Public Briefing

November 13, 2012

Pierre Part, LA

Agenda

- Gas Migration
  - Venting ORW wells
  - Shallow gas migration and pressure monitoring results
  - Area of potential gas accumulation in aquifer
- Stability Analysis of cavern and sinkhole
  - Status of sinkhole and cavern
  - Conceptual understanding of current situation
  - Rock mechanics modeling for stability analysis

Venting at 2 Locations with 3rd Location Tomorrow

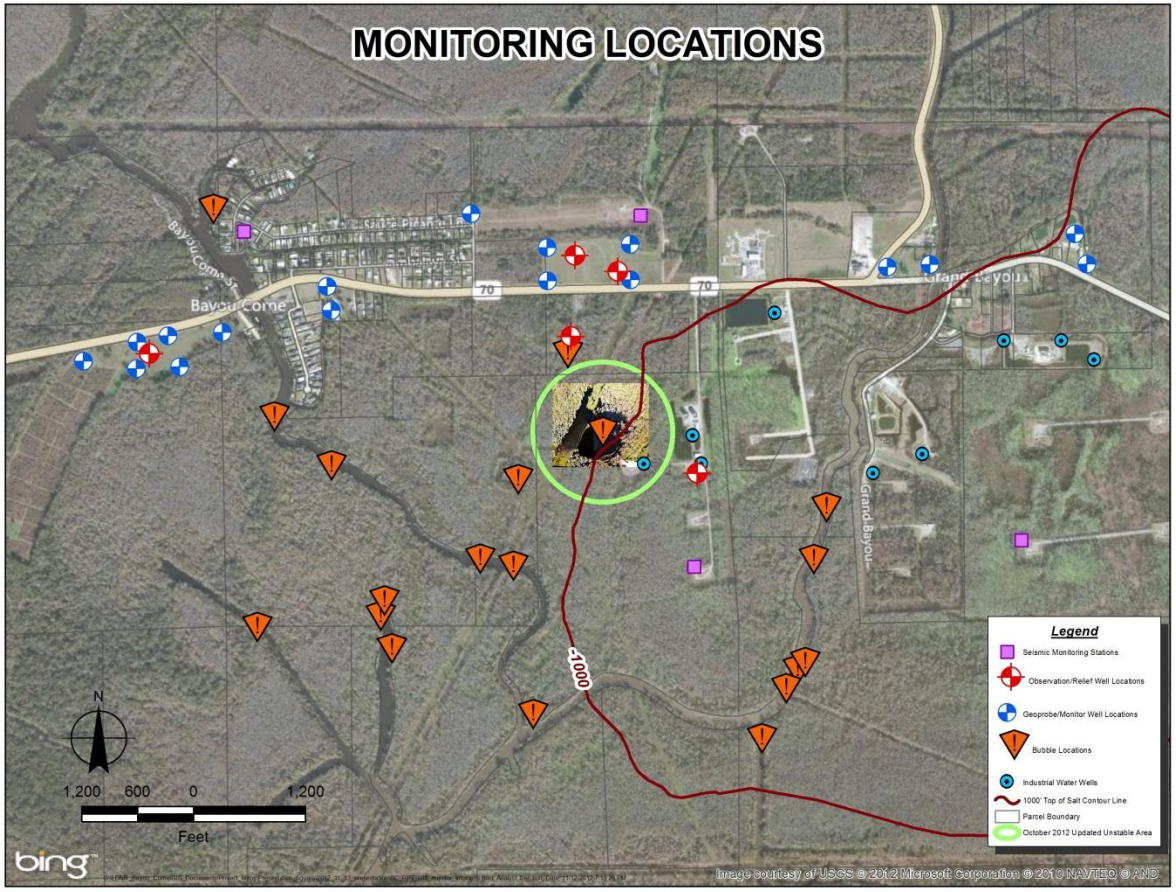
Vent Well Data

- Flowing at 15-30 Thousand Ft^3/Day
- Formation pressures
  - Between 50 & 90 psi
  - Slightly greater than water pressure at these depths and less than rock/soil pressure (frac pressure)
- Total column of gas in aquifer between 5 and 30 feet (at ORW-04, 95-128')

Next Steps

- Adjusting water column to control flow rate—being gentle with wells
- Flare ORW-02
- Cleanout ORW-01 and re-perforate
- Connect ORW-01 to ORW-02 flare
- Cleanout ORW-03 and re-perforate—no gas column but measuring 100% methane in well
- TBC to take over operations by end of November

