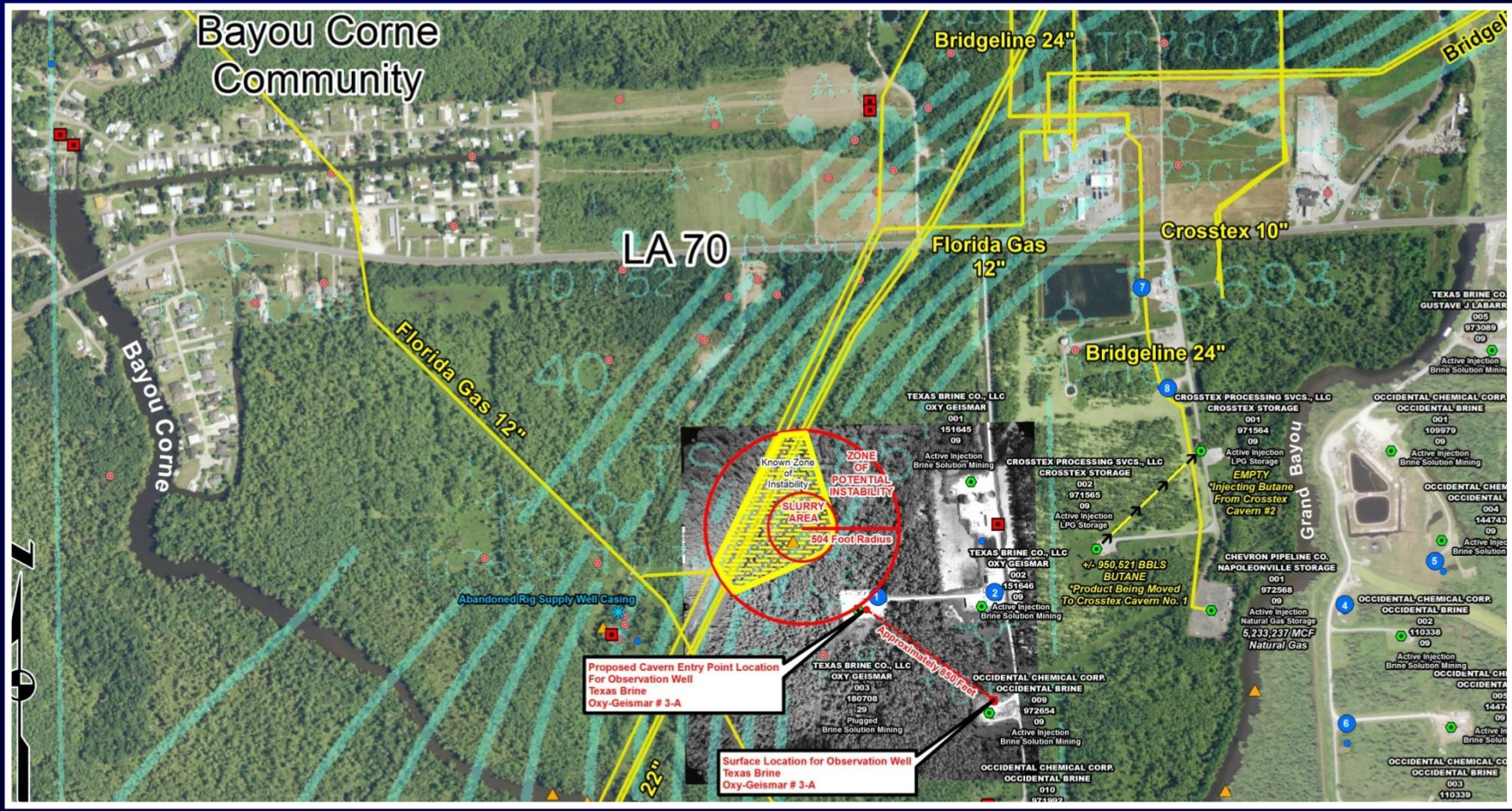




Bayou Corne/Napoleonville Salt Dome

- Slurry Area
- Area of potential instability
- Known area of instability





Sinkhole – Immediate Response/Orders

Received report of sinkhole/slurry in early hours of Aug. 3 – by end of day, DNR/Conservation had:

- **Identified Texas Brine cavern as potential cause**
- **Issued emergency order to Texas Brine to evaluate cavern integrity and remediate**
- **Issued orders to pipelines to empty and shut in – Crosstex pipeline experienced deflection**
- **Issued notice to cavern gas storage operators to take precautions**
- **Formalized Science Work Group and set up meeting at LSU**
- **Made initial determination of potential area of instability**



Continuing Response - Operations

Aug. 9 – DNR/Conservation ordered Texas Brine to drill investigatory well to the abandoned cavern

- **Permit submitted and approved on Aug. 13 deadline**
- **Science Work Group concurs with need for investigatory well**
- **All cavern operators instructed to report daily activities and monitoring efforts**
- **Conservation/DEQ began joint effort to evaluate potential hydrocarbon/saltwater impact on aquifer**





Continuing Response - Assistance

Advised Texas Brine of permit requirement to provide public assistance when sinkhole formed

- Ordered Texas Brine to provide assistance retroactive to date of evacuation order
- Commissioner announces potential penalties for failure to comply with assistance order





