Local Regulatory Considerations

China U.S. Visit: U.S. Experience in Unconventional Regulatory Frameworks

U.S. Department of State Unconventional Gas Technical Engagement Program

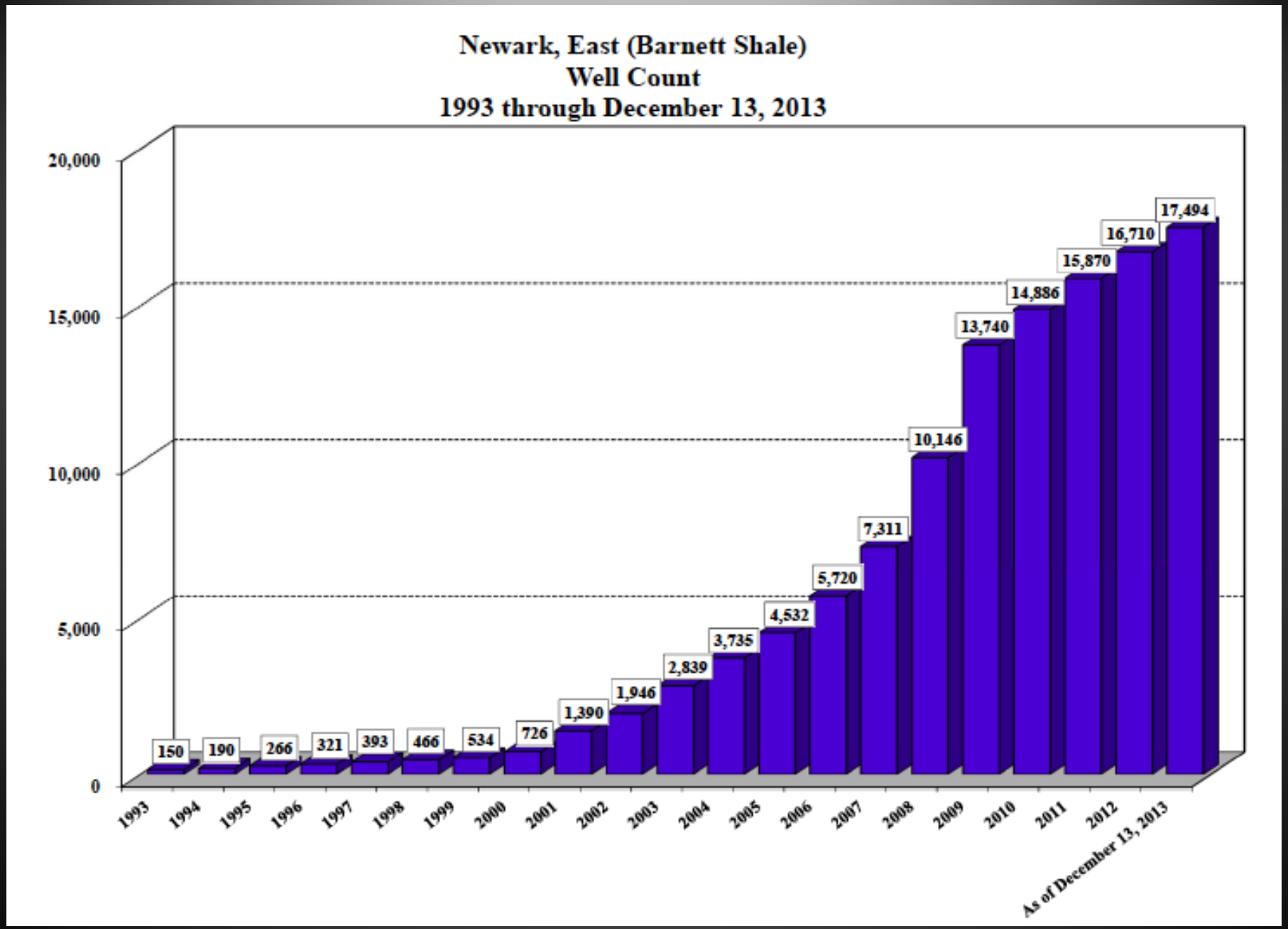
September 20-26, 2014, Dallas, Texas

Regulatory Entities in Texas

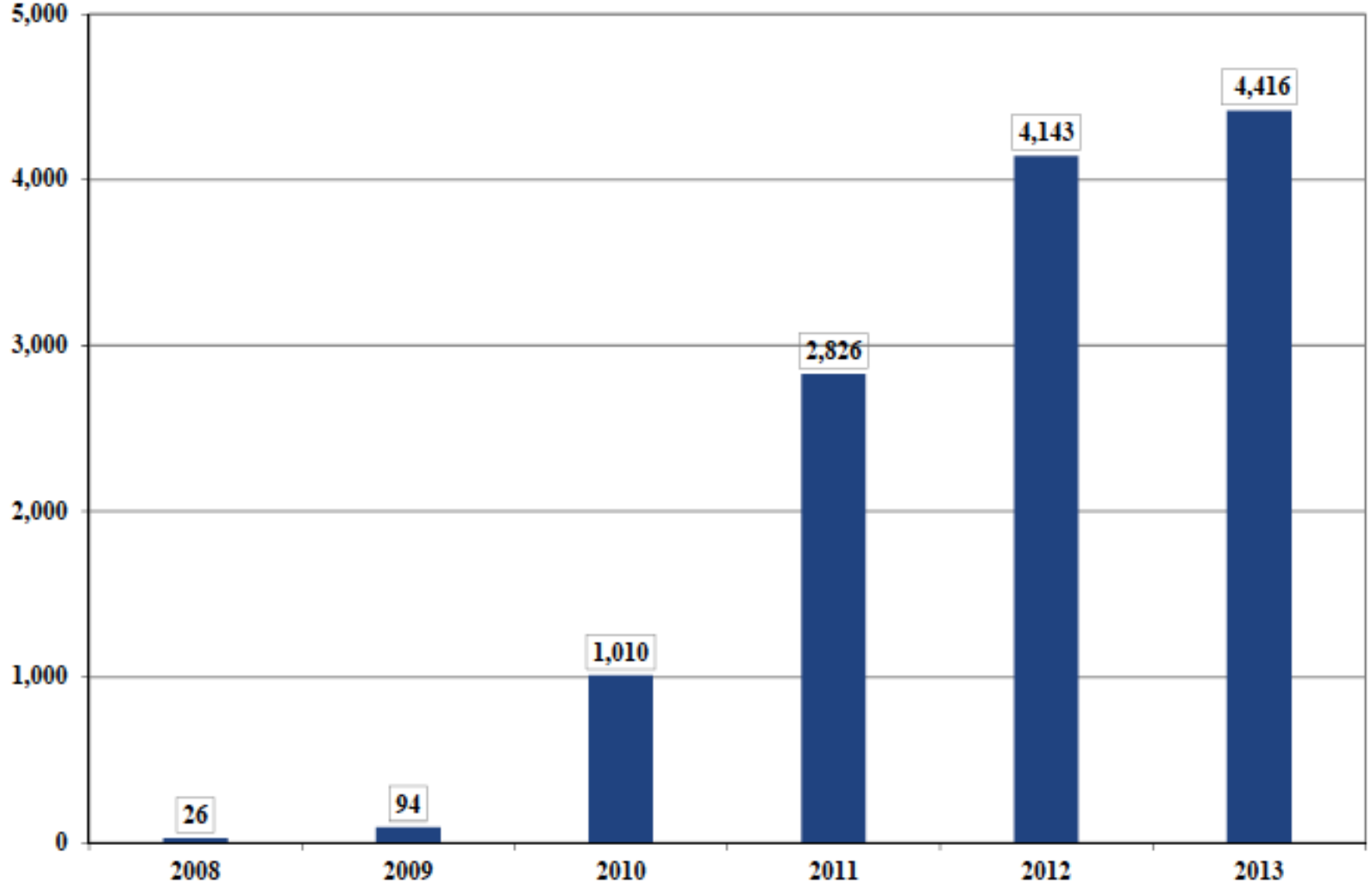
- Environmental Protection Agency (EPA)
- Texas Commission on Environmental Quality (TCEQ)
- Railroad Commission of Texas (RRC)
- Local City and County Regulation (i.e., City of Fort Worth)

Shale Gas in Texas

- **Barnett Shale**
  - 17,494 wells to date
- **Eagle Ford Shale**
  - 5,304 wells to date
- **Haynesville Shale**
- **Wolfcamp Shale/Permian Basin**
  - Over 9,000 permits per year
- **Anadarko Basin**


Newark, East (Barnett Shale)
Well Count
1993 through December 13, 2013
20,000
15,000
10,000
5,000
0
150
190
266
321
393
466
534
726
1,390
1,946
2,839
3,735
4,532
5,720
7,311
10,146
13,740
14,886
15,870
16,710
17,494
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
As of December 13, 2013