Vent Well Locations

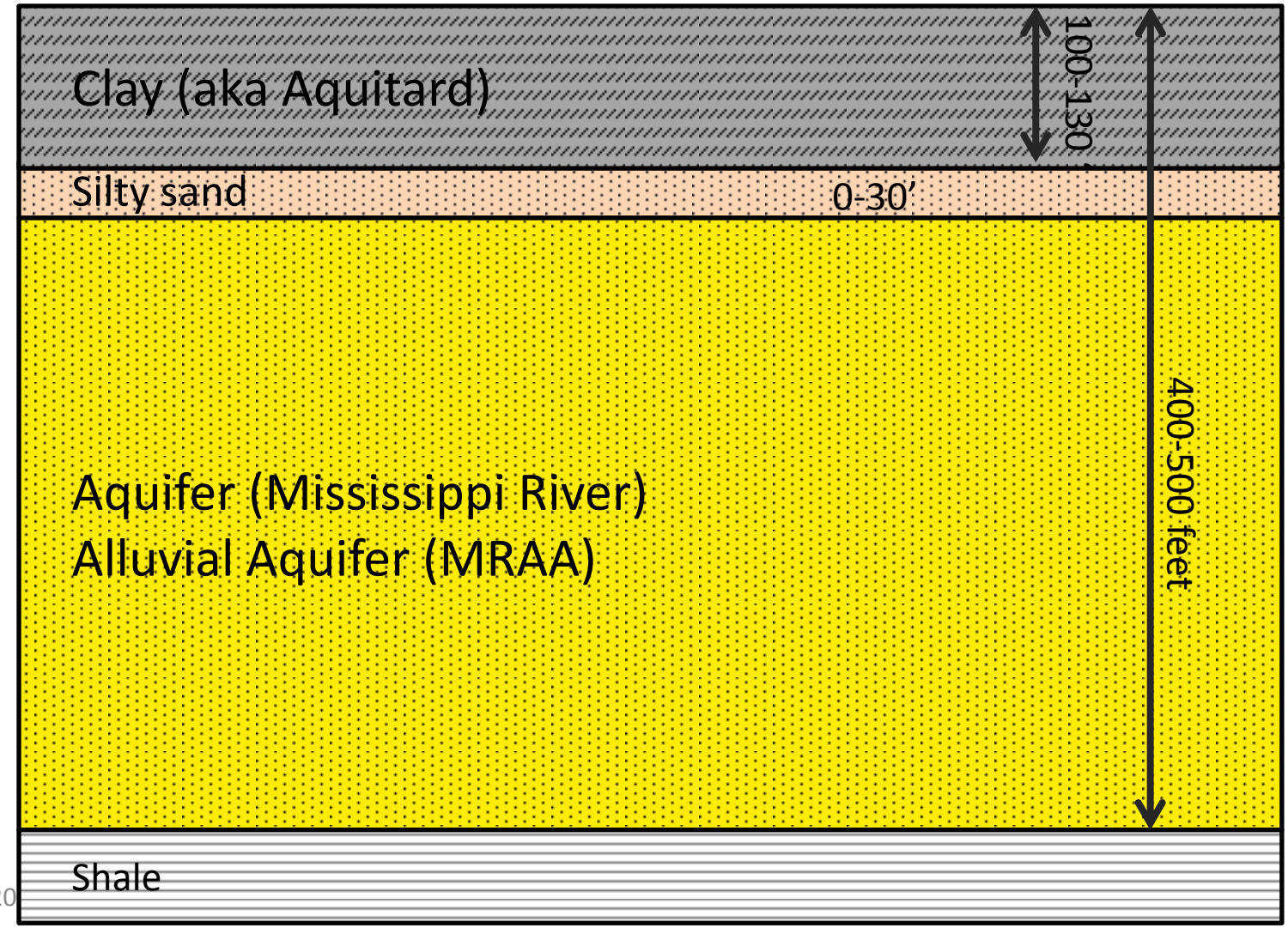


Shallow Gas Results

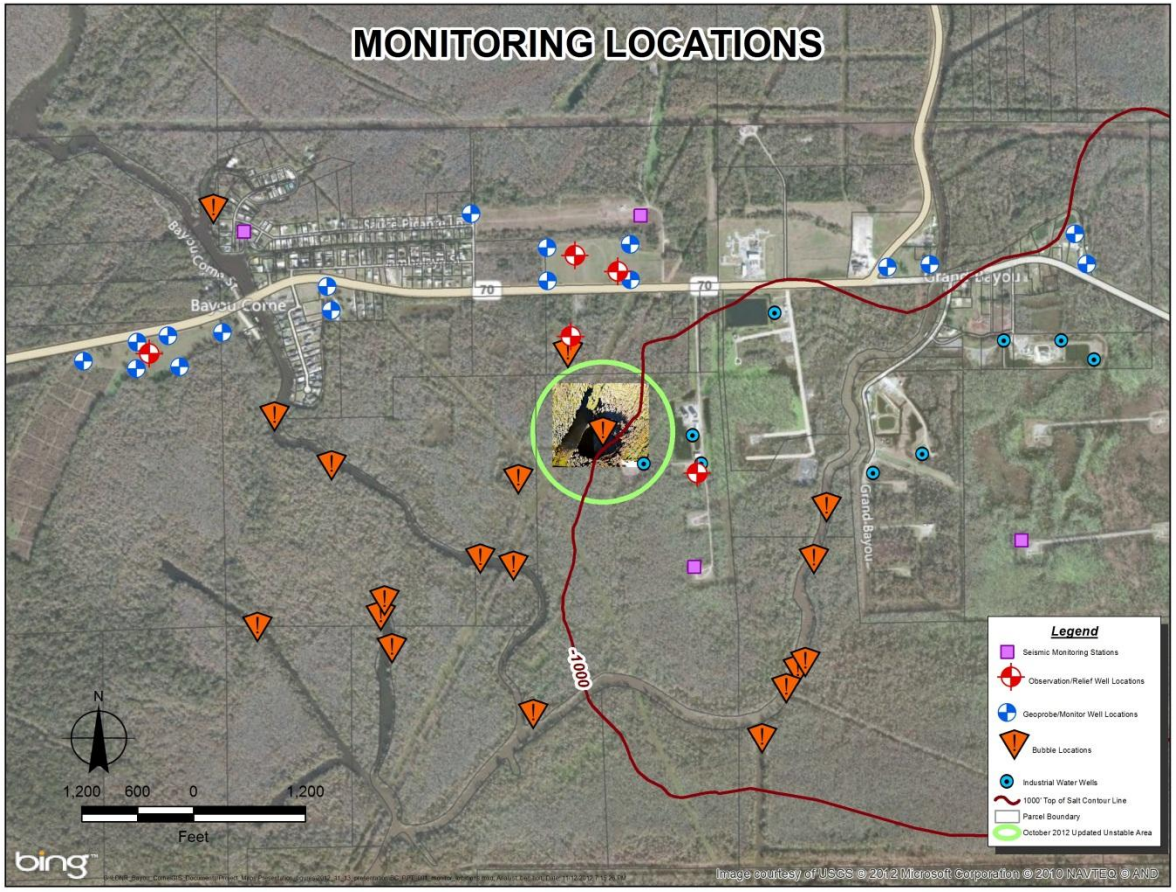
1. Wells completed 20-40 feet deep
2. Gas is predominantly methane
3. Do have pressure in wells
4. Definition: *Formation pressure*: Pressure in gas body, not necessarily wellhead pressure