Drill Rig On Site – Investigatory Well

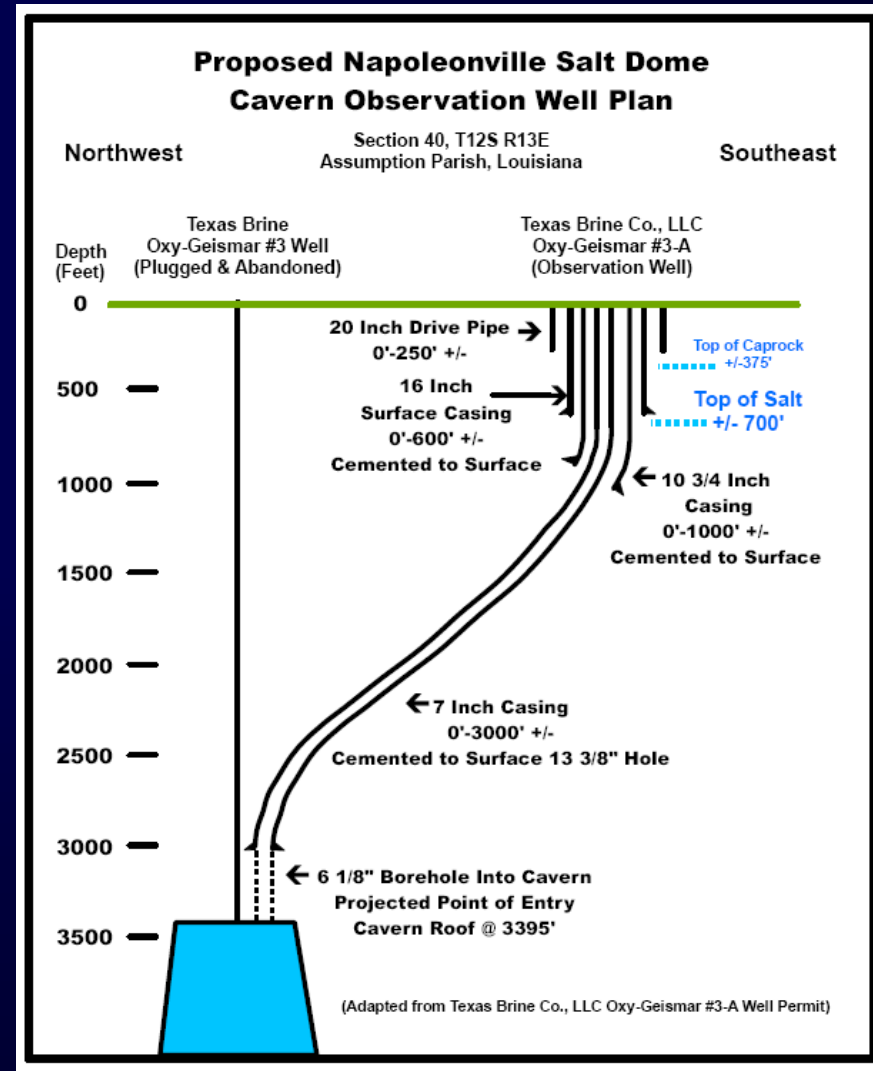




Investigatory Well

Current status: At 600' – surface casing being set – directional drilling will be at about 1,000'

- Drilling from nearby cavern pad
- S-Curve directional drilling to intersect cavern from the top
- Expected 40-day drill
- Blowout preventers and diverter system in place
- Conservation agents on site 24/7





Proposed Testing Upon Cavern Entry

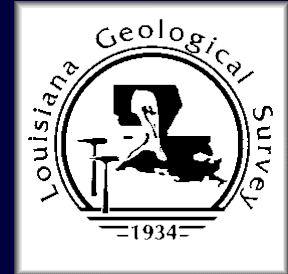
- **Caliper Log from 3000' to top of cavern at 3395'**
 - Data on condition of the salt immediately above the cavern roof
- **Temperature/Pressure log**
 - Temperature and pressure conditions in cavern and possible information on natural gas and brine in the cavern
- **Reservoir Performance Monitoring Log**
 - Data on stratification of natural gas, brine or other contents of the cavern



Proposed Testing Upon Cavern Entry

- **Sonar Survey**
 - In order to determine any change in cavern configuration
- **Shear Wave log**
 - Data related to condition of salt outside cavern and improving accuracy of seismic analysis
- **Direct Sampling**
 - Pressure, fluid and gas in cavern
- **Installation of geophone array**
 - Long-term seismic monitoring if deemed necessary
- **Confirmed as appropriate by Science Work Group**

Science Work Group





Science Work Group

State and Local Government Participants

Christopher Knotts, PE	DNR	Kevin Davis	GOHSEP
Madhurendu Kumar, PhD, PG	DNR	Pat Santos	GOHSEP
Commissioner Jim Welsh	DNR	Chris Guilbeaux	GOHSEP
Gary Ross, PE	DNR	James Smith	GOHSEP
Joe Ball	DNR	Clay Trachtman	DHH
Chris Sandoz, PE	DNR	Johan Forsman	DHH
Thomas Van Biersel, PhD	DNR	Jake Causey	DHH
Donald Haydel	DNR	John Johnston III	LGS
Laurence Bland	DNR	Chacko John, PhD	LGS
Gary Snellgrove	DNR	Warren Schulingcamp	LGS
David Elfert	DNR	Brian Harder	LGS
Kevin Masden	DNR	Riley Milner	LGS
Secretary Peggy Hatch	DEQ	Julius Langlinais, PhD	LSU (Ret.)
Chris Piehler	DEQ	Louis Thibodeaux, PhD	LSU
Celeste Bonnacaze	DEQ	Donald Goddard, PhD	LSU
Dutch Donlon	DEQ	Allan Pulsipher, PhD	LSU
Larry Gill	DOTD	Richard Hughes, PhD	LSU
		Jeff Nunn, PhD	LSU



