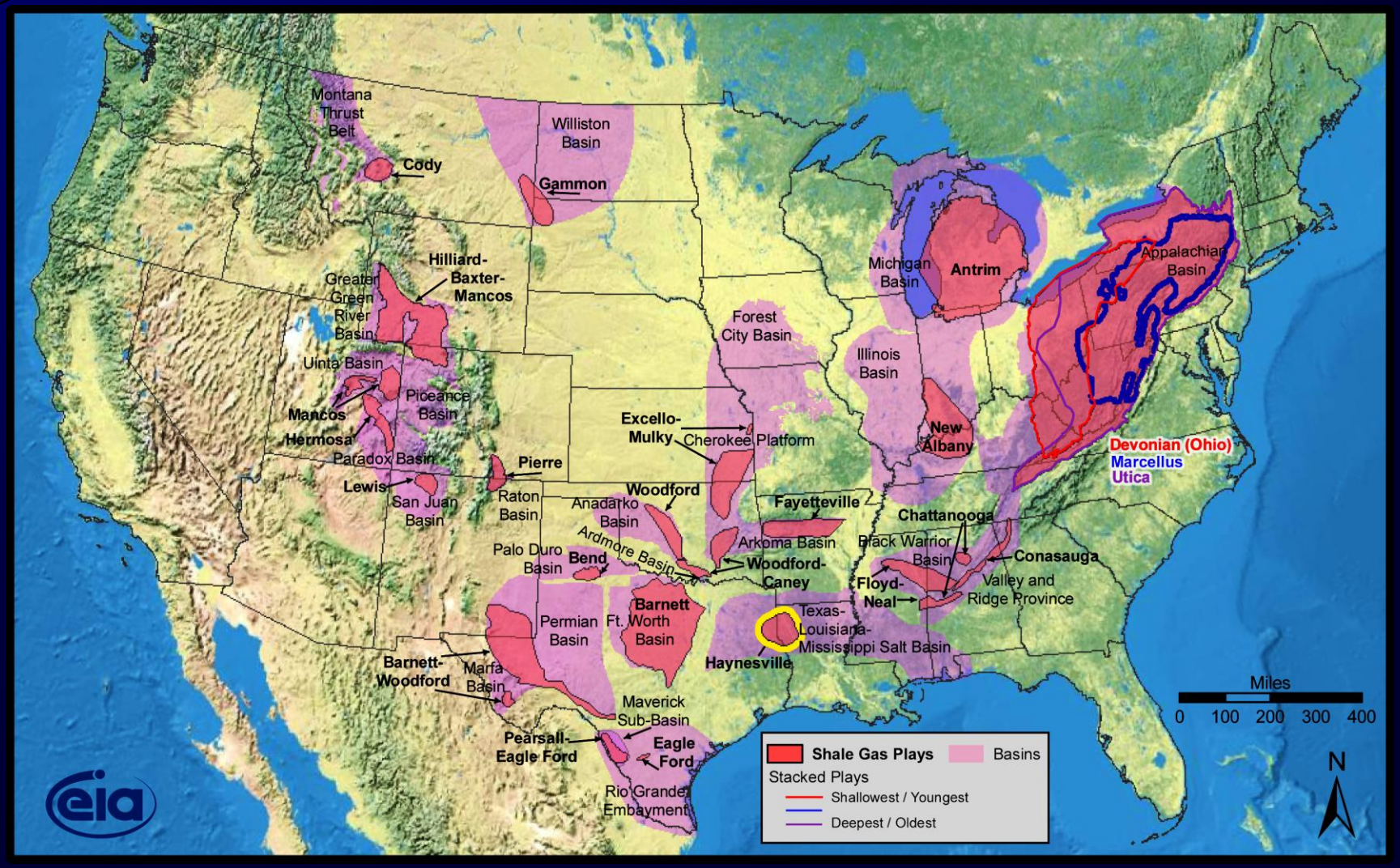
SUSTAINING LOUISIANA'S FRESHWATER AQUIFERS
A CASE STUDY
IN
BRINGING COMMUNITY AND INDUSTRY TOGETHER

