Chapter 14

Brackish Groundwater Desalination in South Texas: An Alternative to the Rio Grande

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Growing Concerns

In the mid-1980s, this author began looking at the potential for utilizing brackish groundwater to supplement the over allocated Rio Grande. It has been done for years in Florida. Why can it not be done in the Rio Grande Valley? In 1988, a trip to look at existing brackish groundwater facilities was made by the Brownsville Public Utilities Board to see what was involved to construct and operate this type of facility. While this process had merit, the mild drought was relieved later in the decade. In the mid-1990s, the Rio Grande Valley was experiencing what would ultimately end up as the drought of record, ending in 2004. Brownsville was yet again interested in pursing this option a little closer, since Brownsville is the last to take water from the Rio Grande after release from the Falcon Reservoir. Much of this water is lost to evaporation, seepage and theft, especially in times of drought. There was some concern, but not desperation, to pursue the alternative to desalinate brackish water.

In 1984, a matching grant was awarded to the Brownsville Public Utilities Board to study the feasibility of providing desalinated brackish groundwater to Brownsville, thus beginning what has been a rapidly growing industry in South Texas.

Regional Planning Efforts

Brackish Groundwater Resources

What was once an unusable supply is now becoming a cost effective means of providing alternative water resources to water user groups. In the Rio Grande regional water planning area (Region M), there are two main aquifers that can yield sufficient quantities of brackish groundwater. Of course, additional treatment will be required, such as reverse osmosis or electrodialysis reversal, to remove total dissolved solids. The aquifers that would supply this brackish water are the Gulf Coast aquifer and the Carrizo-Wilcox aquifer.

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The Gulf Coast aquifer system may be an excellent source of brackish groundwater in many areas. The southern/western portion of the aquifer system is the best brackish groundwater resource because of the dominance of groundwater high in total dissolved solids. In addition, the aquifer system may be an excellent brackish groundwater resource in other areas, in particular in several areas at or near the coast where poor water quality is common.

Brackish Desalination Demand

Based on responses to a survey sent to 63 water user groups in the Rio Grande regional water planning area, the use of brackish groundwater desalination is a strategy that they will be using now and into the future. Thirty of the 44 respondents indicated that they would be pursuing this water management strategy within the next 2 years. They could not wait until the next planning cycle to be included. Over 56,000 acre-feet of brackish ground water is expected to be used over the next 50 years.

Demand for this strategy can be attributed to the reduction of costs, education on desalination, cost of surface water rights, security, and reduction of surface water availability. Projections for this strategy are to be implemented by 2010 but are only projected to remain constant through 2050. Further water supply availability will be studied during the current planning cycle to evaluate increases from the year 2010.

Description of Brackish Desalination

Desalination of brackish groundwater is most commonly accomplished through reverse osmosis. A full-scale reverse osmosis system to treat brackish groundwater would require pretreatment, which would include a cartridge filtration system to remove minimal suspended solids. Acid and a silica scale inhibitor would also be added to prevent scale formation. A full-scale system would be expected to have a membrane life of approximately five years. Chemical cleaning of the membrane would be required approximately one to four times per year. The results of the Valley Municipal Utility District plant indicate that larger reverse osmosis systems treating brackish groundwater successfully meet all state and federal primary and secondary drinking water standards.

Concentrate from the reverse osmosis system must be disposed of in an environmentally acceptable manner. Most of the current or proposed systems will utilize drainage ditch discharge, which ultimately will discharge into the Laguna Madre or the Gulf of Mexico. Other options include disposal to a sewer system and deep well injection.