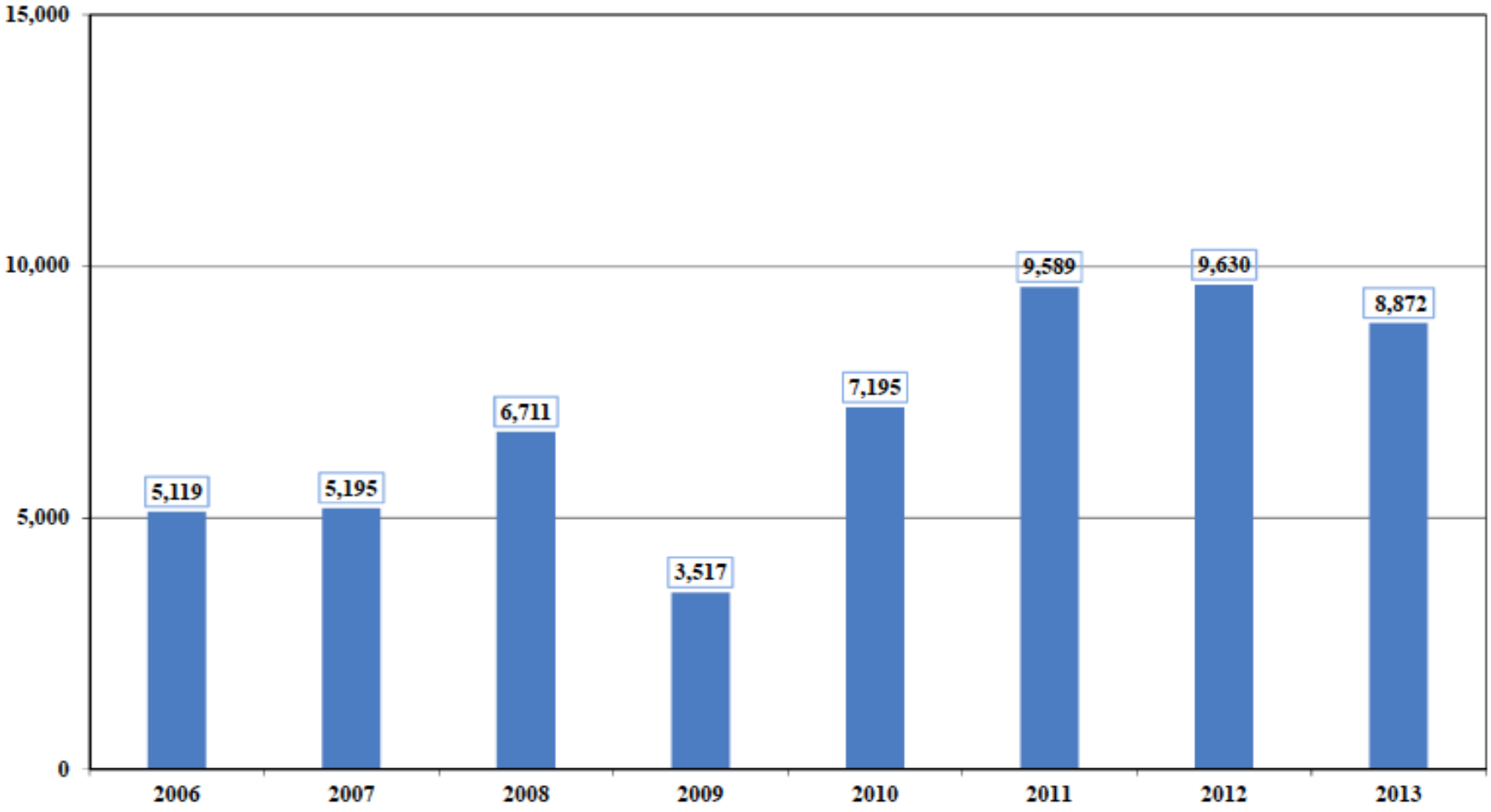
Texas Eagle Ford Shale
Drilling Permits Issued
2008 through 2013



1/09/2014

Source: Texas Railroad Commission DrillingPermitQuery(Includes New Drill & ReEnter Permits)

Texas Permian Basin
(District 7C, 08, & 8A)
Drilling Permits Issued
2006 Through 2013



1/09/2014

Source: Railroad Commission of Texas Drilling Permit Online Query System (Includes New Drill & ReEnter Permits)

Hydraulic Fracturing

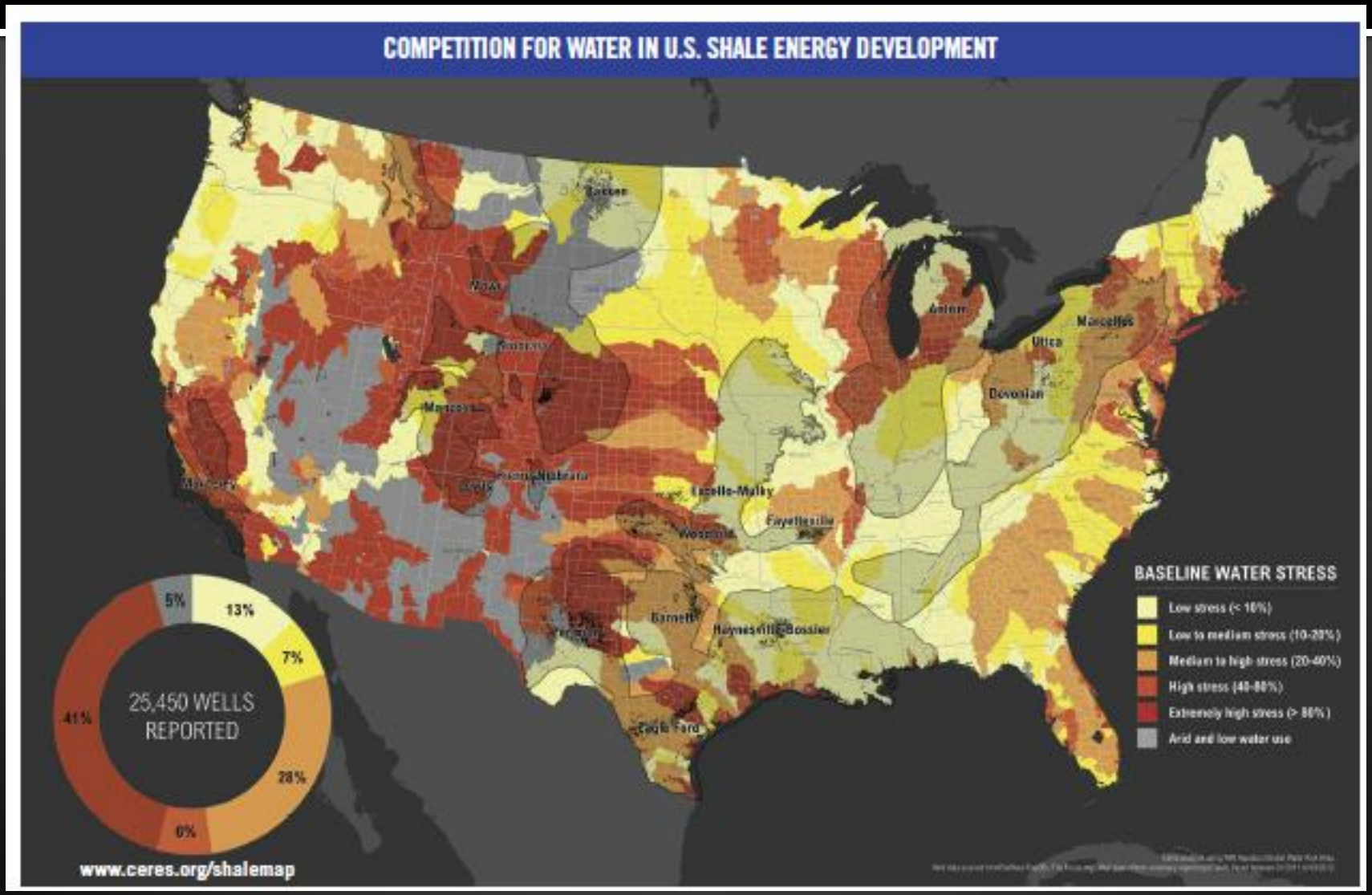
What is it and how does it work?

- A method of drilling wells that releases oil and gas from shale rock by using water and other fluids under pressure to fracture or crack the rock, thereby releasing the oil and gas.
- Freshwater combined with chemical additives and proppant assist with the completion of a well.
- The average well requires between 2 and 9 million gallons of water for hydraulic fracturing.