LOUISIANA
HAYNESVILLE SHALE
OVERVIEW

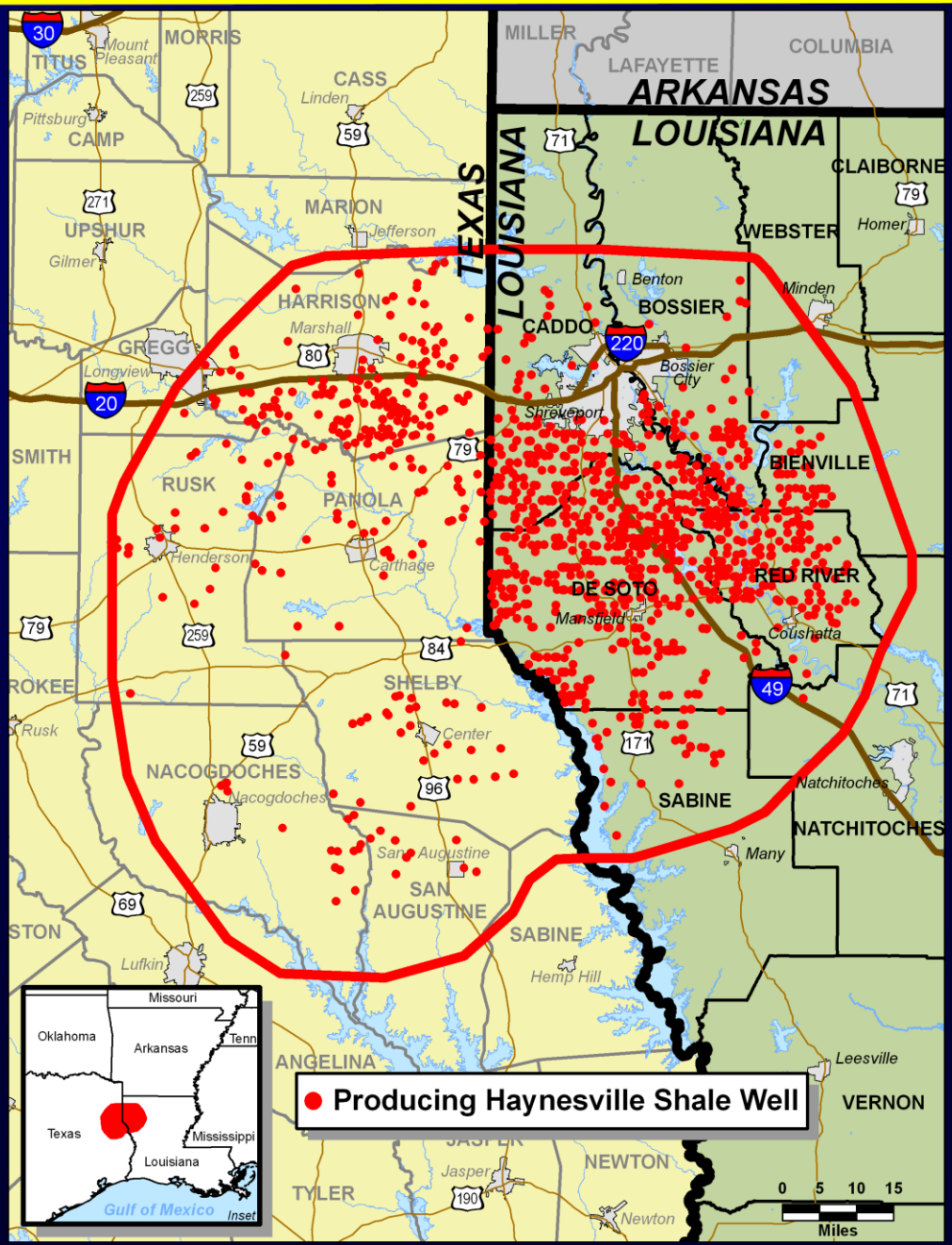
James H. "Jim" Welsh
Commissioner of Conservation
Louisiana Office of Conservation

