effective solutions to the complex

problems of foaming in the anaerobic digesters and for reusing excess methane gas produced in sludge processing.

O&M challenges

Foam accumulating on the surface of sludge being treated in the eight anaerobic digesters was a major operation and maintenance problem. Foaming reduced the capacity of the digesters, which were designed to handle an average load of 98 dry tons of sludge a day. A survey of other plants showed foaming to be a common problem at large wastewater treatment plants around the nation where waste-activated sludge from secondary treatment is digested. The survey revealed no solutions.



A laboratory technician checks a digester for sludge foam in this 1979 photo.

After testing a variety of operational changes to reduce the foam, staff concluded the most cost-effective solution was to install a pipe mechanism that drew off the foam when digested sludge was pumped from the digesters into tanker trucks to be hauled to disposal or reuse sites. Phased modifications of all the digesters was scheduled for 1981-82 at an estimated cost of \$160,000.

Metro's systematized preventive maintenance program plus the capability to make emergency repairs let the Metro system operate 24 hours a day, every day. Examples included:

- Upgrading flow meters at connection points where the wastewater from Metro members was measured.
- Providing erosion protection for Metro interceptors in creek channels, under a \$71,874 contract.
- Phased maintenance work on North Secondary facilities, including simplifying aeration equipment, sealing joints, and painting.
- Rehabilitating the out-of-service North Primary facilities so they would be ready as needed in the next few years.
- Modifying a deodorizer burner to use methane gas from digester tanks instead of costly natural gas.

Exploring consolidation with Denver's Northside plant

A committee of Denver and Metro board members explored consolidating Denver's Northside Treatment Plant with Metro's treatment plant and interceptor networks in 1980. Discussions continued into 1981.

Allen Jones, a board member representing Crestview, said some of the suburbs weren't so sure the transfer was a good idea. "It wasn't fair to the suburbs to pay to upgrade all the dilapidated (Denver) lines," he said in an interview on Jan. 4, 2006. "When the Northside Plant became part of Metro, everyone took over. The money to upgrade should have come from Denver's coffers."

Denver Water was scheduled to start construction in 1981 on a \$22 million water reuse demonstration project on a site just south of the Metro District plant—the same site where its non-potable reuse plant now stands. In August 1980, the Metro board approved an agreement under which Metro would provide up to one mgd of treated effluent to Denver Water for the experiment on recycling it into potable water. Also, Metro would treat wastewater from the project. In return, Denver Water would return treated water for isolated use at the Metro plant.

Metro's lab worked on a federally-required pretreatment program in 1980 for the District to assure that toxic and hazardous industrial wastes were not discharged into the publicly-owned Metro wastewater facilities. Industrial and commercial operations that generate such wastes would eventually be required to pretreat their wastewater to remove toxic materials under the federal program. Work on data collection and procedures at Metro, in cooperation with its members, continued in 1980.

Solids processing and reuse

The City and County of Denver, which owns the Lowry Landfill, contracted in mid-1980 with a company to handle both solid wastes and hazardous wastes placed at the site. As a result, the area available to Metro for land

applying its sludge shrank to 700 acres. That land was comparatively hilly, making sludge disposal more difficult.

As the land area available to Metro for sludge disposal at the Lowry disposal facility shrank from 1,800 acres to 700 acres on July 1, the Resource Recovery and Reuse Department began to make extensive and costly changes in its operations.

During winter and wet weather, the liquid sludge had to be stored temporarily in shallow lagoons awaiting incorporation in the soil. Metro plans called for 24 tanker truck loads (7,000 gallons, each one containing one dry ton of sludge) to be hauled daily in 1980 and 64 loads daily in 1981. Metro built nine lagoons in 1980 and had scheduled a tenth the following year for a total storage capacity of 40 million gallons. The lagoons had to be carefully located on high points of land in the rolling prairie to prevent stormwater washouts and to facilitate pumping when they were emptied.

Metro's board of directors in 1980 appropriated \$378,371 for three new road tractors, three tanker trailers, and two spreader trucks.

Plans for 1981 called for about 20 percent of the sludge production to be incorporated into the soil as a soil amendment on farm lands under agreements with farmers and under state guidelines. Research by Metro and other agencies around the world showed sludge to be safe for land application when properly applied.

Because Metro also lost use of the section of land where its sludge transfer station and personnel/shop facilities had been located at the Lowry site for a decade, it had to build a new \$118,000 shop building near the center of the relocated operations.

Arapahoe County Commissioners issued an order halting all disposal at Lowry because of public reaction to hazardous waste disposal there. The order told Metro to cease sludge disposal at Lowry by December 31, 1982. A number of parties filed a lawsuit over the county's order, and the litigation continued into 1981.

When Metro began using Lowry in 1970, Metro District officials knew the land could not be used indefinitely for sludge disposal. That was a basic reason for the plan to digest sludge and then beneficially recycle it, mainly on farm land where crops could use the nutrients in the sludge, especially the nitrogen.

Sludge pipeline finally approved, but too costly

Federal and state agencies finally approved the long-planned sludge pipeline and drying center project in March 1980. But Adams County Commissioners had yet to act. They scheduled a hearing in July on Metro's application to approve the drying center site. The hearing was postponed until early 1981 so a potential conflict between the site and studies for a new regional airport (now Denver International Airport) could be resolved. In the meantime, cost estimates for the pipeline and drying center had escalated so rapidly that the Metro District began a value engineering study of the project in 1981 to re-examine possible alternatives, including composting.

Projects to improve sludge processing at Metro's Central Plant in 1980 included:

- A start on installing a third boiler and related equipment to ensure adequate digester heating. A total of \$343,840 was appropriated for the project.

- Completing a \$119,200 project involving polymer for use in the dissolved air flotation process for sludge thickening.
- A \$47,000 pilot study on "dual digestion" of sludge using both aerobic (with air) and anaerobic (without air) techniques.

The board approved a 9.5 percent wage increase for the 189 employees of the Metro District for the year beginning December 1, 1980. The employees' benefits package was amended to include dental insurance under a co-payment plan.



Liquid sludge is land applied to agricultural land in 1983.

Compensation increases were applied to an IUOE contract covering operations and maintenance personnel, to an OCAW Union contract covering laboratory personnel, and to administrative employees.

Litigation

Litigation involving the Metro District and its members continued throughout 1980 in various District Courts and the Colorado Court of Appeals.

The lawsuit filed in 1979 against Metro by two of its members, the Alameda and Bancroft-Clover Water and Sanitation Districts, was decided November 10, 1980, in Adams County District Court. Over the City and County of Denver's objections, the judge agreed with Alameda and Bancroft-Clover that their wastewater systems became connected to Metro facilities with completion of a section of Metro's Platte River Interceptor.

As previous "associate" members of Metro, their wastewater had flowed through Denver facilities before reaching the Metro treatment plant, and Denver charged them for services. The court ruled the two districts could now deal directly with Metro regarding billings and payments for wastewater services. Denver appealed the case to the Colorado Court of Appeals.

In a somewhat similar but more far-reaching case, Denver filed suit in Denver District Court late in 1979 against Metro, its other members, and state and federal water quality control agencies. The complaint challenged various aspects of the Metro system of annual charges. It was the subject of numerous motions by the various parties throughout 1980. No trial date had been set at year end.

Denver's appeal of an Adams County District Court case on reapportionment of the Metro Board remained pending in 1980.

The Metro District was found not guilty on a charge of violating a Denver ordinance involving sewage overflows in lower Weir Gulch during spring rains in 1980.

A complex lawsuit involving use of the Lowry waste disposal site began late in 1980. Parties included Metro, Denver, the City of Aurora, and Arapahoe County.

In a precedent-setting move, the City of Golden asked to withdraw from the Metro District effective mid-1982. To help protect some water rights, Golden wanted to have its wastewater



This is the Administration Building (now the Technical Services Building) as it looked in 1979.

treated at the Adolph Coors Co. treatment plant in Golden instead of sending it through the Clear Creek Interceptor to Metro's Central Treatment Plant. Golden joined Metro in 1971. The Metro Board's consideration of the legal and financial implications of Golden's request for exclusion continued into 1981.

In mid-1980, Metro began accepting sludge trucked in from the South Lakewood wastewater treatment plant, operated by the Lakewood Board of Water and Sewer Commissioners. Lakewood paid all costs.

Other matters

In September 1980, Metro filed a foot-high set of documents with the Denver Regional office of the EPA in an attempt to comply with requirements that charges against users of the Metro system be equitable. Six months later, the EPA replied with a 10-page letter demanding additional data. Meanwhile, the EPA continued to withhold \$5.2 million in grant funds due Metro, and Metro lost more than \$1 million in interest income during 1978-80 as a result.

The board attempted to allow a one percent debit or credit on underpayments or overpayments, respectively, on estimated annual charges paid by members in 1979. An Adams County District Court advisory opinion said such a procedure was illegal.

The board also:

- Voted in September to take a neutral position on a November election question concerning creation of a Metropolitan Council with power to absorb the Metro Sewage District.

- Approved revised regulations for accepting septic tank wastes.

In July 1980, Don Allard of Arvada completed two years of hard work as chairman of the Metro Board. Under Allard's leadership, the board began holding retreats to give members an opportunity outside the confines of the boardroom to get to know each other better and to build trust, said Allard.

Robert W. Hite of Denver succeeded Allard. Hite would go on to serve an unprecedented three terms as chairman and would eventually become district manager in 1988.

William E. Korbitz resigned as district manager effective October 4 to establish the Denver office of a national consulting engineering company. The board and staff expressed deep appreciation for his 10 years of dedicated service and leadership through several crises. Korbitz said he always thought public service was a huge reward for those who sought it.

1981—Metro seeks funding strategy

Iran freed its U.S. hostages, President Ronald Reagan survived an assassination attempt, and Sandra Day O'Connor became the first woman appointed to the U.S. Supreme Court in 1981. Meanwhile, the Metro District began the year looking for a funding strategy for critically needed capital improvements. By year end, strong leadership by Chairman Robert W. Hite, incisive decision-making by the board, and strenuous work by staff yielded a financial program that was being implemented.

The high point of the year was voter authorization in October for the Metro District bond issues of up to \$126 million. Metro



This 1983 photo shows 48-inch sewer pipe being installed in downtown Denver.

declared itself most grateful to: 1) the voting citizens who perceived the need for wastewater facilities to assure a healthy environment and economy in the Denver area; and 2) the officials of Metro's 21 member municipalities and other organizations who supported the bond issue authorization and provided interim financing to get projects started. Metro pledged fast, efficient use of bond funds to comply with the voters' mandate.

Comprehensive facilities-planning work completed earlier was invaluable in preparing for the bond issue campaign and for rapid construction starts on new projects.

A change in state law improved the process by which amendments could be made to the service contracts between Metro and its member municipalities. The law governing metropolitan sewage districts was amended to allow more flexibility. Governing bodies of the Metro members then voted by a two-thirds majority to update the charges formula in the contract. The change made the charging system more equitable and may have resolved one long-standing dispute about the service contract.

Sludge management plan revised

Metro revised its sludge management plan to more cost-effectively achieve the goal of beneficially reusing sludge. The projected cost to implement the plan that had been in development for six years to pump liquid sludge to a drying and distribution center in rural Adams County had tripled to \$50 million.

The revised plan called for centrifuging the sludge to dewater it, applying the digested sludge on farm fields, and dewatering and composting sludge cake at the Metro plant. The capital cost was

estimated at \$15 million, with full implementation scheduled in 1983. The new system was expected to save up to \$1 million a year in operating costs compared to the system then in place.

Through 1981 and 1982, the Metro District continued to study the implications of new Colorado water quality control regulations for the South Platte River. A new discharge permit governing Metro's effluent would be needed under the new regulations. Metro believed it would require expensive improvements in Metro's wastewater treatment processes. In 1981, the Metro plant provided treatment better than was required by the state.

Administration

On October 6, 1981, residents of the Metropolitan Denver Sewage Disposal District No. 1 service area voted by a 5-to-1 margin to authorize the District to issue up to \$126 million in bonds to build additional wastewater facilities. It was believed then to be the second-largest bond issue approval by voters in Colorado history and prevented a possible crisis in the environment and economy of the Denver metropolitan area.

Increasing difficulty in getting federal grants for wastewater transmission and treatment projects led Metro to seek local bond funding. The federal logjam had resulted in a serious backlog of capital improvements needed to serve the 1.2 million residents of the Metropolitan Denver Sewage Disposal District No. 1.

District members badly needed additional interceptor sewers to transport wastewater from Metro's connectors to its Central Plant at E. 64th Avenue and the South Platte River. Parts of the interceptor network had been operating at or near capacity since the mid-1970s. Raw sewage overflows posed a

health hazard and could have caused state and federal water pollution control agencies to impose fines or a moratorium on new real estate developments to help prevent them. The resulting slowdown in real estate activity could have produced significant adverse impacts on the area economy.

Intensive preparations for a new bond authorization election began in April 1981. In June, the Metro District board of directors passed resolutions calling for a 10-year facilities construction program and for a special election. Following the favorable vote, Metro began planning to sell about \$76 million in bonds to finance construction of top priority projects through 1984. Other less critical projects would be undertaken later in the 1980s with additional sales of bonds.

In the meantime, design and construction work proceeded on the most critical interceptor projects and on a new program to handle the sludge. The progress prior to receiving proceeds from a bond sale was made possible by: (1) funds advanced to the Metro District by some of its member municipalities in expectation of reimbursement later from bond proceeds; (2) allocation of \$7.2 million remaining in the District's Acquisition and Construction Fund.

During the campaign for voter approval, the Metro District estimated that the cost of debt service for a maximum \$126 million bond issue could add a maximum of \$2.80 to the monthly sewer service bill of an average household in the Metro District service area.

At the beginning of the campaign, the Metro District board of directors pledged to explore a "growth pays its own way"

concept in which new real estate developments would pay some form of sewer connection charge. Funds generated this way would pay for debt service on bond financing for the new facilities to serve the new developments. This revenue would reduce the need for increases in monthly or bi-monthly sewer service bills paid by existing users of the Metro system.

Budget

In 1981, operations and maintenance expenses for the year totaled \$10,480,728 or \$408,502 under budget. For 1982, the O&M budget approved by the board of directors was \$12,780,820.

The Metro District's total budget for 1982, including O&M, capital outlay, and bonded debt service was set by the board at \$15,479,070, compared with \$13,884,770 for 1981. Outstanding bonded debt at the end of 1981 was \$39.7 million.

The main revenue source for the budget was from annual charges the Metro District collected from its member municipalities based on the amount of service provided.

Personnel

The Metro District board of directors hired Jack B. Enger, P.E., as manager effective March 1, 1981. He replaced William E. Korbitz, who had served as manager from 1970 to 1980. Enger had been with the Metropolitan St. Louis (Missouri) Sewer District since 1956 and had been assistant executive director (operations) since 1978. He had a bachelor's degree in civil engineering and a master's in engineering management.

Joseph D. Woodley, director of administrative services since 1970, was appointed deputy manager.



Constructing interceptor sewers was a major effort for Metro in 1982, when this photo was made.

In 1981, the Metro District averaged 200 employees organized into five departments. An 11.2 percent overall average wage increase and some improvement in benefits were approved by the board for the year beginning December 1, 1981.

Membership relations

In June 1981, Denver Mayor William H. McNichols Jr. called for a study of the feasibility of transferring to the Metro District the ownership and management of Denver's "common system" of wastewater facilities. The common system included:

- The Denver Northside Treatment Plant, which provided primary treatment for more than half the wastewater flows coming to the Metro District. Effluent from the Northside

plant received secondary treatment at the Metro plant. In addition, liquid sludge from the plant was received at Metro facilities for final processing and disposal or reuse.

- Sewer mains that carried wastewater to Denver's Northside Treatment Plant from parts of Denver and also from more than 40 suburban areas. Those suburban areas had agreed in the past to pay Denver for wastewater collection and treatment services, although some of the suburban connectors were also members of the Metro District. Denver, in turn, paid Metro for the secondary treatment, and in 1983, would start paying Metro for handling sludge from the Northside Treatment Plant.

The plan was for Metro to manage the common system. This was viewed as a way to simplify the complex wastewater service relationships, legal questions, and transfers of payments between Metro, Denver, and the suburban jurisdictions. Consultant studies of a possible transfer were started and recommendations were expected in 1982.

Service Contract charging formula changes

In July 1981, following extensive studies and a change in the law, the Metro board approved a new charging formula for the service contract. By the end of the year, two-thirds of the Metro member connectors had ratified the amendment so it could be applied in preparing Metro's 1983 budget.

In other 1981 activities:

- The Metro board reapportioned itself in May in accordance with a state law requiring representation

of Metro members based on their current populations. The reapportioned board had 55 members. The board's executive committee was expanded from eight to nine members through a change in by-laws.

- In September, after months of negotiations, the board approved the City of Golden's request for exclusion from the Metro District. The exclusion was to become effective in the summer of 1982 when Golden's wastewater would start receiving treatment at the Adolph Coors Co. plant in Golden instead of being discharged into Metro's Clear Creek Interceptor. Golden agreed to pay Metro \$440,000 for loss of revenue.

Transmission and Engineering

As 1982 dawned, Metro had \$5.8 million available in the Acquisition & Construction Fund to design and build additional interceptor sewers. Extensive planning studies, however, showed new interceptor projects costing \$25-30 million were needed immediately to help prevent raw sewage overflows from Metro's existing interceptor system. The 10-day Weir Gulch sewage overflow in 1980 made it a top priority for expansion.

Major 1981 engineering work was preparing the 10-year capital improvements program to be financed by bond issues. Engineering staff, with assistance from consulting engineers, prepared cost estimates and construction timetables for the \$126 million program. They made significant progress on design and construction starts for some of the projects.

In addition to managing the planning, design, and construction of new physical facilities, the Engineering Department worked closely with the Operations and Maintenance Department on improvements to existing facilities. Staff engineers worked on about 45 projects involving modification of existing facilities.

Engineering and O&M employees developed a system of injecting polymers into interceptors to increase the rate of wastewater flow in the interceptors. The technique would be used in the future, if needed, to prevent or reduce overflows.



Gary Peters reads a nutrient analysis chart in this 1982 photograph.

Treatment

During 1981, the Metro plant treated an average of 140 million gallons of wastewater daily. The quality of effluent was consistently better than required by the state in two key parameters: suspended solids (SS) and biochemical oxygen demand (BOD).

Metro's discharge permit from the Colorado Water Quality Control Division expired at the end of 1981, making securing a new permit a major concern for 1982.

Many of the regulations administered by the Division were established by the Colorado Water Quality Control Commission. In April 1981, the Commission approved a reclassification of the South Platte River under revised standards for the quality of state waters. Translating the state regulations into a discharge permit would determine the allowable pollutant load. Effluent limitations, in turn, indicated the improvements—and the associated costs—that Metro should make in the plant's treatment processes.

State regulations and discharge permits issued pursuant to the revised standards for the quality of state waters were subject to review and approval by the Denver office of the EPA under federal water pollution control laws and regulations. By the end of 1981, the EPA had not acted on the state standards for the South Platte River in the Denver area.

Facility planning continues

Four years of work on the Central Plant Facility Plan that covered the future of the plant to 2000 was expected to be completed early in 1982. The plan would include a report on energy use, including possible re-use of methane gas generated during sludge processing.

In 1981, the Metro board of directors approved the energy report, approved the Phase I study on the Central Plant, and authorized work on Phase II (pre-design of improvements) for the plant.

The plant had ample primary treatment capacity. Improvements in secondary treatment would be needed for added capacity, increased efficiency, and for anticipated new discharge permit requirements. A major question would be the scope of the improvements needed in the system to disinfect effluent before returning it to the South Platte River.

In anticipation of the needed expansion and improvements at the plant, the 1981 bond issue package provided \$1.5 million for addition support facilities such as office space and maintenance shops.

Another 1981 treatment activity was initiating work on an \$80,000 contract to interconnect effluent streams from the Treatment Plant's North and South Complexes. Most plant effluent was discharged to the South Platte River. However, up to 60 mgd, depending on demand, was pumped to the nearby Burlington Ditch under an arrangement with the Denver Water Department and the Farmers' Reservoir and Irrigation Co. Originally, effluent for the ditch could come only from the North Complex. The interconnection would provide flexibility for present and anticipated future pumping to the ditch for water exchange programs.

Solids management

Metro conducted a value engineering study early in 1981 and revised its plans to beneficially reuse sludge. The new

approach was to be implemented in phases in 1982-83. It would allow the Metro District to stop taking sludge to the former Lowry Bombing Range south of Aurora.

The value engineering study showed an alternative sludge management system would be more cost-effective and flexible than the pipeline/drying center project Metro began developing in 1975. The new approach called for:

- Two or three centrifuges to dewater the digested sludge.
- Tanker trucks to haul digested, dewatered sludge (6 to 10 percent solids) to farms or land reclamation areas for injection into the soil using specialized equipment.



In 1984, the Cogeneration Building was under construction. The project was completed in 1986.

The sludge at that point would contain about 5 percent nitrogen and be roughly equivalent to manure.

- Producing centrifuged sludge of 16-20 percent solids for composting. The composting system was envisioned to be used mainly during inclement weather when liquid application to land was not possible. The dry composted product would be used as a soil conditioner or would be placed in sanitary landfills if necessary.

In addition to flexibility in operations and sludge reuse, the new system was expected to save about \$1 million a year compared with 1981 trucking and disposal costs.

In early summer of 1981, Metro began applying about 15 percent of its liquid digested sludge to some large farms and to land around Stapleton Airport where sandy soils needed re-vegetation. The balance of the sludge was trucked as a liquid or a vacuum-filtered “cake” to the Lowry Bombing Range. In future years, Metro expected to apply 80 percent of all its sludge as a liquid directly on farm land and to compost the balance for land reclamation.

Metro’s new bond financing package contained approximately \$15 million for the sludge management program, including engineering, construction, equipment, and land related to composting, plus funds for digester improvements.

In the fall of 1981, following months of intensive work on details of the new sludge management plan, the Metro District board of directors authorized \$862,000 to buy and install the first centrifuge. Test runs of the new centrifuge were scheduled for the spring of 1982.



A vacuum filter—part of the original sludge-handling equipment—is removed through the roof of the Sludge Processing Building in 1981 in preparation for installing the first centrifuge.

In addition to sludge produced in primary and secondary wastewater treatment at the Metro plant, digested primary sludge was received from Denver’s Northside Treatment Plant for reuse or disposal by Metro.

1982—Facilities for the future

In 1982, Argentina invaded the British-owned Falkland Islands, cyanide-laced Tylenol capsules killed 7 people in Chicago, and the first artificial human heart was implanted. Meanwhile, Metropolitan Denver Sewage Disposal District No. 1 began a

construction program that was to continue for the next 10 years as it grew to meet the needs of the burgeoning Denver metro area.

Metro expected its service area population to increase by almost half a million people by 2004. A four-year study of Metro facilities showed that the system would not be able to handle the additional wastewater flows generated by this population without significant expansion.

Thus, in the early 1980s, the Metro District identified numerous projects to increase its transmission capacity and treatment efficiency. It also recommended other projects to enable Metro to meet more stringent state and federal pollution control requirements.

With passage of the 1981 bond issue, Metro was able to commit to the design and construction of those projects in 1982.

The first major step was the sale of \$76 million in short-term bonds. By year end, at least two interceptors neared completion and others were scheduled for construction starts in early 1983.

Centrifuge start-up

One of the most important projects was installation and start up of a 750-gallon per minute centrifuge to thicken and dewater sludge. In its first six months of operation, it saved the Metro District about \$500,000 dollars in sludge recycling costs.

The Metro District continued its successful treatment operations in 1982, processing about 139 mgd and meeting the required discharge limitations. Metro also made progress in water quality control by adopting an Industrial Waste



In this March 1982 photo of the Sludge Processing Building, part of the first 750 gallon-per-minute Humoldt centrifuge for thickening sludge is being installed through the roof.

Control Program. The program was designed to protect Metro from hazardous and toxic materials that might interfere with sludge reuse or cause Metro to violate its discharge permit requirements. It was to be fully operational by 1986.

The board took some significant actions in 1982 that contributed to the growth of the Metro District system. Included were adopting a Central Plant Improvements Program, approving the concept of Metro acquiring Denver's Northside Treatment Plant and common interceptor system, and initiating a growth-related charges policy.

The growth-related charges system, implemented through a service contract amendment, would help retire the \$126 million in bonds the District's voters had approved in 1981.

Metro established its sewer connection charge, or "tap fee," effective January 1, 1983, to help pay for new facilities. In effect, the charge conveyed the burden of payment for the new facilities to those whose addition to the system created the need for those facilities, following the board's philosophy of growth paying its own way.

Growth in metropolitan Denver seemed inevitable. In 1981, Metro committed to keep pace with this growth. In 1982, Metro began to fulfill that commitment. The District's construction program was still in its infancy, but 1982 was a year of progress.

Sewer connection charge helps pay debt service

Capital construction to increase wastewater treatment and transmission capacity increased the Metro District's liabilities and its debt service requirements. New connectors to Metro's system would bear the cost of new facilities required to handle their additional wastewater flows.

The board voted to establish a \$500 sewer connection charge for each new or altered single family residential equivalent unit the Metro District served. Member municipalities agreed to the fee, and it went into effect January 1, 1983.

In mid-1982, funds from the first bond sale were deposited into Metro's Acquisition & Construction Fund. In the meantime, to avoid delay on some of the badly needed interceptors, several member municipalities advanced funds to Metro to design and construct those projects. They included the City of Aurora, Alameda Water and Sanitation District, Bancroft-Clover Water and Sanitation District, the City and County of Denver, and the City of Thornton. The Metro District agreed to continue work on the projects and to reimburse the contributors when bonds funds became available.

Transfer of Denver's Northside Plant

In early 1982, a feasibility study found that transferring ownership and management of Denver's Northside Treatment Plant and common interceptor sewer system to Metro would be favorable to both parties. The study showed the Denver facilities were in generally good condition but said Metro needed to replace the Denver Northside Plant with facilities at its own Central Treatment Plant in the near future.

The study said most of the Metro District's connectors would benefit from the takeover, primarily because of cost savings from consolidation. Another benefit from the transfer of Denver's common interceptors—sewers that carry wastewater from Denver and more than 30 suburban areas to the Northside Plant—was simplified payment procedures. Instead of suburbs paying

Denver for treatment and sludge handling, and then Denver paid Metro, the suburban connectors would pay Metro directly.

Board acts on study recommendation

Metro's board acted in November on the feasibility study recommendation to replace the Denver Northside facilities with treatment facilities at the Metro plant and bond funds were available for the project.

- Transfer of Denver's common interceptor system to Metro.
- A 10-year lease of the Denver Northside Treatment Plant for \$1 per year with the lease automatically terminating earlier if Metro ceased operation at the plant.
- Constructing replacement treatment facilities at the Central Treatment Plant within 10 years.

Metro drew up the agreements with Denver in early 1983.

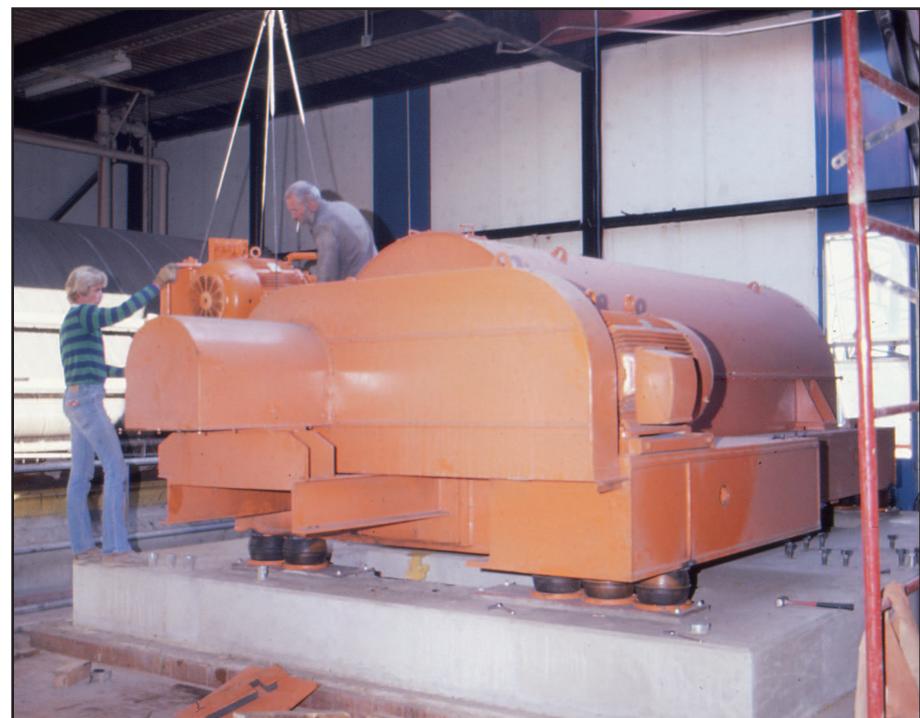
Headcount drops, transmission projects begin, discharge permit delayed

An uncommon event occurred at the Metro District in 1982: manpower requirements dropped in solids recycling. The number of employees dropped to 193 after 23 people had been laid off. Metro placed these employees on recall for up to a year and made extensive efforts to place them in equivalent positions elsewhere.

When the 1981 bond issue passed, it assured Metro its proposed \$88 million transmission expansion program would come to fruition over the next 10 years. Of 15 projects to be funded through bond sales, 12 were transmission projects needed to relieve existing interceptors that had reached or soon would

reach capacity. The program included building nine new interceptors, one force main, and a pump station, in addition to rehabilitation and expansion projects. In 1982, construction began on four of the 12 transmission projects. Three others were in the design stage and at least two neared completion.

The Metro District continued to treat an average 139 mgd daily in 1982. Even though the expired discharge permit had not been reissued by year end, a new permit based on the state's new water quality standards for the South Platte River Basin was expected from the Colorado Department of Health by summer.



The first new 750 gpm centrifuge is assembled after being installed through the roof of the Sludge Processing Building in March 1982.



The Lakewood Gulch Interceptor was under construction in this 1982 photo.

Improvements to increase treatment capacity, efficiency

In May 1982, Metro's board of directors adopted a Central Plant Improvements Program to increase plant efficiency and capacity, and to meet expected discharge permit requirements.

The program was based on a four-year study that evaluated the Metro District's Central Plant treatment capabilities and identified facility needs through 2004 in light of likely revisions to stream standards for the South Platte River and future wastewater flows and loadings.

The study projected that by 2004, Metro's wastewater flows would reach about 185 million gallons a day—roughly 45 million gallons more than the 1982 daily average—and that discharge permit standards were likely to become more stringent than current limitations.

Capacity for primary treatment of that much wastewater appeared adequate if both Metro's Central Plant and Denver's Northside Plant were in operation, but secondary treatment capacity fell short. If the Denver Northside Plant was not in operation, primary facilities at the Central Treatment Plant would not be able to handle the additional flows. In addition, treatment facilities lacked adequate flexibility to allow Metro to meet more stringent pollution control requirements.

To meet these future obligations, the Central Plant Improvements Program called for several projects to increase capacity and some to provide flexibility to meet permit requirements. Several major treatment plant projects then under design included:

- Improving the aeration system in the North Complex to provide more efficient treatment and to reduce annual power costs.
- Modifying the North Complex secondary clarifiers to increase capacity and control floating sludge and odors more effectively.
- Modifying the disinfection systems in both complexes to permit effluent to meet state effluent standards.

The overall quality of Metro's effluent was generally better for the year than required by the state. For most months, the average levels of suspended solids (SS) and biochemical oxygen demand (BOD) were well below the Colorado-mandated 20 milligrams per liter. BOD averaged 18 milligrams per liter for the year.

Centrifuge reduces solids recycling expenses

The Metro District's first centrifuge for thickening and dewatering sludge began operating in May 1982. Tests showed it met specifications and would be able to dewater sludge to a consistency thick enough for composting.

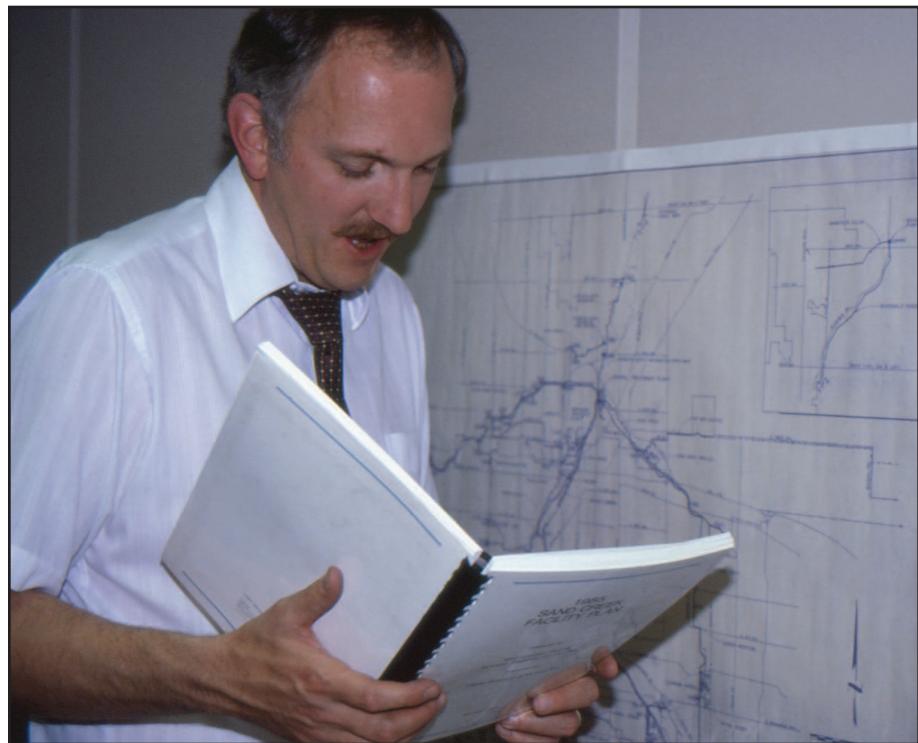
The 750 gallon-per-minute capacity centrifuge was an integral part of Metro's \$15 million solids management program dedicated to processing sludge to a recyclable form. The goal was to use the processed material—in either liquid form or as compost—in agriculture and land reclamation.

The centrifuge took digested sludge at about 2-3 percent solids and thickened it to either 6-8 percent solids for liquid land application or further dewatered it to about 16 percent solids for composting.

By reducing the volume of sludge produced, the centrifuge also reduced transportation costs. In six months of operation in 1982, the centrifuge saved the District almost \$500,000 in solids recycling expenses, primarily in transportation costs.

Future plans called for an additional centrifuge to be used as backup in case of downtime for repairs or unforeseen emergencies.

Long before so-called “green” energy was considered good, Metro’s board authorized construction of a \$4.9 million cogeneration plant that would turn what was then a waste gas—methane—into future revenues.



Retired engineer Ray McNeill discusses interceptor system needs in this 1987 photo.

Methane is produced as a byproduct when sludge is anaerobically digested to make it safe for use as a soil amendment. Metro planned to sell the electricity to the Public Service Company to produce an estimated \$2 million a year in revenues. Design began late in 1982 and construction was scheduled for the latter part of 1983. Four 1,200 kw generators, central to the project, represented a \$2.4 million investment in the cogeneration plant.

The Metro District modified waste gas flares in late 1982 to increase flare capacity and make the existing flares safer to operate. The 4 flares were then used to burn off excess methane gas produced in the anaerobic digesters. Studies showed these flares would not be able to handle the amount of gas projected from sludge digestion in the coming 20 years.

Metro initiated construction of three additional flares and began modifying the existing flares to increase capacity. Additional work began on the flare piping system so the gas could be transferred to the cogeneration facilities in the future.

When the cogeneration plant became operational, the methane would be used to generate electricity, and the flares would be reserved for backup. Construction began at year end and was expected to be completed in mid-1983. Total cost for the project was about \$338,000.

10 percent of sludge recycled as liquid

Metro ramped up land application of liquid sludge in 1982. About 10 percent of all the sludge processed in the Central Plant was applied to farm land. Metro employed two Terra-Gator liquid applicators to inject the liquid into the soil in the



Liquid sludge is piped into a tanker from the loading dock built in 1979. The sludge was hauled to the old Lowry Bombing Range for disposal.

warmer months when frozen ground did not prevent injection. Maximum liquid sludge application was expected to reach about 50 percent of Metro's production in future years. When the composting project was completed, Metro planned that sludge not applied in liquid form would be dewatered with the centrifuge and then composted to be available for dry application.

Metro began building a 10 dry ton/day demonstration composting facility in the fall. It was the first phase of a full-scale project planned for Metro's solids recycling program. The demonstration

operation was to use centrifuged sludge (10 percent solids) to make compost for agricultural application. When completed in mid-1983, the demonstration facility would test various composting methods to establish design parameters for the full-scale project. Design of the 100 dry ton/day facility was expected to begin in late 1983.

Industrial wastes control program emerging

The Metro District's laboratory continued to develop an industrial waste control/pretreatment program in 1982 to protect Metro's system from hazardous and toxic wastes. The program also complied with federal water pollution regulations.

Amendments to the member service contract and the Metro District rules and regulations established Metro's authority to manage such a program. Each member was to implement and carry out its own industrial waste and federal pretreatment requirements. Metro included a provision for it to assume direct pretreatment and control authority for a member if the member was not satisfactorily carrying out its responsibilities.

The Metro District set specific discharge limits for member municipalities and their users for cadmium, chromium, copper, cyanides, iron, oil and grease, phenolic compounds, sulfides and zinc. The limits were put in place to keep pollutants out of the Metro system that might be a hazard to humans or animals or that might interfere with system operation. Limits also assured the Metro District's ability to recycle and reuse sludge.

The program was expected to be fully implemented by early 1986 and would use the laboratory's sophisticated analysis capabilities to monitor wastewater for hazardous pollutants.

Blizzard of '82

As 1982 came to a close, a huge blizzard blew in. Plant Operator Floyd Bolen said he came to work Dec. 24—his anniversary—expecting to pull his normal shift.

As the day wore on, he said it got colder and colder and things got progressively worse. Soon the operator on the 2 p.m. shift called to say he couldn't make it in. Then the midnight shift operator called to say the same thing.

Bolen said that, above all, he remembered how cold it was when they had to work outside.

In the end, Bolen said he pulled a 33-hour shift. Bud Rhea, who worked in RR&R, couldn't get onto the plant, so he parked on York Street and hiked in. He got a front end loader started and cleared a path through the snow so others could get in and out.

With the street cleared, Frank Spicola, an operations supervisor, soon made it in with a pizza.

Bolen said those who were there overnight had eaten everything from the vending machines during the night.

"I don't like pizza," he chuckled, "but I hadn't had anything to eat and I had to break down and eat a slice of pizza."

1983—Ride, Sally, Ride

Among memorable events in 1983, Sally Ride became the first U.S. woman in space, Polish labor leader Lech Walesa won the Nobel Peace Prize, and suicide bombers attacked the U.S. Embassy in Beirut and killed 241 Marines.

Meanwhile, the Metro District was then serving 1.3 million citizens. The big news was an agreement in April between the Metro District and the City and County of Denver for Metro to take over operation of Denver's Northside Treatment Plant and more than 120 miles of "common" interceptor system sewer lines the next year.

Takeover plan: More efficiencies seen

A 1982 study of this arrangement showed that by taking over the Northside plant and eventually replacing it, Metro could provide more efficient and cost-effective service for the members and the metro area connectors. Expanding Metro's primary facilities to replace Denver's Northside's capacity capacity was studied in 1983. When that expansion was completed, the Northside Plant was to be closed and the 52.5 acre site returned to Denver for redevelopment. Estimated cost of the replacement primary facilities was \$14 million.

Metro sought special connector agreements with sanitation districts and municipalities to replace their existing sewage service contracts with Denver. By late 1983, it appeared the Metro District would successfully negotiate special connector agreements or other arrangements with all the suburban governments previously served by Denver. All connectors to the Metro system were to receive equal service at equal cost.

Two years of studies by Denver and Metro staff and consultants showed that this arrangement would be financially beneficial to Denver, to other Metro member municipalities, and to the new connectors, which would be called "special connectors."

Ray McNeill, an engineer who joined Metro in 1975, was assigned 26 Project Action Requests (PARs) at the end of 1983. All were related to the need for new metering facilities brought on by acquiring Denver's common system and its connectors.

"We had to upgrade metering facilities for these (new) connectors," he said, "and some were not new. They were funded by money from other agencies and ranged in size from \$20,000-\$30,000 projects to those valued at up to a quarter- to half-a-million dollars."⁹

McNeill said he cleared most of these projects in 1984. He characterized that activity as similar to opening a McDonald's restaurant. "The first thing you do is move in the cash register so you have a way to bill the customers."¹⁰

Commitment: Build sludge facilities

Also in 1983, Metro committed to build full-scale facilities to convert sludge to compost later in the year when the board approved a sludge management plan. Liquid sludge would continue to be applied to agricultural lands, and a compost production facility would be built at the Metro District Central Plant site. The dual recycling program would allow Metro to reuse all of the sludge it produced at the Central Plant. Metro anticipated marketing both products, with the revenues helping offset operating costs.

Progress on bond-financed construction projects boosted the Metro District's wastewater management goals in 1983. The District spent more than \$34 million on new interceptor sewers and Central Plant improvements. It also completed construction on five projects and put three interceptors and two plant projects into operation by year end.



This 1983 photo through a vault structure shows an interceptor sewer line crossing the South Platte River at the Central Plant.

Operations saves energy, cuts costs

Operations used its budget monies well, keeping its expenses more than \$500,000 under budget. Lower-than-anticipated energy costs helped save \$580,000. These savings, plus higher-than-anticipated investment revenues, allowed Metro to end the year about \$1.5 million in favor of the budget.

The Metro District collected more than \$9.1 million in sewer connection charges (tap fees) in 1983, the first year the fee was imposed on new connections to the District's system.

The board had approved a charge of \$500 for each new or



Steve Pearlman, director of Environmental Services as this book went to press, adjusts a Manning S-4400 portable sampler in this 1984 photo. The machine went in a manhole and pulled samples via vacuum at intervals that varied by the amount of flow.

altered single family residential equivalent sewer tap. The District restricted these funds to paying debt service until the principal and interest on outstanding debt was paid.

In other Metro District 1983 news:

- The EPA released more than \$4.5 million in construction grant funds to Metro after four years of delays.
- The board grew by two additional members (one from Denver, one from Aurora), bringing the total to 56.
- Cogeneration facility construction began in November. The \$6.7 million facility would burn methane from the digesters and produce both heat for the digesters and electricity, which Metro would sell to Public Service Company.
- The Metro District treated an average of 157 million gallons daily.
- Metro's lab performed 188,900 analyses on 19,300 samples.
- The board's plan to implement Metro's industrial waste control/pretreatment program in 1986 continued.
- Metro received a long-anticipated draft discharge permit from the Colorado Department of Health in November.
- Metro completed its first full year of full-scale liquid sludge application, hauling and applying 24.2 million gallons of wet sludge (7,154 dry tons) to agricultural land.
- Metro tested several methods of composting sludge to further refine design criteria for a 105 dry ton/day full-scale compost production facility. The test facility, designed to produce 10 dry ton/day, only produced 2 dry ton/day.



Metro District Board Chairman Bob Hite (standing) smiles as Denver Mayor Bill McNichols signs the documents that will transfer Denver's Northside Plant and common system to the Metro District in 1984.

From 1983 until 2004, the Metro District expected to have adequate capacity to serve its connectors while looking for economical, efficient service for the citizens of metropolitan Denver.

1984-Era of the Common System begins

In 1984, the Democratic Party picked Geraldine Ferraro as its vice presidential candidate, the first time a woman had been chosen by either major party to run for that high office. Later that year, Ronald Reagan was re-elected to his second term as president by a huge margin.

Meanwhile, the Metro District expanded its role as a regional wastewater treatment agency, completing much of its \$126 million sewer improvements program and the takeover of Denver's common wastewater facilities and Northside Plant.

The Metro District system grew dramatically with the facilities transfer. More than 113 miles of common interceptors and the 106 mgd Denver Northside Plant primary facilities were added. Metro also began serving more than 23 additional local governments that had been served through Denver previously. Four others arranged for indirect wastewater treatment services from Metro by contracting with other District connectors.

The facilities transfer restructured Metro's connections with those suburban governments. It also required some internal reorganization so Metro could handle increasing administrative requirements and operate the additional facilities.



Now-retired Transmission Supervisor Jim O'Keefe in a 1985 photo.

As Metro completed 58 miles of newly constructed interceptors and added 113 miles of Denver sewers, Metro's transmission system increased from 62 miles in 1983 to more than 200 miles in 1984.

The Operations and Maintenance Department's responsibilities increased as well. Metro created a Transmission Division in February within the O&M Department to oversee the new, larger interceptor system. The initial Transmission Division staff was 16 people.

"Part of the problem with the common system transfer was what to do with the old (Denver) Northside Plant," said retired Sr. Project Engineer Ray McNeill.

"It was built in 1936 and remodeled in 1956 and 1976. It was very old and manually operated. We concluded it would be cheaper to build a new primary treatment complex at the Central Treatment Plant and abandon Northside," he said in an interview on Nov. 10, 2004.

System growth also added engineering responsibilities. Metro required connectors to have metering/sampling stations to accurately measure each connector's wastewater flows and loadings for charge purposes. This forced many of the new special connectors to build such stations.

During the year, the Engineering Department supervised the design and construction of 19 new metering stations and the upgrading of 18 others. Most, though not all, of those stations were for special connectors.

Jim O'Keefe, a transmission division supervisor when he retired, said when the Transmission Division was created, he transferred to it and "was (given the) same pay but was given a job title change to transmission supervisor. Then the Transmission Division grew into what it is. It used to not be a division, it was just part of buildings and grounds."¹¹

O'Keefe said, "My first job was to walk the Clear Creek Interceptor from here (Metro) to Golden and find every manhole." He did, and became a highly valued employee in the Transmission Division.

"For whatever reason, it became my job to walk the line. That's how you learn all of them: You go and walk through, you drive them. A lot of them were cross country, and there were no roads," he added. "You climbed over fences and

jumped the creeks, whatever. You had a set of prints with you and you go out and find these manholes," O'Keefe said.

"Over a period of time, I got to know where every manhole in the system was. There are 3,750 of them," O'Keefe said.¹²

By 1985, the Transmission Division had divided itself into three distinct work groups: Jim O'Keefe was handling lift stations, Steve Trujillo was handling maintenance repairs, and Leroy Gonzales was handling sampling duties.

As the system expanded and both members and special connectors made plans to extend their own services areas, the board saw the need to plan far into the future to address such questions about growth as:

- Where would new growth occur?
- Where would new interceptors be needed?
- How would new construction be financed?
- Where would Metro's service area be in 50 years?

Long-Range Master Plan Study

To answer these questions, the board initiated a Long-Range Master Plan Study. It would help Metro determine how regional growth might impact the District's wastewater treatment service in the next 50 years.

Meanwhile, the District's bond-financed construction program continued. Most of the interceptor projects were completed by year end. Several of the major Central Plant Improvement Projects were in various stages of design or construction.

The cost of the cogeneration plant had grown to \$7.4 million by 1984, and its in-service date was delayed until April 1985. Metro hoped it would yield about \$1.7 million annually in revenues and save \$125,000 in operating costs.

Work on a 13,400 square-foot second floor addition to the Administration Building was almost finished. First floor and laboratory renovations continued.

Plant operations continued to be efficient, and the District's expenses were about \$1.5 million below budget. A delay in



Bright, shiny new cogeneration engines and generators sit ready to generate electricity and produce heat in this February 1985 photo.



Transmission Supervisor Leroy Gonzales, a 40-year employee, checks gas levels in this 1975.

starting cogeneration and lower-than-expected operating costs for the Northside Plant did the trick. Using Metro's primary treatment facilities to their full capacity helped save \$450,000 in Northside Plant operating costs. These savings, plus investment revenues, allowed Metro to end the year with about \$3.2 million more than budgeted.

In other 1984 actions:

- Metro's board of directors adopted a new Section 9 to the District's *Rules and Regulations* in November to guide Metro staff in dealing with requests for emergency wastewater connections to the Metro system.

- Metro management formed an employee safety committee. It improved the District's working environment and reduced the frequency and severity of on-the-job accidents. A confined-space entry policy and a no-smoking policy for defined areas at the Central Treatment Plant were the committee's first two actions.
- Metro treated an average of 156 mgd during the year with an average total suspended solids (TSS) of 16 mg/L and an average BOD of 17 mg/L. The limits were 20/20.
- Sludge Process Building modifications began in mid-year. The project called for removing unused vacuum filter and incineration equipment from the existing Sludge Processing Building to make room for a second 750 gallon-per-minute centrifuge. New sludge liquid and cake loading areas would also be built as part of the project.
- Support facility modifications and additions began. These included more warehouse space, renovating part of the sludge processing building into offices, and modifying the mechanical/electrical shop and control building. Design was completed in 1984 and the construction contract awarded. Construction was set to begin in early 1985.

U.S. Geological Survey Research

The Metro District began a cooperative research program with the U.S. Geological Survey (USGS) in 1984 to study the effects of liquid sludge application on groundwater quality. The five-year study recommended that closely monitoring water quality at a new sludge injection site near Platteville,



Additional warehouse space was added in a support facilities project that began in 1984. This photo shows the warehouse as it looked in 1979.

Colorado, was essential to determine what impact, if any, sludge injection might have on groundwater quality there.

While Metro was applying METROGRO® Liquid¹³ sludge to farm land at agronomic rates, the application created the potential for pollutants to leach into the shallow water table. The joint Metro/USGS study was expected to provide valuable information on pollutant migration and leachate quality in areas where sludge was being applied. The District and the USGS each contributed \$79,500 for the study over a five-year period.

The Metro District ended the year with the Metro District having 20 members, including cities and sanitation districts, and 23 special connectors.

ENDNOTES

- ¹ Metropolitan Denver Sewage Disposal District No. 1, Resolution 1178-5.a, February 1978.
- ² Metropolitan Denver Sewage Disposal District No. 1, Annual Report, 1978. Unless otherwise footnoted, the source material in this chapter and forward comes from annual reports of the Metro District.
- ³ Interview, Jim Carabajal, March 10, 2005.
- ⁴ Interview, Tim King, November 15, 2005.
- ⁵ Interview, Ray Montez, March 24, 2005.
- ⁶ Interview, Ray McNeill, November 10, 2004.
- ⁷ Interview, Carl Calkins, October 28, 2004.
- ⁸ Metropolitan Denver Sewage Disposal District No. 1, Annual Report, 1978.
- ⁹ Interview, Ray McNeill, November 10, 2004.
- ¹⁰ Interview, Ray McNeill, November 10, 2004.
- ¹¹ Interview, October 21, 2004.
- ¹² Interview, October 21, 2004.
- ¹³ Metropolitan Denver Sewage Disposal District No. 1, Resolution 5b75-7.a, 22 May 1975. This resolution noted that the “highest and best use of the sludge produced” by the Metro District was “recycling it into the soil as a soil amendment and fertilizer” and adopted the word “Metrogro” as the Metro District’s trademark “for the sludge product to be used as a soil conditioner and fertilizer.”



FROM BOD REMOVAL TO AMMONIA REMOVAL AND NAME CHANGE, 1985-1990

1985-Newly acquired transmission system assets create new demands

In 1985, Soviet President Chernenkov died and Mikhail Gorbachev succeeded him as Communist Party General Secretary; a TWA jet was hijacked by Lebanese Shiites and hostages were seized; and the U.S. Congress passed the mandatory Gramm-Rudman budget-balancing bill.

Meanwhile, there were 244 employees on the Metro District payroll (plant operators, engineers, laborers, clerks, accountants, electricians, truck drivers, and chemists). The District's 20 member entities included cities and sanitation districts and 23 special connectors. Members were represented on the District's 56-member board of directors. Through its members and special connectors, Metro served about 1.3 million citizens of metropolitan Denver.

Treatment

The Metro District treated an average of 151 mgd of wastewater in 1985, somewhat less than 1984's daily average of 156 million gallons. Monthly average flows ranged from a low of 134 mgd in February to a high of 170 mgd in July.

Cleaning secondary clarifiers in the winter, 1987.

Treatment operations produced an average of 188 dry tons of raw sludge a day. Anaerobic digestion reduced that to an average of 65 dry tons a day of treated sludge. For the year, Metro produced 23,804 dry tons of digested sludge, 37 percent of which was applied to farm land in liquid form as a soil amendment. Three percent was composted, and the rest was hauled to a dedicated land disposal site.

Anaerobic digestion produced an average of two million cubic feet of methane gas daily. Generators burned the gas and generated approximately 68,000-kilowatt hours of electricity daily after Metro's cogeneration facility began operating in April, plus heat for the digesters and other Metro buildings.

Operations costs

In 1985, the operation and maintenance cost for treating one million gallons of wastewater averaged \$307. Treatment accounted for \$71 of the total, while transmission costs averaged \$14, solids processing \$46, and solids recycling \$31. Administrative costs were \$118 per million gallons, and operating the Denver Northside Plant cost \$27 per million gallons.

Operating costs were lower than anticipated, and investments performed better than anticipated, putting Metro in good shape

financially at year-end. Revenues were \$2.87 million more than expenses as compared to the 1985 operating budget.

Operating expenses were about \$10.7 million—more than \$1 million less than budgeted—primarily because of savings in solids processing and recycling. Good weather and lower transportation costs reduced recycling expenses by \$399,000, and processing costs dropped \$471,000 because less sludge was produced than had been projected.

Revenues were \$31.6 million, almost \$2 million more than anticipated in the 1985 budget.

Annual charges increased only five percent. They accounted for \$24 million of total revenues. Other revenue of \$390,000 included charges for septic tank waste disposal and laboratory services.

Cogeneration produced \$1 million in revenue, \$900,000 less than expected because of start-up delays. Sound operating fund management resulted in \$6.2 million in investment income, \$2.5 million more than expected.

Metro earned another \$5.4 million in investment income in the Acquisition and Construction Fund. Combined with gains on sales of District investments, interest earnings totaled \$11.6 million in 1985. Sewer connection charges dropped from \$10 million in 1984 to about \$8.5 million. The drop in income reflected the slight downturn in metro Denver building activity.

Discharge permit

Metro still did not have a new state discharge permit at year-end, but the Colorado Department of Health had issued a draft discharge permit for public comment in January 1985. The effort



By the end of 1990, the North Plant had been modified to break down ammonia and nitrates in its effluent.

to define parameters for a new discharge permit began in 1979. By the end of 1985, however, a new permit still had not been issued, and questions about water quality standards and Metro's discharge to the South Platte River remained unresolved.

Discharge permit requirements are based on stream classifications and standards set by the Colorado Water Quality Control Commission (CWQCC), which is authorized by federal and state clean water laws to set the standards for pollutant discharges to all state waters. The Colorado Water Quality Control Division within the Department of Health then issues discharge permits.

During the permit process, the organization applying for a permit may comment on requirements proposed in the permit.



South Platte River as seen from the west bank at Metro's treatment plant in 1981.

Permits also are subject to review by the U.S. Environmental Protection Agency (EPA).

When the state issued Metro's draft discharge permit, both the EPA and Metro objected to the proposed limits.

The EPA said certain limits were not stringent enough.

Metro said limits in the draft permit required more than secondary treatment and were not economically reasonable.

To meet these proposed limits, Metro figured it would have to build extensive additional facilities—facilities that would be extremely costly compared to the small benefit Metro thought they would provide to the South Platte River.

Metro requested a hearing on the economic reasonableness of proposed limits in the draft permit. However, the CWQCC chose instead to address revising Segment 15 stream standards at a hearing scheduled for late 1985.

The state proposed stricter stream standards to provide increased protection for aquatic life in the stream. EPA documents suggested even stricter standards were needed than those the state had proposed.

Metro and other interested parties asked the commission to delay the stream standards hearing until March 1986 to provide more time to study the proposals.

Early in 1986, however, the EPA told the state it would take over issuing Metro's discharge permit because of the state's slow response in reissuing the permit. Metro then faced the question: Which government agency would have final authority over its discharges to the South Platte River? Resolution of this issue was not expected until late in 1986.

Studies see future growth

In 1985, Aurora and Thornton, two of Metro's largest municipal connectors, moved forward with plans to expand their wastewater service areas significantly. Metro's service contract required it to receive and treat all wastewater from its member municipalities. As these two connectors grew, Metro's service obligations increased as well.

Seeing such connector growth, Metro's board began a Long Range Master Plan Study in 1984 to identify how service area expansions might impact the Metro District.



METROGRO® Compost from the Metro District is applied to an area in Overland Park that needs to be revegetated in 1985.

The initial study, completed in February 1985, defined Metro's potential service area and possible facilities configuration through 2035. Based on predictions that both population and land development in metropolitan Denver could almost double by that time, the study concluded that metropolitan area wastewater services would be more

efficient and economical if consolidated by major drainage basins, possibly into several regional treatment agencies.

The study recommended that Metro examine potential costs of building new regional facilities and that the board should analyze how such facilities might be financed. It also recommended that the District analyze the legal, institutional and legislative ramifications of service area expansion.

The board of directors adopted both recommendations and authorized Metro staff to undertake the financial study and retain a consulting firm to do the institutional study.

Growth-related charges studied

The financial study recommended that the board reaffirm its "growth pays its own way" policy, which would allow sewer connection charges (tap fees) to be spent for facilities to accommodate new growth. In effect, new customers would pay for the reserve capacity in Metro facilities required to serve growth.

The legal, institutional, and legislative analysis was scheduled to be completed in 1986. It was to examine existing wastewater service arrangements in the Denver area and recommend possible institutional arrangements for future regional wastewater management.

The District also initiated a new Sand Creek Facilities Plan in 1985 to define what wastewater facilities should be constructed to serve the expanding Aurora area. Considerations of water reuse needs were an integral part of the study. It was also scheduled to be completed in 1986.

Sludge disposal services policy created

In February, the board of directors approved an interim policy to allow Metro to provide sludge disposal services for other water and wastewater treatment plants. Metro had accepted sludge from some cities in the past, but the board had never established specific charges and procedures for providing the service.

The board set a rate structure for the service and authorized the manager to contract with treatment agencies when estimated charges were \$20,000 a year or less. When estimated charges exceeded \$20,000, the board would have to approve the contract. In both cases, sludge would be accepted only when technically feasible, and no long-term commitment was made. The practice was discontinued in the mid-1990s because of the federal 40 CFR Part 503 sludge regulations that went into effect then.

Metro agrees to accept Wastek effluent

Late in the year, Metro's board agreed to allow the District to take and treat effluent from Wastek of Colorado Inc., a private hazardous waste treatment facility. The Colorado Department of Health had classified the company's effluent as non-hazardous.

In a contract approved by the Colorado Health Department, Metro would allow the company to deliver as much as 24,000 gallons of effluent a day to Metro for treatment and disposal. Wastek expected to deliver less than 4,000 gallons a day during the two-year term of the contract.

By making Metro's treatment facilities available, the board hoped to discourage illegal dumping of hazardous wastes into the sanitary sewer system.

Cogeneration facility comes on-line

The Metro District began trial operation of its \$7.8 million cogeneration facility in April 1985. Equipment delivery problems and some last minute requirements by Public Service Company of Colorado, the company purchasing the electricity, delayed start-up of the facility for several months. The cogeneration plant used methane gas generated in the anaerobic digesters as a by-product of sludge digestion to fuel the engines. The result: electricity and heat.

At full capacity, the facility's four 2000-horsepower engine generators were rated to produce 5,520 kilowatts (kw) of electricity daily—enough to meet the energy demands of



Interior photo of Cogeneration Facility in 1985 showing equipment. The \$7.8 million facility began operating in 1986.

5,800 residential homes. During the first nine months of operation, electrical production averaged 2,833 kw a day.

Selling the electricity brought the District some \$1 million in gross revenues in 1985. Metro hoped the facility would generate about \$1.7 million annually in future years.