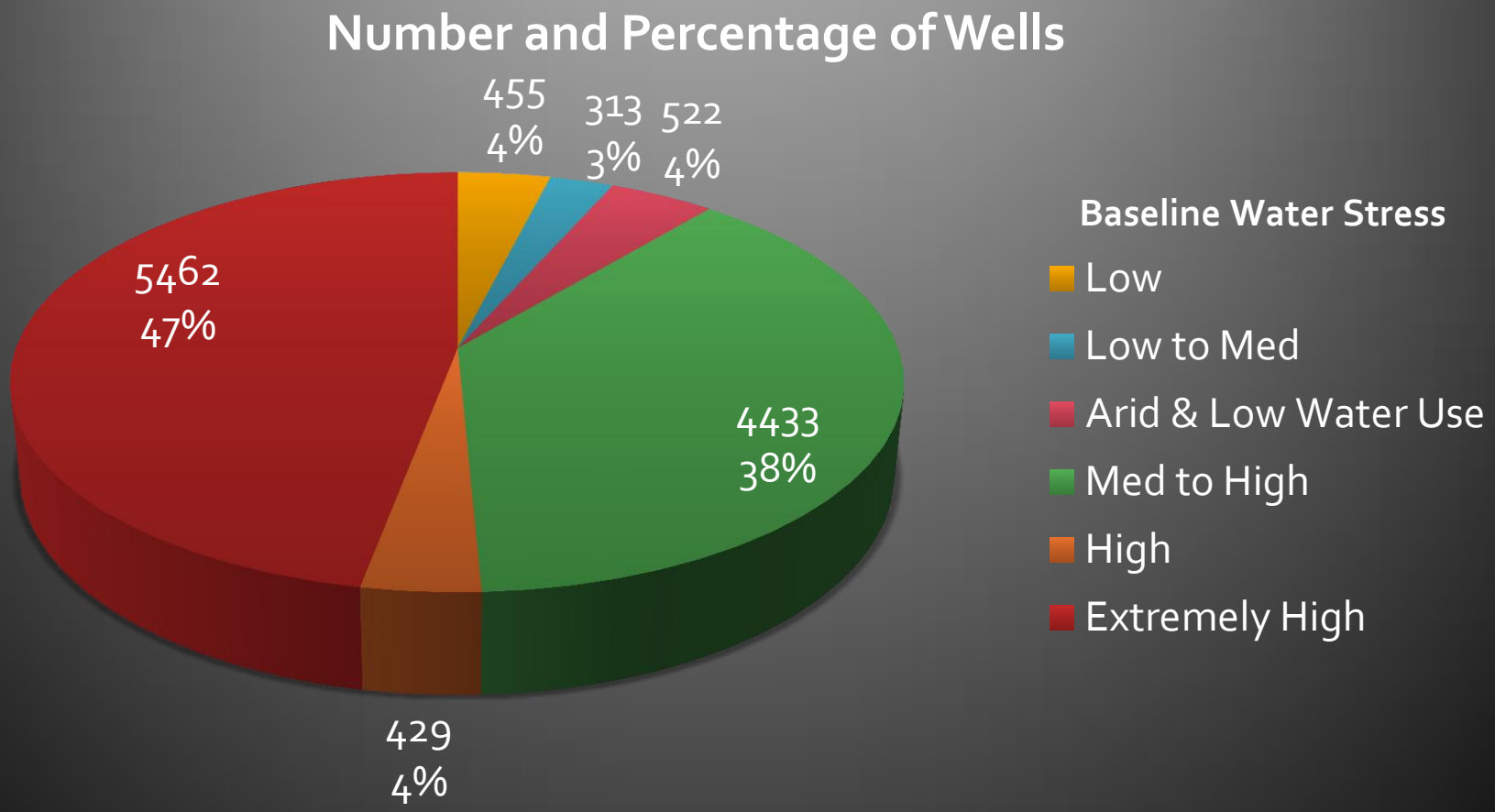
Water Use in Perspective

- 65.8 billion gallons of water used for hydraulic fracturing for oil and gas development across the U.S. from Jan. 2011 through Sept. 2012
  - Enough water to supply roughly 2.5 million Americans for one year
- Texas used a reported 25 billion gallons in 2012 for hydraulic fracturing
  - This represents less than 2 percent of total water usage in Texas
  - 47 percent of Texas shale gas wells are located in areas with high or extremely high water risk
  - High or extremely high risk means over 80 percent of available water for an area is being withdrawn for municipal, industrial, and agricultural purposes each year

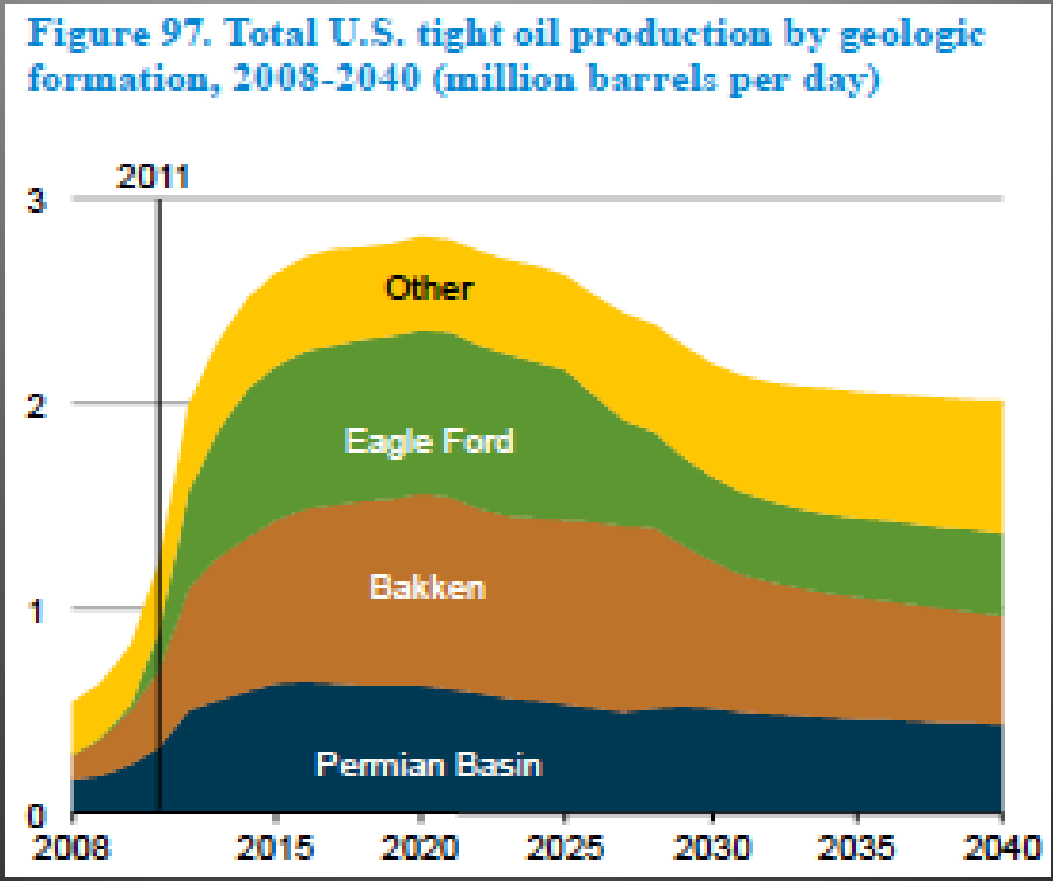
Shale Water Use Across the U.S.



Texas Wells and Water Stress



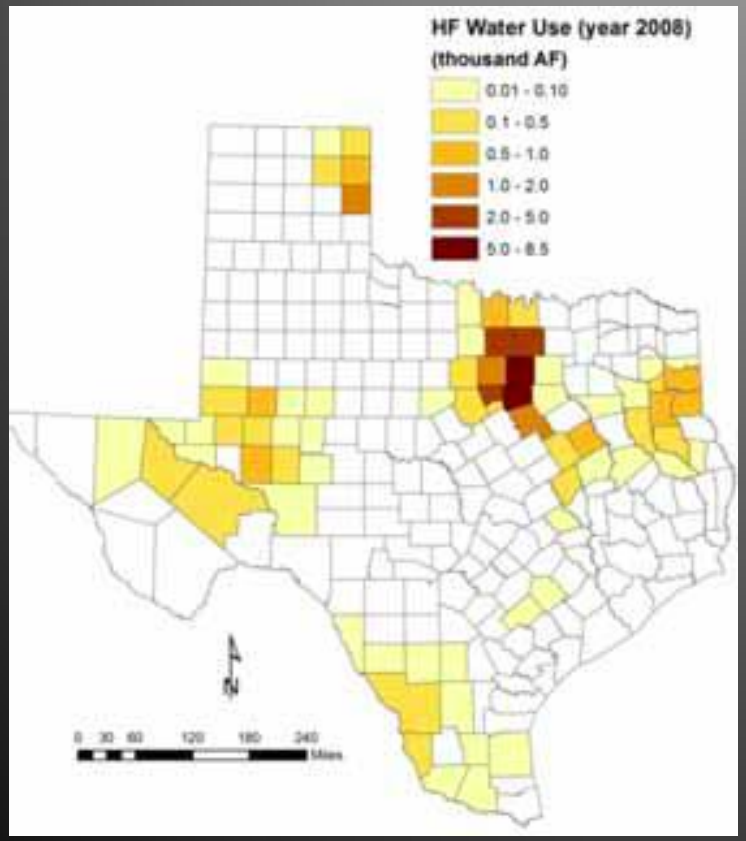
Total and Projected Production 2008-2040



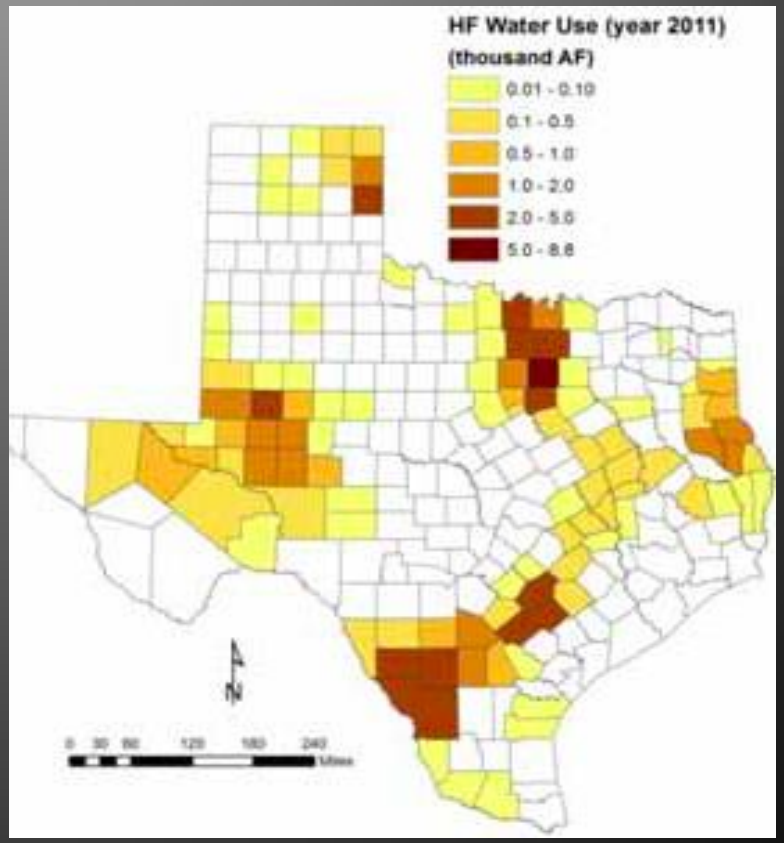
Source: U.S. Energy Information Administration (EIA), Annual Energy Outlook 2013 82 (2013)