Shale Gas Plays, Lower 48 States

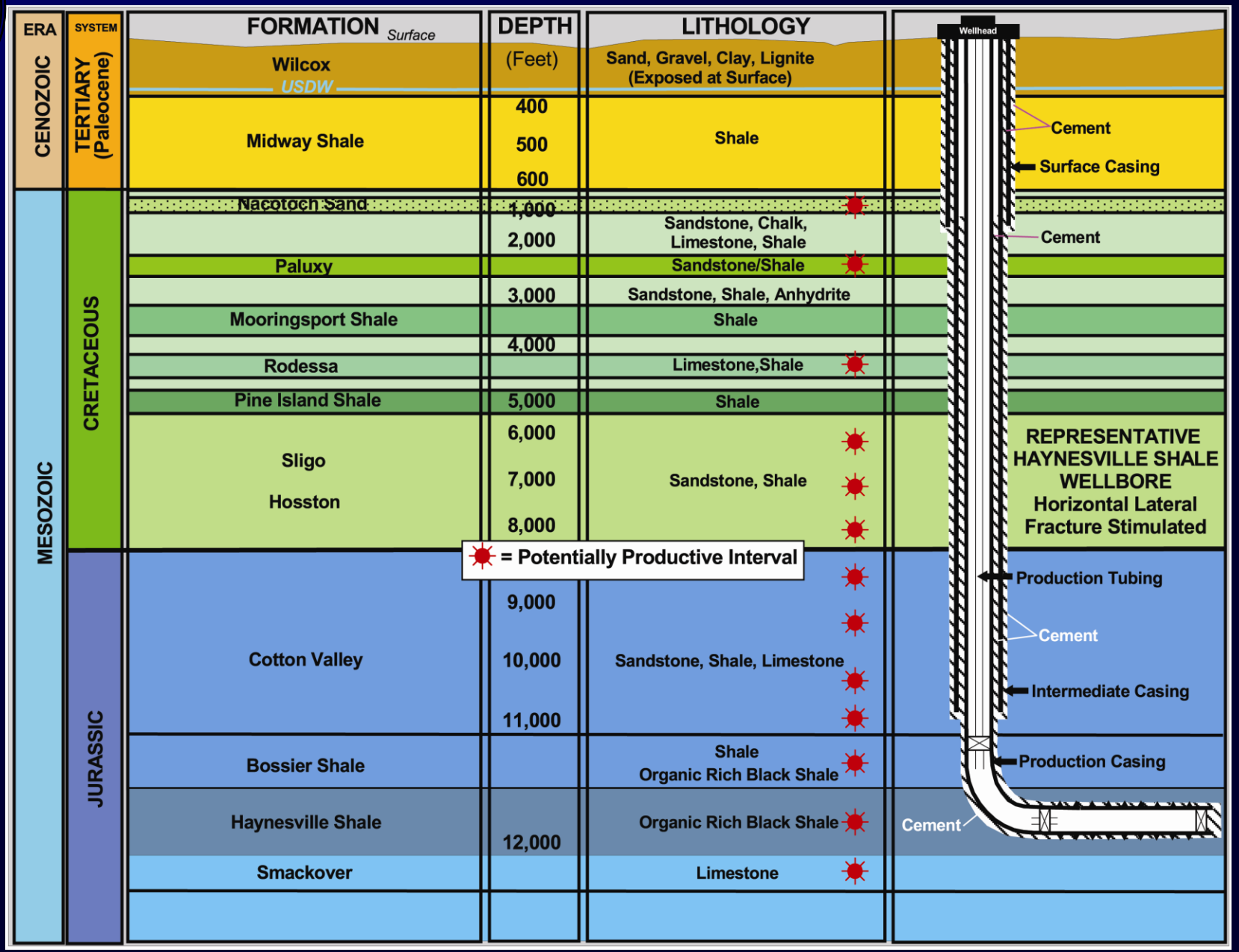


Source: Energy Information Administration based on data from various published studies
Updated: May 28, 2009

