Texas Water Resources Institute

October 1975
Volume 1
No. 10

Municipal Effluent Boon to Irrigation

By Lee Pilgrim, Editor, Texas Water Resources
J. Frank Gray was a college dropout.

In the 1930s somebody made him an offer he couldn't refuse--and he and the City of Lubbock have been reaping benefits ever since.

Against the advice of professors and classmates, Gray quit hi Texas Tech agriculture courses to work for Dr. Fred W. Standefer, who was under contract to "take the Lubbock city sewage effluent and keep it out of the way of the city."

At that time, Standefer was irrigating a 200-acre farm with the city's daily flow of one to one-and-a-half million gallons. Today Gray "keeps out of the way" about 16 million gallons a day, irrigating a total of 5,000 acres (2,000 belong to neighbors) and supplying water to a Southwestern Public Service plant or cooling purposes.

"My teachers and friends just didn't see the potential in it that I did," he says. Gray had toiled and failed on a dryland farm during the protracted drought of the early '30s, and water--even sewage water--meant production to him. Hence, just a year away from graduation, Gray quit Tech to seize the chance to get back into production.

Gray could not have predicted the future significance of using municipal effluent for irrigation. He couldn't have seen that in the final quarter of the century, water would be so scarce that reuse of that resource would be necessary. Nor could he have anticipated the grave problems which have resulted in anti-pollution laws requiring treatment of "waste" water before it is released to rivers and streams.

Public Law 92-500, an effort to improve the nation's water quality, requires municipalities to implement waste treatment that would discharge clean water into rivers and streams. Passed in 1972, the law gives the cities until 1983 to develop successful techniques.

Ahead of the Law

At the present time, most municipal effluents go through only primary and secondary treatments, but by 1985 they will have to receive tertiary treatment, which removes nitrogen and phosphorus. Physical plants for tertiary, or third stage, treatment are costly to build and to operate; and the same results are accomplished when waste water is discharged on land under controlled conditions. This is what Lubbock has been doing since the early 1930s.

"If we were not engaged in this operation--or if somebody were not--," said Gray, "Lubbock would have to go to tertiary treatment. That would probably cost a million dollars a year. Maybe more. Some engineers conservatively estimate it could cost maybe $12 to $15 million to build the additional physical plant facilities, and then $750,000 more a year to operate it."

Thus, giving Gray a cheap lease on land ($3 an acre per year) and allowing him a royalty on water sold to the power plant is a bargain for Lubbock.

Good Deal

It's also a good deal for Gray. His benefits are multiple:

1) While other farmers are pumping from the Ogallala aquifer, ever mindful of its threat of depletion, Gray irrigates with water which reaches his land by gravity flow from the three city reservoirs. No need for electric pumps.

"If we had to pump the full amount of water we have to dispose of, the electric bill would be $30,000 a year or more. We use energy now only to run our sprinkler system--six pivot systems--and to get water from the playa lakes and the storage lakes we have built behind the dams," Gray remarked.

2) The water is rich in nitrogen, phosphorus, and potash (plus some trace elements)--fertilizers that would cost him up to $140 a ton. Russell E. Train, EPA administrator, told municipal officials and consulting engineers at a seminar in April that "if the cost of fertilizers continues to rise at this rate (from $75 per ton in mid-1973 to well over $140 by fall 1974), . . . the use of organic waste in agriculture will become an economic necessity . . . rather than an ecological nicety."

No Need to Fertilize

Nutrients in the effluent preclude the use of fertilizers. Gray has selected crops that are high users of water and nitrogen and has rotated the crops to maintain an effective balance of nutrients in the soil.

Crop quality, as well as yield, is better, he claimed.

3) He can order the water wherever he needs it--from any of the three city reservoirs. "If I need five more hours in the north reservoir, I tell them (the treatment plant) to pump in that direction."

4) The greatest advantage, of course, is the abundance available at all times. However, unless a farmer knows how to dispose of the flow, the effluent, like the magic pudding pot in the fairy tale, could be a woeful case of too much of a good thing. Therefore, Gray has diversified his program to include crops which drink water the year around: small grains (wheat, barley, oats, and rye), row crops (cotton, corn, sunflowers, and grain sorghum), hay a pasture (alfalfa, sudan, and many varieties of perennial grasses).