Hydraulic Fracturing Water Use 2008 and 2011

2008

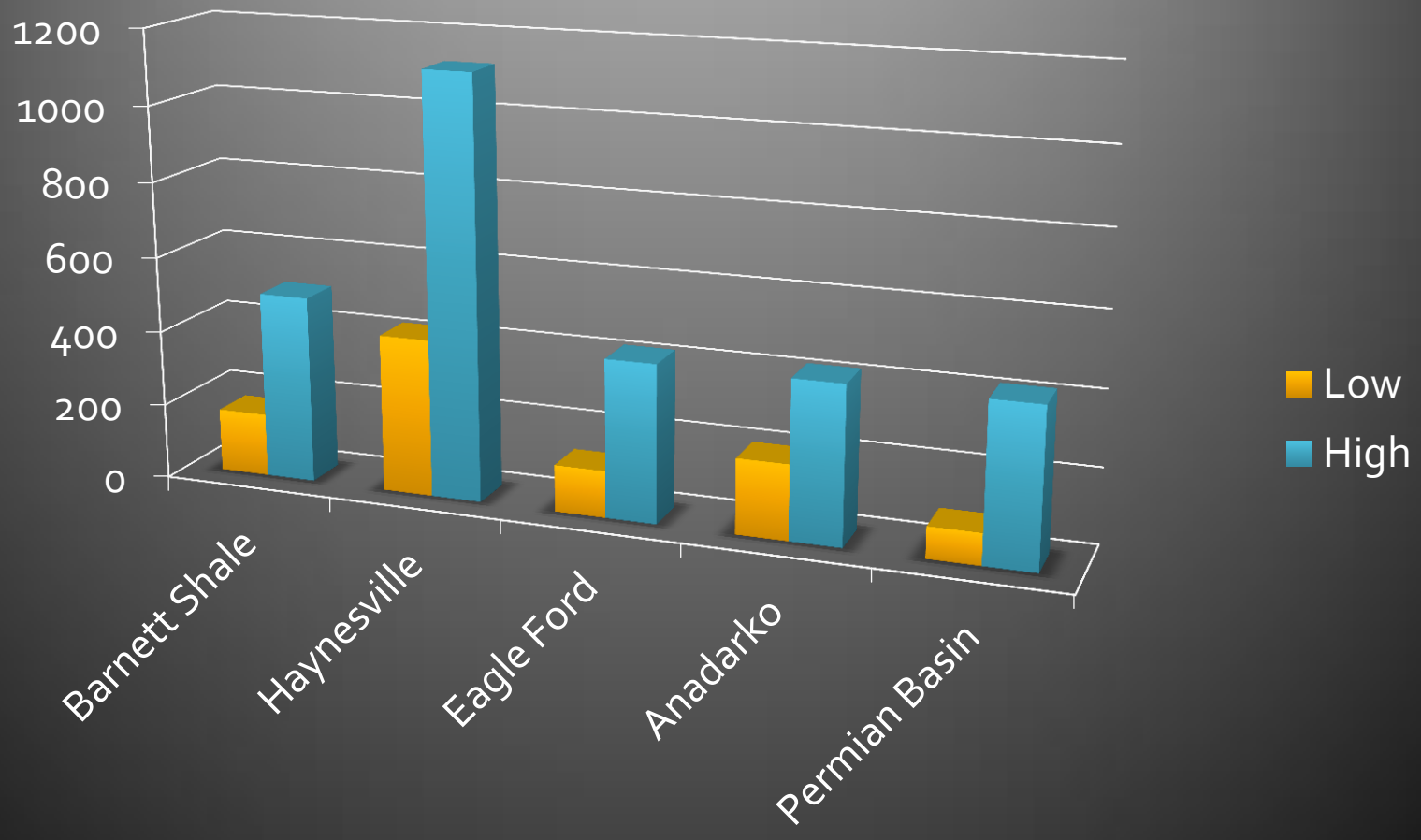


2011



Source: Jean-Philippe Nicot, Robert C. Reedy, Ruth A. Costley, & Yun Huang, Oil and Gas Water Use in Texas: Update to the Mining Water Use Report I (Sept. 2012).

Drilling Water Use by Shale
(in 1,000's gal/well)



Source: Jean-Philippe Nicot, Robert C. Reedy, Ruth A. Costley, & Yun Huang, Oil and Gas Water Use in Texas: Update to the Mining Water Use Report 63 (Sept. 2012).

Common Local Concerns

- Water Use and Contamination
- Hydraulic Fracturing
- Air Quality
- Noise
- Traffic and Road Damage
- Setbacks
- Waste Disposal

COFW Gas Drilling Ordinance

- Comprehensive Noise Regulations, including Noise Management Plan, Pure Tones and Low Frequency
- Compressor Regulations
- Green Completions
- Setbacks
- Gathering line maps with Well Permit
- Fresh Water Fracture Ponds
- Salt Water Pipelines

Noise Management

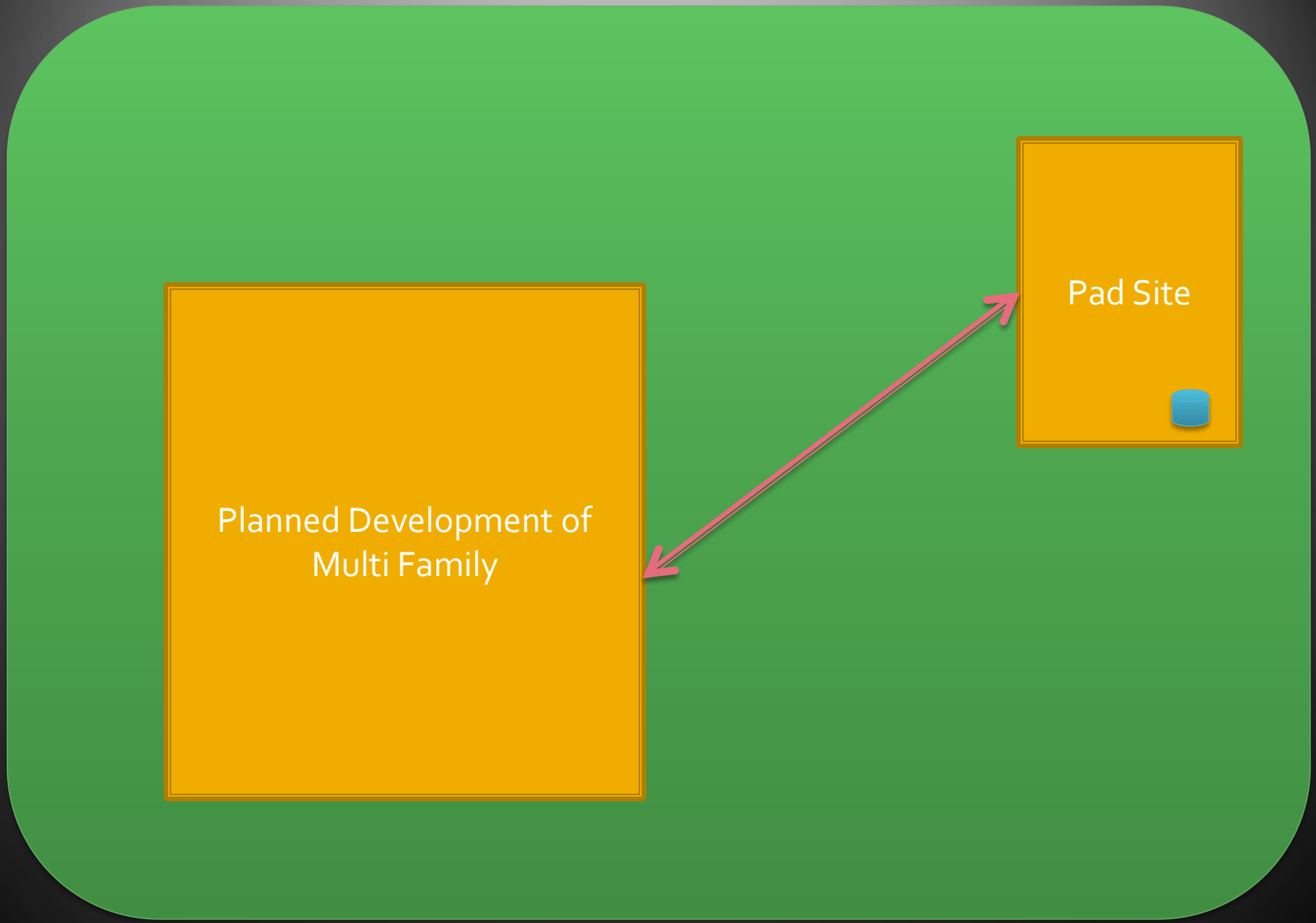
- Every operator with their well permit must provide a plan.
  - Ambient measurements for 72 hours at multiple locations, including one weekend day;
  - Address elevations, distance to residences;
  - Noise mitigation techniques, including noise walls and buffer pads

Noise Restrictions

- Values based on advice of sound expert that has data on almost every Barnett rig.
- May not exceed ambient by 5db(day) and 3db(night);
- 10 db limit over ambient for fracturing;
- 3 db for flowback
- Limits on pure tones and low frequency
- Ordinance limits compressor noise also.

Setbacks

- How do you measure?
  - Wellbore to structure or edge of site
  - More setback, more sites
- Multiple Well site v. Single Well site
- Pad site equipment
- Line Compressors
- Reverse Setback Effect
- What structures are protected?