Shallow Geology

Cross-Section

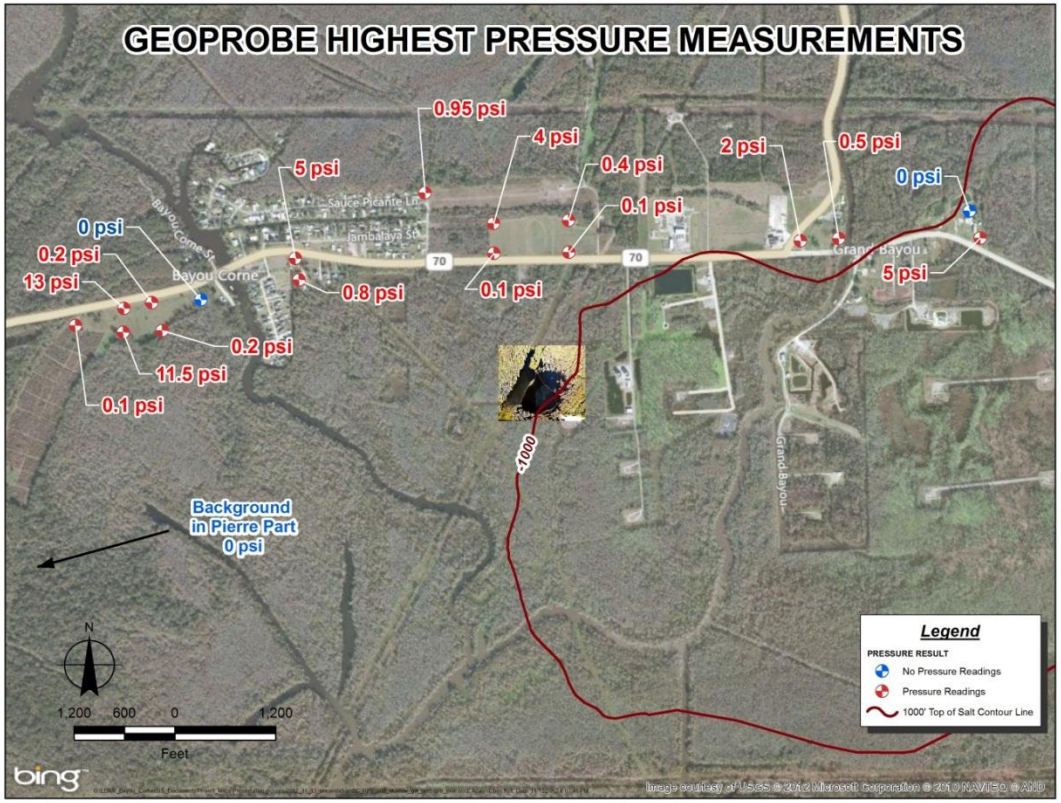


Data Locations



Shallow Pressure Results

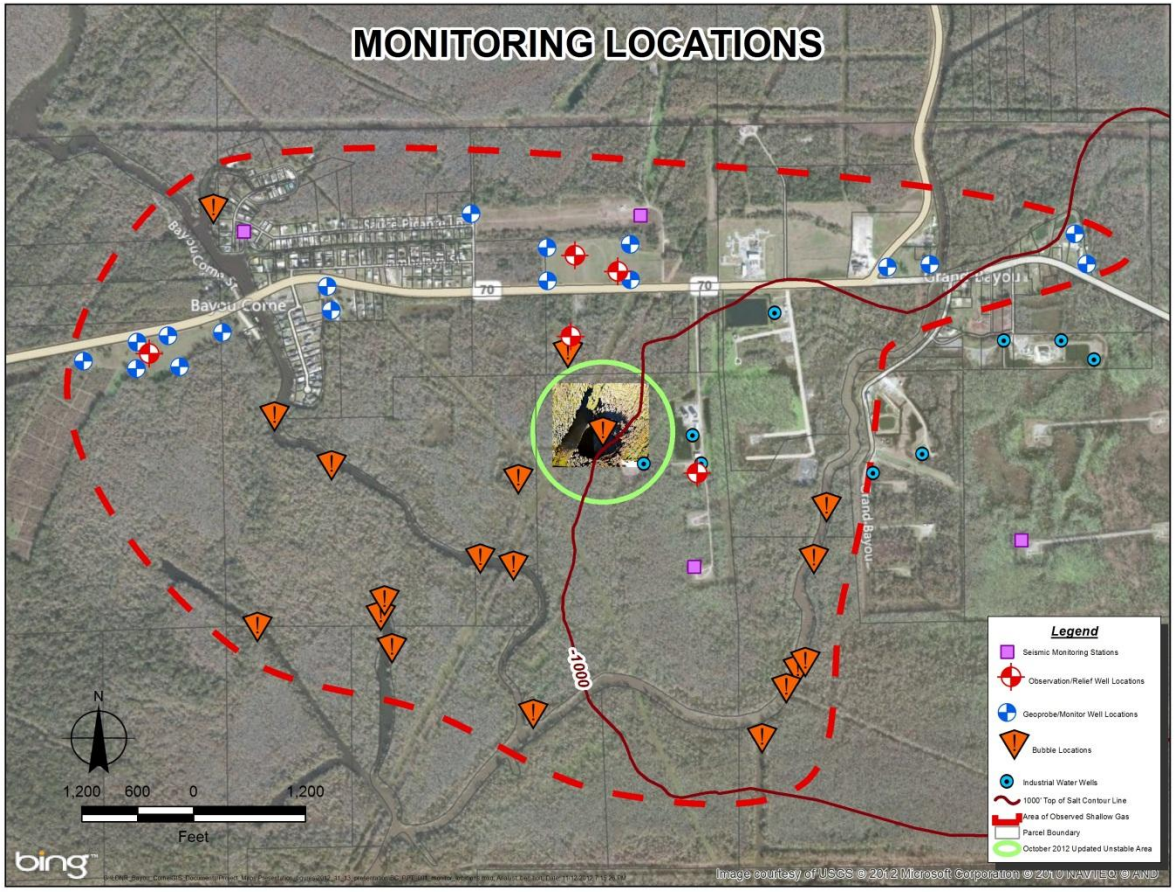
- Positive pressures over monitoring area
- Bubbling observed in two wells
- Two wells have lifted water column during monitoring
- Low pressures (< ½ psi) are likely result of barometric pressure changes
- Formations pressures are about the same in Bayou Corne area when water levels and depths are accounted for
- Lower in Pierre Part background well



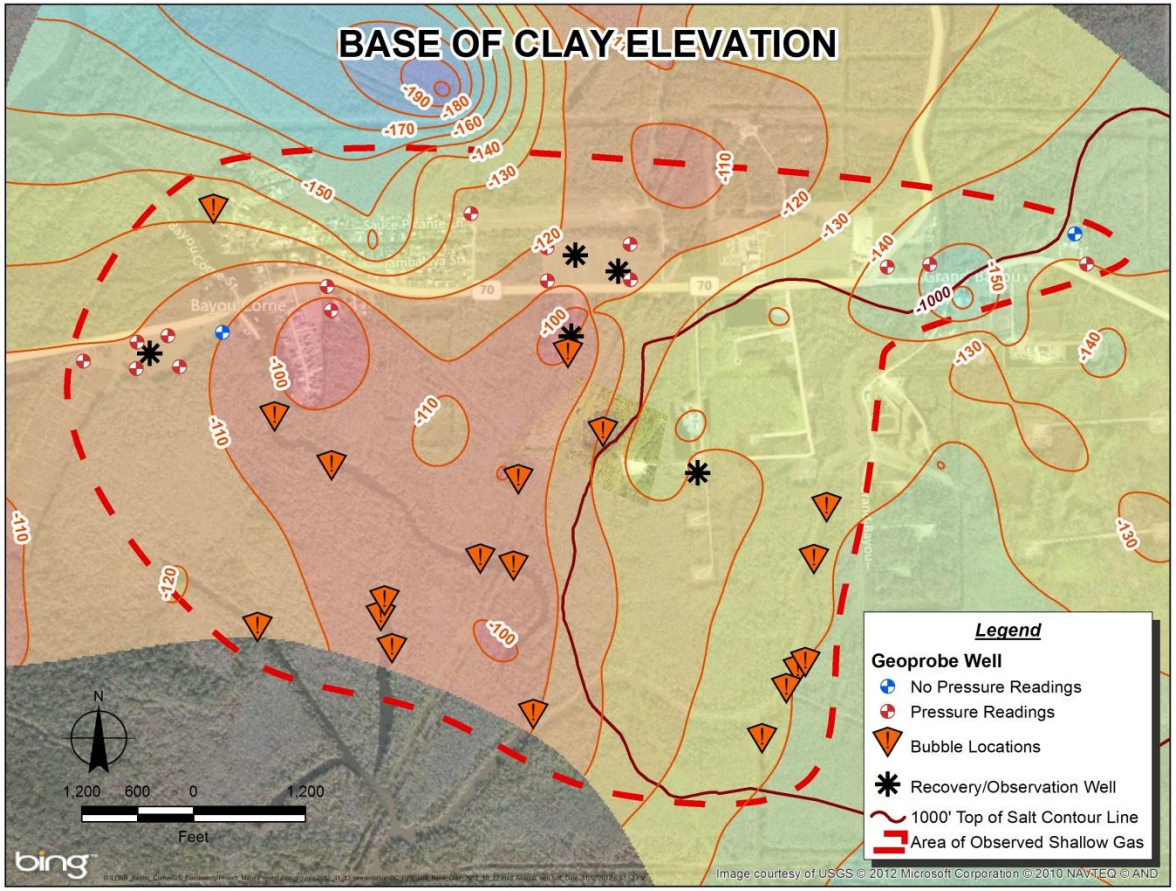
Gas Sample Results

- Still waiting on isotope results from groundwater samples
- Collecting gas samples for isotopic analysis