History of Desalination in South Texas

After the Brownsville Public Utilities Board’s initial review of the potential of treating desalinated water in 1988, a dedicated interest was not present until 1994, when the Brownsville Public Utilities Board pursued the joint feasibility project with the Texas Water Development Board (TWDB). There was, however, a major desalination project that did not include brackish groundwater but utilized wastewater effluent as the source water. Since the initial Valley

Municipal Utility District Plant, there has been substantial development of brackish groundwater treatment plant in the Rio Grande Valley. These developments are listed and described further below:

- 1990 Harlingen wastewater desalination plant
- 1995 Brownsville/Texas Water Development Board brackish desalination feasibility/pilot study
- 1996 LMWD/ Texas Water Development Board sea-water feasibility/pilot study
- 1999 Valley Municipal Utility District first potable brackish desalination plant constructed
- 2001 Southmost Regional Water Authority feasibility study
- 2003 Regional Water Planning Group plan amendment
- 2003 Multiple facilities in planning/design
- 2004 Southmost Regional Water Authority and North Alamo Water Supply Corporation/La Sara regional desalination plant in production
- 2005 North Cameron Regional Desalination Plant under construction
- 2005 North Alamo Water Supply Corporation /Edinburg North and South Plant in design phase

Harlingen Fruit of the Loom

While this project does not utilize brackish groundwater, it highlighted the use of reverse osmosis treatment to desalinate the wastewater into high quality water to be utilized in the manufacturing process to produce textiles. This highly recognized project brought to light the use of the reverse osmosis process as a feasible alternative to conventional treatment methods. It is this author's opinion that this project was the catalyst to develop the desalination of brackish water to come in subsequent years.

When this project was initiated, Fruit of the Loom was considering Harlingen as a viable location for their bleaching and dying operation and the creation of 2,000 jobs. Obstacles included the quality of the water to be provided and the cost. The drinking water was too high in total dissolved solids, mainly carbonate hardness. If the company were to take this water, further treatment would be required, and thus additional costs added, to what was considered an already high cost of water (over $1.20 per 1,000 gallons). This cost did not include wastewater service.

Another alternative was to consider the use of water from the Arroyo Colorado and water from the Rio Grande via the Harlingen Irrigation District. These two alternatives proved to be too costly due to the level of treatment required.

The idea of utilizing wastewater was evaluated as a viable option. The initial cost of water was free from the wastewater plant and was not used for any other purpose. The water was of good quality compared to Rio Grande or Arroyo Colorado water sources. Considering the cost of treatment, it was less costly to treat to the level needed using wastewater effluent than any other source available at the time. The initial cost charged to Fruit of the Loom was $1.20 per 1,000 gallons for both water and wastewater service. The City of Harlingen also constructed a separate facility to treat the industrial wastewater returned to the wastewater plant. The industry shut down operations in Harlingen in 2003. At that time the use of effluent reuse was no longer utilized for this or any other purpose due to lack of demand.

Feasibility Studies

During the initial stage of the drought of record in the Rio Grande Valley, a great deal of interest was given to alternative sources of water, mainly brackish and seawater desalination. In 1985, the Brownsville Public Utility Board and Texas Water Development Board teamed together and authorized NRS Consulting Engineers (NRS) to prepare a feasibility study to take brackish groundwater in the Brownville area and treat it through reverse osmosis or electrodialysis reversal. Results of this study indicated a very good possibility of treating up to 20 million gallons per day (mgd) of brackish well water to serve the Brownsville area. Much was dependent upon subsequent well testing to firm up the supply numbers from previous well drilling in the area. The data from well drilling in the area was quite sparse, as very few entities utilize groundwater for their sources of water in this area.

Results of this study, completed in 1996, are shown in Table 14-1.

Valley Municipal Utility District No. 2 Desalination Plant

The Valley Municipal Utility District No. 2 made a large step in securing its future water supply by utilizing brackish water wells. The district, which provides water service to Rancho Viejo and River Bend Resorts, completed the valley's first municipal reverse osmosis treatment plant in 1999. This 250,000-gallon per day facility provides bottle quality water to its customers while preserving their water supply.

The project was completed utilizing NRS to provide the pilot testing, permitting, design, and construction management. By utilizing the construction management procedure, the district realized over 30 percent savings over conventional construction procedures. The total project costs for construction were $715,000, as compared to the conventional bid price of $940,000. Detailed costs are shown in Table 14-2.