Pad Site
Planned Development of
Multi Family

Setbacks

- 600 feet from Residence without waivers or Council approval;
  - Council may reduce to 300 feet.
  - Wellbore measurement or pad site boundary
- Other limits on schools, churches and public buildings

Fresh Water Fracture Ponds

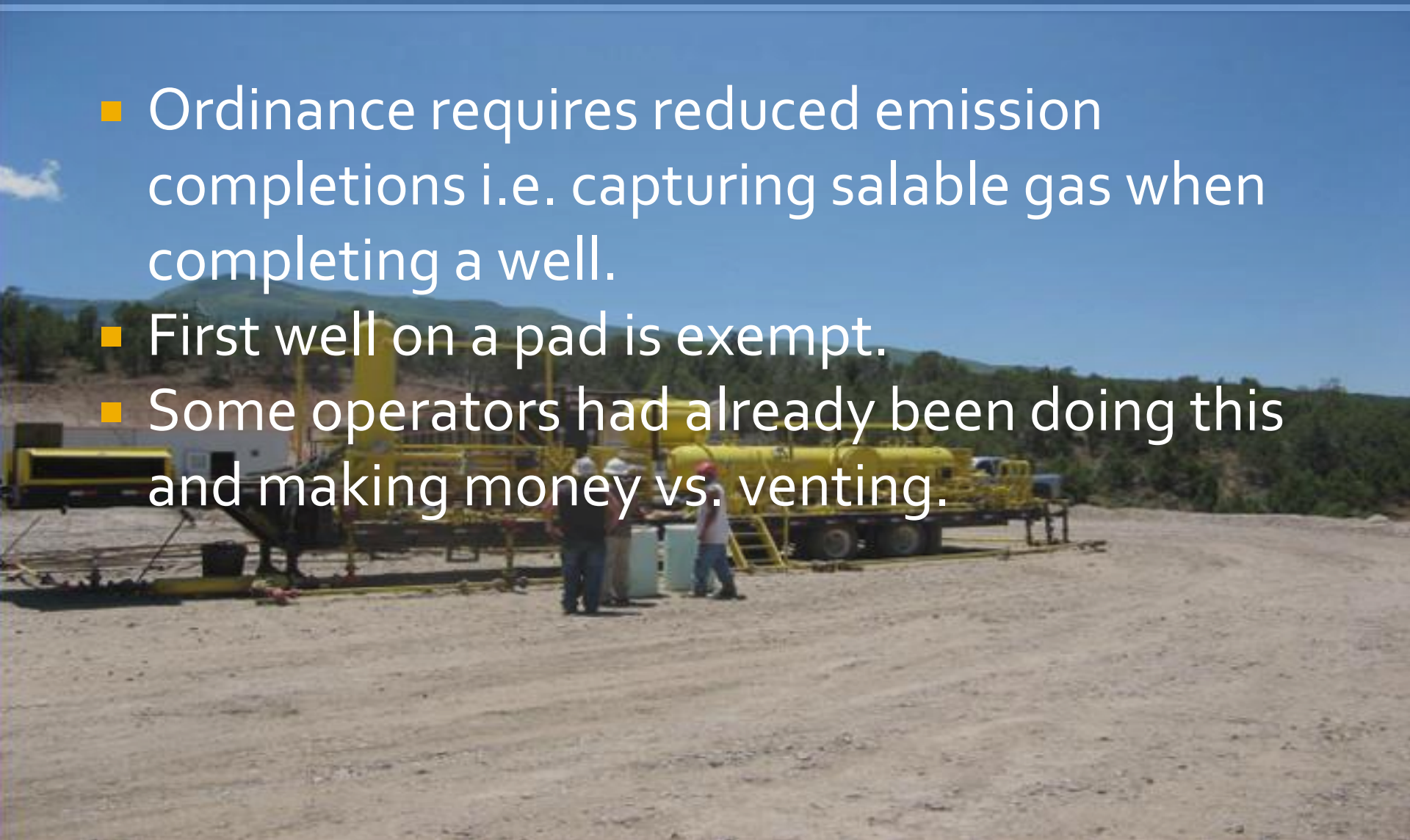
- New Ordinance allows fresh water frac ponds.
  - No liners
  - Can be located adjacent to drill site or in Ag or Industrial Zoning classifications.

Gas Drilling Review Committee

- Formed to meet and consider disputed scenarios;
  - Applies to wells requiring Council approval
  - Pipelines in residential areas; and
  - Truck routes off of commercial routes
- City Staff Departments convene and Operator and Citizens appear.


Chesapeake
8th Avenue Railroad Lease
High-Impact Well Site
Chesapeake Operating, Inc.
8th Avenue Railroad Lease
600' Buffer
Intersection of 8th Avenue and Elizabeth Street.
Chesapeak
8th Avenue
ue and Elizabeth Street
GLENCO
WARNER
ARNER
WARD
PARK HILL
RIDGE GATE
ROBERT
JESSAM
ELIZAB
fer

Green Completions



- Ordinance requires reduced emission completions i.e. capturing salable gas when completing a well.
- First well on a pad is exempt.
- Some operators had already been doing this and making money vs. venting.

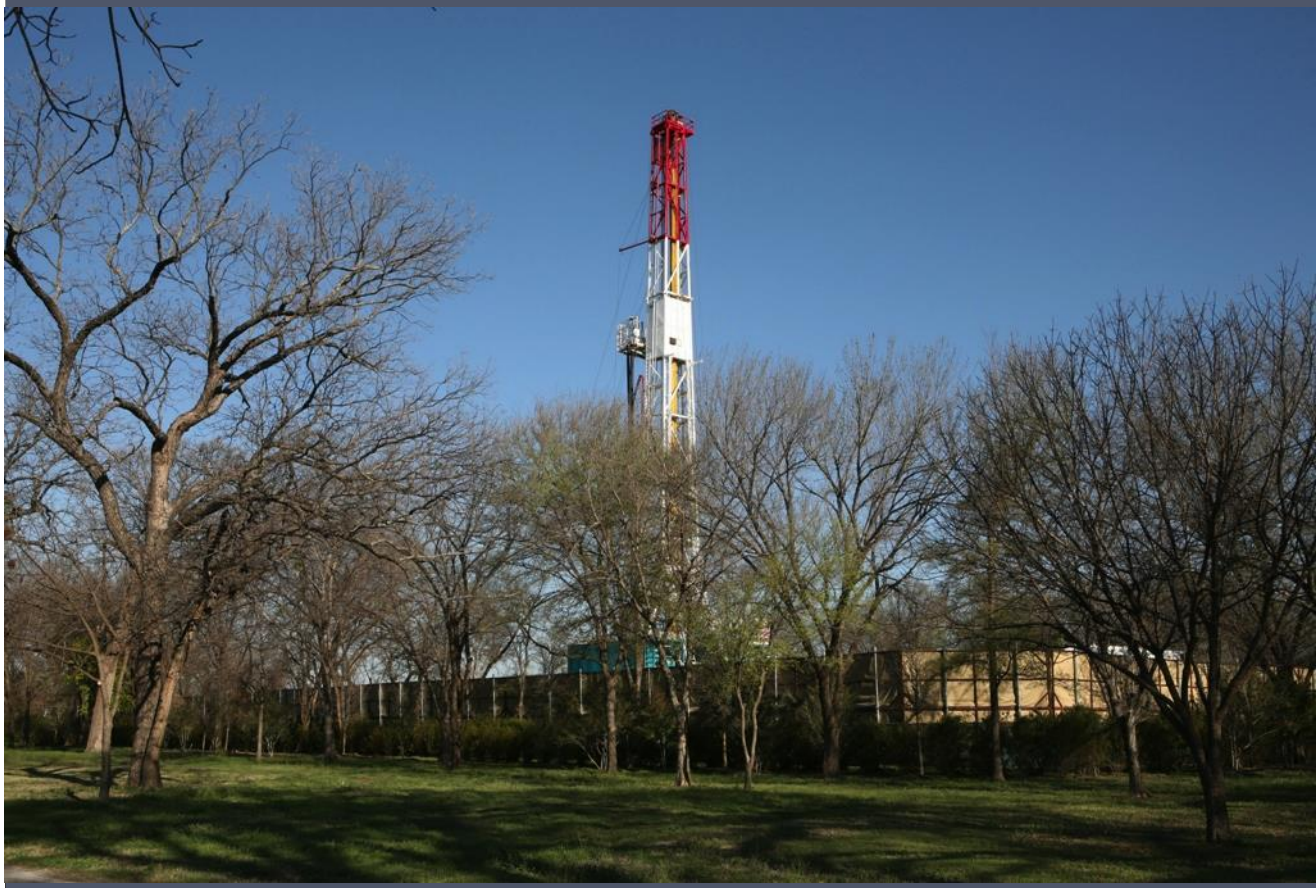
Why Does a City need a Pipeline Ordinance?

- Density-gathering lines and connecting lines more dense than ever seen in urban context;
- Duplication-multiple producers must build out to interstate transmission lines;
- Knowledge-City must know where all of the lines are located;
- Future Land Use and Planning-pipelines have a significant impact on future use by city and private development.