Shallow Gas Area

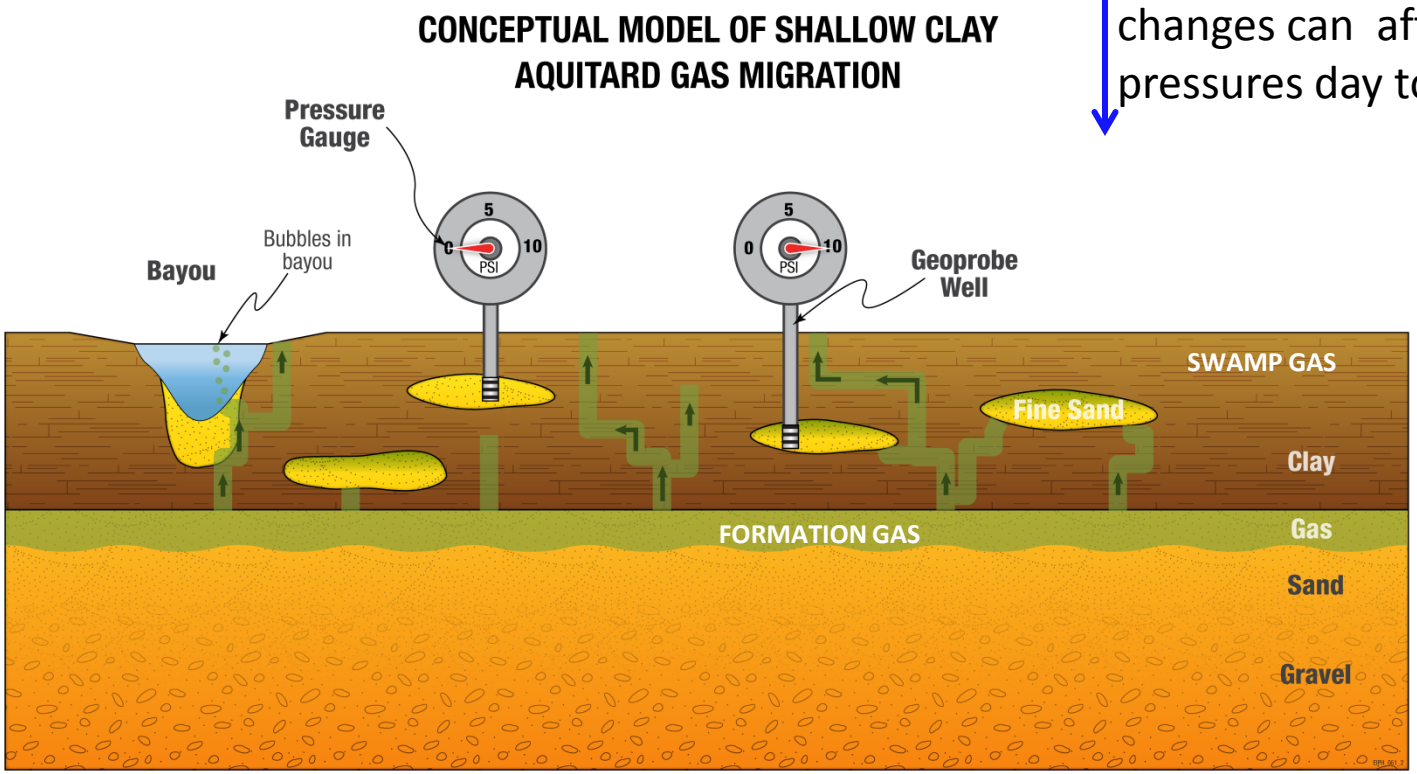


Shallow Gas Area



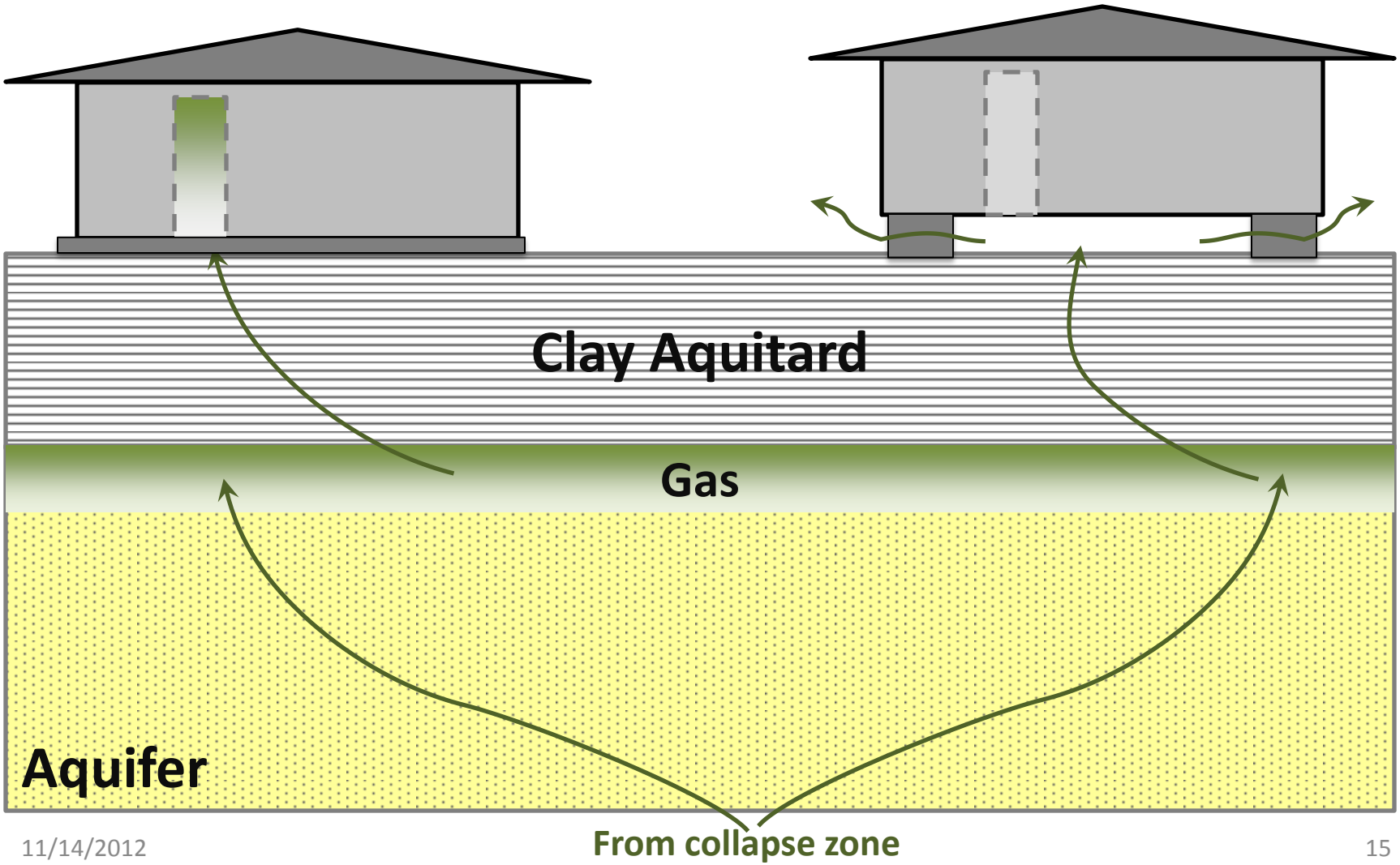
Conceptual Shallow Gas Model

Barometric pressure changes can affect pressures day to day



Calculated gas flow rate very low

Potential Gas Migration Into Homes



Home Safety

- Shaw indoor air expert consulted regarding methane pressures and concentrations—methane pressures are a concern
- Need to get houses monitored for gas accumulation
- Need better understanding of shallow gas migration to refine situation and risks