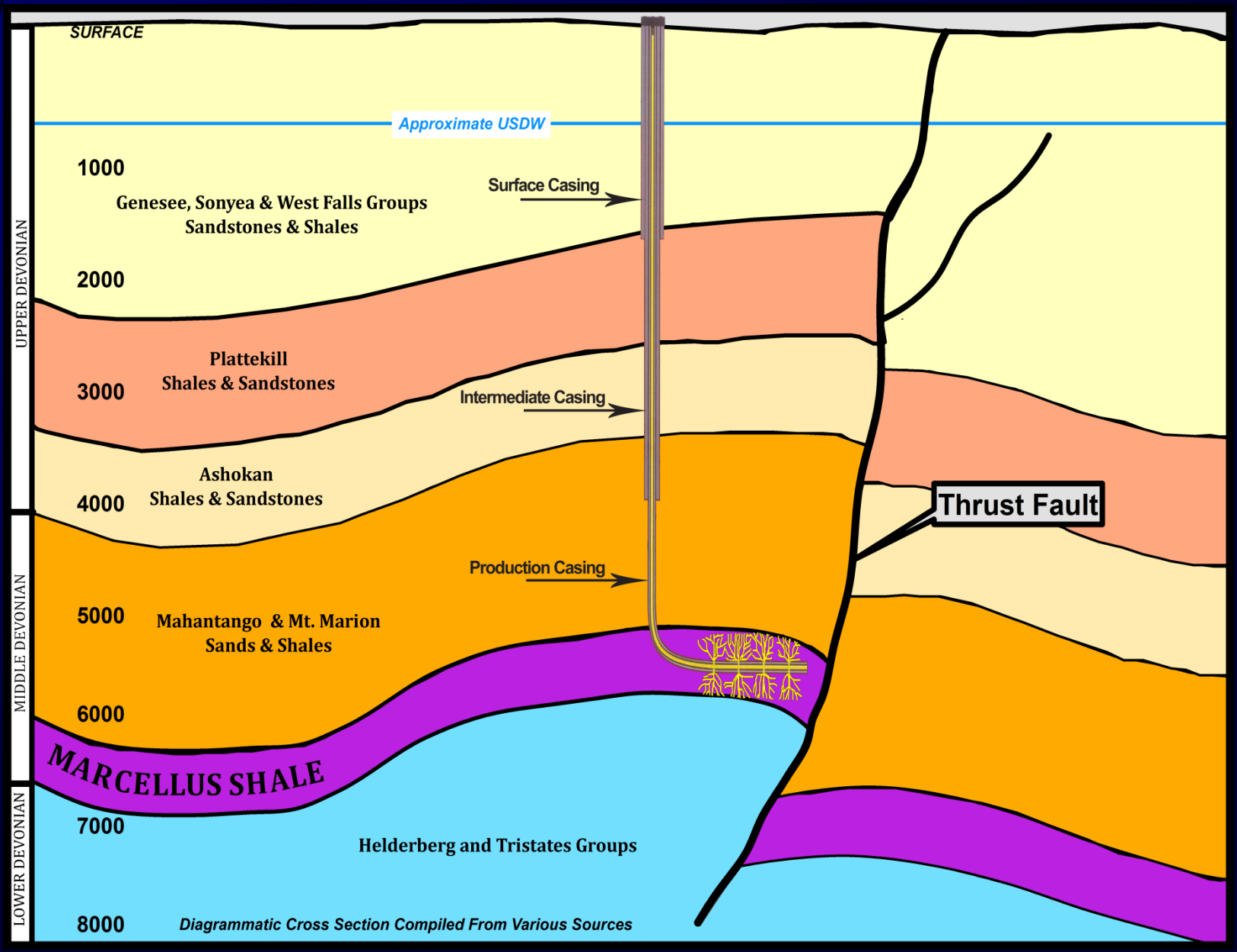
Current Haynesville Shale Activity



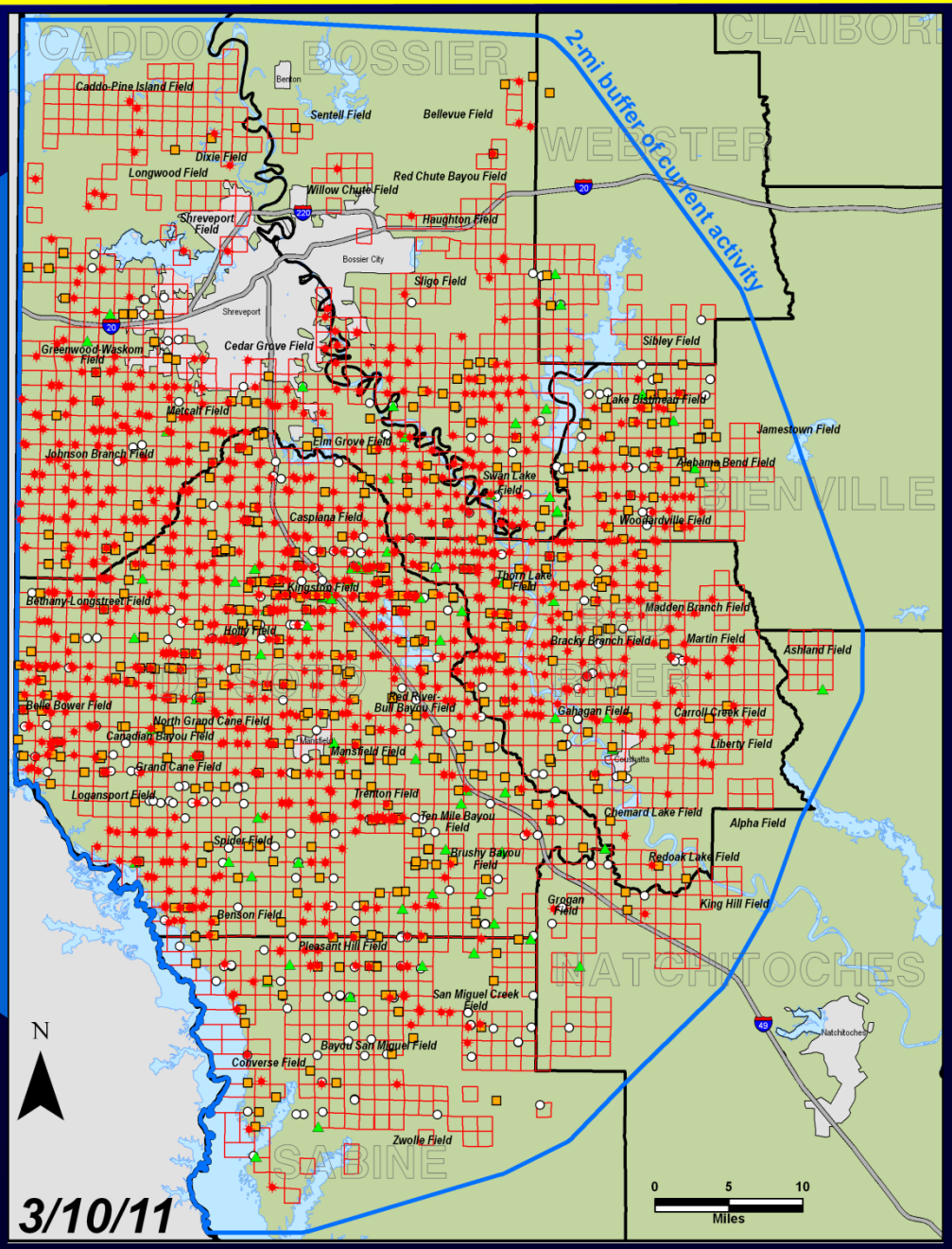
GENERALIZED LITHOSTRATIGRAPHIC COLUMN WITH REPRESENTATIVE HAYNESVILLE SHALE WELLBORE