Rule 29

Hydraulic Fracturing Chemical Disclosure

- Regulated by Texas Railroad Commission
- Operators are required to disclose chemicals used subject to certain trade secret protections
- Operators required to disclose volumes of water used
- FracFocus website

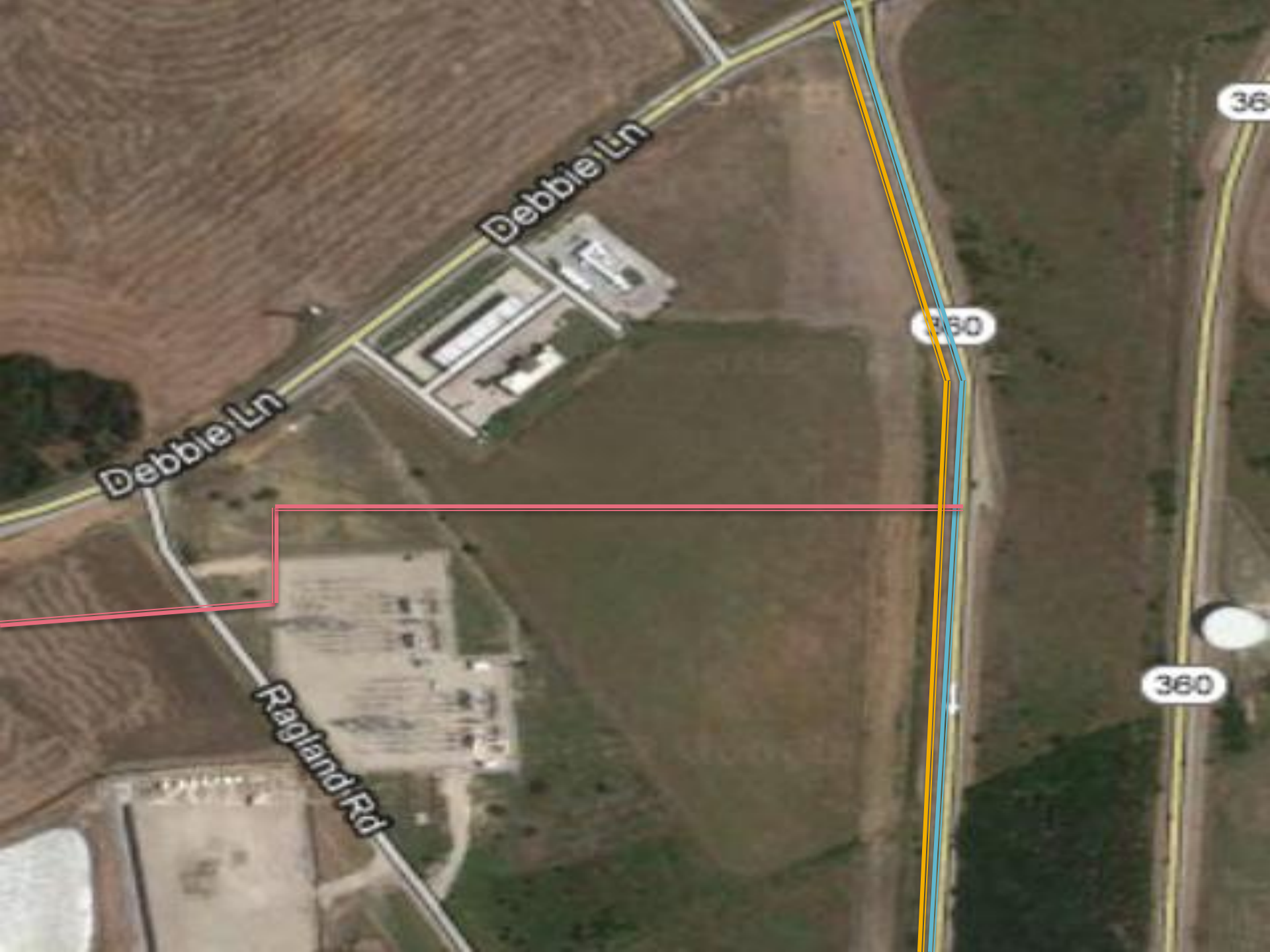


Pipeline Regulation

- Pipelines may not interfere with existing utilities or ROW;
- Must restore to original condition;
- Must meet or exceed federal and state requirements;
- 10 days prior to construction, operator shall give written mailed notice to all tenants, property owners and residents that are located adjacent to proposed line.

City Regulated Pipelines

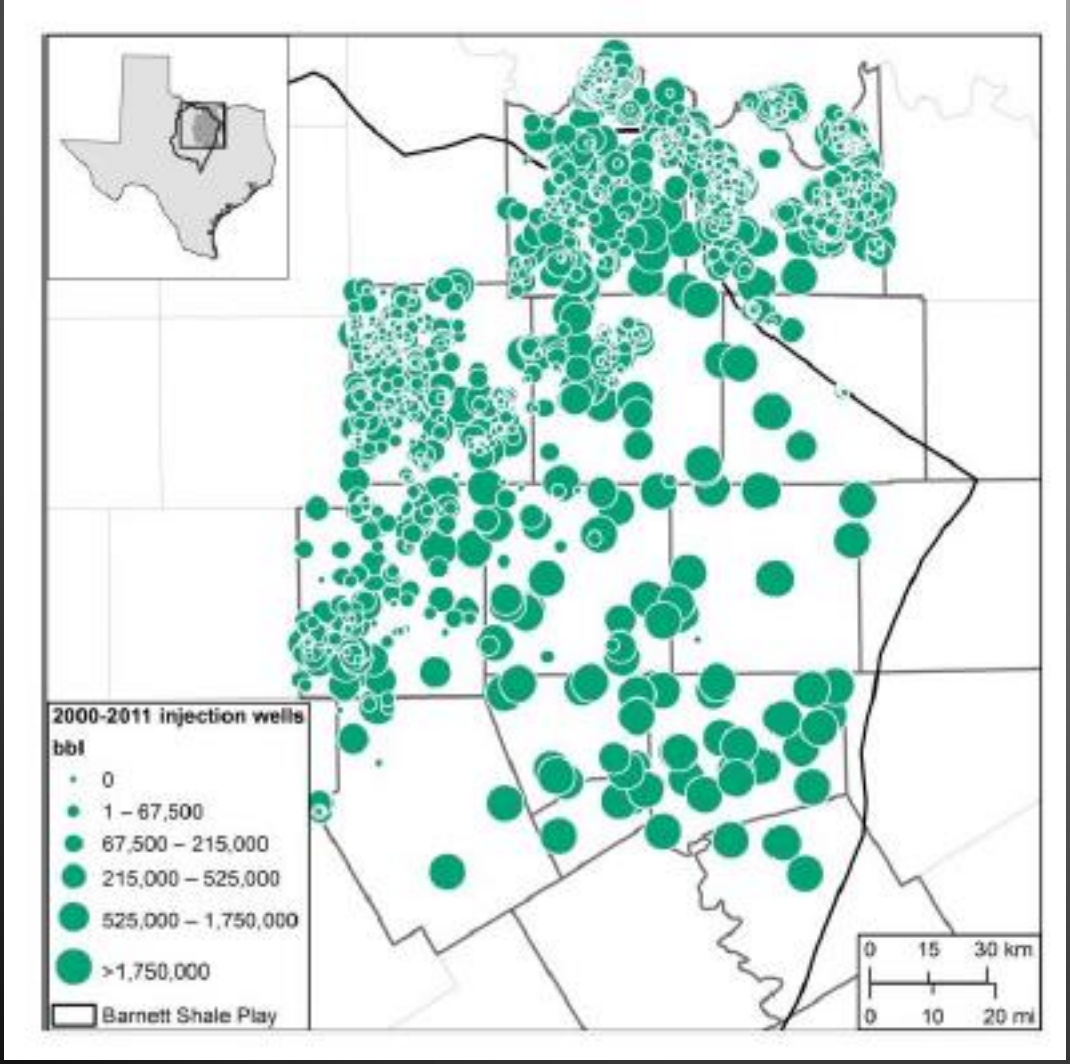
- Must incorporate all federal and state requirements for lines between well and first transfer;
- Obtain permit;
- When applying for well permit must show proposed route to reach transmission line;
- Must submit application to COFW BEFORE making any offer or initiating any negotiations in residential area.


Debbie Ln
Debbie Ln
Ragland Rd
360
360

Waste Disposal

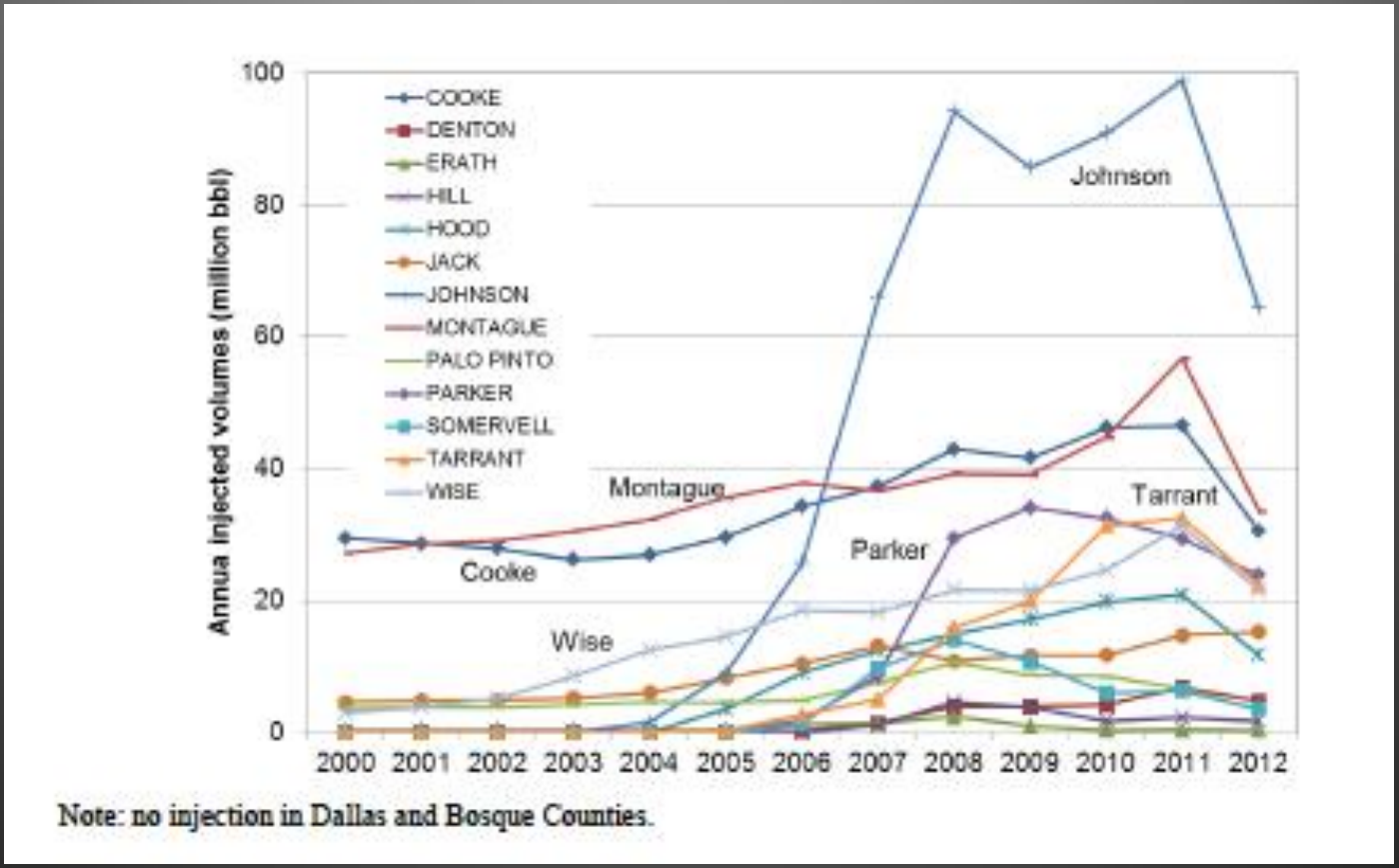
- Significant Issue facing Hydraulic Fracturing drilling.
- Fort Worth had a Moratorium and has now declined to allow wells.
- Tremendous volumes of waste.
- Other jurisdictions are moving to treatment and re-use of waster vs. disposal.
- Consult technology providers such as GE Water.

