LOUISIANA DEPARTMENT OF NATURAL RESOURCES

Tuscaloosa Marine Shale
Louisiana Activity Update

By

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Commissioner of Conservation

David P. Elfert
Office of Conservation

And

Louis Temento
Louisiana Office of Mineral Resources

March 27, 2014
West Feliciana Parish
Challenges of Resource Plays

- Resource or source rock plays—where hydrocarbons originated
- Extraction of hydrocarbons that have not migrated out
- Large geographic area involved
- Requires high technology methods
- Horizontal drilling for increased surface area to make venture economical
- Hydro-fracturing “Fracking”
- Large amounts of water for fracking
- Flowback water management
- Long lateral lengths requiring large pooled units to meet economic needs
- Quick regulatory action to meet new economical and environmental needs
- Cross Unit Laterals
- Low natural gas prices
- Urban drilling activity-environmental concerns/solutions
WHAT IS THE TMS?

Tuscaloosa Marine Shale (TMS)

- Sedimentary rock composed of compacted, lithified clays and very fine sand grains (silt)
- Contains oil generated from organic matter deposited with the sediments
- Oil held tightly between the clays and silts
- Deposited approximately 90 million years ago, marine (ocean) environment
- Depth ranges from -13,000 feet to > -15,000 in E-W Feliciana area
- Approximately -15,000 feet in Ethel Field, East Feliciana Parish
- Will require horizontal wells with long lateral length and hydraulic fracturing to extract the oil economically
- Economics still uncertain, play is in early stages of development
- 1997 LSU study provides in-depth look at the play/Originally exploited in 1975
- Callon, Texas Pacific original operators in TMS
- Encore, Devon, Encana and Indigo II LA. (western “Eagle Ford” part of trend) early operators
- EOG, Justiss Oil Co., Conterra, Halcon, Goodrich latest operators to enter the TMS play
Regulating the TMS Activity

LDNR- Offices/Organization
Permitting/Drilling/Production
Inspection/Enforcement
E&P Waste Disposal
Groundwater Protection
Frac Related Rules/Reporting
ORGANIZATIONAL CHART
LOUISIANA DEPARTMENT OF NATURAL RESOURCES

OS
Office of the Secretary

OC
Office of Conservation
- Engineering Administrative
- Engineering Regulatory
- Environmental
- Geological Oil and Gas
- Injection and Mining
- Pipeline

OCM
Office of Coastal Management
- Interagency Affairs and Field Services
- Permits and Mitigation
- Atchafalaya Basin Program

Legal
- Public Information
- Technology Assessment Energy Office

OMF
Office of Management & Finance
- Fiscal Management
- Human Resources Management
- Information Technology
- Procurement and Contracts

OMR
Office of Mineral Resources
- Geological and Engineering
- Mineral Income
- Petroleum Lands

Boards and Commissions
- Atchafalaya Basin Research and Promotion Board
- Atchafalaya Basin Technical Advisory Group
- Oilfield Site Restoration Commission
- Oyster Lease Damage Evaluation Board
- State Mineral and Energy Board
- Water Resources Commission
- Water Management Advisory Task Force
Construction requirements result in protection of USDW and isolation of hydrocarbon bearing zones.

- Multiple casing strings
- Minimum setting depth
- Cement requirements
- Pressure testing
# T.M.S. Generalized Horizontal Well

<table>
<thead>
<tr>
<th>SERIES/GROUP/FORMATION</th>
<th>APPROX. DEPTH (Feet)</th>
<th>LITHOLOGY</th>
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</thead>
<tbody>
<tr>
<td>Undifferentiated Pleistocene</td>
<td>1000</td>
<td>Sand/Gravel/Clay</td>
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<td>Vicksburg</td>
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<td>Sand/Shale</td>
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<td>Jackson</td>
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<td>Sand/Shale</td>
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<tr>
<td>Yazoo</td>
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<td>Clay/Shale</td>
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<tr>
<td>Sparta/Cook Mountain/Cockfield</td>
<td>3000</td>
<td>Sand/Shale/Limestone</td>
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<td>Cane River</td>
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<td>Wilcox</td>
<td>5000</td>
<td>Sand/Shale</td>
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<td>Midway</td>
<td>9000</td>
<td>Shale</td>
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<td>Selma (Austin Chalk)</td>
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<td>Chalk (Limestone)</td>
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<td>Eagleford</td>
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<tr>
<td>Upper Tuscaloosa</td>
<td>12,000</td>
<td>Sand/Shale</td>
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<tr>
<td>Tuscaloosa Marine Shale</td>
<td></td>
<td>Shale</td>
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<tr>
<td>Lower Tuscaloosa</td>
<td>13,000</td>
<td>Sand/Shale</td>
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</tbody>
</table>