Generalized Cross-Section of Marcellus Shale With Representative Wellbore



Current Haynesville Shale Activity in LA



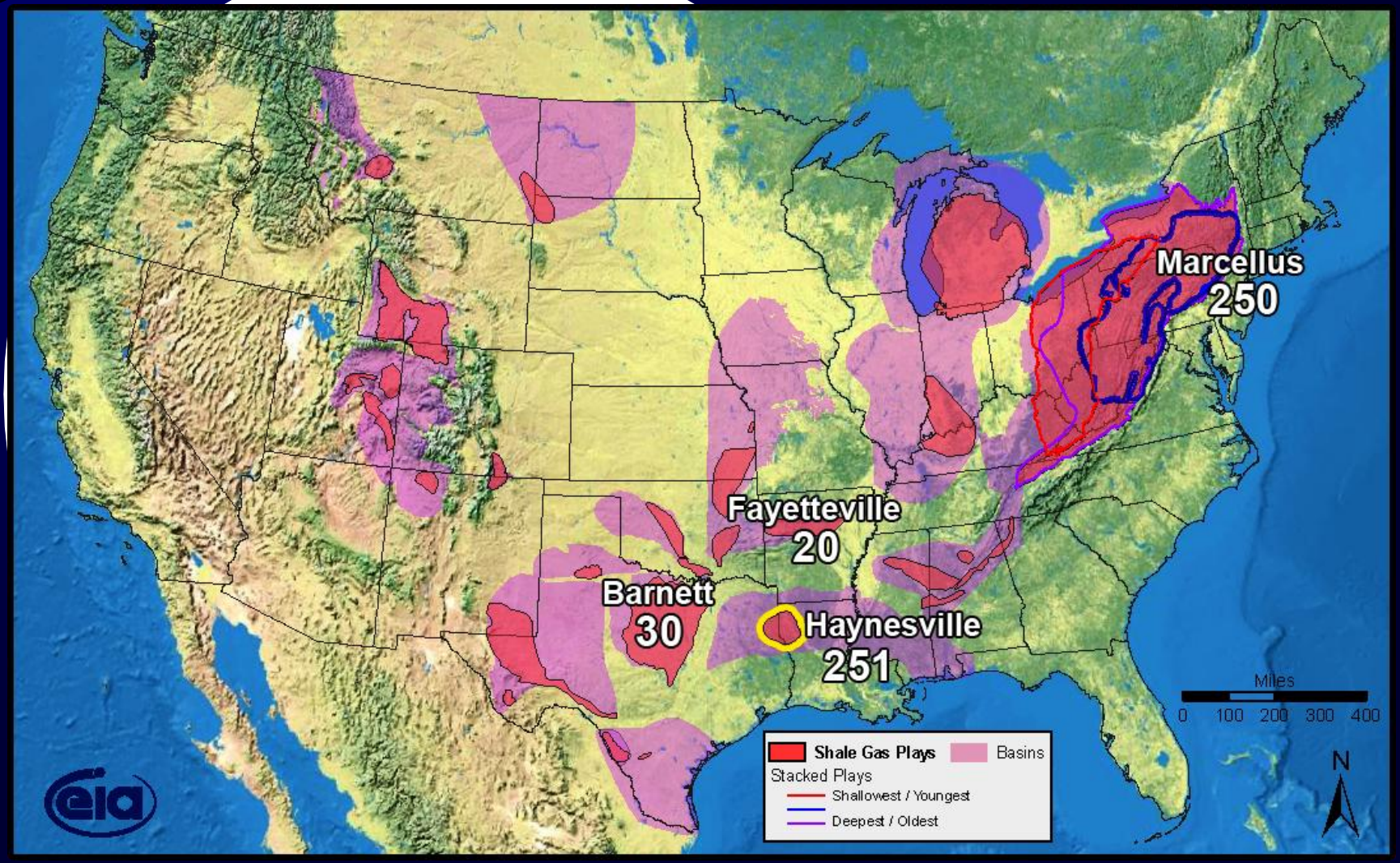
- Producing Well (1,055)
- Permitted Well Waiting on Completion/ Fracturing/Testing/ Other Operations (467)
- Permitted Well Drilling in Progress (122)
- Permitted Well Not Drilling (340)

1,984 Total Wells

- Adopted Unit (2,122)

