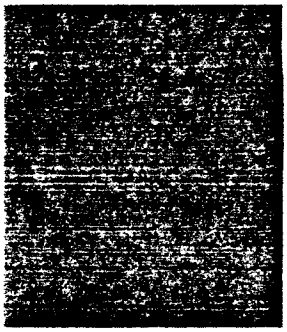

The Second and Concluding Article

Designing an Effective and Acceptable Water Conservation Plan

To be effective, your plan must understand your utility's future water demand and water supply in order to identify problems and bring each into balance. To work, your plan must be acceptable to city council members and consumers. ■ By Carl A. Teinert and William B. Lord*

In the first article of this series, we provided a general overview of water conservation and the new emphasis conservation will have in Texas. No longer will conservation mean only the building of a reservoir to capture surface water flows, but it will also include efforts to reduce consumption of water, reduce the waste of water, increase the reuse and recycling of water and improve the efficiency in the use of water. These efforts will now need to be considered by municipalities as they make application for state assistance in building water projects and for water rights permits.

We also discussed various conservation measures and how they work. Water conservation can be achieved by two approaches. The first approach is to improve system efficiency and the second is to reduce the demands placed upon the system. Techniques to improve system efficiency include: watershed management, evaporation suppression, pressure reduction, metering and meter maintenance, and leak detection and repair. Techniques to reduce system demand include using: information to change the water use habits of consumers, monetary incentives to encourage use reduction, and regulations which prescribe what consumers may or may not do.

With this general information, you are now ready to design an effective and acceptable water conservation plan. Your plan must be effective in the sense that it be capable of achieving the desired results. This requires an understanding of your utility's future water demand and water supply in order to identify problems and bring each into balance. Your plan must be acceptable in the sense that it receives approval from the city council and from the consumers. Consumer acceptability is measured not only by their support during city council consideration, but more importantly by their implementation of water conservation techniques as required by the plan.

Establishing Water Conservation Objectives

Texas law now encourages municipalities to prepare water conservation plans, plans which enable you to suppress long-term water demand and to be prepared for drought or other short-term water supply reductions. These are sensible goals. But each municipality will want to be more specific about the objectives of its own water conservation plan. How much and what kind of water conservation makes sense for your system? The answer to this question will provide you with essential guidance as you decide which conservation measures to include in your plan.

The first step in establishing your water conservation objectives is to project future demands for water.

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Demand will grow as population and economic activity increase. Projections of future population and economic activity are likely to have been developed for other municipal or regional planning purposes. They can be used for water conservation planning as well.

Water utilities, or their consultants, have frequently projected future water demands by determining current water consumption per capita and then simply multiplying projected population by current per capita consumption. This "constant GCD" method is no longer adequate, if it ever was. Too many other factors also shape water demand. Better projections can be developed by including the prospective influence of land use and housing changes, and changes in the composition of the industrial base.

Such factors determine not only how much water will be consumed but also the daily and seasonal patterns of water use. Daily peak demand dictates the amount of water treatment capacity required, while seasonality influences both daily peak demand and the amount of seasonal storage needed. Treatment capacity and seasonal storage can be two of the most costly components of a water system. Controlling these costs can be a major goal of a water conservation program.

Water demand also varies with the weather, primarily due to the relationship between natural precipitation and lawn watering. Reliable weather forecasts do not extend into the future. Instead, it is necessary to treat the influence of weather statistically, as a source of uncertainty. Thus the actual demand for water may exceed or fall short of the projected demand by a small margin (likely) or a larger margin (less likely). Contingency planning for drought or other short-term emergency requires that this uncertainty be quantified and considered.

An important factor in determining future demand for water is the price which consumers will have to pay. Rate increases may be needed to pay for developing new water supplies, for additional seasonal storage, for water treatment and distribution facilities, or for other purposes. These rate increases will affect how much water is demanded, by whom, and when. It is exactly for this reason that pricing is one of the most effective water conservation measures. However, it is best to project water demands initially without considering the potential effects of rate changes. This important factor can receive full consideration in the program development phase of planning.

Future water supplies must be projected next. The yield of the system as it now exists is the base upon which future supplies are projected. That yield may be expected to change, as aquifers are depleted or system enhancements currently under construction are completed, for example. Projections of total annual water supply, and maximum daily deliveries should be prepared.

The "constant GCD" method of projecting future water demands is no longer adequate.

Optional increments in total water supply, seasonal storage, and treatment capacity should be tabulated, along with the earliest dates on which they can be added to the system and their prospective costs. The result should be a stair step-like function which shows potentially increasing values of each of the three main water supply components throughout the planning period.