Heat recovered from the water jackets of the internal combustion engines that spun the generators was used to heat the digesters and four buildings of the plant. This reduced the need to purchase natural gas for space heating and treatment plant operations. Metro expected to save about \$75,000 a year in natural gas costs and \$50,000 in boiler maintenance costs because boilers would no longer be needed to produce heat.

On top of its economic benefits, cogeneration reduced the treatment plant's air pollution by half of what it was when methane gas was simply flared.

The generators were about 75 percent efficient in recovering usable heat and electricity from methane gas.

Pretreatment plan submitted to the EPA

After several years in development, Metro's Pretreatment/Industrial Waste Control Program plan was submitted to the EPA for approval in September.

The federal Clean Water Act required pretreatment. Metro's plan was designed to protect the District's wastewater treatment system from toxic pollutants. It would also protect sludge quality and helped the District meet Colorado stream standards for the South Platte River. When implemented in 1986, the



Above-ground structure at the Brantner Gulch Lift Station as it looked in 1985.

program imposed controls on industries that discharged significant amounts of pollutants to the Metro system.

In 1985, Metro surveyed 1,500 businesses and industries in the service area to determine which ones were discharging pollutants to the sewer system. By year-end, about 100 had been identified as significant pollutant dischargers.

Sixty-nine dischargers were subject to federal pollutant limits established by the EPA. Most were electroplaters or metal finishers. Other significant dischargers were those that manufactured batteries, cans, pharmaceuticals, rubber products, paper, or preserved wood products. While these industries accounted for only one percent of Metro's total wastewater flow, they contributed an estimated 2 to 40 percent of the various heavy metals in wastewater received at the plant.

The Metro board adopted new user discharge limits to regulate pollutants under the pretreatment program. The limits had to be met by all commercial and industrial connectors. Metro set limits for cadmium, chromium, copper, lead, nickel and zinc.

Metro planned to issue discharge permits to significant industrial users in 1986 to limit the amount of these and other pollutants in their effluent. This meant many industries would then have to pretreat their wastewater before discharging it to the public sewer system.

EPA had completed its initial review of the Pretreatment/Industrial Waste Control Program in November. Formal approval was expected in early 1986 but did not occur until December. When approved, Metro and its connectors would implement and enforce the program.

Transmission study examines facilities

In 1984, Metro's transmission system more than tripled in size as newly constructed interceptors and 113 miles of interceptors from the City and County of Denver were added. Such rapid expansion, plus the need to plan for future service area expansion, drove Metro to begin an extensive study of its transmission facilities in 1985 to determine their reliability and capacity limitations.

The Transmission Division needed to locate and inspect the general condition of the inherited transmission facilities. It also needed to pinpoint areas in the entire system where future growth might overload the capacity of facilities in the next several years.

The study divided the District's service area into the major drainage basins: Central Denver, Clear Creek, Sand Creek, and Lower South Platte.

The majority of the lines transferred from Denver to Metro lay in the Central Denver Basin, which contained 66 percent of the District's transmission facilities. The transmission division monitored flow in 12 of those interceptors and made priority surface inspections of six. Results showed two of the interceptors needed immediate capacity relief, but others would have adequate capacity for the next five years. The ongoing study showed most of the lines to be structurally sound, but some lines needed additional study.

Major facilities in the Clear Creek Basin—two interceptors and 18 metering stations—were either new or relatively new and in good condition. No capacity or reliability improvements were anticipated in the near future.

Metro's Sand Creek Basin facilities were less than 20 years old and in good condition. However, Metro thought Aurora's plans to annex 117 square miles to its service area could strain the capacity of Metro's existing facilities there. In 1985, Metro and Aurora agreed to share the cost of updating the 1977 Sand Creek Facilities Plan to determine future transmission and treatment facility needs in the basin.

Metro served only a portion of the Lower South Platte Basin. Its transmission facilities in the Brantner Gulch Sub-basin were new and, based on then-current flow projections, were estimated to be able to continue to provide service until 2010. Facilities planned for construction in 1987-88 were to replace deteriorating interceptors and increase capacity in the Thornton-North Washington Sub-basin.

In addition to this system study, the Transmission Division also began an infiltration and inflow study of Metro's wastewater collection and treatment system in 1985. By evaluating the effect of storms on Metro's system, the division verified that a substantial amount of capacity is used to collect and treat storm water. The division expected to make recommendations after collecting two years of flow and rainfall data.

Two major Central Plant construction projects begin

In 1985, Metro continued its capital construction program with groundbreaking on two major Central Plant projects:



A \$14 million primary expansion project began in 1985. Six new primary clarifiers added 99 million gallons a day to Metro's primary treatment capacity to replace the capacity that was lost when the old Denver Northside facility was closed.

the \$14 million expansion of primary treatment facilities and the \$1 million expansion of plant support facilities.

The primary treatment project was the first Central Plant capacity expansion since 1976. The new facilities would add 99 million gallons a day to Metro's primary treatment capacity. It included a new influent structure, a six-screen bar screen building, four new grit basins, six clarifiers, and two sludge-pumping stations. Construction began in July and was scheduled to be completed in 1987. The project was to replace the primary treatment capacity at the Denver Northside Plant.

In conjunction with this project, design began on the Globeville Interceptor, which carried wastewater from areas near the Denver Northside Plant to Metro's Central Plant.

Modifications and additions to various Central Plant support buildings began early in 1985. Most of those—including warehouse expansion, office space additions, and renovating existing buildings—were complete by year-end.

Additionally, four other plant projects were under construction during the year. Finishing touches were being added to the administration and laboratory building expansion by year-end.

The Sludge Processing Building was being modified for state-of-the-art sludge processing equipment and sludge loading facilities. These changes were 84 percent complete in December. Construction of the 25-acre compost site was almost finished by year-end, but inclement weather delayed completion. The site included three partially enclosed

buildings for composting, an operations and maintenance building, maintenance shop, and a compost storage shed.

Concurrent with the construction going on at the Central Plant, Metro-hired consultants began design work on two new interceptor sewers: the Delgany Interceptor along the South Platte River in Denver and the Lakewood Gulch North Branch Parallel and South Branch Extension in Lakewood. Construction of both was to begin in 1986. Design of the Thornton-North Washington Interceptor was planned for 1986.

Metro spent \$17.3 million on these and other capital projects in 1985. As of December 31, Metro's board had appropriated more than \$125 million for construction projects that were part of Metro's 1981 bond-financed improvements program.

Computer aid for engineering drafting

Another newsworthy event in 1985 was the board's approval of a computer-aided drafting and design (CAD) system for Metro's engineering department. The equipment was considered highly sophisticated. It automated certain engineering drawing functions and allowed Metro to develop an extensive database of maps, construction drawings, piping and instrumentation diagrams, and electrical schematic drawings.

When it became operational in early 1986, the CAD system was used to develop a universal base map of the District's service area and a database containing a wide variety of information about facilities. The system improved productivity, increased timeliness of information and drawings during design work, reduced drafting errors, and improved the quality of final drawings.

1986—Metro begins composting operations

In 1986, the space shuttle Challenger exploded on lift-off on January 28 and killed all seven of its crewmembers; U.S. jets bombed Libyan targets; and a blast at the Soviet power plant at Chernobyl spread nuclear fallout over a large area.

In Denver, the Metropolitan Denver Sewage Disposal District No. 1 celebrated its 25th anniversary. During that quarter-century, the District had gone from doing something that had not been tried before in metro Denver—a cooperative, quasi-municipal structure to manage and control water pollution—to operating a fully functioning major treatment agency day to day.



Sue McClelland operates the new Computer-Aided Drafting and Design system in 1987.

Metro's early concerns were controlling BOD (biochemical oxygen demand) and TSS (total suspended solids). The original mandate in creating the Metro District had been to provide efficient, economical wastewater treatment service to metropolitan Denver municipalities. By 1986, Metro's board and its 263 employees were largely meeting these goals. The ultimate goal—not yet attained—was to help clean up the South Platte River from Denver northeastward. The next two decades would see tremendous progress on that front as treatment methods continued to improve.

Metro began operating a composting facility that it hoped would allow it to beneficially recycle sludge year round. Metro also began an industrial waste control program to help protect the environment from toxic pollutants, and worked with the EPA to finalize its discharge permit.

With receipt of the permit, the Metro District board of directors committed to \$24.5 million in plant improvements to enable Metro to enhance its effluent quality and further protect the South Platte River. Planning and design for these permit-required advanced treatment facilities began immediately.

Administrative highlights

- The number of employees increased from 244 to 263 in 1986. Most of the newly-added positions were in the Operations and Maintenance and the Resource Recovery and Reuse Departments.
- Metro's member municipalities agreed to a service contract amendment during 1986 that removed some restrictions on how the District could use its sewer connection charge



Maintenance workers (left to right): Frank Poehla, Dean Wilson, and Don Lawson discuss a repair job in the shop.

revenues. The old service contract had required sewer connection charges be used only for 1981 bond projects. The change allowed Metro to use those revenues for any growth-related capital project. Two-thirds of the municipalities had to affirm the change so Metro could implement its policy of “growth pays its own way.”

- Metro introduced a journeyman trainee program in the Operations and Maintenance Department in 1986. The four-year program gave selected employees on-the-job and classroom training to qualify them as journeyman electricians or mechanics. The program was expected to be expanded to other departments in the future.

Debt restructured

Metro restructured its debt in 1986. In simplest terms, the debt restructuring extended the average life of and reduced the interest rate on \$111,635,000 of the District's long-term debt. The restructuring gave the District an economic gain (difference between the present value of the old and new debt service payments) of approximately \$3.7 million after all related bond issue costs were paid. Average annual debt service requirements fell by about \$3.4 million and maximum annual debt service dropped by \$4.2 million.

Reducing the annual debt service requirements was a significant achievement. It let Metro pay higher operating and capital costs associated with new discharge permit-required processes without significantly increasing annual charges.

Planning for growth in the Sand Creek Basin

Since 1985, the Metro District and the City of Aurora had been studying the Sand Creek Basin to determine what wastewater facilities would be needed in the future to serve the expanding eastern and southeastern sections of Metro's service area. By 2035, population growth and land development in the Sand Creek Basin was expected to almost triple the wastewater flows from the basin.

To provide wastewater service for the area, the Sand Creek Basin study recommended building a treatment plant and necessary interceptor sewers within the basin as well as major collector sewers and pumping facilities to transmit the flows to the in-basin plant and provide for reuse of the plant's effluent.

While Metro's board of directors accepted the facility plan, it did not formally adopt all of the plan recommendations. The

board did agree that an in-basin plant appeared to be cost effective, considering Aurora's plans to reuse about a third of the basin's treated wastewater for landscape irrigation.

The board authorized Metro's staff to:

- Negotiate an agreement with the City of Aurora to define financial, construction, ownership, and operation arrangements for the wastewater facilities in the Sand Creek Basin.
- Negotiate an agreement with the City of Denver for Metro to take over the East 56th Avenue Interceptor, a line that was integral to Sand Creek Basin service.



Safety Committee employees developed several safety recommendations in 1986, including designating several no-smoking areas at the plant.

- Select a site for the new in-basin treatment plant.

In addition, the board authorized Metro's staff to work with the Denver Regional Council of Governments (DRCOG) to have its facility plan accepted. DRCOG was responsible for regional wastewater management planning. The existing regional plan did not include the in-basin treatment plant, so it had to be amended and accepted by the Colorado Health Department before any facility could be built.

Operations and Maintenance highlights

- In 1986, the Metro District treated an average of 156 million gallons of wastewater a day, up from 151 million gallons in 1985. Monthly average flows ranged from a low of 140 million gallons a day in March to a high of 172 million gallons in July.
- Metro's treatment operations produced an average of 137 dry tons of raw sludge daily compared to an average of 118 dry tons a day in 1985.
- In 1986, Metro's Employee Safety Committee developed several safety procedures designed to protect employees entering potentially hazardous work places such as manholes, the cryogenic oxygen tower, and electrical vaults. The committee also designated no-smoking areas on the plant site, developed a hard hat use policy, and began developing revised emergency evacuation procedures for the Central Treatment Plant.
- The Transmission Division began operating Metro's first hydrogen peroxide feed station in August 1986.

The feed station, located on the Riverdale Force Main in Thornton, pumped a 50 percent hydrogen peroxide solution into the line to prevent pipe corrosion. After operation of the feed station began, test results showed decreased sulfide levels, indicating that corrosive action in the pipeline had been reduced to acceptable levels.

Metro receives discharge permit

After more than a year of negotiations to resolve questions about water quality standards and regulation of Metro's discharge to the South Platte River, the EPA issued the Metro District a final discharge permit on December 7, 1986. Early in 1987, the State of Colorado also issued Metro a final discharge permit.

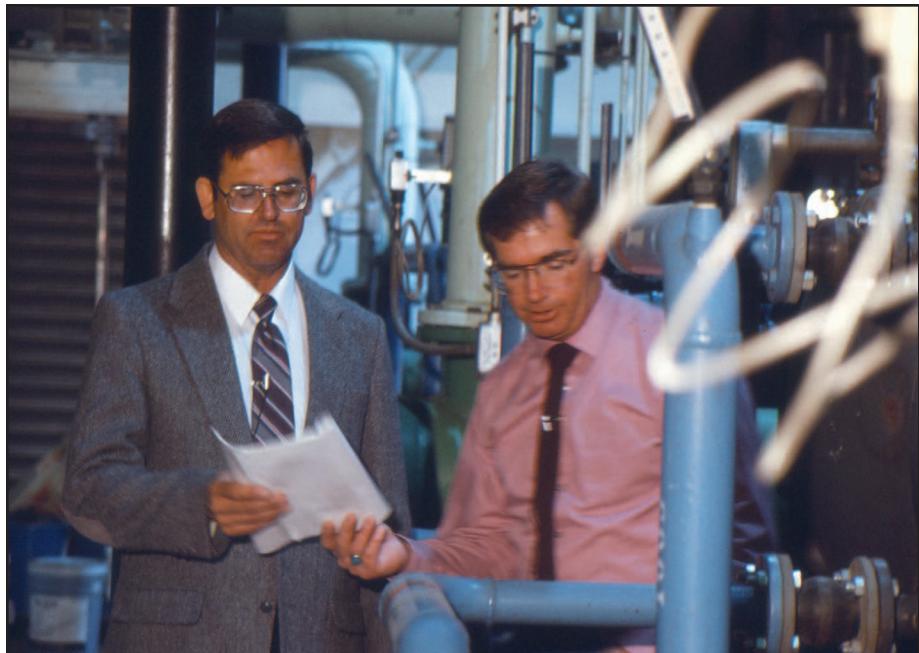
Receipt of the permits capped a year of regulatory actions that profoundly affected the District. Those actions not only shaped Metro's permits, but they significantly impacted Metro's operations and future treatment costs.

Regulatory actions

Early in the year, the EPA notified the Colorado Department of Health that it was taking over exclusive authority to issue Metro a discharge permit under federal law. In assuming this authority, the EPA cited a lack of progress by the state in issuing Metro a new permit to replace the one reissued in 1979.

With the EPA assuming direct permitting authority, Metro District staff worked with it throughout the year to specify details of the federal permit.

In April, the CWQCC of the Colorado Department of Health established new state regulatory standards for Segment 15



Al Hehr and Les McDaniel in the Process Building, 1986.

of the South Platte River. Segment 15 is the reach into which Metro discharges effluent. The standards restricted the amounts of residual chlorine and un-ionized ammonia that could be discharged to the river, and greatly impacted the pollutant limits in Metro's discharge permits.

The Metro District had opposed the stricter un-ionized ammonia standards the EPA and the state claimed were necessary to enhance water quality and increase aquatic life in the South Platte River. In testimony before the CWQCC, Metro District argued that the cost of upgrading water quality to meet proposed new standards for un-ionized ammonia would be significantly higher than the actual benefits to the aquatic life.

In spite of Metro's economic reasonableness argument, the state's CWQCC adopted stricter standards that were subsequently incorporated into both of Metro's permits.

The EPA-issued permit was to be effective January 7, 1987, through December 31, 1991. It imposed tighter controls on amounts of residual chlorine and un-ionized ammonia Metro could discharge to the South Platte River. It also required Metro to conduct an extensive stream water quality monitoring program, conduct bio-monitoring of its effluent as a screening for toxic pollutants, implement an industrial waste control/pretreatment program, and evaluate options for removing additional ammonia.

Requirements of the state-issued permit were similar to those of the EPA-issued discharge permit, but it also imposed strict controls on discharge of total residual chlorine and un-ionized ammonia. The state permit was effective February 7, 1987 through December 31, 1991.

EPA and state take legal action

In March 1986, the EPA and the Colorado Health Department brought separate lawsuits against the Metro District for alleged discharge violations.

The Health Department sued the Metro District for violating the Colorado Water Quality Control Act and the 1979 permit. The lawsuit, filed in Adams County District Court, alleged numerous violations of total residual chlorine limits.

Two days later, the EPA filed suit in Federal District Court against the Metro District on charges of violating the U.S. Clean Water Act.

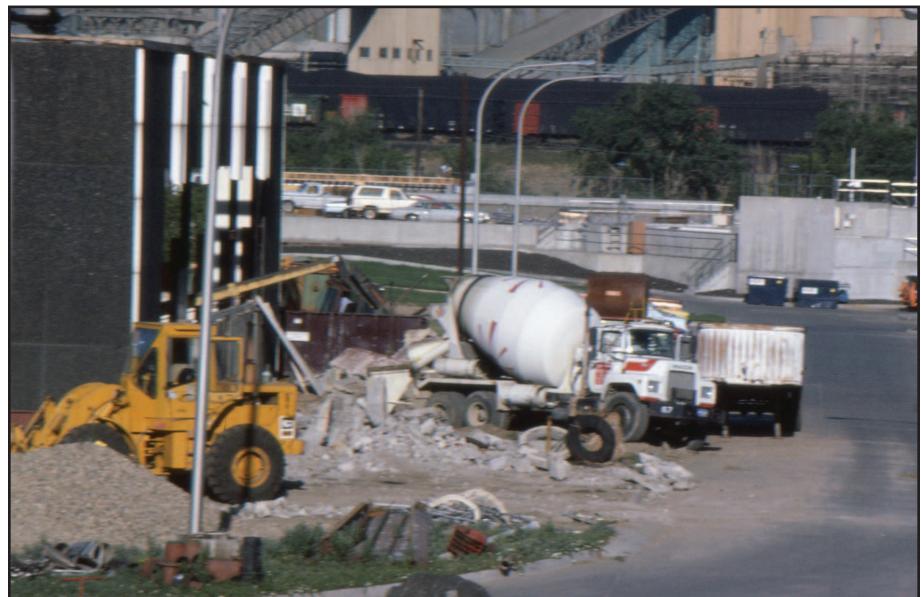
Both suits were in litigation at the end of 1986.

What the actions meant

As a result of these actions, Metro had to meet the constraints of two discharge permits and a federal compliance order.

More time and expense were necessary to monitor and report to two agencies. In addition, to meet more stringent stream standards and permit limits, Metro was facing an estimated cost of \$24.5 million to upgrade its treatment facilities.

Of that \$24.5 million, \$23 million would have to be spent to add nitrification facilities to the north secondary treatment system. Nitrification was needed to reduce the amount of ammonia in treated wastewater.



The Sludge Processing Building was heavily modified in 1986 to receive the second new 750-gpm centrifuges. It had previously housed incinerators and vacuum filters.

Metro also would also have to build a \$1.5 million chlorination/dechlorination system to remove residual chlorine from its effluent.

The new facilities were expected to increase operating costs by about \$1.2 million a year. Chlorination/dechlorination system construction was scheduled to be completed by September 15, 1988, to meet regulatory deadlines. The nitrification facilities had to be completed by October 1, 1990.

Engineering Department

- The Engineering Department completed a facility report on the condition of Metro's Brantner Gulch and Thornton-North Washington Interceptor system in March 1986. The report recommended \$11.3 million in improvements to the system, including replacement of corroded pipelines and expansion of the system's capacity. The system served an area north of the Metro Central Treatment Plant.
- The Metro District awarded three major construction contracts in 1986 for about \$7.8 million. The Engineering Department supervised more than 65 active construction projects—both major and minor—during the year. In addition, six design contracts were under the department's administration.
- Metro's drafting group began operating its newly acquired computer-aided drafting and design (CAD) system in May. The equipment allowed Metro to develop an extensive database of information on interceptors, connections, and service areas. By year end, the drafting group had used the CAD system to create numerous drawings

of metering facilities, on-site facilities, interceptor as-builts, and electrical and instrumentation diagrams. In addition, the drafting group began on-site as-built drawings and a base map of the Metro District service area.

Capital construction progress

Expanding primary treatment facilities, renovating the sludge processing building, completing the compost facilities, and beginning the chlorination/dechlorination modifications topped the capital construction activity at Metro's Central Treatment Plant in 1986.

North primary treatment facility expansion

Expanding the north primary facilities began in August 1985 and continued in full force during 1986. By year end, the \$14 million project was 88 percent complete. The expansion was to add 99 million gallons a day to Metro's primary treatment capacity.

Metro planned to close the Denver Northside Treatment Plant in 1987 when the project primary expansion project was completed. The Northside Plant had been providing primary treatment to wastewater before it came to Metro's Central Treatment Plant for secondary treatment. The new primary facilities would be more efficient and less costly to operate than the 50-year-old Northside Plant.

Chlorination/dechlorination/clarifier modifications

The District began facility modifications in 1986 to improve the quality of treated water it discharged to the South Platte River. The dechlorination system and improvements to existing chlorination facilities would allow Metro to reduce total residual

chlorine in its effluent. Both of Metro's discharge permits placed strict new limits on residual chlorine and required an interim dechlorination system to be fully operational by October 1, 1987.

The \$5.9 million project also included adding clarifier scum skimmers and four scum pump stations to Metro's north secondary treatment facilities.

By year end, about six percent of the project was complete. Although the dechlorination system was to begin operating in 1987, final project completion was not scheduled until July 1989.

Sludge Processing Building modifications

Renovating the Sludge Processing Building was 97 percent complete by year end. The building had stood since the plant was built. It once housed incinerators and vacuum filters that were used to process sludge. By 1987, the building housed two 750-gpm centrifuges and provided office space, equipment storage, and locker facilities for plant personnel.

Compost facility completion

The compost facility was completed in June after several weather-related construction delays. The original target date for completion was January 1986, but high winds toppled steel girders of one building and severe winter weather prevented timely asphalt paving, setting the schedule back. Contractor financial difficulties also contributed to the delay.

Interceptor construction

Metro continued to build interceptors in 1986. The Lakewood Gulch Interceptor project included adding a new parallel line, extending another line, and modifying the existing line.

It began in June and was near completion by December. The 10,000-foot Globeville Interceptor got underway in May. It was scheduled for completion in March 1987.

In addition, construction and modification work on eight metering and sampling stations was completed in 1986. It brought Metro's complement of annual charge meter stations to 66.

Resource Recovery and Reuse accomplishments

- The Metro District completed construction of its 25-acre compost facility in June, 1986. The facility began operating mid-year. It used forced aeration to dry a sludge-and-wood-fiber mixture into a 60-percent-solids compost material. The 25-day windrow composting process took place in three covered, partially enclosed buildings that took up 17 acres of the site.
- The Resource Recovery and Reuse (RR&R) Department began marketing its METROGRO® Compost products in 1986. The first compost sale was to the Homestake I Water Project. The compost was applied to a site below the Homestake Dam to help re-establish natural vegetation.
- RR&R halted sludge disposal operations at the Lowry Bombing Range in June 1986 and immediately began a 10-year program to reclaim and revegetate the 1,100 acres where Metro had disposed of sludge for more than 17 years.
- As part of its marketing efforts, the District began screening finished compost to remove wood fibers from the material to make a higher quality product. Screening also allowed the District to recycle the wood fibers in its composting process.



In 1985, this new Scarab mixing machine was the latest in new technology for building and turning compost windrows.

Metro begins 100 percent sludge recycling

With start-up of Metro's \$14.3 million compost facility in June, the RR&R Department began full implementation of its sludge management program in 1986. The program, approved by Metro's board of directors in 1984, allowed Metro to process and beneficially recycle all sludge produced by its wastewater treatment operations.

The intent of the recycling program was in keeping with a resolution passed by the board on May 22, 1975, which stated that "the highest and best use of the sludge...is for recycling into the soil as a soil conditioner and fertilizer." The same



The first sale of METROGRO® products was in 1986 to the Homestake I Water Project. They used the compost to help re-establish vegetation at the base of the dam.

resolution adopted METROGRO® as the trade mark for Metro's sludge products and directed Metro's lawyers to register it.

Two things were critical to success of the recycling plan: 1) the ability to produce two products—METROGRO® Liquid and METROGRO® Compost—from anaerobically digested sludge and 2) the flexibility to recycle one or both of these products year round.

The District used two large-capacity (750 gallons per minute) centrifuges to produce liquid and cake sludge. As a rule, the liquid product was applied to agricultural

land in good weather, and the cake was further processed by windrow composting during inclement weather.

Metro's RR&R Department had been applying METROGRO® Liquid to farm land for the previous eight years. Frozen ground made it almost impossible to inject liquid sludge in winter, however, and Metro was not able to rely on the liquid sludge application program year-round. Consequently, Metro hauled excess sludge to a dedicated disposal site at the Lowry Bombing Range.

After completing the composting facility (which Metro believed was designed with enough capacity to process 100 percent of Metro's sludge year round), the Metro District expected to compost sludge when liquid application was not feasible.

All the pieces of the sludge management program finally fell into place in the latter part of 1986. The year's statistics show composting did not begin until mid-year. Sludge disposal operations continued for the first half of the year, but were halted once composting was underway.

Of 25,000 dry tons of sludge produced in 1986, only about two-thirds were recycled: one-third as liquid fertilizer, another third as compost. The remaining third was disposed of at the old Lowry Bombing Range.

Liquid application

An average of 33 tons of liquid sludge was applied to farm land daily in 1986. Good weather enabled the operation to continue for 253 days—well into November, when operations were normally halted by poor weather.



In the late 1980s, liquid sludge was land applied using a spreader (right) that was filled on site by a nurse tanker (left) that brought sludge from the plant.

From June through December, RR&R produced an average of 38 dry tons of compost each day it operated. During initial start-up, the compost facility operated at 29 percent of total capacity, primarily because most of the sludge was recycled as liquid during the warmer months.

Production increased gradually during the summer, but odor problems surfaced again in August and September, causing it to be cut back. To control the odors, the RR&R Department reduced compost production and began to apply sludge cake to its agricultural sites as part of that recycling program. Studies continued through 1987 to determine the best way to resolve the problem.

In the meantime, the odor problem proved the importance of a fully integrated and flexible sludge management program. The management program gave RR&R the flexibility to make either product to deal with weather conditions. It also gave RR&R the flexibility to respond to design flaws, equipment downtime, market demand, transportation availability, and other operational problems without having to discard a valuable resource.

Laboratory highlights

- As part of a program to determine the incremental benefits of higher levels of treatment on water quality, the laboratory began extensive studies of the aquatic life in its receiving streams in 1986. The ongoing studies included counting and identifying fish species in the streams, collecting benthic organisms for study, and additional sampling and chemical analyses of the South Platte River.
- The laboratory began using a computerized Laboratory Information Management System (LIMS) in 1986 to more efficiently manage data gathered from laboratory analyses. LIMS provided an immediate status report on any sample received by the lab. Later, information from instrumentation and manual testing would be entered directly into the LIMS data base, increasing efficiency and eliminating redundant paperwork.
- Laboratory analytical work requested by the Operations and Maintenance and Engineering Departments increased significantly in 1986. The requested data were primarily to support design and construction decisions, evaluate maintenance requirements, and optimize operating processes.

- The District's septic wastes program generated more than \$260,000 in revenues in 1986. Contract laboratory work, analyses done for other municipalities, brought in nearly \$30,000. Closed-circuit television monitoring for the dumping bays at the headworks helped control septic waste haulers.

EPA approves pretreatment plan

EPA approved the Metro District's Pretreatment/Industrial Waste Control program in August 1986, almost a year after Metro's staff submitted its plan to EPA.

The pretreatment program was required by the federal Clean Water Act to protect Metro's wastewater treatment system, its sludge, and the receiving stream from toxic pollutants. Metro's laboratory implemented the program.

Metro and its connectors imposed controls on industries that discharged significant amounts of pollutants into the collection and treatment system. Laboratory staff had to maintain and periodically update an Industrial Waste Survey—a record of all businesses that could potentially discharge any non-domestic wastes to Metro's collection system. The survey included more than 10,000 businesses in the metropolitan Denver area.

By 1986, Metro had identified 76 industries that could potentially contribute significant amounts of pollutants to its system. Sixty-five were subject to federal pollutant limits set by the EPA.

After program approval, Metro and its connectors had issued permits to 39 of these industries by year end. The permits generally required industries to meet specific discharge limits



Laboratory Analyst Eugene Jansak (top left), Aquatic Biologist Ron French (bottom), and Laboratory Analyst Dawn Flancher conduct fish studies in the South Platte in 1986.

for cadmium, chromium, copper, lead, nickel, zinc, cyanide, and total toxic organics. In some cases, additional pollutants were regulated to prevent damage to Metro's treatment system and allow Metro to protect South Platte River quality.

Metro bought about \$525,000 worth of sophisticated laboratory instrumentation and field equipment to detect toxic pollutants in industrial wastewater.

As the permit process continued through 1987, laboratory staff examined industries for additional pollutants—particularly silver and mercury. Metro's discharge permit mandated it to comply with silver and mercury requirements by 1990. Rigorous pretreatment limits for these metals was possible for the future.

In addition, the laboratory monitored the toxicity of Metro's effluent, another requirement of the new discharge permit. This monitoring was a way to determine whether anything in Metro's effluent was toxic to aquatic life.

The scope of the pretreatment program was expected to grow during the coming years because of increasing requirements from the EPA. As it did, more industries would be investigated and more permits would be issued to those industries found to be significant dischargers.

1987-Metro begins partial dechlorination

In 1987, new Soviet Premier Mikhail Gorbachev spurred major Soviet political reforms, an Iraqi missile strike killed 37 U.S. sailors aboard the USS Stark, and the so-called “Black Monday” crash of 1987 rocked stock markets.



Laboratory Analyst Dawn Flancher takes a sample in the north chlorine contact chamber in 1986.

The Metro District prided itself in 1987 for continuing to provide quality wastewater treatment economically for the 1.3 million people it then served. Although it met all the requirements set by the new state and federal discharge permits, the District was looking ahead toward meeting even stricter requirements that might be in place in the future. The attempt to peer into a murky crystal ball triggered a complete evaluation of all of Metro's existing facilities and those that would be needed in the future.

Priorities were assigned to the buildings, equipment, and interceptors that should be replaced, improved, or expanded and to the need for new projects that would be required for Metro to continue to meet water quality standards.

The District realized that, to achieve all this, it would need to increase rates to cover the costs. Though never anticipated with pleasure, a rate increase was necessary. The board and staff carefully reviewed all current and future needs to determine those most necessary.

The board understood that any rate increase would affect people's budgets. It proposed a bond issue election to lessen the impact of the rate increase and decided that a \$97 million bond issue election would be proposed to the voters in March 1988. It was the final bond election during the period covered by this history.

In the meantime, Metro held down the 1987 operating costs while raising outside revenues. The cogeneration operation produced more electricity by again increasing its efficiency. The District also reduced costs by changing from applying liquid sludge to applying sludge cake on agricultural land.

Reorganizing departments reduced the need to hire some additional personnel as another cost-saving measure.

The District also took steps to have some capital projects made eligible for a federal construction grant. The steps included maintaining its position on the state's priority list, updating the Central Treatment Plant Facility Plan, and meeting critical environmental standards.

Metro also shut down Denver's old Northside Treatment Plant, which it had taken over in 1984 with the Common System transfer. The expansion and improvements made to the Central Treatment Plant's North Complex meant the District no longer needed the old Northside facility. Metro returned it to the City and County of Denver after cleaning it up. Work on the North Complex was completed on schedule and within the original appropriation.

The laboratory completed the successful startup and implementation of the computerized Laboratory Information Management System. This included the lab's analytical database, the ability to transfer data to the District's main computer, and a sample tracking and management system.

District begins reporting under new discharge permits

The Metro District's discharge permit from the EPA became effective January 7, 1987. A new discharge permit from the Colorado Department of Health became effective February 7. These new permits required the District to make some significant changes in its wastewater treatment.

The new permits adjusted the allowable discharge levels of biochemical oxygen demand (BOD) and total suspended solids (TSS) and reduced the levels of ammonia and chlorine.

Metro placed discharge limits on its connectors for 12 metals that had not previously been regulated.

Other requirements of the new permits included monitoring and reporting flows in the District's interceptor system, bio-monitoring effluent for toxicity, and bio-assaying and chemical analysis of the South Platte River.



Construction project at the plant, 1987.

Board approves projects for \$97 million bond issue election

The Metro District board, at a special meeting on October 27, 1987, adopted a resolution calling for a bond issue election in March 1988 for \$97 million to finance projects the District needed to build between then and 1992. This culminated an effort that began in early summer to determine the amount of a bond issue and the projects that needed to be funded.

The effort resulted in examining the future needs of the Metro District while paying careful attention to the ability of the District's users to finance them.

More than \$140 million in projects was carefully evaluated. A special committee of board members and staff assessed the needs. Top priority was given to meeting the requirements of the District's discharge permit.

The most costly project, and one of the most important, was for removing a significant amount of ammonia from the effluent. Ammonia is a nitrogen-based compound commonly found in wastewater. It is most toxic to fish in its un-ionized form. The EPA had, in preceding years, become increasingly insistent that ammonia be removed from treated wastewater that was discharged into rivers and lakes.

The CWQCC adopted a stream standard in April 1986 that cut in half the amount of un-ionized ammonia that would be allowed in the South Platte River north of Denver. This more stringent standard was included in both the state and federal discharge permits issued to the Metro District in early 1987.

To remove the ammonia, a process called nitrification converts the ammonia to nitrate. Then, another process—called denitrification—removes the nitrate. With only half of the ammonia needing to be removed from the effluent to meet the standards of that day, Metro decided it would only nitrify and denitrify in the North Complex. The estimated cost for this was \$59.6 million.

The other projects the board of directors decided to include for the bond issue to finance were:

- Upgrading the computerized control system for the Central Treatment Plant, \$7.7 million
- Controlling odors from the plant's composting facility, \$11.1 million
- Improving and expanding the anaerobic digester tanks, \$6.8 million
- Expanding the plant's maintenance shops, \$2.8 million
- Repairing the West and Southside Interceptor, \$900,000.

The bond issue election was approved by the voters March 8, 1988, by a 6-to-1 margin.

North primary expansion completed

Expanded primary treatment capacity in the North Complex was completed during the summer when six new primary clarifiers, two new pump stations and new screening and grit facilities were placed in operation. This expansion allowed Metro to shut down the old Denver Northside Wastewater Treatment Plant, a primary-only facility that Metro had leased and operated since 1984.

When the new primary clarifiers went on-line, sludge production was less than expected. This change resulted in a reduced level of treatment in TSS and BOD and forced a higher level of secondary treatment, which was less cost effective and could cause a violation of the discharge permits.

However, employees devised a refined sludge pumping program that helped improve the situation. Instead of pumping on a set timetable, pumping was based on the diurnal flow patterns inherent in the system.

The new grit basins used centrifugal force to remove grit, a concept then new to the District. They were substantially more efficient than the previous grit basins in the North Complex.

Grease handling in the North Complex was improved by installing grease concentrators.

When the Northside Plant was in operation, the District's Central Treatment Plant experienced a lower organic load. With Northside's closing, Metro had to deal with much higher BOD and TSS loadings. Expanding and improving the North Complex helped Metro successfully meet this challenge.

District begins dechlorinating effluent

Since chlorine can be toxic to aquatic life, the EPA required that the District comply with an interim total residual chlorine (TRC) discharge requirement of 0.15 milligrams per liter (mg/L) effective October 1, 1987.

To achieve this, Metro constructed a temporary dechlorination facility and began partial dechlorination in July 1987. In spite of some temporary problems, the District successfully met the EPA's October 1 requirement on TRC.

Permanent chlorination/dechlorination facility construction began in 1987 and was to be completed in the fall of 1988.

Nitrification predesign work completed

The major portion of the predesign phase for the nitrification project was completed, on schedule, in March 1987. The remaining predesign task, a cold weather polymer test, was set to come in February 1988.

The design phase began in June 1987. Design was 50 percent completed by December and was set to be completed in June 1988. Metro took bids on the construction of the project later that summer.

During the design phase in June 1987, two value engineering (VE) workshops were held. Participants in the workshops reviewed the design data and costs estimates, brainstormed alternative ideas with potential cost savings to the project, and developed capital and O&M (operations and maintenance) costs for the proposed ideas.

The District adopted \$6 million in capital cost-saving ideas from the first VE workshop. The second workshop identified an estimated additional \$1 million in capital savings.

Construction was scheduled to begin in October 1988 and continue through June 1991. All major construction was to be completed by October 1990.

The District pursued an estimated \$15 million EPA construction grant to help defray the costs of the nitrification project. Metro hoped this grant would be awarded by September 1988.

District begins upgrading its control system

Closely linked to the nitrification project was a control system upgrade project. The new control system was needed to operate the nitrification facilities. The two projects proceeded concurrently.

Installing the new control system was to begin in October 1988. The new system was to be entirely operational by March 1989.

With both nitrification and denitrification facilities involved, the District decided to complete the transition in each area before connecting it to the system.



Department heads Bill Martin (left) and John Puntenney in a Board meeting, 1986.

At the close of 1987, the control system upgrade project was on schedule.

RR&R switches to more economical cake application

Resource Recovery and Reuse (RR&R) Director Bill Martin said he hoped to realize an annual savings of \$500,000 by switching from applying liquid sludge to applying sludge cake on agricultural land.

Both liquid applicators were converted to use spreader boxes during the year. The design and mechanical work was done in-house.

A significant advantage of applying cake is that it can be done during the winter. Cake could be tilled into the soil with up to 10 inches of frost in the ground, whereas liquid injection was limited to no more than two inches of frost.

However, regulatory agencies were then saying they would allow cake application during the winter for only a limited time. Metro believed composting was the answer for year-round sludge disposal.

Cogeneration capacity increases

In April 1986, the Metro District placed into service its new \$8.2 million cogeneration system.

The project had been developed with three goals in mind:

- Use the waste digester gas (methane) to generate electricity that would be sold to the Public Service Company of Colorado;
- Capture the heat from the generation process to heat buildings on the Central Treatment Plant; and
- Reduce air pollutants by not having to flare the gas.

Shortly after system start-up, it became evident there were myriad design and equipment deficiencies. Forty-seven problems had been identified by late 1986. By the end of 1987, however, all of them had been corrected.

The cogeneration capacity had originally been rated at 4,620 kw, enough for a town of about 10,000 people. By February 1988, the rating had increased because of more efficient operation to an excess of 5,530 kilowatts.

Similarly, the first year's production was 2.2 million kilowatt, hours per month. By February 1988, the output had risen to 2.8 million kilowatt hours per month.

A payback analysis predicted that the revenue generated from selling electricity to the Public Service Company of Colorado would pay for the cost of the construction of the facility by 1999, the year that the contract with Public Service expired.

District receives DRCOG-Boettcher Innovation Award

The Metro District received the first place award for Productivity Improvement in the Denver Regional Council of Governments (DRCOG)-Boettcher Innovation Awards. The District was recognized for constructing and operating the cogeneration facility.

The awards program recognized local government achievements in the categories of productivity improvement, cooperative service and public-private partnership. The District had previously won an award in cooperative service.

1988—Construction begins on ammonia removal project

In 1988, the United States indicted Panamanian military leader Manuel Noriega on drug charges, the Soviet Union began to withdraw troops from Afghanistan, and a Pan Am jet crashed in Scotland. Evidence indicated a bomb was responsible.

In 1988, the Metro District had a 58-member board representing had 20 member municipalities and served 23 other local governments under special connector agreements.

The service area for the District covered approximately 380 square miles, serving a population estimated at 1.3 million. Major 1988 events for the Metro District included:

- Construction began on a \$47.4 million facility for removing ammonia from about half of the treated wastewater



Metro began construction of the \$47 million nitrification/denitrification project in the North Secondary system in 1988. The project was needed to help Metro meet new ammonia limits in its effluent.

that Metro discharged to the South Platte River. When completed, this project would provide advanced treatment at a time when many major U.S. wastewater agencies were struggling to achieve secondary treatment. The ammonia removal (nitrification/denitrification) project constituted the most significant expansion of Metro's plant since the South Complex was completed in 1978.

- The 15-year-old computer-based process control system was replaced with a new, state-of-the-art control system.

It was a necessary step in order to keep from violating increasingly stringent federal and state regulations for both wastewater treatment and sludge processing and reuse.

- Metro began a special EPA-mandated water quality monitoring program in the South Platte River. The program was expected to help determine, by 1992, whether the EPA would require the Metro plant's ammonia removal capability to be doubled in size.
- Metro District residents voted by a 6-to-1 margin to authorize the District to issue up to \$97 million in bonds to finance capital improvement projects that had to be constructed in the next five years. Most of the improvements were needed for Metro to comply with both federal and state discharge permits.
- The full impact of the Denver area's economic recession on the Metro District's revenue structure had to be acknowledged in 1988 finances and in the budget for 1989. A sharp and continuing decline in income from Metro's sewer connection charges (tap fees) was a factor in the need to increase Metro's service charges by 16 percent over the 1988 amount for 1989. Comparable increases were expected for at least several years. The scope of the drop in tap fees also prompted Metro to revise accounts so tap fee income could be used only for growth-related capital projects.
- A role for Metro in the clean-up of hazardous waste sites emerged in 1988 and was thought likely to continue for many years. The EPA required the District to become a participant in a very expensive program



Metro land application customer Lloyd Land (left) and RR&R Field Supervisor Marvin Webb talk about METROGRO® products.

at the Lowry Landfill Superfund Site. In addition, prototype arrangements were worked out under which Metro could receive decontaminated wastewater from other hazardous waste clean-up projects.

Meanwhile, wastewater from almost 1.3 million people and from thousands of businesses and industries flowed to Metro 24 hours a day, 365 days a year through the District's interceptor sewers. An average of more than 150 million gallons of wastewater was treated every day to meet federal and state standards for discharge to the South Platte River. The effluent got cleaner as the Metro plant did a better job of treatment every year.

Each step toward cleaner water also raised the price for sewage treatment service to Metro area homeowners and businesses. Nevertheless, the average sewage treatment charge to the average homeowner in the Metro area remained less than \$10 a month and was the least expensive of all major utility services. The Metro District remained committed to providing the Metro service area with efficient, economical wastewater transmission and treatment.

Bonds sold

In October, \$50 million dollars in bonds were sold at a low bid interest rate of 7.5365 percent, compared to a rate of 6.6 percent on a Metro bond sale in 1986.

The remaining \$47 million in bonds authorized by the voters in 1988 were planned to be sold in 1990 to complete the financing of necessary projects. As a possible alternative to a further bond authorization, Metro considered seeking a loan from a newly established State Revolving Loan Program, which received federal assistance.

It was estimated that debt service payments on \$97 million in bonds plus higher operating costs because of new facilities would add about \$3 to the monthly sewer bill of an average household in the Metro District service area by the end of 1992.

New district manager hired

The Metro Board hired a new manager for the District, Robert W. Hite of Denver, effective September 1, 1988. Hite had been senior vice president and general counsel for Mr.



At a Future Programs Committee meeting in 1986, then-District Manager Jack Enger (left) talks with future District Manager Bob Hite.

Steak, Inc., and had been a member of the Metro board of directors for 17 years. He had served as chairman for three years. Hite succeeded Jack B. Enger, who resigned March 1. W. Henry Waggy, deputy manager and director of Engineering, had served as acting manager during the interim.

Hite reorganized some administrative responsibilities. Personnel, office/clerical support, and records management were transferred to the Manager's office from the Administrative Services Department, which then became the Financial Support Services Department.

Hite said that when he took over as manager,

There had been no new (HR) initiatives. There was no pay for performance system. There was not any kind of evaluation system. There was no study done on (the) prevailing wage. The benefits hadn't been reviewed. We had two unions. It was a mess... The major initiatives in HR were all my suggestions. The retirement plan formula was way behind what it should be in comparison to other entities.¹

With the changes Hite made over the next couple of years, the Metro District began to transform itself and take on a new mantle of professionalism.

\$37.3 million budgeted

Appropriations for the 1988 budget totaled \$37.3 million, including \$24 million for operations and \$13.3 million for debt service. Of the total revenue needed, \$27.6 million was budgeted to come from annual charges for service to Metro's 43 local government connectors. This was up eight percent over 1987. Metro's sewer

connection charges (tap fees) were expected to yield \$7.1 million, but actual income from tap fees was only \$2.8 million.

Actual expenditures for operations in 1988 totaled \$23.7 million, which was slightly under budget. Actual spending on debt service equaled the budgeted \$13.3 million.

In July 1988, the Metro board adopted a 1989 budget showing a 16 percent increase over 1988 in charges to the connectors. The board had cut \$1.7 million of staff requests from the budget. The 16 percent increase in annual charges to a total of \$32 million was due mainly to higher operations and maintenance costs because of new facilities, requirements for higher levels of wastewater treatment, and a sharp decline in income from sewer tap fees. Tap fee income for 1989 was budgeted at \$3.3 million compared with \$7.1 million budgeted for 1988 and the \$2.8 million actually received in 1988.

The 1989 budget appropriations totaled \$38.7 million, including \$25.4 million for operations and \$13.3 million for debt service.

Debt service costs of \$17.2 million on outstanding bonds were to be reduced by \$3.9 million in capitalized interest to be paid from proceeds from the October 1988 bond sale.

Computer-based systems

The Metro District had four computer-based systems in 1988. The largest and newest system was for controlling the complex processes in the treatment plant. The other systems involved a data processing system for administrative functions, the LIMS system to account for the 350,000 laboratory analyses annually, and the CAD system used by Engineering for drafting and other graphics production.



Plant Operator Max Abeyta controls the plant from the process control main console in 1989. The District's process control system was more advanced than many at that time.

Process control system

The process control system upgrade, a major shift from the old centralized system in which multiplexers around the plant fed information to a central control computer, established a decentralized system having three levels of activity.

The first level of the new system included programmable logic controllers (PLCs), which handled comparatively simple tasks such as turning a pump on or off and closing or opening a valve throughout the treatment plant.

The second level was the distributed control system, or DCS, which did most of the work for automatic operation of plant processes.

The third level was the supervisory control system, or SCS—a supervisory computer that received information from the other two levels and could analyze plant data for up to one year. It fed information to the data processing system for management use and for frequent reports to federal and state regulatory agencies.

A wide variety of sensors, probes, and meters throughout the plant transmitted information to the control system about what was happening to flows, water levels, and sludge densities, for example. The control system could react swiftly to the information to adjust treatment processes as necessary.

At the DCS level, units housed in cabinets around the plant took corrective action as needed in the treatment processes. Such activity was immediately shown on the screens of various consoles at several locations that were constantly and closely watched by Metro's well-trained plant operators. If a process control malfunction occurred, the operator received an alarm and could take corrective action on a control keyboard or send personnel to the location of the problem.

In the old process control system (which had been state-of-the-art 20 years earlier), if the central control computer failed, all or most of the plant processes required manual operation. In the distributed (decentralized) system, if a component failed, only the automated treatment operation involved with that component went down, and if the supervisory computer failed, other components of the system continued to operate.

The new sophisticated control system was vital for:

- Efficient operation of a wastewater treatment plant the size of Metro's (more than 150 million gallons of flow a day and 70 dry tons of sludge a day).
- The real-time information needed to meet increasingly stringent regulations, which at the Metro District plant could involve measurement—and control—of three parts of a pollutant in one billion parts of water as just one example.
- Successful operation of the new ammonia removal facilities.

A technical support staff group in the Operations and Maintenance Department oversaw the process control system.

Other systems

Studies began in 1988 on the best way to improve administrative data processing. These studies were expected to be completed in 1989 and a new system installed in 1990.

The Computer-Assisted Drafting (CAD) system for engineering programs was installed in 1986. By 1988, CAD consisted of a host computer, four workstations, and one pen plotter.

To improve flow data reporting and reduce maintenance costs, chart recorders at the metering stations began to be replaced with data loggers and ultrasonic measuring devices.

Contaminated site clean-up

Participating in cleaning up hazardous waste sites and surface water runoff from Stapleton International Airport emerged in 1988 as a new challenges for the Metro District.

EPA Region 8, the EPA offices located in Denver that serve six western states including Colorado, required a systematic

study of the Lowry Landfill by “potentially responsible parties” (PRPs). Because Metro had disposed of sludge in the 1970s near the landfill, the District was among 27 other PRPs that received special notices from EPA to assist with site clean-up. The 28 PRPs chosen for special notice came from more than 400 identified users of the landfill. Metro requested to be exempt, emphasizing that sludge had not been classified as hazardous waste, and the disposal was entirely legal at the time it was done near the Lowry Landfill 15 miles southeast of the center of Denver. The EPA denied the request.

Under the federal Superfund law, as amended in 1986, for cleaning up hazardous waste sites, any party that used a site



Maintenance workers inspect and repair a secondary clarifier in this 1988 preventive maintenance photo.

could be held responsible for any or all of the cost of clean-up of the entire site. If a PRP does not make a “good faith effort” to participate in clean up, it could be required to pay triple costs.

After extensive examination of the legal and financial implications, the Metro board in August and September authorized Metro’s participation in a “Remedial Investigation and Feasibility Study” on shallow groundwater and subsurface liquids at the Lowry Landfill. By participating in this and other studies, costing an estimated \$12 million, the Metro District hoped to avoid liability for the ultimate clean-up, which was expected to cost hundreds of millions of dollars.

Out of the 28 corporate and government agencies that received special notices from the EPA, 13 (including Metro) formed the Lowry Coalition, which then entered into a trust agreement and an EPA Administrative Consent Order for the initial studies.

The Metro board appropriated \$1.5 million to cover estimated costs associated with the Remedial Investigation and Feasibility Study for three years. Allocations from the \$1.5 million included \$700,000 for Metro’s share of coalition costs; \$250,000 for legal counsel by Inman, Erickson & Flynn; \$250,000 for staff work; and \$280,000 for Metcalf & Eddy, Inc., a national consulting firm, as technical advisor to help protect Metro’s interests.

Stapleton Airport

Ethylene glycol, used to de-ice aircraft at Denver’s Stapleton International Airport, entered Metro’s Sand Creek Interceptor as industrial waste and had the potential to overload the Metro treatment plant’s capacity to remove organic pollutants. Such

an overload could cause Metro to violate its federal and state discharge permits and be subject to penalties of \$25,000 a day.

Increasing amounts of ethylene glycol began reaching the Metro plant in the winter of 1988. With EPA approval, the Metro District issued a discharge permit to the City and County of Denver to limit airport discharge of ethylene glycol into the Metro system to nine tons in any 24 hours. Denver constructed a holding tank facility at the edge of the airport to control flow of the de-icing material into the Metro system.

Union Oil Company

A Union Oil Co. of California (Unocal) petrochemicals site in Denver asked Metro for a special industrial discharge permit. The site had toluene-contaminated groundwater, and EPA was requiring a clean-up. Following lengthy negotiations and with EPA approval, Metro agreed to accept discharge of the groundwater after Unocal pretreated it to meet Metro's requirements. An agreement protected Metro against liability during the five or more years of pumping, clean-up, and continuously monitored discharge of the groundwater. The operation was scheduled to start in mid-1989.

Engineering and construction

Construction began on the \$47.4 million EPA-required ammonia removal project in October 1988. The general contract for \$35,798,000 was awarded to the low bidder, a joint venture comprising Summit Constructors, Inc. of Northglenn and The Industrial Company of Steamboat Springs, Inc. The project was set to be completed by March 1, 1992.

The Metro District board appropriated \$43,398,435 for the main contract and for related costs, including \$435,435 for Public Service Company of Colorado to provide electrical power facilities; \$4,064,000 for various engineering services; and \$2,466,000 for contingencies. Engineering design and related work had already cost about \$4 million.

Secondary treatment facilities in the Metro treatment plant North Complex were to be modified to allow nitrification and denitrification of 70 mgd of wastewater flow. Because this modification reduced the North Complex's existing hydraulic capacity by 30 mgd, the South Complex had to be expanded from 85 mgd to 115 mgd capacity.

Work on the North Complex had to be completed before October 1990 to allow Metro to meet ammonia limits in federal and state permits. Expansion of the South Complex was set to proceed in 1991.

The massive construction activity and tight compliance schedule imposed by the regulatory agencies stressed plant operations for two years. Up to 25 percent of plant capacity was out of service from time to time, but operations employees kept the plant operating.

Predesign was completed in March 1987 and final design started in June 1987, with completion in time for bidding one year later.

Project financing included a \$15 million federal grant approved in September 1988, plus proceeds from the voter-authorized bond issue in October 1988.

Residual chlorine removal

The District experienced some difficulties during start-up of the new \$5.2 million chlorination/dechlorination system. Dechlorinating the effluent had been required by federal and state regulatory agencies in 1986. The new system was completed and in operation by October 1, 1988.

The start-up difficulties caused permit violations, but aggressive problem-solving and persistence soon resolved the problems. The very stringent permit limit of 0.003 parts per million of residual

chlorine in Metro's discharge to the river kept Metro fine-tuning the new facilities to avoid discharge permit violations into 1989.

Metro and other treatment plants used chlorine to disinfect treated wastewater prior to discharge. The chlorine dose must be sufficient to keep the fecal coliform count (a measure of disinfection) below the discharge permit limits. However, residual chlorine in river water can be toxic to fish, so it had to be removed from discharges. This is often done by mixing sulfur dioxide with the chlorine-treated wastewater. Metro's disinfection



New dechlorination facilities installed in the North Chlorine Basin were in operation by Oct. 1, 1988.



In 1987, odor scrubbing equipment was tested in the composting facility to see if odors from composting could be reduced.

system used railroad tank cars of chlorine and sulfur dioxide to supply the highly-sophisticated mixing systems until late 2008.

Composting odors

Engineering studies that began in January 1988 and continued into 1989 looked at odor control for sludge composting. Metro's \$11.5 million composting facility was designed to handle 100 dry tons of sludge a day. It was completed in 1986. Full-scale operation resulted in an unexpected level of odors that could violate state air pollution control regulations. Until the problem was solved, most of Metro's sludge production—almost

70 dry tons per day—had to be land applied as sludge cake or liquid to farm land 20 to 40 miles from Metro's plant.

Initial results of a \$382,000 study indicated the odor could possibly be reduced by drawing air through compost piles and then water-washing the odor-laden air. Preliminary estimates indicated such a system would cost \$12 million.

Problems associated with long-term application of sludge to farm land in winter made an effective odor control system critical for a successful sludge reuse program.

Sludge program

Sludge processing projects were in various stages of design or construction in 1988:

- Improvements in the Sludge Processing Building were completed by year-end at a cost of \$6.6 million.
- Repairing the roofs of two digesters for \$122,000 was nearly completed.
- Design for two additional digesters and a new grease handling facility plus repair of three sludge-holding tanks was underway. Bidding was scheduled for mid-1989 on the most critical phase of the project. Progress on this project was delayed from 1987 due to lack of funds.

Service for Thornton

The Thornton-North Washington Street facility plan approved in 1986 was being implemented in phases in 1988-89:

- Construction began in December on an upgrade for the Thornton-North Washington pump station.

It was to be completed in September 1989. Low bidder was Gracon Construction Company at \$1,255,000. Design work cost \$137,000.

- Design was completed on the first phase of the new South Thornton Interceptor system to replace sections of Metro and Thornton interceptors that fed into the lift station. Bidding was scheduled in March 1989. The total package was estimated to cost \$13.8 million for construction and was to eventually include rehabilitation of the badly corroded Barr Trunk Line. Design work would cost about \$700,000.

Other projects

Expanding maintenance shops and administrative office space was included in a Support Facilities Master Plan developed by a consultant in 1988. The Metro board approved implementation in 1989-90 of the plan's first phase for a new warehouse and shops complex plus remodeling the existing shops building for the Transmission Division. A new administration building was set for consideration in 1990-1991.

The Delgany Interceptor Section 3 project to replace a very old six-foot diameter interceptor at the west side of downtown Denver was delayed from 1985 pending clarification of major redevelopment and viaduct projects in the Central Platte River Valley. Design work was revived in 1988, with bidding on construction scheduled for mid-1989.

Long-range planning

A consultant completed a Long-Range Planning Service Area Analysis for Metro in 1987 at a cost of \$150,000.

Discussions on a Metro District Long-Range Plan and Policy continued through 1988 and into 1989. A policy was needed as a guide for Metro to respond to requests for expansion of the Metro District's service area, for providing wastewater services to annexations or other expansions of local governments served by Metro, and for participating in other government agencies' local and regional planning efforts.

Closely related to long-range planning for wastewater services in the metropolitan area were the more specific facility plans for major drainage basins.

A facility plan for the Sand Creek Basin, funded jointly by Metro and Aurora, was completed in 1987. It described



This pump in the Thornton-North Washington Lift Station in 1988 was part of an upgrade approved in 1986 and implemented in phases.

sewer interceptors, pump stations, and a “satellite” treatment plant needed to serve Aurora’s annexations. Elements of the plan also covered the planned new regional airport and Denver annexations related to the airport. Discussions with Aurora on how to implement the plan and how to allow treated wastewater to be reused for irrigating landscape continued through 1988 and into 1989.

The board approved preparation of a Clear Creek/Upper Coal Creek Basin facility plan to cover Arvada’s planned annexation of 18,000 acres late in 1988. This was necessary because a 1977 Clear Creek Basin facility plan did not anticipate the Arvada annexation/development proposal, which called for extensive reuse of treated wastewater for landscape irrigation. Selection of a consultant and agreement on Metro/Arvada joint funding was scheduled in 1989.

1989–Ammonia removal facilities under construction

The oil tanker Exxon Valdez spilled oil and fouled the Alaskan Coast, Chinese pro-democracy protesters were crushed at Tiananmen Square, and a massive U.S. savings and loan bailout was set.

A number of challenges faced Metro in 1989, but goals for improved management were met and other goals were set to be implemented in 1990 and 1991. Major 1989 accomplishments included:

- A potential annual charges increase of 30 percent for the 1990 budget was reduced to 18 percent for local government connectors. The reduction was achieved



A crane lifts a piece of equipment during construction on the nitrification/denitrification removal project in 1989.

despite an economic recession in the Denver area and a continuing decline in sewer connection charges (tap fee) revenue. Actual expenditures were kept below budget by laying-off non-essential personnel, delays in filling staff vacancies, cutting expenditures such as conferences and memberships, and making some minimum-risk changes in the operation of the physical facilities.

- Steps were taken to strengthen the Metro District's financial base, mainly by identifying and beginning to restore minimum fund balances and reserves. This action was essential for maintaining the District's high credit rating in the municipal bond market. As with private citizens, the credit rating affected the interest rate at which Metro could borrow money.
- Construction proceeded on schedule and below budget throughout the year on the ammonia removal facilities—the largest project at the treatment plant in more than a decade.
- A tough decision was made to settle a massive lawsuit by the EPA. Another difficult decision was made to continue participating in very complex technical studies at the Lowry Landfill Superfund Site as required by the EPA.
- Improvements were made in human resources programs and updating of many District policies:
 - ü A Disadvantaged Business Enterprises program was started
 - ü A performance evaluation and merit pay system was developed and instituted in 1990 for management and

administration personnel. This system replaced the more traditional system of pay raises for longevity

- ü The Affirmative Action Plan was updated
- ü Paying cash incentives for employee suggestions that increased Metro's operating efficiency was inaugurated.

In 1990, three steps were taken affecting annual charges paid to Metro by its connectors in 1990. They reduced the 1990 annual charges and shortened the time until Metro would need to issue additional bonds for capital construction. The steps were:

- Capitalization of some interest payments on an assumed 1990 bond issue
- Operational use of interest earned on unexpended bond proceeds
- Use of bond funds to pay staff expenses associated with new construction projects and start-up

Laws and contracts required the Metro District to help protect the environment and provide wastewater services to its local government customers with almost absolute reliability. Although this responsibility required increased revenue each year, the cost to a typical homeowner in the Denver area for sewage service averaged only about \$10 per month.