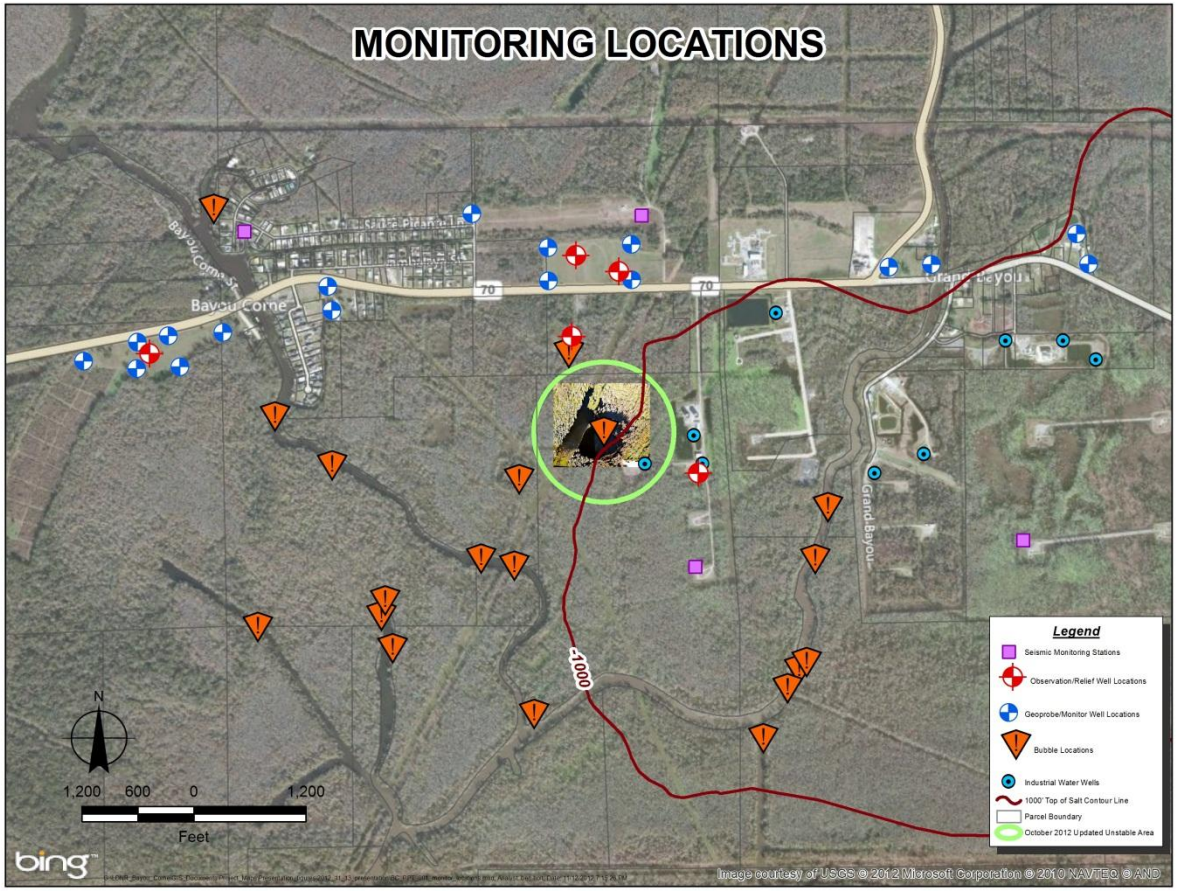
Analysis of Current Situation (Stability Analysis)

1. Gas migration in shallow system
2. Gas and crude oil migration through collapse zone to surface and aquifer
3. Sinkhole
4. Cavern
5. Collapse zone characterization and stability
6. Gas mitigation

Sinkhole Status

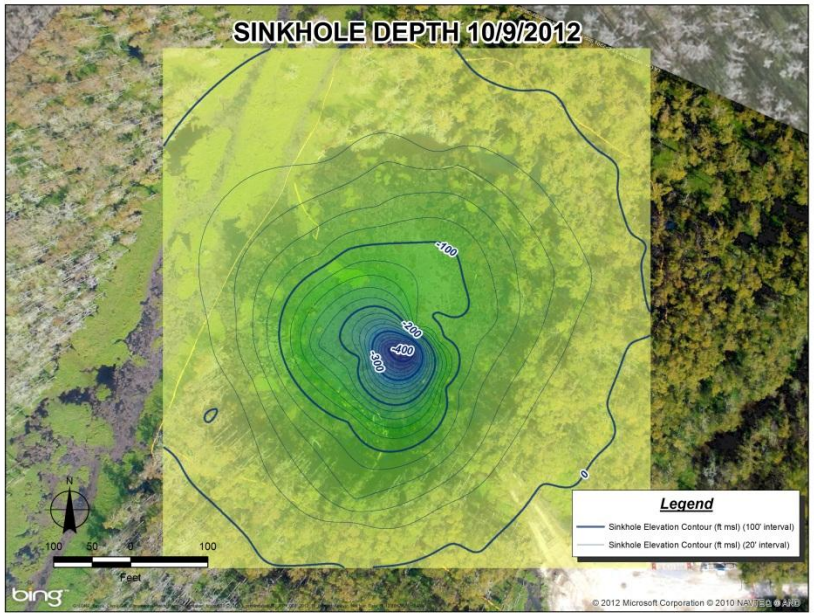
- Area of sinkhole—8 acres as of first November
- Gradual subsidence noted outside of sinkhole to the west
- Large bubble plume has disappeared
  - May indicate gas is being depleted
  - May indicate gas is accumulating in collapse zone

