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Lessons From the Barnett Shale Cities Face Challenges in the Eagle Shale

By Michael G. Morrison, P.E., BCEE
With Bill Pannell, Water Utilities Superintendent, City of Cleburne

Gas well development continues to be an economic boom to Texas communities. Development in the Barnett Shale in North Texas brought jobs and wealth to the area. Local municipalities saw unprecedented benefits, such as:

- Increased water sales revenue
- Increased sales tax revenues
- Increased ad valorem tax revenues
- Royalty agreements and income
- Infrastructure improvements

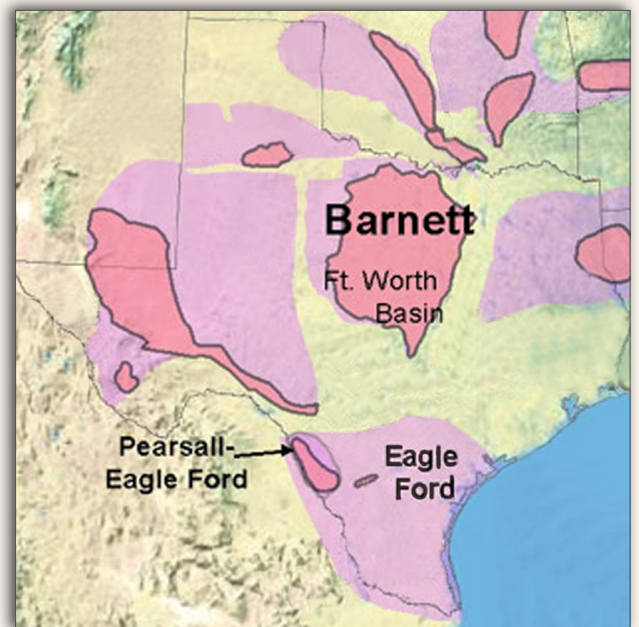
Now, Central and South Texas is beginning to experience the same explosion with the Eagle Ford Shale formation. Municipalities and water entities will face similar challenges along with incredible opportunity.

The Barnett Shale development had the added advantage of being able to use deep disposal wells for flowback directly below the Barnett Shale formation. However, the Eagle Ford Shale development is anticipated to have an increased disposal cost, making the treatment and reuse of flowback water from previous fracking operations more viable. Also, ground water districts did not play a significant role in the Barnett Shale because they were just forming when development reached its peak. The more developed groundwater districts in the Eagle Ford Shale area will have a more significant influence.

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North vs. South

Some differences exist between the developments. The Barnett Shale development in the D/FW metroplex only required about a quarter of the fracking water that is projected for the Eagle Ford Shale development. Developers acquired this water through contracts with municipalities (raw, treated and wastewater reuse), temporary permits from TCEQ for surface water and landowners of groundwater.



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Drought Forces Water Contingency Plans Across State

By Simone Kiel, P.E.



Simone Kiel is an FNI Associate and Water Supply Planner whose 25

years of experience includes water management planning, reservoir operation studies, and groundwater and surface water availability evaluations. Ms. Kiel has worked on teams across the state in Senate Bill 1 Regional Water Planning since its inception. She may be reached at 817-735-7446 or sfk@freese.com. Click on her name above for a direct e-mail link.

Drought contingency plans are required by TCEQ for wholesale public water suppliers, retail public water suppliers, irrigation districts and water users applying for a state water right or state funding for water supply projects.

Plans are required to be updated every five years. For those providers that met the TCEQ's most recent deadline of May 2009, the next update will be needed before May 2014.

Texas is currently in one of the worst droughts since the 1950s. West Texas has already surpassed the 1950s drought, recording the lowest rainfall on record over the last nine months. Many water providers are monitoring their dwindling water supplies as they are actively pursuing additional sources. In response to the ongoing drought, TCEQ sent letters to water providers in June encouraging them to consider implementing their drought contingency plans.