Map of Barnett Shale Injection Wells and Cumulative Injected Volume 2000-2011



Injection Wells

Barnett Shale
Yearly Injected Volumes by County
(including conventional oil and gas)



Source: Jean-Philippe Nicot, Bridget R. Scanlon, Robert C. Reedy, and Ruth A. Costley, Source and Fate of Hydraulic Fracturing Water in the Barnett Shale: A Historical Perspective, S39 (Nov. 29, 2013).

Concerns with Disposal

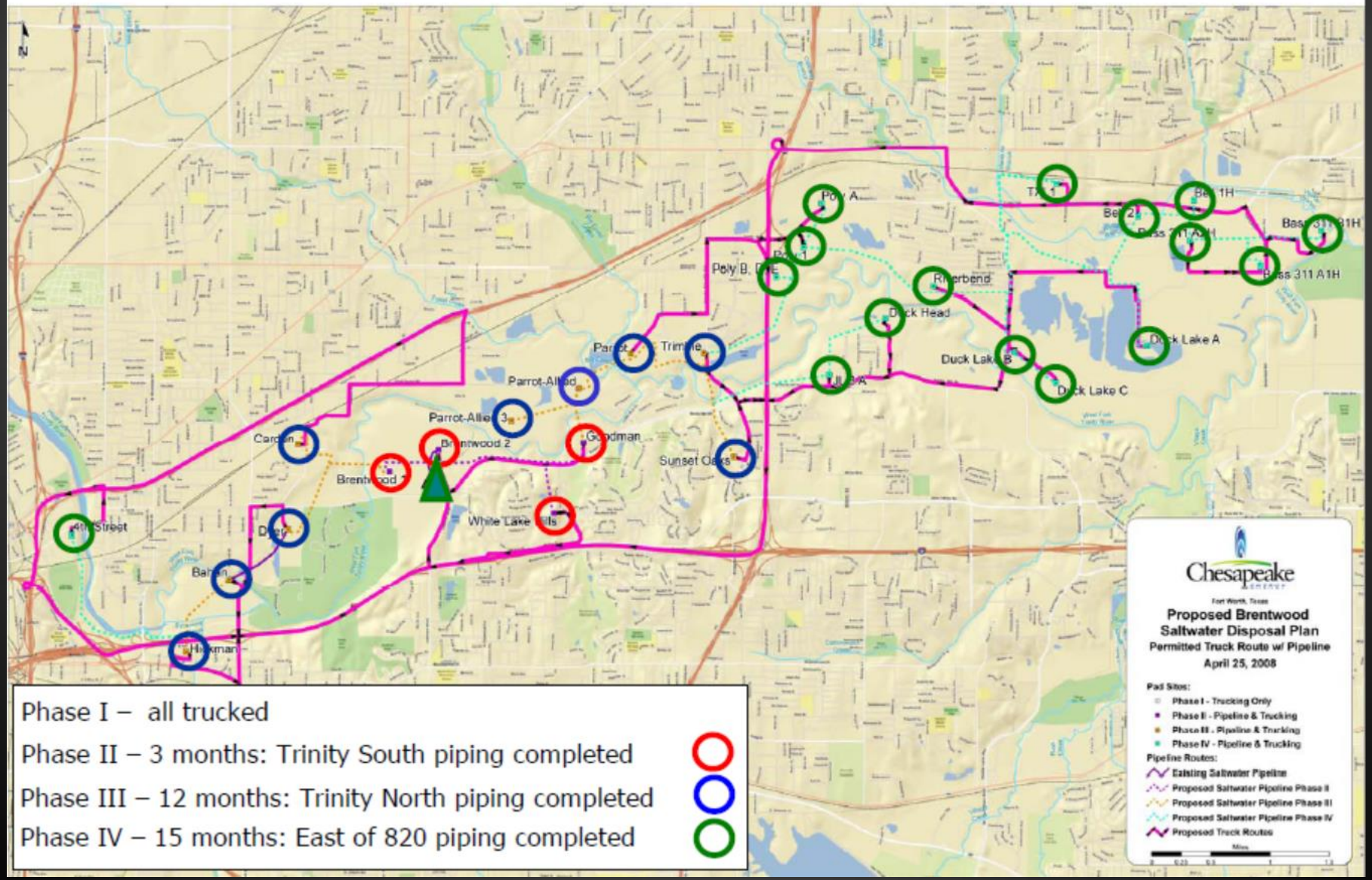
- Increased pollution and damage to roads from truck traffic
- Potential for contamination of other water sources through soil migration or spills
- Impacts to naturally occurring fault lines causing earthquakes
- Water lost from hydrologic cycle

Saltwater Pipelines

- Must obtain permission from the City
- Designed and sealed by a professional engineer
- Locate 5 feet below City utilities
- Automatic shutdown system
- Markers
- FW Pilot Study on Disposal

FORT WORTH

Phase-In Approach



Phase I – all trucked

Phase II – 3 months: Trinity South piping completed

Phase III – 12 months: Trinity North piping completed

Phase IV – 15 months: East of 820 piping completed

Air Quality

- Recent events have placed increased focus on emission from facilities;
  - Condensate tanks
  - Compressors
  - Disposal facilities
  - Well completions
  - Idling trucks
  - Leaking valves
- Texas has been doing real-time monitoring and has an expedited response time on complaints. Real time monitors throughout Barnett.

Air Quality

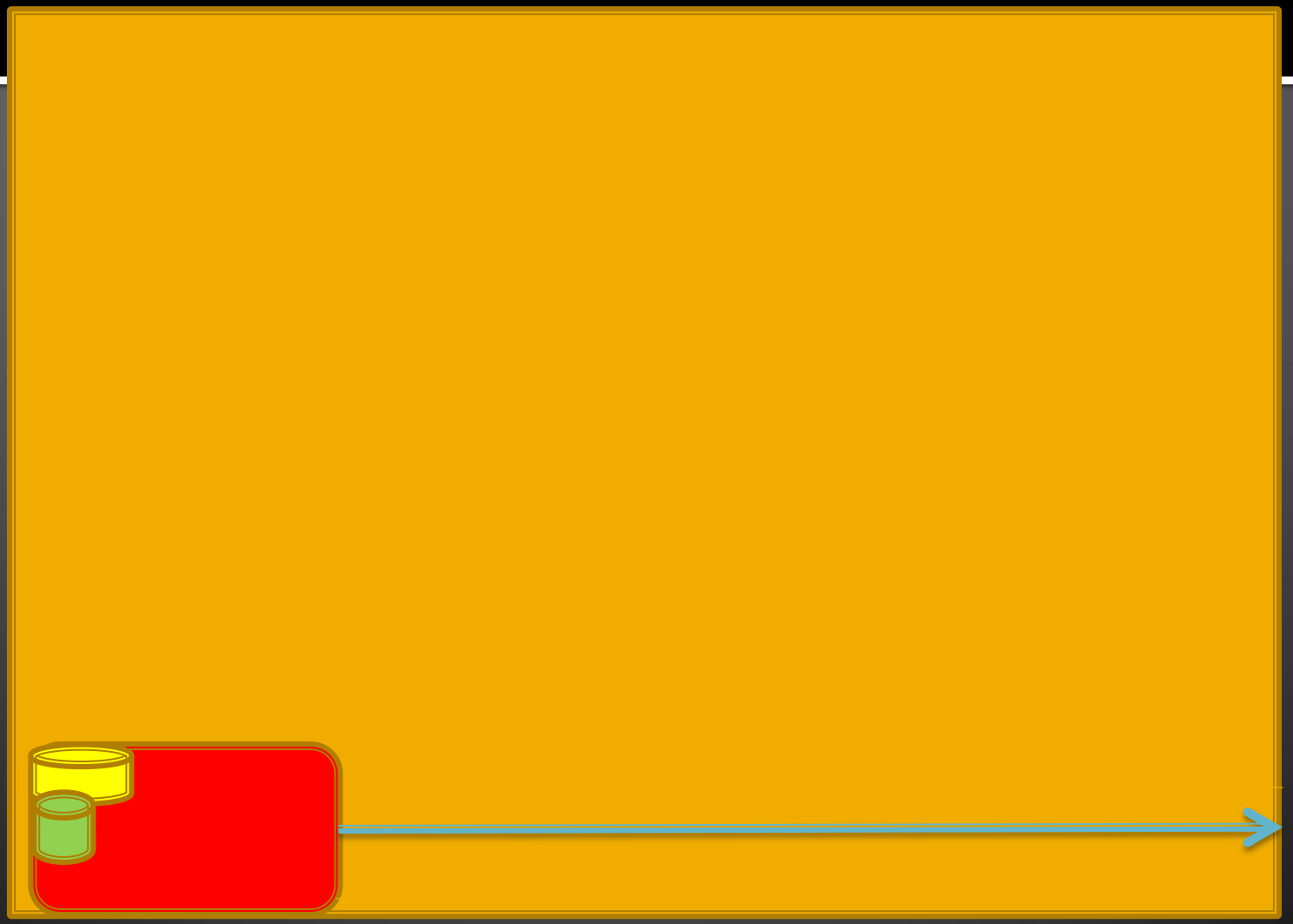
- Fort Worth convened a special panel to develop a methodology for analyzing various impacts from drilling. Consultant was selected and final report is available. New reports also available.
- EPA has newly enacted rules including green completions.