Water supply, no less than water demand, is subject to uncertainties due to weather variability and other unforeseeable factors. The potential effects of these uncertainties must be quantified, preferably with estimated probabilities of occurrence. The often-used concept of "safe-yield", which establishes a planning target based upon an arbitrarily selected level of system reliability, should be avoided. Its use prejudges the critical question of how much insurance (in the sense of costly excess capacity) you can afford to carry to protect you against emergencies. This question deserves to be analyzed carefully, not assumed away. The risk of water shortage, like other risks in life, cannot be totally eliminated. Rather, an explicit decision must be made about how much risk to accept, balancing the costs of running short of water against the costs of building in excess capacity.

Now, by comparing projected future water demands with projected future supplies, it will become apparent where and when problems of inadequate supply are likely to arise. Again, these are as likely to be problems of seasonal distribution of supplies or of treatment capacity inadequacies as they are overall water shortages. And, each will include the dimension of uncertainty, and the costs necessary to reduce that uncertainty. Addressing these revealed problems to bring supply and demand into balance at reasonable cost provides the specific objectives for your water conservation plan. Those objectives will specify what reductions in total water use, peak seasonal use, and peak daily use you hope to achieve and when.

Defining Water Conservation Options

There are literally scores of optional water conservation measures available from which you may choose. You can, and should, narrow that broad field of choice substantially before you undertake a detailed evaluation of your options. That can be done easily and quickly by classifying conservation measures according to whether they:

- effectively reduce total water demand
- effectively reduce seasonal water demand
- effectively reduce peak daily water demand
- increase or decrease system revenues
- are costly to employ

Approval of the conservation plan will depend upon community support. It is necessary, therefore, that a public participation program be a part of the planning effort.

- are relatively acceptable to water users
- are short-term or long-term measures

Now, you can compare the objectives which you have established with the characteristics of the available conservation options, eliminating all of those which do not match well. Be careful, however, that you do not eliminate options too readily, for it is likely that it will take an integrated combination of measures to accomplish your objectives most effectively. It is easy to discard options too soon, when it appears that they cannot achieve your objectives when examined one by one.

Lists of water conservation measures exist in several places. Perhaps the best single source is the state of California, which for several years has had a program somewhat similar to our new Texas law. The state has attempted to assist water suppliers in the preparation of their water conservation plans in many ways, including provision of lists of conservation measures and their characteristics. Research over the past ten years has documented the effects of conservation measures in many places. There is particularly rich and sophisticated literature on the effects of rate changes on water use. Any good consultant in this field should be able to prepare a list of options and their characteristics for you at a very reasonable cost.

Developing the Water Conservation Program

When your water conservation objectives have been established and the options to be considered for attaining those objectives have been defined, it is then possible to put together a program of conservation measures which should meet your objectives with minimum cost. Basically, the process of designing such a program amounts to discovering that combination of measures which is mutually complementary and responsive to identified needs.

Technically, the task is an exercise in operations research, quite similar to that which is performed to optimize production processes in industry or agriculture. Fortunately, water supply system planning seldom requires that the mathematically sophisticated tools of operations research be employed. It is usually sufficient to proceed in a step-wise fashion, bringing in one or a very few conservation measures at a time to satisfy one objective at a time. A computer program is a handy and efficient way of doing this. Some consulting firms have developed such programs, or one who is adept at using spreadsheet programs can do a good job without such help.

In developing your water conservation plan you must also prepare codes and ordinances, prepare an enforcement strategy and provide funding. Codes and ordinances establish the municipality's authority to implement and enforce a water conservation plan. One or more codes, code amendments and ordinances may be required, depending upon the plan. The city attorney should be consulted for this effort. Enforcement will require the cooperation of several municipal departments including police, fire, public works, building, legal and health. This effort must be coordinated and attention given to the other health and safety concerns of the municipality. It is recommended that funding for the conservation program be included in the water utility's budget and be covered by water revenues.

Approving A Conservation Plan

Approval of the conservation plan will depend upon community support. It is necessary, therefore, that a public participation program be a part of the planning effort. You should initiate discussions with special water user groups and with community groups. You should also have an advisory group to review the plan, hold public meetings and forward its recommendation to the city council. An existing group, such as the planning commission, could serve in this role or you may want to appoint an ad hoc committee.

Following preparation of the plan and with the support of the community, the plan should be approved by the city council. This is necessary because the plan will be setting public policy for future water utility activities. In instances where the plan was prepared because your municipality is seeking state financial assistance or making application for a water rights permit, the plan must also be approved by the appropriate state agency. State approval will be more likely if the state is consulted and advised throughout the planning process.

In closing, water conservation will soon become a new tool in the water management program of municipalities. Designing a conservation program for your community requires the establishment of objectives which seek to balance the utility's future demand and water supply. It also requires classifying the various conservation measures according to what they will accomplish. You then seek that combination of conservation measures to meet your conservation needs. The planning activities should also include the preparation of codes and ordinances, an enforcement strategy and program funding.

By considering these elements, you can develop a plan which is effective and acceptable to the community, and one which will be a useful part of your water management program. ■