Texas Water Resources Institute

July/August 1983
Volume 9
No. 4

Coordinated Supply

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Texans seldom know whether their last glass of water came out of a nearby river, from a reservoir hundreds of miles away, or from an underground source. As water in the state becomes more and more limited, though, the source of their city water may very well determine

- the population of the city as well as its economic potential.
- the quality of life in terms of landscaping, recreation, and health.
- the price of water.
- the new laws restricting use of water.

There's a good chance that glass of water has come from an underground source. Over half of all municipal water in Texas now comes from under ground. Twice as many cities, in fact, depend upon groundwater than those depending on surface water. Cities in all areas of Texas and in practically every county draw groundwater for municipal purposes.

In many areas, however, the overpumping of groundwater has lowered the water levels to the extent that major water supply problems have occurred or are projected to occur in the foreseeable future. Because of declining groundwater supplies in many parts of the state, cities are shifting more and more to surface water from rivers and reservoirs.

A city may very well use both groundwater and surface water. Ninety-three cities in Texas now combine groundwater and surface water sources, according to figures presented by Texas Department of Water Resources (TDWR) planners, Herbert W. Grubb and J. D. Beffort, at the 1983 Water Resources Symposium. These cities, supplying 31 percent of all the municipal and commercial water used in Texas, have systems which coordinate both types of supply. By developing a coordinated system, a city can

- augment declining groundwater supplies or augment inadequate surface supplies.
- decrease development costs or treatment costs.
- improve the quality of water from one source by mixing it with a higher quality water.

Most water suppliers using water from both ground and surface sources began by using a single source of supply--primarily groundwater. They were forced to develop surface supplies as water demand grew and groundwater supplies became inadequate to meet needs. These water suppliers continue to maintain dual supplies because of the amount of useful capital invested in both sources, the inherent advantages of each source, and in many cases the fact that neither source by itself can satisfy all of the demands, all of the time. A city water supply must meet three types of water demands:

- 1. Daily operational demand peaks imposed by the water users.
- 2. Seasonal demand varied by the amount of rainfall plus changes in user activities.
- 3. Long-range cycle demand dependent upon weather variations or upon the inconsistencies of the supply and demand curves.

In each of these demands, the degree of available storage--either in reservoirs or underground--determines the extent to which the demand can be met. A well-planned, well-managed, conjunctively-operated supply system can often better meet these demands than a single source system can.

City Supplies

Perhaps the best example of conjunctive use is in the area of Texas affected by subsidence. Houston, the largest water user in the area, has decreased its reliance on groundwater to the degree that now only about 55 percent of the city supply comes from wells. Land surface subsidence due to groundwater withdrawals dictated this conversion to surface water.

Until 1973, the city of Galveston had only one source of water--the Gulf Coast Aquifer. Since that time, the city has converted its supply so that now 66 percent of its water needs are met by developed surface water. The surface water is purchased through Houston's system from Lake Houston in northeastern Harris County. This conversion came about because of subsidence problems in the area and because of saline water encroachment in the city well fields.

El Paso has coordinated water supply sources for many years. Streamflow in the Rio Grande is not always available, so the city has to pump groundwater to make up about 80 percent of the city's current supplies. Critical problems of water level declines and overdrafting of the aquifer now face the city.

The city of Amarillo and surrounding urban areas obtain 52 percent of current water supply from the Ogallala Aquifer and 48 percent from Lake Meredith. By the year 2000, 58 percent of the area's projected urban demand will come from the Ogallala. A rather

unique conjunctive use in this area of scarce surface water and declining groundwater is the city's use of Bivins Lake to artificially recharge the groundwater in the Randall County well fields southwest of the city.

San Angelo uses surface water from reservoirs west and southwest of the city to meet present water demands. Since projected growth in water demand exceeds surface water supplies, the city has purchased groundwater rights and drilled wells in McCulloch County about 60 miles southeast of San Angelo. When demand exceeds surface supplies, the city plans to lay the necessary pipelines from San Angelo to the well field and then pump water from the wells.

Other Coordinated Supplies

Forty-five percent of all the water used in manufacturing in the state in 1980 came from coordinated ground and surface sources. Plant managers most often buy water from a city or utility district, so the decision to coordinate sources has already been made by water suppliers.

