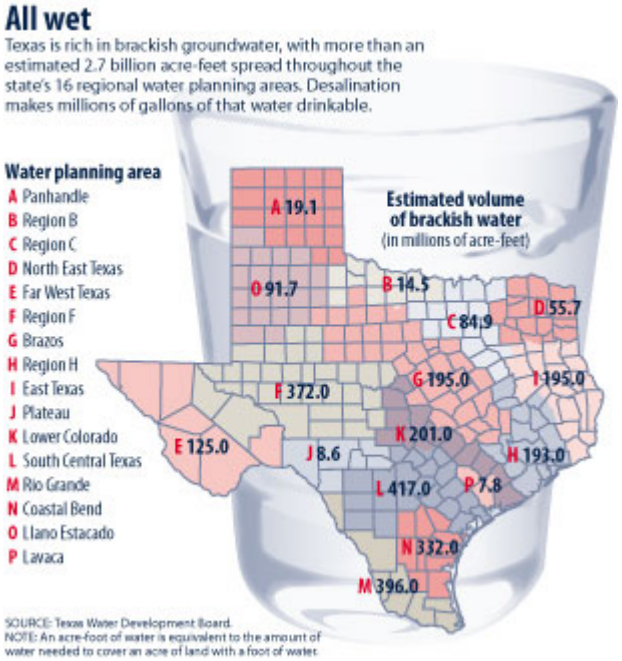
Hard Water Lessons

The Texas population will climb beyond the 27-million mark by 2025, according to the U.S. Census Bureau, taxing the state's limited supply of fresh water.

One way to meet demand for drinkable water is taking salt out of—or desalinating—ocean water and "brackish" water, which account for 97 percent of the world's water. Brackish water is water with a high saline (salt) content.

More than 100 desalination projects are scattered across Texas, producing about 40 million gallons of desalinated water every day, according to the Texas Water Development Board (TWDB).



Water, water everywhere

The salinity of water is measured in terms of its total dissolved solids content in milligrams per liter. Treated drinking water, for example, contains less than 1,000 milligrams (mg) per liter. Brackish water generally contains between 1,000 and 10,000 mg and seawater in excess of 30,000 mg.

Texas' coastline, at more than 360 miles, offers plenty of access to seawater for desalination, but it is brackish water—found in either surface reservoirs or underground formations throughout the state—that may be the leader for desalination, said Jorge Arroyo of TWDB.

"With brackish water, we'll more than likely see that develop in Texas in the immediate future, due to cost and areas where water is needed," Arroyo said. "In West Texas, they have access to brackish water and have more depleted [traditional] water sources. There are several brackish water reservoirs around the state."

Brackish water often is found below ground, brought to the surface and pumped to a desalination facility. The largest desalination project in operation in the state is in Brownsville, operated by the Brownsville Public Utilities Board (BPUB). It pumps out 7.5 million gallons of treated brackish water per day and employs eight full-time personnel.

"We do 7.5 million gallons per day right now, but our facilities are built to be expanded to 20 million per day," said John Bruciak, BPUB general manager.

BPUB's 20 wells pump brackish ground water up from about 300 feet deep, which may be just the edge of a vast and deep supply of underground water, Bruciak said.

"We're drilling at about 300 feet, which is pretty shallow," he said. "We're also doing some exploratory work at about 1,000 feet. It's been in there probably thousands of years and never been tapped."

The Brownsville desalination project came to life when water scarcity due to drought and lower water conditions in the Rio Grande prompted the search for alternative water solutions.

"I'd say what we've done would get us another five years," he said. "And if we had problems with the river, another 5 million gallons a day could be reached in as little as a year."

El Paso, which produces around 101 million gallons of treated water per day, is another area constructing a large desalination project. The city, in cooperation with Fort Bliss, plans to open a 25-well facility capable of producing 27.5 million gallons a day in June 2006, according to John Ballieu, the water system division manager for the city of El Paso.

Corpus Christi is looking to the sea to add to its water supply. Mark Lowry of the civil engineering firm Turner, Collie and Braden said his firm is conducting tests for the city to determine the feasibility of constructing a plant to desalinate up to 25 million gallons of seawater per day.

Get the salt out

The two most widely used methods for removing salts from water are distillation—essentially boiling—and a membrane-based process, where water is forced through specially designed filters. The latter is also known as reverse osmosis (RO). Desalination technology has progressed to the point where treatment plants take up considerably less

room than conventional water storage and treatment facilities, Arroyo said.

"Desalination is getting better and cheaper," he said. "What is neat about desalination is you can add capacity more easily as you need it. For a reservoir, you have to build the entire thing for the completed project."

Brackish groundwater desalination can cost anywhere from 71 cents to $2.37 per 1,000 gallons, according to TWDB's groundwater reports.

The Brownsville project falls in the middle of that range, Bruciak said.

"Our cost per 1,000 gallons is about $1.60, and the next phase could take that down to $1.20," he said. "Right now it's cheaper than regular groundwater, which is about $1.73 per 1,000 [gallons to produce]."

Ballieu expects El Paso's facility to desalinate brackish water for about $1.20 per 1,000 gallons.

Desalinating seawater, on the other hand, can cost between $3 and $4 per gallon because of its higher salinity.

"It takes lots of energy," Bruciak said. "The saltier it is, the more energy you need to get it out. One advantage we [have] as a supply company is we have our own power plant."

Once the salts are removed, the water is, ironically, too pure for humans, livestock and wildlife to drink, since some salts, such as magnesium and bicarbonate, are essential for health.

"[The desalinated water is] blended back in with brackish water at the plant to get the pH—an indicator of the acidity in the water—right before being released," Arroyo said.

In Brownsville's case, about 6 million gallons of day of RO water is blended into about 1.5 million gallons of brackish water, well within federal drinking water standards, Bruciak said.

No swimming in the heavy water

Desalinating necessarily means having leftover material.

"One of the things that happens is you produce a very concentrated stream of brine," Ballieu said.

This liquid brine is high in salt content— as high as 12,000 milligrams per liter, according to Bruciak.

There are several options for disposal of the brine, Arroyo said.

"Along the ocean, they would likely put it back into the ocean," he said. "Another [option] is putting it in with effluent water from a power generation station, which would substantially dilute it." Effluent water is treated wastewater, used in many places for turf irrigation.

Injecting the brine waste deep within the earth is another alternative.

"Fort Bliss contains on their property a geological formation in which we think we can inject the brine," Ballieu said.

The Texas Commission on Environmental Quality allows Brownsville to discharge brine through a drainage ditch flowing into local salt flats, Bruciak said.

Whether it is seawater or brackish water, Arroyo said it only makes sense to make use of the available resources.

"From [TWDB] standpoint, it's just due diligence," he said. "The resource is there; we just have to use it. Because we suffer from drought so frequently in Texas, you want to develop water sources that are going to be there in the event of drought."

by Clint Shields, reprinted from June 2004 issue of *Fiscal Notes*, the newsletter of the Texas Comptroller. Thanks to Comptroller Carole Keeton Strayhorn and *Fiscal Notes* editor Greg Mt. Joy.