Science Work Group

Federal Government and Industry Advisors

Stephen Spencer	USDOJ	Mark Cartwright	Texas Brine
R Williams	USGS	Kenneth Blanchard	Texas Brine
Mark Meremonte	USGS	Joel Warneke	Texas Brine
Elizabeth Lemersal	USGS	Greg Ball	Chevron
Jon Kolak	USGS	Laura Swafford	Chevron
Stephen Hammon	USGS	Cung Vu	Chevron
Max Ethridge	USGS	Bob Langan, PhD	Chevron
Michael Blanpied	USGS	Michael LeBlanc	CrossTex Energy
Harley Benz	USGS	Bobby McDonald	Florida Gas Pipeline
J Rubenstein	USGS	Bob Thoms, PhD	Texas Brine consultant
William Leith	USGS	Joe Ratigan, PhD	Consultant to Oxy
Steve Hickman	USGS	Bill Goodman	Respec
William Ellsworth	USGS	Ted Bourgoyne. PhD	BEI
John Lovelace	USGS	Boyce Clark, PhD	Arcadis
George Arcement, Jr.	USGS		
Rebecca Fuller	USCG		
Dayton Pannell	USCG		
Steven Horton, PhD	University of Memphis		
David Borns	Sandia National Laboratories		
Stephen Bauer	Sandia National Laboratories		



Science Work Group Activity

- Meetings were held on:
 - August 6th
 - August 14th
 - August 17th
 - August 22nd
- Ongoing information exchange via emails and conference calls

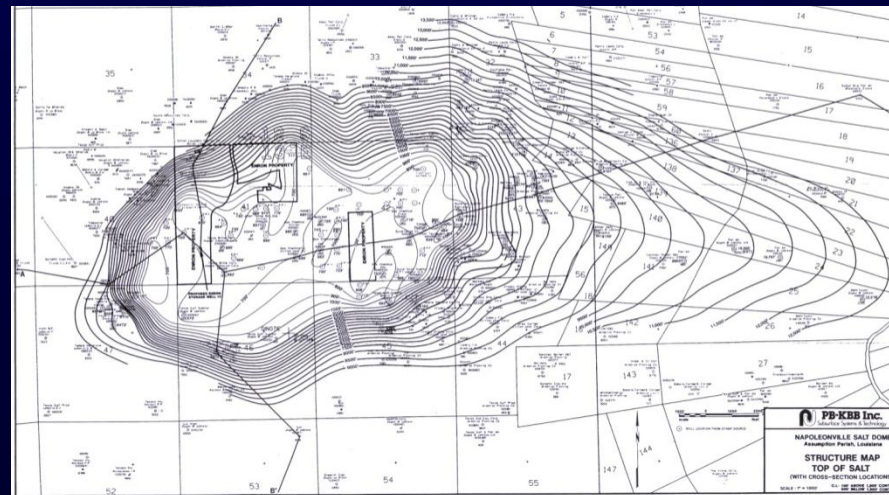




Science Work Group Activity

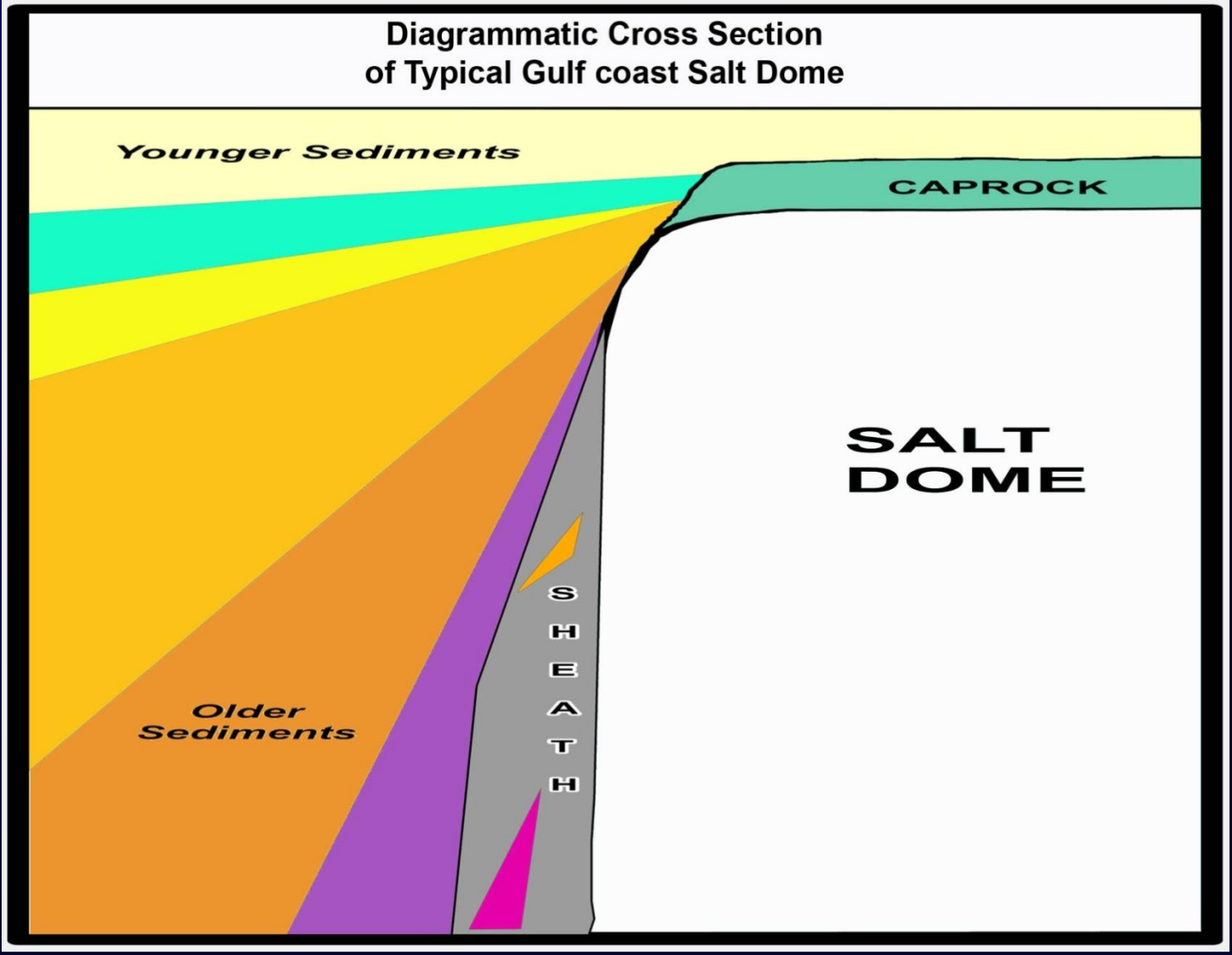
Current theories for possible causes for slurry hole / bubbling