Southmost Regional Water Authority

The Southmost Regional Water Authority (Authority) is a conservation and reclamation district created in 1981 and organized pursuant to Article XVI, Section 59 of the Texas Constitution. Its mission is to provide the most cost-effective and reliable alternative water supply to its members. The Southmost Regional Water Authority's operating history began in 2000, when it was activated to address long-term regional water supply issues in the southern Cameron County region. The project provides for a blended output of 7.5 mgd and is allocated as shown in Table 14-3.

Table 14-1. Brownsville feasibility study projection of costs (1996 dollars).

CAPITAL COST PROJECTIONS	PHASE I	PHASE II	PHASE III	TOTAL
REVERSE OSMOSIS	$6,251,850	$2,187,900	$2,187,900	$10,627,650
OFFSITE TRANSMISSION[1] & CONCENTRATE DISPOSAL	$1,130,155	$1,663,253	$372,223	$3,165,630
WELL FIELD DEVELOPMENT	$1,720,000	$2,110,000	$2,200,000	$6,030,000
TOTAL CAPITAL	$9,102,005	$5,961,153	$4,760,123	$19,823,280
PRODUCT WATER EA. PHASE, MGD	2,830,000	2,830,000	2,830,000	8,490,000
ANNUAL DEBT SERVICE @6%, 20 YRS.	$793,554	$519,720	$415,009	$1,728,284
DEBT SERVICE PER 1000 GALLONS	**$0.77**	**$0.50**	**$0.40**	**$0.56**
OPERATION AND MAINTENANCE PROJECTIONS	***(CUMULATIVE TOTALS)***			
POWER @ $0.038/KWH	$81,508	$172,537	$298,083	
MEMBRANE REPLACEMENT	$70,000	$140,000	$210,000	
CHEMICAL	$92,000	$184,000	$276,000	
LABOR	$100,000	$100,000	$100,000	
MAINTENANCE	$50,000	$70,000	$90,000	
CARTRIDGE FILTER REPLACEMENT	$35,000	$70,000	$105,000	
WELL PUMP REPLACEMENT	$20,000	$40,000	$60,000	
TOTAL TREATMENT O&M PER YEAR	$448,508	$776,537	$1,139,083	
OPERATIONAL COST/1000 GALLONS	**$0.43**	**$0.38**	**$0.37**	(Blended)
TOTAL ANNUAL COST COMPARISONS				
TOTAL $$ PER YEAR	$1,242,062	$2,089,812	$2,867,367	
TOTAL $$/1,000 GALLONS (Blended)	**$1.20**	**$1.01**	**$0.93**	(Blended)
TOTAL $$/ACRE FOOT OF WATER PRODUCED	$391.79	$329.60	$301.49	
COMPARISON TO 100% RO PRODUCT WATER				
TOTAL $$/1,000 GALLONS	*$1.79*	*$1.48*	*$1.40*	(Pure RO)
COMPARISON OF WATER RIGHTS VALUES				
VALUE OF WATER RIGHTS SAVED	$2,694,690	$5,389,379	$8,084,069	
ANNUALIZED COST OF WATER RIGHTS	$234,935	$469,871	$704,806	
COST PER 1000 GAL WATER RIGHTS SAVED (Not deducted from project costs)	$0.23	$0.23	$0.23	

Demonstration of tangible success

The key to successful completion of this project was a direct result of communication. The following is a list of items that were implemented to complete the project.

Regional approach—A regional approach brings difficulties in coordination between political bodies. The only negative aspect to this approach is the feeling of losing control of the entity's destiny. This happened to the Laguna Madre Water District, an original project participant. They opted out of participation in the final project. For the most part, if a feeling of cooperation can be maintained through Authority leadership, the regional process has great advantages to all members, including capital and operation cost benefit economies of scale. Leadership of the Authority was instrumental through two chairmen, Robert H. Lackner and Billy R. Bradford, Jr.