**Representative Tuscaloosa Marine Shale Horizontal Wellbore**

- **Conductor Casing**
- **Cement**
- **Surface Casing**
- **Cement**
- **Production Casing**
- **Perforations**

**Approximate USDW**

**Productive or Potentially Productive Intervals**

- Gas ⬤

**1st Intermediate Casing**

**2nd Intermediate Casing**
Ground Water Use Advisory

Commissioner of Conservation Jim Welch 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 purposes.

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.

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.

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

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.
Exploration & Production (E&P) Wastes primarily include:
- Drilling fluids
- Flowback water
- Produced water

E&P Waste regulations ensure proper disposal to minimize environmental impacts of resource development.

Manifest and reporting systems ensure transparency and accountability.

Waste Management options include:
- Onsite disposal using conservative limiting criteria
- Well injection
- Commercial disposal
- Recycling in limited cases
LOUISIANA
Commercial Fluids & Solids Disposal Facilities

- Solids & Fluids Disposal Facility (Type A)
- Fluids Disposal Facility (Type B)
- E&P Waste Landfill Facility Permitted by DEQ (Type DEG)
- DEQ/DNR Class 1
- E&P Waste Transfer Facility (Type T)

Legend:
- Facility Name
- Parish
- Facility Type

NOTE: Data from this map are not to be used for legal purposes.
Hydraulic Fracturing Rule

LAC 43:XIX.118

• Effective as of October 20, 2011
• Must file application with and receive work permit to hydraulically frack from the appropriate district office (Lafayette, Shreveport, & Monroe) prior to beginning fracking operations. Sec. 118.B.
• Following completion of hydraulic fracturing the operator must file a Well History and Work Resume Report (Form WH-1) in accordance with Sec. 105 & Sec. 118.C.
• LAC 43:XIX.105 requires:
  – At least 12 hours prior notice must be given to the manager of the appropriate district office, so that a Conservation representative may have a chance to witness the fracturing operations.
  – Within 20 days of completing work under the work permit, the work must be described on the Well History and Work Resume Report and submitted to the appropriate district office.
What Must Be Reported?

• With the Well History and Work Resume Report (Form WH-1), the following information must be reported:
  – Types and volumes (in gal.) of hydraulic fracturing fluid used in the operation.
  – A list by type of all additives used during hydraulic fracturing operations. Specifically list the following for each type:
    • Specific trade name and suppliers.
  – List of chemical ingredients in fracturing fluid subject to requirements of 29 CFR 1910.1200(g)(2) and their associated CAS numbers. Also specify for each chemical ingredient:
    • Maximum ingredient concentration within the additive expressed as a chemical by mass of each chemical ingredient;
    • Maximum concentration of each chemical ingredient expressed as a percentage by mass of the total volume of hydraulic frac fluid used.
How to Report?

• On the Work History/Well Resume Report (Form WH-1) submitted to the appropriate district office within 20 days of completion of the hydraulic fracturing operations.

• Frac Focus Chemical Disclosure Registry – online accessible registry sponsored by Groundwater Protection Council and the Interstate Oil & Gas Compact Commission.
  – Fracfocus.org
  – Search for specific well information by location, operator, well name, etc.
  – Under new reporting requirements, must report within 20 days of completion of hydraulic fracturing operations.
  – Reporting on Frac Focus does not fully replace WH-1 Requirement.

• Similar Publicly Available Websites.
Like similar statutes or regulations in other jurisdictions, the new fracturing information reporting requirements provide that specific chemical ingredient identity and CAS numbers entitled to trade secret designation pursuant to 29 CFR Sec. 1910.1200(i), do not need to be reported.