- Salt dome movement
- Regional tectonic activity
- Failed casing on OXY #3 well
- Cavern failure
- Salt or caprock instability
- Natural gas seepage
 - Into OXY #3 Cavern
 - Along flank of salt dome
- Combination of the listed theories





Science Work Group Area of Focus





Science Work Group Consensus

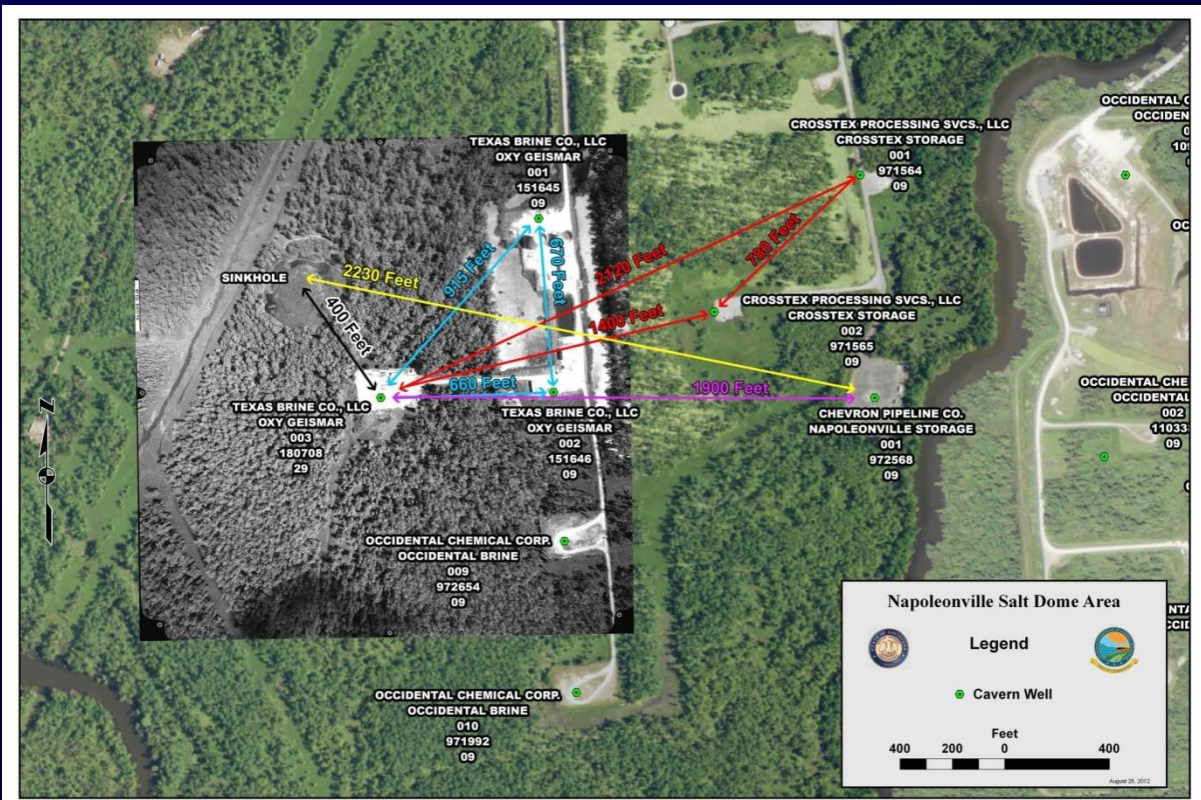
Work Group studied and reached consensus on:

- Commissioner's decision to order drilling of investigatory well
- Evaluation/testing of existing water wells necessary and appropriate
- Tests proposed by Texas Brine for investigatory well are appropriate
- Crosstex determination that storage caverns had not been compromised