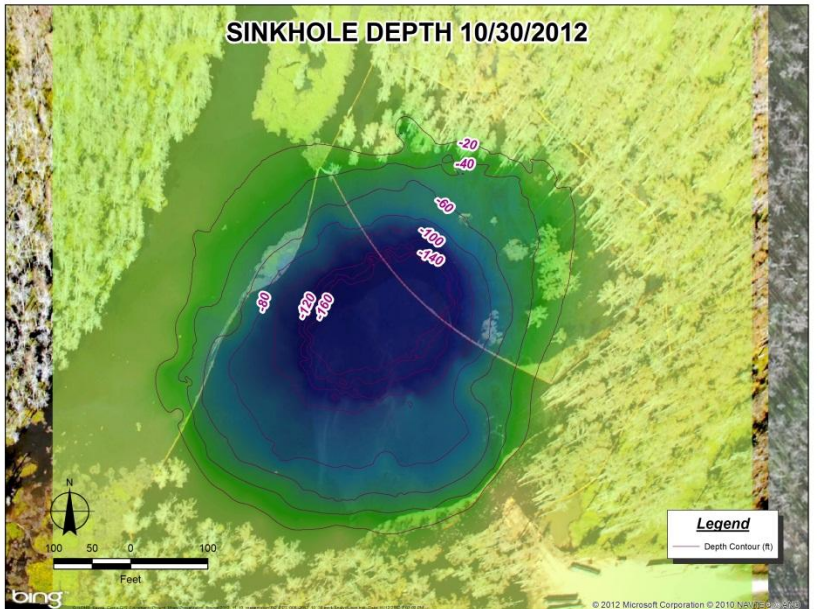
Estimated Area of Maximum Subsidence

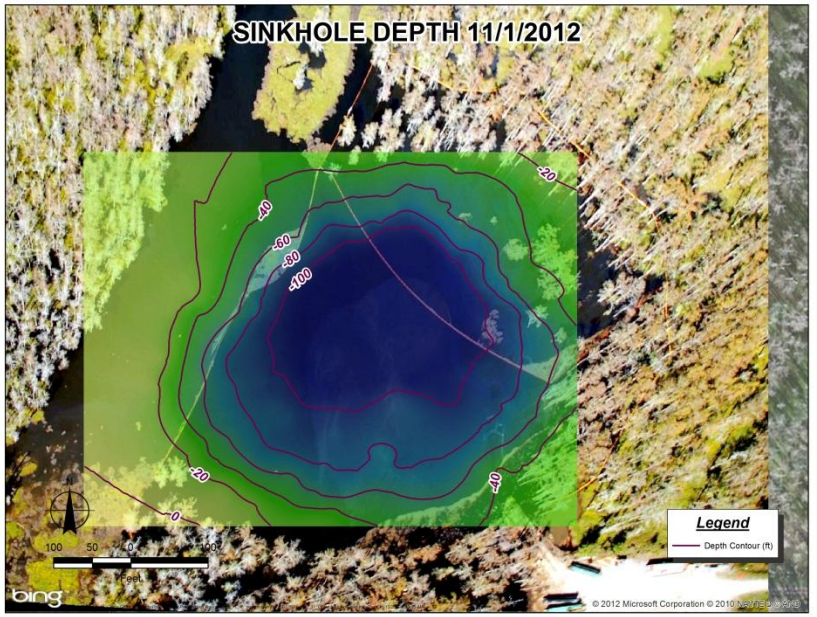


Being reviewed by Itasca

Sinkhole Changes Over Time

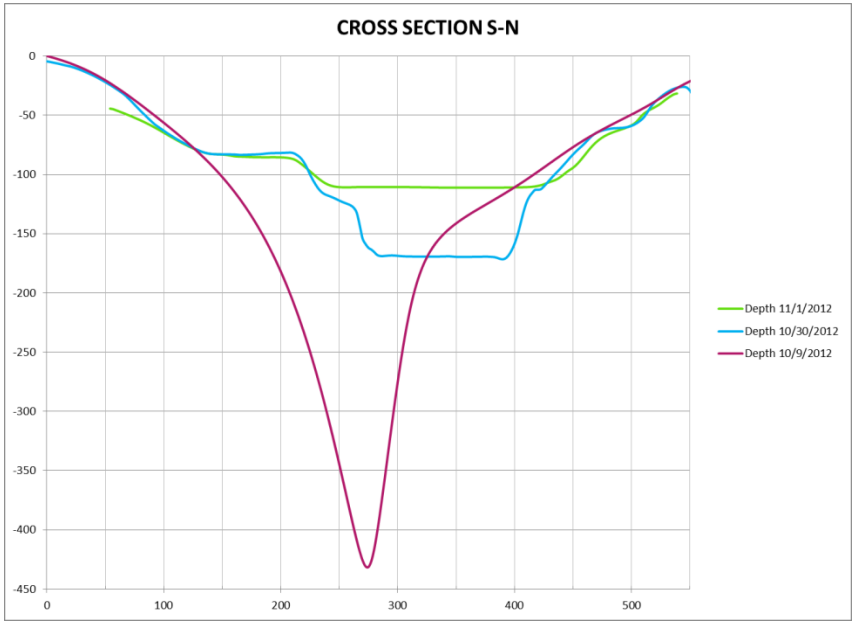


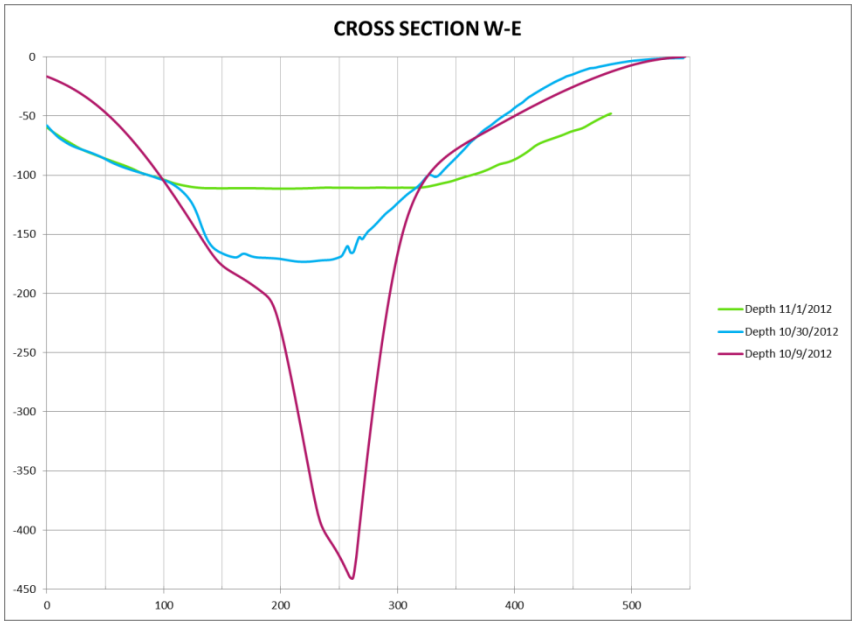




Nov. 1. Volume: 660,000 cubic yards

Sinkhole Cross-Sections