When a trade secret is claimed by the party entitled to make such a claim, then the following information must be provided:

- The chemical family of the trade secret ingredient; and
- A statement claiming that trade secret protection is being made.
  - Statement may be as simple as stating that the ingredient is “privileged”, “proprietary” or a “trade secret.”

Despite this protection, no party can withhold trade secret information from a health care professional when such disclosure is required by state or federal law.
TMS ACTIVITY UPDATE

- Wells
- Units
- Production
- How to Access Information
T.M.S. UNITIZATION

• 26 Hearings held to date

• 32 Units adopted to date

• 1 Upcoming hearing for Little Comite Creek Fld. on April 15

• Units configured to accommodate long horizontal laterals

• Unit Sizes: Dependent upon operators’ ability to drill horizontal laterals to a length that fits their individual economics and technical expertise as well as their geological interpretation

• Unit Sizes range from 720 acres (East Feliciana Parish, Ethel Field) to 1348 acres (Concordia Parish, North Bougere Field); approximately one mile wide by the approximate proposed horizontal lateral length.
# TMS Production by Unit/Well

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Parish</th>
<th>Well Name/Unit Name</th>
<th>Cumulative Prod. (bbls.)</th>
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<tbody>
<tr>
<td>Baker Creek</td>
<td>West Feliciana</td>
<td>Murphy 63H #1 - TMS RA SUA</td>
<td>48755</td>
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<td>Lake Rosemound</td>
<td>West Feliciana</td>
<td>TMS RA SUA</td>
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<td>Bayou Sara</td>
<td>West Feliciana</td>
<td>TMS RA SUA</td>
<td>-</td>
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<td>Spillman</td>
<td>West Feliciana</td>
<td>TMS RA SUA &amp; SUB</td>
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<td>Northeast Spillman</td>
<td>West Feliciana</td>
<td>TMS RA SUA</td>
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<td>East Feliciana</td>
<td>Richland Farms Inc. 74 H No. 1</td>
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<td>East Feliciana</td>
<td>Beech Grove Land Co. 68H No. 1</td>
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<td>Ethel</td>
<td>East Feliciana</td>
<td>TMS RA SUA; Lane 64 NO. 1</td>
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<td>Clinton</td>
<td>East Feliciana</td>
<td>TMS RA SUA</td>
<td>-</td>
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<tr>
<td>North Chipola</td>
<td>St. Helena</td>
<td>Weyerhaeuser No. 1</td>
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<td>North Chipola</td>
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<td>Weyerhaeuser 60H No. 1</td>
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<td>St. Helena</td>
<td>Weyerhaeuser 60H No. 2</td>
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<td>St. Helena</td>
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<td>North Chipola</td>
<td>St. Helena</td>
<td>Weyerhaeuser 73H No. 1</td>
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<td>North Chipola</td>
<td>St. Helena</td>
<td>TM RA SUC</td>
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<td>St. Helena</td>
<td>TMS RA SUA; Weyerhaeuser 14H NO. 1</td>
<td>105850</td>
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<td>St. Helena</td>
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<td>Tangipahoa</td>
<td>Winfred Blades No. 1</td>
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<td>Little Silver Creek</td>
<td>Tangipahoa</td>
<td>TMS RA SUA</td>
<td>-</td>
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<tr>
<td>Little Silver Creek</td>
<td>Tangipahoa</td>
<td>TMS RA SUB and SUC</td>
<td>-</td>
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<td>Northwest Wilmer field</td>
<td>Tangipahoa</td>
<td>TMS RA SUA and SUB</td>
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<td>Fluker</td>
<td>Tangipahoa</td>
<td>TMS RA SUA; Soterra 6H No. 1</td>
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<td>Kentwood</td>
<td>Tangipahoa</td>
<td>TMS RA SUA; Thomas 38H No. 1</td>
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<td>Flatwoods</td>
<td>Rapides</td>
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<td>Lake Roseau</td>
<td>Avoyelles</td>
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<td>Roxana</td>
<td>Rapides</td>
<td>TMS RA SUA; Broadway H No. 1</td>
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<tr>
<td>Vick</td>
<td>Avoyelles</td>
<td>TMS RA SUA; Paul 15H No. 1</td>
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<tr>
<td>Oden Lake</td>
<td>Rapides</td>
<td>TMS RA SUA; Lambright H No. 1</td>
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TMS Production Totals by Parish
And
Total cumulative for TMS in Louisiana