EPA lawsuit

The Metro board, on advice of legal counsel, voted 40-to-1 in March 1989 to settle the EPA lawsuit out of court. EPA filed the lawsuit against the Metro District in 1986. A federal court judge

signed the consent decree August 17. The EPA had alleged that the Metro District, in discharges of treated wastewater to the South Platte River in the early 1980s, had violated the federal Clean Water Act. None of the alleged violations posed a threat to public health. The Metro District denied the allegations.

A similar, parallel lawsuit against Metro by the Colorado Water Quality Control Division was dismissed after the EPA case was settled.

Under the federal court consent decree, Metro agreed to pay a civil penalty of \$1,125,000 to the U.S. Treasury in three annual payments, without interest. The penalty amounted to about 87 cents for each of the estimated 1.3 million people the Metro District served.

In addition to the penalty, requirements included in the consent decree were expected to cost the Metro District up to \$147,000 in one-time costs plus an estimated \$40,000 a year thereafter, mostly in the industrial pretreatment and toxic wastes control program.

Administration and finance

The board adopted a Planning and Service Area Policy in June 1989. At the same time, the board rescinded two five-year-old resolutions that had placed limitations on requests by special connectors to approve expansion of their wastewater service areas.

The service area policy was an outgrowth of long-range planning studies in 1986-87. It provided some answers to inquiries from other public agencies and developers about the Metro District's position on expansion and coordination of wastewater services.

The Engineering Department's Planning Division cited the following areas where Metro service policy issues existed:

- The 45-square-mile Denver annexation for a new regional airport and a development corridor in the northeast corner of the metropolitan region. Aurora had annexations stretching eastward along the south side of the new airport. The Metro District and Aurora jointly developed a facility plan to serve the Aurora growth areas. However, questions arose about wastewater service for the Denver annexation, the new airport, and the Aurora areas.
- The Lower South Platte Basin stretching northward from the Metro plant at East 64th Avenue into Weld County where the Big Dry Creek joins the South Platte River. Jurisdictions with plans to serve in the basin included the City of Thornton (a Metro District member whose wastewater was pumped to the Metro plant); the City of Westminster (a Metro member but one also having its own treatment plant on Big Dry Creek); and the cities of Broomfield, Northglenn, and Brighton, each of which had their own wastewater treatment plants in the area and were not Metro members. Since the 1970s, the Metro board had discussed a new multi-jurisdictional regional wastewater plant in the Lower South Platte Basin and the projected need for such a plant by the year 2010. However, no jurisdictional arrangements had been worked out. Meanwhile, Northglenn was asking the other local governments to use and pay for excess capacity in the Northglenn plant.



One improvement District Manager Bob Hite made shortly after he took over in 1988 was to brighten up the landscape around the facility to make it a nicer place to work.

- Arvada's planned annexations of up to 31 square miles westward to the foothills.
- The City of Aurora's annexations totaling several thousand acres in the Upper Cherry Creek Basin where wastewater could not flow by gravity to the Metro facilities that served the rest of Aurora. Developing the annexation parcels in the vicinity of South Parker Road was not expected for several years, but a wastewater service plan was needed before development could begin. The Upper Cherry Creek Basin included a dozen wastewater agencies whose discharges were linked to water quality in Cherry Creek Reservoir.

Also in the basin was the Havana Water and Sanitation District, which was a Metro special connector that had to pump all of its wastewater to reach a Metro interceptor.

Stringent management controls and cutbacks helped Metro cut actual operating expenses for 1989 by \$1,784,290 from the budgeted total of \$24,676,287. Technical management and support actual expenses included \$822,859 in engineering staff costs that were paid from bond proceeds associated with new construction projects.

Actual capital outlay was held to \$480,216 compared with \$717,400 that was budgeted. Debt service payments for 1989 were \$16,793,517 on \$198 million in outstanding bonds that had been issued to finance capital improvements. Capitalized interest of \$3,904,213 from 1988 bond issue proceeds was used to reduce 1989 debt service to \$12,889,304, which was to be financed by connector charges.

Operating revenues for the year totaled \$34,637,935, up \$580,051 from the budget estimate. Annual charges payments by Metro's 43 local government connectors constituted the major source of income, which totaled \$32,015,025 for 1989, up 16 percent over 1988 as a Metro District-wide average. Non-operating revenues, mainly interest income, totaled \$6,237,594, up \$2 million over the budget estimate. This brought the total 1989 income to \$40,875,529. Savings on actual expenses compared with the budget went into the General Fund to help reduce annual charges in later years.

For 1990, the Metro board adopted an operating budget showing total anticipated revenues of \$42.6 million. Operating revenues included \$37,739,308 in annual charges paid by connectors, an increase of 18 percent over 1989.

The 1990 operating expenses budget totaled \$26.7 million. Debt service was budgeted at \$17.8 million. The portion of that to be financed by connector charges was reduced to \$11.8 million through use of \$4.2 million in capitalized interest and \$1.7 million interest income from 1988 bond issue proceeds.

Reasons for the increases in the 1990 budget and the annual charges to connectors included:

- EPA requirements for ammonia removal facilities and for removing residual chlorine from treated wastewater. In addition to debt service on the capital costs of the new facilities, annual operating costs were increased.
- Unanticipated Metro District involvement in the Lowry Landfill Superfund Site studies, which were expected to cost at least \$500,000 a year for three years.
- A continuing decline in sewer tap fees resulting from the Denver area's economic recession.

An employee performance appraisal system was developed with help from a consultant. It went into full effect at the start of 1990. In 1989, the manager froze all step increases in pay for non-union employees. The semi-annual performance appraisals for non-union employees were to be used instead as the basis for individual pay raises within salary ranges for each position.

Administrative and management employees received 1989 salary increases that averaged three percent, in line with prevailing wage levels in the Denver area. Laboratory workers who were members of the Oil, Chemical and Atomic Workers Union received wage adjustments averaging 2.25 percent.

The District's Affirmative Action Plan was updated. It had last been revised in 1983.

A new board committee on Disadvantaged Business Enterprises was organized to broaden DBE participation in Metro's purchases of good and services. Legal restrictions, such as one pertaining to accepting low bids, prevented set-asides for disadvantaged business enterprises in Metro construction projects.

A special committee of directors worked for several months on a comprehensive revision of the Metro District's bylaws. The revised bylaws expanded the executive committee from 9 to 11 members.

A five-year, \$2 million plan for administrative computer equipment and services was approved. Implementation began with a five-year lease/purchase of a main computer with payments of \$11,565 per month.

Engineering and construction

Construction on the ammonia removal facilities proceeded on schedule and under budget in 1989, but a major interceptor and pump station program ran into political and technical problems.

The EPA, in a 1986 federal discharge permit issued to Metro, required that ammonia be removed from almost one-half of the treated wastewater that Metro discharged to the South Platte

River. That requirement was being met by providing nitrification and denitrification facilities in the North Complex. The new facilities were required to be operational by November 1, 1990.

Work was progressing very well on the ammonia removal project under a \$35,798,000 contract awarded late in 1988 to a joint venture of Summit Constructors, Inc. of Northglenn and The Industrial Company of Steamboat Springs.

By the end of 1989, two of the four secondary treatment quadrants in Metro's North Complex had been modified and were back in service. Work was mostly complete on the new East Blower Building, North Chemical Building, North Polymer Building, and Centrifuge Centrate Tank. Change orders had increased the construction cost to \$36,180,748. Other costs such as engineering and electrical power supply improvements boosted the total price for the project to more than \$40 million.

The ammonia removal process reduced the rated annual average capacity of the North Complex from 100 mgd to 70 mgd. To maintain the Metro plant's then-current rated capacity of 185 mgd, modifications had to be made to the South Complex to increase its capacity from 85 mgd to 115 mgd. That work, which was included in the Summit/TIC contract, was scheduled to begin after the North Complex was back in full service. It was to be completed in 1992.

The Metro District received a \$15 million federal grant for the ammonia removal project. It was one of the last major grants in Colorado under a federal program that was soon phased-out.



A major component of the ammonia removal project was the East Blower Building, which is shown here in 1990. It supplies air to the process for oxygen.

Interceptor and pump station projects delayed

Interceptor and pump station projects were delayed several months by political and technical problems and, as a result, had significant cost over-runs.

A \$5,246,881 contract for the South Thornton Interceptor Section 1 was awarded in March to a joint venture of Binder and Trainor construction companies. The new interceptor was to be connected to the Thornton-North Washington pump station. The station was being totally renovated under a \$1,255,000 contract awarded late in 1988 to Gracon Construction Company of Loveland.

The pump station project was scheduled for completion in October and the interceptor job was set for completion in May 1990, but both were interrupted by a noisy public controversy over a proposed bypass.

To make critical repairs at the 10 mgd pump station and to connect the interceptor to the station, Metro had planned to bypass wastewater into the nearby South Platte River for up to 24 hours. The Colorado Water Quality Control Division and the EPA had previously given their written approval for the bypass. Elaborate procedures were in place to notify and protect all interested parties downstream of the proposed bypass.

Although the two projects were designed to assure adequate sewage service in western Adams County, the Adams County Board of County Commissioners publicly objected to any bypass and threatened a lawsuit. With the ensuing political pressure and considerable media coverage, the state and federal agencies withdrew their approval.

After a two-month delay for a study of alternatives, a specialty subcontractor was hired to make the necessary connection between pipelines filled with wastewater under pressure rather than using the planned bypass. The episode cost the Metro District about \$400,000 in unbudgeted funds, including contractor-delay claims.

The interceptor project was also delayed early in 1990 in a dispute over an Adams County open cut permit.

The pump station and Thornton Interceptor Section 1 projects had been planned in a 1986 facility report. That report covered the wastewater facilities needed to serve the North

Washington Street Water and Sanitation District and the Thornton area stretching from East 64th Avenue northward past 136th Avenue. A package of construction projects for the area was expected to cost \$9.5 million. The City of Thornton agreed to reimburse the Metro District \$2.25 million for replacement of the deteriorating Thornton East Outfall sewer.

The package of planned Thornton-North Washington projects included rehabilitation of the Barr Trunk Sewer plus construction of the Niver Creek Outfall and construction of Section 2 of the South Thornton Interceptor. A contract was awarded late in 1989 to the Tierdael Construction Company for the Barr Trunk/Niver Creek job, and the Metro board approved an appropriation of \$1,003,000. The Section 2 interceptor project was scheduled for a construction start early in 1990 at an estimated cost of \$1.4 million.

Arvada annexation plan

A City of Arvada annexation plan covering up to 20,000 acres triggered a joint Metro District/Arvada study of how wastewater services should be provided in the area. An 18-month, \$302,000 consulting engineer's study was approved late in 1989. It covered the Clear Creek Basin, Upper Big Dry Creek Basin north of Standley Lake, and the Upper Coal Creek Basin.

The City of Arvada was scheduled to annex an initial 4,400 acres in 1990 as the nucleus for a massive development called the Jefferson Center. The annexation and development, to be phased over the next 20 years, would extend Arvada's boundaries westward along the Colorado Highway 72 foothills at Coal Creek Canyon, northward to the vicinity of the Rocky Flats Plant, and southward to North Table Mountain



In 1989, this above-ground portion of the Delgany Main Sewer Section 3 could be seen from Packinghouse Road near the stockyards.

near the City of Golden. Wastewater from parts of the area would not flow by gravity to the Metro treatment plant.

Because of a lack of an adequate domestic water supply for the Arvada growth, the city and developers originally proposed three small wastewater treatment plants to facilitate water reuse for urban landscape irrigation. However, Arvada, as a Metro member municipality, had to deliver wastewater from all parts of the city to Metro District facilities unless an exclusion was granted for an area. The joint study, expected to be completed in late 1990, was to explore alternative sewage collection and treatment systems. A 1977 Facility Plan for

the Clear Creek Basin did not anticipate developments of the magnitude of Jefferson Center or a big demand for wastewater reuse. In later years, reuse became more important.

The Delgany Main Sewer Section 3

The Delgany Main Sewer Section 3 project was awarded in May to Lillard & Clark Construction Company on a bid of \$1,426,917. Completion was scheduled for February 1990. Initial design was done in 1966, but progress was delayed by questions about major land uses in the river valley northwest of downtown Denver. The Delgany Main, which served much of downtown Denver, had been built with three courses of hand-laid brick a century earlier and was one of the oldest interceptor sewers in the Metro system. Work had been done previously on Sections 1 and 2.

Section 3 included a 72-inch diameter sewer from 16th and Delgany Streets in lower downtown Denver to 17th Street and Grinnell Court, plus twin 48-inch siphons under the South Platte River to connect to the existing Platte River Interceptor. This work would allow an existing part of the system to be dewatered, inspected and rehabilitated later as necessary. The final phase of the whole project was to be Section 4 from 17th Street to 31st Street along Grinnell Court.

Interceptor projects

Three facility reports on interceptors were completed in 1989 by the Engineering Department's Planning Division. The reports covered current conditions and future needs. They also recommended management plans for portions of the Metro District's interceptor system.

For the Berkeley and North Pecos Street Interceptors, serving both suburban districts and city areas around the northwest corner of Denver, the total cost of recommended improvements was estimated at \$2.2 million. Metro recommended that the work be done in the 1990s.

The most significant recommendation with an estimated cost of \$1.8 million was for elimination of a portion of the 75-year-old Berkeley Interceptor within the Berkeley Water and Sanitation District and reconnection of existing individual property service lines to the Berkeley District's local sewer system.

Recommended lining of the 60-year-old Pecos Interceptor would cost an estimated \$400,000.

For the Bear Creek and Platte River interceptor systems in the southwestern quadrant of the Metro area, recommended improvements to be done in the 1990s were estimated to cost \$550,000.

Other engineering activities in 1989 included:

- Purchasing and retrofitting installation of two static mixers to improve the chlorination (disinfection) and residual chlorine removal process at a total cost of \$321,000. A \$5.2 million chlorination/dechlorination project contract had been completed late in 1988.
- Installation of the mixers in the sulphur dioxide part of the process. This was necessary to assure compliance with the stringent limit of 0.003 milligrams of residual chlorine per liter of effluent discharged to the river. The limit is equivalent to 3 parts of chlorine in 1 billion parts of water.

- Receipt of a report from a consultant on possible solutions to the sludge-composting facility's odor problem. One suggested feasible solution would cost about \$13 million. Another consultant was retained to conduct experiments and examine less costly alternatives. A report on that study was due in July 1990. The studies covered how to control excessive odors from compost piles and how to treat ammonia-laden gases when they were drawn off the piles.
- A start on implementing a treatment plant support facilities plan that had been adopted by the Metro board late in 1988. A consultant was scheduled to be retained for \$264,000 to do a preliminary design for a new warehouse and shops building. The master plan also covered a laboratory storage building, vehicle services building, and remodeling of the old warehouse for use by the Transmission Division. The package of new support facilities was estimated to cost \$4 million.

Water quality studies

Water quality studies in the South Platte River and for potential future wastewater treatment requirements raised a \$70-\$112 million question in 1989.

A \$190,000 engineering study concluded that additional facilities for removing ammonia from all effluent would have capital costs between \$70 and \$112 million. Such costs were compared with the \$40 million Metro was spending on facilities for ammonia removal from almost one-half of the treatment plant's effluent. Total ammonia removal

would also cost an estimated additional \$3 million to \$4.7 million in annual operations and maintenance expenses.

Laboratory staff's preliminary study indicated that dissolved oxygen levels in the river might not meet state and federal requirements in the future. The problem was apparently caused by complex interactions in the river as a result of the Metro District's removal of residual chlorine and the beginning of ammonia removal.

Metro hoped more definitive conclusions would be available in 1990-91 for the segment of the river between 64th Avenue and Fort Lupton, where Metro's discharge impacts were measured.

The EPA, in the 1986 discharge permit issued to Metro, required studies to be done to help it decide whether to require total ammonia removal in a new five-year permit to be issued in 1991. Removing ammonia from treated wastewater benefited aquatic life.

The ammonia removal project underway in 1989 would modify the North Complex of Metro's treatment plant and provide a compensating increase in capacity in the South Complex. Since the South Complex could not be modified to provide ammonia removal, a new and separate facility would be required to nitrify/denitrify South Complex effluent.

Permit limits met

Despite severe stress on plant operations in the summer of 1989 from construction of the North Complex ammonia removal facilities, the O&M staff kept Metro from incurring major discharge permit variances. At various times, up to half the north secondary treatment facility was out of operation.



Water Quality Officer Duane Humble takes samples in the South Platte River in 1987.

A high priority was placed on the start-up of the facilities during the latter part of the year. One quadrant of the north secondary aeration basins was placed into service as soon as it was available to provide the opportunity to collect operational data, develop and refine process control strategies, and determine probable future electrical power and chemical requirements of the ammonia removal process. Initial start-up was successful and was a head start for ensuring that Metro would be in compliance with the new effluent discharge requirements in 1990.

Metro had both state and federal discharge permits, and operations were directed to meeting the most restrictive effluent limits of the dual permits, as follows:

<i>30-day Average Parameters</i>	<i>Limit</i>
Carbonaceous Biochemical Oxygen Demand (CBOD5) – mg/L	17
Suspended Solids (SS) – mg/L	30
Fecal Coliforms – No. per 100 mL	2000
<i>Instantaneous Parameters</i>	<i>Limit</i>
Total Residual Chlorine (TRC) – mg/L	0.003
Oil and Grease – mg/L	10

Sewer inspections

The Transmission Division obtained equipment for sewer lines inspection and servicing. Studies had shown that it would be cost-effective for the Metro District to have its own equipment

instead of contracting for services. Metro had about 230 miles of interceptor sewers, ranging from 4 inches in diameter to 96 inches.

The Transmission Division's first installation of an electronic data logger and telephone transmission line between a remote meter/sample station and the treatment plant was completed at the Aurora/Sand Creek station. The system recorded and stored flow data in a personal computer hooked to a telephone line. It was expected that all major meter/sample stations would get similar installations in the next few



A Transmission Division crew prepares for a television inspection of a Metro District interceptor sewer in 1989.

years. The new system reduced the labor-intensive work of personnel visiting the stations and collecting flow charts.

In the Laboratory Services Department, a total of 347,519 tests and analyses were performed in 1989, compared with 306,721 in 1988, an increase of 11.7 percent.

A relatively new EPA program was industrial pretreatment and toxic waste control. It required all local government connectors under Metro oversight to assure that certain listed chemicals and compounds from significant industrial users



Dawn Flancher checks an electronic data logger at the Aurora-Sand Creek station in 1989.

did not enter the publicly-owned sewer system in harmful amounts. The pretreatment program barred interference with the treatment process and prevented the prohibited materials from ending up in the river or on farm lands where sludge was used. By the mid-1990s it had become very effective.

Sludge reuse

Studies on the cause of excessive odors from the compost facility continued in 1989. The odors, which could exceed air quality standards, occurred when the facility was operated at a level necessary to compost the average of 65 dry tons of sludge produced daily at the Metro plant.

At the same time, Metro was anticipating the EPA's publication of a new sludge regulation under 40 CFR Part 503. The new regulation would cover applying sludge to farm land. Metro had planned no major changes in the compost facilities until the EPA published the new regulation. It appeared that the new regulation would greatly increase the amount of agricultural land that Metro would need for applying its liquid and cake METROGRO® sludge. Metro also believed the proposed regulation would greatly increase its costs for processing and recycling sludge as a fertilizer and soil conditioner.

In the meantime, the RR&R Department continued to truck-haul liquid and cake METROGRO® products to more than 80 farm sites in northeastern Colorado. Some of the sites were 70 miles from the Metro plant.

Metro had determined it was more cost effective to haul sludge cake at 17 percent solids rather than liquid sludge at seven percent



Field Supervisor Donna Hull (now the director of the Resource Recovery and Reuse Department) checks to make sure her 4-wheeler is secure in her pick-up in 1993.

solids. Therefore, most of the sludge applied on farm land was cake that was tilled into the soil immediately after spreading on the land.

In 1989, the RR&R Department hauled 6,000 truckloads a total of 300,000 miles for the agricultural application program.

Intergovernmental relations

Metro continued to participate in the Lowry Coalition in 1989 in studies on how to clean up the hazardous waste site at the

landfill on the former Lowry Bombing Range southeast of Denver. Five final work plans were due at the EPA Regional Office in January 1989. Progress was also made on three other work plans. The coalition included 13 companies and municipalities that agreed to cooperate with the EPA on the study phase of Lowry Superfund Site remedies.

In mid-year, Metro decided to file a federal court case against the District's general liability insurance carriers from 1969 to 1986 to determine their liability for Metro's costs for participation in the Lowry Superfund Site situation.

In 1989, Metro and the coalition additionally studied a key question about the degree of toxicity of materials placed at the landfill versus the volume of materials as possible measures of potential responsibility. A second key question was how to relate to entities that deposited "de minimis" (comparatively small) amounts of hazardous materials at the Lowry site. The EPA wanted to reach a consent decree settlement on that issue; however, it said responsible parties should try to work out an allocation of responsibilities by the end of the year.

In answering a third major question, the Metro board approved having Metro and the coalition participate in a study on deep groundwater in addition to an initial study on shallow groundwater. Metro's share of the additional cost was estimated to be between \$206,000 and \$241,000 over three years.

The cost to Metro for the Lowry Superfund Site program began in 1988 when the board appropriated \$1.5 million for studies regarding a Shallow Groundwater and Sub-surface

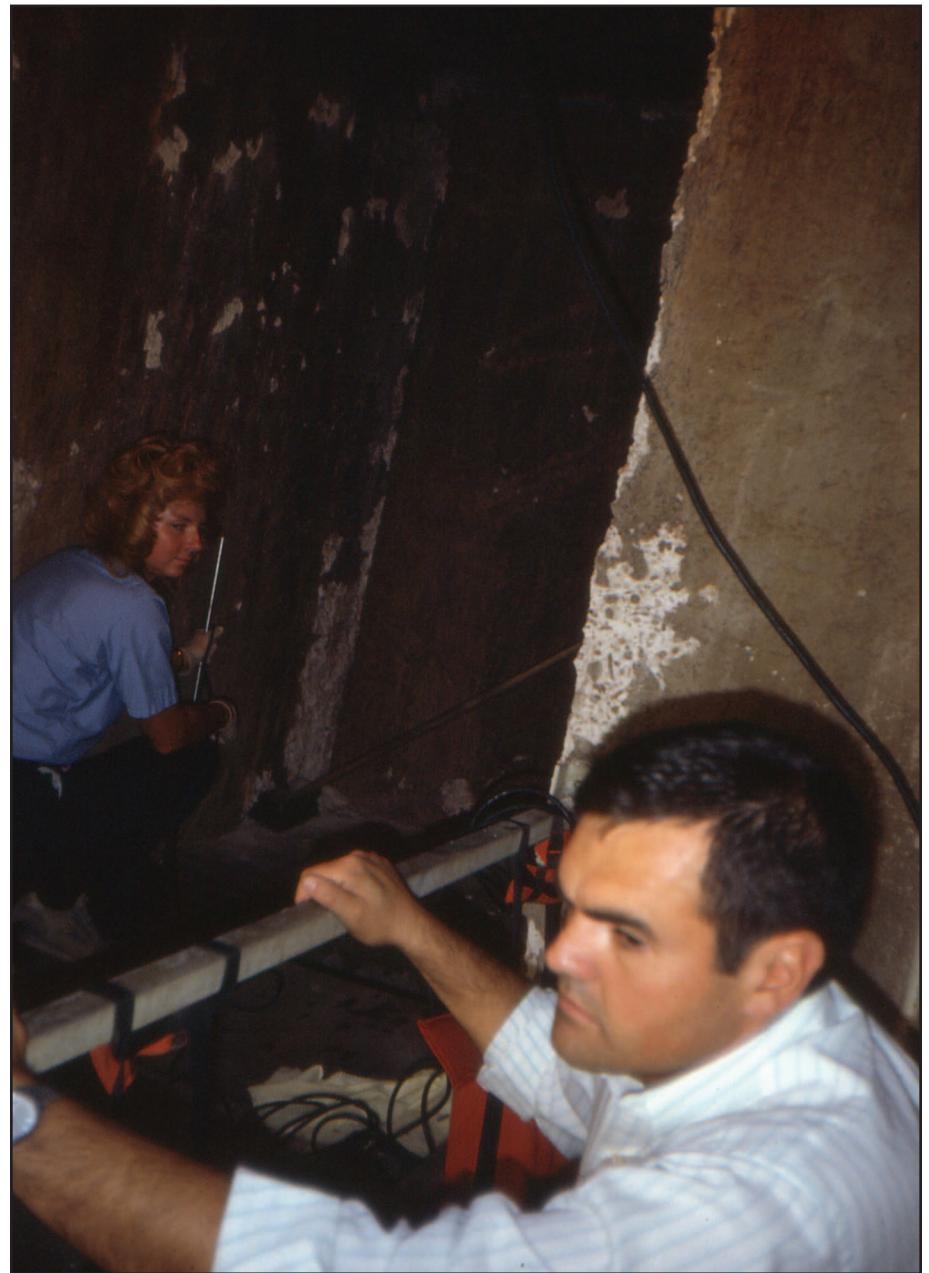
Liquids Operable Unit. Total operating expenses through 1989 were approximately \$1,057,000. Authorized expenditures included an initial \$150,000 for a consulting engineer to provide technical expertise to protect Metro's interest.

Liquidated damages assessed

The City and County of Denver was assessed \$76,000 in liquidated damages for violating a Metro permit that allowed Denver's Stapleton Airport to discharge stormwater contaminated with ethylene glycol, a de-icing agent, into the Metro system. All but \$11,500 of the penalty was suspended on the condition that Denver comply with the permit requirements. Those requirements had been approved by the EPA, which supported Metro's assessment of liquidated damages.

During winter storms, the de-icing material flowed off the Stapleton Airport facilities into Metro's Sand Creek Interceptor and to the Treatment Plant. The discharge permit for Denver was negotiated in 1988 to limit "slugs" of ethylene glycol, or similar de-icing material, to nine tons a day at Metro's plant. Such overloading could have resulted in Metro violating its state and federal government permits. To control the amount of de-icing material, the airport constructed holding basins to store run-off during storms and to control the flows to the Metro interceptor.

The City of Thornton objected and delayed the board's approval of 1988 final (actually measured) wastewater flows and pollutant loadings from March until June. Thornton objected to Metro's determination of the city's 1988 flows/loadings and requested a hearing on an appeal.



Calibration of the Thornton-86th Ave. metering station in 1989.

In 1988, Metro staff had conducted several tests on the station that meters and samples Thornton wastewater entering the Metro system near 86th Avenue and Steele Street. Staff concluded that the flow meter should be recalibrated and told Thornton that all the 1988 flow measurements should be increased by 12 percent. Thornton objected to the procedure and to the resulting \$100,000 increase in charges the city would have to pay to Metro. In May, a board hearing committee generally upheld the Metro staff methodology for recalibration, but ruled that, because of inadequate notice, the increased flows and charges would be limited to November and December of 1988. As a result, the meter/sample station was scheduled to be replaced in 1990.

The City of Aurora requested exclusion from the Metro District for about 56 acres that the city had annexed south of Cherry Creek Reservoir. The city had obtained a contract for wastewater service from a nearby treatment plant that the new Arapahoe County Water and Wastewater Authority had taken over from the Arapahoe Water and Sanitation District. The Aurora annexation property was in the Cherry Creek Basin and could not be served by gravity flow to Metro facilities in the Sand Creek Basin. To reach Metro interceptor sewers, Aurora would have had to construct and operate a pumping system and several miles of force main.

DIA

Officials of the new regional airport that was to become Denver International Airport (DIA) reviewed the airport's plans at a Metro board Future Programs Committee meeting. Alternatives for wastewater service at the airport included:

- Sending all wastewater including ethylene glycol or other de-icing materials to the Metro plant

- Treating the wastewater at a new plant near the airport site and reusing the treated effluent for landscape irrigation at the airport and adjacent real estate developments
- Recycling the de-icing material at an airport plant

Preliminary steps were taken for application of METROGRO® sludge on some of the airport's 40 square miles.

Metro stopped contributing \$35,000 per year to DRCOG for a regional clean water program in mid-1989 because Metro believed it was not receiving adequate benefits from the program. After lengthy discussions and negotiations, Metro agreed to contribute \$12,000 for 1990.

1990—Name change

In 1990, the George H. W. Bush administration told Congress in May that more than 1,000 savings and loan associations—40 percent of the industry—might eventually have to be seized by the government (twice the number it had initially projected); Iraq invaded Kuwait in August; and East and West Germany were reunited in October.

Topping the news at Metro in 1990 was the name change to Metro Wastewater Reclamation District from Metropolitan Denver Sewage Disposal District No. 1. District Manager Bob Hite said, "I think the biggest accomplishment's been in moving the District from (being) just another sewage treatment plant to a metropolitan wastewater reclamation district with the focus on environmental stewardship."² The name change recognized the movement away from the notion of disposing of sewage to the importance of reclaiming water, an extremely valuable resource in the arid West.



The new Metro Wastewater Reclamation District name was adopted in 1990. Paul Dennis suggested the name in an employee contest.

The change also recognized that the “No. 1” part of the old sewer district name was no longer needed because it appeared there would never be a district No. 2 or No. 3 in metropolitan Denver.

Paul Dennis, a journeyman trainee in the process maintenance group, submitted the winning Metro Wastewater Reclamation District name in a contest held among employees.

With the statutory responsibility to provide wastewater transmission and treatment services to approximately 1.3 million people in the Denver metropolitan area, Metro faced a challenge to do that efficiently and economically while complying with

federal and state laws. The public’s concern for and desire to improve the environment had resulted in increasingly stringent regulations and difficult financial straits for Metro.

Ratepayers were told that the annual charges for service would increase 16 percent each year in 1989, 1990, and 1991. The actual increases were 16 percent in 1989 and 1991, and 18 percent in 1990. Metro hoped the 1992 increase would be just 4 percent.

The board’s willingness to approve the necessary rate increases allowed Metro to absorb major unanticipated costs, maintain safe reserves, and position itself for a more stable financing pattern in the 1990s.

Significant factors affecting the increase in annual charges for service from 1989-1991 were the beginning of debt service on the \$50 million in bonds issued in late 1988, the \$47 million capital costs of the new ammonia removal facilities, the increased operating costs associated with the new facilities, and the settlement of the 1986 EPA lawsuit requiring the Metro District to pay a penalty of \$375,000 a year for three years.

Additionally, the District’s commitment to conduct or be involved with remedial investigations and feasibility studies for the Lowry Superfund Site resulted in additional unanticipated expenses. Metro estimated it would spend \$5 million on these studies through 1993.

Metro also had to maintain several significant reserve accounts in its financial system to assure bond holders and to protect against major emergencies. Wastewater system reliability was mandatory. Wastewater flows into Metro’s sewers and treatment facilities

were continuous. The wastewater had to be processed regardless of breakdowns or other emergencies. Having the best possible maintenance and having funds available when necessary to make repairs and cope with emergencies would keep the system running.

The Metro District had 20 member municipalities, including cities and sanitation districts. It added its 24th special connector, Lochmoor Water and Sanitation District, to its list of special connectors in 1990. Lochmoor covered a residential subdivision of 56 lots in the vicinity of West Quincy Avenue and South Wadsworth Boulevard.

Special connector agreements spelled out the service terms for those entities. All 44 member and special connectors received the same level of treatment at the same price.

The service area for the District covered approximately 380 square miles, with a population estimated at 1.3 million. The transmission system included 235 miles of interceptor sewers, 3 pumping stations, and more than 75 flow meters and samplers at connection points throughout the metropolitan area.

Ammonia removal facilities

The \$47.2 million ammonia removal facilities project at the Metro District Central Treatment Plant was substantially completed in 1990. It came in ahead of schedule and cost less than was budgeted. It was the largest single improvement project at the treatment plant since the South Complex was built in the mid-1970s.

Federal and state discharge permits that had become effective in 1987 required Metro to limit the amount of un-ionized ammonia discharged to the South Platte River



The East Blower Building was just beginning to take shape in this 1989 photo. The building is part of the nitrification/denitrification project in the North Complex. It supplies oxygen to the microorganisms.

by November 1, 1990. The purpose: to protect aquatic life, and it added emphasis on protecting the environment to the emphasis on protecting public health.

The project schedule for the design and construction of a project of this magnitude was tight. At times, up to 25 percent of the treatment plant capacity was unavailable because of construction disruptions. The work, however, was completed without mishap.

The nitrification/denitrification process in the treatment plant's North Complex began to remove ammonia. About half of Metro's average of 140 mgd discharged to the river was so treated.

Because of complex chemical and biological interactions in the river, the EPA was concerned that ammonia removal from half of Metro's discharge would not provide the desired level of aquatic life protection it thought necessary. The EPA thus required Metro to undertake additional studies before renewing Metro's discharge permits for 1992 through 1996.

In the meantime, the North Complex ammonia removal facilities performed better than anticipated. Ammonia in the effluent was reduced below the permit limits of 10 to 15 milligrams per liter (mg/L), depending on the time of year. Also, the initial operations in 1990 indicated that chemical and electrical power costs would be significantly less than had originally been estimated.

The improvement project included reconstructing or improving:

- the North Complex's secondary treatment basins to provide increased aeration, enhance ammonia removal, and improve operations monitoring for up to 70 mgd. To

maintain service capability, each of the four quadrants was taken out of service, renovated, and put back in operation.

- the North Chemical Building, where sodium bicarbonate was to be stored, prepared, and fed into the North Secondary to control alkalinity levels. (Nitrification tended to reduce alkalinity to unacceptably low levels for the treatment process.)
- the North Polymer Building, where polymer was to be stored, prepared, and fed into the North Primary system for better solids removal.
- the 500,000-gallon Centrate Holding Tank to transfer centrate from the sludge-dewatering centrifuges back to the North Secondary.
- the East Blower Building, containing two air compressors of 2,500 horsepower each. Improvements were also made at the older West Blower Building.
- secondary treatment facilities in the South Complex to increase capacity from 85 mgd to 115 mgd to compensate for lost capacity in the North Complex. Total treatment plant capacity was thus maintained at 185 mgd. The nitrification/denitrification process reduced the capacity of the North Complex from 100 mgd to 70 mgd.

In the South Complex secondary treatment facilities, new draft-tube mixers were installed in the aeration basins, and center-feed equipment replaced peripheral feed in the clarifiers. The change in the feed system reduced problems with foam.

Improvements were also installed in electrical transformers and switch gear to power the larger equipment. Public Service Company did the work at a cost of \$536,000.

The construction contracts provided bonuses for completing phases of the projects early. This arrangement encouraged the contractor to finish the North Complex facilities and move onto the South Complex almost a year ahead of schedule. Metro had received a \$15 million federal grant for the ammonia-removal project, and 95 percent of the grant was paid in 1990.

Ammonia removal (nitrification) involved microorganisms that, when provided with oxygen in the form of compressed air in the North Complex secondary aeration basins, convert ammonia

into nitrates. However, Metro's discharge permits limited the amount of nitrate in the effluent to 10 mg/L so river water could be used downstream as a raw water supply. Therefore, denitrification was included to break down some of the nitrates into nitrogen gas, which is released into the atmosphere.

Initial operation of the ammonia removal facilities showed they reduced the volume of sludge previously produced at the treatment plant. Thus, in addition to improved protection of aquatic life in the South Platte River, the cost of processing and disposal fell and partially offset the debt service and operational costs of ammonia removal. The reduced sludge volume also delayed the need to build two additional anaerobic digesters.

Ammonia and dissolved oxygen studies

Metro launched a study to be completed in the fall of 1991 to examine alternatives to revise the South Complex so it, too, would remove ammonia. The capital cost range to modify the South Plant was estimated from \$75 million to \$112 million.

As part of this study effort, Metro hired a consultant to develop a computer-based stream model and use it to analyze various alternatives, including changing the quality of Metro's effluent.

The limit for un-ionized ammonia in the river was 0.1 mg/L, or one-tenth of a part per million. The dissolved oxygen requirement was 4.5 or 5 mg/L, depending on the season.

Alternatives the task force looked at included:

- Removing all or part of Metro's effluent from the river through agricultural exchange or some other reuse alternative



Dissolved air flotation is an important part of the sludge dewatering and concentration process.

- Increasing the critical flow through a change in the flow regime in the river
- Releasing some of the effluent into the river at different locations, either with some or no additional treatment
- Modifying the river channel to mitigate dissolved oxygen sags
- Aerating the stream where there were dissolved oxygen sags

Sludge program

The Resource Recovery and Reuse Department focused its 1990 efforts on county government regulations and a new federal sludge regulation then in development.

Adams County proposed regulations that would have prevented wastewater treatment agencies from land-applying treated sludge to agricultural lands as a soil amendment. The proposal included a fee schedule that would have cost Metro an additional half-million dollars a year and did not recognize that Metro served an estimated 200,000 of the county's 272,000 residents. The added costs would thus have burdened these residents as well.

Working with other wastewater treatment agencies that land-applied sludge, Metro opposed the Adams County proposal and negotiated compromises in which the U.S. Soil Conservation Service (now the U.S. Natural Resources Conservation Service) played a role.

At the federal level, Metro maintained a keen interest in the ongoing development of federal sludge regulations that are now known as the "503 Regulations" (40 CFR Part 503).



A barrel section of the above-ground portion of the 78-inch Clear Creek Interceptor pipeline is moved into position for installation in August 1983. From the northwest corner of the plant to the headworks, the above-ground run is 1,100 feet.

This complete set of regulations, developed by the EPA, was to have taken effect in 1991 but was delayed. Early drafts—especially the section involving pathogen destruction—indicated Metro may have had trouble complying.

The biggest proposed change was restrictions the new regulation was to place on the amount of sludge a wastewater treatment agency could apply to the land. The effect on Metro was to require it to acquire permits and permissions to apply sludge to

additional parcels of privately owned farm land, thereby increasing hauling costs and the time needed to reach permit sites.

Composting facility odor problems continued to plague Metro. Among the recommendations of a two-year study were facility changes costing about \$13 million in capital costs and fine-tuning the composting process. Among the changes: two-stage deodorizers, which staff fabricated and installed, and using biofilters to help reduce the odors. The biofilters reduced the facility's capacity to about 20 dry tons a day.



Colin McKenna, who would be named director of Engineering in 1990, checks the controls for the south aeration basins in this late 1970s photo.

Additional capital construction

Although the ammonia removal facility was the largest capital construction project at \$47.2 million, support facilities were also in the offing. A new 54,500-square-foot maintenance shops and purchasing offices/warehouse building came out of a 1989-1990 Support Facilities Master Plan. By late 1990, architects had been contracted to begin a new administration building design as well as designs for remodeling and expanding several other buildings.

The Master Plan called for the maintenance shops/warehouse to be completed by 1994. Meanwhile, two temporary modular buildings were installed to help relieve overcrowding in the existing Administration/Laboratory Building. One of these was used as the meeting room for Metro's 58-member board.

Several transmission-related capital projects were completed as well, including Sections 1 and 2 of the South Thornton Interceptor, the Barr Trunk Outfall, and the 10 mgd Thornton-North Washington lift station. The Delgany Interceptor Section 3 project was completed early in 1990. This original pipeline, one of the oldest in metro Denver, had been in rehabilitation for several years. The board also approved the sale to Thornton of a small parcel of land at the treatment plant for a pump station for Thornton's water rights exchange program.

Other activities

Metro applied to the Colorado Water Resources and Power Development Authority for a state revolving fund loan of nearly \$21.9 million in 1990. Metro wanted to use the loan in lieu of another bond for capital improvements.

Capitalized by federal funds, the loan would save Metro ratepayers about \$6 million in long-term interest costs.

Metro also added a new charging parameter, Total Kjeldahl Nitrogen (TKN), to the annual charges load calculations. TKN was added to the calculation formula to fairly distribute the cost of ammonia removal after Metro began incurring increased costs for removing ammonia in 1990.

In other actions, Metro added an entire new department in 1990: the Regulatory and Connector Relations Department (R&CR). Formed under Stephen R. Pearlman, former Connector Services Officer in the Laboratory Services



Steve Pearlman was named director of the Regulatory and Connector Relations Department in 1990.

Department, R&CR would handle all Metro's relationships with regulatory bodies and all of its connectors.

Colin McKenna became director of engineering in 1990, replacing W. Henry Waggy. McKenna had been in charge of Metro's construction projects prior to that. Mary Ann Tavery was named Treatment Plant Superintendent in 1990. She was Transmission Superintendent prior to that.

Local 2-477 of the Oil, Chemical, and Atomic Workers Union, which represented about 25 employees in the Laboratory Services Department, filed a lawsuit against Metro in mid-year. The suit contended that Metro was violating a state law requiring it to pay prevailing wages. Metro responded that determining what prevailing wages were was not subject to negotiation by the union but was solely the purview of the board. The case was dismissed and the board approved a 3.25 percent prevailing wage increase for lab employees in July.

Lowry Landfill Superfund site

More than 40 depositions had been taken in the lawsuit by the end of 1990, and some 150,000 pages of documents had been copied. Metro hoped to recover money it was spending or might be required to spend on the studies and possibly the ultimate remedy at the Superfund site.

ENDNOTES

¹ Robert W. Hite, Interview, July, 2007.

² *Ibid.*



CONSOLIDATING GAINS AND CONSTANT IMPROVEMENTS, 1991-1997

1991—Major process change in North Secondary Complex

A United Nations coalition led by the United States drove Iraqi forces from Kuwait in 1991; the Senate confirmed Supreme Court Justice Clarence Thomas following bitter nomination hearings; and the old Soviet Union dissolved.

Meanwhile, Metro's new \$47.2 million nitrification/denitrification system met or exceeded its design standards. This allowed the Metro District to meet all of the conditions related to its permit.

This system included extensive modifications to the District's treatment facilities. Improvements in the North Secondary Complex equipped it to remove ammonia from the effluent, making Segment 15 of the South Platte River a more hospitable environment for aquatic life. Segment 15 is the 26-mile reach between the Burlington Ditch headgate in Denver and Fort Lupton.

Operations employees optimized the nitrification/denitrification process in the North Secondary Complex by monitoring influent flows and loadings, dissolved oxygen, air volumes and pressures, solids concentrations, and effluent quality.

By 1997, the plant had 10 anaerobic digesters. Nitrification/denitrification was added in 1989-1990.

They also optimized the South Secondary capacity using the new wastewater treatment system. However, construction activities that continued through the end of the year kept staff from completing this task, and more study was needed in 1992 to determine the peak performance of this portion of the Central Treatment Plant.

The Metro District saved an estimated \$7.5 million in interest costs over the next 20 years by getting \$21.9 million in financing for capital projects through the Colorado Water Resources & Power Development Authority. These funds were acquired through a State Revolving Loan Fund loan that used matching federal and state funds to provide lower-than-market-rate financing for wastewater system construction and improvement projects.

The District's board of directors approved an annual budget for 1992 that included a four percent increase in annual charges for service, the smallest increase since 1986. The 1992 increase was equivalent to adding an average of 29 cents a month per household to wastewater bills in the District's service area.

Thirty years of progress

By 1991, thirty years had passed since the Metro District was created. The hard work by the founders—both board and staff—was showing a positive effect that users of the South Platte River were only then beginning to realize. The river was cleaner for:



Metro's new \$47.2 million nitrification/denitrification system met or exceeded design standards in 1991 and allowed the District to meet all the conditions of its discharge permit. An aeration basin and dissolved oxygen probe are shown here.

- Fish, waterfowl, vegetation, and other aquatic life that lived in and along it;
- People who played along its banks and in its waters;
- Farmers who used its water to irrigate their thirsty land; and
- Towns that used its water as supplies for drinking water and for industry.

The Metro District had grown and changed during that time. There were 27 sewage treatment facilities in the metro area when the Metro District was formed, and only two could comply with the then-new Colorado wastewater treatment and discharge laws. By 1991, the Metro District was in compliance with federal and state laws and most of those 27 facilities had been closed.

The District's challenge in 1961 was to consolidate sewage treatment for the area into one large, efficient operation that could provide secondary treatment, keep sewage out of the river, and protect public health and the environment. By 1991, the public health protection challenge had largely been met, ammonia removal was emerging as the new challenge, and protecting the environment was the order of the day. One challenge remained constant: Keeping the cost of wastewater treatment affordable for the District's ratepayers.

Nitrification alternatives study

Metro's successful operation of the new nitrification/denitrification facilities for the first full year during 1991 did not keep the EPA Region 8 from being concerned that ammonia removal from about half of Metro's effluent would not be sufficient to protect aquatic life.



In the early 1990s, modifying parts of the channel of the South Platte River—including near the 88th Avenue drop structure at the bridge (shown before modification)—was adopted as a way of raising dissolved oxygen levels in the river.

To understand the problem better, the District had commissioned a major study in 1990, the Nitrification Alternatives Study, because ammonia in the effluent was thought to cause low levels of dissolved oxygen (DO) in the South Platte River.

The 1990 Nitrification Alternatives Study showed that adding ammonia removal facilities in the South Complex could cost Metro from \$72 to \$112 million. It would also increase operating costs by \$2 to \$4.5 million a year. Metro thus looked for other ways to effectively meet the same stream standard goals.

Presented in late 1991, the Nitrification Alternatives Study showed that ammonia discharged to the river was reduced during 1991. Monitoring data showed water quality had improved.

The study used extensive water quality modeling. It verified what Metro already knew about the DO levels from its ongoing monitoring efforts: Even if the District had nitrification/denitrification facilities in the South Complex, DO standards throughout Segment 15 might not be met.

The analysis concluded that ponding near the 88th Avenue bridge and the Fulton Ditch diversion was likely a major cause of DO depletion. Modifying the stream channel at these locations would significantly improve water quality.

The study further showed that Metro could comply with in-stream chronic and acute ammonia water quality standards with existing plant facilities for both the current and the foreseeable future.

After evaluating a host of potentially beneficial ways to bring the DO levels into consonance with stream standards, the study came up with eight preferred alternatives. It also recommended that none of these eight be developed by itself into a District Effluent Management Plan. Rather, each alternative featured techniques in various combinations that the study said could be beneficial for Metro to consider in further detail.

National biosolids regulations

From the early 1970s, Metro had been among a handful of wastewater treatment agencies in the United States seeking ways to beneficially recycle domestic sewage sludge. Metro had tried incineration in the late 1960s. Extreme operating difficulties, odor, and air pollution problems convinced Metro that incineration was not a viable way for it to dispose of sewage sludge.



In the field with a TerraGator biosolids spreader are (left to right): Tom Zeliff, Keith Hagan, Rick Menor (face shows only), Tony Quintana, Gary Arundle, Jay Allen, Jeff Andrew, Jim Hudak, Rob White.

The District began cooperative research with Colorado State University in 1971 to investigate beneficially applying both liquid and cake biosolids—referred to then as sludge—to agricultural land. Experiments conducted over more than a decade showed that domestic sewage sludge could safely and beneficially be applied to land. Colorado soils often lack organic matter and nutrients, and domestic sewage sludge could stabilize and enrich the soil while adding nutrients slowly and naturally.

The Metro District and other responsible wastewater treatment agencies were developing environmentally sound practices to beneficially apply what would later (in the 1990s) come to be called biosolids. Meanwhile, the EPA was developing a set of sludge regulations called the 40 CFR Part 503 Regulations, or “the 503 Regs” for short.

The implementation date, although anticipated in October 1991, was pushed back to October 1992. The complete effect on the District’s biosolids recycling activities was unknown, but the new regulations were expected to drive staff size up. Metro also believed the 503 Regulations would force it to modify its operations, change the METROGRO® product line as it was then known, and increase its costs.

The 503 Regulations dated to a 1977 federal Clean Water Act mandate that required federal sludge regulations to be implemented in 1978. In 1988, the Natural Resources Defense Council sued the EPA to force compliance. The judgment asserted the EPA was 10 years late in issuing sludge regulations.

Local biosolids regulations

Weld and Adams counties implemented their own new local regulations in 1991. The District found the most significant effects of complying with these local regulations were the increased time needed to process the paperwork and to interact with county staff and the public at local hearings.

Weld County also prohibited biosolids application from sites in the 100-year flood plain. With this change, Metro lost half its 20 approved sites for sludge disposal. Additionally, the Town of Lochbuie in Weld County passed an ordinance establishing a water supply protection district. The ordinance controlled all surface activities over the designated water supply area. Lochbuie recommended to Weld County that sludge application within this designated area be disallowed, and the county agreed.

Adams County regulations enacted in February 1991 applied only to unincorporated areas. Adams County also

contracted with the U.S. Soil Conservation Service (now the U.S. Natural Resources Conservation Service) to advise it in the sludge application site review process.

Studies

The District continued efforts to develop more cost-effective beneficial use methods with studies of two ways to reduce the water content of sludge. One investigation involved thermal treatment; the other involved chemical treatment. Both were tried on METROGRO® Cake, which was about 84 percent water. Although fuel costs were not at that time the issue that they are now, transporting high water content sludge was expensive—especially when some agricultural application sites were more than 100 miles away.

Both methods had the additional benefit of killing pathogens (disease-causing microorganisms)—an increasingly important issue in the expected 503 Regulations. Staff evaluated the studies, but for a number of reasons neither method proved practicable for Metro.

Other system-related studies during 1991 included one to relocate the Delgany Common Interceptor near Union Station. Metro needed to eliminate conflict between the Delgany Common Interceptor and the Regional Transportation District's (RTD) 20th Street project, an automobile/high occupancy vehicle access from I-25 to downtown Denver via the 20th Street corridor.

The Delgany Common Interceptor was to be abandoned between 16th and 31st Streets and replaced with a new interceptor adjacent to the east bank of the South Platte River. Local sanitary service would be maintained by new collectors. This plan eliminated

the conflict between the RTD roadway project and the existing interceptor sewer. RTD and Metro shared the relocation cost.

Denver studied ways to reduce traffic congestion and delays at the intersection of Speer Boulevard, Sixth Avenue, and Lincoln Street in 1988. The city developed a plan to depress southbound Speer Boulevard into a tunnel from approximately 7th Avenue and Acoma Street to 5th Avenue and Sherman Street. Implementing this plan meant relocating the Cherry Creek Common and Cherry Creek Interceptors. District staff helped Denver and its consultants prepare the relocation study.



Segment 15 river studies in the early 1990s included fish shocking in the ponded area upstream of the 88th Avenue Bridge.

The board authorized the district manager to enter into an agreement with Merrick & Company in 1991 to design the new Resource Recovery and Reuse (RR&R) Services Building. Metro needed the additional space to provide room for new RR&R staff needed to comply with the 503 Regulations and for current RR&R staffers who were then located in temporary housing. Construction of the new services building began in July 1992 and was completed by January 1993.

1992—Year of Clean Water

South Africans approved an end to minority rule in 1992, Hurricane Andrew ravaged Florida and Louisiana, and former Arkansas governor Bill Clinton beat George H.W. Bush in the 1992 presidential race.

Twenty years after the federal Clean Water Act was signed, the EPA led the nation in observing 1992 as the “Year of Clean Water,” and the Metro District continued to play a major role in cleaning up the South Platte River.

The river had become much healthier and better able to support aquatic life than it had been just two decades earlier. The EPA’s Region 8 administrator helped the District mark this progress in February with a plaque. The citation recognized the District for “outstanding accomplishments and the wisdom and determination that made them possible.” The EPA and the Colorado Department of Health speakers also recognized the District later that year for its achievements at a District-sponsored “Year of Clean Water” celebration.

The board adopted a strategic plan that contained 11 near-term goals. Adopting the goals allowed Metro to plan long-range capital



Nitrification rates were measured with instruments such as this as part of the Segment 15 studies in 1992.

needs more effectively. Accomplishing them would also enable the District to better serve metro Denver’s population cost-effectively and continue to protect and improve the environment.

The Colorado Department of Health issued Metro a new discharge permit in September 1992. It required the Segment 15 Studies in a compliance schedule that Metro had negotiated into the permit. The studies further explored solutions to the DO sag problem and explored less costly alternatives to spending \$72 to \$112 million to build additional

nitrification/denitrification facilities in the South Complex if such facilities might not even solve the DO sag problem.

In an early effort at collaborative problem-solving, Metro formed a Scientific/Technical Advisory Team (STAT) to guide the multi-faceted Segment 15 Scientific Studies project. The District's members on the STAT included staff from Engineering, Laboratory Services, and Regulatory & Connector Relations.

The STAT also included the consulting engineering firm Camp Dresser & McKee, Inc., plus subcontractors and specialists such as the EPA, the University of Colorado, and the U.S. Geological Survey. The specialists covered biological and stream sciences, public health, wildlife, and local government planning.

The STAT study group focused on how to protect the total river environment and meet the standards. Field and laboratory studies were included in the Segment 15 project.

Field and lab studies

Field studies concentrated on Segment 15 aquatic life. District scientists mapped wildlife habitats in a survey of the ever-changing river's whereabouts over the course of the study.

Segment 15 was divided into several sub-segments for this survey. Each sampling area represented all categories of river habitat: riffles, runs, glides, and pools. These habitat designations were important in the study of population distributions.

The study team also counted fish to determine the number of species and individual fish within species.



Patty Biddle (left), a student/summer intern, gathers fish larvae in this June 1993 collection effort for the Segment 15 Fish Studies.

The District began laboratory studies at the Red Buttes Laboratory in Wyoming, a facility known nationally for this type of work. These studies measured the effects of varying dissolved oxygen (DO) levels on several species of fish found in Segment 15. The DO levels in the tests mirrored the daily DO fluctuations in the South Platte River.

Metro also conducted extensive water quality studies, 24-hour flows and water chemistry monitoring, and solids-settling rate tests.

In addition, the U.S. Geological Survey tested groundwater seepage to determine the quality and amount of groundwater entering the streambed, and the EPA's Ecological Services Laboratory from Athens, Georgia, studied sediment oxygen demand and reaeration rates for two weeks in September 1992.

Stream channel improvements

The Nitrification Alternatives Study had concluded that ponding near the 88th Avenue bridge was causing a significant DO sag. Because of this sag, the state required predesign work for stream channel modification as part of the District's new 1992 discharge permit. The Segment 15 Studies included this work.

A primary concern was how channel modifications could increase DO, maintain river channel stability and boater safety, and protect wildlife habitat.

To help answer reaeration and channel stability questions, Metro conducted river geomorphology studies. River



Engineer Bob Neal (left) discusses stream channel modifications in the South Platte River in this 1993 river channel physical model at the Colorado State University Hydraulics Laboratory in Fort Collins, CO with a representative from that laboratory CSU civil engineering professor Dr. Chester Watson.

bottom soil characteristics in the channel bottom were measured. Velocities and depths were studied as well.

River channel model

The District contracted with one of the leading hydraulics labs in the United States—the Colorado State University Hydraulics Laboratory in Fort Collins—for reaeration and river channel modification hydraulic models. One model showed that vertical-faced, roughened-surface drop structures optimized reaeration. The other showed the most feasible channel modification alternative included building between four and seven drop structures (low, man-made waterfalls), removing the existing 88th Avenue drop structure, and channelizing the river.

This second model tested alternative channel modifications and their effects on channel stability and flood control in a 1-to-25 scale model of the river at 88th Avenue. It showed that boat chutes would help protect boaters. The Colorado Division of Wildlife worked with Metro to minimize wildlife habitat loss.

A Preliminary Design Alternatives Team (PDAT) representing several interested constituencies worked with the District on the stream modifications at 88th Avenue. Final design of this portion of the project was expected to begin in August 1993.

Additional effluent management studies were undertaken in 1993. They evaluated whether one or more water resource management strategies could be considered in selecting a nitrification alternative for implementation. The study components included water and reuse water demand and supply, legal and environmental constraints, and applicable engineering technologies.

The Scientific/Technical Advisory Team continued to oversee tests and review data and results in 1993. As data were developed, they were incorporated into a Water Quality Computer Model that was first developed to profile DO levels in Segment 15. The model was redefined to reflect the additional data gathered in 1992.

The Segment 15 Studies continued into 1994, when Metro hoped then to have enough data to be able to draw an accurate picture of the South Platte River. The District hoped the results of this picture would show that the unique South Platte River system could be protected and enhanced by site-specific standards.

The Segment 15 Studies made an important contribution to the art and science of river modeling across the country.

They added to the body of knowledge and contributed to the ecological health of the South Platte River.

New Maintenance Shops and Warehouse Building

As 1992 was coming to a close, District staff occupied a new Maintenance Shops and Warehouse Building southeast and across the railroad tracks from what was then the Administration Building. The \$5.8 million facility put purchasing, warehousing, and shop functions under a single roof. Parts could be ordered, received, stored, issued, and sometimes installed in the same building.

The Process Maintenance group shared the building with Purchasing and warehouse staff. Parts issue and tool check-out efficiency improved, and repair turn-around times were reduced. The efficiency was important because the process maintenance group handled more than 1,000 work orders a month. The high-density storage concept in the warehouse allowed the same number of items to be stored in about half the space needed before.

The new shop facilities included individual workstations for mechanics and electricians plus new equipment.

The District's mechanics and electricians were highly capable craftspeople. Broadly skilled and trained, they could repair virtually every piece of equipment needed to keep the plant operating.

The new shop facilities gave mechanics and electricians the ability to manufacture parts for process equipment that were no longer in production or for which no spares existed. This capability kept the District from having to scrap otherwise serviceable equipment that may have only needed a simple shaft or other easily manufactured part.

For example, the \$40,000 lathe in the machine shop could cost \$300 per hour or more if the District's mechanics had to rent time on a similar machine in a job shop. Mechanics used the lathe frequently, and it soon paid for itself—both monetarily and through the additional repair and manufacturing capabilities it provided.

Discharge permit

The District began operating under a new Colorado discharge permit on September 1. Issued under powers delegated to the state by the federal government, this permit contained two important compliance schedules.

One schedule involved evaluating depressed DO levels in the South Platte River. It also required the Segment 15 Studies to determine causes and recommend solutions. The other schedule provided time for the District to study the concentration of five organic chemical compounds in the wastewater influent and effluent.

Effluent limits on two of these compounds were to take effect January 1, 1995. Limits on the remaining three compounds were deferred so studies could be completed. If these studies indicated limits were needed on one or more of the compounds, a new compliance schedule would set the limits and dates.

The new permit also changed biomonitoring requirements somewhat but still required monthly tests on two species: Ceriodaphnia dubia and fathead minnows.

One additional feature of the new permit was recognition of a new outfall that discharged previously unrecognized groundwater from the District's storm water collection system to the South Platte River. The permit required the District to monitor the quality and volume of ground water that resulted mostly from routine maintenance of primary and secondary clarifiers in the South Complex.

Metro received its first storm water discharge permit from the state in 1992. Under this permit, the District implemented best management practice protocols. This included building a system to capture potentially contaminated storm water runoff and return it to the headworks for treatment.

Biosolids management

The District received preliminary copies of the long-anticipated new federal biosolids regulations in November 1992. Called the Sewage Sludge Use and Disposal Regulation (40 CFR Part 503), the new 503 Regulations were not officially published in the Federal Register in 1992 as had been expected. Nevertheless, preliminary copies of the new regulations gave

the District enough information to confirm that its operational procedures would need to be modified for it to comply.

The Regulations' published limit on molybdenum could have reduced significantly the number of years that biosolids could be applied to a site. The Resource Recovery and Reuse (RR&R) Department, the Regulatory & Connector Relations (R&CR) Department, and the Laboratory Services Department evaluated the full impact of this new limit.

Another concern arose when Adams and Weld counties withdrew several permits that had allowed Metro to apply biosolids to privately owned agricultural land. As a result, Metro was forced to truck biosolids to sites up to 120 miles from the Central Plant. Implications of this growing restriction on biosolids application became clearer in light of the District's production of 25,881 dry tons (159,222 wet tons) of biosolids in 1992 alone.

To offset future anticipated losses of farm land for applying biosolids, the District initiated plans to acquire land of its own in late 1992. The first parcel was about 10,000 acres. It was intended to replace relatively close-in, previously approved, privately owned agricultural land that had been lost to beneficial reuse. Metro planned to lease this land to farmers who would raise grains and grasses.