All retail water providers and wholesale providers are required to develop a drought contingency plan. For some providers, this current drought may be the first time that their plan has been implemented. The plans are designed to provide a water system with the ability to set different response levels based on the severity of the drought. It is important to monitor both the identified drought triggers and associated reductions in water use when your drought plan has been initiated.

Setting drought triggers and achieving water reduction goals can be challenging. Drought triggers can be based on water storage (e.g., lake or aquifer elevations), system demands or a combination of multiple triggers. Consideration should be given to a safety factor for conditions worse than historical droughts. Also, drought triggers may need to be adjusted as your customer base and demand increases from growth (i.e., reserve supplies should be adjusted for growth). The amount by which water use can be reduced during drought will vary with the time of year, customer buy-in and the



water system's enforcement ability. Customer buy-in is essential for the success of any voluntary and some mandatory restrictions. For systems that are located close to each other, consolidated public messages can reach a greater audience and help reduce customer confusion. Following this drought, it would be prudent to conduct an audit of your drought contingency plan to assure that it is functioning as intended.

As of July 22, nearly 640 water systems have implemented voluntary or mandatory water restrictions, with more than 50 systems reporting moderate to severe restrictions.

Any water system that has initiated mandatory drought restrictions is required to report this to the TCEQ, which can now be done online. Additional information on the Texas drought and public water systems under restriction can be found on the TCEQ's Texas Drought Information [web page](#). ☆

Drought Triggers Priority Questions

By Guest Author - Brad B. Castleberry, Principal; Lloyd Gosselink Attorneys and Counselors



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in Austin. His specific areas of practice include water supply planning and permitting, water quality management and environmental defense. A recent adjunct Professor of Water Law at Texas Tech University School of Law, Mr. Castleberry was the 2005 recipient of the Texas AWWA Service Award, the 2009 WEAT Outstanding Service Award and the 2010 Water Environment Federation Bedell Award, all in recognition of his service to the water and wastewater industry. He can be reached at 512-322-5856 or bcastleberry@lglawfirm.com. Click on his name above for a direct e-mail link.

In addition to drought contingency plans, some systems may need to begin thinking about the stability of their water supplies, especially if the source is surface water. Surface water rights in Texas are governed by the prior appropriation doctrine, which means first in time, first in right. Because the state retains ownership of surface water, it assigns permits for beneficial use with a priority date. The older the surface water right, the more valuable it is under the prior appropriation system.

We have already seen priority calls made in the Brazos and Colorado River basins. These calls have led to water rights prior to 1980 in the Brazos and 1950 in the Llano watershed being restricted from diversions. TCEQ expects to receive more priority calls, which could lead to more curtailments and possible limitations on supplies. TCEQ is already planning to implement a portion of HB 2694 that deals with priority uses. Its first stakeholder meeting to discuss this process will be held on August 11, 2011 in Austin. For more details about this meeting, click [here](#). TCEQ is particularly interested in stakeholder input regarding the following issues:

- What type of notice, and opportunity for hearing and appeal is required after this order is issued?
- Another drought issue that may arise, even for senior rights with large purveyors, is the potential to have curtailments based on contracts. If a water system has entered into a wholesale contract for surface water supplies, then curtailments may be possible under the terms and conditions of that wholesale provider's contract, drought contingency plan and Section 11.039 of the Water Code. Specifically, if a wholesale provider's drought contingency plan triggers curtailment, then all of its customers will share in a pro-rate reduction of supplies as required by law. So, even if supplies appear to be stable because of seniority in the prior appropriation system, there is still a possibility of having curtailments due to trigger points and contracts with a wholesale provider.
- And while groundwater supplies are not regulated under these same principles, it is important to note that there may be curtailment restrictions imposed if supplies are located within a groundwater conservation district. There are no uniform standards that apply across the state for groundwater usage during a drought -- provisions would be specific to the District where a water system is located. As such, there may be a possibility for curtailment based upon a District's adopted management rules, which means it is always wise to review and understand any local rules applying to groundwater supplies. ☆
- How should "drought" and "emergency shortage of water" be defined?
 - How should development and implementation of conservation plans be considered?
 - What conditions should be required for issuance of an order?
 - What should the duration of the temporary order be?