<table>
<thead>
<tr>
<th>Total Production by Parish (from Greatest to Least)</th>
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<tbody>
<tr>
<td>2. Avoyelles = 144,309 bbls.</td>
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<tr>
<td>3. Tangipahoa = 131,812 bbls.</td>
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<tr>
<td>4. East Feliciana = 93,231 bbls.</td>
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<tr>
<td>5. West Feliciana = 48,755 bbls.</td>
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<tr>
<td>6. Rapides = 13,733 bbls.</td>
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<tr>
<td>7. Vernon = 843 bbls.</td>
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Total Production = 804,768 bbls.
SONRIS  http://sonris.com/
Strategic Online Natural Resources Information System
   Energy
   Coastal Management
Mineral Resources-State owned lands/water bottoms

Conservation
   Well Data/Production & Test Data/Unitization Data
   GIS-Maps with various land/culture and oil and gas layers
   Oil and Gas Hearing Transcripts-Not available online
   Unit Survey Plats-Available online
API Offshore Area Code Information
Area Code Information
Consumer Information
District Information
DNR Glossary
Drip Point Information by Field
Drip Point Information by Name
Drip Point Information by Organization
Facility Code Description
Field List by Requested District & Area
Field Listing
Fields by Parish
Group Code Information
LUW Information by Code Number
LUW Type Codes Information
LUWs by Field
LUWs by Name
Location Codes
Operation Type Codes
Organization Information by Name
Organization Ledger Listing-Alpha
Organization Ledger Listing-Numeric
Organization Type Codes
Organizational Mailing Address List
Organizations by Parish
Parish Code Information
Product Type Code Information
Retrieve Operator Compliance Details
Reservoir Nomenclature Abbreviations
Scout Report Codes and Terminology
Well Class Type Information
Well Status Code List
SONRIS DATA ACCESS – LITE – WELL INFORMATION

- Offshore Wells By Parish
- Orphan Wells By Parish
- Permitted Wells By Date
- Permitted Wells By Date/Parish
- Retrieve Compliance Review By Serial Number
- Scout Report Information
- Severance Tax Relief Report
- Well Count for Field By Organization
- Well Count for Organization By Field
- Well Permits by District
- Wells by API Number
- Wells by Field ID
- Wells by Lambert Coordinates
- Wells by Lambert Coordinates - Tabular
- Wells by LUW
- Wells by Organization Name
- Wells by Parish
- Wells by Section, Township and Range
- Wells By Section, Township, Range By Parish
- Wells by Serial Number
- Wells by Specific Field / Operator
- Wells (Excluding Well Status 03,28,29,30)
Disposition by Field, Operator, Report Date
Disposition by Operator, Date and Field
Field Production by Parish for a Period
Field Production by Year
Field Production for an Organization by Month
LUW Production By Month
LUW Production By Year
Louisiana LUW Production by Year
Monthly Parish Production for a Period
OGP Data Entry (Oil & Gas Production)
OGP Ledger by Commingling Facility
OGP Ledger by LUW

Operator Oil/Gas Production for a Year
Operator Production by Parish
Organization Production for a Field by Month
R5D Data Entry (Gas Disposition)
R5D DE Disposition by Operator & Field for 3 years
Ranking Gas Production by Field
Ranking Gas Production by Operator
Ranking Oil Production by Field
Ranking Oil Production by Operator
Statewide Monthly Production for a Year
Yearly Production by Parish
The majority of information collected by the Office of Conservation is available to the public free of charge through the DNR website – SONRIS (www.sonris.com)

- Access to the DNR Database
- Access to map-based (GIS) information (Geographic Information System (GIS))
- Access to images of documents on file
Key personnel to answer questions regarding SONRIS/TMS

Well production information—Production Audit Section 225-342-5530
225-342-4500 or 225-342-5265

TMS well/unit information:
Geologist Mike Kline 225-342-3335

TMS Page-Conservation Web page-News and Events-Tuscaloosa Marine Shale
Leasing Private Lands

Land man will visit with an offer. He should have:
1. Map to describe area of interest
2. Lease Form – the lease form is the contract to set the terms of the lease.