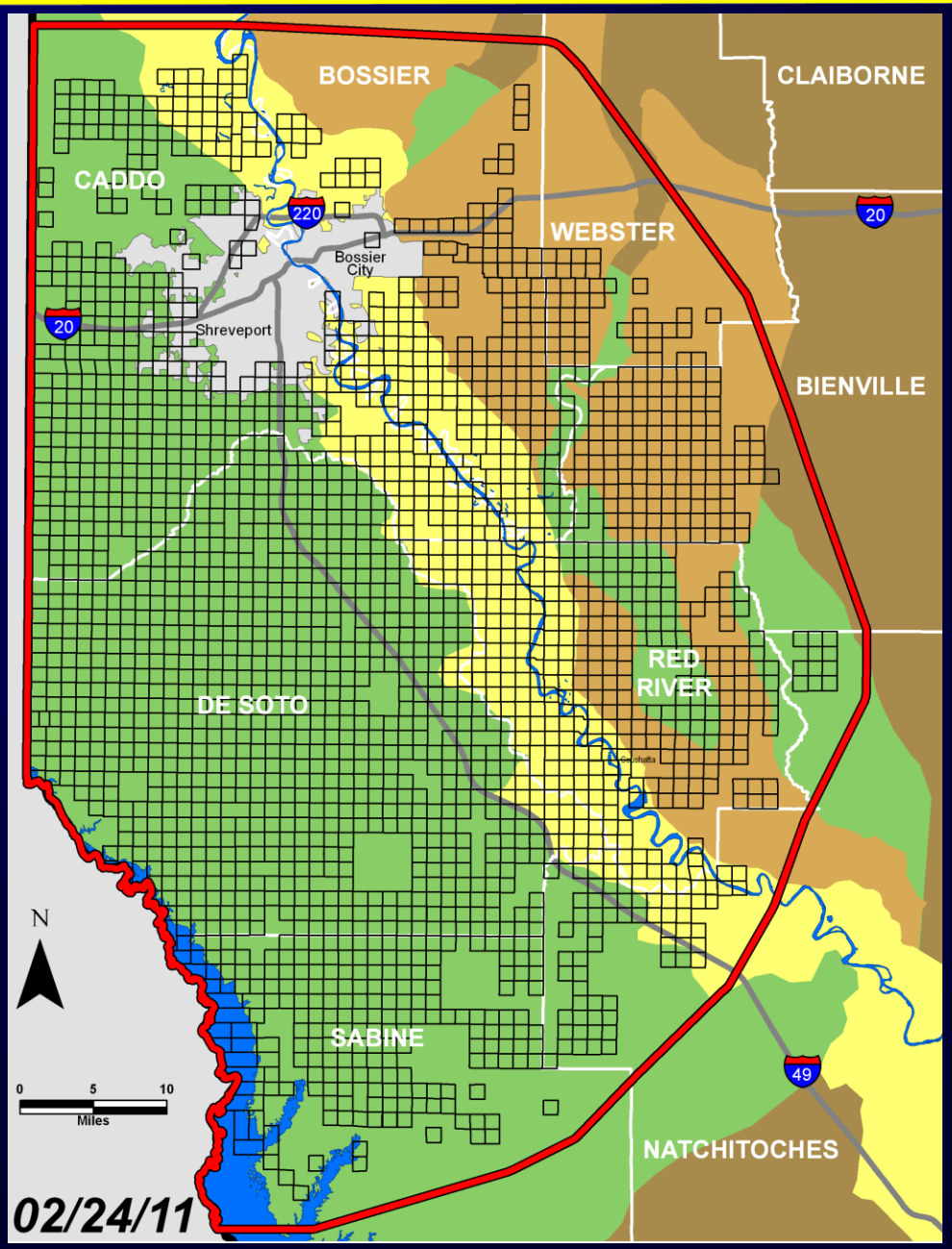
2,122 Adopted Units

Estimated Ultimate Recovery in Tcf
(Tcf = Trillion cubic feet)



Data compiled from various sources by Office of Conservation Engineering Division
2008

Northwest Louisiana Aquifers



Ground Water Use Advisory

Louisiana.gov > Department of Natural Resources

Web Posting

For Release:
October 16, 2008

Ground Water Use Advisory:
Commissioner of Conservation Recommends Wise Water Use Planning in the Haynesville Shale

Commissioner of Conservation Jim Welsh recommends that oil and gas operators with interest in developing the Haynesville Shale in Northwest Louisiana choose their water sources for use in drilling or hydraulic fracture stimulation operations wisely. Of particular interest are areas in the lower Caddo and Bossier Parishes and DeSoto Parish where the Carrizo – Wilcox aquifer is used as the main source of drinking water supply for domestic

Therefore, if ground water must be used for drilling or hydraulic fracture stimulation purposes, it is recommended that the Red River Alluvial aquifer be utilized for these purposes, where feasible, as the source of ground water supply in lieu of the Carrizo - Wilcox aquifer.

Based on USGS and other published information on ground water resources in Northwest Louisiana, the Red River Alluvial aquifer system is a high yield system comprised of coarse gravel and sand formations continuously recharged by the surface waters of the Red River. It is further documented that the Red River Alluvial aquifer system, due to its hardness and high dissolved solids, is seldom used for domestic and public supply

The Commissioner further encourages oil and gas operators to use the available surface water resources or other acceptable alternative water sources in Northwest Louisiana, where practical and feasible.

law.

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Provided below are links to published documents, resources and references available for water quality and use in Northwest Louisiana. If you have any questions or need further clarification, please contact Environmental Division staff at 225-342-8244 or by email at http://dnr.louisiana.gov/gwater.

Directive Issued to Industry for Frac Water Reporting

BOBBY JINDAL
GOVERNOR

State of Louisiana
DEPARTMENT OF NATURAL RESOURCES
OFFICE OF CONSERVATION
MEMORANDUM

SCOTT A. ANGELLE
SECRETARY
JAMES H. WELSH
COMMISSIONER OF CONSERVATION

September 15, 2009

TO: **All Concerned**

FROM: **James H. Welsh**
Commissioner of Conservation

SUBJECT: **Reporting Requirements for Water Use in E&P Operations**

To promote effective groundwater resource management and to aid in the development of policies and regulations to protect these resources, it is the policy of this Office to require the reporting of information related to water use in drilling, completion, stimulation and workover operations.

Specifically, the water source and associated volume must be reported on page two (2) of the 'Well History and Work Resume Report'(Form WH-1) which must be filed within twenty days after completion or recompletion operations. The water sources must be identified by either the water well number or water body name, as appropriate. Separate water volumes for rig supply use and stimulation operation use must be provided. A completed example of page two (2) of the 'Well History and Work Resume Report'(Form WH-1) is attached.

Due to revisions of the WH-1 form, water source and associated volumes are now reported on page 3.

fracturing stimulation operations.

A revised 'Well History and Work Resume Report'(Form WH-1) is available from the department web site at the following address:http://dnr.louisiana.gov/cons/CONSEREN/documents/WH-1.dot

The policy is effective immediately. Questions on implementation may be directed to Mr. Robert "Bob" Romero at (225) 342-8242 or robert.romero@la.gov.