Table 14-2. Valley Municipal Utility District construction costs (1999 dollars).

Building	$64,039
Reverse Osmosis System, Chlorination, Electrical and Instrumentation	$450,000
Offsite Utilities	$89,800
Well/Pumps	$100,498
Site Work	$9,987
Total	$714,324
Plant Capacity, gallons	250,000
Value of Water Rights Saved @ $1,500/acre-feet	$409,500

Table 14-3. Southmost Regioanl Water Authority water allocation.

Allocation of water sales (Based on 2001 annual water sales)

Available capacity from Authority	7.5	mgd	**Water supply, mgd**
Entity	**Water Sales**	**Percent**	
Brownsville Public Utilities Board	5,869,000,000	92.91%	6.9681
Valley MUD No. 2	158,545,873	2.51%	0.1882
City of Los Fresnos	143,981,700	2.28%	0.1709
Brownsville Navigation District	132,536,000	2.10%	0.1574
Town of Indian Lake	12,935,000	0.20%	0.0154

Mr. Lackner pushed for the planning and construction of the facility, and Mr. Bradford lead through the construction and start-up of the facility.

Construction management—Construction management of the design and construction of the plant has great advantages for control and cost savings of the facility. It is expected that over $4,000,000 was saved with this approach. Drawbacks include additional coordination efforts and potential for "finger pointing" of any problems. Proper contract by construction discipline (such as civil, mechanical, electrical, etc.) and communications minimized these potential difficulties. For time management, change orders were issued to contractors on site to accomplish additional work. Actual bidding of every aspect would not have accomplished the time and cost goals of the project. Typically with this process change, orders are not for errors or omissions but for additional work required to finalize the project.

Weekly planning, design, and operation meetings—The single most important aspect to the success of this project was a result of communications from the beginning of the project development. The owner's representatives were involved in planning, design, construction, and operations of the plant. This provided for valuable input and pride of ownership of the team.

Timeline—An aggressive timeline was established early in the project. At the time of design, there was a desire to have treated water within 18 months. Major portions of the project design and bidding were completed in the summer of 2002. Funding was not in place until December

2002. Contracts initiation could not be issued until January 2003. Additional delays for property acquisition delayed the well field completion and subsequent projects. Heavier than normal spring and summer rains helped to delay some of the well completions. In spite of external difficulties, initial project start-up was approximately 14 months after initiating construction. Final start-up and operation took an additional six months. Realistic timelines should be communicated with the owner to eliminate unrealistic expectations and disappointments.

Project layout—The plant site is situated on a 17-acre site, suitable for multiple cost effective expansions. A smaller site plan could be used if conventional methods of construction were used. Facilities were laid out to allow construction room for multiple contracts. Inside the plant building, additional room for expansion and maneuverability were keys to the current and future ease of operation.

State permitting—Permitting through the Texas Commission on Environmental Quality took about eighteen months. Delays were due to the inexperience of the Texas Commission on Environmental Quality in reviewing permits of this type. Continuous communication and education helped to move the process along. Objections to the permit by non-affected parties added several months to the process. The permitting process is the longest lead-time item to consider. Another issue is that this is considered an industrial wastewater discharge and all that it implies. Work should take place to properly classify this as a water treatment by-product. Permitting steps should be one of the first things to start in the planning process.

Land and rights of way—Land acquisition can be both expensive and time intensive. Once the word gets out of a public entity in pursuit of property, cost escalates. Negotiations were completed for this project successfully, but took substantial time. This, along with the permitting process, should proceed as soon as possible. Options should be pursued in case well testing does not prove suitable sites.

Partial start-up—Due to large lines sized for full start-up and future supplies, low velocities on partial start up create certain opportunities not present under full operations. There do not seem to be many ways around this problem if partial supply is needed. Perhaps better timing of bringing all facilities on line simultaneously could be a goal, but for the most part this would have to be an ideal situation, considering multiple contractors each having their own construction issues.