Primary Terms – amount of time the contract is valid; usually 3 – 5 years.
Price Per Acre
Royalty – percentage of royalty produced by the unit
Ideas to consider in advance:

Surface Leasing – Separate lease to allow surface facilities
Will the well be located on your property?

Unitization - Will you be included in a unit?
Royalty payments are dependent on unit participation.

Length of Terms -
How deep will the well be?
It may take a long time to drill.

Royalty & Price per Acre
What is a fair value?

Is it good to be the first or last to lease?
Favored nations clause
Brokerage firms – broker leases to drilling company
for percentage of royalty
Ideas to consider in advance:

What companies are leasing in the area?

1. OMR Interactive Maps

Web based interactive map allows user to select which map features are visible to build a clear view of relative information.
SONRIS Interactive Maps - GIS

Welcome to the Department of Natural Resources

LATEST NEWS

Mineral and Energy Board holds March Lease Sale

**During Groundwater Awareness Week, March 9-15**

**February Lease Sale by Mineral and Energy Board results in $1.1 million for state**

**DNR Atchafalaya Basin Program announces new primitive camp sites and photo contest**

**State Mineral and Energy Board holds January Lease Sale**

**Mineral and Energy Board holds December lease sale**

**Conservation Statewide Order 29-E Fee Schedule for 2013/14**

**Mineral and Energy Board brings $2.6 million in revenue from November Lease Sale**

News Archives>

UPCOMING MEETINGS AND EVENTS

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
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<tbody>
<tr>
<td>MAR 25</td>
<td>Oil and Gas Hearings</td>
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<tr>
<td>APR 01</td>
<td>Oil and Gas Hearings</td>
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<td>APR 08</td>
<td>Oil and Gas Hearings</td>
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<td>APR 09</td>
<td>State Mineral and Energy Board Meeting and Lease Sale</td>
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<tr>
<td>APR 15</td>
<td>Oil and Gas Hearings</td>
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</table>

View All Meetings >

Message from the Secretary

Welcome from DNR Secretary

Stephen Cheust and the men and women of the Louisiana Department of Natural Resources who work every day to ensure and promote sustainable and responsible use of the natural resources of our state so that they are available for the enjoyment of future generations.

Working for Louisiana

Welcome to DNR.

Stephen Cheust and the men and women of the Louisiana Department of Natural Resources who work every day to ensure and promote sustainable and responsible use of the natural resources of our state so that they are available for the enjoyment of future generations.
SONRIS Interactive Maps - GIS

DNR uses its Administrative Web Server as the electronic access portal to information about DNR stored in static pages on the Administrative Web Server, and to update SONRIS information available from other DNR Web servers. The public now has access via their Web browser to various tool sets within SONRIS.

These servers provide this service to the public via dynamic pages generated on a number of Web Servers. For more information on how these Web servers fit into DNR's computing architecture and future direction, you are invited to review the project overview for the Strategic Online Natural Resources Information System (SONRIS).

Disclaimer
The information on this Web site has been carefully prepared from the best available sources of data. It is intended for general informational purposes only and should not be considered authoritative for navigational, engineering, other site-specific uses, or any other uses. The Louisiana Department of Natural Resources (DNR) does not warrant or guarantee its accuracy, nor does DNR assume any responsibility or liability for any reliance thereon.
SONRIS Interactive Maps - GIS

[Image of a map with various regions and counties labeled, along with a table of contents for different categories such as Oil/Gas, Mineral Resources, Coastal Management, etc.]
SONRIS Interactive Maps - GIS
SONRIS Interactive Maps - GIS
## SONRIS Interactive Maps - GIS

### Department of Natural Resources

**Content Management Search**

Back to Search | Print this page

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<table>
<thead>
<tr>
<th>Row</th>
<th>ApplicantName</th>
<th>CompanyName</th>
<th>Description</th>
<th>Page</th>
<th>Refnum</th>
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<th>CreateDate</th>
<th>Date</th>
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<td>1/4/2012 12:34AM</td>
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SONRIS Interactive Maps - GIS
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SONRIS Interactive Maps - GIS
## SONRIS Interactive Maps - GIS

### State Lease Information

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Ideas to consider in advance:

Which companies are leasing in the area?

2. Clerk of Court Office
   Leases Documents are recorded.
   Terms of lease are public information.
Thank you for the opportunity to speak to you today

Questions?