Response to Concerns Raised





Nearby Storage Caverns

Chevron Natural Gas Storage Cavern

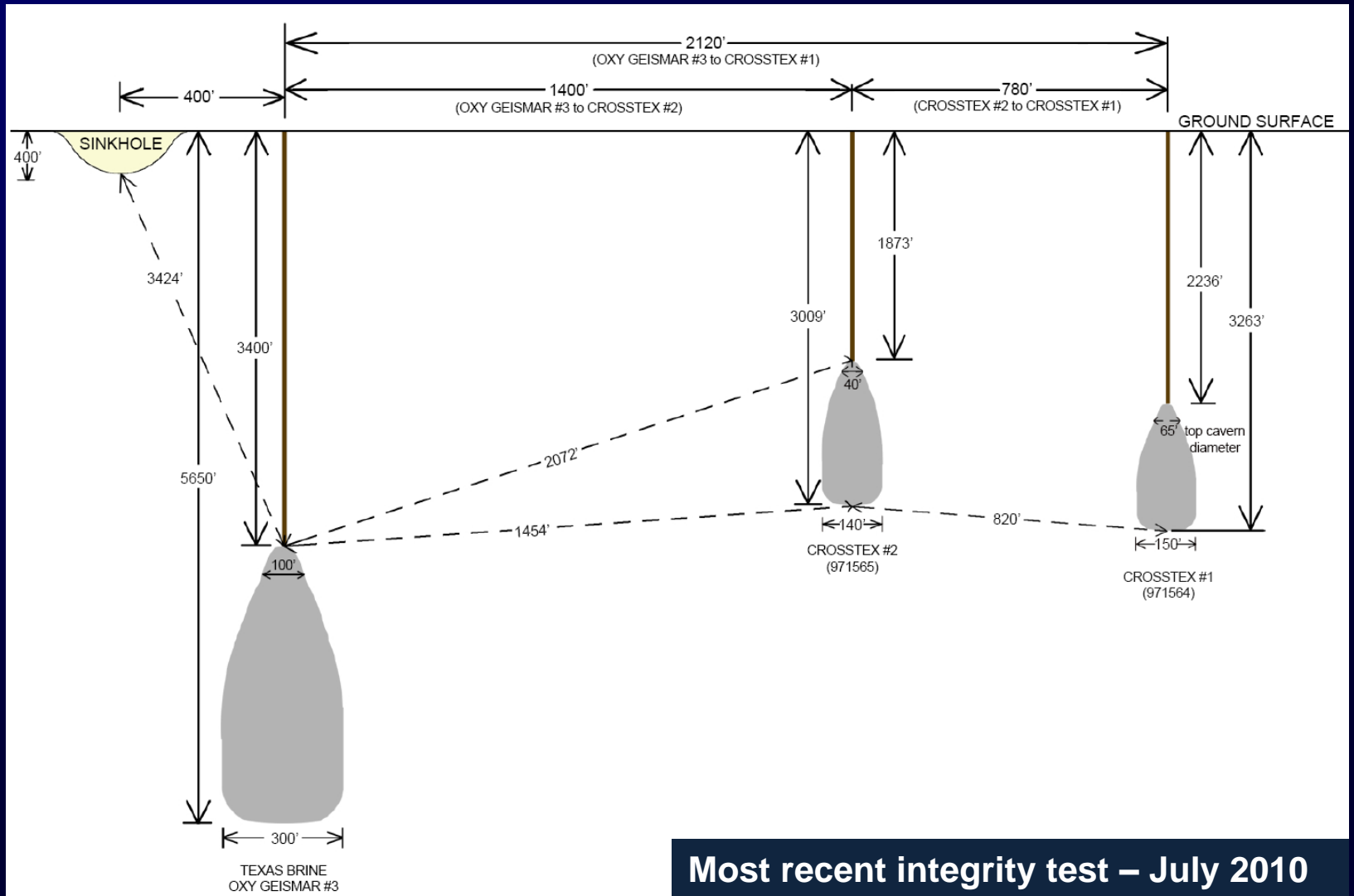
- Chevron has already begun drawdown on cavern

Crosstex LPG No. 2

- Relocating butane load to Crosstex No. 1, located 800' further away
- Conservation/DEQ reviewed expanded risk management plan submitted by Crosstex at request of DEQ
 - Assessment indicates worst-case scenario of release and explosion at Crosstex No. 2 site would create force strong enough to break windows only to approximate 1,600' radius – does not include Bayou Corne community