Construction meetings—Even though there were 15 construction contracts, monthly meetings were held to discuss accomplishments, schedules, and issues related to construction. The project provided for an on-site professional engineer, three project representatives, a part time technician, and graduate engineers. This procedure of monthly meetings should be implemented for all projects of this type.

Local permitting—Overlooked as a requirement, the local ordinance required that the Authority apply for an industrial waste discharge permit to dispose of the backwash cleaning solution to the Brownsville Public Utility Board’s wastewater treatment facilities. This minor amount of water, meeting all quality requirements, was subject to an application process that rivaled that of the state’s concentrate disposal application. Developers of future projects should be aware of local permitting conditions, even though they are the beneficiaries.

Goals—At the onset of a project of this type and magnitude, set realistic goals for completion with proper projections of costs. This project set high goals to complete in 14 months but certain delays should be expected. These include funding, rights of way, permitting, weather, and construction difficulties. Six to 12 months should be allowed for start-up and the development of operational standards, especially if this is the first facility of this type for an organization.

Conclusions—The project is a huge success. This does not mean there is no room for improvements on issues that arise. Accomplished was a regional desalination plant that provides each entity with over 40 percent of their current water supply, supplementing the water from the Rio Grande. This is done to diversify resources for dependability. The newfound source of water is of highest quality and is provided at costs comparable to those of conventional surface water treatment. Oversized facilities will provide cost effective expansions in the future.

North Alamo Water Supply Corporation—La Sara Project

The North Alamo Water Supply Corporation provides water service to rural areas in Hidalgo, Willacy, and Cameron counties. The La Sara project, planned in 2003 to replace the original surface water plant nearby, was completed in 2004. This 1.0 mgd (blended 1.25 mgd) facility services the northeast portion of Willacy County, including La Sara, Port Mansfield, and San Perlita.

Construction of this facility was completed using multiple contracts and managed by NRS. In-kind services provided by North Alamo Water Supply Corporation aided in making this project highly cost effective, especially considering its size. Existing ground storage and pumping facilities were utilized, reducing the cost of this facility. Total construction cost was less than $2.2 million and is described further in Table 14-4.

By utilizing brackish groundwater, the North Alamo Water Supply Corporation realized a surface water savings of over 1,120 acre-feet. Current value of surface water rights is $2,000 per acre-foot. The value to North Alamo Water Supply Corporation is over $2.2 million, or an amount equal to the project cost of the facility.

North Cameron Regional Water Project

The entities of North Alamo Water Supply Corporation, East Rio Hondo Water Supply Corporation, and the City of Primera teamed together to plan and construct a regional shared brackish groundwater treatment plant. The group initiated testing of the groundwater conditions for this project in 2003. Results indicated that a good supply of brackish water was available from the Gulf Coast aquifer located in Northwest Cameron County, west of the City of Primera. The project is currently under construction, with projected completion in May 2006. Table 14-5 further describes the cost of the project.

The projected final construction cost for this 2.0 mgd (2.5 mgd blended) brackish desalination plant is $5.9 million. Unlike the La Sara project, this project is not located near existing ground storage and pumping facilities or offsite distribution. These are included in the project cost. Upon completion, this project will save the regional participants over 2,800 acre-feet of water rights

Table 14-4. La Sara Project costs.

North Alamo Water Supply Corporation
Reverse osmosis process (two trains of 0.5 mgd each)