METROGRO® products

The demand for both METROGRO® Cake and METROGRO® Compost exceeded supply in 1992. The District cooperated with the City and County of Denver in a test using grass clippings and leaves as a compost amendment. While

these materials could be incorporated satisfactorily into compost windrows, handling costs were prohibitive and the amendment “burned up” too quickly for it to be satisfactory.

Resource Recovery and Reuse staff studied more cost-effective beneficial reuse application methods. At year end, planning was underway for an in-depth solids management study in 1993. This study was to be a joint effort by the RR&R, Engineering, and Operations and Maintenance (O&M) staffs. It would address several issues including solids dewatering and handling, thermal drying, and chemical conditioning.

Lowry Landfill Superfund Site developments

Progress continued in 1992 to find specific contaminants at the Lowry Landfill Superfund Site. Metro participated actively in the EPA-sponsored Remedial Investigation/Feasibility Studies for four of the six operable units. (After a site is listed on the National Priorities List, a remedial investigation/feasibility study (RI/FS) is performed at the site. For a more complete discussion, please see <http://epa.gov/superfund/cleanup/rifs.htm>.)

The Lowry Coalition, in collaboration with the EPA, recommended a \$61 million remedy. Metro was an active participant in the Lowry Coalition for more than four years.

The EPA accepted the Lowry Coalition’s proposal. It consisted primarily of a complete site containment system and a pump-and-treat system for the contaminated liquids.

A companion study of the soils and sediments and of the surface water was scheduled for 1993. The District waited for the EPA’s response to this study’s recommendation, which was that no



METROGRO® Compost was produced using dewatered biosolids extracted from the Metro District's wastewater treatment process. State and federal regulations published in 1992 established strict pathogen and metals limits.

cleanup action was needed because the soils and sediments at the site contained such low levels of contaminants.

The District expected the EPA to offer a site-wide remedy by the end of 1993. The major contributors to the site had all reached settlements with either the EPA or the site’s owner/operator coalition.

Major engineering projects

Engineering led the Segment 15 Studies project. It also managed other major projects and studies in 1992. One was the Clear Creek/Upper Coal Creek Facility Plan. The City of Arvada

adopted this short- and long-term basin direction document in 1992. Water reuse in the distant future was a factor in this plan.

The Delgany Common Interceptor relocation study involved reaching agreement with the RTD on both temporary and long-term locations for this key sewer line. Design and utility cost agreements were reached in December.

Several major engineering efforts involved the I-25 corridor from 20th Street to U.S. Highway 36. In a \$1.6 million project, the Platte River/West and Southside Interceptors were relocated out of the way of new structures and highways. Design was also completed for relocating the Platte River Interceptor at the 38th Avenue interchange in 1992. Construction was scheduled for 1993-1995.

Other I-25 corridor jobs included reinforcing the Berkeley Interceptor with cured-in-place lining under I-25 at 54th Avenue and relocating the Clear Creek and Clear Creek Parallel Interceptors for the I-25/I-76 interchange.

A relocation for the Barr Trunk at Washington Street to I-25 was designed to prevent conflict with a new highway structure for the I-25/US 36 interchange. Design work began for relocating both lines of the Sand Creek Interceptor at Quebec Street to allow for enlarging the intersection. This project involved a special investigation of environmental concerns.

Design also began on a project that concerned the District because of its direct impact on the people in the neighborhood. A portion of the Berkeley Interceptor was scheduled to be abandoned in 1993 because of its age and poor condition. Approximately 100 homes were directly connected to this interceptor.

This project required Metro to reconnect these homes to newer sewers in the area while causing the affected homeowners minimal disruption. The District conducted a public outreach effort to minimize homeowners' concerns. This communication helped prevent resistance, the project proceeded smoothly, and Metro began construction in late 1993.

At the Central Plant, the Vehicle Service and Laboratory Storage Buildings were incorporated into the Maintenance Shops and Warehouse Facility project. The \$613,000 Resource Recovery and Reuse Service Building was also completed at year end and was occupied in early 1993.

Construction continued on a 2½-year digester and solids holding tank improvement project. Major work was done on the eight digesters and two holding tanks, a new mixing system was introduced, and new floating-cover modifications came on line.

New flare controls were also activated, raising system pressure from 8 inches of water pressure to 13 inches. Water heating improvements and digester insulation were completed in the 1992-1993 winter season as well. Only two sludge holding tanks were usable during 1992.

Design was completed and construction began on the \$3.1 million Grease Processing Building. This facility would allow Metro to process in the digesters a portion of the nine dry tons of grease that enter the headworks daily, thus reducing disposal costs.

Engineering also completed design and began construction on improvements to the cogeneration facility. A gas booster compressor was added to the system. Weld repairs

were also made to the cogeneration system's digester gas pipes. Most of the supply gas piping in the Cogeneration Building was removed, re-welded at a facility in Kansas, and reinstalled and tested during one two-week period.

Studies began on a new Administration Building, the Laboratory/Technical Services Building, and the ultimate use for the old Facilities Maintenance Shop Building. These studies were expected to be completed in 1993, with the goal of tying all these support facilities together in a comprehensive plan.

Operations and maintenance

Metro completed the year with no variances from either the old or the new permit. This was the second year in a row that

the District had achieved a 100 percent compliance record and qualified for an Association of Metropolitan Sewerage Agencies (AMSA) Gold Award. The District received its first AMSA Gold Award in 1992 for a perfect year in 1991.

That award was the first in a string of 17 years of compliance awards. On but one occasion during those years did Metro have a noncompliance, and it caused no environmental harm.

Having one or two of the District's eight anaerobic digesters out of service for construction at all times made it difficult to comply with the new permit. The operations staff tweaked parts of the process and optimized centrifuge operations to compensate. Metro ended the year with biosolids production at 77.9 dry tons per day, a 7 ton-per-day increase over 1991.

The Facility and Process Maintenance groups planned, scheduled, and constructed 22 projects that improved employee safety and equipment reliability. These projects were valued at \$160,000. Among these were painting the cryogenic plant towers and equipment and refurbishing primary pump buildings.

Transmission Division employees developed a flow data verification program that improved flow metering accuracy. Employees also upgraded a TV camera used to inspect large-diameter interceptor pipelines. The higher resolution camera improved inspection data quality and enabled the Division to maintain the interceptor sewer system better.

Safety

An increased emphasis on safety awareness and improved safety programs helped push lost-time and non-lost-time accidents



In this 1993 aerial view of Metro's Central Treatment Plant, the 17 acres of sheds where biosolids composting takes place can be plainly seen.

to their lowest levels in recent history during 1992. Only four lost-time accidents and 59 non-lost-time accidents occurred. A major component of safety awareness was having all District departments represented on the Safety Committee. Involved employees were a big help in promoting safety awareness.

Training and development

At year end of 1992, Metro had 11 employees in the established journeyman training programs. Four new journeyman trainees were accepted in 1992: two in the RR&R Mechanical Program and two in the O&M Mechanical Program.

Four employees completed all journeyman training program requirements and graduated. They included one from the Plant Operators Program, one from the RR&R Mechanical Program, and two from the O&M Mechanical Program.

The RR&R Department continued to develop a Field Operator Journeyman Training Program. This three-year program was scheduled to be implemented in the spring of 1993, with the RR&R staff providing most of the instruction.

In addition to skilled employee training, Metro also developed professional development courses for ongoing delivery. A training plan workshop, enhancing communications on the job, and learning from conflict were among the courses developed and delivered.

Laboratory Services

Laboratory employees participated in the Segment 15 Studies and handled the constantly expanding Hauled Waste Program. They also completed 514,400 analyses in 1992, a 2.5 percent increase from 1991. Error rates fell and analysis turnaround

times improved, with 96.6 percent of analyses completed within the established 14-day turnaround time requirement.

Pretreatment program

Because federal regulations required publicly owned treatment works designed to treat more than five million gallons a day to run an industrial pretreatment program, the District determined which of the permitted dischargers were in "significant noncompliance" (SNC) at any time in the year. For 1992, only 21 of the 97 permitted dischargers were in SNC. This number compared to 42 of 95 permitted dischargers in SNC in 1991.



In 1992, O&M staff conducted a chlorine leak drill in which personnel donned hazmat suits and applied an emergency "C" clamp to the tank car containing chlorine (which is used to disinfect the water before it is discharged).

The SNC list was even smaller when dischargers were removed who were in SNC only because they violated outdated local pollutant limits that were modified or rescinded in 1992. SNC numbers then dropped to only 11 in 1992, as compared to 27 in 1991.

Proactive pretreatment efforts and increased enforcement actions were two reasons for the dramatic drop in dischargers on the SNC list.



Plant Operator Joe Falcone takes a sample at the North outfall as the treated water is discharged to the South Platte River.

Metro added two industrial waste specialists to Pretreatment Division staff in 1991 and increased its visibility to the dischargers it monitored. It also stepped up its efforts to inform significant industrial users of pretreatment requirements, including holding a comprehensive, “you-really-need-to-be-there” workshop in July.

Awards

The Metro District received an award from “Keep Denver Beautiful,” a public-private partnership that honored Metro for environmental achievement in beneficially reusing biosolids.

For the fifth consecutive year, the Government Finance Officers Association of the United States and Canada awarded the Finance Division a Certificate of Achievement for Excellence in Financial Reporting.

Northglenn-Thornton settlement

A long-running dispute over whether the District or the City of Northglenn would provide wastewater treatment services for certain parts of the City of Thornton was resolved in 1992. Because Thornton was a Metro District member entity, the District's service contract gave Metro the right to treat all flows originating there. However, Northglenn had sought authority under the Denver Regional Council of Government's Clean Water Plan to treat the flows from certain Thornton annexation areas in Adams County. DRCOG resolved this issue in Metro's favor, and the Colorado Water Quality Control Commission ratified DRCOG's action.

In a related and subsequent matter, the District worked closely with Thornton and Northglenn to develop a three-way agreement to resolve a number of outstanding issues

between the two communities. This agreement provided that Metro would treat flows from all future Thornton annexation areas in Adams County, while Northglenn would treat flows from a six-square-mile area in Weld County.

Through negotiation, the District secured the right to treat flows originating in most parts of Thornton that also were in Adams County, while allowing Thornton flows originating in Weld County to go to the Northglenn wastewater treatment facility. Related to this specific issue, the District also worked with Thornton and Northglenn to develop a three-way agreement resolving several other outstanding annexation and service issues between the two communities.

Finance

Financial performance was strong in 1992. The District received \$47.8 million in operating revenue, a \$1.6 million increase over 1991. The primary reason for the higher revenue was a four percent increase in annual charges for service. Interest income declined in 1992 because interest rates dropped and high-yielding securities were sold or matured.

Operating expenses increased from approximately \$15.2 million in 1991 to \$27.3 million in 1992. The increase reflected rising personnel and materials costs.

The 1993 budget included a 3.9 percent increase in annual charges for service. It also incorporated a 2.7 percent reduction in operating expenses from the 1992 budget figures, which accounted for a savings of \$800,000.

1993—New regulations for biosolids

During 1993, a bomb exploded at the World Trade Center in New York City and killed five people, President Bill Clinton issued the “Don’t Ask, Don’t Tell” policy for gays in the military, and the U.S. Congress approved the NAFTA trade pact.

The Metro Wastewater Reclamation District moved ahead on several important fronts. One was a major, long-range solids management study to help the District determine the best options to manage wastewater treatment plant residuals. Metro also believed that some action would be necessary soon to remain in compliance with the new federal and state biosolids regulations that were promulgated in 1993. Solutions were expected to be costly.

The District continued its groundbreaking Segment 15 Studies during 1993. These federally mandated studies were driven by a requirement to raise dissolved oxygen (DO) levels in the South Platte River and the desire to solve the problem cost effectively. The studies were headed toward completion in the summer of 1994 when the District was to submit its recommendations on the required stream channel modifications.

The District earned another AMSA Gold Award for 100 percent compliance with the numerical conditions of its discharge permit. This was the second consecutive year for an AMSA Gold Award recognizing the District’s environmental excellence.

Metro contained operations and maintenance costs in 1993. The number of employees was kept stable and even reduced in a few cases. National surveys indicated that the District’s operations and maintenance costs were well below the median for the largest wastewater management agencies in the United States.

The District's first Ten-Year Plan for Service was implemented. It linked the strategic planning process with the annual budgeting process. It also allowed for an orderly transition from one year to the next because it addressed anticipated changes in facilities and resources needed over the next 10 years. This allowed the District to better allocate its resources to meet future needs.

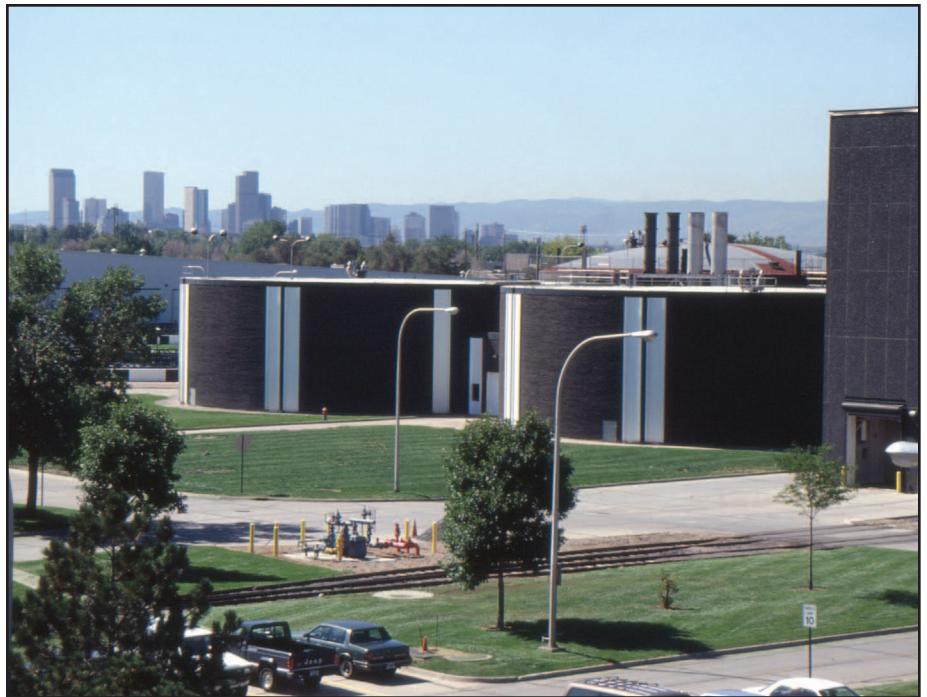
The board also adopted a policy of cash funding all capital projects costing \$250,000 or less as well as non-growth capital projects anticipated to last 20 years or less. This policy was implemented to reduce the District's growing debt service payments. The board's stand on this issue showed great courage, even though it resulted in an 8.5 percent increase in annual charges for 1994.

Finally, the District refunded just over \$64 million worth of bonds at year end when interest rates were low, saving ratepayers \$7.1 million in debt service through 2012.

Biosolids—Better technology for a better environment

One of the District's major concerns in 1993 was devising ways to deal with biosolids for the next 20 years or more. As part of the wastewater-cleaning process, mostly-organic solid materials are removed and processed in anaerobic digesters to reduce the volume and kill harmful organisms.

After treatment, these domestic wastewater solids can be beneficially recycled. Called "sewage sludge" before 1993, the term "biosolids" was introduced in 1993 to differentiate this residual material from other sludges. Biosolids, naturally rich in nitrogen, phosphorous, potassium, iron, zinc, and other nutrients essential to plant life as well as in organic materials, conditions



In 1993, the Metro District had eight anaerobic digesters for treating biosolids.

and builds soil and helps it retain moisture. Biosolids also have lower levels of certain pollutants than domestic wastewater sludges that do not meet the regulatory criteria for land application set forth in the 503 Regulations. The pretreatment regulations, established earlier, were the main reason for "clean" biosolids.

Successful use of biosolids

A board policy adopted in 1971 committed the District to recycling biosolids. The major way Metro recycled biosolids was by applying them to agricultural land.¹ The federal 503 Regulations that govern such biosolids suitability and application took effect in 1993. Despite this regulation, some opposition

to applying biosolids as soil amendments continued. This opposition threatened the District's biosolids recycling program.

Some people opposed biosolids because they believed the material presented a health hazard. As this history was being prepared, no documented cases had arisen in which properly treated and applied biosolids have caused disease in humans or animals.²

Others opposed biosolids land application because they thought the nitrogen would contaminate their groundwater. When biosolids are applied at agronomic rates—the rates at which plants can uptake and use the available nutrients as they grow—the migration of nitrogen into groundwater is minimal or non-existent.



During the middle 1990s, the District relied upon this 5-wheeled TerraGator rear-discharge biosolids spreader for land application of biosolids.

Still others opposed biosolids for cultural reasons. Late 20th-century American cultural norms made it largely inconceivable for many people to even think of doing anything with human waste except get rid of it. However, recycling treated wastewater solids as soil amendments simply returns needed nutrients and organic materials to the soil where they originated.

Some people opposed biosolids because they thought biosolids contained high levels of metals. People unfamiliar with wastewater treatment (and the federal pretreatment regulations) did not realize that the stringent federal regulations severely limited the metals content of land-applied biosolids. Additionally, the District's model Industrial Pretreatment Program limited the amounts of industrial pollutants that got into the wastewater in the first place. The effect of this limitation was that Metro produced what the federal regulations defined as "exceptional quality" biosolids with respect to metals content.

Resource Recovery and Reuse

The Metro District produced more than 70 dry tons of METROGRO® biosolids a day in 1993—about 19 trailer loads a day. In some parts of the United States, biosolids were being disposed of by burying them in landfills or by incinerating them.

At Metro, water was removed from the biosolids after digestion until the remaining material contained about 16-17 percent solids. This material was called METROGRO® Cake. It was applied to agricultural lands under the 503 Regs. In 1993, Metro applied about 90 percent of its METROGRO® Cake to land in a 150-mile radius north and east of Denver. It was applied at agronomic rates based on the crops farmers intended to grow. Farmers paid \$3 an acre to have METROGRO® Cake applied.

Among the benefits of farming with biosolids were increased yields –farmers often reported increases of 10 to 20 percent in the first few years—and higher protein content in wheat. Soils were also enriched and stabilized. They became less susceptible to erosion. The nitrogen in the METROGRO® products was released slowly and in harmony with plant uptake needs.

With expertise from soil scientists at Colorado State University, the Metro District pioneered many of the biosolids processing and application methods now used nationwide. This relationship had begun more than two decades earlier.

The Metro District produced a product called METROGRO® Compost with the remaining 10 percent of its METROGRO® Cake. This was a composted mixture of biosolids and natural amendment material such as wood chips. Metro mostly used waste wood fiber, thus keeping yet another reusable material from going to Colorado's landfills. The District had also tried leaves, grass clippings, and other organic materials as amendments for composting, but they were not as suitable as wood chips. By 1993, METROGRO® Compost was being used for home gardens and lawns and in large projects such as riverbank and mine land reclamation. It was also used to help revegetate areas of Glenwood Canyon along I-70.

Through its Industrial Pretreatment Program, the Metro District carefully controlled industrial pollutants discharged into the wastewater treatment system. This allowed METROGRO® biosolids products to comply with both state and federal regulations for agricultural use. Recycling biosolids improved soil and increased agricultural production with a product that came from producing cleaner water for the South Platte River.

Land acquisition

The board responded to a growing concern that the District would not always have enough land on which to recycle its biosolids. There was also the threat that privately-owned land for biosolids application could become suddenly scarce. In March, the board approved acquisition of two contiguous parcels of land near Deer Trail, Colo. One parcel was about 9,260 acres; the other about 640 acres. The land was then farmed by a farmer from the Deer Trail area under Metro's direction.



In this 1995 photo at Metro's farm, a Ford Versatile Farm Tractor can be seen pulling a John Deere 630 Series disc that was 24 feet wide. In the early days of applying biosolids at its farm, Metro always incorporated them. Later, at the urging of the soil conservation districts, Metro stopped incorporating to help preserve soil structure.

At year end, the RR&R Department was busy developing a biosolids application program for the Deer Trail site. Studies of biosolids application to rangelands by wastewater treatment plants in Albuquerque, N.M., and Fort Collins and Colorado Springs, Colo., had shown positive results. Applying biosolids on various rangelands was shown to control soil erosion, improve vegetative cover, and significantly increase grass production. RR&R planned to study, develop, and implement a program for the new Deer Trail site in 1994.

USGS groundwater monitoring project

Metro pursued two cooperative groundwater monitoring projects with the U.S. Geological Survey in 1993. One was for the continued study of groundwater quality at what had been the old Lowry Bombing Range near Denver where the District had deposited sludge from 1969 through 1986. The other was for a groundwater study on Metro's Deer Trail property. Metro planned to use the Deer Trail site study to gather valuable historical data on a site that had never had biosolids applied to it before and then monitor the effects following application of METROGRO® biosolids.

The self-implementing federal 503 Regulations became effective in 1993. As a result, Metro had to determine whether it would need to build new facilities to comply with the new regulations.

The District hired the consulting engineering firm Black & Veatch to conduct a far-reaching solids management study. One key requisite was to recommend whether the District would need to build additional anaerobic digesters. Results were anticipated in 1994.



In this April 1994 photo, U.S. Geological Survey employees sample the South Platte River near their gauging station at Henderson, CO. Note the tractor tire embedded in the far bank of the river.

In response to the 503 Regulations, the District cut sales of METROGRO® Compost to the general public in half in 1993. Preliminary assessment of the regulations indicated that meeting the requirements for unrestricted distribution of METROGRO® Compost would be difficult. The District hoped that, with processing changes, METROGRO® Compost could again be made available to consumers in the near future.

Other RR&R developments involved:

- Road Tractors. Major equipment purchases included two replacement road tractors needed to transport METROGRO® products to remote agricultural sites

and a replacement service truck needed to aid in the repair of equipment at these remote sites.

- New Quarters. The RR&R staff moved out of the Annex I temporary building adjacent to the Administration Building in January and into a new building located near the compost facility.
- Field Operator Training. The department implemented a field operator training program and continued the mechanic journeyman training program to ensure that qualified operators were available to meet future demands in the department.
- Lowry Superfund Site. The EPA released its proposed plan for the Lowry Superfund Site clean up. EPA determined that no remediation action was needed for Operable Units 4 and 5. As anticipated, Metro's Superfund Officer position was eliminated in late 1993.
- Safety. Safety activities included updating the Accident Reporting and Investigation Procedures, implementing a Safety-Toe Work Shoe Program, conducting a Hazard Communication Program, updating the Prescription Safety Glasses Program, and continuing the fire extinguisher training and safety awareness programs.

Engineering

Facility reports were completed for the Administration Building, Laboratory/Technical Services Building and Facilities Maintenance Building. The board and staff deliberated on these designs and projects as well as the purchase of the Denver Water Reuse Facility

property and completion of the Lammers property purchase. (The Denver Water Reuse Facility property lay a few hundred yards from Metro's south property boundary and the Lammers property was just north of the District's entrance road off York Street.) Metro also bought six more acres in 1993, bringing the total plant property purchased since 1986 to 34 acres. Design on the support facilities was scheduled to begin in 1994.

Process improvements

- Digester/Sludge Holding Tank (SHT). Completing this three-year project involved reconstructing the holding tanks and rehabilitating all the digester tanks. The project included new structural concrete and plastic lining of the SHT plus roof insulation, gas mixing in two digesters, and structural improvements to the floating gas holding covers for the digesters.
- Grease Processing Building. The Grease Processing Building housed the four grease concentrators that separated excess water from grease and scum material removed in the clarification process. Before the Grease Building was built, a recycler charged by the pound to haul away grease and scum. The recycler collected \$285,000 from the District in 1993, so removing water was expected to save the District money. Metro also hoped to feed some of the concentrated grease to the digesters in the future.
- Chlorination/Dechlorination Facility Modifications. The major work in this area was completed in 1988, but operation since then had identified various modifications that were needed to increase reliability and maintenance

flexibility to meet the stringent instantaneous discharge permit requirements for chlorine residual. Parts of the systems for solution mixing, solution piping, and electrical power were duplicated or were separated to allow for their partial maintenance shutdown while still delivering chemicals to meet permit requirements. The District's Process Maintenance Division constructed the modifications without interrupting the process. The construction methods used cost some \$12,000 more than alternative methods, but the alternative methods would have involved temporarily discharging chlorinated effluent.

- Secondary Clarifier Performance Testing. The District participated with the American Society of Civil Engineers

Clarifier Technical Research Committee to establish a standard clarifier performance testing protocol. Testing was done on the North and South secondary clarifiers, and the results were evaluated by prominent scientists and engineers in the field. The testing identified deficiencies and possible corrections to increase the performance levels of the units. Metro decided that improvements would be considered with future process needs.

- Interagency Cooperation through Construction Partnering on Large Projects. The District participated in three projects with other agencies that required a high level of interagency cooperation to expedite the work, react to changing conditions, and minimize interrupting service to the public. The projects were at I-25 at 20th Street, I-25 at 38th Avenue, and the Speer-Sixth-Lincoln Interchange. The RTD, Colorado Department of Transportation, and the City and County of Denver led these activities.

These three projects included relocating large Metro District interceptors under busy streets to allow for major bridge construction. Partnering during construction involved a commitment from all parties to construct quality facilities. The organized effort identified construction problems and proposed solutions at an early stage to minimize delays and cost impacts.

- Delgany Common Project. Redevelopment in Denver's lower downtown area drove a review of the existing condition and future of the 100+ year-old Delgany Common Interceptor. Replacing the Delgany Common had been



Contractor workmen place a 78-inch diameter reinforced concrete pipe for the Delgany Common job.

considered for many years. Inspections of this 92-inch diameter sewer in 1993 showed that the replacement time had arrived. The new line would be Delgany Interceptor Section 4. It would be located along the east bank of the South Platte River. Predesign of this approximately \$9 million project was completed, and final design was begun in 1993. Construction was anticipated to begin early in 1995.

- Power Reliability Improvements. The District improved the Central Treatment Plant power supply grid to



This view looks upstream at the drop structure constructed 4000 feet upstream of the 88th Avenue Bridge.

increase the ability of the system to interrupt a power fault at the closest breaker. These changes affected various parts of the plant and were accomplished without violating the plant's effluent discharge permit limits.

Segment 15 Studies

Engineering, Laboratory, and Regulatory and Connector Relations personnel continued to work on the \$3.5 million Segment 15 Studies during 1993.

The Segment 15 Scientific Studies and Stream Channel Improvement Project begun in 1992, helped improve the water quality in the South Platte River. This study investigated the seasonal physical, biological, and chemical process at work in Segment 15 of the South Platte River so water quality could be improved.

The project was an extensive and complex scientific effort. It helped determine the causes of dissolved oxygen (DO) sags in some areas of Segment 15. Based on the findings, the Metro District would propose ways to raise the low DO levels.

Field and Lab studies

The Segment 15 Studies included both field and laboratory research. Investigators looked at biological and physical data in tasks ranging from counting fish and waterfowl to gathering data on the chemical make-up of the water and modeling the flow of the river using a scaled model at Colorado State University's Hydrology Lab. Effluent management studies in 1993 evaluated the effects of various water resource management strategies on solving the DO problems.



Maintenance employees gather at the parts window in the warehouse to get parts for their jobs for the day.

Operations and Maintenance

Following a 27-year career with the District, former director of O&M John Puntenney retired on June 27. Mary Ann Tavery, a 24-year District veteran with extensive experience, succeeded him as director of O&M.

O&M treated 140 mgd in 1993, down slightly from the 142 mgd in 1992. The reason for the lower number was never determined, but consensus among those in the best position to judge was that two factors dominated:

- In 1993, Denver Water completed a comprehensive program of installing water meters for all its Denver users, who made up roughly half of Metro's served population.

- Metro area water customers—including suburban customers, who had been metered for some time—appeared to be conserving more water than they had in past years. The growing popularity of low-flow toilets and low-volume shower heads was a probable influence.

Influent biochemical oxygen demand (BOD), a measure of the degree to which the incoming wastewater is polluted, rose to 119 tons per day, an increase of 11.2 percent over 1992. Total suspended solids (TSS), another measure of pollutants in wastewater, increased from 116 tons per day to 121, a 4.3 percent increase. The best explanation for these phenomena was that, with the economic recovery in metro Denver, more high-strength dischargers such as restaurants were contributing more pollutants to the system.

O&M, the Lab, Engineering, and R&CR deserved much of the credit for helping the District earn its second consecutive AMSA Gold Award in 1993 and for achieving its third consecutive year of meeting all discharge permit limitations. These feats involved meeting specified numerical limits on some 10,000 chemical and biological tests of the District's effluent.

WASTEWATER TREATMENT SUMMARY		
	1992	1993
Wastewater treated (million gallons per day)	142	140
Influent BOD (tons per day)	107	119
Influent TSS (tons per day)	116	121

Process Control System Upgrade project

A \$1.1 million Process Control System Upgrade project was substantially completed in 1993. This system controlled and monitored activity in all of the plant treatment processes. It included field instrumentation, programmable logic controllers, a distributed control system, a supervisory computer system, and a communications network.

The upgrade was needed because some components of the process control system had reached the end of their life cycle, were no longer supported by the manufacturer, or needed to be replaced. Some components also no longer had the capacity to process data or to support users efficiently.

Maintenance Control System study

The District completed a study of its Maintenance Control System in August 1993 with the help of a consultant, EMA, Inc. This study concluded that the software had several severe deficiencies. The O&M staff recommended that it be replaced and the consultant be retained to help with software procurement and implementation.

Despite a staff reduction of 6 during 1993, the Buildings and Grounds Division maintained 110 plant site acres, 4 miles of streets, and 365,000 square feet of parking space. It provided and monitored electrical, heating, air conditioning, ventilation, mechanical and janitorial maintenance for 56 buildings containing 498,000 square feet of working space.

The Sanderson Gulch Interceptor overflowed briefly during July 1993 because of poor construction and a line blockage caused by debris placed in the line by vandals.



Part of Metro's growing success in the 1990s was a solid preventive maintenance program. Here, a worker cleans the fine bubble diffusers in an aeration basin in the North Plant.

The blockage was cleared, service was restored, the line was repaired, and the spill area was quickly decontaminated.

The Transmission Division relocated in 1993 to spaces that had previously been occupied by the Mechanical and Electrical Shop. A consultant estimated it would take 6 months and cost \$54,000 to rehabilitate these shop spaces for the Transmission Division. Transmission personnel did the job in 2½ months for less than \$23,000.

Laboratory

The Lab's (and Metro's) first robot, ICABOD, donned its lab coat in 1993. ICABOD stood for "I Can Analyze BOD." Engineer Mike Carver gave ICABOD its name.



Laboratory Analyst Cindy Kondo runs BOD samples using ICABOD.

Metro bought the \$159,000 robot to take over the brain-numbing, time-consuming mechanical chores associated with BOD analysis. It removed the BOD bottle top, determined the required dilution, added seed and inhibitor if needed, added dilution water, took a dissolved oxygen reading, recapped and sealed the BOD bottle, and racked it for incubation. ICABOD also performed a similar process after five days of sample incubation.

With more than 40,000 BOD analyses performed each year, ICABOD freed the time of highly-trained lab technicians for jobs requiring more thought. The robot was expected to pay for itself in four years.

In addition to its usual workload, the laboratory continued with its considerable additional workload for the Segment 15 Studies. An automated mercury digestion and analysis system and an automated total nitrogen system were also put into service. The Laboratory Information Management System central processing unit was upgraded as well, increasing processing power six times.

The District processed 8.9 million gallons of routine septic tank, grease trap, and portable toilet waste (collectively called hauled wastes), receiving \$588,095 for this service. The District also processed 478,457 gallons of non-hazardous, non-routine wastes, which generated \$87,479 in revenues, and earned \$59,391 for performing 6,454 analyses on 1,904 contract service samples, the vast majority of which were from District connectors and other municipalities.

Regulatory & Connector Relations

The Regulatory and Connector Relations (R&CR) Department worked on the Segment 15 Studies, legislative activities, the Industrial Pretreatment Program, and the public information program.

Successful legislative liaison efforts resulted in a change to the District's enabling legislation by eliminating the 50-year limitation on District contracts. Future bond issues could have been jeopardized had this amendment not passed.

Metro begins 'Good Guy' Gold Awards

The Metro District instituted a Gold Awards program in 1993 that was quickly dubbed the "Good Guy Awards" by Pretreatment Division staff. These awards were to be presented to significant

industrial users that achieved 100 percent compliance with the District's pretreatment requirements and demonstrated a commitment to environmental excellence the preceding year.

The District had previously only taken enforcement action against significant non-compliers without recognizing pretreatment excellence. Of the approximately 100 significant industrial users the District regulated, no more than 12 were in significant non-compliance (SNC) with pretreatment requirements at any time in 1992 (the year for which the awards were given). This was a drop from the 27 firms in SNC in 1991. For 1992, the number of firms in SNC dropped to 7.

Seven companies won a Metro District Gold Award for their 1992 environmental performance. They were Ajax Custom Plating Co., Colorado Radiator, Colorado Serum, Goldberg Brothers Inc., Mid-Atlantic Plating, Sachs-Lawlor Company—all of Denver—and Ball Packaging Products Group, Metal Container Division, of Golden.

In other pretreatment actions, Metro again passed its annual audit by the EPA and the Colorado Department of Public Health and Environment with flying colors. EPA auditors noted that the recordkeeping and records organization were outstanding.

In September, the District banned dry cleaning establishments in its service area from discharging perchlorethylene (also known as "perc") to the sanitary sewer system. This action was required so the District could meet its perc discharge limit beginning January 1, 1995. The District's numeric limit was five parts per billion—about one half gallon of perc in the 140 million gallons of water Metro treated daily. The EPA listed perc as a suspected carcinogen.

The board also moved to amend its rules and regulations to allow connectors to delegate their pretreatment program responsibilities to the District. If all connectors delegated this responsibility, Metro could run a more cost-effective and efficient pretreatment program for all. Englewood was the first connector to take advantage of this change. Denver was expected to follow in 1994, saving its citizens about \$360,000 a year.

Public information and education

The District's public information and education program grew in 1993. An October audit showed that, in its first 18 months, it had produced positive media coverage worth more than \$100,000 had an equivalent amount of advertising space been purchased. The Public Information staff had also produced attractive printed and



Peter Undiks of Rocky Mountain Retinning was one of the company representatives honored at the District's 1995 Gold Awards ceremony. Board Chair Richard Plastino is on the left and District Manager Bob Hite is on the right.

video materials and provided tours of the Central Treatment Plant to more than 400 visitors, many of whom were students. The tour program was expanded to help educate children about the science, engineering, and environmental principles at work in cleaning wastewater, as well as to highlight career possibilities in wastewater treatment. Public Information and RR&R also combined efforts to produce a 14-minute video to help educate people near areas where biosolids are land-applied about biosolids and its benefits.

Finance and Administration

During 1993, the Training and Development (T&D) staff coordinated 57 training classes, 24 more than in 1992. All departments took advantage of the in-house training, with 867 employees participating, up 525 from the 1992 total. The T&D staff saved the District more than \$36,000 in training costs. This estimate was based on what it would have cost to have contract trainers deliver the same training.

Taking advantage of favorable interest rates in December, the District saved its ratepayers \$7.1 million in gross debt service costs by refunding sewer bonds issued originally in 1985 and 1986. The annual average savings through 2004 was expected to amount to about \$155,000 on the Series 1993A bonds, and about \$285,000 through 2012 on the Series 1993B bonds. The net present value savings in debt service to be realized by the District was about \$3.4 million, or 5.3 percent of the total bonds refunded.

Cash funding of some projects begins

The 8.5 percent annual charges increase for the 1994 budget (58 cents per household per month) represented a courageous move by the board to reduce the District's long-term debt

service obligation. The board voted in July to cash fund non-growth related capital projects. This policy specified cash funding for non-growth capital projects with a life of 20 years or less and all capital projects valued at \$250,000 or less. While that meant slightly higher rates in the near term, it would reduce Metro's dependence on borrowed money over the long term.

For the sixth consecutive year, the Finance Division earned the Government Finance Officers Association of the United States and Canada Certificate of Achievement for Excellence in Financial Reporting.

1994—Getting a grip on finances

In 1994 world and national news, a major earthquake rocked Los Angeles, Congress abandoned the Clinton health care reform effort, and Republicans won control of the U.S. Congress for first time in 40 years.

In metropolitan Denver, the Metro board and staff made significant gains on a number of fronts. Some highlights included:

- Through conservative fiscal management, Metro ended 1994 with a budget surplus of \$1.1 million.
- Long-range planning activities continued to position the District to cope with anticipated future costs while ensuring a strong financial base.

The District's cost for wastewater treatment was among the lowest in the nation for organizations of comparable size, population served, and level of treatment. The District's environmental performance also remained high.



The Metro District frequently conducts tours of its facilities, as it is doing here for students in an urban ecology class at Metro State College in 1994. They are looking at the Chlorine Contact Basin.

Progress toward long-term improvements in the South Platte River continued as well. The board approved a plan in July that was expected to span the remaining years of the 20th century. Metro estimated this plan would save ratepayers \$70-\$80 million while raising dissolved oxygen levels and improving fish habitat.

The first phase of the plan called for building a new drop structure, or low-head, man-made waterfall, about 3½ miles downstream from Metro's outfalls, modifying the channel, and lowering an existing drop structure just downstream from the 88th Avenue bridge during 1995. Metro thought that up to six additional drop structures might be needed in succeeding years further downstream, depending on the results of the improvements brought about by the 1995 construction. In addition:

- The District and the EPA mutually terminated the consent decree under which the District had operated since April 3, 1989.
- The District did \$117,112 more business with Disadvantaged Business Enterprises in 1994 than in 1993. Some 133 such firms shared in 11 percent (\$965,354) of the \$8,738,141 in purchases made by the District.
- Staff did more with less, as demonstrated by staff reductions and conservative spending that resulted in the budget surplus.

In addition, as a member of AMSA's board of directors and chairman of its legislative policy committee, District Manager Bob Hite helped advance reauthorization of the Clean Water Act.

This key legislation drove much of what Metro did. Together with other regulations, virtually every aspect of Metro's operations was overseen by some regulatory agency. The

net effect was to raise the cost of treating wastewater. Metro won several awards during the year, including:

- Gold Award from AMSA for the third consecutive year. Metro met specified numerical limits on some 10,000 chemical and biological tests of the District's effluent and had no discharge permit violations.
- Biosolids Management Merit Award from the Rocky Mountain Water Pollution Control Association for excellence in all aspects of biosolids management.
- GFOA Certificate of Achievement for Excellence in Financial Reporting for the seventh consecutive year.
- Distinguished Budget Presentation Award for the first year from the Government Finance Officers Association of the U.S. and Canada for the District's 1995 Annual Budget. It recognized the budget document as having met program criteria as a policy document, an operations guide, a financial plan, and a communications device.
- AMSA Public Information and Education Award for overall public information and education efforts.
- MultiMedia Award from the Colorado Special Districts Association for overall public information and education efforts.

South Platte River improvements

Metro expected to begin building what was thought might become as many as eight drop structures in 1995 to increase downstream oxygen levels.



Water that has undergone secondary treatment leaves a secondary clarifier in the 1996 photo. The next step is disinfection.

During 1994, consultants worked on studies to determine site-specific dissolved oxygen standards for the river downstream from Denver and on a plan for meeting those standards.

Metro's engineering staff believed it could do so for \$25-\$40 million. If Metro were required to meet what were being referred to as "national" criteria for dissolved oxygen, cost estimates increased by \$70-\$80 million or more.

Metro expected to continue working with state, regional, and federal agencies to keep the South Platte River clean. The District felt the section of the river between Denver and Fort Lupton, Segment 15, was already prospering from this approach.

Engineering

The primary engineering challenges in 1994 were the diversity of several key studies and design projects and managing construction on other projects. These challenges were joined with a major engineering study on solids management that provided a road map to more than \$50 million in anticipated capital improvements expected over the next several years. Major projects included:

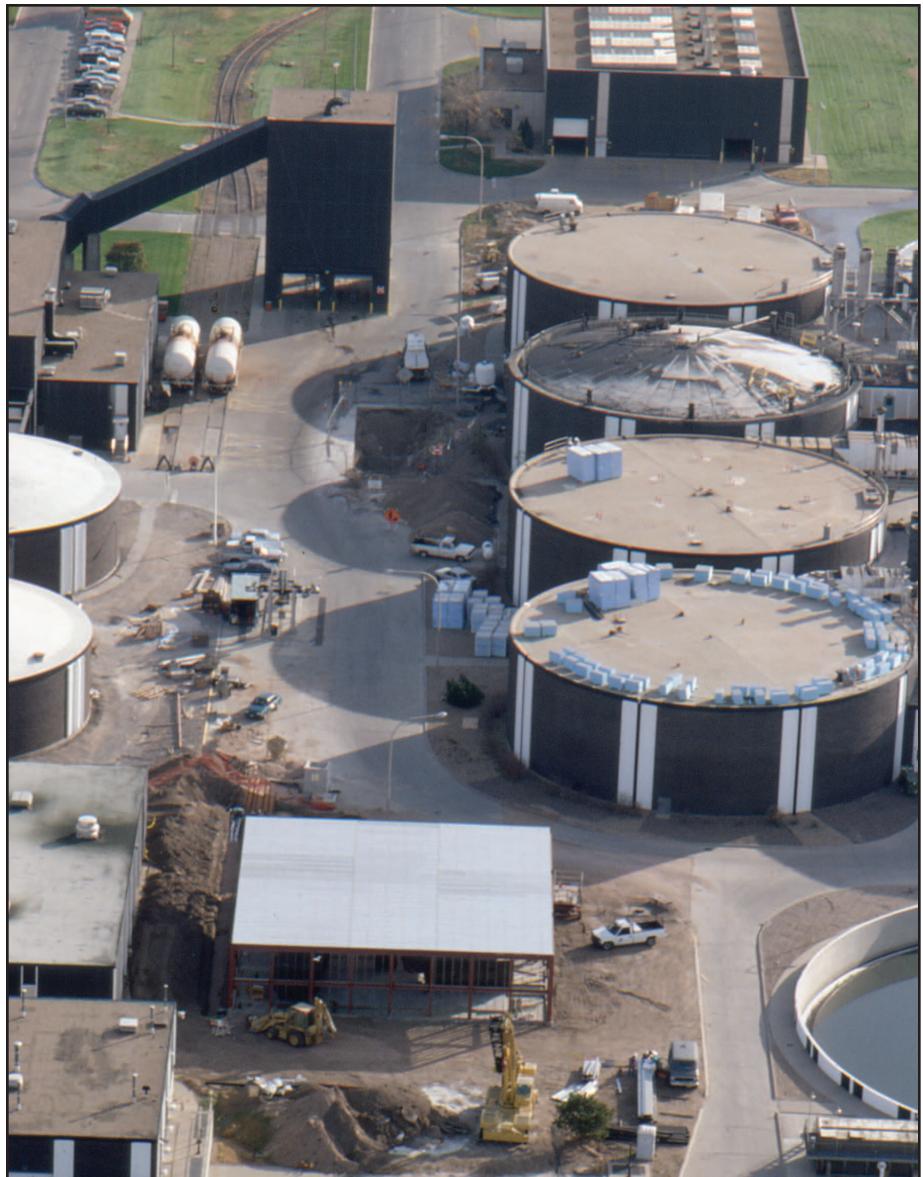
- Final design of the Delgany Section 4 Interceptor. This \$9 million project was to parallel the South Platte River in Denver's old Lower Downtown and abandon and replace an historic 78-92 inch brick sewer. Construction was set to start in early 1995 with projected completion by April 1996.
- Designing a new Facilities Maintenance Building. The old warehouse on the District's plant site provided a beginning point to centralize facilities maintenance work and equipment, including storing paint, lawnmowers, steam cleaners, and



This photo shows defective reinforced concrete pipe that was placed as "rip-rap" on the banks of the South Platte River north of the Metro District's facilities at 64th and York.

other material. Before this centralization, major tools were stored throughout the plant; it was time-consuming to locate them. The building also would allow supervisors to be co-housed with the employees they supervised.

- Beginning the design of a new Administration Building. To be located near the York Street entrance north of the main plant, this badly needed new facility would relieve overcrowding and cut traffic and non-essential personnel on the plant site. It also would improve overall security and safety, would free space for a new laboratory in what was then the Administration Building, and would release



This 1993 aerial view of the digester area shows the Grease Processing Building under construction (bottom center of photo). Metro removes about nine tons of grease a day from the wastewater it cleans. Also note insulation atop digesters for installation as part of digester insulation project.

some temporary buildings for other uses. The original Administration Building had been built in 1966, and Metro had simply outgrown it. The design for the new Administration Building was to be completed in 1995, with construction set to begin that September and span a year.

- Beginning the design of a new laboratory. This project was especially challenging because the new lab was to be in the same building as the current lab. Design and construction would be demanding. The existing laboratory had to function without interruption while adjacent construction was going on just feet away. This design was to be completed in August 1995.
- Digesters 9 and 10. Digester 9 was substantially completed in 1994, and Digester 10 was scheduled for mid-1995 completion. Both units were needed to meet biosolids regulatory requirements stipulating more retention time.
- Comprehensive Solids Management Study. This study was completed in September. It addressed EPA's Part 503 Sludge Use and Disposal Regulations and four near-term strategic planning goals the District's board had established in 1992. More than 50 alternatives for solids handling were reviewed, and six were short-listed for detailed evaluation.
- Transmission System Study. An extensive study was made of the current and future capacities of the transmission (sewer interceptor) and treatment systems. This study was scheduled to conclude by April 1995. It would involve a very large mapping database for the interceptor system.

Finance and Administration

With the board's approval of the 1995 budget in mid-1994, the District increased its reliance on cash funding and decreased reliance on debt funding for certain projects. The board decided to cash fund non-growth, capital projects with a life of 20 years or less and all capital projects valued at \$500,000 or less (up from \$250,000) from the general fund, thus doubling the value of cash-funded projects from the 1993 level. This decision was calculated to save metro area citizens more than \$20 million in debt service payments over the following decade. Growth-related and higher-cost projects were to continue to be financed through bonds.

Metro adopted the Oracle software system in 1994. Oracle was a relational database that reduced data duplication and improved data integration. Adopting Oracle let the District integrate three

different systems with new, less expensive software, greatly reducing the annual software maintenance charges. Immediate savings were realized in 1994, and savings were conservatively calculated to be \$50,000 annually for calendar years 1995 and 1996. The system improved accuracy, required less labor, and made budgeting and finance operations much easier.

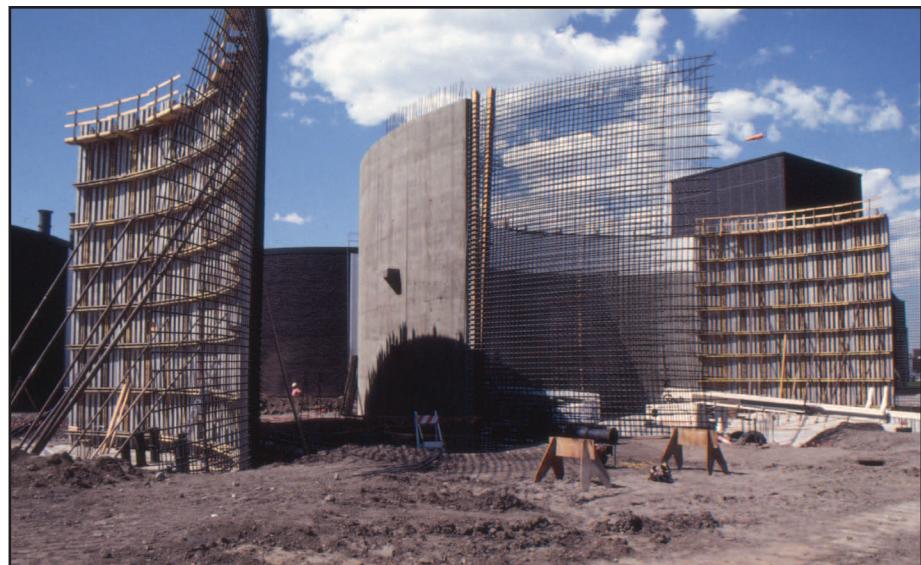
Metro also adopted a multi-year, phased approach for personal computer and software replacement. The goal: To provide staff with modern, cost-effective, efficient automated tools that improved productivity. To ensure staff took advantage of these new tools, Metro established an extensive in-house training program.

Metro introduced its staff to e-mail in 1994. The following reference to e-mail may seem quaint now, but this was the description in the Annual Report for that year:

Included in the computer training was an emphasis on electronic mail, generically known as 'eMail.' With its use, division and department heads report definite improvements in internal communication, with some using the system to transmit 20-30 messages per day. Such usage has significantly reduced the amount of paperwork generated at the District and the associated costs of managing, filing, routing, and photocopying. A memo which may previously have taken all day to get to as many as 170 people can now be transmitted in less than a second.³

Laboratory

The Lab performed more than 90,000 additional analyses on about the same number of samples in 1994 as in 1993. The



In 1994, Digesters 9 and 10 were under construction, as seen here.

number of analyses grew from 500,000 to 590,000 and illustrated a demand for more analyses out of each sample taken to enable the District to meet growing regulatory requirements.

Routine use of a simultaneous inductively coupled plasma emission spectrometer, total nitrogen analyzer, and two gas chromatograph/mass spectrometry systems improved lab efficiency and data quality and reduced errors.

The Lab devoted a great deal of time and attention to a cooperative effort with Engineering to design a new laboratory. The existing lab had grown inadequate over the years. The new laboratory would be more spacious and efficient. Lab techs would no longer have to break equipment down and reconfigure it to run different analyses and experiments with a significant loss of time. The new lab would also be designed to greatly reduce the opportunity for sample contamination. Safety would improve with an efficient, state-of-the-art system for exchanging air and removing fumes.

Operations and Maintenance

In a highly uncommon (for Metro) occurrence, O&M cut nine positions because construction had slowed and fewer people were needed for O&M staff support. This reduction resulted in an immediate, first-year saving of \$600,000 and contributed significantly to the \$1.1 million surplus the District enjoyed at the end of the calendar year.

Water conservation efforts throughout the District's 380-square-mile service area continued throughout 1994, and the influent volume fell again during this dry year. Total Suspended Solids (TSS) increased, and biochemical oxygen demand (BOD) stayed roughly the same when compared to 1993.



This 1994 photo shows mature wheat at Metro's farm property east of Deer Trail, CO, which Metro bought to use as a land application site for its biosolids.

The 1993 upgrade of the Process Control System proved its effectiveness in 1994. The control system provided excellent monitoring for the liquids and solids moving through the plant.

Work also progressed on purchasing a second generation Maintenance Control System to plan and schedule maintenance. After consultations, Metro determined the old system, purchased in 1986, could not be upgraded and could no longer meet Metro's needs in scheduling maintenance and providing a history of that maintenance as a base for future scheduling. A detailed Request for Information was issued to 12 vendors outlining requirements in basic maintenance management, transmission, vehicle maintenance, and inventory control. Seven firms responded and three were short-listed for product demonstrations. Metro planned to choose a new system in 1995.

O&M pursued safety aggressively in 1994. The pay-off was a 62 percent accident reduction over 1993—only 12 accidents compared to 32. More than 30 supervisors participated in the Safety Training and Observation Program (STOP), which featured constant audits. Employees who were seen working unsafely were immediately counseled about the unsafe act and what must be done to be safe in the future. With incentives and the emphasis by supervisors, O&M's efforts helped reduce the District's workman's compensation payments dramatically.

Regulatory & Connector Relations

The District completed the first major phase of regulating the discharge of the suspected carcinogen perchloroethylene (perc) into the metro area's sewer systems. New limits of five parts per billion were set to take effect in January

1995. The District had to control perc so that no more than approximately one-half gallon would be discharged into the 140 million gallons of wastewater Metro treated daily.

Though perc discharge rates had never been exceedingly high, the District conducted an aggressive campaign to identify dry cleaners and wholesalers dealing with the chemical. Once the sites were identified, the District issued "zero-discharge permits." Concurrently, the pretreatment group made sure drains were being plugged or berms built around floor drains to ensure no accidental spills of perc would be discharged into sewers.

Following the lead of Englewood in 1993, 19 connectors to Metro, including the City and County of Denver, delegated their industrial pretreatment program responsibilities to the District in 1994. With this action, Metro created a more effective, efficient, centralized program while effecting considerable cost savings for area citizens.

MetroMoeba, a seven-foot microorganism mascot in a costume, was conceived as a public information tool in 1994. The huge amoeba appeared at water festivals, the News 4 Education Expo, and similar gatherings. Representing microorganisms that clean wastewater, the silver-costumed character was designed to capture children's attention and help explain microorganisms to them. The character made multiple 1995 appearances.

R&CR staff members participated in several organizations to improve communication and expand the District's influence with local, state and federal government agencies. Among these were the Water Management Advisory Committee of DRCOG, the Governor's Metropolitan Water Supply Investigation Technical

Advisory Committee, and the Denver Mayor's South Platte River Commission. Metro's Governmental/Legislative Liaison continued to be a major point of contact for connector governments.

Resource Recovery and Reuse

Biosolids were land applied for the first time to Metro's 10,000-acre site near Deer Trail in 1994. Metro bought the site in 1993. Owning farm land allowed Metro to monitor, year-in and year-out, the true impact of biosolids application.

Metro also began negotiations to buy another 41,000 acres next to the initial site. Metro hoped this site plus the initial site would provide enough land on which to apply its biosolids for the next 100 years. The sites offered good proximity to the Central Plant and would help the District contain application costs.

Increasing prosperity along the Front Range promoted residential growth. At the same time, growing restrictions on land application areas meant Metro was rapidly losing control over distances to application sites. Metro sought to grow crops such as wheat, millet, milo, small grain corn, and sunflowers on its Deer Trail property. Biosolids had traditionally doubled the yield of such crops in the first few years after beginning application. In 1994, the land owned by the District was farmed under a custom farm agreement. Starting in 1995, the agreement was on a one-third (for Metro) two-thirds crop share basis with the tenant farmer.

The District met all federal 503 regulatory requirements and similar state regulations in 1994, even though most requirements did not have to be met until 1995. Distribution of METROGRO® Compost for home and garden use

was discontinued for a year to enable Metro to develop production methods that met new requirements.

Metro developed a static pile composting procedure to ensure the product would meet the new 503 Regulations. The demand for METROGRO® Compost remained high, and a waiting list was developed for it. The District began getting requests for compost around Christmas for spring application. Metro sold METROGRO® Compost to consumers for unrestricted use on lawns and gardens, but the majority was sold in bulk to wholesalers from the Denver metro area.

The District was included in a unilateral order from the EPA to clean up the Lowry Landfill Superfund Site. The District had applied sludge to four areas adjacent to the original 160-acre Superfund site from 1969 through the 1986. Metro thought it should have very limited liability and began negotiations with the EPA and others charged with the clean up. Though the order still stood at year end, settlement talks continued. The District hoped to extricate itself from the Lowry Superfund Site by the summer of 1995.

1995—Holding the line

An earthquake in Kobe, Japan killed 5,000 people in 1995; the Murrah Federal Building in Oklahoma City was bombed, 168 people were killed and 800 injured; and Quebec voters rejected secession from Canada.

In Denver, Metro's 350 employees held the line on costs and helped improve the environment at the same time. The Metro District also won the Water Environment Federation's George

W. Burke Jr. Facility Safety Award. This prestigious award recognized Metro's active and effective safety program and safety record. A key factor in getting the award was reducing accidents by half. The number of accidents fell from 89 in 1990 with 312 employees to 49 in 1995 with 350 employees.

In containing costs, the 1996 budget included an increase of 1.8 percent in the District's O&M costs. Adjusted for inflation, the O&M portion of the budget did not increase and the annual charges increase for 1996 was 2.1 percent—the smallest in years. Metro was heading toward a zero-percent increase in annual charges for 1997.

Compared to similar wholesale agencies serving similar size populations and having similar average daily flows and treatment levels, Metro's expenses and staff were lower. Metro's cost-per-thousand-gallons-treated ranked in the lowest third among similar-sized treatment agencies including Milwaukee, Seattle, and Passaic Valley, New Jersey.

Segment 15 of the South Platte River

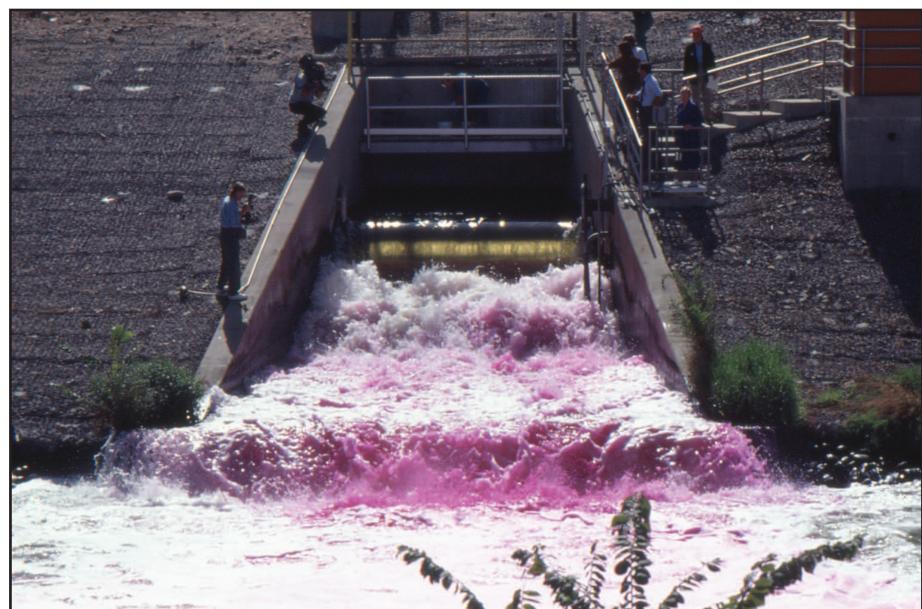
The Colorado Water Quality Control Division, the EPA, and the District had historically taken differing approaches to cleaning water. Regulatory agencies were charged with cleaning up the nation's and Colorado's waters through permits and other legal means. Metro was charged with cleaning wastewater for the 1.3 million metro Denver residents it served—roughly a third of Colorado's population—through the operation of its 185 mgd treatment facility.

Even though these organizations had a common goal, they had sometimes taken adversarial positions in achieving it. The

regulatory agencies typically assumed a control strategy—a top-down approach with rules aimed at point sources such as the District.

The District, which had monitored both the waters upstream of its discharge point into the South Platte River and the downstream waters since the late 1960s, knew that many of the biological effects in the river were not a result of the treated wastewater it discharged. Because of the regulators' historical control orientation, however, the District and the regulators often looked only at in-plant solutions for improving water quality.

In the early 1990s, the Metro District began scientific studies on Segment 15 of the South Platte River to determine how to improve the level of dissolved oxygen in the river to protect the fish.



As part of the Segment 15 studies, red dye is added to effluent as it is discharged from the outfall to assess how long it takes that slug of water to move downstream.

These District-funded Segment 15 Studies demonstrated that cost-effective water quality improvements, made downstream of the discharge point, would increase the amount of dissolved oxygen (DO) in the South Platte River more effectively and economically than traditional in-plant improvements.

In addition to developing innovative ways to improve the DO in the river, the Metro District had undertaken a series of scientific laboratory studies to determine the DO level needed to protect the fish that lived in this segment of the river.



Process Control Supervisor Earl Coley checks equipment in the North Bar Screen Building.

The numbers and diversity of aquatic organisms in the South Platte River were significantly affected by factors other than DO. These factors included climate, hydrology, water diversions, and the geomorphology of the river.

With the agreement of the regulatory agencies, the Metro District expanded its studies to evaluate other stream improvements that could increase the number and diversity of aquatic species in Segment 15 of the South Platte. The District also evaluated the economic feasibility of such improvements.

The Metro District believed this common sense approach to the environment embraced a restoration strategy rather than a purely control strategy for improving our water resources. It would also reduce the need to build expensive steel-and-concrete facilities at the plant.

Operations & Maintenance

The O&M Department ran and maintained the Central Treatment Plant and the interceptor system with a crew of 142 people. Increasing automation over the past few years had enabled O&M to become more efficient.