ABUTEC
SHALE
SHALE
SHALE
09/26/2012 07:30

RRC Planned Development

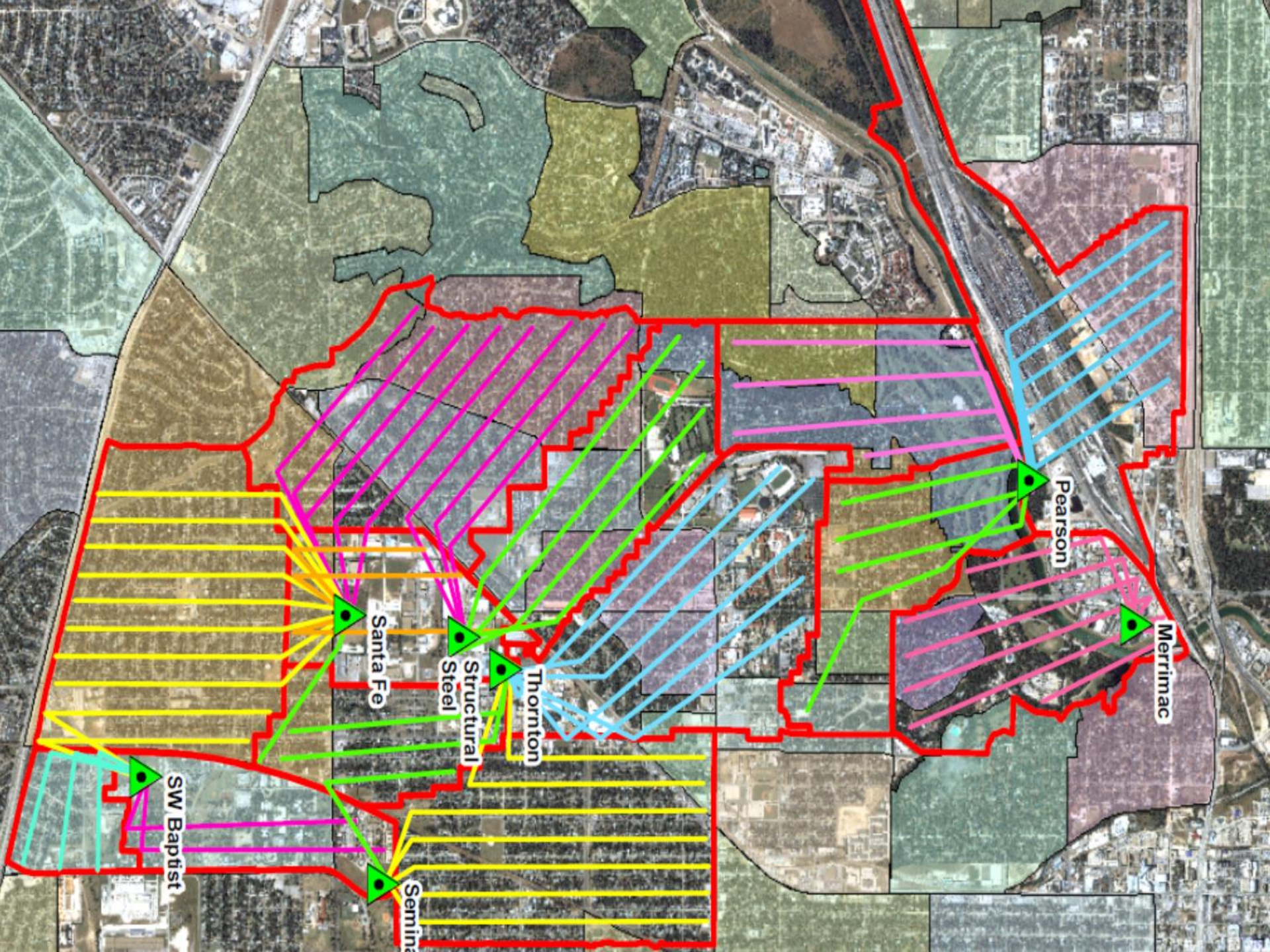
- Mineral and Surface Owner must be notified
- Advanced plan of development must establish size and location of production site- 1 for every 80 acres of surface
- Pipeline corridors
- Once approved is binding on later production activities

Planned Energy Site



Master Plan

- Common Pad Sites-used by multiple operators
- Common pipeline corridors, under or along city streets
  - Encourage shared pipelines
- Saltwater pipelines, centralized treatment facilities
- Common Compressor Locations


Pearson
Merrimac
Santa Fe
Structural Steel
Thornton
SW Baptist


I 30
Vickery
Ramp
Clara
Buck
Rosedale
Mistletoe
University
Old University
Rogers
Merrimac


• 4 wells permitted by the City of Fort Worth
• 1 well drilled
• 1 well currently drilling
Collinsworth
Mopac
Rivertront
Rogers

Truck Traffic and Road Damage

- Approximately 1,200 truck trips needed to drill one well.
  - Each truck weighing up to 80,000 pounds
- Another 300 truck trips annually are needed to maintain the well.
- Impact of truck traffic needed for production is equivalent to 8 million cars.
- Impact of truck traffic required to maintain the well is equivalent to an additional 2 million cars per year.

Truck Traffic and Road Damage

- Road damage from drilling trucks was estimated in one Texas shale to be $2 billion.
- The Texas Department of Transportation estimates that renovating state-maintained rural routes to accommodate drilling traffic will cost $1 billion a year.
- Oil and gas activity is projected to be ongoing for at least the next 20-30 years.

Alternatives to New Water

BRACKISH WATER

- Abundant supply of brackish and sea water
- Nine legislative bills introduced in 2013 Session regarding brackish water
- Concerns remain over well corrosion, contamination, and regulation

RECYCLE/REUSE

- Variety of methods on or off-site (microfiltration, vapor recompression, etc.)
- Trucking and disposal rates reduced 60%
- More expensive than current injection disposal
- 16 Tex. Admin. Code Ch. 4, Subch. B—Rules addressing recycling by oil and gas operators

Recycle/Reuse by Shale

Barnett Shale

- Fresh Water: 92% (20% groundwater and 80% surface water)
- Brackish Water: 3%
- Recycled/Reused: 5%

Eagle Ford Shale

- Fresh Water: 80% (90% groundwater and 10% surface water)
- Brackish Water: 20%
- Recycled/Reused: 0%

Haynesville Shale/East Texas Basin

- Fresh Water: 95% (70% groundwater and 30% surface water)
- Brackish Water: 0%
- Recycled/Reused: 5%

Permian Basin

- Fresh Water: 20% in Far West and 68% in Midland (100% groundwater)
- Brackish Water: 80% in Far West and 30% in Midland
- Recycled/Reused: 0% in Far West and 2% in Midland

Anadarko Basin

- Fresh Water: 50% (80% groundwater and 20% surface water)
- Brackish Water: 30%
- Recycled/Reused: 20%

Flowback/Produced Water Volume by Shale

Estimated flow back/produced water volume relative to HF injected volume

Play / Region	Comment
Delaware Basin (Permian Basin)	Close to 100% in year 1, 150% well life >200% well life
Midland Basin (Permian Basin)	50%-100% in year 1
Anadarko Basin	~50% in month 1, 90% at month 6
Barnett Shale	10-20% month 1, 20-60% well life 70% year1; 150% in 5 years
Eagle Ford Shale	20% over life; 20% over life
Haynesville Shale	20% over life; 15% over life
Cotton Valley Fm.	60% month 1, >100% well life; 40% or 100% over life


Sheraton
NOTICE
NATURAL GAS PIPELINE
CONSTRUCTION

Financial Impacts

Source: The Perryman Group prepared for the Fort Worth Chamber of Commerce

- **Increased Output (gross product)**
  - Total impact in 2011 in Barnett Shale area is $11.1 billion in annual output (gross product)
- **Increased Jobs**
  - In 2011, Barnett Shale was responsible for 100,268 jobs
- **Important Source of Tax Revenues**
  - In 2011, approximately $1.6 billion in additional fiscal revenues were generated due to Barnett Shale and related activity

Financial Impacts

MUNICIPALITIES

- $31 million in royalties
- $30 million in bonuses
- $25 million in tax revenues (directly for natural gas and mineral rights)

SCHOOL DISTRICTS

- $2.7 million in royalties
- $2.5 million in bonuses
- $45.8 million in tax revenues (directly for natural gas and mineral rights)

- Entire FW Ordinance and other information at:

- WWW.FortWorthGov.Org

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Austin Fort Worth