OFFICE OF CONSERVATION
OF THE STATE OF LOUISIANA

JAMES H. WELSH
COMMISSIONER OF CONSERVATION

JHW:CS
Attachment

Post Office Box 94275 • Baton Rouge, Louisiana 70804-9275 • 617 North 3rd Street • 9th Floor • Baton Rouge, Louisiana 70802
Phone (225) 342-5540 • Fax (225) 342-2584 • www.dnr.state.la.us/conservation
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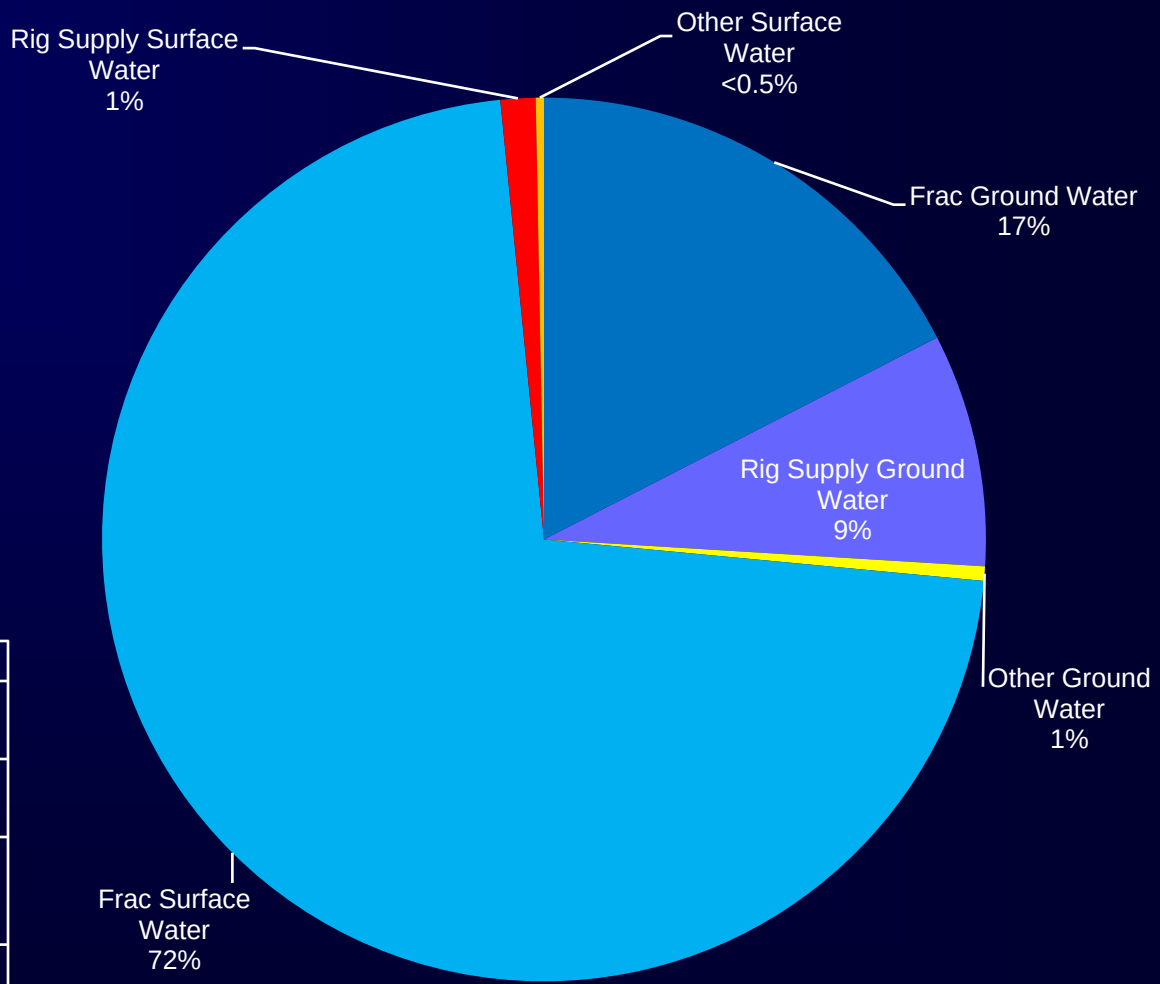
Drilling and Stimulation Operations
Haynesville Shale Natural Gas Well Development

Reported Usage from 10/1/2009 to 2/1/2011

Source	Volume (Gallons)
Frac Groundwater	810,384,455
Frac Surface Water	3,340,652,866
Drilling Rig Groundwater Supply	395,802,431
Drilling Rig Surface Water Supply	59,403,197
Other Groundwater	24,403,351
Other Surface Water	13,917,380

Water Stats

Frac Stages	8982
Total Frac Water Used (gallons)	4,151,037,321
Volume per Frac Stage(gallons)	462,150
Average Frac Stages per Well	10.1
Average Water Use per Well	4,928,734
Average Frac Water Use per Well	4,351,251