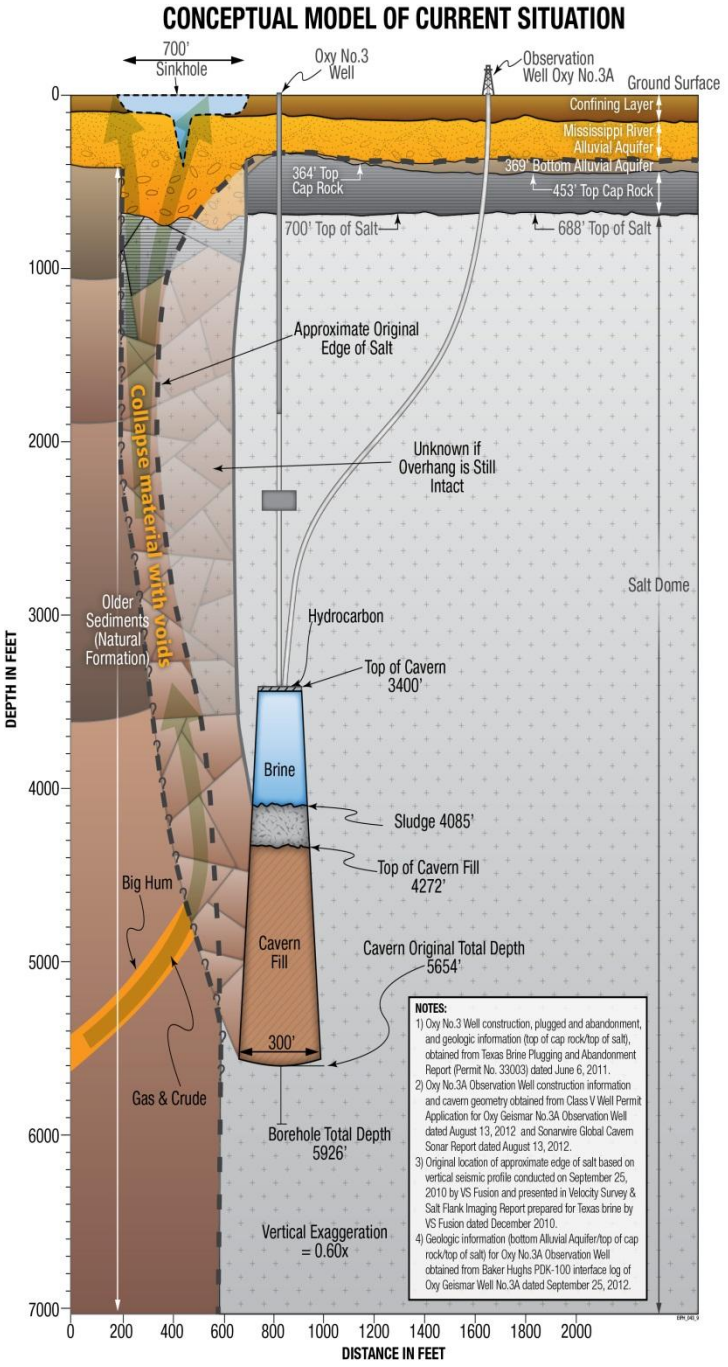




Cavern Stability

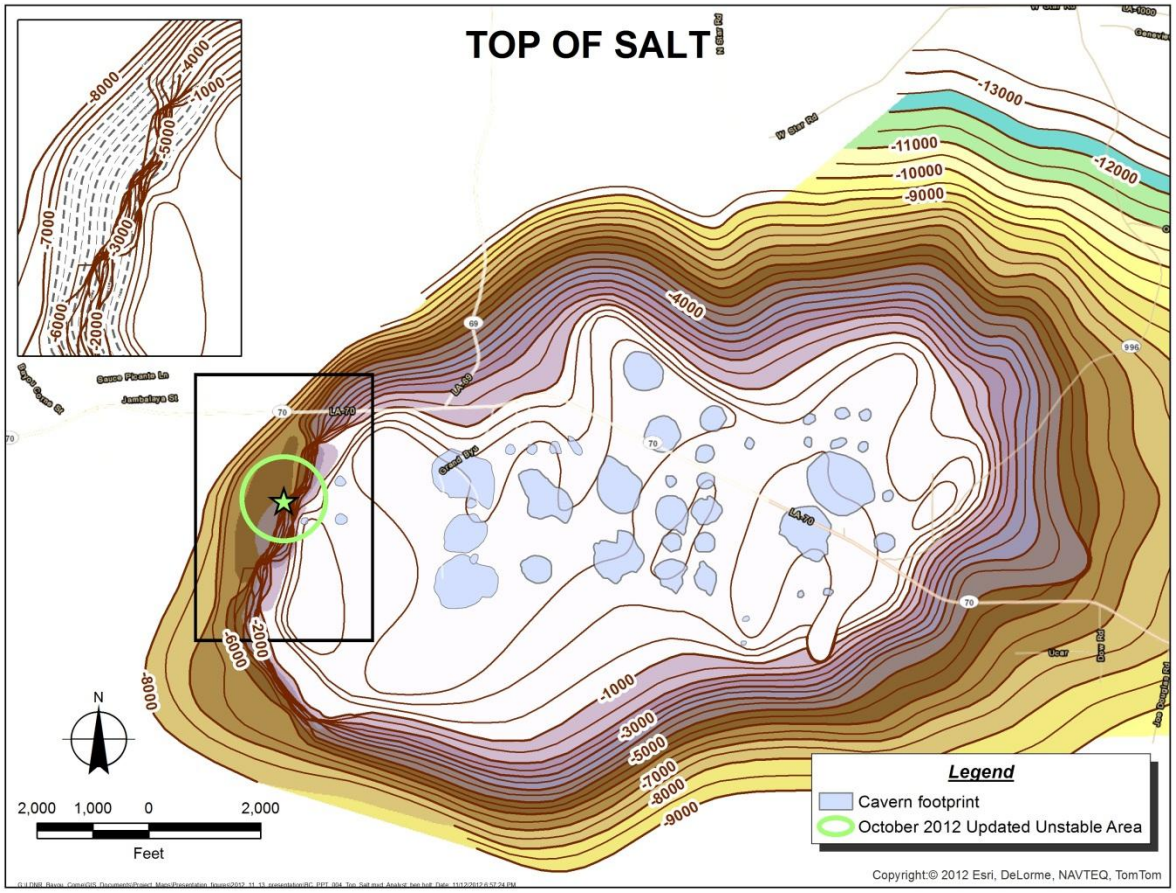
Conceptual Model Basics

- Still have un-accounted for volume of voids (Fill minus sinkhole volumes)
- Unknown volume of voids in collapse zone
- Sinkhole and collapse zone changing
- Big Hum is one likely source of oil and gas