Description	**Contractor**	**Cost**
Land purchase	NAWSC	$50,000
Test wells	J&S Water Wells	$40,000
R.O. building and concrete containment	Haraway Cont.	$169,393
R.O. system	AES	$957,148
Electrical	Metro Electric	$340,443
SCADA	Trac & Trol	$5,000
Well development	J&S Water Wells	$377,063
Fencing	Kanaf	$7,000
Site work	NAWSC	$5,000
Paving		$18,500
Concentrate line (415 L.F. @ $15/L.F.)	NAWSC	$6,225
Well line (146 L.F. @ $15/L.F.)	NAWSC	$2,190
Ditch crossing casing and installation	NAWSC	$5,000
Ditch crossing piling	Oden Contractors	$9,500
Product water line to ground storage (200 L.F. @ $15/L.F.)	NAWSC	$3,000
Subtotal Project Construction		$1,995,462
Engineering/Const Mgmt		
Preliminary engineering/permitting/pilot testing		$26,500
Laboratory testing		$5,000
Design engineering		$82,500
Construction management		$75,000
Start up/training		$8,250
Subtotal Engineering/Const Mgmt		$197,250
Total Project Costs		**$2,192,712**

annually at a capital value of $5.6 million. Each participant is contracted for an equal share of the output of the plant.

North Alamo Water Supply Corporation/Edinburg

North Alamo Water Supply Corporation has two surface water treatment plants, located northeast and southeast of Edinburg, and provides wholesale treated water to the City of Edinburg. Currently under design with projections for construction in Spring 2006 are two 3.0 mgd (3.5 mgd blended) brackish desalination plants located at each of these existing surface water plants. Test wells were drilled in the Gulf Coast aquifer to confirm the supply source of brackish water. Total projected cost for each plant is $5.9, million for a total of $11.8 million for 7.0 mgd blended capacity. This yields 7,840 acre-feet of surface water rights savings at capital value of over $15.6 million.

Table 14-5. North Cameron Regional Water Project costs.

North Cameron Regional Water Project Reverse osmosis process (2 mgd)			
Description	**Contractor**		**Cost**
R.O. building/concentrate line/offsite	Rio Valley		$644,900
R.O. system	AES		$1,783,651
Well drilling/pumps	J&S		$375,000
Ground storage (2 MG)	NATGUN		$950,000
Fencing	Kanaf		$45,000
High service/chlorination building	Peacock		$255,000
Secondary containment/pipe, valves, pumps installation	Rhiner		$320,882
PVC piping/valves/accessories/pumps	Nat'l Waterworks		$288,576
Fiberglass piping/wetwell	Nat'l Waterworks		$89,954
Electrical	SCI		$841,722
Generator	Unknown		$50,000
SCADA	SCI		$191,000
Chlorination	Moody Bros.		$60,000
Paving	Rhiner		$25,000
Grading	Rhiner		$20,000
Subtotal Project Construction			$5,940,685
Contingencies		0%	$0
Total Project Construction			$5,940,685
Land purchase	NAWSC		$100,000
Test wells	J&S/NAWSC		$40,000
Test wells evaluation	Raba/ERHWSC		$30,000
Engineering/Const Mgmt			
Preliminary groundwater evaluation	NRS/NAWSC		$15,000
Total engineering costs	NRS		$664,150
Legal			$20,000
Laboratory testing			$20,000
Total Engineering/Const Mgmt			$719,150
Total Project Costs			**$6,829,835**

Other Planning Efforts

Through the regional planning process and notoriety of the on-going brackish desalination efforts, many entities have included brackish desalination as one of the strategies to meet future demands and reduce their dependencies on the Rio Grande. Notable projects include a 2.0 mgd (2.5 mgd blended) Willacy County Regional Project to provide water to all entities located in

Willacy County. Discussions have taken place for desalination possibilities with the City of McAllen also. If an entity has a choice between a surface water supply and brackish groundwater supply, it behooves them to evaluate the alternatives.

Cost Factors in Desalination

Total Dissolved Solids

The degree of TDS is a good general indication of what it will cost to remove TDS to meet drinking water standards. The higher the TDS, the higher capital, operation, and maintenance costs. For example, a 3,000-TDS feed water could yield 80 percent (8 out of 10 gallons supplied) where as a seawater plant at 35,000 TDS feed water would only yield around 45 percent, thus increasing the size of the units. Pressures to remove the lower TDS level is only 180 psi, compared to upwards of 900 psi for the seawater, an obvious increase in power costs.