Steam electric power plants, on the other hand, are generally planned and built around one or the other, or both, sources of water. Power plants must have large amounts of water for cooling and a small amount of high quality water for boiler makeup. Plants often use surface water for the tremendous amounts of water required for cooling, but pump enough groundwater for boiler makeup. Another way power plants coordinate water is to build one unit to be supplied with groundwater for cooling and another unit to be cooled with surface water.

Conjunctive use plays a small part in supplying agricultural water use. Normally when both sources are used for irrigation, groundwater supplements the primary source, surface water.

The irrigation areas in El Paso and Hudspeth Counties, areas in Reeves and Ward Counties, and in Cameron and Hidalgo Counties in the Lower Rio Grande Valley have a significant amount of coordinated water use. Other examples are in Comanche, Eastland, and Erath Counties where farm ponds or floodwater retarding reservoirs supply surface water in normal to high rainfall years. In these areas, when the irrigators have exhausted their surface supplies or have used their water right allotments, they pump groundwater to fulfill the water needs of their crops.

Legal Issues

Conjunctive use of groundwater and surface water is a complex issue involving not only water supply and demand, but legal and institutional considerations as well. The differences in Texas law regarding groundwater and surface water, in fact, greatly hinder the adoption of coordinated management of water supply systems.

Groundwater belongs to the landowners beneath whose property such water can be found. The landowner may obtain and use this water without regard to any effect on adjoining landowners. He can sell rights to groundwater just as he can any other type of

property. Groundwater can be used either on the land where it is pumped or piped to another location. Surface water flowing in streams and rivers, however, is the property of the state. Cities, industries, farmers, ranchers, and other users may divert it for beneficial use only with proper permits issued by the Texas Water Commission.

The institutional structure of water suppliers also often complicates conjunctive use of water sources. Most present agencies in Texas have the authority to develop, conserve, or protect either groundwater or surface sources, but not both.

The hydrologic differences of groundwater and surface water, however, make coordinated management an attractive alternative. Surface water is generally a resource which must be used as it becomes available, or it is lost for good--either from evaporation or streamflow. Groundwater generally moves very slowly if at all and often can be saved for future use.

A surface water supply varies with the amount of rainfall received in the watershed, while most groundwater sources remain stable. Chemical quality and temperature of groundwater also remain relatively constant. Groundwater requires little treatment and is reasonably safe from pollution.

As groundwater levels decline and as water needs grow, the competition for the remaining supplies will continue to increase. This will mean fewer and fewer options for adding new water supplies.

In order to satisfy water needs, surface water supplies should be developed where possible to simultaneously replace declining groundwater supplies and to provide for growth in total demand. Substituting surface water for groundwater will more than likely mean higher direct costs to the user. These costs may have to be equitably distributed throughout the entire region which will benefit from the conversion.

Groundwater supplies and surface water supplies should be developed conjunctively whenever possible. A city having the capability of using each independently or the two in conjunction has many advantages over one with a single source.

How Texans develop water supplies in the next few years will determine to a great extent what kind of a state they will leave to their children. Coordinating the use of groundwater and surface water is one way in which Texans can stretch existing supplies and use future supplies more effectively.

A Conjunctive Supply System

The Colorado River Municipal Water District (CRMWD) distributes both groundwater and surface water to its customers. The District supplies part or all of the water for the cities of Midland, Odessa, Big Spring, Snyder, Stanton, San Angelo, and Robert Lee, as well as a power plant in Ward County and 14 industrial customers throughout the region. Industrial uses include petroleum refining, petrochemicals production, natural gas processing, metal refining, and oil field enhanced recovery operations.

Approximately 74 percent of the water supplied by CRMWD comes from Lakes J. B. Thomas and E. V. Spence and other diversions from the Colorado River. The remaining 26 percent of the annual supply comes from the region's very limited groundwater resources pumped from well fields in Martin, Ector, and Ward Counties.

The CRMWD currently delivers about 50 thousand acre-feet per year to its customer cities and industries, but the Texas Department of Water Resources predicts that the region will require 113 thousand by the year 2000.

The District estimates that an additional surface water supply will be needed by 1990 or shortly thereafter. To meet this increased demand, the state has granted CRMWD a permit to build Lake Stacy on the Colorado and Concho Rivers in Runnels, Coleman, and Concho Counties.