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IMPROVED MANAGEMENT STRATEGIES MAY SAVE TEXAS MUNICIPALITIES MILLIONS ANNUALLY

A newly established research project of the Water Resources Center at Texas Tech University could result in savings of 2.5 to 3 million dollars annually to Texas municipalities. The research targets three areas of municipal water supply wherein improved management strategies can net savings of 5 to 15 percent of the annual pumping costs.

The project, entitled "Management Strategies for Energy Efficient Operations of a Municipal Water Supply," recently received funding from the Texas Higher Education Coordinating Board through their Advanced Technology Program. Dr. Lloyd V. Urban, P.E., Director of the Water Resources Center, and Dr. Billy J. Claborn, Professor of Civil Engineering, are the co-principal investigators. And, at least three graduate students are to be involved in the project.

The primary purpose of the research is to develop management strategies for energy efficient operation of a municipal water supply which, upon implementation, will cause an immediate and continuing reduction in the power used by a municipality to produce and deliver potable water to its citizens.

Prior Proof

For example, "a 1987 study of the Midland, Texas, water system showed that savings can range from 5 to 25 percent of the energy employed just to pump groundwater," states Dr. Urban. The savings are achieved when optimal decisions are made in selecting the most energy-efficient wells to use to produce a given amount of water.

"If only half of the cities in the state which rely wholly or partially on groundwater were to adopt the improved management program, the savings could easily be 2 to 2.5 million dollars per year based on the amount of groundwater annually pumped for municipal use and an average improvement of 15 percent," says Urban.

Research Objectives

The overall objective of this

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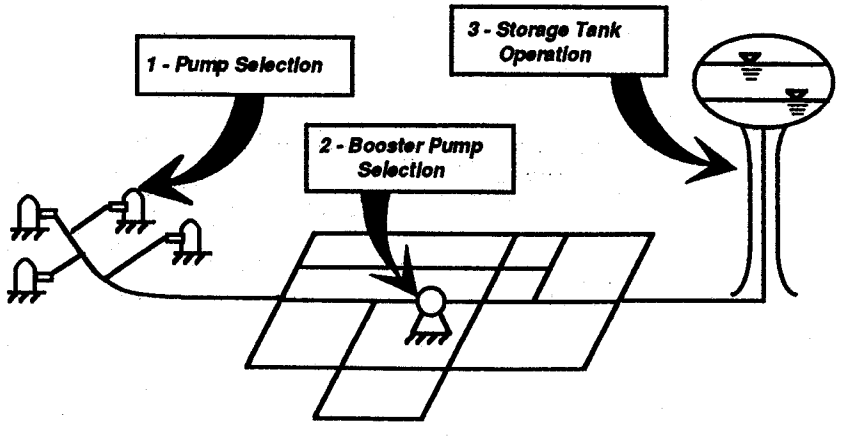

Three Opportunities for Energy Savings in a Municipal Water Supply System

RESEARCHERS DEVELOPING IMPROVED EVAPORATION/EVAPOTRANSPIRATION MODEL

To provide engineers and others with a methodology by means of which precise estimates of free water evaporation and crop water requirement (evapotranspiration) can be made, Dr. John Borrelli, Professor of Agricultural Engineering, and Dr. Clifford Fedler, Assistant Professor of Agricultural Engineering, are conducting research entitled, "Estimating Free Water Evaporation and Crop Water Requirements With Limited Climatic Data." This research effort is sponsored by the Water Resources Center and continues work initiated by Borrelli and Muhammad Sharif, who completed his Ph.D. in 1989.

Free water evaporation data are needed for a variety of design purposes, including the design of evaporation ponds for waste disposal, aquacultural systems, and water supply system reservoirs. Information on crop water requirements (evapotranspiration) is needed for various hydrologic studies; sizing of irrigation systems and municipal water supply systems are examples. And, while there are several accepted methods available for estimating free water evaporation and evapotranspiration, obtaining the necessary climatic data to use these methods presents a problem.

Common Methods

The two most commonly used methods for estimating free water evaporation and evapotranspiration are the Blaney-Criddle method (SCS, 1967) and the FAO-24 Penman Method (Doorenbos and Pruitt, 1977). The Blaney-Criddle method is commonly used to estimate evapotranspiration because the only input required is temperature. However, it has been demonstrated by various comparative studies that this method is not very accurate for areas of high winds. The Penman method, while more accurate, requires wind run, solar radiation, and humidity data, which are not commonly available to the user.

Research Objectives

The four basic objectives of this research project are:

1. To adapt a theoretical equation (one containing no calibrated coefficients which was developed by Borrelli and Sharif) for free water evaporation for use with daily climatic data;

2. To provide a methodology to develop the climatic data needed for evaporation and evapotranspiration equations that use solar radiation, relative humidity, and wind run data;

3. To provide a literature review of crop coefficients (calibrated in Texas or similar climates) for the most commonly grown crops in the High Plains of Texas; and

4. To prepare a report containing the procedures for estimating evapotranspiration and free water evaporation, and for obtaining the climatic data necessary for these calculations.