A major accomplishment in 1995 included a plant operations Silver Award from AMSA. The District's effluent met specified numerical limits on 10,000 chemical and biological tests during 1994 with just one exception.

Cogeneration facility and utility rate study

In August 1995, consultant PLM Technologies, Inc., completed a study of the cogeneration facility and utility rates. The study made certain that the Metro District was

receiving maximum benefits from the cogeneration facility at minimum costs, in light of the deregulation of utilities by the U. S. Congress. Utility rates were reviewed to determine potential cost savings available to the District.

Metro implemented the consultant's recommendations later in 1995. During scheduled summer and winter cogeneration capacity tests with Public Service Company of Colorado (PSCo), O&M clearly demonstrated that summer capacity increased from 3,909 kw (kilowatts) to 5,499 kw, and winter capacity increased from 4,031 kw to 5,460 kw. The capacity increase was expected to increase annual revenues by \$364,000 until the end of the PSCo contract in 1999.

District staff compiled a scope of work for a consultant to review cost-effective ways to clean the digester gas. Some people thought cleaning the gas would reduce the cost of maintenance on the cogeneration equipment, and some didn't. The study would look at the issue.

O&M staff also researched buying natural gas on the spot market. They determined potential cost savings were available to the District. A statement of interest was expected to be issued to natural gas brokers in early 1996. O&M staff also negotiated with PSCo to get a transmission time-of-day electrical rate for the plant. This rate was expected to reduce electrical costs.

Maintenance Control software

In November, the board authorized a contract with SQL Systems, Inc., for maintenance software and implementation services. SQL's product was a newly developed graphical user interface software application based on the Windows operating system.

This purchase completed the Maintenance Control System upgrade that District staff had been working on for several years. SQL was selected from a two-phase competitive bidding process. The project cost was \$981,500, considerably less than the original estimate of \$1,245,000.

New Facility Maintenance Building

In December, 31 employees from the Facility Maintenance Division moved into their new shop facility. At a cost of \$1.3 million, the new building consolidated and expanded the offices, shops, locker rooms, and equipment storage for the facility maintenance operation.

The paint shop was improved by adding a two-ton monorail, a sand blasting room, and a new HVAC system designed to remove fumes more efficiently. The project included a larger flammable storage building with a containment area.

Plant flows and loadings

Plant flows, BOD and TSS loadings were significantly higher in 1995 than in 1993 and 1994. The higher flows were attributed to high precipitation in May and June. A peak flow of 234 mgd was treated at the plant on one day in June; this was 67 percent higher than the average annual flows in 1993 and 1994. While some of the higher BOD and TSS loadings in 1995 were attributed to the scouring of solids in the interceptors during the spring storms, the BOD and TSS strengths were also higher in the months preceding the 1995 storm than in 1994. The higher loadings may have been caused by modest growth in the Metro District's service area and a better economy.

Hydrogen peroxide injection

The hydrogen peroxide station began operating again in June. Located at 104th Avenue and Riverdale Road, the station was commissioned to reduce hydrogen sulfide, odors, and corrosion in the South Thornton Interceptor. Hydrogen peroxide is a strong oxidant that had performed well in reducing the sulfide levels in wastewater. The District received no odor complaints from Thornton residents after the station start-up. Metro also contracted with CH2M Hill, Inc., to study the system and recommend ways to permanently correct or mitigate the odor problem.

Resource Recovery and Reuse

The Metro District was in compliance with the biosolids 503 Regulations months before the effective date of February 19, 1995. All 10 anaerobic digesters were in operation, and the District easily met detention time, percent volatile solids reduction, and temperature requirements for producing Class B biosolids. The biosolids were applied to the District's Deer Trail property at the agronomic rate required by the regulations.

The District bought approximately 36,000 acres of agricultural land near Deer Trail, Colo., in April and began negotiations for an additional 4,000 acres. When they were all completed, these purchases would bring the District-owned land total to about 50,000 acres on which the Metro District could beneficially apply biosolids.

The 36,000-acre purchase was adjacent to the 10,000 acres the Metro District bought in 1993. T.H. "Tommy" Thompson, a local farmer, was farming the land under a two-thirds/one-third shares

agreement. Farming operations on the first 10,000 acres yielded approximately 72,000 bushels of wheat that sold for \$360,000.

The District firmly believed in beneficial reuse—recycling—as the only environmentally sound method for disposing of biosolids. Metro was then producing 74 dry tons (20 truckloads) of nutrient-rich biosolids a day, biosolids the EPA classified as “exceptional quality.”

Other significant RR&R actions included:

- Engineering began studies for future facilities needed on the Deer Trail property.
- METROGRO® Compost was again made available for sale to wholesalers and the general public. The compost had



This mid-1990s photo shows the wheat harvest in progress at Metro's farm near Deer Trail, CO.

been taken off the market in 1994 while the Metro District developed production methods that would consistently meet federal and state standards for unrestricted distribution.

- Efforts to settle the Lowry Landfill Superfund Site lawsuit continued. A trial date of March 11, 1996, had been set at year end.

Engineering

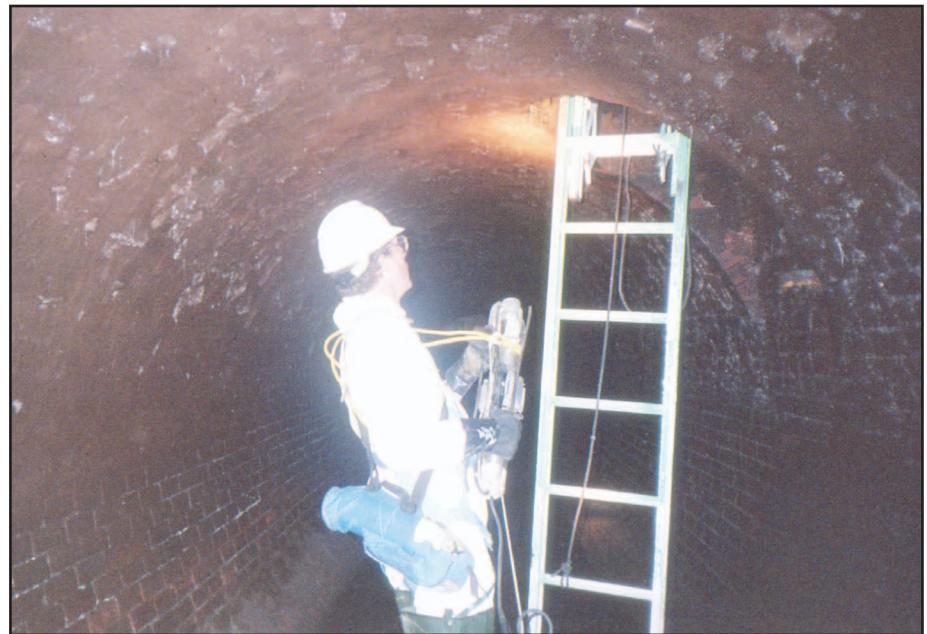
The Metro District's discharge permit became effective in 1992 and required Metro to make improvements in the South Platte River, including a drop structure 4,000 feet upstream of the 88th Avenue bridge, channel modifications, and modifying the drop structure at the bridge.

Upstream drop structure construction began in early 1995. It was only 70 percent complete by year end—less than had been anticipated. Heavy spring rains and above-average snowfall during the 1994-1995 winter produced unusually high spring flows in the river. The high flows interrupted construction from April until September.

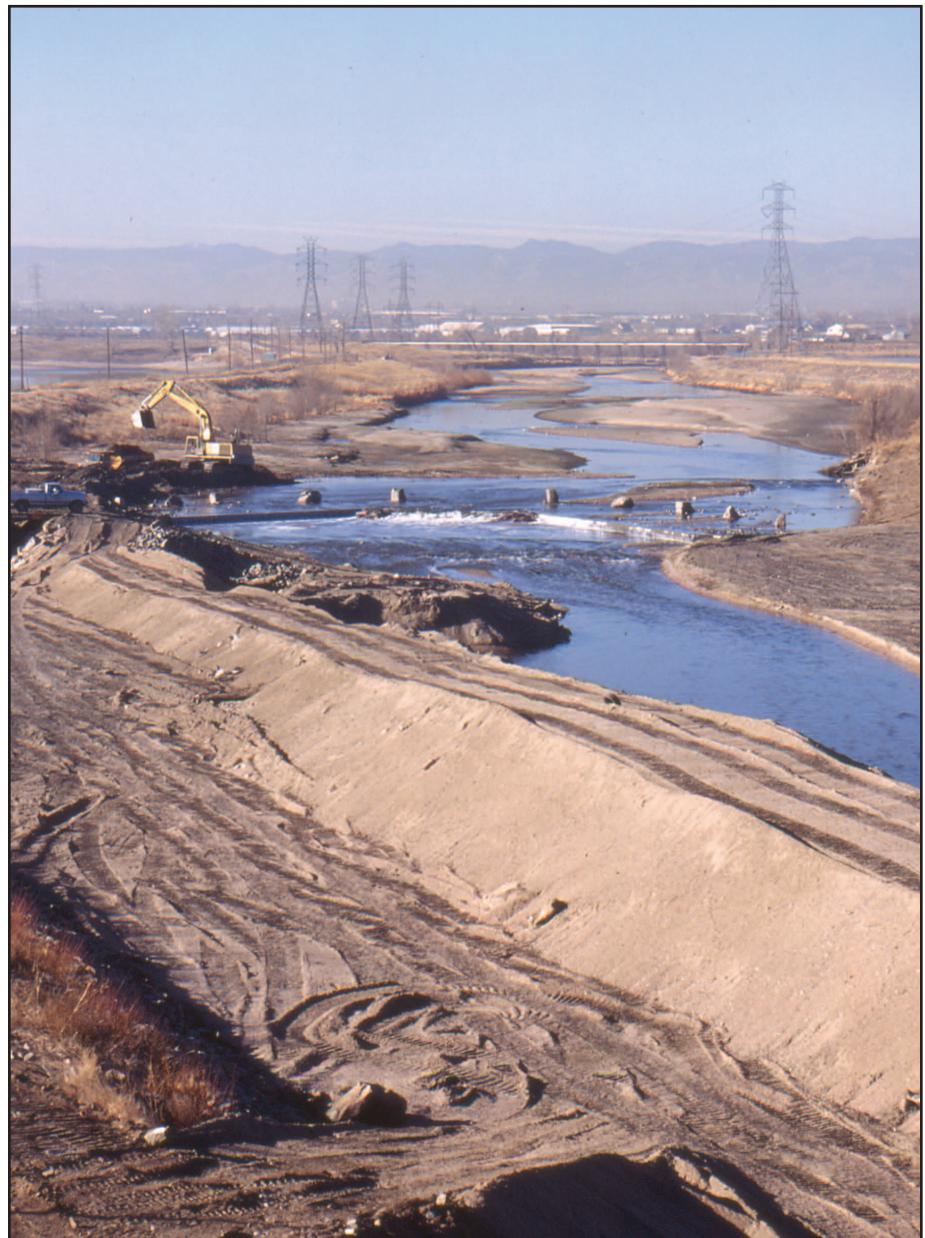
When construction resumed, the contractor, Kelly Trucking, made excellent progress. By year end, the upper drop structure was almost complete, reconstruction of the banks was complete, and a substantial portion of the channel excavation work was also complete. However, little work at the 88th Avenue bridge had been completed other than work on the piers, because a major U.S. West Communications telephone conduit had to be relocated. Substantial completion was estimated in April 1996 with landscaping to be started soon thereafter.

In other Engineering Department milestones:

- Digester 10 was completed and put into service in February 1995, completing a \$4.5 million, two-digester improvement project required to ensure the District's compliance with the new biosolids regulations.
- Design agreements were executed to improve the efficiency of screening and grit removal equipment in the South Plant and for polymer handling in the solids-processing facilities.
- The Metro District began the design and construction phases of 21 small treatment plant projects and completed 27 others during 1995.



An engineer examines the hand-laid brickwork that lines the Delgany Interceptor Sewer in downtown Denver. It is one of the oldest in the metropolitan Denver area.



In 1996, the first drop structure was under construction 4,000 feet upstream of the 88th Avenue Bridge on the South Platte River north of Denver.

- The \$9 million project to replace and abandon a major portion of Delgany Interceptor (Section 4), one of Denver's oldest sewers, continued during 1995. The historic brick masonry line was constructed in the early 1890s. The project was 85 percent complete by year end. Challenges included maintaining access to affected businesses and coping with old, undocumented structure foundations and utilities.
- Ten sewer rehabilitation design and construction phases were begun, and nine were completed on transmission system projects. One major sewer rehabilitation effort was replacing 3,000 feet of 42-inch reinforced concrete sewer on the Clear Creek Interceptor. This line had failed because of surface overloading.
- Design for the new Administration Building was completed. Located east of York Street and north of the plant entrance, this building would house the office of the Manager; the Finance, Office Support, Records Management, and Human Resources Divisions; the Engineering and Regulatory & Connector Relations departments, and the board room. Construction was expected to begin in April 1996 with completion in 12 months.
- Design for the Technical Services Building was completed in late 1995. The old Administration Building would be remodeled, expanded, and designated the Technical Services Building. It would house an expanded laboratory, information services, and a human resources training center. Phased construction would begin in 1996 and continue through late 1997.

- The old Warehouse Building was remodeled and redesignated the Facilities Maintenance Building. It included an on-site storage area for some of the Metro District's inactive records. Though classified inactive, these records were frequently needed by District staff and legal counsel.
- A design agreement was executed at year end for a new Transmission Division building. It was to be built east of the Burlington Ditch at the southeast edge of the Central Plant site.
- A design agreement was also executed to remodel the facilities that housed treatment plant supervisory personnel and served as the hub for the plant's extensive automated control system. A major HVAC system renovation was included.

Laboratory Services

The Laboratory Services Department's workload grew in 1995. The number of samples received for analysis increased 6.6 percent: 31,110 in 1994 vs. 33,146 in 1995. The number of analyses performed increased 2.8 percent in 1995, from 660,142 to 678,401.

Improvements were also made to the automated biochemical oxygen demand (BOD) analysis system (nicknamed ICABOD), increasing its throughput by 15 percent. The accuracy and precision of BOD analyses had been improved and the error rate reduced. The automated analysis system was also enhanced and upgraded to significantly improve its analytical throughput.

The Lab developed and implemented 11 new LIMS applications and interfaced one analytical instrument to

LIMS. These improvements further computerized and integrated the laboratory and its related functions.

Water quality

The Water Quality Division continued working on the scientific studies related to improving Segment 15. The University of Wyoming's Red Buttes Laboratory conducted 14-day studies on the hatchability and survival of embryo/larval stages of three fish species under a Metro contract. The studies were conducted under varying dissolved oxygen conditions using diurnal exposure regimes.

The studies also included measuring the effects of repeated low dissolved oxygen concentrations on juvenile fish of



Fish studies conducted for Metro by the University of Wyoming's lab at Red Buttes, WY, in 1993 were part of the suite of Segment 15 studies.

four species by completing 30-day growth and survival studies using diurnal dissolved oxygen exposure regimes. The primary species tested included largemouth bass, long-nose dace, plains killifish, and central stoneroller.

Pretreatment/Industrial Waste Control

Through 1995, 21 connectors had signed pretreatment agreements delegating their pretreatment responsibilities to Metro. The District's Pretreatment/Industrial Waste Control Program had previously been structured so each connector regulated its own industrial dischargers, with the District exercising oversight. This resulted in built-in inefficiencies and duplications.

Metro identified more than 100 previously unreported businesses that could have been subject to federal categorical standards. Categorical determinations were made for those businesses, with only a few requiring permits. The District helped a number of industrial users (IUs) who were subject to categorical standards eliminate their discharges and avoid being permitted. Many remaining IUs were to be subject to proposed regulations, although not subject to categorical standards at that time. The District warned them of the standards to come.

The District also joined the EPA Region 8 Pretreatment Partnership for Pollution Prevention Work Group. This participation increased opportunities to educate IUs about pollution prevention and encouraged their participation. Additionally, the District and several IUs hosted international groups learning about industrial pretreatment in the United States. The EPA sponsored one such group's visit to the District in 1995.



Biomonitoring studies conducted on fish at the University of Wyoming's Red Buttes Laboratory in 1995 were part of the Segment 15 suite of studies aimed at improving the South Platte River.

Regulatory air issues

Regulatory staff voluntarily conducted an air quality regulations compliance self-audit that showed noncompliance with some air permit requirements. The District volunteered the information to the Colorado Department of Public Health and Environment (CDPHE) and negotiated a Compliance Order on Consent that required the District to apply for permit modifications.

Among the most significant permit applications submitted to the Colorado Air Pollution Control Division (APCD) was one for an operating permit to comply with Title V of the 1990 Clean Air Act Amendments.

Metro submitted construction permit modifications to the APCD to address the Compliance Order and submitted Air Pollutant Emission Notices (APENs) with each of the permit applications. Additionally, the District persuaded the Air Quality Control Commission to delay the hazardous air pollution reporting schedule for publicly owned treatment works. Metro also received closure notices from CDPHE and the Oil Inspection Section of the Department of Labor and Employment for two underground storage tank leaks on its property.

Metro continued to develop the scientific basis for a flexible and innovative Segment 15 improvements plan. Two scientific workshops brought together the best minds representing District staff and consultants, regulators, and other affected interests. These workshops explored and developed concepts for improving the South Platte River.

Metro believed a long-term action plan would come together in 1997. When approved, the District intended to implement the plan and continue improving the river beyond the steps already being taken.

Public information & education

The Colorado Chapter of the Public Relations Society of America awarded Metro a Silver Pick for its community relations program. The outreach effort included participation in the annual News4 Education Expo, publications, videos, regular communication with the news media, and similar activities. MetroMoeba, the District's 7-foot amoeba mascot, was also part of the education effort.

Metro provided 48 Central Treatment Plant tours to 1,078 people. Thirty-one tours for 949 people were for local school groups.



Elementary school children view Metro's plant during this 1996 tour.

Foreign VIPs, other wastewater professionals, a Denver Museum of Natural History group, and local citizens made up the rest.

A senior leadership group from the Changchun, China Sewage Company spent a week at Metro learning about its operations. After receiving a World Bank loan, they visited leading United States sewerage agencies to learn best management practices.

Administrative Services

The Metro District earned a Certificate of Achievement for Excellence in Financial Reporting from the Government Finance Officers Association (GFOA) of the United States and Canada for the eighth consecutive year. For the second consecutive year, the District also earned the Distinguished Budget Presentation Award from the GFOA for its 1996 budget.



Barbara Thomas, Metro's long-time receptionist, at her desk in the old Administration (now Technical Services) Building.

Information Services (IS) began replacing the aging Digital Equipment Corporation network operating system with Microsoft's NT operating system. The NT system would enable IS to provide services such as automated back-up of individual desktop computer hard drives. This service had not previously been available to networked District computer users (about half the employee population). IS also completed phase one of a new budget system. Data were transferred from the old Focus system to the new Oracle-based system, improving reporting capabilities and reducing the time required to set up each year's budget. Phase two was to be completed in 1996.

Human Resources revised the employee handbook and the summary retirement plan description. It also made significant revisions to its Family Medical Leave Act policy, conducted diversity training for most of the employees, developed and issued personalized employee benefit statements, and developed a retirement plan annual report.

The Board passed the 1996 budget in July. The O&M portion of the budget was \$32,842,161, a \$591,408 increase over the 1995 O&M budget. Adjusted for inflation, there was no increase in the O&M portion of the budget for 1996.

A key issue in developing the 1996 budget was the amount required to meet projected capital requirements. A 2.1 percent increase in annual charges allowed the District to continue to cash fund capital projects of relatively small value—\$1.5 million—as well as all non-growth-related capital projects with a life expectancy of 20 years or less. This policy required the District to:

- Cash fund projects valued at approximately \$97 million through 2005; and
- Defer an anticipated \$50 million bond issue until 2001 or beyond.

For the next 10 years, the District anticipated spending \$178 million on capital construction projects. Of this amount, \$96 million—54 percent—would be needed to meet more stringent regulatory requirements. Approximately \$54 million was to be used to maintain existing facilities and increase operational efficiency. An additional \$12 million would be allocated to provide increased capacity. The remaining \$16 million would be reimbursed to the

District for construction projects requested by other governmental entities such as the Colorado Department of Transportation.

MetroMoeba video

In 1995 Public Information Officer Steve Frank donned a costume made by Lab Assistant Gayle Webb that transformed him into the 7-foot MetroMoeba.

The District created a five-minute video that featured MetroMoeba explaining to kids how wastewater is treated. The cast of MetroMoeba: The Video included several employees and their children. The video was made available free to teachers in the Metro District's service area.

1996-Board: No increase in annual charges for service in 1997

In 1996, U.S. Astronaut Shannon Lucid set a 188-day space flight record, TWA Flight 800 crashed in the Atlantic Ocean killing 230 people, and a bomb exploded at an Olympic Games Park site in Atlanta, Georgia.

Conservative fiscal management helped the District end 1996 with a favorable budget variance of \$3 million.

The board continued to cash fund all capital projects with a value less than or equal to \$1.5 million and all non-growth capital projects with a life of 20 years or less. This policy reduced the size of the District's long-term debt service obligation.

Staff developed and implemented "probability factoring" to improve capital project cost/timing projections. As a result, fewer dollars for capital projects were

included in cash flow schedules each year, reducing potential increases in annual charges for service.

After a year, this innovative concept appeared to be working well. For the 12-month period from September 1995 through August 1996, the estimated amount of capital projects expenditures with probability factors was approximately \$16,804,000; without probability factors, it was approximately \$21,651,000. Actual capital project expenditures for that same time period were approximately \$16,543,000.

The most notable result of the District's exceptional financial condition was the board's decision not to increase



MetroMoeba (PIO Steve Frank) poses with Buyer Terry Skrabonja and Storekeeper Kathy Reed in this 1995 photo in the Purchasing Division's lobby.

annual charges for service in 1997. For the first time in the District's history, planning projections indicated no increases in annual charges or bond issues would be needed through 2006, barring any unforeseen events.

Metro's cost for wholesale wastewater transmission and treatment services remained among the lowest in the nation for agencies of comparable size, population served, levels of treatment, and amounts of wastewater treated.

Awards

The District received three prestigious national awards from AMSA, which represented the 180 largest wastewater treatment agencies in the country: the Operations Award, the Gold Award for Environmental Performance, and Public Information and Education Award.

The AMSA Operations Award was given annually to the member agency that demonstrated the most outstanding project, system, or method relating to wastewater treatment operations. It had to have been developed and successfully implemented cost effectively while achieving environmental compliance objectives.

The District was the focus of a great deal of attention by other AMSA member agencies because of the degree to which District operations and maintenance were automated.

Automation in operations resulted in significant savings and an enviable compliance record, as evidenced by the District winning its second consecutive annual AMSA Gold Award for Environmental Performance, the District's fifth such award in six years.



Bob Erickson of the EPA and Joni Nuttle of Metro's Lab take flow measurements of the Fulton Ditch in this 1997 photo. The measurements were part of the Segment 15 studies.

District employees were proud to be associated with an agency that excelled and was a nationwide model of how publicly owned treatment works should operate.

The third AMSA award was for the MetroMoeba video. This five-minute production was judged best in the Public Information and Education Video category.

Segment 15 of the South Platte River

In April 1996, the Metro District completed the first of what was thought might be up to eight drop structures on Segment 15 of the South Platte River. When completed after the turn of the century, Metro believed these planned river modifications would improve habitat for wildlife in and along the river and save the District's ratepayers some \$80 million. The installation strategy was to install and test each structure to see how it performed and how much it improved dissolved oxygen levels.

About 4,000 feet upstream of the 88th Avenue bridge, the first constructed drop structure spanned the river, dropping the water over an almost-natural-looking weir.

The 250-foot structure was shaped roughly like an inverted U with the opening pointed downstream. As the water dropped over the top, it tumbled and was reaerated. The District tested the reaeration during the year and found that the structure performed as designed.

After the structure was installed, students under the direction of science teacher Peggy McCoy at York Junior High School in Thornton helped with a bank revegetation project. They planted 50 small cottonwood trees near the new drop structure.

Meanwhile, the Metro District continued to prepare for a hearing on dissolved oxygen before the Colorado Water Quality Control Commission in April 1997. Engineering, Laboratory Services, and Regulatory and Connector Relations collaborated to prepare Metro for the hearings.

Operations & Maintenance

Metro's visibility in the wastewater treatment community grew in 1996 because of its highly automated plant and maintenance operations and its low costs. Increased automation over a number of years had enabled O&M to consistently and reliably operate the plant and transmission system and to keep costs down.

Plant flows and loadings continued to increase gradually from the levels in the early 1990s. They were lower than the 1995 levels because precipitation was higher that year resulting in a scouring of solids in the District's and connectors' collection systems. Higher loadings were attributed to modest growth in the District's service area and an improving economy.

Automating annual charge flow metering

In November 1995, the board awarded a contract to Sutron Corp. for a data logger and radio telemetry system for the Annual Charge Flow Metering Program. Transmission staff completed installation of the data logger equipment in 1996 at 46 annual charge flow metering stations. Data were collected and stored in the data loggers on site, transmitted to the Transmission Shop using a radio modem, and compiled on a personal computer. The new, automated system reduced the staff time needed to collect and process the flow data.

Tours highlight automation in O&M

The District hosted tours and workshops for more than 170 wastewater professionals from plants across the United States. These tours highlighted the process control system and the District's maintenance management program.

O&M reorganization

When the senior process control supervisor retired and the control systems supervisor resigned, O&M was reorganized. The Facility Maintenance and Process Maintenance Divisions were merged and placed under the direction of the senior maintenance supervisor. Two division head positions were eliminated, but

the change did not cause any difficulties in meeting regulatory requirements or operating and maintaining the plant.

In the Transmission Division, the sampler and equipment operator positions were eliminated and their duties merged with the interceptor system operator position. The District could operate and maintain the transmission system with one less employee.

Resource Recovery and Reuse

The District produced approximately 74 dry tons of biosolids a day—more than 27,000 tons a year. All the material was either applied to agricultural land as METROGRO® Organic Soil Conditioner and Fertilizer (96 percent) or as METROGRO® Organic Soil Conditioner and Fertilizer Compost (4 percent).

The District acquired about 1,280 additional acres of agricultural property near its Deer Trail North property. This acquisition provided improved access through the entire Deer Trail property. Negotiations continued on approximately 3,200 acres of nearby state-owned land. The District owned approximately 46,000 acres of land near Deer Trail at year end.

Farming operations

During 1996, the District and T.H. "Tommy" Thompson, Jr., the farmer for the District's Deer Trail property, operated for the first year under a 10-year lease/grazing agreement. The Central Deer Trail property produced approximately 39,000 bushels of wheat on 2,500 acres. The District's share of this harvest was 13,000 bushels.

The District did not share in the revenues from the crops harvested on the North and South Deer Trail property because Thompson had completed all seeding on these properties



RR&R O&M Senior Supervisor Marvin Webb congratulates Field Mechanic Jeff Andrew on his completion of the RR&R field mechanic journeyman training program. He was the fifth mechanic to complete the program.

before the District acquired it. In 1997, the District would get a one-third share of revenue from the harvest of the entire Deer Trail farm in addition to lease money from grazing.

Although Metro made progress toward developing a comprehensive farm management plan for its Deer Trail property in 1996, all was not well on the farm.

RR&R staff, the District's engineering staff, Tommy Thompson, and Dr. Dwayne Westfall, professor of soil science at Colorado State University, were developing the farm plan. When their draft was completed, Arapahoe and Elbert county commissioners as well as two soil conservation districts (Deer Trail and Agate) were to be consulted and advised.

Metro's land lay across two conservation districts, and problems arose because members of those districts were unhappy at being left out of the creation of the plan. They had severe reservations about using biosolids on land they believed was poor to start with and that was, in their judgment, being farmed poorly.

Their angst bubbled over at the end of the year when soil conservation district board members attended a triennial hearing on the state's biosolids regulation. They complained bitterly and publicly about Metro, its farming operations, and biosolids. It would take a decade of concerted effort to repair this damage, and the worst was yet to come.

One part of the efforts to repair damage with the community near Metro's agricultural property involved contributions to various local charities and Metro's payment of fees to the counties in lieu of taxes. Payments totaling approximately \$50,000 were made

to Arapahoe and Elbert counties to offset the counties' loss of revenue when Metro's property was taken off county tax rolls.

Lawsuit settlement

In a major development, the District negotiated a \$1.9 million settlement of the Lowry Superfund Site lawsuit. The lawsuit could have run into millions of additional dollars.

As part of the settlement, Metro continued with the Lowry reclamation project at what had been the old Lowry Bombing Range that Metro had used as a dedicated sludge disposal site from 1969-1986. All basins were removed, earth work was completed, and native grasses were seeded.



Improving Metro's farm management methods was one subject discussed in this meeting with members of the Deer Trail and Agate Soil Conservation Districts at the METROGRO Farm.

RMWEA involvement

The District's support of the Rocky Mountain Water Environment Association's efforts to promote public acceptance of biosolids played a key role in RMWEA winning second place nationally in the public acceptance category of the EPA's annual biosolids program competition. Director of RR&R Bill Martin co-chaired the RMWEA Biosolids Committee, which conducted the public acceptance program.

The RMWEA Biosolids Committee, with help from Metro, also hosted the Water Environment Federation's annual Biosolids Conference in Denver in August. It was WEF's most highly attended biosolids conference to date.

Engineering

During 1996, the Engineering Department worked on a number of projects relating to Segment 15, the District's treatment processes, the interceptor sewer system, and support facilities projects.

Segment 15, South Platte River

- A Phase II study began to evaluate additional possible improvements to the South Platte River stream bed to increase the dissolved oxygen in the river.
- Design began on an Effluent Equalization/Treatment Pond Pilot Project to evaluate the benefits of flow equalization in reducing ammonia levels.
- The Segment 15 Interim Evaluations Study was completed. This study identified and evaluated ways to improve the environment for aquatic life in the South Platte River.



A carp hovers along the bank of the South Platte River near the Metro District's outfalls in this 1997 photo.

- Construction of the Stream Channel Improvements Project at 88th Avenue was completed.

Treatment process

- Design was completed and construction bids were received on a project to upgrade the screening and grit removal facilities in the South Complex.
- Design was nearing completion at the end of 1996 on a project to improve the performance and reliability of the solids-processing facilities.

Interceptor system

- Construction was completed in December on the \$9 million Delgany Interceptor Section 4 Project. This sewer replaced a major portion of the historic 78-92-inch brick masonry Delgany Sewer constructed in 1895. Challenges included maintaining access to affected businesses and navigating old, undocumented structure foundations and utilities.
- The \$2.2 million Berkeley Interceptor Project was completed in December. It included rehabilitating and replacing major portions of the interceptor and significantly modifying the collection system.
- Design began on the Sanderson Gulch Common Interceptor Rehabilitation Project. This work was to restore approximately 20,000 feet of sewer that was constructed in the 1950s.

Support facilities

- Construction of the new Administration Building was more than 80 percent complete. District staff occupied it in the spring of 1997.
- The old Administration Building was being remodeled to become the Technical Services Building. Phased construction began in January 1996 and was about 64 percent complete at the end of the year.
- Construction began on the new Transmission Building. This new building was to house interceptor maintenance personnel and facilities. Remodeling continued on the existing Control Building, which

housed plant supervisory personnel and was the hub for the plant's extensive automated control system.

Laboratory Services

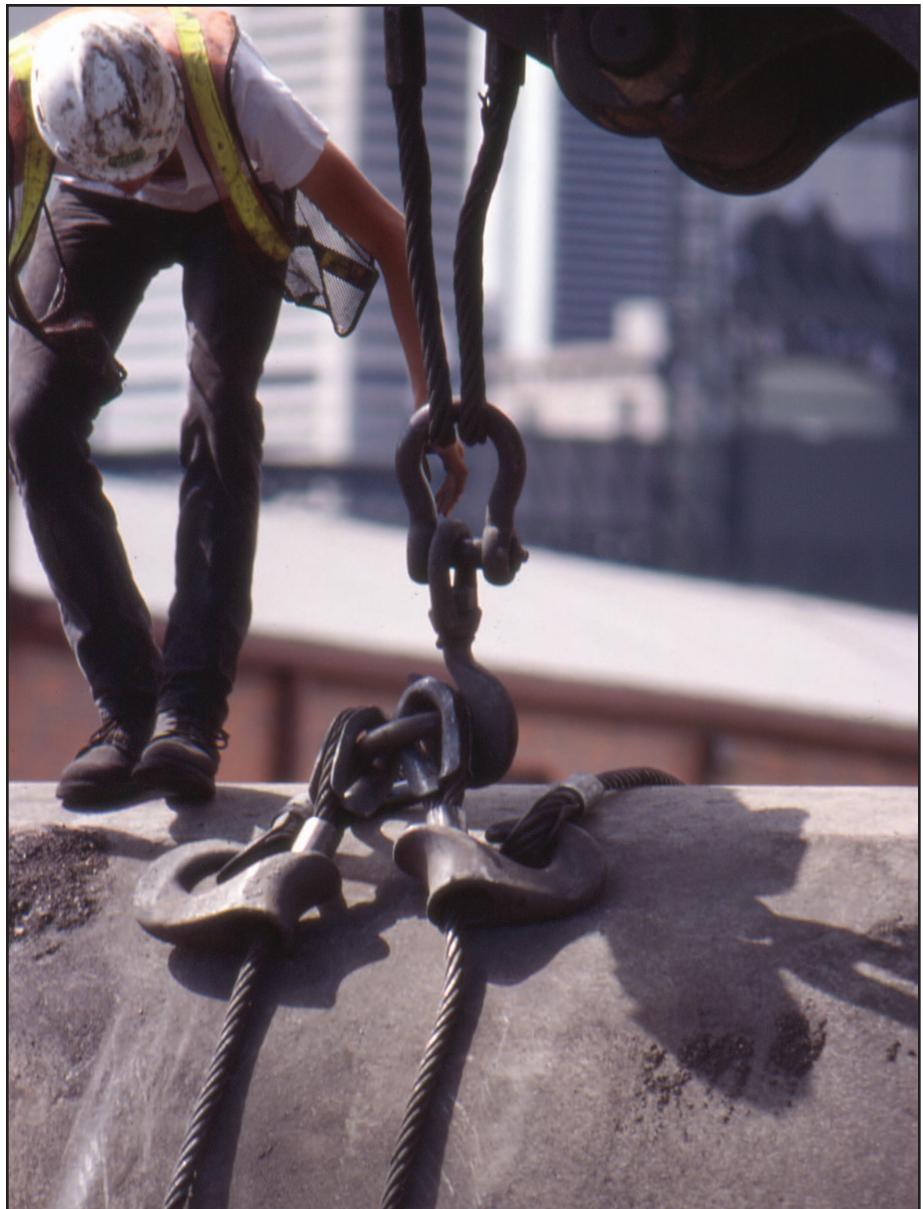
A major challenge for Laboratory Services was to produce its half-million-plus annual analyses amid the construction of new laboratory facilities in the new Technical Services Building. Laboratory Services and Engineering devised numerous "work-arounds" during construction.

Laboratory Services also upgraded the quality of its data to ensure that they were defensible. In addition, it successfully participated in and fulfilled the requirements of an internal audit of the National Pollutant Discharge Elimination System program.

Laboratory Services broadened its in-house capability to conduct reaeration and time-of-travel studies using gas tracers. This capability saved additional consultant fees, provided new data in support of a site-specific standard for Segment 15, and would continue to provide additional benefits for the District. As required, the Lab also achieved lower detection limits on some analyses.

Driving toward a paperless lab, the department completed the Inductively Coupled Plasma-to-Laboratory Information Management System (LIMS) interface and began the interface for automated BOD data capture. It also implemented the LIMS upgrade study and was on pace to acquire a new client-server-based LIMS.

Laboratory personnel reviewed both state biological monitoring and Whole Effluent Toxicity (WET) testing protocols as well as federal WET and Total Maximum Daily



Construction of the Delgany Interceptor Section 4 project was completed in December 1996. Here, a worker rigs a piece of pipe for pick-up by a crane while the project is under construction.

Load development. They hoped to clarify these regulations and produce a more flexible, common sense approach.

A description of the impacts of the construction of the drop structure 4,000 feet upstream of 88th Avenue was provided to the U.S. Army Corps of Engineers. The description, complete with illustrations, demonstrated how the wetlands were being mitigated and gave assurance to the Corps that the construction activities would be beneficial and provide a net gain of wetlands.

The District also monitored and assessed the impact of its discharges on waters other than the South Platte River in support of a watershed management approach to permit negotiations. This monitoring provided valuable information on upstream coliform contamination and E. coli and total coliform ratios. It led to published conclusions that the effect of the District's effluent could not be distinguished from or was masked by upstream water quality in the South Platte River.

The Laboratory also monitored and tested the efficiency and effects of in-stream structures designed to enhance water quality and to make recommendations for subsequent work. The efficiency and effects of the newly constructed reaeration structure upstream of 88th Avenue, the lowered 88th Avenue structure, and several urban drainage structures were measured using in-stream monitors, time-of-travel, and in-stream gas tracer techniques.

Data collected in these studies were provided to the Segment 15 model, to the engineering consultant, and to the regulators. Metro hoped the data would help develop more efficient approaches to higher dissolved oxygen levels in the stream

segment. Recommendations were provided to enhance the design of future structures and increase the reaeration efficiency of the stream channel prior to subsequent work.

Pretreatment wins first place nationally

Metro's Pretreatment/Industrial Waste Control Program won first place in the nation in the 51-100 major industrial waste discharger category for 1996. Fifty-two agencies competed for the National Pretreatment Award in this size category.

The District's two-pronged approach to ensuring environmental protection through industrial pretreatment included: 1) active encouragement of pollution prevention initiatives by its industrial customers and 2) firm, consistent enforcement designed to bring violators quickly back into compliance.

Metro recognized nine metro Denver businesses in 1996 with a Gold Award for environmental excellence for 100 percent compliance with its industrial waste pretreatment requirements during 1995. By complying with these regulations, these nine environmentally responsible businesses kept prohibited wastes out of the wastewater treatment system.

In the enforcement arena, the District helped the EPA Criminal Investigation Division and Denver Wastewater Management "bust" a Denver business for suspected violations involving pretreatment program compliance. The investigation ultimately led to criminal charges that resulted in penalties to the business, AAA Plating, 3031 Blake Street, Denver, and a year in Federal prison for its owner for violating the Clean Water Act.⁴



Molly Castleberry (left; Lab), Cynthia Lynch (Engineering), and Shian Kung (right, Lab) confer over drawings as the Lab was being rebuilt and expanded in 1996.

In other R&CR department activities

- The dissolved oxygen studies at the University of Wyoming's Red Buttes Laboratories, the Phase II aquatic improvements study, and the work to update the Segment 15 "Reanalysis of Alternatives" were kept on schedule and within budget. In preparing for the April 1997 CWQCC hearing on dissolved oxygen standards, these studies provided the basis for negotiating final dissolved oxygen standards and for the District's plan to meet those standards. The Nitrification Alternatives Committee periodically updated the board on the progress of this work.

- In September 1996, the R&CR Department received its application package for the District's new Colorado Discharge Permit System permit. At year end, preparation of the application was about 75 percent complete. No complications were expected to prevent the District's completing and submitting the application on time.
- The five-minute video featuring the MetroMoeba character explaining wastewater treatment was included in the non-point source pollution exhibit at the Children's Museum of Denver in June for a two-year run. An estimated 500,000 people were expected to visit the exhibit.
- R&CR also managed a review of the District's Sewer Connection Charge methodology, including the effectiveness of the method for funding growth-related capital costs and developing alternative methodologies for board consideration. The project resulted in the development and adoption of a new Sewer Connection Charge methodology for 1997.

Administration

Administrative Services successfully implemented a new Oracle purchasing/accounts payable system. This cooperative effort involved Purchasing, Finance, Information Services, and Office Support staffs plus other District departments. It was the first integrated system of these two important functions to be used at the District. Productivity benefits included:

- Having only one integrated vendor list for Purchasing and Finance eliminated the major duplication of time and effort required to maintain two separate lists.

- Automatically matching invoices with purchase orders and receiving records by computer did away with much of the work of manually matching documents. Approving invoices via the computer system sped up payment by eliminating the routing of documents to obtain signatures. These changes helped the District to qualify for more vendor discounts for early payment.
- Paperless receiving of delivered materials and services made it easier to keep up with who ordered what and where it should go.

The Finance Division implemented the Oracle fixed-asset system. This system had proven more flexible than the previous system. It interfaced with the Oracle general ledger and the Oracle accounts payable systems and eliminated the need to make manual journal entries. It also allowed the Finance Division staff to track expensed assets and to store more details about each asset in the system, providing better inventory tracking. It also eliminated the duplication of effort formerly required to update the annual charges model each year.

The Finance Division also implemented new banking services that increased operating efficiency, substantially lowered net banking service costs through an increase in interest income, and further strengthened District accounting controls to prevent fraudulent check writing. A direct deposit program for employee pay checks was initiated.

The District saved \$5.3 million in debt service, or eight percent of the outstanding issue over the next 15 years, through a very successful advance refunding of remaining



Seen in this 1993 photo is Cathy Mitchell, who started as an accounting clerk. She is now District Manager Cathy Gerali, succeeding Bob Hite in 2008.

\$64 million in the 1986B Series Sewer Refunding Bonds. They were replaced by 1996 Sewer Refunding Bonds.

The Human Resources training staff researched and introduced computer-based training, providing training on demand and made safety and other training more accessible to employees.

Work was substantially completed on the first edition of the District Training Catalog. It listed over 50 internal training courses, over 200 training videos, 600 book titles, and nearly 100 other reference sources.

Information Services (IS) converted the District's proprietary PC network and messaging protocol to an industry-standard network using Microsoft's NT operating system. It also installed automated software that allowed it to track, monitor and assist PC users via Help Desk from one central location—an invaluable plus when part of the District staff occupied the new Administration Building in 1997.

The District's purchasing officer was nominated for Advocate of the Year by the Minority Enterprises Incorporated (MEI) Supplier Council for the second consecutive year. The nominations reflected the supplier community's recognition of the Metro District's sincerity toward supporting minority businesses.

Natural springs and native fish

In the spring-fed pond just outside the Administration Building, the Metro District and the Colorado Division of Wildlife (CDOW) initiated a trial to see whether the pond could provide the right habitat to encourage growth of Colorado native fish species.

The trial period began in the summer of 1996. The study was conducted with minimal pond management. Species such as common carp, which would compete for habitat and food, were removed to give the native fish a better opportunity to become established.

Before the pond was stocked, employees and their families helped fish out the non-native species so the District and CDOW could start afresh. The goal was to see whether these species could establish reproducing populations in this pond.

In the long run, the native species could never establish themselves because of competition from carp and crawfish.⁵

Awards

1997-EPA Region 8 Operations and Maintenance

Award. First Place, Large, Advanced Plant Category. Best operated and maintained large, advanced wastewater treatment plant in the six-state Region 8 area.

1997-EPA National Operations and Maintenance

Award. 2nd Place, Large, Advanced Plant Category. Second best operated and maintained large, advanced wastewater treatment plant in the United States.

Association of Metropolitan Sewerage Agencies. Sixth Gold Award for Environmental Performance in seven years for perfect compliance with discharge permit numerical limits.

Colorado Chapter, American Public Works Association Environmental Project (Under \$2 Million). For the Grease Processing Building improvements resulting in savings of \$72,000 for the first year and \$265,000 per year thereafter.

Government Finance Officers Association of the United States and Canada. Tenth consecutive Certificate of Achievement for Excellence in Financial Reporting.

Government Finance Officers Association of the United States and Canada. Distinguished Budget Presentation Award.

Metro's accomplishments in 1997 set a benchmark for future exceptional performance. This was especially true of the

1997 Operations & Maintenance Award from the EPA in which Metro won first place in Region 8 and second place nationally in the large, advanced plant category. Regional and national recognition showed the staff they could compete with anyone and that winning was fun. They were proud of the recognition and determined to work harder than ever to make sure Metro remained eligible for similar future awards.

One major challenge that faced the Metro District in 1997 involved Segment 15 of the South Platte River. In April, the Colorado Water Quality Control Commission agreed with staff's proposed improvements plan for Segment 15 to cost-effectively meet its regulatory standards for dissolved oxygen



Marsha Casteel (standing, right) trains employees to use the new computer-based purchasing system in this 1996 photo.

while improving the quality of water in the South Platte River. By year-end, Metro was in pre-design for the plan, which was expected to both save ratepayers some \$80 million over the next several years and improve the river as a fish habitat.

Doing more with less—and with quality—resulted in a 5.5 percent reduction in annual charges for service that took effect in 1998. Reducing annual charges and proposing to hold the line there for a decade became possible because of sound, long-range financial planning implemented over the past several years. In addition, cash flow projections indicated no bond issues would be needed during the 10-year planning period ending 2007. This very positive financial picture was further bolstered by the District's plan to be virtually debt-free by 2014, even with the lower annual charges for service rates. District Manager Bob Hite said he believed the Metro District was the only major wastewater utility in the United States to achieve this.

Another challenge—this one concerning biosolids—also faced the Metro District and was on its way to being met at year end. Metro employees began working with the Agate Soil Conservation District, Elbert County, the Deer Trail Soil Conservation District, Arapahoe County, and other interested parties to develop a biosolids monitoring program and soil erosion control measures for Metro's Deer Trail agricultural property.

Some citizens, including a number of Metro's Deer Trail property neighbors, had expressed concerns about the District's decision to accept pretreated groundwater from the Lowry Superfund Site for further treatment. Although neither the District's biosolids nor its effluent would be affected in a

significant way by Metro treating the Lowry Superfund Site groundwater, it was clear some people were uneasy. Metro began a concerted effort to educate citizens about biosolids and expected to continue to work to allay unfounded fears.

The District was proud of its accolades and of keeping its cost of wastewater treatment among the lowest in the country for agencies of comparable size, population serviced, levels of treatment, and volume of wastewater treated. In 1997, staff completed a draft 50-year Strategic Plan to ensure the District would be in a position to meet the challenges of the future and to assure adequate and proper resources would be available.



Purchasing staff, mid-1990s: Back row from left: Cheryl Dye, Marsha Casteel, Theresa Skrabonja, Karen Dowis, Leo Gengler, Byron Haynes Front: Geri Martinez, Lucille Romero.

100 percent compliance and low rates

To win the EPA O&M awards, the District compiled an impressive, sustained record of performance. In 1995 and 1996, the District had zero violations of its NPDES permit and Part 503 biosolids regulations. The District also had only one minor numerical violation in the previous decade. In addition, the Metro District had zero sanitary sewer overflows in its 232-mile interceptor sewer system.

The District accomplished this exemplary compliance record with no rate increase to the 55 local governments it served. Metro also established a zero-percent increase in its annual charges



In this 1996 photo, one of Metro's two 750 gpm Humboldt Wedag centrifuges is being rebuilt. These centrifuges have been decommissioned in place.

for 1997 and implemented a 5.5 percent decrease in charges in 1998. Annual charges had increased just 2.1 percent in 1996.

Automation

The District used best management practices in employing technology as a strategy to help it comply with its permits and reduce costs. Key to this strategy was Metro's use of automation at the Central Treatment Plant. The District's process control system automated most of its processes. The innovative element was that it controlled the process, not just monitors and alarms.

Automation helped provide consistency and reliability in both liquid stream treatment and biosolids processing using minimal operations staff. The laboratory, engineering, finance, purchasing, warehouse, industrial waste/pretreatment, and the interceptor-monitoring program all used automation as well. The District was rapidly integrating these systems so that employees could share their information and work together.

Planned versus reactive maintenance

The District's planned maintenance philosophy resulted in 98 percent of the equipment being available for operational use. Reactive maintenance was kept to one percent of all work performed. A key program element was the comprehensive use of a computerized maintenance control system. Integrating purchasing and the warehouse resulted in a productive and efficient maintenance workforce.

Financial management program

The District's financial management program resulted in no rate increases and no new bond issues forecast for the

next 10 years. Helping make this possible were reduced expenditures for personnel, utilities and chemicals; creative cash funding of some projects; and developing and funding a rolling Ten-Year Capital Expenditure plan.

Operations & Maintenance

The Transmission Division managed the District's interceptor sewer system with no spills or overflows from operational or maintenance errors during the year. A potential overflow in the Weir Gulch Parallel and the Sanderson Gulch common interceptors was averted by the quick response of Transmission Division employees. The move to the new Transmission Division shop facilities was completed in September 1997.

O&M continued moving toward implementing the new Maintenance Control System SQL R5 software package. A project team comprising Maintenance, Transmission, Information Systems, and Resource Recovery and Reuse worked to bring this system online in early 1998 and interface it with Purchasing and Finance's Oracle software.

Grease processing costs fell 25 percent in 1997, and Operations looked for them to go to zero in 1998 because of the new Grease Processing Building, keeping another recyclable resource from going to landfills. In other cost-cutting measures, O&M cut plant electrical costs by six percent, saving \$175,000 in electrical energy costs.

The Control Systems Division achieved two key goals: providing hardware and software enhancements for the process control computer and improving data integrity



Following the 1996 Buffalo Creek forest fire, the Metro District participated in a 1997 revegetation research project in the burn area with the EPA and the Colorado Department of Public Health and Environment. Biosolids compost was applied in varying amounts to prepared test plots.

for all process information. Assessing the control system for the year 2000 compliance also began.

Resource Recovery and Reuse

Metro produced and recycled 29,713 dry tons of biosolids in 1997. Between 97 and 98 percent of the material was recycled as a soil amendment for production agriculture. The remaining two to three percent was composted with wood chips and became METROGRO® Compost.

Metro developed a new METROGRO® Compost bag in 1997. The District sold the compost to consumers for \$2 a bag.

After 30 years with Metro, William J. Martin, long-time director of the RR&R Department, retired. Barbara L. Millett and Marvin H. Webb took over the leadership in RR&R.

Biosolids help Buffalo Creek burn area recover

The EPA, U.S. Forest Service, Colorado State University, the Colorado Department of Public Health and Environment and Metro applied composted biosolids in varying amounts to research plots in a small area burned by the Buffalo Creek Fire of 1996. It was the first scientifically controlled test program on a burn area. The research looked at plant establishment, bio-mass production, species diversity, and other effects. The objective was to determine appropriate levels of biosolids application to promote post-burn ecosystem recovery. The work involved preparing the ground by breaking up the crust the fire formed, applying the biosolids at different rates, and seeding the prepared ground with native grasses. Early results looked promising.

Administrative Services

Moving into the new Administration Building enabled the Administrative Services Department to redesign and reorganize a number of administrative resources and functions to better meet the District's needs. The additional space allowed for central office supply storage and a larger copy room.

Information Services (IS) worked toward identifying and resolving Year-2000 compliance issues. About 95 percent of the Year-2000 identified issues were resolved; the balance was



The dark green area in the upper center of this photo was one of the test plots where biosolids compost was applied in the 1997 Metro/EPA/CDPHE Buffalo Creek fire revegetation experiment.

anticipated by January 1999. IS also tested and implemented personal computer hardware, telephones, and network systems in the Administration and Transmission buildings.

IS and Public Information developed Metro's first internet website. It was almost ready to go live at year end.

Human Resources made training opportunities more accessible to employees. More than 200 employees were trained with a new CD-ROM-based training system. HR tracked and monitored the program with a newly installed software package that improved scheduling, attendance tracking, and feedback evaluation.

Records Management and IS developed and implemented a system to index and track the District's software licenses and media in compliance with Microcomputer Standards and Procedures. IS incorporated system implementation into the reorganization of the satellite file station in support of Metro's disaster recovery plan. Records Management coordinated with District staff and an off-site vendor to provide backup computer media storage and rotation services.

A pilot program began collecting information needed to incorporate electronic records into the District's records management filing and retention scheduling systems. Records Management provided indexing and research support to both staff and legal counsel for the ongoing Lowry litigation effort as well as the growing number of Open Records Act requests from the public.

The Finance Division helped Metro select a new outside investment management service that cost half what the previous vendor had charged. Finance also oversaw the

refunding of the 1991A Bond Issue through the Colorado Water Resources and Power Development Authority.

Purchasing tested and ensured the compatibility of new software to improve maintenance and inventory control. The SQL Systems software had to be compatible with the Oracle Finance and Purchasing software installed in 1996. Implementing the inventory program was expected in early 1998.

The procurement process and warehouse inventory volume were analyzed for efficiency, effectiveness, and reliability. Purchasing annual quantities of selected items continued to be more cost effective than processing several purchase orders per item during the year. It also resulted in price discounts and delayed the need to increase staff. Identifying and maintaining critical stock parts would contribute to managing warehoused materials and supplies for maximum plant maintenance efficiency while conserving inventory dollars.

Engineering

Collaboration between departments was one key reason the District won the EPA's O&M Award, and the Segment15 Improvements Program was a major effort in Engineering. All phases of this major project benefited from their technical input. As the project continued, Engineering staff provided and supervised design services, test site development, and water quality data evaluation.

Engineering conducted a number of studies and completed record drawings on a variety of facilities. Transferring manual interceptor drawings to an electronic format was in process, with 976 drawings completed during the year and 231 in production. An additional



The Transmission Division moved into the new Transmission Building in 1997.

130 drawings were waiting for transfer. All new drawings were added to the system in an electronic format as they were created.

The new \$6.3 million Administration Building project was completed in 1997, and it was occupied in July. Located just off York Street, this 45,000-square foot building was built to house 80 staff members. The District's board room was there as well.

The old Administration Building underwent its \$7.2 million metamorphosis to become the Technical Services Building, housing the Laboratory Services Department, Information Services, and a staff training room.

Other major 1997 construction projects included:

- Berkeley Interceptor Rehabilitation, \$2.9 million—Completed March 1997.
- Process Control Building Remodel, \$.71 million—Completed December 1997.
- Transmission Shop and Garage, \$2 million—Completed September 1997.
- South Barscreen & Grit Facility Improvements, \$2.7 million—Completion scheduled June 1998.
- Sludge Process Building Improvements, \$3.5 million—Completion scheduled March 1999.

Laboratory Services

The majority of the construction work on the new Technical Services Building was completed by year end. The Laboratory Services Department and its customers experienced no interruption in service because of the extensive work-arounds that were developed as construction rolled through the various labs.

The department selected three high rerun rate processes—ICP, mercury and furnace—to become quality improvement “test beds.” Results were just beginning to be seen at year end, and Laboratory Services personnel were encouraged by the initial efforts.

Computer technology and automation were playing an increasingly important role in the work being done by Laboratory Services. BOD (biochemical oxygen demand) analyses were directly interfaced with LIMS (laboratory information management system). This linkage eliminated the

need to key information into the Lab's database. Additional system enhancements included automated results calculation and cross-checking of those results. Adding these technologies directly increased efficiency and reduced errors.

Results of fish tests guided by Laboratory Services Department experts demonstrated that South Platte River native fish could tolerate lower DO levels than called for by national criteria documents. These empirically derived data supported a lower, site-specific DO standard for Segment 15 of the South Platte River.

The laboratory also performed reaeration studies using dye tracers and propane gas to measure the effectiveness of the new drop structure the District built in 1996. These studies confirmed that the drop structure worked as designed and demonstrated water quality improvement over a longer reach of river than was originally predicted by the computerized Segment 15 model. As a result of new data provided from the fish and reaeration studies, the District was able to finalize a Memorandum of Understanding with regulatory agencies resulting in a site-specific DO standard for Segment 15.

Key monitoring information provided through biweekly water quality assessments, 48-hour studies, and incremental assessment studies during 1997 also enabled the District to upgrade the Segment 15 model and remain proactive—rather than reactive—to constantly changing water quality standards.

Data provided by Laboratory Services were also a key component in helping the Metro District win the 1997 EPA O&M Award. The Lab's analyses provided proof that industrial



This view shows the Process Control Building as it appeared in 1995.

waste pretreatment was being conducted properly, that the District's processes were working, and that the numerical limits specified in the District's discharge permit and by the state and federal biosolids regulations were being met.

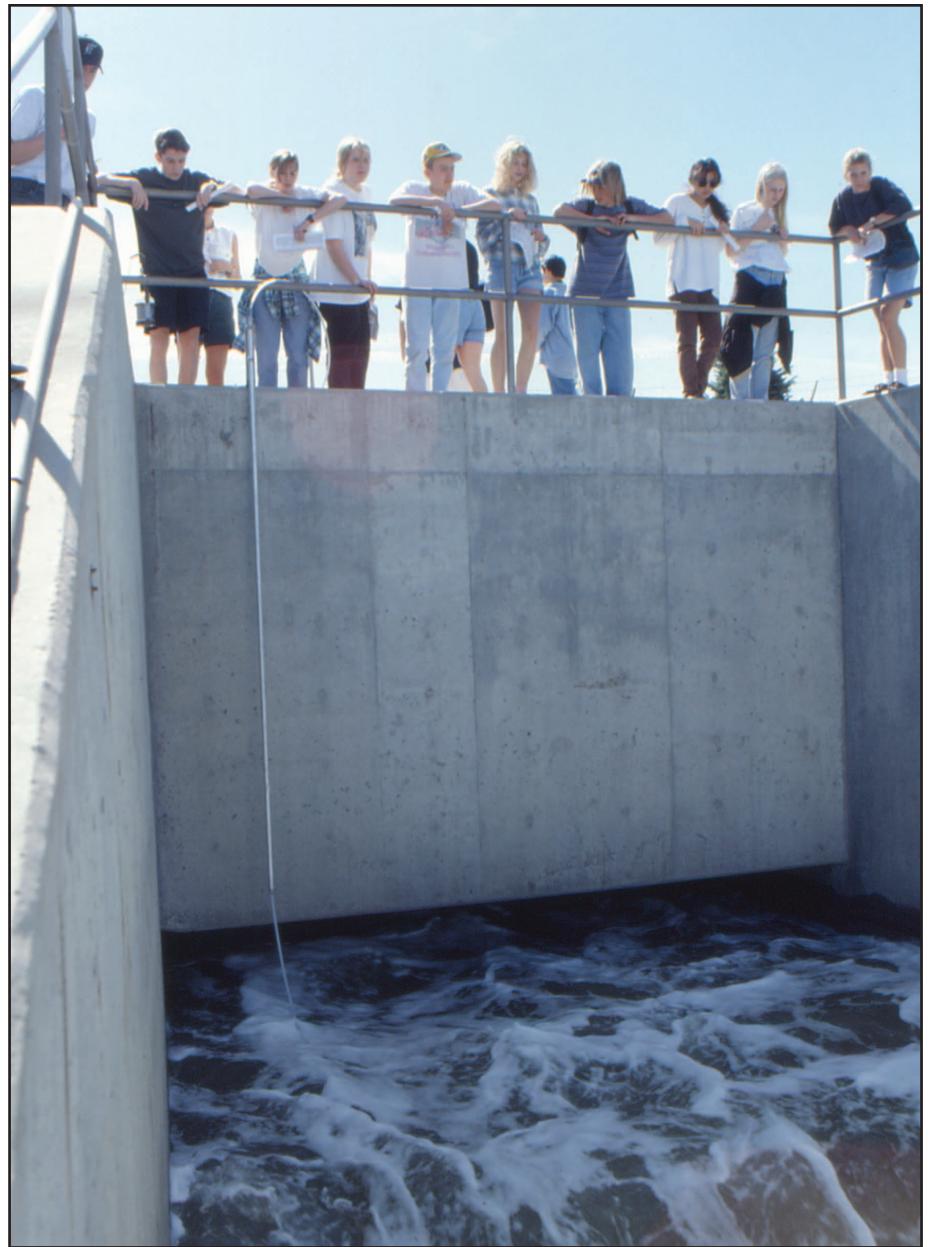
At year end, the Metro District inked a new contract with Oil, Chemical, and Atomic Workers Local 2-477, which represented laboratory workers. It ended four years during which bargaining unit employees had worked without a contract.

Regulatory & Connector Relations

Technical assistance and enforcement resulted in a new low for the number of industrial dischargers in significant noncompliance and a new high for industries in 100 percent compliance.