E&P Waste Fluids Use for Frac Water Supply

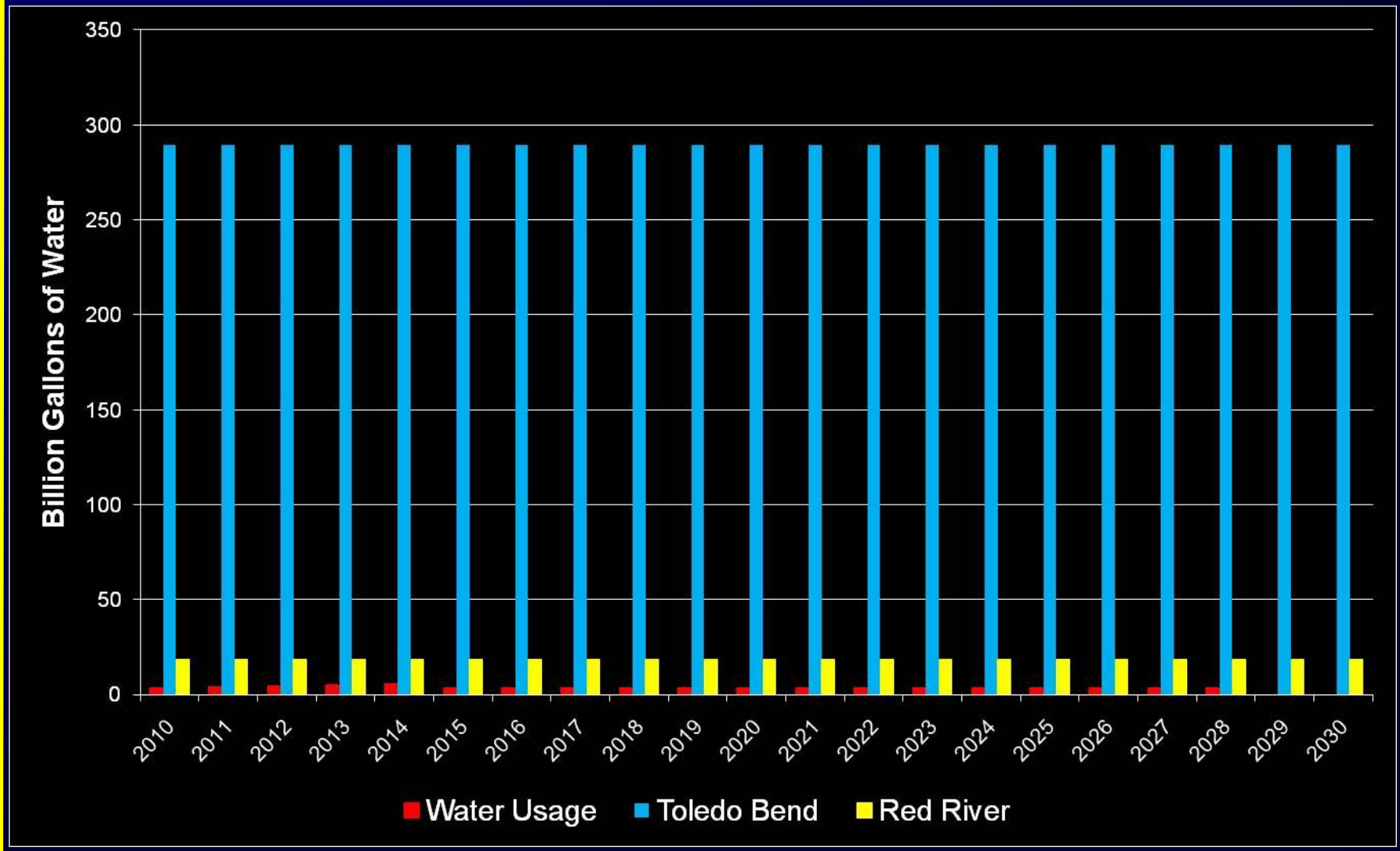
LAC 43:XIX.Subpart 1.Chapter 3 Amendment

Allows Operators to Use E&P Waste Fluids for Frac Supply Purposes

1) **Promulgated November 20, 2009**
2) **Amended June 20, 2010**
3) **Limitations:**
   - i. **Used as Frac Supply Only**
   - ii. **By the Same Operator**
   - iii. **With Operator Affidavit Confirming Landowner Consent**

Red River & Toledo Bend Yield Capacity

Red River & Toledo Bend Yield Capacity vs. Projected Surface Water Usage @ 70% Level



Sources: Jim Pratt, Executive Director – Sabine River Authority

Jamie Triplett, Hydraulic Eng. – US Army Corps of Eng.

Haynesville Shale Water Resource Management Summary

Agency Action:

1. **Timely Response**
2. **Sufficient Oversight**
   - i. **Policy and Regulation Adjustments**
   - ii. **Resource Use Reporting and Monitoring**
   - iii. **Increased Waste Minimization / Recycling Opportunities**
   - iv. **Industry and Public Education / Outreach**

Sustaining Louisiana's Fresh Water Aquifers – A Case Study in Bringing Community and Industry Together

James H. "Jim" Welsh
Louisiana Office of Conservation

The statements made during the workshop do not represent the views or opinions of EPA. The claims made by participants have not been verified or endorsed by EPA.

The Haynesville Shale Natural Gas Play in Louisiana lies more than 10,000 feet below the surface. It is a consistent 500-foot thick layer underlying an area approximately 80 miles south to north by 60 miles east to west across the north Louisiana/east Texas border. In order to commercially produce the wells in the Haynesville Shale, operators use the technique known as "Hydraulic Fracturing". Fracking, as it is referred to, requires large volumes of water - up to 5 million gallons per well. Ground water had been the usual source for this drilling technique over the years, but as development in the Shale heightened, the potential for impacts on local domestic water use had become a real concern.

Recognizing that the extensive water demand could pose a stress on nearby fresh water aquifers, the Louisiana Office of Conservation (the state's regulatory authority) began to pursue alternatives to satisfy industry's need for water for this type of exploration and production (E&P) activity, while trying to avert impacts to the immediate source of water for area neighborhoods and the local community.

The Conservation Office wasted no time in researching and finding ample yield in several surface water sources. By combining this course of action with a few other water management procedures, and with amendments to the existing regulations, the office provided a successful and manageable solution. In this case, the outcome included appropriate use and protection of surface water, ground water and domestic water supply. Collectively, all stakeholders would share in the effort to conserve, protect, and sustain the state's fresh water aquifers.