Dr. Borrelli explains the progress made on this research as follows. "We have already taken the standard FAO-24 Penman method and programmed it into our computer along with long-term average climatic data. We obtained our climatic data from 18 Class-A weather stations throughout the State of Texas with supplemental data from the surrounding areas including Kansas, Arkansas, Oklahoma and New Mexico. These data will be used to develop generalized grass reference evapotranspiration contour maps for the State of Texas.

"Next, we will gather the coefficients that are available for various crops grown on the High Plains so that we can estimate evapotranspiration using the FAO-24 Penman method," says Borrelli. Borrelli explains that the FAO-24 Penman method is not really a method for calculating potential evaptranspiration, but is actually a grass reference that estimates evapotranspiration for a short, green cool season grass with adequate water. To obtain crop water requirements, one merely needs to multiply the appropriate crop coefficient times the grass reference evapotranspiration as calculated by the FAO-24 Penman method.

"We will also gather existing procedures for estimating humidity, solar radiation and wind run. These data will be input into a generalized computer model to obtain mean monthly estimates of climatic data for locations without a weather station.

"Then, during the spring semester, an Agricultural Engineering graduate student will run correlations on the various weather parameters so

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SAVE . . . Continued from Page 1

research is to develop easily used management techniques to significantly reduce the amount of energy used to pump water throughout municipal service areas without impairing the reliability or performance of the system.

Specific objectives are:

1. To demonstrate the viability and economy of a new well selection algorithm (a step-by-step procedure for well selection);

2. To derive a method for choosing the best set of booster pumps to meet a current demand; and

3. To validate the feasibility of lower overhead tank water levels during winter months to reduce energy costs.

Booster Pump Selection

Municipal water distribution systems are looped systems that provide multiple routes for delivery of water to a specific point. Pressure in the system is maintained by booster pumps. Multiple pumps may be located at a single booster pump station.

When there is a need to increase the pressure at a particular point in the system, a selection must be made of the proper booster pumps to use. This decision offers opportunities for energy savings if the optimal decision is made.

High Water

Common practice is to fill elevated water storage tanks to their maximum water level, and periodically refill them as they empty throughout the day. Yet, during periods of low demand, such as occur during the winter months, the pressure at the point of delivery is greater than that needed to meet the consumer's need because of the smaller amount of flow in the lines connecting the consumer to the elevated tank or booster pump.

A simple change in the operating procedure to allow the water level in the elevated tanks to decline during the months of low use offers opportunity for considerable energy savings.

"For example," Urban explains, "lowering the operating level in a tank by 10 feet during the months of low demand could mean a 5 to 15 percent reduction in energy use."

Implementation of this practice of lowering the water level in elevated storage tanks during the low demand months would impact every municipality in the state. The savings would be in the range of 5 to 15 percent of the energy costs associated with booster pumps in the distribution system.

"Again, assuming half of the cities in the state adopt the suggested management practice, savings will easily be 2.5 to 3 million dollars annually," notes Urban. However, Urban observes that two problems remain.

1. There must be a demonstration to the satisfaction of the Texas State Board of Insurance that such an operating procedure does not increase the fire risk.

2. Municipalities must be shown that the concept is viable, workable and economical.

The project began on January 15, 1990 and is scheduled for completion by December 15, 1991. **KSD**

WRAY NAMED CHAIRMAN OF CIVIL ENGINEERING

Dr. Warren K. Wray, who joined the Civil Engineering faculty at Texas Tech University in 1978, has been named Chairman of the Department effective January 1, 1990.

Dr. Wray received his academic degrees from Washburn (B.S., 1967), Kansas State (B.S., 1968), Air Force Institute of Technology (M.S., 1974), and Texas A&M University (Ph.D., 1978). He is a Registered Professional Engineer in Ohio, Texas and New Mexico. His subspecialty within Civil Engineering is soil mechanics.

His primary academic responsibility at Tech has been the three graduate courses: Advanced Soil Engineering, Advanced Foundation Engineering, and Geotechnical Engineering Research; as well as undergraduate Introduction to Geotechnical Engineering, and Geotechnical Engineering Laboratory. Each course inherently involves correlation of soil moisture and its movement.

The personnel of the Water Resources Center are highly pleased with Dr. Wray's promotion since they have in him a friend of long standing with basic competence in the complex phenomena of soil moisture behavior. **GAW**

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that we can develop weather parameters of the FAO-24 Penman method at sites not having an extensive weather station," states Borrelli.

The Borrelli-Sharif evapotranspiration model will provide an alternative method for calculating the grass reference evapotranspiration and free water evaporation. If the validation study indicates good results, the Borrelli-Sharif model should provide a reliable prediction method for areas, such as the Texas Panhandle, having high winds.