In September, using District information, the EPA served a sealed search warrant on Jemm Company, a metal plating company at 3300 Walnut St. in Denver, for possible environmental violations. District pretreatment staff members reviewed records, conducted a thorough physical investigation of the premises, and interviewed employees. The investigation ultimately resulted in criminal charges against the company for violating the Clean Water Act.⁶

Metro negotiated with regulatory agencies to establish site-specific DO standards for Segment 15 and a plan to raise DO levels. The improvement plan was a long-term commitment that would span seven years and save District ratepayers about \$80 million. Predesign for follow-on in-stream drop structures and a fish entrainment structure began in 1997. Engineering, Laboratory Services, and R&CR contributed.



At Bring Your Daughters and Sons to Work Day in 1994, employees' children view the treated effluent as it discharges into the South Platte River.

Kids come to Metro

The District invited children and grandchildren of employees to spend a day at work with mom, dad, grandmother, or grandpa in April as part of Bring Your Daughters and Sons to Work Day. Metro provided a short program to tell the kids how Metro cleaned the water, then everyone went on a plant tour. Back at school, the children could usually tell their teachers how Metro cleaned the wastewater. They came away with a better sense of what mom, dad, grandmother, or grandfather does, and their parents and grandparents were proud to show them off to their friends.

Lowry Superfund Site clean-up

As part of the settlement of the lawsuit in June 1996 between Metro and the owner and operators of the Lowry Landfill, Metro agreed to accept pretreated groundwater from the site, subject to EPA approval. The EPA approved this change to the Record of Decision as part of the site clean up.⁷ EPA came to this decision after re-evaluating its earlier Record of Decision. It determined that: (a) the District could safely treat this groundwater, and (b) having Metro treat this groundwater would be the best overall environmental solution. The availability of a new Aurora sewer near the site made this option technically feasible where it had not been before.

R&CR managed the Lowry groundwater treatment program for Metro. Staff began developing an industrial waste pretreatment permit for the Lowry groundwater in 1997. This activity extended into 1999. Once the permit was finalized, Metro could begin treating about 14,400 gallons a day of slightly contaminated groundwater—roughly one ten-thousandth the volume of

wastewater the District normally treated. If left untreated, this groundwater could contaminate other groundwater near the superfund site. Under the permit, Metro could refuse to accept the pretreated Lowry groundwater if it did not meet the pollutant concentration limits Metro established in the permit.⁸

Unlike most pretreatment permits, this one was opened to public comment during its development. It set forth stringent safeguards over Metro's acceptance of the Lowry groundwater (it established limits and monitoring requirements on a large number of pollutants and pollutant groupings) and was updated several times after the original version took effect.⁹

Controversy unfolds

On June 26, 1997, CNN's MoneyLine with Lou Dobbs aired a story about biosolids and Metro in which Dobbs said in his introductory statement that there is “growing opposition” to the federal government’s policy promoting the use of “sewage sludge” as a fertilizer. The show included Dobbs talking about the treatment of groundwater from the Lowry Superfund Site as a plan to treat “Superfund waste.” He called the water “hazardous, toxic waste” and said EPA would “pipe it through sewers and spread it on farm land.”

In the same story, CNN reporter Bill Dorman said groundwater from the Lowry Superfund site would be treated at Metro and spread on Metro-owned farm land near Deer Trail, Colo., as fertilizer. The segment also included an interview with a rancher who lived near Metro’s eastern Colorado property and comments by Adrienne Anderson, a Metro board member who was appointed in mid-1996.

The EPA's proposal that Metro treat the Lowry groundwater caused considerable public distrust and even hostility toward Metro in eastern Colorado near the Metro farm. Elbert County issued a cease-and-desist order in June 1997. The order banned biosolids application on the roughly 30,000 acres of District-owned land in Elbert County. After meetings and negotiations with county officials and soil conservation district members, the ban was partially lifted in September.

Lifting the biosolids application ban

Lifting the biosolids application ban in Elbert County hinged, in part, on Metro creating a plan to monitor land application activities and results that addressed biosolids quality, soils, surface water, and groundwater in and around the Deer Trail property. The agreement with Elbert County that eventually resulted in the ban being lifted also addressed developing soil erosion control plans to which the District and the Agate Soil Conservation District could mutually agree.

To begin building a plan, Metro had to open lines of communication with members of the community who felt affected by Metro's presence there. With input from community members around Metro's farm property, the regulatory compliance group in R&CR began developing the monitoring plan in August. Development continued through the rest of 1997 and into 1998 and 1999. The public information staff monitored public sentiment and provided feedback.

To make the plan work, the District agreed to pay for the monitoring and community stakeholders got to pick the monitoring agency. They picked the U.S. Geological Survey

as a neutral, scientifically qualified third party to conduct the monitoring. The independent monitoring plan gave Elbert and Arapahoe counties (Arapahoe was the other county in which Metro's farm property lay) control over disseminating the monitoring results under an Intergovernmental Agreement negotiated in 1998. Meanwhile, RR&R was required to develop and implement erosion control plans. Elbert County lifted the cease-and-desist order unconditionally in April 1998.

R&CR communicated with public officials, neighbors, and others about the Lowry cleanup, biosolids, and the Deer Trail property. Fact sheets, news releases, facility tours, letters, one-on-one conversations, and other formal and informal communication efforts highlighted the stringent pretreatment limits the District was developing and would enforce on the Lowry groundwater. The message consistently emphasized just how minimally the pretreated Lowry groundwater would affect the District's biosolids.

Independent monitoring plan

The independent USGS monitoring plan that Metro developed with input from farmers, neighbors, and other stakeholders concerned with Metro's activities was time and money well spent. Three successive surveys of neighbors around Metro's farm property and other interested parties in 2000, 2003, and 2006 showed the USGS independent monitoring program to have been the single most important factor in enabling stakeholders to eventually trust what Metro had told them about the effects of biosolids on the property.

Soil conservation districts and people living near Metro's farm mounted efforts to regulate biosolids-related agricultural

practices via the biosolids regulations. At the same time, Metro staff worked to keep routine revisions to the Colorado Biosolids Regulations focused on human health and water quality. The efforts to change the regulations eventually failed because the biosolids regulations address water quality rather than agriculture.

Farm management plan develops

RR&R staff, Tommy Thompson (Metro's tenant farmer), and Colorado State University Professor Dwayne Westfall developed a farm plan for the Deer Trail property. It addressed property management issues to control soil erosion through techniques such as residue management, wells, fencing, roads, and structures.

RR&R focused on addressing soil erosion concerns on the District's farm property near Deer Trail. When the property was purchased, severe wind and water erosion were evident on the central part of the property. Together with Thompson, the District took steps to control these problems. About 2,500 acres in this area were being strip farmed. Chemical fallow, minimum-till, and stubble mulch techniques were being used. A diversion structure was built to control water runoff. Similar soil erosion control measures were implemented on 1,860 acres in the North property.

The District revised its biosolids incorporation policy for the Deer Trail property following input from members of the Agate and Deer Trail Soil Conservation Districts, Natural Resources Conservation Service staff, and the farmer. Although immediate incorporation had been a long-time practice by Metro, it was discontinued except for areas where it was required by the Colorado biosolids regulation or by county regulations. Not incorporating the biosolids reduced compaction,



Biosolids cake rides up the steel Serpentex conveyor belt to the cake storage tower.

prevented the soil from being worked unnecessarily, reduced moisture loss, and helped preserve soil and root structure.

Complications and litigation

Complicating the strained relationships with its eastern Colorado neighbors were activities by an environmental activist and Metro board member, Adrienne Anderson.

Appointed in 1996 by Denver Mayor Wellington Webb, Anderson complained publicly about the EPA's decision to allow Metro

to treat the Lowry groundwater. She claimed it was tainted by plutonium wastes from Rocky Flats, the nuclear weapons trigger factory northwest of Denver.¹⁰ She also claimed Metro, the EPA, and other organizations were involved together in a cover-up designed to allow superfund site polluters off the hook.¹¹ Her claims got the attention of the media, environmental activists, students, Metro's eastern Colorado neighbors, and others. Controversy swirled. Anger and fear were palpable.¹²

Anderson claimed Webb had appointed her "to represent the sewer workers." In 1997, Anderson filed a complaint with the U.S. Department of Labor claiming whistle-blower status under several federal environmental statutes. Her complaint began a long, winding, eight-year journey through the Labor Department's administrative law system and, eventually, the federal court system. In September 2005, the U.S. Court of Appeals for the Tenth Circuit¹³ issued its decision affirming a U.S. Department of Labor Administrative Review Board's (ARB) ruling against Anderson.¹⁴ The Tenth Circuit affirmed the ARB's determination that Anderson was not a person protected as a whistleblower under the statutes.

Anderson continued to claim plutonium and other radionuclides were present in the groundwater coming from the Lowry Superfund site after Webb failed to reappoint her in 1998. A lawsuit brought in April 2000 by PACE (formerly OCAW, the union representing Metro's laboratory employees), two farmers living near Metro's property, a student, and others that sought to stop Metro from treating the groundwater from the Lowry Landfill site made the same claim. The suit, filed in Denver District Court, was dismissed because the state court lacked jurisdiction to hear the case and the plaintiffs failed to join necessary parties in the lawsuit.¹⁵



Executive Committee of the Board of Directors, 1997. Standing: Anthony Ferraro, Bob Hite, Stan Williams, John Dingess, Kathryn Jensen, Don Allard, Martin Flahive, Lewis Short, Ron Lovan. Seated: Robert Werner, John Wilder, Richard Walker, John Kempfer.

The excitement in eastern Colorado eventually died down as Metro and USGS testing showed again and again that the Lowry groundwater had no appreciable effect on Metro's biosolids, there were no appreciable levels of radionuclides, and there was no danger to the public from Metro treating the Lowry groundwater.¹⁶ A published USGS study from soil and biosolids monitoring at Metro's farm property that began in 1999 said in 2004 that "the plutonium data are below the detectible level for all samples...with a distribution near zero. There are no published regulatory values for plutonium in biosolids."¹⁷

ENDNOTES

- ¹ Resolution 575-7a, Board of Directors, Metropolitan Denver Sewage Disposal District No. 1, May 22, 1971.
- ² City of Los Angeles v. Kern County, 462 F. Supp. 2d 1105, 1107-08 (C.D. Ca. 2006); and National Research Council, “Biosolids Applied to Land: Advancing Standards and Practices,” 2-4, 205 (2002).
- ³ Metro Wastewater Reclamation District, Annual report, 1994.
- ⁴ Frank, Steve, “Metro Wastewater Reclamation District, U.S. EPA and Denver Serve Sealed Search Warrant on Suspected Polluter,” Metro Wastewater Reclamation District Press Release, May 3, 1996, and interview, Theresa Pfeifer, Metro District regulatory officer, October 29, 2008.
- ⁵ Interview, Jim Dorsch, Metro District water quality scientist, October 28, 2008.
- ⁶ Frank, Steve, “US EPA and Metro Wastewater Reclamation District Serve Sealed Search Warrant on Suspected Polluter,” Metro Wastewater Reclamation District Press Release, September 19, 1997.
- ⁷ The EPA’s granted this approval in the Second Explanation of Significant Differences in November 1997.
- ⁸ Metro Wastewater Reclamation District, “Treatment of Groundwater from Lowry Superfund Site,” fact sheet prepared December 1998.
- ⁹ Metro Wastewater Reclamation District and City of Aurora Utilities Department, Industrial Wastewater Discharge Permit

- No. I-118 issued to the City and County of Denver and Waste Management, Inc. for the Lowry Landfill Superfund Site at 3500 South Gun Club Road, effective August 1, 1999.
- ¹⁰ Metro Wastewater Reclamation District, Minutes of the Regular Meeting of the Board of Directors, June 17, 1997 and July 15, 1997.
- ¹¹ “Recycling Plutonium: How the EPA is Disbursing Toxic and Radioactive Waste from the Lowry Landfill to Sewage System and onto CO Farm lands and Public Parks,” downloaded from <http://www.democracynow.prg/print.pl?sid=-4/05/04/1420225> on June 16, 2004.
- ¹² Metro Wastewater Reclamation District, Minutes of the Regular Meeting of the Board of Directors, June 17, 1997. Comments by Lucinda Boyd and John Kalcevic.
- ¹³ 422 F.3d 1155 (10th Cir. 2005).
- ¹⁴ ARB Case No. 01-103, 2003 DOL Ad. Rev. Bd. Lexis 40, May 29, 2003.
- ¹⁵ PACE Local 5-477 et. al. v. City and County of Denver, et. al., Case No. 00CV1826, Order on Motion to Dismiss June 9, 2000.
- ¹⁶ Lowry Landfill Superfund Site Discharge Monitoring, e-mail, Steve Frank to Todd Hartman (reporter, Rocky Mountain News), April 27, 2004.
- ¹⁷ Yager, Tracy J.B., David B. Smith, James G. Crock, Effects of Surface Applications of Biosolids on Soil, Crops, Ground Water, and Streambed Sediment Near Deer Trail, Colorado, 1999-2003, Scientific Investigations Report 2004-5289, p. 9.



INTO THE NEW MILLENNIUM, 1998-2006

1998-Mending fences at the farm

India and Pakistan conducted nuclear tests in 1998, Islamic terrorists bombed the U.S. embassies in Kenya and Tanzania, and the U.S. House of Representatives impeached President Bill Clinton in a sex-and-perjury scandal.

Close to home, District Manager Bob Hite said that Metro's 1998 accomplishments had become possible because of "dedicated employees committed to excellence and because the board of directors made forward-thinking decisions." But the year was not without difficulties.¹

METROGRO Farm developments

Neighbors around Metro's farm property continued to be concerned about biosolids use on the property and soil erosion. Many of these expressions were quite vocal and included complaints that were magnified by the media. Metro employees worked on a comprehensive farm management plan to allay these concerns by looking at future erosion control measures. Elbert and Arapahoe County Commissioners, Agate and Deer Trail Soil Conservation Districts, and the Natural Resources Conservation Service helped Metro develop the plan. Several media outlets followed the story.

With input from Elbert and Arapahoe County Commissioners and interested citizens (stakeholders), Director of Regulatory

and Connector Relations Steve Pearlman and Regulatory Compliance Officer Duane Humble continued developing a far-reaching, independent monitoring program that remained in place as this book was being written.

Many times during development of the program, Humble was heard to say that the plan would not work unless it had the non-Metro stakeholders' input. The plan called for the U.S. Geological Survey to monitor, evaluate, and report on the environmental effects of the District's application of biosolids at its farm property for the next six years. The Elbert County Health Department would disseminate the monitoring information. Neighbors feared biosolids would pollute groundwater and surface waters, contaminate crops, and run off onto adjacent properties. The third-party monitoring plan, replete with stakeholders' input, was implemented in 1999.

Relationships with Deer Trail area residents and the Elbert County Commissioners improved during the year, both because of the monitoring plan and because Metro worked to hear and address their complaints and fears. In April, the Elbert County Commissioners passed a resolution completely lifting the cease-and-desist order they had issued in June 1997.

Soil erosion concerns

The Resource Recovery and Reuse (RR&R) Department, together with the District's tenant farmer, continued to address soil erosion

This 1999 photo shows the North Complex of Metro's Central Treatment Plant in the foreground at sunrise, with downtown Denver in the background.

concerns on the District's farm property. Approximately 16,000 acres were planted in winter wheat, and another 3,000 acres were planted in corn, millet, barley, and sudex. In previous years, the only crop grown on the property had been winter wheat.

Planting a variety of crops provided vegetative cover throughout the year that helped stabilize the soils and make them less susceptible to wind and water erosion. By September, the tenant farmer had constructed diversion structures to protect waterways that affected 4,200 acres.

Metro purchased two sections of property located at the southeast corner of the north property from the Kissler family. Metro planned to exchange these two sections plus two other sections for state-owned property in the District's south property to remove "islands" of non-Metro-owned property from Metro's property. The exchange was to take place in 1999.



Engineer Eric Jenkins (left) and Regulatory Compliance Officer Duane Humble check erosion at one of the ephemeral creeks on Metro's farm property in this 1998 photo.

Good neighbor demo

To help demonstrate its determination to be a good neighbor, the District agreed with Arapahoe County in 1998 to address road deterioration and to control dust on County Roads 217 and 34. These two roads were the primary access roads Metro used to reach the Deer Trail property.

The asphalt surface on County Road 217 had deteriorated significantly as a result of District truck traffic. Dust control for residences was a problem on County Road 34, which was then a gravel road. Approximately 1½ miles of road improvements were completed in 1998. Negotiations with Arapahoe County were set to begin in 1998 or early 1999 to plan the next phase of the road improvement project. About seven miles of County Road 34 were eventually paved.

Metro began groundwork at the farm in November to build five grain bins, fuel and chemical containment facilities, and a storage facility in 1999. Earlier in the year, three modular units that had served as offices and meeting rooms at the plant were moved to the farm property to provide staff with offices, rest rooms, a lunch room, a meeting room, and protection from severe weather.

Lowry pretreatment permit

Meanwhile, Pretreatment Division staff worked on an industrial waste pretreatment permit under which Metro would allow groundwater that would be treated on-site at the Lowry Landfill Superfund Site to come to Metro for further treatment. Allowing the treated groundwater to come to Metro was to be part of the District's settlement with the EPA over Metro's liability as a so-called "potentially responsible party" in the Lowry Landfill

Superfund Site clean up. The EPA had amended its Record of Decision as to the remedy in 1997 to allow Metro to treat the pretreated Lowry Landfill Superfund Site groundwater.

Mine tailings remediation project near Leadville

The Metro District participated in 1998 in a successful EPA mine tailing remediation project near Leadville, Colorado. In a demonstration of the beneficial use of biosolids, Metro provided 920 dry tons of biosolids and 140 tons of compost that were incorporated into about seven acres of land just south of Leadville.

The land had been badly contaminated by mine tailings during Leadville's heyday as a mining center. Leaching metals salts, the absence of nutrients, and acidic mine tailings deposits had prevented vegetation from growing along the banks of the Upper Arkansas River. The result: bank erosion and a contaminated river. The EPA asked the District to provide biosolids to help establish a soil horizon where vegetation could take hold. The vegetation would then stop or reduce erosion and keep the Arkansas River from transporting heavy metals.

Experience at contaminated mine sites in Poland and Pennsylvania had shown that biosolids could help tie up metals salts and increase metal ion absorption. The organic matter and nutrients in biosolids also provided a medium to establish a vegetative cover, thereby reducing soil erosion. Within weeks of completing the project, vegetative cover was evident for the first time in many years.

National Biosolids Partnership

District Manager Robert W. Hite served as the first chairman of the National Biosolids Partnership Management Committee. The Partnership, formed by the EPA, the Association

of Metropolitan Sewerage Agencies (AMSA), and the Water Environment Federation (WEF) in 1997, included representatives from all three organizations and promoted environmentally sound biosolids projects and programs.

For the seventh time in eight years, ASMA honored the Metro District with a Gold Award. This award was a tribute to Metro employees' dedication to protect and improve the environment.

Financial position

The Metro District was in the strongest financial position it had ever experienced. The District reported year-end net revenues over expenses of approximately \$1,786,000



RR&R Operations Specialist Nate Nigon, shown here on one of the three Leadville sites, was one of the many RR&R employees who helped out on the mine tailings revegetation project in 1998.

favorable to budget. Hite reported that the District's expenses and staffing levels continued to be among the lowest in the country for agencies of comparable size, population served, levels of treatment, and volume of wastewater treated.

Metro's staff implemented an innovative long-term fixed asset replacement program to ensure that adequate funds were available to replace aging facilities. The board had authorized an initial deposit of \$6 million from the General Fund in 1997 to establish the Fixed Asset Replacement Fund and committed to an annual contribution of \$3 million until staff developed a fixed asset replacement schedule during the next 2 to 3 years.



Transmission Division employees repair asphalt around a manhole they have just repaired in this 2000 photo.

Annual charges for service were 5.5 percent lower than in 1997, and projections indicated annual charges would remain low for some time to come. This level of expense was unprecedented and placed the Metro District in a unique position nationwide.

Influent flows and loadings

The influent flows and suspended solids loads had increased from the early 1990s, when loadings leveled off for several years. The higher loadings were attributed to residential, business, and commercial growth in some parts of the District's service area.

Wastewater Treatment Summary			
	1996	1997	1998
Wastewater Treated (million gallons per day)	146	154	165
Influent Suspended Solids (tons per day)	136	143	146
Influent Biochemical Oxygen Demand (tons per day)	131	137	130

Weather-related challenges

Vandalism and intense rainstorms on July 24-25 caused several sections of the Sanderson Gulch Common Interceptor to fail. Wastewater backed up into two homes and caused extensive damage to basements and homeowner belongings. The District retained a contractor to replace the failed pipe, and District personnel helped the homeowners clean up and restore or replace damaged walls, carpets, furniture, and personal items. Smaller

amounts of wastewater from the same storms backed up into five homes along Branch 43 of the District's Bear Creek Interceptor.

At the plant, the two storms also washed large amounts of sand down the Sand Creek Interceptor. The bar screens in the South Complex became plugged and almost shut down. O&M crews managed to get one bar screen in service before any wastewater spilled over the influent channel walls.

Crews work the problem

"It was a constant battle to keep the bar screen open," said Plant Operator Penny Payne, who was at the plant that night with fellow Plant Operator Les Brunner and others from the Operations, Maintenance, and Transmission Divisions. She recalled the incident: "The area in front of the bar screen threatened to overflow. Everybody was at the headworks... all night."

Payne, the first woman to become a plant operator at Metro, said when the event was over: "We were all thinking, 'We did it!' Things like that pull people together."

During inspections after the event, transmission crews were not able to find any washed out or damaged pipeline along Sand Creek, and the source of the sand was also never found.

Public Service Company of Colorado (PSCo) also experienced operational problems during the hot summer weather that resulted in numerous power outages. Most were brief and did not result in any permit violations by Metro. The Administration Building, however, was affected by PSCo's rolling blackout program.



Volunteers work to pull an old tire from the South Platte River during a 1998 river clean-up event that Metro helped host.

Computerized maintenance management system implemented

District staff successfully implemented a Computerized Maintenance Management System (CMMS) in March. Sixty-three users in Maintenance, Operations, Resource Recovery & Reuse, Warehouse, Purchasing, Laboratory Services, Office Support, Finance, and Engineering connected to the system, supplied by Datastream Systems, Inc.

Metro's maintenance employees used the CMMS to write work orders, issue preventive maintenance schedules, order parts from the warehouse, plan and schedule the maintenance work, and record the history and cost of the work. The Purchasing/

Warehouse Division used the system to automate ordering, receiving, inventorying, and distributing parts. The CMMS—for the first time—was integrated with Oracle Financials, the software the District used for budgeting, accounting, and purchasing functions.

Metro maintenance crews completed piping and pumping improvements in March that allowed operations employees to pump 100 percent of the grease and scum to the anaerobic digesters. These improvements eliminated the cost of hauling the grease to an out-of-state processor and saved the District \$265,000 annually.

Effluent pH permit amendment

For most of 1998, operations crews adjusted the pH of the effluent by adding sodium carbonate to it before it was discharged to the South Platte River. The chemical adjustment kept the pH of the effluent at or above 6.5, which was the permit requirement. Regulatory & Connector Relations staff worked for and got an amendment to the District's discharge permit that included a temporarily lower pH limit. The amendment became effective in November and allowed the District to discontinue adding sodium carbonate while it investigated the effectiveness of flow equalization ponds to increase effluent pH. Operations then discontinued the chemical adjustment, saving the District \$14,000 a month.

Cogeneration alternatives project

Metro's electrical power sale agreement with PSCo was set to expire in April 2000, and District staff continued to look into alternatives to operating the cogeneration facility. The District published a request for proposals, asking respondents to address



By 1998, data from the first drop structure (upstream of 88th Avenue) were beginning to accumulate to help in planning other structures downstream.

eliminating biogas (methane) without flaring it, providing hot water to heat the digesters, having reliable service, complying with air quality requirements, and generating a return on District investments. Four proposals were received and evaluated. The study schedule called for staff to make a recommendation on the operation and maintenance of the cogeneration facility to the board in early 1999. Trigen-Colorado Energy Corporation eventually won the right to operate the facility.

Segment 15, South Platte River

Design of Phase II of the stream channel improvements on Segment 15 continued. This phase of the project covered the reach between 88th Avenue and the Brantner Ditch diversion structure.

The improvements were to enhance stream reaeration. The goals were to meet dissolved oxygen standards, reduce losing fish from the river to irrigation diversions, and enhance boat passage.

Design was scheduled to be complete in August 1999, and substantial completion was to be achieved by December 2000. The estimated project cost for Phase II was \$6 million. Phase III improvements, between the Brantner Ditch and Brighton Ditch diversion structures, was underway. It was anticipated to be completed by the end of 2000.

Near year end, Metro issued a contract to investigate the feasibility of providing partial South Complex nitrification facilities to the Denver Water Department as part of their reuse project. It was thought that the proposed facilities could be located at the Central Treatment Plant and that Metro District staff would operate and maintain them.

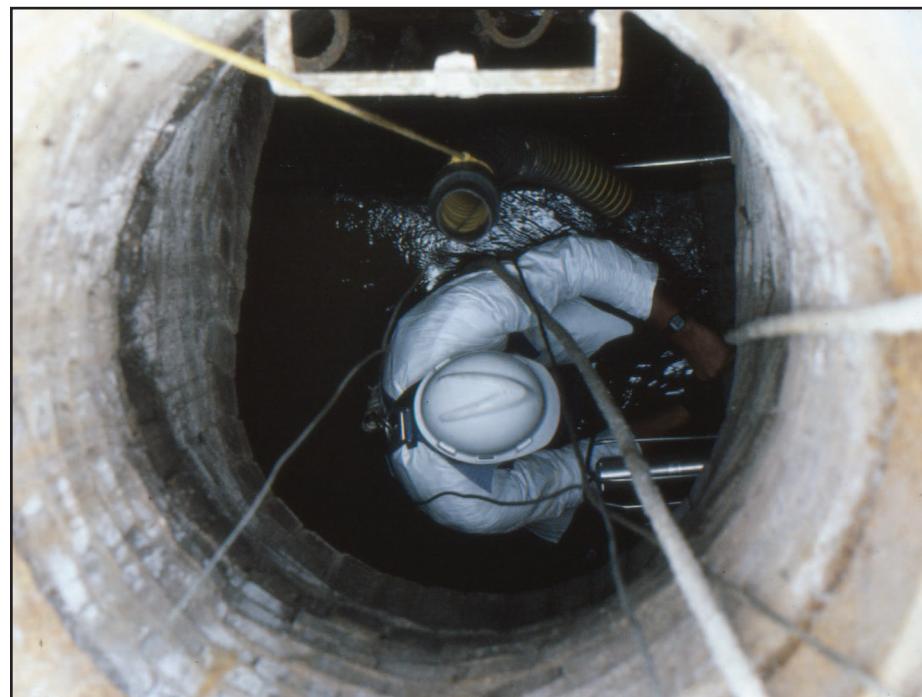
Construction was completed and pilot testing was initiated at year end on a one-million-gallon pond to pilot-test the rate of nitrification of effluent from the South Complex. This work was also a requirement of the Memorandum of Understanding with the regulatory agencies. The test results showed natural nitrification not to be dependable enough to assure permit compliance.

Treatment process

Design began in the spring on a \$10 million project to improve the Central Treatment Plant medium- and low-voltage electrical systems. Design was scheduled for completion at year end 1999, and construction was to be completed over a three-year period. Reconfiguring the plant's electrical distribution system was part of this project. It would improve Metro's Year 2000 (Y2K) readiness.

Construction was completed on \$2 million in improvements to the South Primary bar screens and grit removal facilities. The work included installing four new bar screens, two new shaftless screw conveyors, two new hydraulic screening compactors, new grit collection mechanisms, a new grit pumping station and a major overhaul of electrical and HVAC systems.

In January, construction began on \$2.5 million in improvements to the Solids Processing Building. The work included adding a new polymer system, a backup solids conveyance system, and miscellaneous building improvements. Construction was completed in June 1999.



In this 1998 photo, a Transmission Division employee enters a manhole.



In 2002, during a rehabilitation of the Sanderson Gulch Interceptor, temporary above-ground pipe was laid in the gulch to facilitate the work.

Interceptor system

Design of major improvements to the Sanderson Gulch Common Interceptor was completed in November 1998. The \$4 million project included rehabilitating or replacing about 22,000 feet of an 8- to 24-inch diameter sewer that was mostly constructed in 1952. The design provided for tunneling under a radium site found along the sewer alignment to minimize the amount of contaminated soil likely to be disturbed. Construction completion was scheduled for August 2000.

Design was completed in November on modifications to the Brantner Gulch Lift Station. The work, costing just under \$1.2 million, included adding a pump and major electrical system modifications.

Construction of Section 2 of the Sand Creek Parallel Interceptor was completed in June for the cost of \$1.8 million. It consisted of 5,400 feet of 42-inch and 60-inch pipe running west from the Aurora Sand Creek Treatment Plant.

The Cherry Creek Common Interceptor Rehabilitation Project was about 90 percent complete at the end of 1998. The work included 7,300 feet of cured-in-place liner, 7,700 feet of slip liner, and rehabilitating 44 manholes with calcium aluminate mortar. The cost was \$1.6 million.

Support facilities

Remodeling and expanding what had been the Administration Building was completed in mid-1998. It was renamed the Technical Services Building. The construction contract was \$5.5 million, and the project took nearly three years to complete because the lab

had to continue to operate during construction. Not one day of laboratory production was lost. What had begun as a small, one-story administration building had become the TSB, which housed the Laboratory, Information Services, and training facilities.

Department head change

In November, Barbara L. Millett was named the director of the RR&R Department. She and Marvin Webb had previously shared department management responsibilities.

1999—Getting ready for Y2K

In world events for 1999, U.S. President Bill Clinton was acquitted in an impeachment trial in the Senate. Closer to Denver, two Colorado teenagers killed 13 people and themselves at Columbine High School in Jefferson County, Colorado.

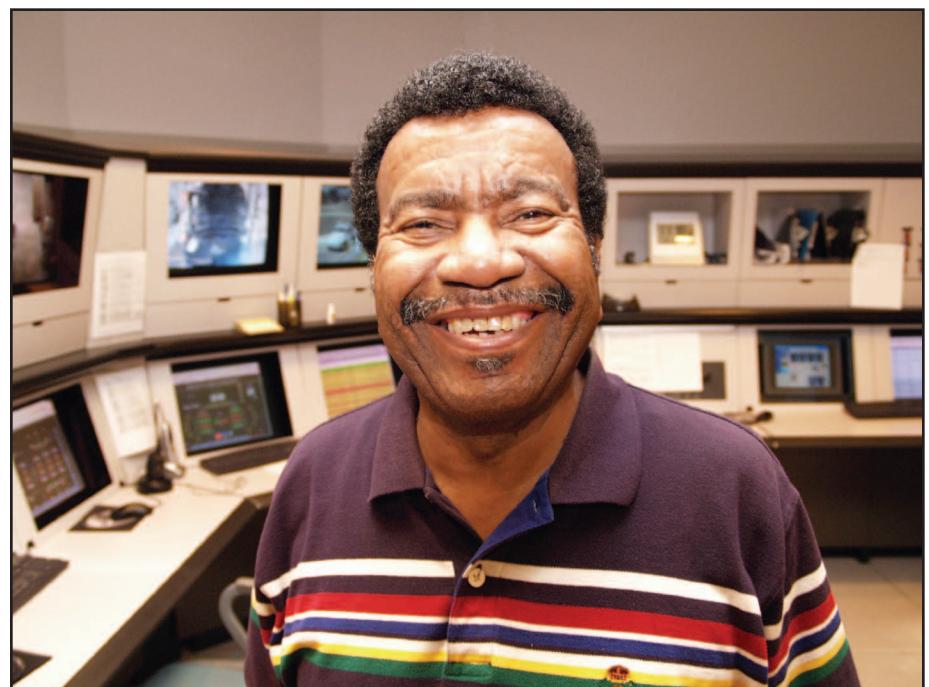
Meanwhile, 1999 was the year of getting ready for Y2K (the year 2000) at the District. By the beginning of the year, prognosticators had speculated broadly on what would happen when 11:59:59 p.m. on December 31, 1999, rolled over to become 00:00:00 a.m. on January 1, 2000. Pundits postulated that older computers, created when January 1, 2000 had been a very long time in the future, would not be able to handle the date change.

Fears were rampant that computers that controlled one or two functions and were imbedded deep within various machinery would go haywire when the date rolled over. Disaster would ensue, the doomsayers cried.

The 1999 workloads of Operations and Maintenance, Engineering, and Information Services were dominated by preparations for Y2K. Work included installing 21,750 feet

of high-voltage cable, reconfiguring control wiring in all three of the Central Treatment Plant's electrical substations, installing a new 15KVA transformer at the Cogeneration Building, modifying the methane engine generator controls, and installing a new 1,000 kw diesel generator. Substantial work was required to evaluate and perform necessary modifications on more than 150 software applications used at the District.

All hardware, including personal computers, servers, and network equipment, was evaluated for compliance and upgraded or replaced as appropriate. District staff, together with outside consultants, performed evaluations and modifications on plant



Plant Operator Floyd Bolen retired at the end of 2006 with 30 years service. He is shown here in the control room, from which plant operations are controlled.

equipment, control systems, and building facilities to ensure compliance. This included identifying the possible effects of Y2K problems in embedded chips throughout the District.

Midnight approaches...

When 11:59:59 p.m. on December 31 rolled around, a full complement of staff from a variety of disciplines was in place at critical locations throughout the plant. The atmosphere was tense.

Dick Keasling, a now-retired electrical maintenance supervisor who started at Metro on June 28, 1977, was one of those on duty at the plant that night, waiting to see what surprises midnight might bring. He was in charge of power distribution. He said the electricians had “islanded” off part of Metro’s plant from the Xcel power grid and were running it on power from the cogeneration facility (cogen).

As midnight approached, Keasling, a former Marine, said, “I was out there with some of my people and the president of NEI (an electrical engineering consultant). We were sitting in cogen on one of the tables, swinging our feet, swapping sea stories, and watching everything run as smoothly as it had ever run.”

Then he chuckled. “The thought crossed my mind to cut the feeder breaker for the second floor of the Process Control Building at midnight to scare the department heads and supervisors that were sitting there watching TV. But discretion became the better part of valor,” he said.

Midnight came. Then 12:00:01 a.m., 12:00:02 a.m. Nothing out of the ordinary happened. The minutes ticked by, and the transition to 2000 came and went uneventfully. With only a



Treatment Superintendent Steve Walker and the gas turbine-powered cogeneration system in 2003.

couple of minor reporting exceptions, the District incurred no Y2K-related problems.

Trigen and cogeneration

Throughout 1999, District employees were busy with a variety of projects.

Trigen-Colorado Energy Corporation got the nod to operate the cogeneration facility, and Operations & Maintenance worked with them to prepare for a smooth turnover of the facility to them in 2000 and to reduce cogeneration personnel, parts, and maintenance costs for 1999. In April 2000, the Metro District

signed an agreement for Trigen to convert the District's methane biogas into low-cost electricity. Under the 20-year contract, Trigen was to modernize, operate, and maintain the existing five-megawatt cogeneration facility and provide electricity to the District.

The District retained ownership of the facility, paid Trigen an operating fee, and supplied Trigen biogas from the digesters to fuel the engines that generated the electricity. The District planned to use the electricity to power a portion of its plant. Trigen planned to install new gas turbines to convert the biogas to electricity and maintain the existing equipment for back-up power.

Purchasing and Maintenance analyzed the parts inventory to see whether on-hand spare parts and equipment could be reduced. Targeting a potential 20 percent stock reduction, Maintenance successfully identified about 2,000 items (13 percent), valued at about \$640,000 that could be deleted or reduced in quantity.

Risk Management Plan

Regulatory & Connector Relations staff developed, evaluated, modified and documented the Metro District's Risk Management Program (RMP). It was submitted to the EPA before the June 21, 1999, deadline. The 1990 Clean Air Act Amendments compelled Metro to develop a risk management program to increase safety to the public with regard to hazardous chemicals. The program was required for facilities that housed more than a threshold amount of certain hazardous chemicals.

Metro had more than the threshold amount of both chlorine and sulfur dioxide. Metro used chlorine to disinfect the wastewater and sulfur dioxide to dechlorinate the water prior to discharging it to

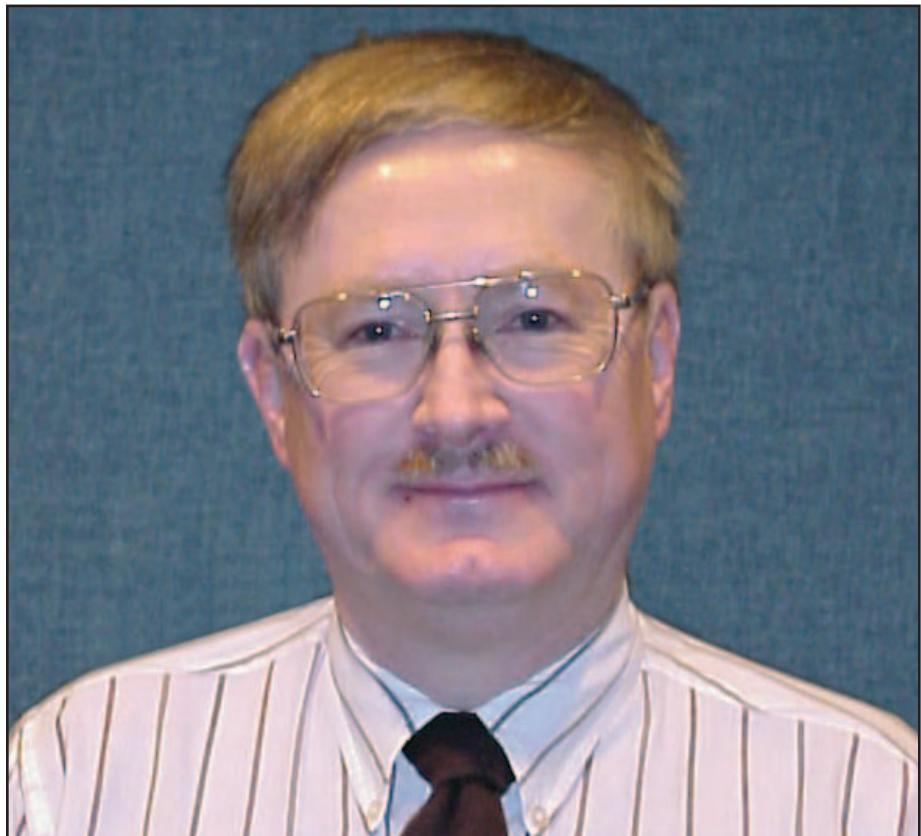


Water Quality Officer Dr. Todd Harris won an EPA watershed protection award in 1998.

the South Platte River. Staff also participated in RMP activities with local agencies and produced brochures and a video for presenting project information to the public to inform them of the program.

National Biosolids Partnership (NBP) gap analysis

Metro participated in a pilot gap analysis of a prototype Biosolids Environmental Management System in January to help the



Governmental Officer John Van Royen won an EPA watershed protection award in 1998

NBP gain practical perspective and examples of functioning biosolids management systems. The results showed the District consistently and effectively followed many of the environmental management practices for biosolids and appeared to be one of the top organizations in searching out and implementing best practices.

The Government Finance Officers of American awarded the Metro District its 11th consecutive Certificate of Achievement for Excellence in Financial Reporting for the year ended 1997.

The Metro District completed construction of a chemical mixing/containment structure on the METROGRO Farm's south property and a fuel pumping and containment facility on the METROGRO Farm central property. Metro also completed construction of five grain bins (174,000 bushel capacity) and a storage building on the METROGRO Farm central property. Construction of a truck scale on the west side of the METROGRO Farm central property was also completed.

Soil conservation

Metro entered into a cooperative agreement with the Agate Soil Conservation District in September to construct terraces over approximately 25 acres of District property located in Elbert County. Metro and the conservation district believed the terraces would reduce soil erosion from blowing during severe winds and minimize soil loss due to water run-off during severe storms. It was the first time the two organizations had worked together to solve a common problem. In other farm-related activities, the Metro District completed improvements to an existing roadway bridge on the METROGRO Farm South property.

The EPA presented both Governmental Affairs Officer John Van Royen and Water Quality Officer Todd Harris the 1998 Watershed Protection Award for Exemplary Service to Segment 15 of the South Platte River. Van Royen and Harris received the awards for their contributions to improving the total quality of the South Platte River environment.

The Metro District recognized 18 industrial dischargers in April for 100 percent compliance with pretreatment requirements at the annual Gold Awards presentation.



Laboratory employees Chandra Worsham, Shian Kung, Molly Castleberry, and Glen Jones discuss a problem.

In May, the District Manager received the AMSA President's Award for his significant contributions towards achieving the organization's goals and objectives. The GFOA awarded the Metro District its fourth consecutive Distinguished Budget Award for the 1999 budget.

Industrial waste discharge permit issued to the Lowry Superfund Site

The Metro District and Aurora issued an Industrial Waste Discharge Permit to the Lowry Superfund Site, effective August 1, 1999. The final permit was modified to incorporate

some of the comments received from the 43 respondents during the public comment period, which ended mid-December 1998. A Responsiveness Summary report was released in June 1999 that identified all comments received and the modifications incorporated in the final permit.

District Manager Bob Hite was elected to the Mountain States Employers' Council, Inc. (MSEC) Board of Directors as its first public sector appointment. MSEC is a non-profit membership organization serving approximately 2,100 employers. Additionally, the Rocky Mountain Minority Supplier Development Council named the Metro District its Corporation of the Year. This award recognized Metro for its leadership in the economic development of minority business in the community.

Lab awards

The Rocky Mountain Water Environment Association (RMWEA) awarded Senior Laboratory Supervisor Molly Castleberry its Laboratory Analyst Excellence Award. RMWEA also honored Metro with its 1998 Award of Merit in recognition of an excellent safety record in the wastewater industry for zero lost time accidents in 1998.

The EPA selected Metro's laboratory as one of 20 in the United States to participate in the nation-wide EPA Whole Effluent Toxicity Test Methods Interlaboratory Variability Study.

Stream channel improvements

In October, Metro completed design of the next phase of the stream channel improvements on Segment 15 of the South Platte River. This phase addressed dissolved oxygen improvements for

the reach of river between Fulton Ditch and the Brantner Ditch diversion structures. The design included one new drop structure to enhance stream reaeration and raise dissolved oxygen levels. Some additional work was done near 88th Avenue to improve boater safety and reaeration. Construction was scheduled to begin in early 2000, and the estimated cost was \$4 million.

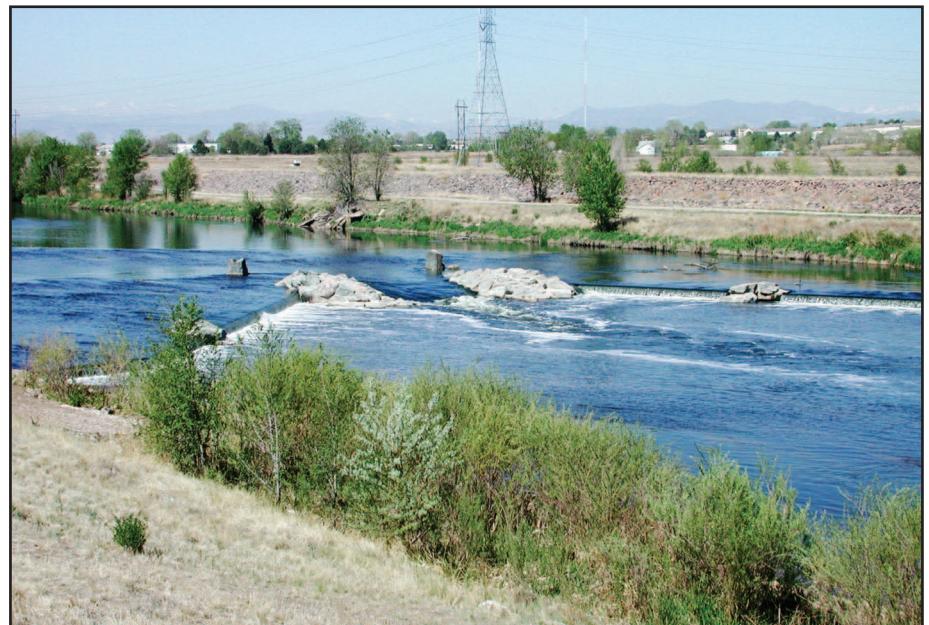
Records Management resumed the systematic destruction of inactive records that had met their prescribed legal and operational retention times. Because of ongoing litigation, the destruction had been suspended for almost a decade.

Based on an agreement with Arapahoe County for major road improvements to reduce dust and improve safety on County Roads 217 and 32, the second phase of a proposed three-phase project was well underway in November. It was scheduled to be completed in March 2000. Improvements by Arapahoe County included road widening, installing new culverts, reducing crests and valleys, and asphalt paving. The improvements were expected to cost \$1.8 million.

Metro substantially completed modifications to the Brantner Gulch Lift Station in December. The project, which cost just over \$1.2 million, included adding a new pump and major electrical modifications, including a new backup generator.

2000—Metro welcomes the new millennium

The world celebrated the new millennium; scientists announced the milestone mapping of the human genome; and the Russian nuclear submarine Kursk sank in the Barents Sea, killing all 118 crewmen aboard.



The first drop structure was installed about 4,000 feet upstream of the 88th Avenue Bridge over the South Platte River to help improve dissolved oxygen levels.

Major news at Metro was the Pretreatment Division winning, for the second time in four years, the EPA's first place award for the best industrial waste pretreatment organization in the country managing 51-100 industrial dischargers. Also, the District received the AMSA Platinum Award for 100 percent compliance with its discharge permit for five consecutive years.

All was not roses for Metro, however, as a section of high-density polyethylene pipe collapsed in a manhole in the Weir Gulch Interceptor in southwest Denver on January 15. The collapse resulted in between 200,000 and 250,000 gallons of wastewater being discharged into Weir Gulch. Metro quickly notified downstream agencies that could potentially be

affected, and the event became a major news item in Denver for the entire Martin Luther King Jr. holiday weekend.

Transmission responds quickly

The Transmission Division stopped the sewage spill within hours of its discovery that Saturday afternoon. It then made a repair overnight and cleaned up the spill site Sunday morning. Water quality monitoring by District employees indicated the wastewater did not reach the South Platte River. The concentration of fecal coliform bacteria that came down Weir Gulch into Barnum Park Lake was substantially reduced by dilution and cold temperatures in the lake. Kudos went to employees in the Transmission Division, Laboratory Services, and Regulatory & Connector Relations for their timely and effective response to the emergency.

Following the pipe collapse, Metro employees inspected all the manholes on the Upper Weir Gulch Interceptor during January and February and determined that 51 of the 61 manholes showed various degrees of hydrogen sulfide corrosion. Western Slope Utilities was awarded a contract for the rehabilitation.

Metro employees, Black & Veatch, and Western Slope Utilities mobilized quickly for this project, worked with area neighbors to avoid complaints during construction, completed the work without any sewage spills, and identified the most cost-effective, efficient rehabilitation methods for each manhole. The repair work was completed almost 30 days ahead of schedule and well within budget.

Northglenn pump station failure

On February 3, 2000, Northglenn (not a Metro connector) had a catastrophic failure of its pump station. The entire lift

station was flooded with raw sewage. As a result, 2,000 gallons of sewage were discharged to Grange Hall Creek. Under the Metro District's rules and regulations, indirect emergency service was authorized to Northglenn through the Thornton/Northglenn Interconnect. Without the emergency service, nearly four million gallons of sewage would have flowed into the creek. By February 6, Northglenn was able to get one of its pumps working and stopped sending its sewage through the interconnect.

Steve Frank, the District's public information officer, was awarded first place in the Water Environmental Federation's member photo contest for submitting the best overall photograph entered in the competition. He also received recognition for four other winning photos: two of clarifiers, one of a mountain creek, and one of compost piles.

Sludge Processing Building improvements

The District's Sludge Processing Building Improvements Project, with Burns & McDonnell as the engineering consultant, won the national award in the Support Systems category from the American Consulting Engineers Council (ACEC). The ACEC award had been given in annual design competitions on a state and national level for 31 years to recognize engineering achievements that demonstrated the highest degree of merit and ingenuity. The improvements were designed to extend the life of several support systems to the biosolids dewatering process and allow for incremental additions to accommodate growth.

Metro hosted a National Biosolids Partnership (NBP) meeting to address the Environmental Management System (EMS) Demonstration Program on March 29, 2000. At the

meeting, a District EMS Team was established to work on this project. The EMS blueprint was expected to be completed in July 2000, and was to include a set of standard procedures or steps that biosolids professionals could use as tools to demonstrate to their communities a commitment to go beyond simply meeting regulatory requirements and improve their environmental performance.

The NBP was set to launch a national EMS training workshop in early September for the 25 organizations then participating in the EMS Demonstration Program and other interested parties. The national workshop's focus was to roll out and test EMS documents and to select the elements of the



This photo shows the biosolids cake storage tower and the sludge processing building as they appeared in 1999.

independent, third-party verification program. The final EMS blueprint was to be formally adopted in October 2000.

The March/April 2000 issue of *Government West* published District Manager Bob Hite's article entitled "Building Financial Strength." The article provided a broad overview of the District's comprehensive planning program. It also addressed how successful automation and computerized maintenance management had been critical in reducing costs and improving performance.

Pretreatment program modified

The District modified its Pretreatment Program to include the Hauled Wastes Program in 2000 and so notified the EPA. This modification did not involve any changes to the District's rules and regulations or operation of either of the programs. It was strictly a submittal to the EPA to incorporate the two.

Including hauled wastes in the Pretreatment Program gave Metro some enforcement power for its hauled wastes monitoring, and the change was expected to benefit the District. In addition, it granted the EPA oversight authority for that program. Metro had not previously had enforcement power related to hauled wastes.

EPA claims Metro Sanitary Sewer Overflow violation

On June 9, 2000, the EPA notified the District and the Water Quality Control Division of the Colorado Department of Public Health and Environment (CDPHE) that the District had violated its National Pollutant Discharge Elimination System (NPDES) Permit as a result of sanitary sewer overflows (SSOs) on at least 10 occasions from June 6, 1997 through January 15, 2000. EPA asked CDPHE to inform it of any enforcement action taken by CDPHE in this matter.

Of the ten SSOs that were cited in the EPA notice, with only one exception, none were the result of inadequate operations and maintenance or from inadequate sanitary sewer capacity. One SSO was almost certainly not a District event, another was clearly the result of intentional vandalism, and seven were the direct result of construction activities in the interceptor system. The exception was an SSO of approximately 100,000 gallons that resulted from an operations error, and Metro established procedures to prevent that kind of error from happening again. In every instance, the District responded immediately to mitigate any negative impact of the SSOs.

In August, the CDPHE notified the District that it would not seek civil penalties in this enforcement action against the District for the SSOs. Staff had negotiated a draft Compliance Agreement with CDPHE. It included a compliance schedule that required the District to complete an independent review of its interceptor sewer inspection program and complete the inspection of most interceptor sewers by December 31, 2006. The Compliance Agreement was sent to the EPA for review and approval, and Water Quality Control Division staff expected to receive comments on the draft agreement sometime later in the year.

Basic Standards Hearing

The Colorado Water Quality Control Commission held a Basic Standards Hearing in July to address water quality proposals from Farmers Reservoir and Irrigation Company (FRICO), Thornton, and various proposals from the Water Quality Control Division. FRICO and Thornton had proposed new numeric standards for nitrates, fecal coliforms, total phosphorus, and total organic carbon. The proposed standards were significantly more stringent than

then-current standards. They would have been very expensive and unreasonable, would have provided minimal (if any) environmental or human health benefit, and would have significantly impacted the District's operations. Based on the efforts of District staff and a number of other dischargers, industry representatives, and municipal water suppliers opposing the proposals, the Commission rejected all of the Thornton and FRICO proposals.

An apparent leak in a scum line at the Central Treatment Plant caused some soil to be slightly contaminated in the area where the leak occurred. Surface and groundwater were not affected. The contaminated soil was removed to an area near the Compost Facility where it was stored and dried. It was taken to the METROGRO Farm in accordance with state and federal biosolids regulations. Because no surface water or groundwater was affected, it was not necessary to report this spill to the CDPHE and the EPA.

Groundwater discharge from Lowry Superfund Site begins

Denver and Waste Management Inc. (collectively known as the Denver Trust) began discharging highly treated groundwater from the Lowry Superfund Site to the Metro District's Central Plant on July 25. The discharge was delayed temporarily by a lawsuit brought in April 2000 by PACE (formerly OCAW, the union representing Metro's laboratory employees), two farmers living near Metro's property, a student, and others who sought to stop Metro from treating the groundwater from the Lowry Landfill site. The suit was filed in Denver District Court. It was dismissed because the state court lacked jurisdiction to hear the case and the plaintiffs failed to join necessary parties in the lawsuit.

In the meantime, Denver and Waste Management fulfilled all the start-up requirements in their discharge permit. The Denver Trust had installed an aggressive, ongoing sampling and analysis program to ensure discharge permit requirements were met. In addition, the District, as discharge program overseer, was also to analyze samples, and the U.S. Geological Survey would sample and analyze to provide an independent, third-party verification. If the permit requirements were not met, the District had the authority to stop the discharge.

When operation of the cogeneration facility was transferred to Trigen, it was the first (and only) outsourcing of a major treatment process by Metro.

Although not part of his job responsibilities, Chief Construction Engineer Arne Holst reviewed Public Service Company of Colorado utility bills for April through July 2000 and identified a miscalculation that resulted in the District receiving a rebate of \$80,000. The miscalculation had occurred during the transition of the cogeneration facility.

Sixth GFOA award

For the sixth consecutive year, the District received the Government Finance Officers Association of the United States and Canada's Distinguished Budget Presentation Award for its current budget.

On a Saturday in late September, the District joined Adams County Parks Department, Urban Drainage & Flood Control District, the cities of Brighton and Commerce City, and the Greenway Foundation for the eighth annual Adams County River Sweep. More than 100 volunteers helped pick up trash and other items along the South Platte River Trail.



Drex Disbrow (on ground), Rudy Castro (on step), and Jim Smolinski, all of RR&R, pause in the field in the early 1990s with their TerraGator spreader.

2001– International Union of Operating Engineers votes for ‘open shop’

George W. Bush was inaugurated as president, and a U.S. Navy EP-3B electronic intelligence aircraft and a Chinese fighter jet collided in mid-air. Meanwhile, terrorists hijacked four U.S. airliners, crashing two into the World Trade Center in New York, one into the Pentagon in Alexandria, Virginia, and one into a wooded area in western Pennsylvania.

Members of the International Union of Operating Engineers (IUOE) Local No. 1 at Metro voted in March for an open shop that would allow individual employees to decide if they wished to join the union or not. Following the vote in favor of an open shop, the IUOE notified its members at Metro that it would no longer represent District plant and field employees. Local No. 1 had represented Metro employees since 1970.

At Metro, the board of directors adopted revisions to the Capital Financing Policy to provide for cash funding from the General Fund Capital Project Account for all improvement and growth-related projects or portions of projects, and cash funding from the Fixed Asset Replacement Fund for all replacement projects or portions of projects. These revisions replaced the then-current cash funding policy which was based on project dollars and asset life with a policy based on type of project only.

In June, following the retirement of Harry Harada, Shian-Shien Kung was appointed director of Laboratory Services. In December, Mitch Costanzo was appointed director of Resource Recovery and Reuse to succeed the retiring Barbara Millett. Steve Rogowski was appointed to succeed

Mary Ann Tavery as director of Operations & Maintenance. Tavery had announced she would retire in March 2002.

Routine records destruction

The Records Management Division, the Information Services Division, and several other departments and divisions implemented a new standardized directory structure and developed practices for classifying and copying electronic documents into electronic file repositories. Working with District legal counsel, Records Management began incorporating electronic records into the annual systematic destruction of inactive records. In November 2001, the District’s updated Records Retention and Disposition schedule became available on the Intranet.

The roof of Sludge Holding Tank No. 2 was damaged in January as a result of accumulated foam in the tank. The repairs were completed approximately three weeks ahead of schedule and within budget. During the entire repair period, the Metro District remained in compliance with the 503 Regulations. As a precautionary measure, and for a few days thereafter, Metro took some biosolids to a landfill because of a concern that they might not have met the pathogen destruction requirements in state and federal regulations.

Metro completed repairs on Digester No. 4, which suffered a roof failure in December 2000 when large amounts of foam over-pressurized the structure. No regulatory violations occurred while the digester was out of service.

In other biosolids-related activities, Thomas H. Thompson, Jr., the District’s lease farmer at the METROGRO Farm, died in January.

His son, Thomas H. Thompson III, continued farming operations. Construction work was completed on the METROGRO Farm north internal road. The one-mile project eliminated access problems on the north property and improved safety.

The National Biosolids Partnership (NBP) launched its biosolids Environmental Management System (EMS) in February. The District participated with approximately 25 other POTWs (publicly owned treatment works) in this initial effort to develop an EMS to serve as a nationwide blueprint for POTWs and the way they manage biosolids.



This summer 2005 photo shows the 17 acres of composting buildings on the south end of the Metro District's property.

In March, for the first time in the Metro District's 35-year history, its employees achieved one million man-hours without a lost-time accident.

Rules and regs change adopted

Metro's board adopted amendments to Sections 5 and 6 of the District's Rules and Regulations, primarily to make the administrative changes related to combining the hauled waste and industrial pretreatment programs, and to expand the authority of the District to levy penalties against connectors for violations of the provisions of Section 6. The amendments were approved by the EPA on August 9, 2001.

The Government Finance Officers Association of the United States and Canada awarded the Metro District its seventh consecutive Distinguished Budget Presentation Award.

Metro approved a Memorandum of Understanding for sharing additional ammonia conversion facilities between the Metro District and Denver Water in April. The agreement was aimed at saving both utilities money since both utilities needed to remove ammonia from the water.

Metro purchased two Volvo L150D articulated front-end loaders to be used for composting and as backup to the loaders at the METROGRO Farm. Metro also purchased two replacement Ag-Chem Terra-Gator biosolids side-discharge spreaders.

The routine biannual reapportionment of the Metro District board of directors resulted in the number of directors increasing from 60 to 66.

Laboratory Services, underwent an audit by CDPHE that included parallel sampling. No discrepancies were found.

Electronic forms on Intranet

Information Services went live with a new District-wide intranet. It included electronic forms to help reduce paper use.

Metro adopted the Riverdale and Thornton-North Washington Force Main Expansion Study as the management plan for future improvements to the force main and lift station.

The district manager set up a Working Better Together group coordinated by the human resources officer to address concerns plant and field employees had following the IUOE's departure from the Metro scene. It sought to assure formerly unionized employees that their concerns would continue to be heard and addressed by management.

A General Fund Environmental Assessment and Response Program Account for Small Regulatory Assessments, Studies, and Projects was established.

The Metro board adopted a sewer connection charge of \$1,400 per Single Family Residential Equivalent (SFRE) for 2002, a 1.8 percent increase over the 2001 charge of \$1,375. The board also adopted a 2002 Reactivation Charge of \$60 per SFRE. This was the same charge adopted for 2001.

The board established a charge of \$65 per 1,000 gallons for disposal of hauled wastes in 2002. The Metro District had charged the same amount since 1997. In addition, it entered into an Intergovernmental Agreement with Park Creek Metropolitan District related to the Stapleton Redevelopment Site.



The Metro District picks up its second EPA national award for pretreatment at the Water Environment Federation WEFTEC conference in Anaheim, CA. Left to right: Bob Hite, Steve Pearlman, Theresa Pfeifer, Leroy Gonzales, Barbara Orr, Jim Mallorey.

Metro again joined with other agencies for the ninth annual Adams County River Sweep. More than 125 volunteers helped pick up trash and other items along the South Platte River Trail.

Metro created a District-wide Strategic Information Technology Plan in October.

The board of directors granted Denver International Airport's request to temporarily increase the maximum allowable glycol-contaminated storm water it could discharge to the District.