Gray says the grasses in the past have been vital to his program because they dispose of about four and one-half million gallons per year. As the municipal flow increased, he used forage crops to take care of it--grasses, perennial or annual. Gray says it's pretty hard to get too much water on your perennial grasses. Expansion, diversification, and storage accommodations have since lifted the pressure.

Long-Term Contracts

Gray is in the fifth year of his third long-term contract with Lubbock. The present contract is a 20-year agreement. His operation is partly on city-owned land, for which he pays an annual lease fee based on acreage. Under the contract, he defrays the cost of preparing the land and constructing water conveyance facilities. He has leveled more than 1,600 acres and has constructed about 40 miles of underground pipelines. His pipeline starts at the city reservoirs which receive the effluent from the secondary treatment plant. These reservoirs have a capacity of 60 to 70 hours of flow.

Because the constant percolation of water though the soil has "artificially" recharged the underground water table, Gray's operation in only 27 years of intensive irrigating has raised the water table under the farm to within a few feet of the surface. (The water table in the area drops from one to three feet per year and recharges an average of one inch or less per year.) The city now is planning a series of wells to use this underground water. It will be pumped back up the canyon to keep the canyon lakes at a constant level. Also there are plans to use the water to irrigate city parks and a cemetery, and as a coolant at a city generating plant. That's THREE times the water is used. This ground water is reduced in biological oxygen demand (BOD), organic carbon phosphorus ammonia, virus, and bacteria.

6) Gray can be a good neighbor and make money doing it. He supplies water to adjacent farms on a cash basis as well as to the nearby electric plant. Under the contract with his farmer neighbors, Gray is not required to furnish water during the summer because he must make sure he fills the needs of the power plant. He pointed out that it is in winter that he needs to dispose of the greatest amount, and that is the time the farmers can use the water for preplanting irrigation. Although he is not obligated to furnish water in summer to neighboring farms, he has not failed since he made the deal.

Model Project

Gray's operation is something of a model. The longest continuous project of significant size in the United States, the Gray farm is visited by federal and state officials as well as representatives from cities where such an endeavor might be under consideration. Since the passage of Public Law 92-500, Gray has been the focus of many questions involving this economical (relatively speaking), practical means of tertiary sewage treatment.

In addition Gray would emphasize the importance of a long-term contract and of complete cooperation between the city and the farm operator. For the city's own protection, he feels that the city should own the land.

Other points from the pioneer in effluent use; 1) It is advisable to keep water management under one "master." 2) Depending on the type of farming, such an operation would be feasible from 30 to 50 miles from the city. 3) As a rule of thumb, the operation uses 1 million gallons per day per 100 acres if most of the land is in forage crops; for crops such as cotton, the acreage would be doubled. 4) Erosion and runoff problems must be controlled by properly scheduled applications and crop selection, along with diversion terrace, dike, and dam construction around the farm. 5) Forage crops, particularly bermuda grass, help eliminate the high nitrate content in underground water. 6) The effluent must be free of industrial waste water which might be toxic to plants.

Trying to keep ahead of the fast-flowing effluent is probably the biggest problem Gray meets. That, coupled with having to take it in all kinds of weather when it is not needed. But he says there are others. Getting farm workers is difficult because of the objectionable odor and fear of disease. Gray thinks there is no need for this fear when secondary treatment has been used and when chlorine has been added. However, he says precautions are used in handling this water.

To offset those disadvantages, he points to advantages--increasing crop yield, improving soil conditions, recharging the aquifer, and preventing pollution. A visit to the Gray farm is evidence that benefits outweigh problems.

Thoroughly sold on the vast potential of using municipal effluent for irrigation, Gray hope to see some research conducted to determine whether or not sewage effluent can be used safely in producing food for human consumption. He says the United States Health Department has not recommended using waste effluent for food production, especially food that is not processed. Gray says this source of water would be a real benefit to growers of high cash vegetable crops if it can be proved safe. He pointed out that only high cash crops would warrant the cost of operations removed from the city reservoirs by as much as 30 miles.

Gray's satisfaction with his "deal" with Lubbock is echoed by Lubbock city officials. Because the operation is looked on as a successful pioneer venture, both parties are frequently called on to tell the success story from coast to coast.

No wonder. Where else can pollution control, water re-use, and diversified farming with cheap water and no fertilizer costs be tied up in a single package?