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Mike Morrison

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Technical Leader for Central Texas Water Resources Group. He assisted the City of Cleburne in managing impacts of the Barnett Shale development. Mr. Morrison is a contributing author to the textbook *Wastewater Treatment Plants, Planning, Design and Operation*. He may be reached at 512/617-3150 or mgm@freese.com. Click on his name above for a direct e-mail link.

Lessons Learned

Freese and Nichols assisted several cities in managing this new water demand and challenges to their systems, including the City of Cleburne. This partnership provides excellent benchmarks for similar entities in the early stages of the Eagle Ford Shale development. The most critical lesson was securing municipal surface water, groundwater and municipal system agreements whenever possible. This gave some degree of control and helped protect the aquifer.

Difficult Challenges

Outside Wells Impacting the City's Water Supply

Every city well was impacted to some degree (lowered pumping levels, decreased production rates and longer recovery times). A few wells were dramatically impacted with catastrophic pump failure due to a 70-foot drop in static levels over a six-month period.

Unauthorized Water Diversions and Theft

Water theft was a big issue, requiring extra man hours to monitor watershed and distribution systems. The city confiscated unpermitted pumping equipment found in nearby rivers and spent \$25,000 on hydrant locks to deter water thieves from stealing another company's authorized hydrants. The City also lost countless water from unmetered hydrants.

Time and Effort for Processing Permits and Applications

With the overwhelming amount of drilling permit applications, the City



was inundated with permit reviews and approvals which required more administrative hours than staff could accommodate. Establishing a procedure in advance of applications and adjusting permit fees to include the additional man hours is essential.

Noise and Visual Abatement for Drilling Operations

Drilling and production was not confined to remote locations. Many of the actual production wells were within the city limits and in local neighborhoods. Noise and visual abatements were a big concern and required the development of ordinances and codes to address these issues.

Traffic Controls

Water hauling caused many problems, including several fatal accidents and damage to roads from overloaded water haulers. Since it took place on private lands, the county could do little to regulate this activity but request speeding enforcement by the Department of Public Service. Also, portable truck inspection and weigh stations were set up on a random basis, resulting

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Legislative Update

AquAlert readers most likely know about the Texas Water Plan created by Senate Bill 1 at the beginning of this century and are familiar with the projects identified to assure an adequate and safe water supply for Texans through 2060. The cost over the 50-year period is estimated at \$18 billion.

Great progress occurred during the 82nd Legislature on providing funding for the Texas Water Plan, but the current budget situation could not accommodate the required state funds. However, the legislators did approve Senate Joint Resolution 4, a constitutional amendment that will provide \$6 billion to implement parts of the state water plan, if approved by voters. Proposition 2, “The constitutional amendment providing for the issuance of additional general obligation bonds by the Texas Water Development Board in an amount not to exceed \$6 billion at any time outstanding,” will be on the **November 8 ballot**.

It is important for all of us in the water industry to make sure family, friends and neighbors know how important Prop 2 is to keep Texas the visionary and economic envy of the rest of the country. More information on Proposition 2 - SJR 4 can be found [here](#).

in a decrease in accidents and better company control over their drivers and loads.

Impacts on Water Distribution System Operations

Restrictions on the locations and rate at which water can be withdrawn from the system are important. The city installed orifice plates on the authorized hydrants to slow down the delivery rate. At the peak of the Barnett production, it was not unusual to have 10-15 trucks filling simultaneously in a small area, causing problems with pressure.

Code Enforcement

The drilling sites themselves must be monitored frequently to ensure compliance with applicable permit requirements.