Finance received its 14th consecutive Certificate of Achievement for Excellence in Financial Reporting from the Government Finance Officers Association.

Camp Dresser & McKee Inc. won the first place state-level American Consulting Engineers Council (ACEC) award in the environmental category for its work on the Metro District's South Platte River Improvements Project.

December 31 marked the end of the first full year for Trigen-Colorado Energy Corporation operating the Metro District's cogeneration facility.

The Metro District achieved 100 percent compliance with its discharge permit in 2001. This milestone marked nine years the District had achieved 100 percent permit compliance in the previous 10 years.

2002-Denver Water MOU nixed

The Winter Olympics were held in Salt Lake City, Utah, in February; and Chechen guerrillas seized a Moscow theater and Russian troops used gas in a deadly rescue raid.

Metro worked with the CDPHE to develop an aquatic life classification system as well as new biological and nutrient criteria to ensure that the Metro District's interests were heard and that further regulation was scientifically justified.

District governmental staff participated in 10 separate work groups during the year. These groups reached consensus on anti-degradation guidance; submission by the state of a reasonable, flexible nutrient criteria work plan to the EPA

Region 8; a complete re-write of the state's Water Quality Protection Handbook; and a number of other issues.

The District supported HB 02-1344 in the legislative session. The bill increased state discharge permit fees sufficiently to adequately fund the state's permit program and ensure continued delegation of the National Pollutant Discharge Elimination System program.

Service Area Utility Plan

The District adopted the Service Area Utility Plan as the management plan for the Metro District's transmission system. The plan recommended improvements, assessed



The Metro District works 24 hours a day, seven days a week, in sun, rain, snow, or freezing cold to treat metro Denver's wastewater, as these employees demonstrate in a spring snowstorm photo from 1998.

the current hydraulic capacity of the system, examined the future ability of the system to provide adequate service based on long-range population and land use trends, and reviewed the District's potential service area. Its findings were to be incorporated into the Central Treatment Plant Facility Plan.

As a requirement for satisfying stipulations of the compliance agreement with the CDPHE regarding sanitary sewer overflows, the Utility Plan also evaluated the inspection and monitoring programs of the District's Transmission Division in detail. The Interceptor Facility Inspection Program, published as part of this effort, served as the basis to identify facility rehabilitation needs to ensure the District facilities were in proper operating condition. Metro also met all elements of the Sanitary Sewer Overflow Compliance Agreement with the Colorado Department of Public Health and Environment.

'No' to Denver Water MOU

Metro elected not to proceed with negotiations with Denver Water concerning sharing ammonia conversion facilities pursuant to the Memorandum of Understanding executed in April 2001.

Ideally, the shared facilities would have allowed the Metro District to meet ammonia removal requirements in its next discharge permit as well as meet the needs of Denver Water for its non-potable Reuse Plant, saving both agencies millions of dollars. As negotiations progressed, however, it became clear that Denver Water's need to have very low ammonia levels at all times of the day was not compatible with the District's ammonia conversion goals and would essentially eliminate the cost savings the District had envisioned in the shared facilities concept.

Additionally, the District would have been exposed to the risk of not being able to meet the limits proposed in the agreement and could have incurred substantial penalties. The District and Denver Water still needed to enter into an agreement to allow Denver Water access to the District's effluent channels and conduits in order to get reusable effluent for Denver Water's Reuse Plant. Denver Water also needed easements to access and maintain its facilities on District property.

The District anticipated providing sanitary sewer service to the Reuse Plant and later agreed to treat sludge from the Reuse Plant under year-to-year agreements. Negotiations on these issues continued.



Director of Resource Recovery and Reuse Mitch Costanzo kicks off the Environmental Management System for Biosolids at Metro in December 2002.

EMS for Biosolids implemented

In December, the District implemented the Environmental Management System for Biosolids. It had adopted the NBP Code of Good Practice as its biosolids management policy to guide the production, management, transportation, storage, use and disposal of biosolids. This step was one element of an EMS Blueprint developed by the partnership.

Elements of the blueprint included: (1) Code of Good Practice, (2) Elements of an EMS, (3) EMS Guidance Manual, (4) National Manual of Good Practice, and (5) a Third-Party Independent Audit Program.

The partnership promoted planning and implementing environmentally sound biosolids projects and programs to meet local and environmental needs, ensured protection of public health, and improved communications between wastewater agencies and the public. The major focus was greater public awareness and acceptance of land application of biosolids as a result of a strong biosolids management program.

Three Information Services groups were consolidated into the Information Services Division. The goal was to improve access to data, eliminate redundant data, and improve operational efficiencies. The Metro District developed a Strategic Information Technology Plan to establish overall direction of the District's information technology; define, prioritize, and coordinate system purchases/upgrades for the next three to five years; and develop implementation strategies and cost estimates.

2003-New facility master plan unveiled

The United States launched attacks against Iraqi forces in March, with opening strikes targeting Saddam Hussein; California voters recalled Governor Gray Davis and elected actor Arnold Schwarzenegger; and an earthquake in Iran killed 50,000 people in December.

In years leading up to 2003, the Metro District had been experiencing severe foaming problems—an industry-



The Pretreatment Group wins the EPA's national first place award again in 2003. Front row, left to right: Lori Maag, Rue Eich, Theresa Pfeifer, Kathy Upchurch. Back row: Chris Tindera, Yolanda Brown, Eugene Jansak, Barbara Orr, Jessica Jones, Jane Gowing, Ted Gruber.

wide problem—in all of its digesters. In February and March, these problems resulted in serious operational upset conditions at the Central Plant. The upset put the District at risk of violating its discharge permit and state and federal biosolids regulations for Class B biosolids.

Biosolids landfilled

Because the sludge had to be moved through the digesters faster than normal to keep up with capacity needs, the District was in danger of not meeting the regulatory requirement of a 15-day retention period in the digesters. In addition, because the secondary treatment process performance was lower than desired and resulted in a lower quality of effluent, there was a chance of the District exceeding effluent permit limit values.

To address the immediate problems facing effluent quality, staff recommended expediting solids removal from the treatment system and landfilling all biosolids at risk of not meeting regulatory requirements for biosolids quality.

For 38 days in February and March, the Metro District temporarily ceased land application of biosolids and instead hauled biosolids to the BFI landfill. By late March, the solids processing operations and the foaming situation were back under control. Land application resumed on April 1, 2003. In May, the board ratified a \$174,665 emergency contract with BFI Waste Systems to dispose of the biosolids at the BFI Tower Road landfill.

Digesters 1-3 foam sensing equipment

The board of directors appropriated \$130,000 for radar foam level-sensing equipment in Digester 1, 2, and 3. This action

was based on positive reviews for the new radar sensors installed in 2002 in Digester 4 and Holding Tank 2.

Installing the sensors in the remaining fixed-cover digesters (7-10) and Holding Tank 3 was to be coordinated with future capital projects, either during capital improvement or cleaning projects. Sensors would not be installed in the floating cover digesters (5 and 6) because of instrument span and range problems associated with the moveable covers.

Participation in building a regional treatment facility

For years, the Metro District had evaluated ways to meet capacity issues at the Brantner Gulch Lift Station, which served the northern portion of Thornton and was slated to reach capacity in about four years. Under its Service Contract, the District was obligated to treat all of Thornton's wastewater. Based on projected growth in the Lower South Platte River Basin area, additional capacity (either a new regional wastewater treatment plant or expansion of the Brantner Gulch Lift Station) appeared to be required and in place by 2009 to avoid risks of wastewater overflows.

The 2001 Riverdale and Thornton-North Washington Force Main Expansion Study, conducted by Carollo Engineers, described the facility improvements and costs to meet future capacity needs through continuing to pump flows from the northern Thornton service area back to the Central Treatment Plant.

Based on a feasibility and financial analysis through 2017, the 2002 Lower South Platte Wastewater Utility Plan, completed by Carollo Engineers, concluded that building a new regional

wastewater treatment plant downstream from Brighton in cooperation with Brighton and the South Adams County Water and Sanitation District was technically and financially feasible for the Metro District and other participants.

Because of the board's concern that the 2002 analysis did not continue through the service area build-out, another study called the LSP (Lower South Platte) Plant—Comparative Analysis of Long-Term Financial Impacts Study was conducted in 2003. It presented better facility and financial information through 2040 and concluded it would be significantly less expensive for the District to participate in a new downstream treatment plant than to continue pumping wastewater back to the District's Central Treatment Plant.



The new cake tower was in operation in May 2004 when this truck pulled out with a load of biosolids to go to the farm.

The board's concerns revolved around an immediate need to provide additional service to the northern Thornton service area, higher risks of overflows associated with the Brantner Gulch Lift Station, and growth expected in Thornton's service area. Shorter-term needs included designing and building storage basins now to provide sufficient capacity through 2009 at the Brantner Gulch Lift Station.

Board members said the most appropriate long-term capacity solution from an operational efficiency standpoint would a regional treatment plant. They directed staff to move forward with discussions with the City of Brighton and South Adams County Water and Sanitation District (South Adams County) for construction of a new Lower South Platte Regional Wastewater Treatment Plant to be completed by 2009.

In April 2003, staff and legal counsel began negotiations with Brighton and South Adams County on development of an intergovernmental agreement for a new regional wastewater treatment plant, likely to be located in the Brighton area. The coalition would be called the Regional Wastewater Treatment Plant Authority.

High-Solids Centrifuges and Cake Storage Improvements Project

Four new high-solids centrifuges were placed into service in 2003 as part of the High-Solids Centrifuge and Cake Storage Improvements Project. The \$11 million project also included complete rehabilitation and expansion of the sludge holding tanks and biosolids cake storage tower.

The four new high-solids centrifuges were pre-purchased for \$3,895,000. They were delivered in December 2002. Start-up was completed in July 2003.

Operation of the new centrifuges began in conjunction with the new cake storage tower. The new centrifuges meant the biosolids cake would contain less water. The drier cake helped reduce the daily number of truckloads needed to transport biosolids to 17 from 22, thus saving fuel and reducing exhaust emissions.

Changes in the type and configuration of tower unloading gates to handle the drier biosolids resulted in new loading procedures at the cake tower. Metro hoped the project would be completed by April 2004.

O&M staff conducted training on all new equipment and placed various processes in and out of service to accommodate construction schedules. The full impact of these improvements on the biosolids management operations was not fully known pending final completion that would include additional cake storage capacity and optimization of the high solids centrifuges operation.

Digesters No. 11 and 12 project

In February 2000, the Solids Management Facilities Study Update prepared by Rothberg Tamburini & Winsor recommended numerous in-plant facility and other improvement projects throughout the Digester Complex. Concerns included a finding that the District's 10 digesters were at capacity. Without additional capacity, the District's digestion system would not be able to meet federal regulations. Also, many of the Digester Complex facilities had reached the end of



Black & Veatch employee Art Tim (left) and Field Operator Fay Wicks of the RR&R Department check out the biosolids loading panel in the newly-remodeled cake storage tower in this 2003 photo.

their useful life, and Metro hoped additional capacity and changing to a two-phase digestion system would help address the foaming problems experienced in 2003 and earlier.

The Solids Management Facilities Study recommended building an additional digester (No. 11) in 2003 and another digester (No. 12) by 2012. Because the District was experiencing higher solids loadings than projected, a March 2001 follow-up study concluded that proceeding immediately with construction of Digesters Nos. 11 and 12 was necessary.

In April, the Metro District entered into amendment No. 3 in the amount of \$197,000 to the professional services agreement with CH2M Hill, Inc., to provide design services for additional facility improvements associated with the Digesters 11 and 12 project.

In November, the District appropriated \$16.6 million for the Digesters 11 and 12 project, which included:

- A \$12,683,000 construction contract with Western Summit Constructors, Inc.
- An amendment for \$1,742,000 to the professional services agreement with CH2M Hill, Inc., to provide construction engineering services, resident engineering services, and post-construction services.

In addition, several sole-source agreements allowed the District to purchase and install equipment for the Digesters 11 and 12 project that was compatible with existing equipment in the Digester Complex and throughout the Central Plant, and was also necessary to maintain the integrity of the process control and



In July 2004, Digesters 11 and 12 were under construction to provide Metro with more biosolids processing capabilities.

HVAC systems. The sole-source agreements provided a substantial price discount, avoided costly software and wiring changes, and integrated with other District systems, software, and applications.

Other projects

Metro completed extensive work on the Process Control System replacement project. Information Services completed the upgrade. O&M facilitated the switchover of treatment processes to the new system and conducted extensive training on the new system.

Construction was completed for improvements to the medium- and low-voltage power distribution systems at the Central Treatment Plant at a cost of \$10,885,604.

Metro completed an upgrade of the Computer Maintenance Management System (7i), which is used to plan, schedule, organize and control daily maintenance activities at the Metro District.

The board selected Richard P. Arber Associates to provide design and construction phase engineering services for the Brantner Gulch Peak Flow Storage Basin(s) Project and amended the agreement for the Brantner Gulch Emergency Storage Project. The peak flow storage basin would keep any overflows at the facility during peak flow periods from going off-site and polluting the surrounding area. Metro also completed construction of the \$468,780 Brantner Gulch Lift Station Pump Replacement and Polymer Feed Project. In November, the board awarded a \$419,000 construction contract to MLL, Inc., for a 250,000-gallon emergency storage tank at the Brantner Gulch Lift Station.

Metro issued 2003A Sewer Refunding Bonds for \$11.46 million. The refunding was expected to realize net present value savings of approximately \$328,000 over the life of the bonds. Metro also issued 2003B Sewer Refunding Bonds in the amount of \$15.5 million. The refunding issue was expected to realize net present value savings of approximately \$1,270,000 over the life of the bonds.

RR&R

The District took delivery of two new 37-foot end dump trailers from Intermountain Wholesale for \$35,995. Resource Recovery and Reuse used the trailers to haul biosolids. Metro also purchased two dump trucks from McCandless International Trucks of Colorado for \$115,870 to replace vehicles used by both RR&R and O&M.



This 2004 photo shows steel workers tying “rebar” to build the sidewall of Digester No. 11.

RR&R took delivery of a Scarab compost mixing machine from Scarab Manufacturing for \$253,684. The new machine straddles compost windrows and turns the pile inside out to make sure all the material is evenly composted. It replaced a machine that was 18 years old.

Metro awarded a 35-month contract at a cost of \$275,070 to Parker Ag Services for routine cleaning of the anaerobic digesters. This odd number contract allowed subsequent contracts to coincide with the calendar year. In November, the contract was extended by 12 months.



In November 2005, the \$12.6 million construction of digesters 11 and 12 was complete and the new digesters had begun operation. The two new digesters were needed to help process growing solids loads.

Metro also completed entry of all historical biosolids application data into the new Biosolids Record Reporting program. The program was developed in-house to assist RR&R in electronically tracking all biosolids-related data associated with the land application program.

The board approved an agreement with tenant farmer Thomas H. Thompson III to market the Metro District's share of crops harvested from the METROGRO Farm in 2003 and, if it was in the District's best interest, in 2004.

RR&R received about 10,000 cubic yards of free yard waste from Mountain States Wood Recyclers for use in the composting

operation. The free material was the result of tree damage from a spring snowstorm. Annually, Metro's composting operations required about 10,000 cubic yards of yard waste to serve as a carbon source for the composting microorganisms.

METROGRO Farm

As part of Metro's ongoing efforts to become recognized as good neighbors in the Deer Trail farming community, RR&R held a picnic and open house at the METROGRO Farm's new maintenance shop facility in June. The picnic allowed the farm's neighbors surrounding the farm property to see the new facility. It was a social event held to get neighbors to visit the METROGRO Farm when there was no business to conduct.

Metro also sent two Metro employees and Deer Trail area resident Pam Whelden to the Water Environment Research Foundation's Biosolids Research Summit. The objective of the event was for stakeholder groups to work together to identify the top research needs relative to biosolids and the biosolids industry.

Metro installed a 50,000-pound capacity lift at the maintenance shop facility at the METROGRO Farm, which cost \$69,580. The maintenance facility let RR&R work on heavy equipment at the farm without having to "low-boy" it back to the District.

In October, Metro initiated the first phase of a five-year Deep Soil Monitoring Program at the METROGRO Farm. The project was coordinated by the District and Dr. Dwayne Westfall, a professor of soil and crop sciences at Colorado State University, to evaluate nitrate accumulation (downward migration of nitrates into the soil) as a result of the District's biosolids land application program and, particularly, the use of agronomic loading rate calculations.



The shop building at the METROGRO Farm was built in 2002. Locating a shop at the farm keeps Metro from having to haul heavy equipment back and forth via low-boy trailer to perform routine maintenance.

Pretreatment

In April, the District recognized 16 industrial dischargers who demonstrated a commitment to environmental excellence at the 10th annual Metro District Gold Awards Program. Industrial waste dischargers who were recognized were violation free for the previous year and demonstrated a commitment environmental compliance.

The Pretreatment Group replaced zero-discharge permits for perchloroethylene with No-Perc Discharge Advisories. Certification requirements were then replaced with inspections by the District.

Between 2003 and 2005, Metro closed more than 30 wells used to monitor groundwater below the former Lowry Bombing

Range where the Metro District had disposed of wastewater sludge from 1969 to 1986. After obtaining permission from the Colorado Department of Public Health and Environment and the City and County of Denver, the District established a joint agreement with the U.S. Geological Survey to decommission the wells. The USGS did the work, and the District shared the cost.

Copper studies

The District cooperated with the South Platte Coalition for Urban River Evaluation on a copper toxicity study of the South Platte River and its tributaries from Chatfield Reservoir to the confluence with Big Dry Creek. Laboratory Services completed the water effect ratio studies, toxicity testing, and modeling using the biotic ligand model on copper.

Security officer

Metro hired a full-time security officer in recognition of the increasing threat to the external environment in which Metro found itself operating and the possibility of threats to the District's infrastructure. Later that year, the board awarded a two-year contract with three one-year contract extension options to Securitas Security Services USA to provide unarmed, armed, and special security services to the District. The board also appropriated \$545,000 for projects to improve security at the Metro District.

Board actions

The board took a number of actions during the year. It:

- Approved an agreement for \$794,000 with Brown and Caldwell for the final design memorandum, final design, and bidding phase services for the Dissolved Air Flotation Rehabilitation Project.

- Approved a \$560,000 preliminary design phase agreement for engineering services for the Primary Treatment Improvements Project with Black & Veatch.
- Approved a joint funding agreement with the U.S. Geological Survey to cover the Metro District's share of the Deer Trail Independent Monitoring Plan for 2004 and appropriated \$229,050 from the General Fund to cover the sixth-year (through December 2004) expenses.
- Determined it was not feasible to provide service to portions of Rooney Valley that fell within the borders of Lakewood, thus granting Lakewood's request for an exclusion of this territory.
- Approved an agreement with the City and County of Denver to relocate a portion of the District's Interceptor South Branch to build a new bridge at 8th Avenue and Tennyson Street.

The district manager received a final report from management consultant EMA that reassessed the Metro District's progress since the 1996 competitive assessment and looked at how the District compared in 2003 to the most productive utilities in the country.

The board also adopted a sewer connection charge of \$1,600 per single family residential equivalent (SFRE) and updated capital investment fractions to be used in calculating the large-user exception. It enacted a reactivation charge of \$70 per SFRE for 2004. This represented a 7.7 percent increase over the 2003 reactivation charge of \$65. In addition, it established a charge of \$65 per 1,000 gallons for disposal of hauled wastes in 2004.



To demonstrate its sincere intent to be a good neighbor, the District began hosting a summer picnic at its maintenance shops on the METROGRO Farm. Neighbors from the surrounding area were invited to share some barbecue with RR&R employees, including Becky Patterson (green jacket).

Around the District...

Technical Support/Data Assurance Officer Carl Calkins was presented a special annual safety award for his contribution to the Metro District and the Laboratory Services safety programs.

Metro extended the authorization for additional biochemical oxygen demand capacity granted (in 2002/2003) to Denver International Airport to the 2003/2004 de-icing season. These year-by-year authorizations allowed DIA to discharge de-icing fluid to Metro to prevent it from overflowing into the environment.

Metro entered into an intergovernmental agreement with the Havana Water & Sanitation District and the Arapahoe County Water & Wastewater Authority to allow a physical interconnect between the sanitary sewer systems of these two wastewater entities.

The board awarded a construction contract for \$636,490 to rehabilitate 59 manholes and remove one manhole on the Metro District's South Thornton Interceptor. It also granted an easement on the Metro District's Brantner Gulch Lift Station property to United Power, Inc., to install an underground electric distribution line.

Metro initiated the Retiree Health Insurance Funding Assistance Program to provide a subsidy to help retirees pay health insurance premiums. It also established a VantageCare Retirement Health Savings Plan to offer employees a means to set aside money to pay for health-related items such as health insurance premiums, eyeglasses, co-pays, and prescription drugs.

The board adopted the fifth amendment to the Metro Wastewater Reclamation District Amended and Restated Retirement Plan and distributed the republished Sewage Treatment and Disposal Agreement (service contract).

Information Services completed in-house redesign of Metro's external web site in November.

The Laboratory Services Department implemented electronic MSDS (Materiel Data Safety Sheet) and Chemical Inventory Systems.



Members of the Future Programs Committee vote during their January 2006 meeting.

The Lab received approximately 32,000 samples in 2003. With two fewer lab analysts, it produced six percent more usable analytical results, or approximately 184,000 usable analytical results, not counting quality analysis/quality control data. It also provided analytical support for special projects such as high solids centrifuge performance testing, molybdenum source identification, final effluent nitrite and nitrate concentrations meeting 2004 discharge limits, Lowry groundwater permit compliance, METROGRO Compost application at a Haymen fire site, and final effluent aluminum testing.

Metro Operations & Maintenance collected and treated more than 50 billion gallons of wastewater in 2003. The Transmission



Aircraft deicing fluid is a high oxygen demand solution that can be treated in a wastewater treatment plant such as Metro's, but the plant must have sufficient capacity to handle it.

Division inspected more than 2,000 manholes, cleaned more than 20 miles of sewers, and completed more than 30,000 work orders. Metro experienced zero sanitary sewer overflows in 2003 and met all elements of the Sanitary Sewer Overflow Compliance Agreement. The Transmission Division video-inspected more than 28 miles of interceptor lines during the year, exceeding both the District's goals and regulatory requirements.

2004-National recognition for RR&R

A U.S. spacecraft made a successful Mars landing; the European Union admitted 10 new members in an eastward expansion; and a tsunami triggered by a massive earthquake killed more than 140,000 people in 12 countries in South Asia and Africa.

In October, the EPA named the Metro District a first-place national winner of EPA's 2004 National Clean Water Act Recognition Award for outstanding biosolids management in the Large Operation Projects category.

The EPA selected the District based on its proactive management of the METROGRO Farm, active stakeholder involvement, an effective public relations program, and comprehensive monitoring by the U.S. Geological Survey.

R&CR and Laboratory Services combine

To address the District's increasing awareness of environmental concerns, the Regulatory & Connector Relations and Laboratory Services Departments were combined to become the Environmental Services Department. This new department was responsible for managing the District's regulatory compliance and development programs, intergovernmental activities, public information and education programs, water quality monitoring and assessment, and analytical services. Steve Pearlman took over the new department when Shian Kung, who had headed Laboratory Services, retired.

U.S. Geological Survey report

The U.S. Geological Survey released its final interpretive report "Effects of Surface Application of Biosolids on Soils, Crops, Groundwater, and Streambed Sediment near Deer Trail, Colorado, 1999-2003", by Tracy Yager. The report was based on data collected in response to concerns about potential contamination of groundwater underlying biosolids application sites at the Metro District's METROGRO Farm near Deer Trail.

The USGS monitored biosolids at the production site and in groundwater, soils, streambed sediment, and crops at the farm.

The report showed variations of trace-element concentrations consistent with the expected natural variation. All plutonium concentrations in any medium sampled, including biosolids, were below the minimum detectable level and near zero.

The report also stated that concentrations of the monitored constituents were less than Colorado regulatory limits for groundwater and, based on soil samples, the biosolids had no measurable effect on the concentration of the priority parameters analyzed.

The USGS said it believed better tracers (anthropogenic [man-made] compounds) were needed for a more complete picture. The anthropogenic compounds could be monitored in stream beds and wells to determine if biosolids could possibly have affected concentrations in the study area.

In related actions, the board approved an extension of the 2004 joint funding agreement with the USGS to cover the District's share of the cost of meetings, monitoring, and new monitoring plan development through March 31, 2005, and appropriated \$45,000 to cover the extension.

The board also approved a new seven-year intergovernmental agreement with Elbert and Arapahoe Counties to continue the USGS independent monitoring program at the METROGRO farm. The agreement also acknowledged Metro's farm management plan, and the counties' agreement to impose no restrictions on the Metro District's biosolids land application operation.

Enhanced primary clarification

The Central Treatment Plant Facility Plan recommended construction of enhanced primary clarification facilities to address current capacity issues and to provide immediate interim relief until the longer-term primary treatment improvements could be constructed.

Enhanced primary clarification involves adding ferric chloride followed by a polymer to the wastewater in order to increase the removal efficiencies of the primary clarifiers. When studied, primary treatment typically removed 25 to 30 percent of the biochemical oxygen demand (BOD) and 50 to 60 percent of the total suspended solids (TSS). The study indicated that adding



Laboratory Assistant Tina Virgilio and Laboratory Analyst John Mechling process total suspended solids samples in the TSS lab in August 2006.

ferric chloride and polymer to the wastewater prior to primary clarification should significantly improve BOD removal efficiency to 50 percent and TSS to 80 percent. The process would be used on an as-needed basis to reduce loadings to the north secondary treatment system and the anaerobic digestion process.

CH2M Hill, Inc. provided the engineering services, with Stanek Constructors, Inc. doing the construction of the clarification facilities. The \$1,555,000 project was completed at the end of 2004.

In a related action later that year, the board entered into Amendment No. 1 in the amount of \$1,803,000 to the professional services agreement with Black & Veatch to provide final design and bidding phase services for the follow-on Primary Treatment Improvements Project.

South Primary Effluent Conduit Rehabilitation Project

Metro entered into a \$510,462 agreement with URS Corporation in January for design and bidding services for the South Primary Effluent Conduit Rehabilitation Project. The project began in 2004 and was substantially completed at the end of 2005. It addressed severe corrosion and deterioration of the south primary effluent conduit, which was built in 1976 when the South Plant was built.

Another major project begun in 2004 was the Disinfection System Improvements Project. Metro signed a \$220,000 agreement with Camp Dresser & McKee Inc. for preliminary design services for the project to address capacity and safety issues in the disinfection system and eventually rid the District of disinfecting with chlorine and sulfur dioxide gas.



In this 2005 photo, Metro is preparing to begin construction on the South Primary Conduit Rehabilitation Project. In this project, more than 1,000 feet of reinforced concrete conduit that connected the South Primaries to the South Secondary treatment system were replaced while the plant continued to run.

Related to the disinfection system project was a \$98,755 contract awarded to Glacier Construction Co. Inc., for construction of the Plant Water Chlorinated System Distribution Upgrades Project. This system provided non-potable water to various Metro treatment processes, irrigation, fire protection, and maintenance activities.

Continuing to look ahead to rehabilitation and construction needs, the board awarded a \$7,569,000 construction contract to Glacier Construction Co., Inc. for the Dissolved Air Flotation Rehabilitation Project and entered into Amendment No. 1 in

the amount of \$1,185,000 to the agreement for professional services with Brown and Caldwell for construction, resident, post-construction engineering services, and facility drawings.

Metro signed a \$1,315,000 agreement with Carollo Engineers for preliminary design phase services for the Secondary Treatment Improvements Project. This \$40.7 million project addressed discharge permit requirements and capacity needs as well as aging equipment.

Other facilities actions by the board included a \$115,080, five-year agreement with HDR Engineering, Inc., for the Central Treatment Plant Conduits Study Project to study potential rehabilitation and replacement projects over the next 10-year planning period. It also appropriated \$90,000 for engineering design services for proposed re-alignment of the Thornton-North Washington Force Main parallel line. The re-alignment was needed to avoid lengthy, expensive condemnation proceedings to acquire easements on property already in dispute, which could have potentially delayed the project.

Interactions with other agencies

Metro negotiated a discharge permit amendment with the Colorado Water Quality Control Division to eliminate the requirement for additional South Platte River drop structures and to allow time to update the Metro District's water quality model.

In a multi-agency Memorandum of Understanding, Metro staff successfully negotiated elimination of a requirement that the District build flow equalization

and fish entrainment structures and instead provided for further study of appropriate aquatic improvements.

The Colorado Water Quality Commission adopted a new copper criteria. The less-conservative criteria better defined what effects copper may have in hard waters such as those in the South Platte River.

Staff successfully negotiated with the Colorado Water Quality Control Division to apply the drinking water maximum contaminant level as the most stringent discharge permit limit for organics, arsenic and other human health water quality criteria.



The South Primary Effluent Conduit Rehabilitation Project was in full swing in Oct. 2005 when this photo was made. It had been put in service in 1976 and badly needed rehabilitation.



District Project Manager Orin Padgett, P.E., inspects a piece of the 500 feet of 11-foot 2-inch inside diameter fiberglass reinforced pipe that was used in the South Primary Effluent Conduit Rehabilitation Project in October 2005. The fiberglass reinforced pipe lines the original 12-foot by 9-foot reinforced, cast-in-place box conduit and conveys primary-treated wastewater to the aeration basins.

Pretreatment

The EPA approved a non-substantial modification to the Metro District's Industrial Waste/Pretreatment Control Program. This modification updated the District's procedures for implementing the Pretreatment/Industrial Waste Control Program. The update reflected the District's responsibility for complying with the industrial waste survey requirements when delegated through a Pretreatment Delegation Agreement.

Metro submitted the five-year update of the Risk Management Plan to the EPA. As part of the update, the Emergency Action Plan was also revised and updated.

Board revises biosolids policy

One of the requirements of the NBP Environmental Management System for Biosolids was for the District to have a policy on beneficially reusing biosolids that was consistent with current practices and objectives of the system. In 1978, the board adopted 100 percent beneficial reuse of Metro's biosolids as District policy when it passed Resolution 1178-5.a.

However, the board recognized that weather and other unforeseen constraints such as the digester foaming problem in January 2001 could prevent 100 percent of the biosolids from being beneficially reused. Accordingly, it modified the 100 percent beneficial reuse language in a new resolution, 0704-6.f, adopted July 20, 2004. The new language established 100 percent beneficial reuse as a goal but not a hard-and-fast requirement.

The board appropriated \$100,000 to continue using the services of Western Environmental Analysts to provide water quality modeling for Segment 15 of the South Platte River for the next five years. It also adopted Metro's Amended and Restated Retirement Plan, which was last amended and restated in its entirety in 2001.

A sewer connection charge of \$1,740 per single family residential equivalent and updated capital investment fractions to be used to calculate the large-user exception were agreed to, along with a reactivation charge of \$75 per SFRE for 2005, which represented a 7.1 percent increase over the 2004

reactivation charge of \$70. The board continued the charge of \$65 per 1,000 gallons for disposal of hauled wastes.

RR&R celebrates birthday

The Resource Recovery and Reuse Department celebrated its 30th anniversary as a department in 2004 with a reception for Metro District staff and department retirees.

RR&R also took delivery of two new Red River live-bottom trailers. The \$57,200 trailers replaced two end-dump trailers. The conveyor belt system in the live-bottom trailers moves material out the back of the trailer without having to raise the trailer in the air.

RR&R also purchased a portable trommel screen in 2004 for \$169,000 to replace the 16-year-old screen RR&R used to separate large pieces of wood fiber from processed compost to make fine compost material for home distribution.

In September, the board approved a subsidy payment to tenant farmer Tom Thompson III for the 2003/2004 crop season to compensate him for poor crop yields, which were mostly due to drought. The payment was in lieu of participating in federal farm subsidy payments and was in accordance with terms of the METROGRO Farm and Grazing Lease Agreement.

The board extended its authorization for additional biochemical oxygen demand capacity granted to Denver International Airport for the 2004/2005 deicing season. It also approved an agreement with Denver Water regarding operation of Denver Water's two pump stations at the Central Plant and the District's acceptance of sludge from the nearby Denver Reuse Plant. The agreement further approved a capital recovery

rental charge to make sure that the District recovered its total capital costs for treating the Denver Reuse Plant sludge.

Metro personnel appointments and achievements.

- Director of O&M Steve Rogowski was appointed to a three-year term on the Water Environment Research Foundation's Research Council.
- Water Quality Specialist Steve Lundt was inaugurated as president of the Colorado Lake and Reservoir Association.
- Public Information Officer Steve Frank took office as president of the Rocky Mountain Water Environment Association at its annual conference. RMWEA is



Field Operator Tim Friedrich inserts a temperature probe into a compost windrow to make sure sufficient heat is being generated inside the windrow to kill pathogens.

the leading association of water quality professionals in Colorado, New Mexico, and Wyoming.

- RR&R Program Administrator Donna Hull was appointed by the governor to a three-year term on the Colorado Pollution Prevention Advisory Board.
- Public Information Specialist Kathy Jeffrey was elected secretary of the Rockies Alliance of Process Technology. The Alliance was an industry-driven partnership of industry and education professionals working together to develop the skilled technical workforce needed for the future of the process industries.
- Water Quality Specialist James Dorsch led the Colorado State Monitoring Council's Data Storage and Retrieval Task Force to adopt a statewide means of data storage, allowing the state, permitted agencies, and volunteer groups to share water quality data collected in Colorado.

Awards and reports

Metro again received a Certificate of Achievement for Excellence in Financial Reporting from the Government Finance Officers Association for the annual financial report for the fiscal year ended December 31, 2003. The District had received this award every year since 1987.

2005-A ‘Triple Crown’ year for Metro

The Kyoto Protocol took effect and 141 nations prepared to cut greenhouse gases; Hurricane Katrina devastated the U.S. Gulf Coast; and New Orleans was evacuated and submerged as its levees gave way;

In 2005, the Metro District won the “Triple Crown” of national awards for outstanding achievements relating to its performance with:

- Its second consecutive five-year Platinum Award from the National Association of Clean Water Agencies
- Its first place national award for Operations and Maintenance from the EPA.
- Certification of its Environmental Management System for Biosolids by the National Biosolids Partnership.



Director of Operations and Maintenance Steve Rogowski (left) accepts Metro's second consecutive Platinum Award from Ken Kirk, executive director of the National Association of Clean Water Agencies in August 2005.

NACWA Platinum Award

The Metro District won its second consecutive National Association of Clean Water Agencies' Platinum Award.

Ken Kirk, executive director of the association said, "This (Platinum) Award represents the Metro District's second five-year period without a single numerical violation of its discharge permit. This is a truly remarkable achievement."

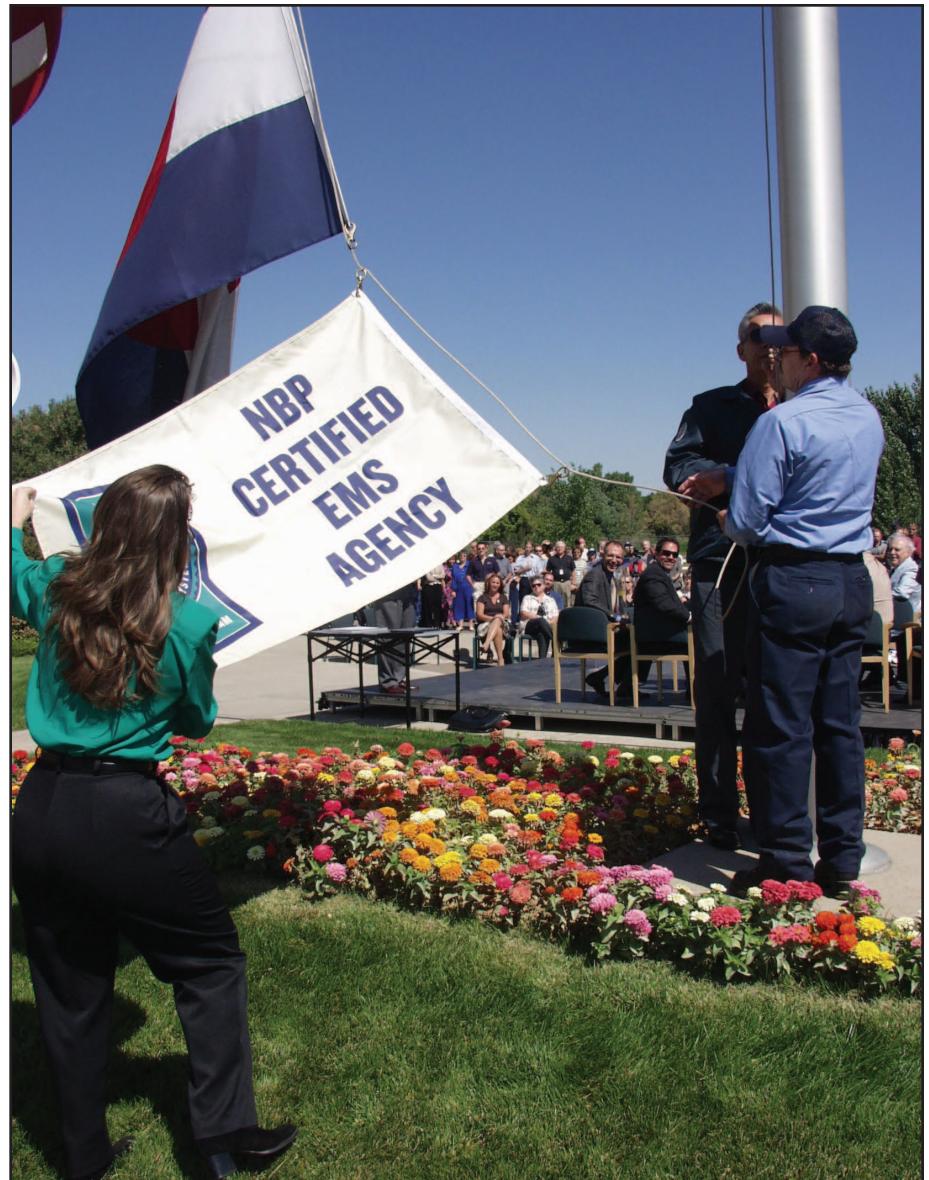
Kirk praised Metro District employees and added that only five other wastewater treatment agencies in the country had achieved such a record, and the District was the largest. During the 10-year period represented by the two Platinum Awards, the District discharged almost 530 billion gallons of treated water into the South Platte River and completed more than 100,000 chemical and biological analyses to verify there were no permit violations.

Congressman Bob Beauprez (Colorado 7th District) visited with Metro District employees on August 19 to celebrate the District's Platinum Award and its Environmental Management System for Biosolids certification.

EPA Operations and Maintenance Award

In September, the Metro District and the Durham Advanced Wastewater Treatment Facility in Tigard, Oregon, tied for the EPA first place national award for Operations and Maintenance, Large Advanced Plant category for 2005.

In a letter congratulating the Metro District, EPA Assistant Administrator Ben Grumbles wrote, "EPA based this selection on the plant's demonstrated creative and outstanding Operations and Maintenance practices."



It was a proud moment for Metro on August 31, 2005, when the EMS Certification flag was raised at an all-employee ceremony. Jim Carabajal, Metro's most senior employee, is at the flagpole and is assisted by newest employees Chrissy Jackson (holding the flag) and Al Kappan.

The Metro District won the EPA's first place national award for biosolids management in 2004 and first place national awards for industrial pretreatment in 1996, 2000, and 2003.

Environmental Management System for Biosolids Certification

The District's Environmental Management System for Biosolids was officially certified on July 30, 2005, by the National Biosolids Partnership.

The Partnership is an alliance of the Water Environment Federation and the National Association of Clean Water Agencies, with advisory support from the EPA. Municipal wastewater treatment facilities, biosolids users, stakeholders for regulatory agencies, the farming community, and environmental organizations provided the Partnership continuing feedback.

The Metro District was the eighth agency in the nation to earn this certification, which is entirely voluntary.

Audit verification

The path to Environmental Management System certification was tough. It took Metro about a year and a half to get ready for audit. In April, the Metro District participated in a three-day Third-Party Readiness Review Audit conducted by the audit firm NSF International on behalf of the Partnership. The readiness audit concluded that the District was ready to be audited.

In July, NSF International conducted the on-site verification audit, the last step for the Metro District's Environmental Management System for Biosolids to be officially certified by the



Former Representative Bob Beauprez (left) visited the Metro District in August 2005 to congratulate employees for their "Triple Crown" performance. Here he speaks with District Manager Bob Hite.

Partnership. The District received official notification in August that its EMS for Biosolids program had been certified on July 30.

On August 31, in ceremonies attended by Metro District employees and board members at the District's facilities, Metro received its EMS certification from the Partnership. Representatives of the National Association of Clean Water Agencies, the Water Environment Federation, the National Biosolids Partnership, and the EPA were also present for the celebration and praised the District and its employees for its achievement.

"Sadly, as we have seen events unfold on the Gulf Coast in the news, we are reminded of what wastewater treatment agencies like the Metro District do for public health. The people of metro Denver should be proud of what the District has accomplished on their behalf," said Tim Williams, who represented the National Biosolids Partnership for the Water Environment Federation.

Other awards, honors, and appointments

An award by the Rocky Mountain Water Environment Association (RMWEA) and recognition by the Colorado Safety Association (CSA) was icing on the cake in an outstanding year for Metro.

RMWEA recognized Metro for its outstanding results in biosolids management and for becoming the eighth wastewater treatment agency in the country to be certified by the National Biosolids Partnership. The District's biosolids program was also honored in September at the association's annual conference in Albuquerque, New Mexico.

Recognition for Safety

The District was also recognized by the CSA on October 1 when it achieved one million hours worked without a lost-time accident, the second time in its history.

In 2001, the Metro District achieved one million man-hours worked without a loss-time accident, and if it had not been for one accident in 2003, the District would have been very close to having had two million hours without a loss-time accident.

It took approximately 17 months to reach a million man-hours worked without a loss-time accident again. According to the CSA, fewer than one percent of companies ever reach this level

of safety. This accomplishment reflected the District's proactive approach to safety and employees' commitment to working safely.

One of the benefits of working safely is lower Workers Compensation rates. Metro received a dividend check for \$55,823 from Pinnacol Assurance in late 2005. The amount was based on the Metro District's paid premium-and-loss ratio for its 2003/2004 Workers' Compensation coverage.

In the finance field, Metro received the Government Finance Officers Association of the United States and Canada's Distinguished Budget Presentation Award for the 11th year in a row.

District Manager Robert W. Hite was elected by the Mountain States Employers' Council, Inc., Board of Directors to serve



Bucket loader delivers a load of biosolids to the Volvo articulated spreader in the field.

as its vice-chair/chair-elect for 2005-2006. He had served on the Council since 1999 and continued as chair of the Council's Retirement Board.

Maintenance Superintendent Jerry Lee received the RMWEA's Plant Maintenance Merit Award for outstanding leadership in the Metro District's plant maintenance program.

Operations Superintendent Steve Walker received the Water Environment Federation's William D. Hatfield Award of a wastewater treatment plant operator who had demonstrated outstanding performance and professionalism.

Public Information Officer Steve Frank received the Water Environment Federation's Arthur Sidney Bedell Award for extraordinary service to the Water Environment Federation.

Denver board member Chris Erzinger was honored as a "Neighborhood Hero" by the Daniels Fund and the Denver Police Department. Denver Police Chief Gerald Whitman and former U.S. Senator Hank Brown presented the award to Erzinger.

The Associated Builders and Contractors Rocky Mountain Chapter Excellence in Construction Award was presented to Western Summit Constructors, Inc., for its work on the Metro District's High-Solids Centrifuges and Cake Storage Improvements Project.

District Governmental Affairs Officer Barbara Biggs, who was appointed by Governor Bill Owens to the Colorado Water Conservation Board in March 2004, was elected its chair.

Metro again received a Certificate of Achievement for Excellence in Financial Reporting from the Government

Finance Officers Association for the Metro District's annual financial report for the fiscal year ended December 31, 2003.

The National Association of Clean Water Agencies elected District Manager Robert Hite to be its representative on the Water for People Board of Directors. Water for People is an international non-profit organization that helps impoverished people worldwide by supporting sustainable drinking water, sanitation, and hygiene projects.

The National Biosolids Partnership re-elected Hite as its chairman for the eighth consecutive year since its inception.

Metro District Water Quality Officer Todd L. Harris, Ph.D., was selected by the Water Quality Control Division to participate in a scientific technical advisory committee that reviewed the applicability of available information on temperature and its effects on aquatic life.

Cathy Gerali was promoted to the new staff position of deputy manager.

Sharon Weakland was selected to succeed Jerry Lee as maintenance superintendent. Lee retired at the end of 2005 after 37 years at the Metro District.

South Primary effluent conduit rehabilitation

During the summer and fall of 2005, the District, URS Corporation and Stanek Constructors conducted what was believed to be the largest bypass pumping operation in the Rocky Mountain region while rehabilitating the South primary effluent conduit.

For 53 days, primary effluent was pumped to the south aeration basins. The 50 million gallons a day of effluent bypassed the existing 12-foot wide by 9-foot high cast-in-place reinforced concrete box conduit. That conduit had carried all effluent from the South primary clarifiers and some effluent from the North primary clarifiers to the South secondary treatment complex since 1976. Bypassing the conduit required thirteen 18-inch pumps and more than 20,000 feet of high-density polyethylene pipe.

The South primary effluent conduit was constructed as part of the Central Treatment Plant's South Complex in 1976. Its flows averaged 65 million gallons a day, with a peak capacity of about 200 million gallons a day. Except for brief shutdowns of fewer than four hours, this conduit had been in continuous service since it was built.

Inspections in 1998 and 2000 by URS showed significant microbiologically induced corrosion to the ceiling and upper walls of the conduit. In many areas of the 1,020 foot-long conduit, up to seven inches of concrete had corroded away when the sulfuric acid attacked the cement and reinforcing bars. This corrosion developed when bacteria that thrived in the sewer environment ingested hydrogen sulfide from the effluent and secreted sulfuric acid. The deteriorated areas were above normal effluent water levels because the bacteria could not survive under water.

If this conduit and its tributary conduits had not been rehabilitated, deterioration would have continued. At some point, failure would probably have occurred. This would have resulted in a major sewage spill, a shut down of secondary treatment in the South Complex, and a violation of the Metro District's discharge permit.

Five hundred feet of the conduit box top was sawed off and an 11-foot-2-inch diameter corrosion-resistant fiberglass-reinforced pipe was laid in the existing box structure. Low-density concrete was poured into the bottom of the old box to support the new pipe. During the pour, the pipe was strapped in place to keep it from floating.

Another 500-foot east-west run of the conduit was rehabbed using "shotcrete," a quick-setting concrete that was projected or "shot" under pressure onto a surface to form structural shapes.

Repairs also included rerouting the South secondary scum piping and installing three cured-in-place pipes.



A bypass pump with HDPE pipe sends primary effluent around the South effluent conduit to the South aeration basins during the 2005 South Primary Effluent Rehabilitation Project.

Cooperation among Metro District's Engineering and O&M departments and the contractors was crucial. Elaborate plans and back-up plans were created to allow rehabilitation of an operating plant without spilling a drop or causing a permit violation.

With only minor items left to finish at year end, the \$9.1 million project was completed in February 2006. The construction contract with Stanek Constructors, Inc. was \$6,908,000.

Other construction, operations

In January 2004, Western Summit Constructors began construction of two CH2M Hill-designed anaerobic digesters.



Engineer II Jenny Trujillo (r) discusses progress on the primary access bridge concrete rehabilitation job with the contractor, Restoration Corp.

Construction was completed in October 2005, and the \$12.6 million digesters began operation in November 2005.

Metro completed construction of the Plant Water Chlorinated System, which served the treatment process, irrigation, fire protection, and maintenance activities throughout the Central Treatment Plant. Glacier Construction Company completed the project at a cost of \$104,310.

O&M finalized the 2005 Central Treatment Plant Operating Plan. This annual plan identified the overall strategy for running the plant during the coming year. It had become more critical as plant construction and upgrade activities such as the South Primary Effluent Conduit Rehabilitation project increased.

Metro averaged flows of 128 mgd in 2005, slightly above flows received in 2004. Plant flows had decreased sharply since 2001, primarily due to drought.

Cured-in-place pipe was installed in two reaches of the Platte River Interceptor. Western Slope Utilities completed the project at a cost of \$279,871.

O&M completed startup of the Enhanced Primary Treatment Project, which improved primary treatment effectiveness through the addition of ferric chloride and polymer to the raw wastewater.

Metro completed and implemented a new Interceptor Infrastructure System that tracked attributes and results of inspections and other information for the Metro District's Transmission system. It was the primary system to support the new Geographic Information System.

Metro experienced disruptions in dewatering polymer supply and quality due to industry-wide shortages of raw chemicals and reduced production capacity.

Additional Metro projects

- Undertook a major five-year maintenance overhaul of one of the South Secondary cryogenic plants that provided oxygen for the activated sludge process.
- Completed a multi-year \$7 million project to replace the Metro District's Process Control System.
- Completed rehabilitation of approximately 5,500 feet of 42-, 48- and 54-inch reinforced concrete lines and one diversion structure on the Sand Creek Interceptor System by InsituForm Technologies, Inc. at a cost of \$1,587,000.

Contracts and appropriations

- Entered into a \$222,027 agreement with ABB, Inc. for the purchase of hardware to be installed as part of the Dissolved Air Flotation Rehabilitation Project. The \$10.9 million project addressed several improvements that would provide an additional 20 years of service life to the 37-year-old facilities.
- Entered into Amendment No. 3 for \$1,160,000 with Camp Dresser & McKee Inc. for the Final Design and Bidding Phase Services for the Disinfection System Improvements Project.
- Entered into Amendment No. 1 in the amount of \$615,000 to the Professional Services Agreement



Engineering Technician Tammy Archuleta and Engineer I Jenny Trujillo (formerly Rivera) talk about a 2002 job at the plans table in Engineering.

with Camp Dresser & McKee Inc. for development, implementation, and training services for Phases II and III of the Geographic Information Systems Project.

- Awarded a \$3,192,251 construction contract to ERS Constructors for the Thornton-North Washington Parallel Force Main Project and entered into Amendment No. 4 in the amount of \$254,800 to the Agreement for Professional Services with Black & Veatch Corporation for construction engineering services, resident engineering services, and post-construction engineering services.
- Awarded a \$362,561 contract to Restoration Corporation for the Primary Access Bridge Concrete Rehabilitation Project.

- Ratified emergency actions to stabilize substantial erosion of Sand Creek and the possible catastrophic failure of the Metro District's Sand Creek Interceptor and appropriated \$159,771 from the Fixed Asset Replacement Fund.

Agreements

The board approved an agreement with Denver Water for the Reuse Plant's long-term access through 2054 to the Metro District's effluent for use at the Reuse Plant; the District's short-term acceptance of sludge from the Reuse Plant to be approved/rejected on an annual basis through 2008; a 2005 Capital Recovery Rental Charge of \$19,878 to recover total capital costs to make facilities available to treat the sludge and the cost to treat the sludge based on current annual charges for service unit costs. This allowed the District to treat Denver Water's sludge, assuming sufficient capacity existed, until Denver Water could build its own solids processing facilities.

The board approved 3 requests for service area expansions for the Goldsmith Gulch Sanitation District (1 property previously on an independent septic system), and 2 expansions to the Willowbrook Water & Sanitation District for about 42 acres in unincorporated Jefferson County.

Metro engaged in negotiations for an easement option and/or land lease across the METROGRO farm with qualified wind development firms that responded to Xcel Energy's request for proposals to construct a wind energy project.

The board entered into an intergovernmental agreement with Aurora to jointly develop a master plan for treating



In this view of the South Plant from southeast to northwest, the two cryogenic towers can be seen on the left. They were designed to produce 40 tons each of 98 percent pure oxygen daily.

and conveying wastewater flows tributary to the Sand Creek Basin. The study would be a joint effort with costs equally shared by Aurora and the Metro District.

The board entered into a professional services agreement in the amount of \$268,392 with Camp Dresser & McKee Inc. to provide professional consulting services for the South Platte River Segment 15 Aquatic Life/Habitat Assessment Project.

Other board actions

The board rescinded the Metro District's voluntary affirmative action compliance plan and expanded its program of diversity

initiatives to continue fostering and maintaining an environment of equal opportunity for all current and prospective employees without regard to race, religion, age, gender, national origin, sexual orientation, veteran status, or physical limitations.

Metro reinstated the Retiree Health Insurance Funding Assistance Program adopted in July 1996 to allow retirees to use the cash value of their unused sick leave balance in excess of 480 hours, up to a maximum of 480 hours, to pay for all unreimbursed health-related expenses in addition to assisting in funding retirees' and eligible dependents' health insurance premiums.

The board was reapportioned, increasing the number of members from 66 to 67. Thornton's representation increased from four to five directors.

Glendale's request to become a special connector to the District was granted and the board authorized the district manager to enter into a special connector agreement with Glendale subject to the following conditions: (1) Glendale would construct all capital improvements necessary to connect to the District's system, according to District standards and specification; (2) Glendale would pay a sewer connection charge, estimated to cost approximately \$5.8 million, based on a current inventory of existing sewer connections and associated water tap sizes; and (3) the sewer connection charge would be based on the District's 2005 sewer connection charge of \$1,740 per single family residential equivalent.

The first amendment to the January 2004 amended and restated retirement plan was adopted to provide for a one-time, ad hoc increase in the benefits of retirement plan



Field Mechanic Keith Hagan does a quick maintenance check in one of Metro's pick-up trucks.



A maintenance worker adjusts foam “knockdown” spray in the North aeration basin complex during the South Primary Effluent Rehabilitation project in Oct. 2005.

participants who terminated employment prior to January 1, 2005. The increase was retroactive to January 1, 2005, and addressed the loss of purchasing power caused by inflation.

Revisions to the 2005 estimated annual charges for service, the 2006 calculation of estimated unit charges, and the 2006 estimated annual charges for service were approved. The board also adopted a 2006 sewer connection charge of \$1,820 per SFRE and updated capital investment fractions to be used in calculating the large-user exception. A reactivation charge of \$75 per SFRE was set for 2006, the same as the 2005 reactivation charge.

Pretreatment

A new Pretreatment Information Management System was implemented, replacing the Metro District’s aging Industrial Waste Administration System.

The District recognized 13 industrial dischargers who demonstrated a commitment to environmental excellence at the 12th annual Metro District Gold Awards program.

Metro participated in the development of the Federal Pretreatment Streamlining Rule published October 14, 2005, and was a participant in the development of “Planning for Decontamination Wastewater: A Guide for Utilities,” published by the National Association of Clean Water Agencies in October 2005.

Lowry Landfill Superfund Site

Metro completed decommissioning of seven monitoring wells on Sections 28 and 30 of the former Lowry Bombing Range. This action concluded a three-year effort by District staff to close 41 monitoring wells installed by the USGS on seven different sections of land on the site.

Metro entered into a consent decree with the EPA to close the Lowry III litigation.

Metro also entered into an amendment to the June 1996 settlement agreement between the Metro District and Chemical Waste Management, Inc., Waste Management of Colorado, Inc., and the City and County of Denver to provide for continued payments from the Lowry Landfill Superfund Site Environmental Protection/Cleanup Trust Fund in the event of a default by Denver and Waste Management and provided that certain conditions were fulfilled.



RR&R Field Operator Tim Friedrich, left, Mechanical Maintenance Supervisor Ray Montez, and RR&R Operations Specialist Nate Nigon chuckle about something on the job in the compost area.

Biosolids

USGS distributed its final report: *Effects of Surface Applications of Biosolids on Soil, Crops, Ground Water, and Streambed Sediment near Deer Trail, Colorado, 1999-2003*. The report culminated five years of independent monitoring of the environmental effects of the biosolids application program at the METROGRO farm required in the intergovernmental agreement with Elbert and Arapahoe Counties.

High-solids centrifuges and the additional biosolids storage capacity added in 2004 reduced the wet ton volume of biosolids. The reduction let the RR&R Department modify its operating schedule. For the first time since it was formed in 1974, RR&R implemented a six-day work week and gave employees Sundays off.

Metro initiated a biosolids processing protocol in early 2005 to ensure regulatory compliance with both state and federal Class B biosolids requirements.

RR&R and Public Information produced a new biosolids video in 2004 and began distributing it in 2005. The video was crafted to help the District recruit private farmers for biosolids land application. The drought, which began in 2002, caused crop failures at Metro's farm, which meant nitrogen was not being extracted from the soil. Reduced nitrogen uptake by plants meant less biosolids could be applied, so Metro had to find farmers who wanted biosolids for their farms.

Metro contracted with METROGRO Farm tenant farmer T. H. Thompson III to market all of the District's share of the 2005 and 2006 crop harvest. Thompson also exercised his option to extend the Amended and Restated Farm and Grazing Lease Agreement, which expired in August 2005, for another five-year period.

Metro completed construction work on an airstrip on the METROGRO Farm's south property to provide for all-weather access for agricultural aircraft performing aerial chemical applications.

The board approved the both the 2005 and 2006 joint funding agreements with the U.S. Geological Survey to cover the

Metro District's cost share of the Independent Monitoring Plan for a comprehensive environmental study near Deer Trail, Colorado, effective April 1, 2005 through December 31, 2005, and January 1, 2006 through December 31, 2006.

New farmable terraces were completed on the METROGRO Farm's central property, and Metro completed the drilling and proper registration of three existing wells on the METROGRO Farm's south property.



From a cherry picker in the southeast corner of the plant, this view shows three METROGRO® trucks and other equipment near the RR&R maintenance facility. The white building on the left is Building 2A, the original compost test facility.

Equipment upgrades

RR&R took delivery of a new \$339,957 six-wheeled, articulated Volvo biosolids applicator machine with a 20-yard side-discharge Kuhn-Knight spreader box. It would be used to apply biosolids to agricultural sites.

RR&R also took delivery of a new Volvo articulated front-end loader with extended bucket reach from Power Equipment Company. The new loader was to be used at the biosolids land application staging areas. It also took delivery of three more new Red River Live Bottom trailers.

Regulatory relations and water quality

Metro staff secured the following outcomes at the June 2005 Basic Standards for Surface Water Rulemaking Hearing: elimination of the obsolete water quality standard for the protection of drinking water supplies of 0.5 mg/L total ammonia; amendment of Colorado's anti-degradation regulations to include a provision that assigned a use-protected designation to effluent-dominated/dependent waters, such as Segment 15 of the South Platte River, recognizing that any future anti-degradation review would effectively prevent the effluent from degrading the effluent and thereby eliminating the prospect of any future anti-degradation review; and adoption of interim temperature standards that reasonably reflected the conditions in effluent-dominated/dependent waters where the in-stream temperature was clearly a function of the effluent temperature.

Staff also completed permitting and installation of 19 permanent groundwater quality monitoring wells along the east and west

sides of the South Platte River to more accurately measure the impacts of groundwater on the water quality of the river.

Metro completed all requirements of the November 2000 Sanitary Sewer Overflow Agreement with Colorado Department of Public Health and Environment and submitted its final report.

Safety and security

A gasoline leak in 2005 at the Suncor refinery southeast of and adjacent to the plant caused employees to be evacuated and sent home as a safety precaution. An after-action assessment resulted in a number of procedure changes to improve safety, including an upgrade and regular testing of the alarm systems.

The Colorado National Guard Full Spectrum Integrated Vulnerability Assessment Team accomplished a vulnerability assessment of the Metro District. Also Metro participated with the Commerce City Police Department in securing a Department of Homeland Security Buffer Zone Grant of \$127,000 to provide monies for District communication gear, detection equipment, and perimeter protection.

Other events

In September 2005, the U.S. Court of Appeals, Tenth Circuit, issued its decision in an appeal filed by former board member Adrienne Anderson. The court ruled in Metro's favor, thus negating Anderson's claim to whistleblower protection and ending an eight-year legal battle.

Records management relocated one of the Metro District's onsite inactive records storage centers before the building was demolished as a part of the Primary Treatment Improvements Project.

The District entered into a \$308,000 agreement to provide software and configuration, implementation, and training services for a new records management system as well as a \$45,000 agreement for consulting services related to this project.