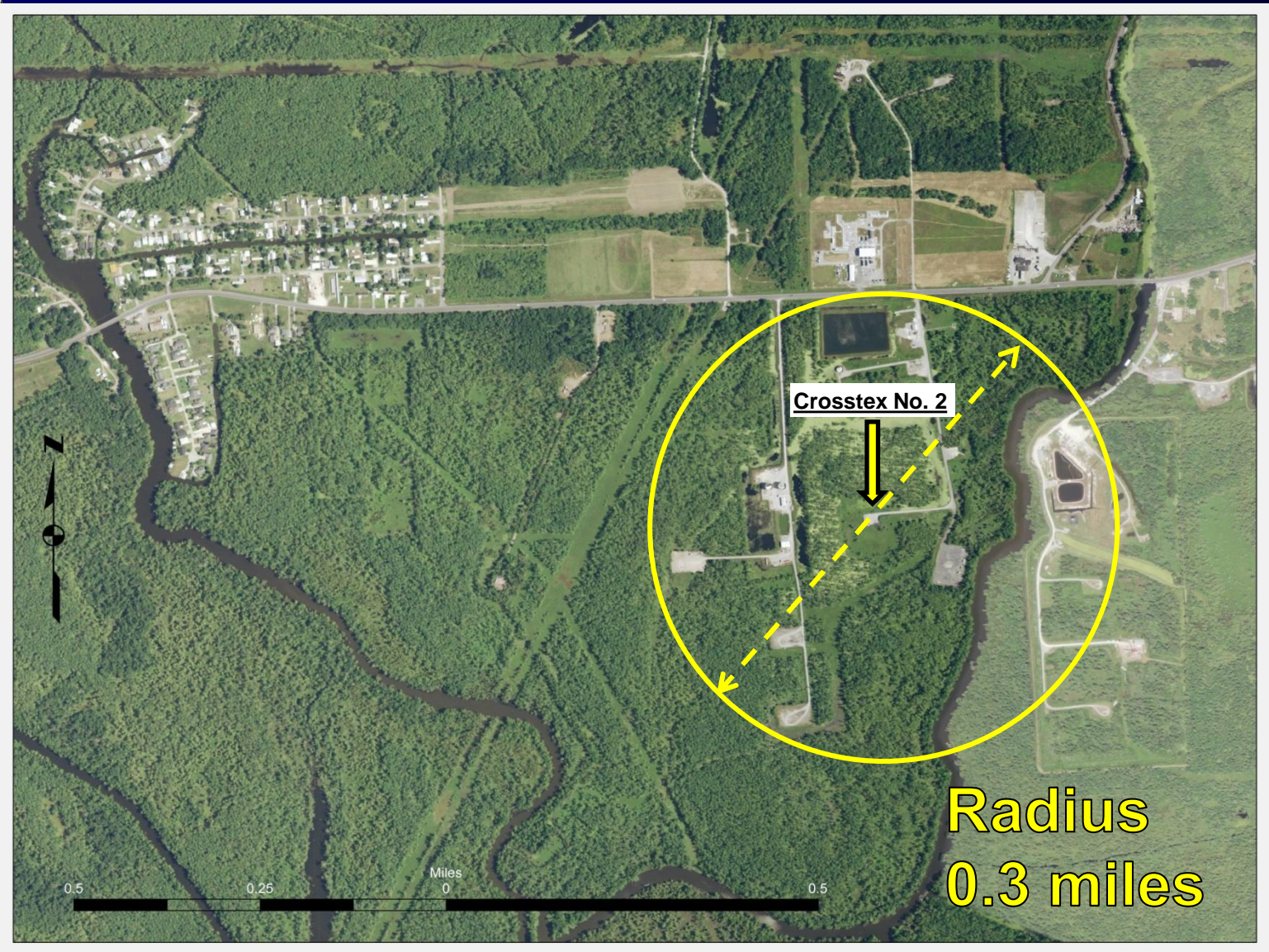
Distance Between Caverns



Most recent integrity test – July 2010



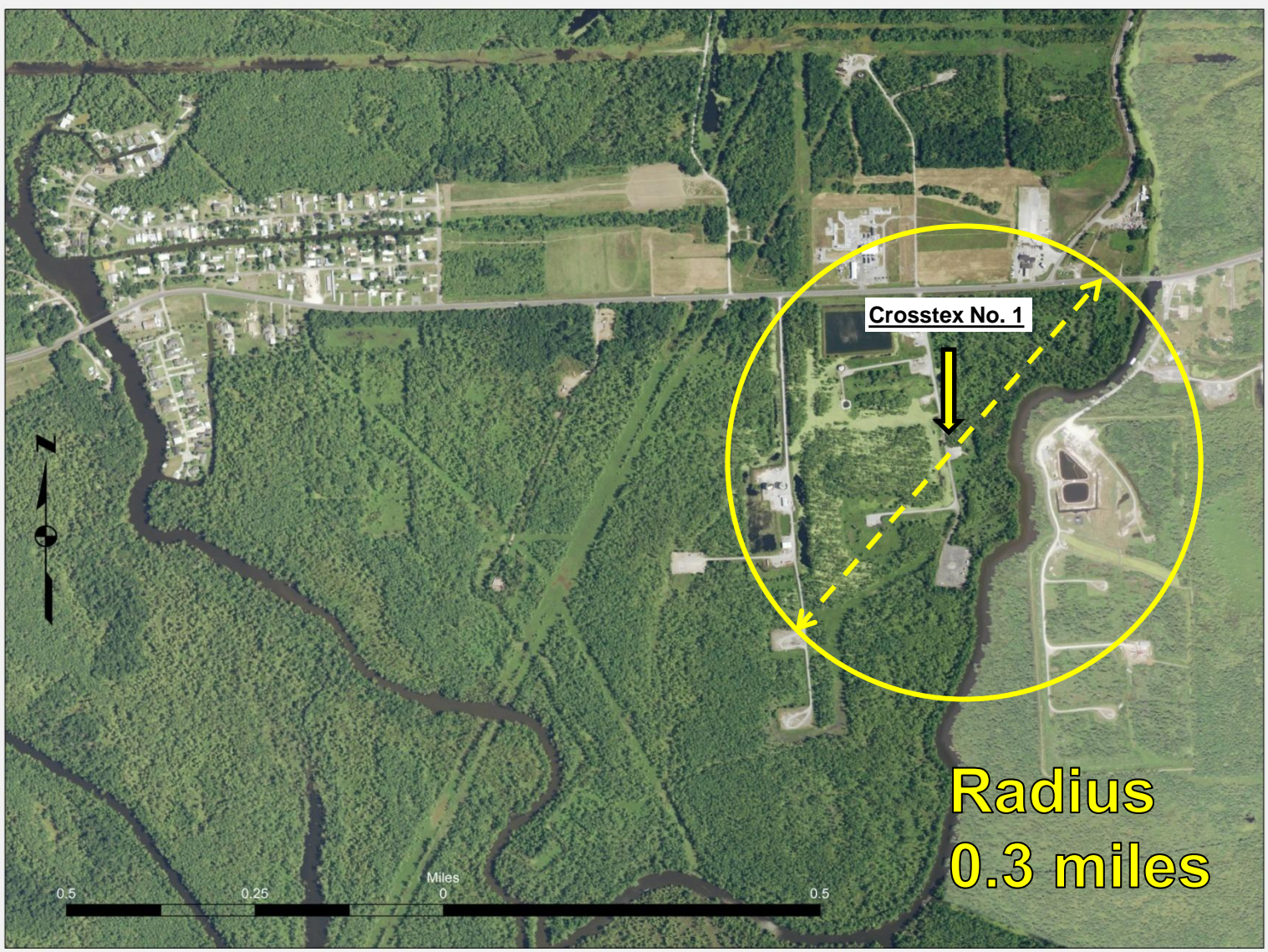
Crosstex # 2 Worst Case – Area of Maximum Impact