General Tips on Managing Drilling Development

- The water-providing entity should develop the water rate sale structure early on, including water usage categories for surface water supply (raw and treated), groundwater and wastewater reuse.
- Identify water take points and restrictions such as water permits, metering requirements, flow restricting devices and deposit and payment fees.
- Issue dual permits for flowback water disposal facilities (industry and city use)
- Establish procedures for use of royalties and permit income, restrictions and conditions. Restricted funds should be restrictive in the use of the revenue. It is easy to forget that

this revenue stream is highly variable with market forces. At a minimum, do not allow the funds to become encumbered. Some of the funding from both royalties and permits should be reinvested into employees and tools for monitoring.

- Establish ordinances, regulations and codes for drilling permits, noise abatement, and other Standard Operating Procedures (SOPs) for the oil and gas industry. Cleburne had to develop a completely new set of regulations and operating practices to address the new water demand and production development requirements.
- Protect your watersheds. In Cleburne, mud farms (land disposal of flowback water) sprang up everywhere. The Railroad Commission permits for these sites do not require notification to municipalities within the impacted watershed. The City, working with the County Commissioners, was able to obtain copies of permits within its watershed and could map out locations and monitor surface runoff pollution from these sites.

Drought Impacts Drilling Water Sources

Development of gas wells requires the use of hydraulic fracturing (known as fracking) to increase production. For example, an average of six million gallons per well, ranging from 1 to 13 million gallons per well, is required in the Eagle Ford Shale. Due to the present drought conditions, there

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Freese and Nichols University
Upcoming Classes

To register for a seminar, click here or call 817-735-7509

Nutrient Removal and Recovery: Implementation, Optimization and Operation

August 25, 2011
8:30 a.m. - 3:00 p.m.
FNI - Fort Worth

September 27, 2011
8:30 a.m. - 3:00 p.m.
GBRA - Seguin

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is concern that a lack of available water will slow down development activities.

Groundwater is the primary source of water that is being used for fracking in the Eagle Ford. However, many of the aquifers used to provide water to the natural gas industry are not responsive to short-term variations in climate because the water used comes from the artesian portions of sandstone aquifers. Although short-term variations in climate can have indirect impacts on groundwater availability. For example, water levels in an aquifer will decline faster if the irrigators pump more water in response to the drought. Many Trinity wells drilled for Barnett production impacted the City’s wells. A few wells had dramatic static water level drops of 70 feet in a six-month period. Groundwater is regulated and permitted by local groundwater

conservation districts whose rules and regulations vary across the state.

The 2020 Eagle Ford Shale fracking water requirement is equivalent to the annual water usage of the City of Boulder, CO (population 95,000).

The use of surface water is regulated by the state through TCEQ. If a natural gas producer has a temporary permit from TCEQ to use surface water, the producer might lose that permit during a drought. In that case, a producer could switch to groundwater, if available, or contract for water through a third party such as a landowner, city or water authority. Another potential source of water is treated municipal wastewater or treated flowback water (pressure-released water from a previous fracking operation). ♻️

Projected Water Use for Hydraulic Fracking (in acre feet*)

Region/Shale	Year					
	2010	2020	2030	2040	2050	2060
Barnett	27,900	40,300	17,400	1,900	0	0
Haynesville	0	400	1,400	1,200	600	100
Bossier	800	7,300	4,900	3,300	1,700	200
Eagle Ford	600	17,600	31,900	27,200	20,900	14,600
Woodford	0	300	9,300	7,300	5,700	4,100
Pearsall	0	2,500	7,600	6,000	4,700	3,400
Wolfberry	1,700	9,500	9,000	5,500	2,300	0
East Texas Tight - Gas Plays	3,500	5,200	4,600	3,100	1,500	100
Anadarko	1,900	3,100	300	0	0	0
South Gulf Coast Basin	900	1,800	2,300	1,700	1,100	500
Permian Basin	4,300	7,200	4,200	1,200	0	0
Annual Totals	41,600	97,900	92,900	58,400	68,500	23,000

*1 acre foot = 325,851 gallons