Human resources began using a new online tracking tool to identify, schedule, and document training activities to ensure personnel attained and maintained skill sets required at the Metro District.

Information Services oversaw replacement of the Metro District's aging telephone and voicemail systems with an Avaya system. The \$229,000 contract with North



Volvo articulated biosolids spreader applying biosolids, spring 2005.

American Communications Resource, Inc., included equipment, software, installation, and training services.

2006—New beginnings for Metro

A West Virginia blast in January killed 12 miners; the avian influenza virus was found in Western Europe and Africa; and the Senate began immigration overhaul debates as guest-worker programs came under discussion.

At Metro, 2006 was a year of new (and some not so new) beginnings as the District began needed capital construction projects in earnest to meet new demands.

Annual operating expenses

Metro's annual operating costs increased an average of 3.6 percent over the 12-year period from 1995 through 2006. During that time, nearly 150,000 single family residence equivalent (SFRE) connections were added to the system. The change increased the population served by 36.4 percent from about 1.1 million to about 1.5 million people.

For comparison, the National Association of Clean Water Agencies Index rose during the period 1994-2005 (the latest period for which they had numbers) at the same annual average rate.

Despite the growth in the population it served, Metro's cost increases were comparable to those of similar agencies. These increases were reasonable considering the costs of labor, materials, and supplies over the period in addition to increases in the costs for insurance and security, which were not reflected in the Denver/Boulder/Greeley Consumer Price Index.

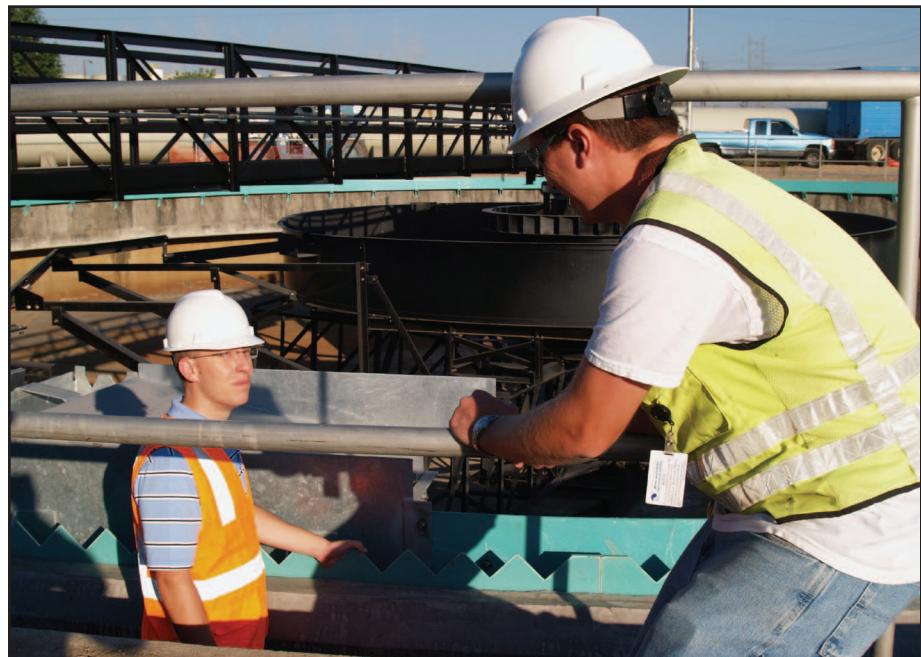


Plant Operator Mark Gillespie pulls an NPDES sample at dawn.

Gravity thickeners

Excavation for the first of four new gravity thickeners began early in 2006. The thickeners were part of the Primary Treatment Improvement Project that rehabilitated and improved the North and South Complex primary clarifiers. The gravity thickeners increased the concentration of primary sludge from approximately one percent to between five and eight percent. They also provided additional treatment capacity in the digesters. The improvements made the existing secondary treatment systems more efficient.

During 2006, primary clarifiers 7-10 (the four oldest and smallest primaries) were gutted. New rake arms and other equipment were installed. The sludge pumping station for these primary



Engineers Matt Duncan (left) and Joe Schroeder confer on the Primary Treatment Improvements project, which was initiated in 2006.

clarifiers was removed, and a new one was built in its place. The existing sludge pumps were replaced, and the new gravity thickeners were under construction during most of 2006.

When the four new 60-foot-diameter gravity sludge thickeners were to begin operating in the summer of 2007, they would be fed from a centralized flow-splitting structure. Thickened primary sludge would be pumped to a holding tank and blended with thickened waste-activated sludge prior to anaerobic digestion. The gravity thickeners produced sludge with five-to-eight percent solids concentration. They also captured 95 percent of the solids fed to the thickeners.

Overall, the Primary Treatment Improvement Project cost \$24.7 million.

Thornton-North Washington Parallel Force Main

The \$4.6 million Thornton-North Washington Parallel Force Main project moved forward during 2006. It ran from the existing Thornton-North Washington Lift Station east of York Street and north of I-76 to the Central Treatment Plant.

The new 42-inch steel pipe carried sewage uphill, under pressure, from the lift station to the plant for treatment because the service area to the north is at a lower elevation.

The new force main ran parallel to an old pre-stressed cylindrical concrete pipe force main built in 1966. When Metro completed the new one, it drained and inspected the old force main while continuing to provide service to people in Thornton and the North Washington Street Water and Sanitation District.

The path for the new force main was close to the South Platte River, and it crossed the river on Metro's property just north of the Central Treatment Plant. ERS Constructors tunneled under I-76 and I-270 to install it without disrupting traffic. Black & Veatch was the consultant.

Disinfection System Improvements Project

The board approved the \$15 million Disinfection System Improvements Project to replace the old chlorination/

dechlorination system. It would convert the gaseous chlorine and sulfur dioxide system to one that uses liquid sodium hypochlorite and sodium bisulfite. The project expanded the capacity of the existing chlorine contact chamber.

The liquid hypochlorite and liquid bisulfite systems would eliminate the risks that came with storing large amounts of gaseous chlorine and sulfur dioxide. The two systems operated in parallel until performance of the new one was well established.

Dissolved Air Flotation Rehabilitation Project

At year end, Metro was finishing the renovation of eight Dissolved Air Flotation (DAF) thickening units.

At most, six were in service at any one time in 2006. The units thickened a daily average 93 dry tons of waste activated sludge and reduced the volume of liquid Metro had to process.

Construction completion was scheduled for August 2007.

Maintenance keeps Metro humming

The Maintenance Division maintained about 2,500 major pieces of equipment at the Central Treatment Plant. It also maintained four lift stations, Transmission Division equipment, electrical and mechanical equipment for the composting site, and janitorial maintenance for 56 buildings with 600,000 square feet of working space. Grounds maintenance covered 182 acres, four miles of streets, and 400,000 square feet of parking lots.

An upgrade of the Computerized Maintenance Management System to a web-based system was planned for completion in 2007. It was expected to be more intuitive and make training easier.



Engineer III Brenda McMillan, district project manager for the DAF building rehab project, inspects the DAF polymer bag connection.

Televising interceptor lines

Metro paid \$158,000 for a video-equipped 2006 Chevrolet high-cube diesel truck. The new vehicle replaced the old TV-inspection truck, which was worn out. The goal was to inspect and clean approximately 10 percent (23 miles) of interceptor sewer lines each year.

In 2006, the District inspected 29 miles of its system, videotaping 13.2 percent and cleaning 12.2 percent. Those figures compared to 12.2 percent and 12.6 percent, respectively, in 2005.

In addition, 2,637 surface inspections were carried out, and 6,037 requests for locating Metro's interceptor sewers were handled. Of those location requests, 1,313 required a field location effort.

Since 2001, the truck and video equipment have been used to inspect 154 miles of interceptors, more than half of Metro's system. The District has been using video to inspect the interior of interceptor sewers since 1988.

Critical Incident Response Plan introduced

Metro issued its new Critical Incident Response Plan (CIRP) to members of the Critical Incident Team during 2006. The CIRP was designed to help Metro respond to a wide variety of critical incidents ranging from a wastewater spill on or off the plant site to a chlorine or sulfur dioxide leak or a medical emergency at the METROGRO Farm.

The plan was comprehensive, covering all business areas of Metro. It identifies communication strategies, defines lines of authority, and provides guidance on the required level of response to critical incidents. It was also consistent with

guidelines provided by federal and state governments and industry groups such as the Water Environment Federation.

Exercise Green Cloud

Metro held its first emergency evacuation drill in several years October 25 with a plant-wide evacuation exercise that simulated a chlorine line break near the disinfection area. Seventeen members of the Safety/Security Committee acted as controllers during the drill. The facility was evacuated in less than 12 minutes.

It was the first evacuation exercise in some time, so only employees in the Administration Building actually left the plant. Employees on the plant site evacuated to various gates based on wind direction where controllers counted them there to assure no one was missing.



Electrician Instrumentation Technician Patti George and Electrical Maintenance Supervisor Ron Nicholson talk about the coming day's work in this 2006 photo.



Interceptor Systems Operator Craig Thomas checks progress as a Transmission Division crew checks a sewer with the television system.

The exercise was a complete success and several useful lessons were learned. Metro planned future exercises.

Automated waste hauler entry control and billing

A cooperative effort between Information Services, Laboratory Services, and Security resulted in a triple win for Metro.

Using a new Lenel Access Control System, staff issued badges to the drivers of each waste hauler truck. The haulers swiped their badges at the main gate prior to entry. The system displays the truck information to the security guard, who then determined if the truck was allowed to enter.

The entry information is used to automatically bill the waste hauler. If a hauler becomes ineligible to use Metro's facilities, Laboratory Services can easily disable the card, thus alerting the security guard that the truck is not allowed to enter.

Truckers responded favorably to the system because it expedited procedures at the gate.

Knowledge mapping

In 2006, Donna Hull, Jim Carabajal, Gayle Webb, and Arne Holst had each worked at Metro for more than 25 years. Carabajal was approaching 40 years of service. They had packed a lot of knowledge and experience into their long careers that made them invaluable in the knowledge mapping process, an important component of Metro's succession planning program.

Knowledge mapping is a process to identify, capture, and retain critical knowledge in an organization. It is designed for employees expected to retire in one to three years and is critical to succession planning, ensuring knowledge isn't lost when employees leave an organization.

Beginning in 2006, the foursome met for monthly knowledge mapping discussions that included regular homework assignments. Their goal was to identify the most critical and complex information that needed to be passed on to successors.

As each member focused on three to five critical job responsibilities, the group brainstormed ways to document the information, so those who follow in their footsteps won't be without their wisdom and experiences.

LABWORKS and LIMS

In January, Metro began using a new computerized laboratory information management system called LABWORKS. The old system, LIMS, which had served Metro well for 18 years, was decommissioned.

LABWORKS took advantage of new technology and open architecture, which made it easier to interface data with other Metro systems to support operational decision-making and timely reporting to regulatory agencies.

Information Services, Lab staff, and the Pretreatment Division spent a significant amount of time evaluating and modifying business practices to ensure the features and functionality of the system could be leveraged to the fullest extent possible.

GIS

During 2006, Metro incorporated Geographic Information System (GIS) technologies into its systems. The technology allows spatial mapping components to be linked with tabular information. The result is quicker and easier access to information and improved workflow for Metro's Transmission Division.

Incorporating GIS technologies led to a significant reduction in the number of physical inspections performed by Transmission staff in support of Metro's Line Locate Program.

Interim EMS Third-Party Audit

The Metro District maintained its certification from the National Biosolids Partnership (NBP) during 2006 after successfully completing an interim third-party external audit as part of its Environmental Management System (EMS) for Biosolids.

The NBP originally certified Metro's EMS for Biosolids on July 30, 2005.

The interim audit included six positive observations, five minor non-conformances, and one opportunity for improvement.

Metro developed a management response that identified corrective actions to address the minor non-conformances and established a timeline for completion.



(Left to right) Donna Hull, Gayle Webb, Jim Carabajal, and Arne Holst, each with more than 25 years' service, formed a knowledge mapping group that met regularly to make sure their knowledge didn't leave with them. As this book went to press in 2009, Hull and Carabajal were still working at the District.

Green fleet initiative

Noting the significant increase in fuel prices that began in late 2005 and continued into 2006, the Resource Recovery and Reuse Department (RR&R) began developing and implementing a green fleet concept. While the specifics of the plan had not yet been finalized in 2006, RR&R staff developed some intermediate steps that would become part of the formal program.

One concept was pilot-testing biodiesel fuel in two road tractors that transported biosolids from the treatment facility to agricultural land application sites in eastern Colorado. The pilot test began in June 2006 and was scheduled to span a year.



Barbara Orr in the Environmental Services Department tries out a new hybrid car, one of the first in Metro's "green fleet."

RR&R gathered “before biodiesel” operating data to establish a baseline to compare it to “with biodiesel” operating data. The evaluation looked at fuel efficiency, changes in required maintenance, fuel mileage and availability, and emissions.

The other initiative was to consider replacing additional vehicles with ones that had smaller and more fuel-efficient engines. When practical, the possibility of replacing four-wheel drive vehicles with two-wheel drive vehicles was also considered, along with the possibility of replacing gas-engine vehicles with hybrids.

Successful day-to-day biosolids management

Success in this arena came when one considered the day-to-day tasks required to manage biosolids, along with unexpected twists dished up by Mother Nature. In spite of the combined challenges, the RR&R Department accomplished a lot during 2006.

Examples of some of the more significant challenges included:

- Continued impact of drought on the METROGRO Farm that resulted in poor yields. Minimal nutrient uptake from the soil, in turn, reduced Metro’s ability to apply biosolids.
- The need to encourage more private farmers to use biosolids and permit their land for application.
- Because private farm sites were much smaller than the METROGRO Farm, Metro could not apply as much biosolids at a single site and had to move frequently to different locations. Sometimes all of the equipment was moved, and new staging areas were set up as many as three or four times a week.

- Loss of several irrigated private farm sites due to the Colorado State Engineer's decision to shut down some farmers' irrigation wells.
- Changes to the state biosolids regulations that resulted in a new method of calculating agronomic loading rates (how much biosolids can be applied to a field). The change reduced the loading rate by 30 percent, thereby increasing the amount of land Metro needed in its land application program.



Field Operator Sean Rutt and RR&R Specialist Nikki Stefonick talk about a problem in the field.

- A snowstorm that hit on December 20 and essentially shut down eastern Colorado, together with all of Metro's land application sites.

Despite the noted challenges and many smaller ones, Metro passed the following biosolids management program milestones in 2006:

- Transported, handled, and managed 29,198 dry tons of biosolids (129,463 wet tons).
- Filled 5,646 tractor trailers with biosolids.
- Covered 521,508 miles with those trucks without a single accident. (This would be equivalent to driving to the moon and back and then almost twice around the earth).
- Complied with every county, state, and federal biosolids regulation.
- Accomplished this without working Sundays or District holidays.
- Reduced overtime by 13 percent from 2005.

EPA's top water administrator visits Metro

Ben Grumbles, the EPA's Assistant Administrator for water, visited Metro on June 27 to observe the District's approach to sustainability.

Director of RR&R Mitch Costanzo talked about how Metro beneficially recycled biosolids. Director of O&M Steve Rogowski showed Grumbles key features of Metro's Central Treatment Plant such as the Cogeneration Building. The facility produced heat and electricity from what would otherwise be a waste



Ben Grumbles, EPA's top water administrator (red tie), visits Metro. Mitch Costanzo (r) explains composting to Grumbles.

gas. Governmental Affairs Officer Barbara Biggs talked about environmental improvements Metro made off the plant site.

Steve Gunderson, head of the Water Quality Control Division at the Colorado Department of Public Health and Environment, was also present for the tour.

Metro bans molybdenum-containing water treatment chemicals

On June 20, Metro announced a ban on molybdenum-containing water treatment chemicals being discharged to its sanitary sewer system after January 1, 2007.

Metro banned the chemicals under provisions of the Federal Clean Water Act and the Colorado Water

Quality Control Act. Violators faced penalties of up to \$32,500 a day for each prohibited discharge.

EPA approved the ban on June 6, 2006, and the Metro board approved it earlier that same year. The ban prohibited all discharges of molybdenum-containing water treatment chemicals to Metro's sanitary sewer system from cooling towers, boilers, closed-loop heat transfer systems, and any other cooling or heating systems.

The molybdenum ban was required to protect the quality of Metro's biosolids.

New analytical equipment for the laboratory

Metro purchased a new Inductively Coupled Plasma-Mass Spectrometer for \$147,990.

The new ICP-MS combined the benefits of the two old metals-monitoring machines while achieving lower metals detection limits. Metro could then conduct all metals analyses required by its permits efficiently, accurately, and precisely.

Metro bought a new segmented flow analyzer to track nutrients and other constituents. It replaced a similar piece of equipment and analyzed samples more quickly and at lower detection limits.

Metro's lab would use it to analyze the nutrient components of all samples for the solids recycling program, including sludge, soils, compost, and biosolids.

Deer Trail Independent Monitoring Program

The board approved Metro's share of a 2007 joint funding agreement with the U.S. Geological Survey

for the seven-year Deer Trail Independent Monitoring Program for a comprehensive environmental study.

The price tag was \$199,990.

The year-long USGS study included an air quality component to measure the inorganic content of wind-borne particulates from biosolids-applied fields on/around the METROGRO Farm. The results did not show any negative effects following the land application at Metro's farm.

Aquatic Life/Habitat Assessment Project

The board approved the Aquatic Life/Habitat Assessment Project and negotiated with Camp Dresser McGee for design services. The project was to help the Metro District develop effective aquatic life/habitat improvements along the South Platte River.

In 1995, Metro entered into a memorandum of understanding with the EPA, the Water Quality Control Division of the Colorado Department of Public Health and Environment, and the Colorado Division of Wildlife. The agencies were trying to reach consensus on dissolved oxygen (DO) standards for Segment 15 of the South Platte River needed to protect and maintain viable populations of aquatic life.

In 1997, the same agencies entered into a second MOU and all four parties agreed to support the set of dissolved oxygen (DO) standards developed during the study. The standards were subsequently adopted by the Colorado Water Quality Control Commission.

The second MOU required Metro to construct in-stream improvements directly related to DO (mainly drop structures to



Metro purchased this segmented flow analyzer from OI Analytical to track nutrients and other constituents in solids recycling program samples, including sludge, soils, compost, and biosolids. Lisa Lucero demonstrates it.

increase DO levels). It also called for measures to maintain fish habitat, including flow equalization facilities to regularize the discharge of Metro's effluent, and fish entrainment facilities to prevent fish from leaving the river through irrigation ditches.

Metro also agreed to additional studies and changes to its existing monitoring programs.

By 2004, it had become apparent to Metro that neither flow equalization nor fish entrainment would achieve the environmental benefits anticipated in the 1997 MOU. In addition, these new improvements would be operationally difficult and would cost significantly more than expected. At Metro's request, the other three parties to the MOU agreed to amend the 1997 MOU.



Water Quality Scientist Jim Dorsch (right) shows reporters Christine Gomez (left) and Heidi McGuire the drop structure at 124th Avenue in 2006 as they discuss improvements Metro is making to the South Platte River near there.

The amendment dropped the requirement for Metro to construct the flow equalization and fish entrainment facilities. Instead, it directed Metro to update and recalibrate the Segment 15 Water Quality Model. Metro was also asked to complete a comprehensive assessment of potential improvements to aquatic life/habitat. The goal was to find ways to improve this habitat in lieu of the equalization and entrainment facilities.

At the completion of the aquatic life/habitat assessment in 2006, the four parties entered into amendment 2 to the 1997 MOU. It committed Metro to design and construct habitat improvements as recommended in the Aquatic Life/Habitat Assessment (PAR 991) Final Report of June 2006. The cost was not to exceed \$6 million.

PAR 991 was a habitat improvements project for the reach of the South Platte River that extended from the Brantner Ditch diversion to Henderson Road. It had several diverse habitat elements and was bracketed by two other reaches with relatively good habitats and flow conditions.

Specific planned improvements included backwater pools, riffles, snags, spur dikes, and bank re-vegetation. The first phase of the habitat improvements spanned three years. It was a pilot study to assess methods and impacts so that Metro could plan for follow-on improvements to the river.

Fish shocking

A laboratory crew went into the South Platte River several times in October for Metro's annual scientific effort to gather fish data by shocking fish. When the fish came to the surface, the scientists captured, counted, weighed, and measured them.

Metro had one of the most comprehensive stream monitoring programs in Colorado. Metro's water quality scientists had gathered fish data like this for 20 years at eight sites from 31st Avenue near the Pepsi bottling plant to Weld County Road 18 near Fort Lupton. They had collected 18 different species of fish—most of them native—and their studies provided the scientific community with data from the urban South Platte River.

The river downstream of Metro was the single most diverse Colorado watershed in terms of number of fish species. For nine months each year, 85 percent of the South Platte River north of Denver was wastewater that Metro treated and released.

Recalibrated water quality model for Segment 15 of the South Platte River

Metro continued to develop the Segment 15 Water Quality Model. It allowed the Colorado Department of Public Health and Environment to set appropriate limits for ammonia, nitrate, dissolved oxygen, and other constituents when it renewed Metro's permit in 2008.

In addition to Metro, the Water Quality Model also set discharge permit limitations for several utilities along the South Platte River. It was originally developed in the early 1990s to determine how dissolved oxygen problems in the river could be addressed.

Segment 15 of the South Platte began about 1½ miles upstream of Metro's outfalls at the Denver-Adams County line and extended to the river's confluence with Big Dry Creek near Fort Lupton.

Because water quality conditions in the South Platte River were changing constantly, the Segment 15 Water Quality Model needed to be updated and calibrated periodically.



Laboratory and water quality employees shock fish in the South Platte River in 2006 to count, weigh, and measure them as part of the annual collection of such data on the river.

Metro had been modeling water quality in the South Platte River since the early 1980s.

Dr. William M. Lewis, head of the Limnology Center at the University of Colorado-Boulder, was in charge of the study. Following water quality modeling and other studies, Metro spent \$9 million in the 1990's to construct four drop structures (low-head dams) to improve dissolved oxygen.

The new study spanned about three years and extended the modeled portion of the South Platte River from its confluence with Big Dry Creek to its confluence with the St. Vrain River. An estimated \$150,000 was spent in 2006. An additional \$150,000 was spent during the previous two years.

Alfa Laval Centrifuge lawsuit

After 13 months of negotiations with Alfa-Laval, Inc. Metro filed a lawsuit against the company in early 2006 because the new high-solid centrifuges were not performing as guaranteed.

They were supposed to produce a dewatered biosolids cake that was 26 percent solids at 28 lbs/ton of polymer consumption. During performance testing in July and August of 2004, the centrifuges averaged 22.8 percent cake at a polymer consumption rate of 34 lbs/ton.

The unmet performance guarantees were costly to Metro in terms of additional polymer usage, and the lower cake solids resulted in more truckloads of biosolids that had to be hauled because the wet-ton volume was higher.

RWTPA negotiations

At year end, Metro was concerned that decisions being made by the Regional Wastewater Treatment Plant Authority (RWTPA) were not in the best interests of the District and its ratepayers. Metro asked the other two RWTPA parties (City of Brighton and South Adams Water and Sanitation District) to renegotiate various provisions of the IGA (intergovernmental agreement), because significant changes had occurred from the time when the IGA was signed in September 2005 and the end of 2006.

For example, when the parties signed the IGA, estimates were that the new treatment plant and common interceptor would cost \$110 million. Later cost estimates showed the price tag to be \$145 million or more. Such increases meant the savings Metro had projected were rapidly disappearing.



In Sept. 2003, Metro was installing and checking four new Alfa Laval Centrifuges in the Process Building. The old, orange Humboldt centrifuges can be seen in the background.

In addition, flow projections also changed significantly from those estimated at the time the IGA was signed. Later projections showed that Metro's flows would likely always be greater than those of the other two entities.

Costs were proportionate to flows. However, under the terms of the IGA at the time, Metro would not have had a say in how the money

was spent that was commensurate with its monetary contributions. As 2006 came to a close, the issue still had not been settled.

Beginning again

In its early years, Metro's board and employees fought through basic problems such as BOD and TSS removal, sludge disposal, labor-management relations, and a budget that was sometimes hard to balance. Because of the mix of large and small member municipalities, the board was sometimes accused of being fractured in its early years. The path toward the future was but dimly outlined. Obstacles seemed endless. Board members and employees strained to peer through the fog.

As the first 45 years came to a close, board members had overcome their differences and settled into a policy-making role that guided the District along a path that became clearer day by day. Employees picked up their share of the job and moved from competent to excellent. The District is now in control of its finances and its future to a degree that other utilities envy. Biosolids management is under control. In 2005, Metro became the eighth wastewater treatment agency in the nation to become EMS certified. It was also named the best large, advanced plant in the country by the EPA in 2005 and completed 10 consecutive years without a numerical violation of its permit. It is marching steadily on a path toward advanced wastewater treatment and nutrient management and is positioned to be far more than the sewage disposal plant its founders envisioned as it treats metro Denver's wastewater for the next 45 years and beyond.

The board does the public's business month in and month out without bombast or fanfare. They have a plan in place to make



Laboratory Analyst Tanya Bayha prepares BOD samples for analysis in this late 1990s photo.

almost a billion dollars in capital improvements before 2018, but there is no panic in the face of such a large number. Metro's employees are accustomed to turning in exemplary performances, even during tough times. They are proud of their accomplishments and of the recognition they've received for their efforts.

Citizens of metropolitan Denver and people living downstream as well should take pride in the Metro District's accomplishments. Its work has improved public health and the environment while it made the South Platte River better. No longer is that body of water the disappointing "dry bed of sand, (sic) into which the water had

sank and disappeared,” as Francis Parkman described it in 1846. Downstream of Metro, the river supports 18 different species of fish—most of them native. Metro’s fish studies have provided the scientific community an abundance of data from the urban area of Denver downriver to Weld County Road 18 near Fort Lupton. The river is cleaner, and so is the water going into Barr Lake. It is no longer the offense to the nose as it was in the early 1960s.

In the words of the late Bob Hite, who served as district manager for 19 years, “I think the biggest accomplishment has been in moving the district from just another sewage treatment plant to a metropolitan wastewater reclamation district with a focus on environmental stewardship.”



Maintenance Worker Al Kappen (left) and Sr. Maintenance Worker Ted Lacy clean aeration basins.

END NOTES

¹ Metro Wastewater Reclamation District, 1998 Year in Review.

¹ Metro Wastewater Reclamation District, 1998 Year in Review.

² Author’s personal observation.

³ Metro Wastewater Reclamation District, Minutes of the Regular Meeting of the Board of Directors, June 17, 1997 and July 15, 1997.

⁴ US EPA, “Lowry Site Remedy Continues,” Lowry Landfill Superfund Site Information Update No. 16, March 2004, p. 5.

⁵ Metro Wastewater Reclamation District, 1998 Year in Review.

⁶ Metro Wastewater Reclamation District, 1998 Year in Review.

⁷ Penny (Patience) Payne, Interview, Oct. 29, 2008

⁸ Ibid.

⁹ Interview, Dick Keasling, Nov. 9, 2004.

¹⁰ Ibid.

¹¹ PACE Local 5-477 et. al. v. City and County of Denver, et. al., Case No. 00CV1826, Order on Motion to Dismiss June 9, 2000.

¹² Yager, Tracy J.B., David B. Smith, James G. Crock, Effects of Surface Applications of Biosolids on Soil, Crops, Ground Water, and Streambed Sediment Near Deer Trail, Colorado, 1999-2003, Scientific Investigations Report 2004-5289.

¹³ 422 F.3d 1155 (10th Cir. 2005).

¹⁴ Robert W. Hite, Interview, July 2007.



As the sun sets over Denver in this late November 2006 photo, the Metro District continues its 24x7 job of protecting public health and the environment in metropolitan Denver and downstream in the South Platte River.

Timeline

1959

- A Feasibility Report was prepared by the Inter-County Regional Planning Commission, Joint Sanitation Committee. The chairman was Carl Jacobson.

1960

- Metropolitan Sewage Disposal Districts Act of Colorado was adopted. It was amended in 1981, 1982, and 2007.
- Arvada became the first municipality to pass an ordinance to create the Metro District.

1961

- Civic leaders of 13 metropolitan Denver cities signed an historic agreement on May 15, 1961, that created the Metropolitan Denver Sewage Disposal District No. 1.

1962

- December 11—Voters approved a \$32.5 million bond issue by a 9-1 margin. The vote allowed Metro to begin construction on the collection system and hire a full-time manager

1963

- The Metro District adopted its Bylaws. They were amended in 1982, 1989, and 2007.
- Board met in a formal public hearing and adopted the Rate Schedule.
- District hired Jerry Winegart.
- Began pre-design of Central Plant (now the North Plant).

1964

- The first Service Contracts between the District and its Connectors were entered into.
- Groundbreaking ceremonies for the \$17.3 million Central Plant were held on a Saturday in September.

1965

- The Board determined that the Metro District would make every attempt to provide effective sewage treatment at the lowest possible cost.
- The South Platte River flooded on June 15, 1965. The plant was then under construction, mostly at excavation stage.

1966

- Central Plant was completed and began accepting test flows from Denver's North Side Plant late in the year.

1967

- The plant facilities were officially accepted from the contractor, Mead and Mount Construction Company, on March 21, 1967; the dedication ceremonies were held on May 21.
- Between September and December, when data were continuously available, the plant removed in excess of 88% of the suspended solids and in excess of 90% of the biochemical oxygen demand.
- To keep the plant in operation 24 hours a day, seven days a week required 60 operators plus nine supervisory and administrative people.
- The plant was covered by a construction warranty until March 1968. Thereafter, the District was responsible for all repair expenses.
- Most maintenance work was done on an 8-hour day shift basis with call outs at other hours for emergencies. The maintenance crew consisted of 17 building and ground maintenance men, three electrician-instrument technicians, four mechanics and three supervisory and administrative employees.
- The Lab performed some 30,000 analyses in 1967 and was involved in various research projects. The Lab also analyzed the samples necessary to enable Metro to charge its member municipalities for its work on their behalf. There were two chemists and four lab technicians, plus the samplers.
- Three new members joined the District in 1967: the City of Aurora, (Jan. 18); the Applewood Sanitation District (Aug. 15), and the Pleasant View Water and Sanitation District (Oct. 17).

Timeline

- Of the 19 municipalities, 13 were classified as “connecting municipalities” (meaning their works connected directly to Metro’s) and four were “associate municipalities,” meaning their service was provided by one of the connecting municipalities. Forty other municipalities had a contract with one of the connecting municipalities and were served indirectly as non-members of the District. There were 42 board members.

1968

- A no-strike bill was presented in the Colorado House to prevent Metro workers from being represented by a labor union. A proposed change to the bill would allow workers to strike if they first notified the Colorado Industrial Commission of any intent to strike.
- The State Industrial Commission ruled that Metro fell under the Colorado Labor Peace Act. District Manager Jerry Wingeart and legal counsels Robert Inman and John Flynn said Metro was the only political subdivision in Colorado that appeared to be in that position under that act. The board was opposed to approaches by municipal employees and operating engineers unions to hold representation elections at Metro.

1969

- The Metro District Board said it would not appeal a district court decision permitting Metro District employees to join a union and negotiate for a contract.
- A Denver Post article of March 12 said, “The Metro District is cited as a major offender in a Tri-County District health department list of 22 firms which will have to clean up their property as part of a major rat-control program beginning this week.”
- During its September board meeting, former Board Chairman Charles M. Dosh requested the board conduct an investigation of the District’s operations and threatened to request a congressional probe if it did not.
- Jerry Wingeart resigned as manager of the Metro District after a more than 1 ½ hour closed-door executive session. The resignation, effective immediately, was announced at 12:10 a.m.

1970

- The State Air Pollution Control Board took the Metro District to task for air pollution.
- The Colorado Water Pollution Control Commission criticized Metro’s attempts to rectify problems at its overloaded plant.

1971

- By 1971, the Metro District was nearing capacity for both primary and secondary treatment. The earliest time by which it could construct new facilities to relieve the pressure was 1975.
- The service charge per million gallons treated increased just 17 percent from 1967-1971 while the Denver Metro Area Consumer Price Index as compiled by the University of Denver went up 21 percent.
- The District’s sludge incinerator/dryer units were shut down because of increasingly stringent state air pollution standards.

1972

- The hydraulic capacity of the primary treatment facilities was exceeded in 1972 for the first time and the hydraulic capacity of the secondary treatment facilities was exceeded more than ever before.
- Metro’s first long-range planning report was produced during 1972.
- The City of Golden joined Metro Apr. 15. First flows were received Nov. 17.
- Fruitdale applied for membership in late 1972. It was accepted on Feb. 20, 1973.
- Metro began conducting research on land application of sewage sludge. It also established agriculture test plots near Watkins.
- After more than a year in preparation, Metro implemented its Comprehensive Preventive Maintenance Program.
- Experiments with sludge digestion showed that anaerobic digestion reduced sludge volume by 40 percent.
- Congress passed the far-reaching Clean Water Act, and it was signed into law by then-President Richard Nixon in October.

Timeline

1973

- Voters in the Metro District's service area approved a \$25 million bond issue on April 3 by more than a 3-1 margin.
- Metro's first annual update of its long-range planning study was presented to the Board in the Spring of 1973.
- Inflation caused problems for Metro in 1973, causing prices for materials, supplies, and electrical power to be higher than budgeted for.
- Chlorine, ferric chloride, and stators for Moyno pumps became scarce.
- Metro beneficially recycled sewage solids (sludge) in 1973 by trucking vacuum-filtered sludge cake (about 16% solids) to the old Lowry Bombing Range, spreading the solid material onto the surface to dry and then disking the dried sludge cake into the soil with farm implements. The sludge-applied areas were seeded with wheat after adequate dormant time to minimize seed inhibition.
- Wastewater flows into the District's Central Plant in 1973 exceeded the 1972 flows (the previous high) by 25 percent for primary flows and 17 percent for secondary flows.

1974

- After experiencing several regulatory, technical, and legal delays, the CH2M predesign study report was implemented two years after board acceptance.
- The plant expansion contract was formally awarded to Mead & Mount Construction Company at a special Board of Directors meeting on April 29, 1974, and construction finally began on May 1, 1974.

1975

- The number of directors on Metro's Board grew from 54 to 62 in 1975, indicating that the population to be served had continued to grow. Costs grew along with population.
- Inflation also strained Metro's budget. Staff efforts to compensate reduced an anticipated \$800,000 shortfall by 90 percent.
- Despite delays caused by federally mandated guidelines and regulations, major construction efforts moved forward in 1975. The

South Plant, the eight new anaerobic digesters, and the first section of the Platte River II interceptor were all part of this effort.

- Efforts to change the annual charges formula progressed in 1975, and the consultant's report and recommended changes were presented to the board.
- A contract was let in November 1974 to build a new access road to the central plant, including a bridge across the South Platte River. The new road and bridge would provide access to the District-owned property on the north side of the South Platte River

1976

- In December, the South Plant went online when flows were directed there for the first time, roughly doubling Metro's treatment capacity.
- In September, the Board of Directors occupied the new Board Room in the Administration Building, and in November, the Metro District Central Treatment Plant had a new main entrance and a new address.
- Construction of the 8 anaerobic digesters reached the 90 percent completion point by the end of the year, and the final portion of the Platte River II Interceptor construction reached 34 percent completion.
- Solids processing and recycling continued to be a major cost and item for the Metro District. The new sludge drying and distribution center project continued to be delayed by the environmental impact statement procedure, and District personnel began looking for additional methods of sludge recycling.
- Work on the revision of the annual charges structure continued throughout 1976.

1977

- The Project Action Request (PAR) system began. The first PAR was entitled "RPC Force Main - Vault Fan (construction phase)," and Gary Flesner was the District Project Manager. The project cost was about \$4,200.
- Eight new 244,000-cubic-foot anaerobic digesters were completed in 1977 to digest Metro's sludge.

Timeline

1978

- On October 3, 1978, a major fire and explosion occurred at Continental Oil's (CONOCO) refinery on the southeast fenceline of the Metro District's plant killing three Conoco employees, hospitalizing 12 persons, and causing extensive damage to the Conoco plant and surrounding area, including about half a million dollars' damage to Metro facilities.
- The inability of the Colorado Water Quality Control Commission to revise state water quality standards and reclassify streams receiving effluent complicated Metro's planning and budgeting efforts enormously.
- EPA issued its Environmental Impact Statement (EIS) for the Denver region following a 3-year investigation.
- EPA also issued its 3-years-in-the-making EIS on Metro's Sludge Reuse Project. Although EPA approved Metro's plan to build a sludge drying and fertilizer distribution facility near Watkins, the approval also carried with it some costly requirements.
- Metro staff and several board members worked to revise and update the 14-year-old service contract to devise a more equitable annual charges formula.
- Metro sold the Aurora Sand Creek wastewater treatment plant back to the City of Aurora, which needed it to generate reuse water for parks and golf course irrigation.

1979

- "Risk" budgets in 1978 and 1979 resulted in cost overruns despite severe belt-tightening in operations and maintenance.
- In June, Metro's board adopted a reapportionment that listed the service area population as 1,004,535, which warranted 66 directors. Crestview Water and Sanitation District and the Lakewood Board filed suit in Adams County challenging the reapportionment. The result was a new reapportionment that gave the served population as 1,068,134, warranting 57 directors and a change in the proportion of directors representing Denver.
- Metro struggled with whether it could (or should) continue to seek federal grants for 75 percent of the cost of badly needed wastewater

transmission and treatment facilities or whether it should try to obtain 100 percent local financing for the capital improvements.

- To be eligible for a \$6 million construction grant for an additional interceptor in the Sand Creek Basin, the EPA said Aurora, Denver, Arapahoe County, and Adams County would have to agree to a series of land use and growth management policies. Metro believed that, as a special district, it had no power to coerce other local governments to adopt land use and development policies but could only ask for cooperation.

1980

- By the end of 1980, Metro had determined that federal grants, together with their various use limitations as well as the uncertain timing of their receipt, "were an unacceptable financial incentive to the District's member municipalities."
- The Denver Water Department announced the beginning of construction in 1981 of a \$22 million potable water reuse pilot plant just south of Metro's plant.
- Public reaction to hazardous wastes being disposed of at Lowry Landfill caused the Arapahoe County Commissioners to order all disposal at Lowry to cease by Dec. 31, 1982. The order cost Metro all but 700 acres of land it had previously had available to it for sludge disposal in mid-1980. Metro had been disposing of sludge at the old Lowry Bombing range since the winter of 1969-1970.
- William Korbitz resigned on Oct. 4 as district manager. Don Allard of Arvada completed two years as chairman of the Board in July. Robert W. Hite of Denver took over as chairman.

1981

- Jack B. Enger, P.E., was appointed manager on March 1, 1981.
- The District struggled during 1981 to find a funding strategy for critically needed capital improvements.
- Voters authorized Metro District to issue bonds up to \$126 million.
- The 1981 State Legislature amended the law governing metropolitan sewage districts to allow more flexibility in the Metro District Service Contract.

Timeline

- The Metro District's sludge management plan was revised to achieve the goal of cost-effective beneficial reuse of sludge. The cost of implementing a previous six-year-old plan to pump liquid sludge to a drying and distribution center in rural Adams County had tripled to \$50 million, making it much less desirable than it had seemed early on. The revised program called for centrifuges and composting.

1982

- A 4-year study of Metro's facilities showed that Metro's system would not be able to handle the anticipated population growth of half a million people by 2004 without significant expansion.
- From the \$126 million in bonds authorized by the election in October 1981, Metro sold \$76 million in short-term bonds despite high interest rates. The proceeds were used to continue design and begin construction of critically needed interceptors and treatment facilities.
- Construction of the \$4.9 million cogeneration plant was approved in July.
- A 10-dry-ton-per-day demonstration composting facility began construction, with completion expected in mid-1983.
- The first 750-gallon-per-minute Humoldt centrifuge for thickening sludge was installed and began operating.
- The Board adopted a Central Plant improvements program, approved the concept of Metro acquiring Denver's Northside Treatment Plant and its common interceptor system, and initiated a growth-related charges policy.

1983

- In April, the Metro District signed an agreement with the City and County of Denver to take over operation of Denver's Northside Treatment Plant and common interceptor system.
- The Metro District imposed a sewer connection fee (tap fee) for new connections to the District's system. Revenues were earmarked to pay debt service costs for the 1981 bond projects, and the announced philosophy was "Growth pays for growth." Metro collected about \$9.1 million that first year.
- Construction of the cogeneration facility began in November.

- The Metro District committed to construction of full-scale facilities for converting sludge to compost in late 1983 when the board of directors approved a sludge management plan.

1984

- Metro expanded its role as a regional wastewater treatment agency in 1984 with the completion of much of its \$126 million sewer improvements program and the takeover of Denver's common wastewater facilities.
- The Metro District system grew dramatically with the addition of more than 171 miles of interceptors and the Denver Northside Plant primary facilities. Its services were extended to more than 23 local governments, which previously had been served through Denver. These local governments are now referred to as Special Connectors.
- With the acquisition of the Denver common system, the District planned to build new primary treatment facilities at its Central Plant to replace the older Denver Northside primary facilities.
- The Board of Directors initiated a Long-Range Master Plan Study.
- Work on a second floor addition to the administration building was almost finished, while renovations to the remainder of the building continued.
- Ground was broken on a full-scale compost site, and modifications to the sludge processing system were in progress.

1985

- The \$7.8 million cogeneration facility went online in April.
- Sewer connection charge revenues dropped from about \$10 million in 1984 to \$8.5 million in 1985. During the middle and late 1980s, metro Denver was in a recession, and housing starts had dropped sharply by the end of the decade.
- A Long-Range Master Plan Study was completed that looked at identifying how service area expansions might impact the Metro District.
- Metro submitted its Pretreatment/Industrial Waste Control program plan to the EPA for approval in September.

Timeline

1986

- The Metro District marked its 25th anniversary.
- The number of employees increased from 244 to 263.
- Restrictions on the sewer connection charges were eased so sewer connection revenues could be used for any capital facilities project.
- The compost facility began operating in June.
- Metro's first computer-aided drawing system became operational.
- Employee Safety Committee developed procedures for entering potentially hazardous places such as manholes, designated no-smoking areas on the plant, developed a hardhat use policy, and began developing revised emergency evacuation procedures for the Central Plant.
- The industrial waste control (pretreatment) program began.
- EPA filed a lawsuit against Metro.
- EPA issued Metro a final discharge permit on Dec. 7 after a year of negotiations.

1987

- The Denver Northside Treatment Plant was shut down.
- The Laboratory successfully started and implemented a computerized Laboratory Information Management System.
- Co-generation increased its efficiency and produced more electricity.
- The District began partial dechlorination in October using a temporary facility.
- The District reduced costs by switching to applying sludge cake on agricultural land.
- Reorganizing departments within the District reduced the need for hiring additional personnel as another cost-saving measure.
- The District took steps to have some capital projects eligible for a federal construction grant.
- The board of directors proposed a bond issue election to lessen the impact of necessary rate increases.
- Renovation of the old sludge processing building was completed. The renovated building then housed two 750-gpm centrifuges and provided office space, equipment storage, and locker facilities for plant personnel.

1988

- Voters approved \$97 million worth of sewer bonds by a 6-1 margin for projects the District needed to build in the next five years in March.
- Revenues from sewer connection charges (tap fees) dropped sharply, contributing to the need to increase Annual Charges by 16 percent in 1989.
- Robert W. Hite assumed duties as district manager on Sept. 1. He had been a member of the board for 17 years and had served as chairman for three years. He succeeded Jack B. Enger.
- Long-Range Planning Service Area Analysis of Metro that began in 1987 was completed.

1989

- Revenues from sewer connection charges continued to fall.
- A 30 percent increase in Annual Charges for 1990 was narrowly averted. (The increase ended up being 18 percent.)
- Steep, budget-driven reductions in expenditures were achieved by laying off non-essential personnel, delaying filling vacancies, cutting expenses such as memberships and attending conferences, and making some minimum-risk changes to the way in which the facilities were operated.
- Metro and the EPA in March settled the lawsuit EPA filed in 1986 for \$1,125,000 in civil penalties. Metro paid the penalties in three annual payments of \$375,000 each.

1990

- The board changed the name of the organization from Metropolitan Denver Sewage Disposal District No. 1 to Metro Wastewater Reclamation District in recognition that the sewage Metro cleans in its daily actions is valuable as reclaimed water.
- The District's commitment to conduct and/or be involved with remedial investigations/feasibility studies for the Lowry Superfund Site resulted in additional unanticipated expenses.
- Significant factors affecting the increase in Annual Charges for Service for the 1989-1991 period were the start of debt service on \$50 million

Timeline

in bonds issued in late 1988, the \$47 million capital costs of the new ammonia removal facilities, the increased operating costs due to the new facilities, and the settlement of the 1986 EPA lawsuit requiring the Metro District to pay a penalty of \$375,000 per year for three years.

- The Regulatory and Connector Relations Department was formed in August with Steve Pearlman as its leader.

1991

- The District completed improvements to the Nitrification/Denitrification System and optimized its performance. This \$47.2 million system involved extensive modifications to the District's treatment facilities.
- The Nitrification/Denitrification System allowed the District to meet all related conditions of its discharge permit during the year.
- Metro completed the Nitrification Alternatives Study. Regulatory agencies anticipated that an additional reduction in ammonia discharged into the South Platte River beyond that which was achieved with the Nitrification/Denitrification System would be required to meeting stream standards.
- The Nitrification Alternatives Study identified four potentially viable “non-traditional” techniques for meeting the Segment 15 water quality standards.

1992

- EPA designates 1992 the Year of Clean Water
- Work began on the Segment 15 Scientific Studies and Stream Channel Improvements Project.
- The new Maintenance Shops and Warehouse Building was completed.

1993

- Implementation of the District's first Ten-Year Plan for Service.
- The board approved purchasing approximately 9,900 acres near Deer Trail, Colorado.
- The federal 503 sludge regulations became effective.
- District instituted its “Good Guy” Gold Awards.

1994

- The District and the EPA mutually terminated the consent decree.
- The Board decided to cash fund non-growth, capital projects with a life of 20 years or less, and all capital projects valued at \$500,000 or less from its general fund.
- The District adopted the Oracle software system.
- The District adopted e-mail.
- The District experienced just one numerical permit violation in 1994, which allowed it to qualify for an Association of Metropolitan Sewerage Agencies (AMSA) Silver Award for plant operations (which was awarded to Metro in 1995).

1995

- The District purchased approximately 36,000 acres of property near Deer Trail, Colorado, adding to the 1993 purchase.
- District employees held the line on costs in 1995, and the 1996 budget contained an increase of just 1.8 percent in the District's Operating and Maintenance (O&M) costs.
- The Metro District was in compliance with the new federal 40 CFR Part 503 biosolids regulations months in advance of the effective date of February 19, 1995.
- The board of directors authorized a contract for maintenance software and implementation services.
- In December, 31 employees from the Facilities Maintenance Division moved into their new shop facility. At a cost of \$1.3 million, the new facility consolidated and expanded the offices, shops, locker rooms, and equipment storage for the facility maintenance operation.

1996

- Staff developed and implemented capital project probability factoring.
- The board decided not to raise Annual Charges for Service in 1997.
- Metro adopted a new Sewer Connection Charge methodology for 1997.

Timeline

- Elbert County issued a cease-and-desist order in late June banning Metro from applying biosolids to the 30,000 acres of farm land it owns in Elbert County.
- Metro began a concerted effort to work with Elbert County and others to resolve misunderstandings and disputes.

1997

- A new grease cleaning unit was installed in the Grease Processing Building.
- The Colorado Water Quality Control Commission accepted of staff's plan for Segment 15.
- The District received the EPA's 1997 Operations and Maintenance Award for Region 8 for large advanced plants and won the second-place O&M award in the entire nation for large advanced plant operations.
- Metro worked throughout the year with Elbert County and others to resolve misunderstandings and disputes related to Metro's farm property and an agreement Metro was working on with US EPA to take care of Metro's obligations to help with the clean-up of the Lowry Landfill Superfund Site.

1998

- Staff implemented the Fixed Asset Replacement Program.
- To help resolve the Elbert County cease-and-desist order issued in 1996 and resolve misunderstandings with neighboring landowners around its farm property, the Metro District agreed to implement an Independent Monitoring Program. Under an Intergovernmental Agreement developed with Elbert and Arapahoe Counties, the US Geological Survey would conduct the monitoring program, Metro would pay for it, and Elbert County would serve as a neutral go-between working with Metro, interested parties, and USGS.

1999

- The Metro District signed an intergovernmental Memorandum of Understanding (MOU) on Jan. 20 with Elbert and Arapahoe Counties obligating it to implement an Independent Monitoring Program.

- The District signed an agreement with Trigen-Colorado Energy Corporation, a company that specializes in generating electricity from renewable sources. This was the first and only part of Metro's treatment process to be "outsourced."

2000

- Jan. 1, 2000, came and went without trouble.
- The USGS Independent Monitoring Program went into effect in January on Metro's farm property near Deer Trail, CO.
- On January 15, a section of high-density polyethylene pipe collapsed in a manhole in the Weir Gulch Interceptor resulting in a discharge of 200,000 gallons of wastewater into Weir Gulch. Water quality monitoring by Metro indicated the wastewater did not reach the South Platte River and the concentration of fecal coliform bacteria initially introduced into Barnum Park Lake was substantially reduced by dilution and cold temperatures in the lake.
- Metro initiated its Comprehensive Planning Program.
- On June 9, the EPA notified the Metro District and the Water Quality Control Division of the Colorado Department of Public Health and Environment (CDPHE) that the District had violated its National Pollutant Discharge Elimination System (NPDES) Permit as a result of Sanitary Sewer Overflows (SSOs) on at least 10 occasions from June 6, 1997, through January 15, 2000.
- Metro began accepting highly treated groundwater discharged from the Lowry Landfill Superfund Site to the Central Treatment Plant.
- The Metro District received its second EPA first place Industrial Waste Pretreatment Award.
- The Paper Allied Industrial Chemical and Energy (PACE) workers union local that represented several employees in the Laboratory Services Department was decertified by a vote of the represented workers.
- The roof of Sludge Holding Tank No. 2 was damaged in late December by accumulated foam in the tank.

Timeline

2001

- For the first time in its 35-year history, Metro's employees achieved in March a million man-hours worked without a lost-time accident. Metro's safety programs had reduced the number and severity of accidents and resulted in a safer, healthier environment for employees.
- Many long-time Metro employees began to retire. Harry Harada, who had headed the Laboratory Services Department, retired and was replaced as director by Shian-Shen Kung. Mitch Costanzo, from Engineering, was selected to head the Resource Recovery and Reuse Department with Barbara Millett's retirement, and Steve Rogowski from Planning was selected to replace Mary Ann Tavery in Operations and Maintenance.
- CH2M Hill, Inc., was selected to perform engineering services for the Central Treatment Plant (CPT) Facility Plan Project.
- Studies by the Water Quality Division concluded that cadmium contamination in the South Platte River was not due to Metro District discharges.
- The District purchased hardware and software upgrades for the Process Control System, Control Network, and Control Room.
- The Colorado Department of Public Health and Environment conducted parallel sampling and analysis of final effluents in an audit of the Laboratory. Metro passed the audit with flying colors.
- Metro's Intranet was introduced in June.
- December marked the end of the first full year of Trigen-Colorado Energy Corporation's operation of Metro's cogeneration facility under a 20-year contract.
- Substantial completion was achieved in December for a reaeration structure in the vicinity of 136th Avenue.

2002

- Metro adopted the Service Area Utility Plan, which is the management plan for the District's Transmission System.
- Metro implemented its EMS for Biosolids in December.
- Three Information Services groups were consolidated into the Information Services Division.

- The District elected not to continue negotiations with Denver Water regarding sharing ammonia conversion facilities pursuant to a Memorandum of Understanding executed in April 2001.
- Steve Rogowski took over as the Director of Operations & Maintenance.
- A drought that affected all of Colorado and the West impacted numerous Metro District activities. Flows decreased and farming operations suffered.
- Construction of the new Shop and Equipment Building at the METROGRO Farm was completed.
- Notice to proceed on the installation of four new Alfa Laval high solids centrifuges was given in July.
- The Metro District's new Discharge Permit was issued on December 30.

2003

- Metro temporarily ceased land application of biosolids and instead hauled them to the BFI landfill because Metro was not confident the retention time in the digesters would be sufficient to effect the pathogen kill required to produce Class B biosolids.
- Foam Sensing Equipment was installed in Digesters 1, 2, and 3. Digester foaming in February had caused Metro to fear there would not be enough space in the digesters to treat the sludge.
- Metro hired its first full-time security officer.
- Metro completed in-house redesign of external web site.

2004

- A massive exodus of senior employees continued as baby boomers and the generation prior to that began to retire.
- The District reissued the Industrial Wastewater Discharge Permit for the Lowry Landfill Superfund Site in August.
- The Metro Wastewater Reclamation District tied for first place nationally in the US Environmental Protection Agency's annual Exemplary Biosolids Management Award competition in the Large Operating Projects category for 2004. EPA presented the award to Metro at a National Clean Water Act Award ceremony.

Timeline

- Metro met all the requirements of its Sanitary Sewer Overflow Compliance Agreement. The Transmission Division inspected 34 miles of sewers using a closed circuit TV system (the goal was 22 miles) and generated several rehabilitation projects as a result of the inspections.
- The District established a Citizen Participation Group for its Environmental Management System for Biosolids.
- Construction began on Digesters 11 and 12 in January.
- Installation of four new Alfa Laval high solids centrifuges was completed in July. The centrifuges were performance tested in July and August of 2004.
- Laboratory Services and Regulatory and Connector Relations were consolidated into the Environmental Services Department under the leadership of Stephen R. Pearlman.
- In March, the District negotiated a permit amendment with the Colorado Department of Public Health and Environment's Water Quality Control Division that eliminated the requirement for Metro to construct additional drop structures on the South Platte River and allowed additional time for Metro to update its water quality model.

2005

- The Metro District won its second consecutive National Association of Clean Water Agencies Platinum Award for five consecutive years without a numerical permit violation. Two Platinum Awards represent 10 perfect years. Metro was the largest of five agencies nationwide to have achieved back-to-back Platinum Awards.
- On July 31, 2005, the Metro Wastewater Reclamation District became the 8th wastewater treatment agency in the U.S. to earn certification for its Environmental Management System for Biosolids from the National Biosolids Partnership (NBP).
- In October, the Metro District won the EPA Operations and Maintenance Award for 2005. This award, presented at the annual Water Environment Federation technical conference (WEFTEC), is one of a series of awards the EPA created to recognize the best treatment plants in the USA. Metro's Central Treatment Plant was

one of two plants the EPA judges determined to be the best operated and maintained large wastewater treatment plant in the USA.

- The City of Glendale joined the Metro District in November, making it number 57 in the family of local governments Metro serves. Glendale was the first new connector since 1990, when Lochmoor Water and Sanitation joined the District.

2006

- The Metro District issued its new Critical Incident Response Plan (CIRP) to members of the Critical Incident Response Team.
- The District continued efforts to prepare for the exodus of employees nearing their retirement years with its succession planning program.
- Metro began using a new computerized Laboratory Information Management System called LABWORKS in January. The old Laboratory Information Management System had served Metro for 18 years.
- Metro incorporated geographic information system (GIS) technologies into its systems. This allowed Metro to link spatial mapping components with tabular information.
- Metro began introducing hybrid vehicles into its fleet. The so-called "Green Fleet" program began with just two vehicles.
- Substantial completion of Digesters 11 and 12 was achieved in September.
- Notice to proceed was given in October for the \$15 million Disinfection System Improvements Project. It converts the gaseous chlorine/sulfur dioxide disinfection system to one that uses liquid sodium hypochlorite/sodium bisulfite and replace the Plant Water Chlorinated system, which had reached the end of its useful life.
- After 13 months of unproductive negotiations, Metro filed a lawsuit against Alfa Laval because the four new centrifuges in 2004 were not performing in accord with the guarantees.

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1963

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Secretary Robert Wham Denver
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Secretary Cyrus Colburn Denver
Treasurer Carl Jacobson Westminster

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Secretary Charles Dosh Denver
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Treasurer Dean Lund. Denver

1980

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Chairman Pro Tem . . Charles Wemlinger . Aurora
Secretary Richard Beckfeld . . Fruitdale
Treasurer Dean Lund. Denver

1981 and 1982

Chairman Robert Hite Denver
Chairman Pro Tem . . Charles Wemlinger . Aurora
Secretary Richard Beckfeld . . Fruitdale
Treasurer Wesley Brown Thornton

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Chairman Lewis Short Lakewood
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Secretary David Erickson . . . Denver
{7-84 - 6-85} Ted Hackworth . . . Denver
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Treasurer Ted Hackworth . . . Denver

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Chairman Ted Hackworth . . . Denver
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Secretary Greg Kelly Arvada
Treasurer K.K. Ciruli Denver

1991

Chairman Robert Broom . . . Aurora
Chairman Pro Tem . . K.K. Ciruli Denver
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Treasurer Richard Plastino . . . Lakewood

1992

Chairman Robert Broom . . . Aurora
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Glossary

Annual Charges - Charges imposed by the Metro District for the treatment of sewage and other services which, together with other lesser revenues, cover the District's operation, maintenance, and capital expenditures; debt service; and required cash reserves.

Biochemical Oxygen Demand - The measure of the quantity of oxygen used in a 5-day period by bacteria during the biochemical oxidation of organic matter in wastewater at a specified temperature, and under specified conditions. The greater the BOD, the greater the degree of pollution.

Clarifier - A tank used to settle solids.

Cogeneration - The simultaneous generation of electrical energy and heat from the same fuel (at the Central Plant, methane gas from the digesters).

Cornell, Howland, Hayes &

Merryfield (CH2M) - founded in 1946 and still in business today.

Digester - A treatment facility in which the solids removed during primary and secondary clarification are subject to anaerobic decomposition to the point of rendering the product nonputrescible and inoffensive.

Dissolved air flotation - Process used for separating solid and liquid particles inside a tank and concentrating the solids, utilizing chemical conditioning to enhance flocculation (formation of wooly tufts) and diffused air to raise the conglomerating particles to the liquid's surface where the particles are then removed by skimming.

East Side Plant - located at Smith Road and Wabash Street, was abandoned in May 1966 and is now a park area.

Effluent - Wastewater, treated or untreated, that flows out of a sewer, a basin, a treatment plant process, treatment plant, or industrial outfall.

Influent - Wastewater or any other liquid flowing into a reservoir, basin, or treatment plant, or any unit thereof.

Metro Engineers, Inc. - formed through the joining partnering of three separate engineering companies for the Metropolitan Sewage District project; the firms that partnered were Phillips-Carter-Osborn, Inc., Ken White & Associates, and Henningson Durham Richards, Inc. (now known as HDR).

Glossary

North Side Plant (also Northside)

- Owned by Denver, the plant was located at Franklin Street at approximately 50th Avenue. It was closed in 1987 after Metro District took over its flows and treatment for better efficiency and cost savings.

Porteous Process - A heat process where steam is injected into sludge under pressure, which helps to coagulate the solids, break down the gel structure, and reduce the hydration of the solids.

Primary treatment - Mechanical treatment utilizing screening, skimming and settling.

Ringlemann Scale - Used in the early days of emissions measurements, it was a visual scale of the opacity (from clear to black) of the smoke leaving a leaving a stack.

Secondary treatment - Biological processing through the use of microorganisms.

Segment 15 - The segment of the South Platte River that extends from the Burlington Headgate in Adams County to Big Dry Creek in Weld County. It is the reach of the South Platte River that Metro effluent discharges into.

Suspended Solids - The insoluble, settleable, and nonsettleable (colloidal) solids that either float on the surface of or are in suspension in water or wastewater.

Terra-Gator - A manufacturer's trade name for a machine with a low soil-compaction rating and which can apply sludge to the surface or inject it into the soil.

Total Kjeldahl Nitrogen (TKN) – A measure of the total ammonia and organic nitrogen together.

Weir - A device in the flow of a channel or basin that causes the liquid to back up behind it and flow over it, and may be used in flow monitoring, control and/or measuring.

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