**Radius
0.3 miles**



Crosstex # 1 Worst Case– Area of Maximum Impact

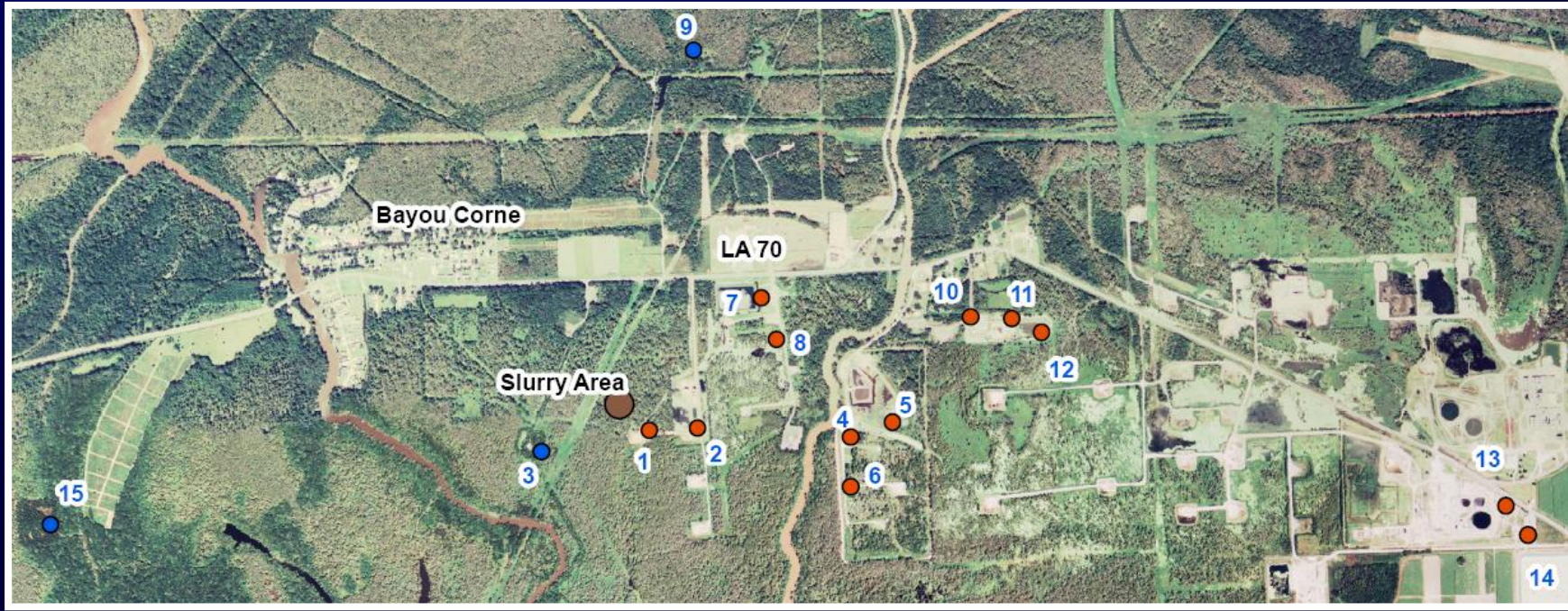


**Radius
0.3 miles**



Bayou Corne Groundwater Conditions

Existing ground water wells evaluated – sampling does not indicate presence of hydrocarbon or increased salinity in alluvial aquifer at these locations





Ground Water Observation Well Plan

Observation well action plan for the Mississippi River Alluvial Aquifer developed as extra measure to ensure public safety

- Observe aquifer conditions
- Monitor water quality
- Monitor water level

Site identified and driller under contract to drill initial observation well

- Ready to drill - pending access authorization from landowner
- Information gathered from initial well will dictate next steps in the investigation
- Also evaluating installation of vent wells in the alluvial aquifer



Initial Ground Water Observation Well

Site selected based on several factors

- Positioned between area of concern and populated area – best location to ensure public safety
- Area where top of aquifer shallow with overlying clay – gas more likely to be in shallowest spots and linger longest under heavy clay





Path Forward

Investigatory Well

- Ongoing oversight of drilling progress and safe operations
- Applying guidance and recommendations from Science Work Group in testing cavern
- Assessing condition of salt above cavern roof
- Testing temperatures and pressures within cavern
- Sonar survey of cavern configuration
- Sampling of cavern contents