Power Costs

Power cost account for around 40 percent of the operational costs of a facility. Work is being implemented to recover excess pressures during the process. Investigation into off-peak power contracts would be helpful in controlling the ultimate cost of the facility.

Location

Not all locations will be of equal cost. One of the major factors is the ability to discharge the concentrate generated at the plant. Coastal communities have a great advantage over inland communities. The location of the facility near the well field and distribution system will also enhance the attractiveness of this alternative.

Economies of Scale

If entities can work together to construct regional facilities, they can reap the rewards of lower unit cost for construction and lower operational costs by building less facilities with less manpower.

Construction Method

Construction management of multiple contracts in South Texas has resulted in as much as 30 percent savings over convention construction methods. General construction contracts will normally be higher, due to the lack of local experience in this field.

Water Treatment Trends

Based on our experience, there has been a downward trend in costs to construct brackish and seawater desalination plants, due to technology advances in the industry over the years. Conversely, with increasing regulations in drinking water standards, the cost to treat surface waters has been increasing. The degree of contaminant removal through RO compared to conventional filtration is much greater with RO. Consideration should be given to these alternative methods when evaluating additional treatment capacity needs.

Replicating Success

The success of an initial concept or project is the ability of the project build to support and provide for a model for subsequent projects that continue to improve. The concept of brackish desalination started conceptually in the mid-1990s. Over the last 5 years, projects have been designed and/or implemented to provide over 17 mgd of additional high quality treated water, or over 19,000 acre-feet of additional water supply. This equates to a water rights cost savings of over $47 million. Educating the public on the cost effectiveness is a key to further the completion of similar facilities.

Innovation

The use of brackish groundwater is innovative in South Texas, as it is using a water supply that was once deemed useless and quite uncommon in Texas, even though Florida has been treating water this way for many years. State-of-the-art technology is used to treat and monitor project components.

The implementations of the projects have been innovative, beginning with the Valley Municipal Utility District project. The use of multiple projects by construction discipline has been used successfully on all projects completed in South Texas. In these cases, the engineer acts somewhat as a general contractor, but bids as many as 20 contracts per project and controls the coordination between contractors without the markup normally placed on the purchase of equipment and subcontractors. Because of the nature of the construction, there are very few local or state contractors familiar with the construction of these types of facilities. This method has yielded savings upward of 30 percent over conventional methods of construction. Owners should understand that the savings gained increases the shared responsibility of project success between the owner and the engineer.

All projects have been implemented with one or more partners, thus creating an economy of scale and saving additional construction and operation dollars for each participant.

Water Supply

Only recently has there been substantial well testing and monitoring in South Texas. With the implementation of several projects, we will be able to better monitor and define aquifer characteristics. This is important in determining the ultimate yield of the aquifer. Most wells were drilled in the 1950s, during a major drought, but have not been used due to their brackish nature. Brackish groundwater cannot be used for irrigation, so demand would be only for municipal use.

Issues to be Addressed

We need to continue working in several areas to improve the success of brackish desalination. The growing concern of concentrate disposal is primary on the list and more important to inland communities without the ability to discharge into a salt water body along the coastal areas.

Because power accounts for 30 to 50 percent of operational costs, technology advances in power savings through energy recovery, fuel cell development, and renewable sources should be pursued.

Conclusions

We must realize that all sources of water are limited and we must use them wisely and efficiently. Seawater provides the most unlimited source of water but most often carries the highest cost to implement. Brackish water has shown to be a viable alternative to the limited surface water supplies in South Texas. From the initial feasibility studies starting in 1995 to the largest brackish groundwater facility in Texas to date, this is a growing industry and is expected to grow into many areas of the state to account for increasing demands and decreasing supplies.

The use of brackish desalination is not for everyone and will not take the place of surface water. What it will be is an opportunity for entities to provide a reliable water alternative and diversify the supplies while improving water quality in the process.

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