The study began in September of 1989 and is scheduled to be completed by the end of August 1990. KSD

KATHY DEARDORFF JOINS WRC STAFF AS ASSISTANT TO THE DIRECTOR

Perhaps a substantial majority of those of our readers who reside on the High Plains will recall Kathy Redeker, the cheerful, competent, helpful lady who from 1975 to 1987 served as receptionist, then Executive Secretary, and finally as Information/Education Director for the High Plains Underground Water Conservation District.

In the intervening two years Kathy served as Vice President and Business Manager of Sierra Tejas Properties in Midland, Texas, and as Executive Secretary to the Vice President of AAR Oklahoma, Inc., in Oklahoma City.

Also, during these two years, she became Mrs. Kathy Deardorff. Kathy's husband, Michael, is a Lubbock native who has spent 20 years working in the broadcast media. He is presently the Chief Executive Officer of Sierra Tejas Marketing which is a company primarily concerned with water and air filtration and conditioning. Sierra Tejas Marketing also continues to produce and market broadcast quality audio and video.

Kathy has taken over the job that was so competently filled by Raynell Keller since the day the Water Resources Center was created -- and the functioning of the WRC continues with a smoothness unexpected when Raynell first announced her plans to retire. Kathy is certainly among friends in her present position. GAW

WRC

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SOLID AND HAZARDOUS WASTE MANAGEMENT SEMINAR SET FOR MARCH 15, 1990

Sixty million tons (1987) per year of hazardous waste are being generated by industries in the State of Texas, and over 16.8 million tons of solid municipal waste are generated within the state each year. That is equivalent to 3.6 tons of hazardous waste and one ton of solid municipal waste generated per person per year in Texas.

As of October 1988, Texas reported the highest number of operating landfills in the nation, with 934 landfills operating within the state, and with 38 new landfill applications on file. In 1989, approximately 140 of these landfills operated in the Panhandle and South Plains areas of Texas.

> ***The primary purpose of this seminar is to make information regarding the management of solid and/or hazardous wastes available to those in the region who are most closely impacted...***

Speculating on the effects of new regulations being developed by the U. S. Environmental Protection Agency, Linda B. Wyatt, P.E., Regional Engineer with the Texas Department of Health in Lubbock, says, "approximately 75 percent of the landfills existing currently in the Panhandle and South Plains will be forced to close." The new EPA regulations are expected to be released in late April.

Increased attention to solid municipal waste management and control will no doubt result in more requirements for separation of hazardous materials from solid wastes.

To address these and other concerns involving solid and/or hazardous waste mangement, the Water Resources Center at Texas Tech University in conjunction with the Center for Hazardous and Toxic Waste Studies, the Center for Advanced Research and Engineering, and the College of Engineering is sponsoring a one-day seminar to update regional planners, councils of government, small quantity hazardous waste generators and others regarding solid and/or hazardous waste problems as they affect municipal services, select local businesses and area citizens. Regional cosponsors include the South Plains Association of Governments, the Permian Basin Regional Planning Commission and the Panhandle Regional Planning Commission.

The seminar is scheduled for March 15, 1990, in the Senate Room of the University Center on the Texas Tech campus. Registration begins at 8:00 a.m. and the sessions will conclude around 4:30 p.m.

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According to Dr. Lloyd V. Urban, Director of the Water Resources Center at Texas Tech University, "the primary purpose of this seminar is to make information regarding the management of solid and/or hazardous wastes available to those in the region who are most closely impacted by the laws, regulations and requirements of EPA and the Texas Water Commission."

The morning sessions are to be devoted to municipal solid waste management. The afternoon sessions of the seminar are to be directed toward hazardous waste management for the small generator. Small quantity generators of hazardous wastes may include school districts, institutions of higher education, medical facilities, dry cleaners, mechanic shops, metal finishing and repair shops, and paint shops.

Representatives of the Environmental Protection Agency, Texas Department of Health, Texas Air Control Board, City of Lubbock and Texas Tech faculty have been invited to participate in the seminar to discuss various aspects of solid and hazardous waste management as well as regulatory priorities.

Attendees will also have the opportunity to visit with various exhibitors who may provide professional services related to solid and/or hazardous waste management and to interact one-on-one with seminar speakers.

Registration is limited, so interested parties are encouraged to contact the Water Resources Center at Texas Tech University, P. O. Box 4630, Lubbock, Texas 79409 or call 806-742-3597, for further information regarding who should attend, registration fees, or to reserve seating.

WHO SHOULD ATTEND?

Those individuals who are charged with the management of municipal solid waste for regional municipalities, hazardous wastes for small quantity generators, as well as engineers and consultants who have an interest in solid and hazardous waste management are invited and encouraged to attend this important meeting. **KSD**

(Cut here and return to reserve seating)

ADVANCE REGISTRATION

Name _____ **Phone Number** _____

Company Affiliation _____

Address _____

City, State, Zip Code _____

Please reserve _____ **seats. Payment of** _____ **is enclosed.**

Advance registration is $30.00 and registration the day of the seminar is $40.00.

Return to the Water Resources Center, P. O. Box 4630, Lubbock, Texas 79409.