Path Forward

Other Operations

- Ongoing review of reporting on cavern operations in nearby area
- Continued monitoring for evidence of renewed seismic activity
- Continued review of records and data to identify potential alternative causes of natural gas bubbling and subsidence
- Subsidence surveys reviewed
- Coordination with Science Work Group on theory and analysis of information gathered and data required

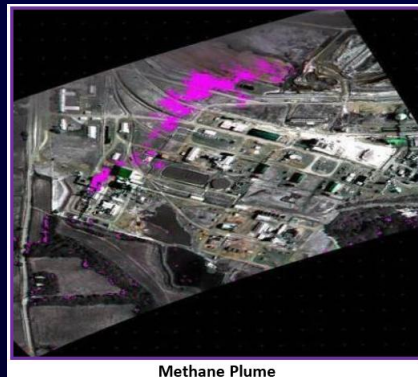




Path Forward

Public Safety

- Continued testing of ground water, and identifying sites for observation wells
- Continue to make information readily available to public and local officials
- Coordinate with EPA and DEQ on use of EPA plane equipped to detect natural gas and other releases



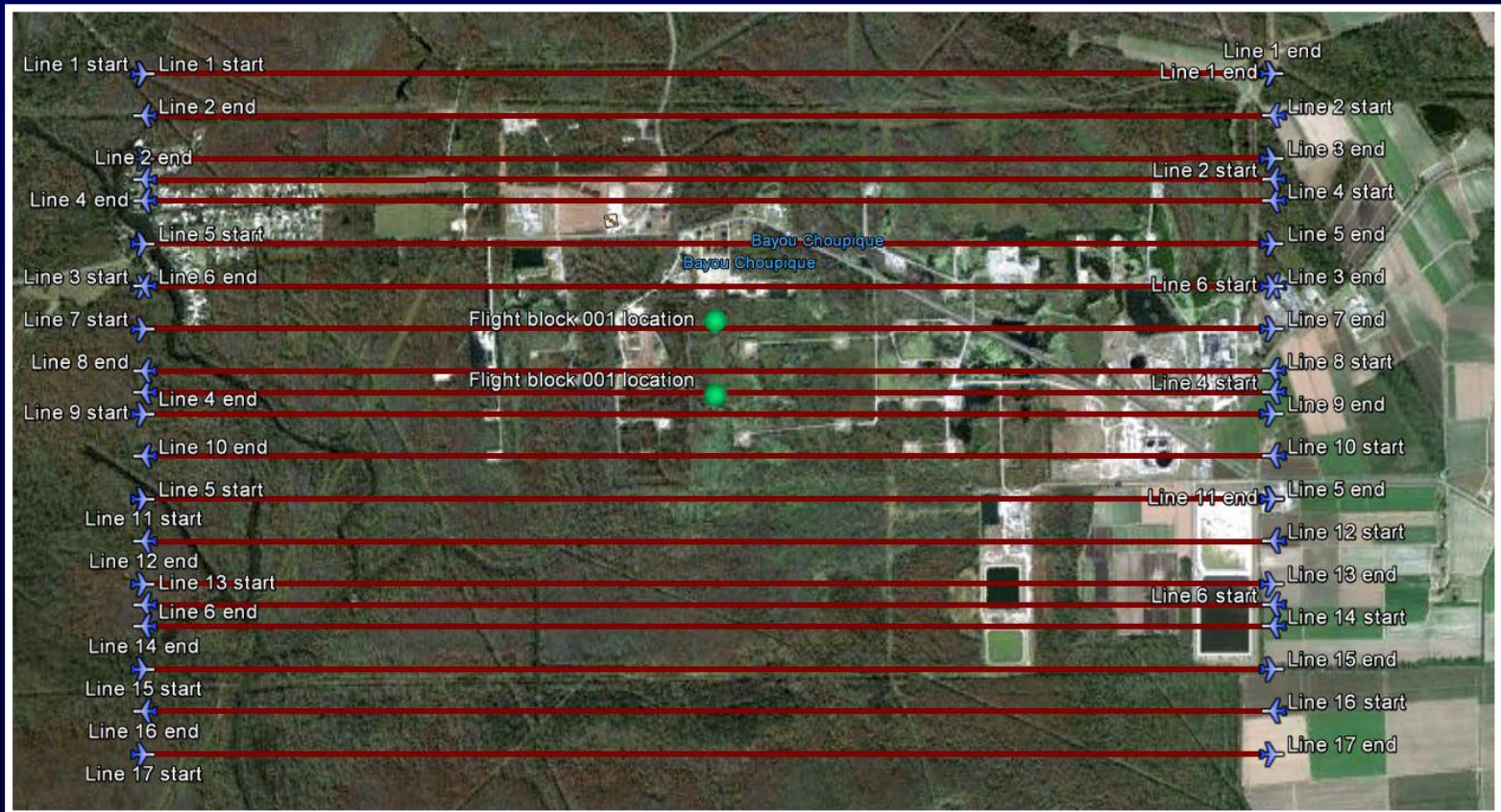
Methane Plume





EPA FLIGHT PLAN

- Will be flying low to ground – about 300 feet
- Multiple passes over the area with detection equipment
- Flight will take several hours



Continuing Commitment



- **DNR/Office of Conservation is committed to providing all necessary staff and resources to this situation until the causes are identified and problems resolved**
- **All residents and officials are always welcome to contact us with concerns and questions**
- **Information is made available on our website**
- **Please visit our Bayou Corne website for more information at**

<http://dnr.louisiana.gov/>



Bayou Corne/Napoleonville Salt Dome