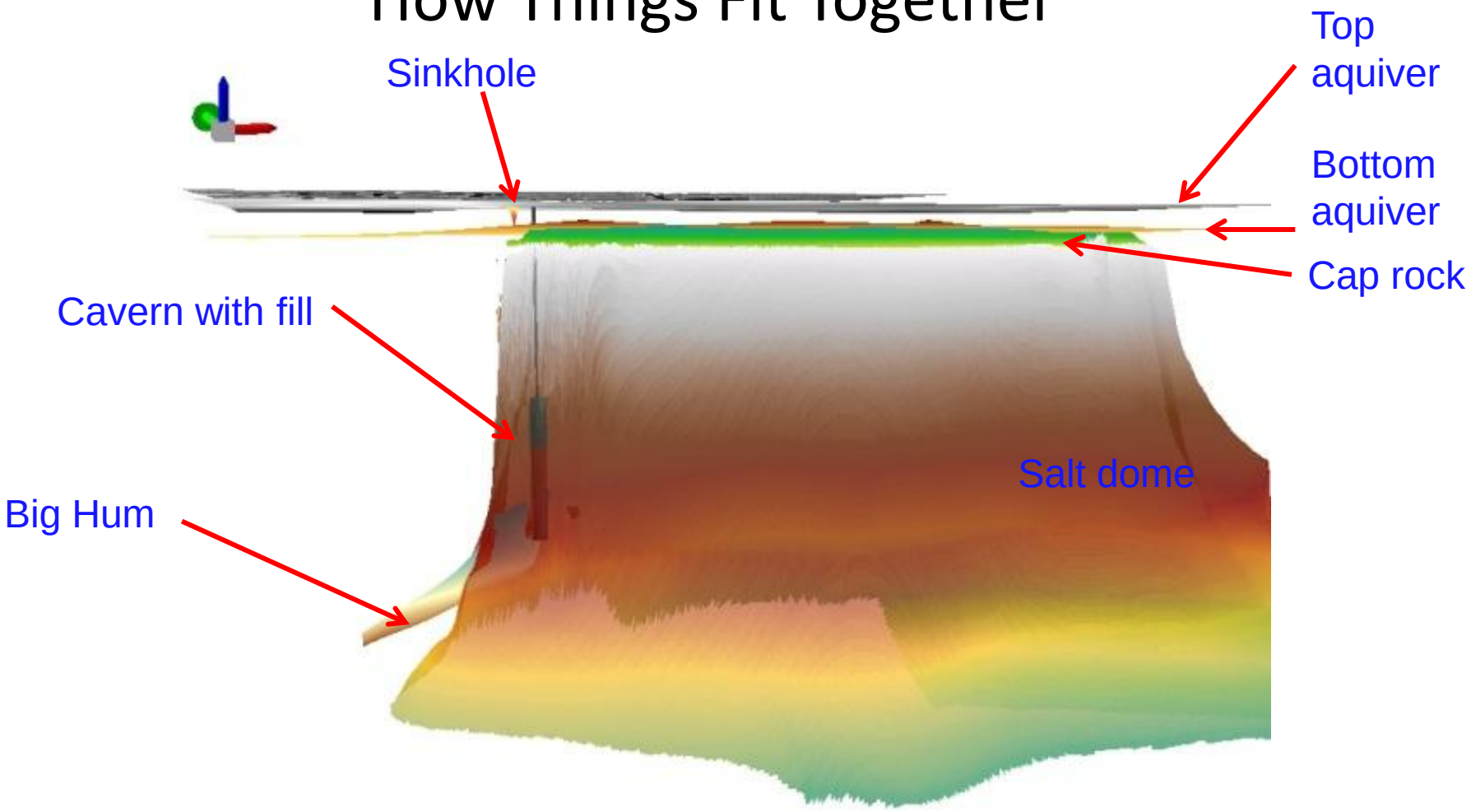


Top of Salt and Overhang

Now Includes Data from 2007 3D Seismic



Pre-collapse 3D Geologic Model
How Things Fit Together

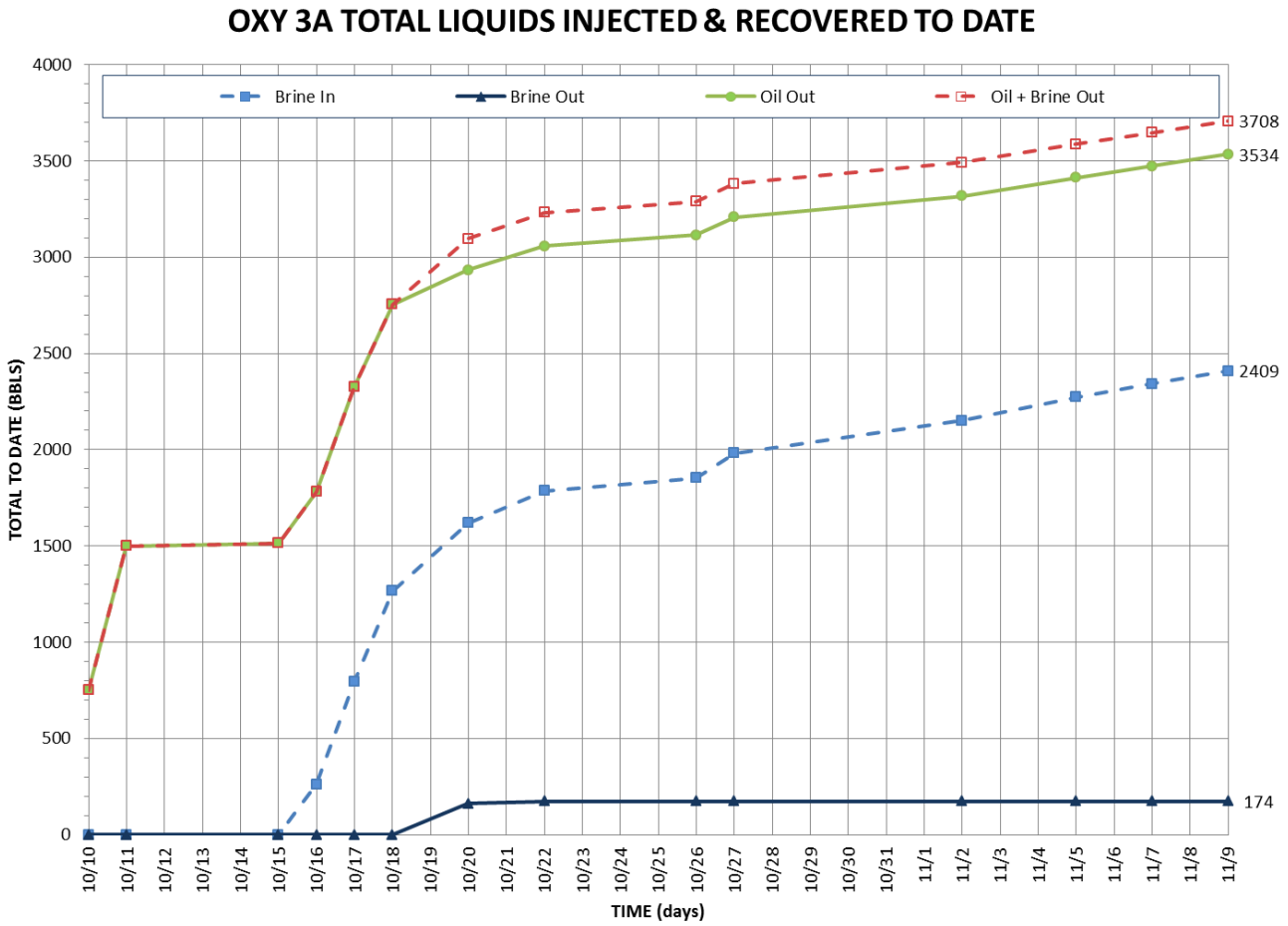


Pre-collapse

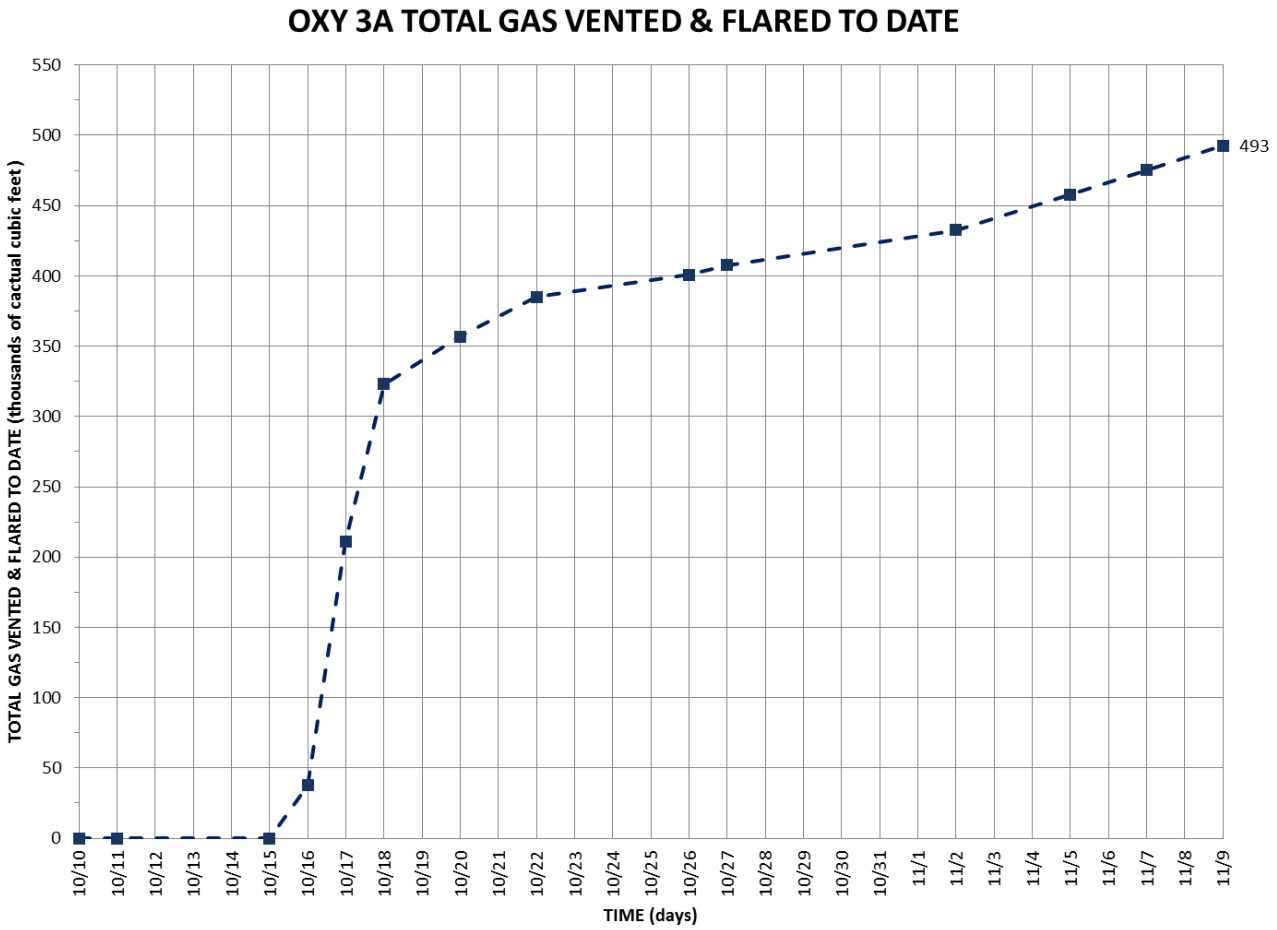
Looking north, no vertical exaggeration

Cavern Fluid Recovery

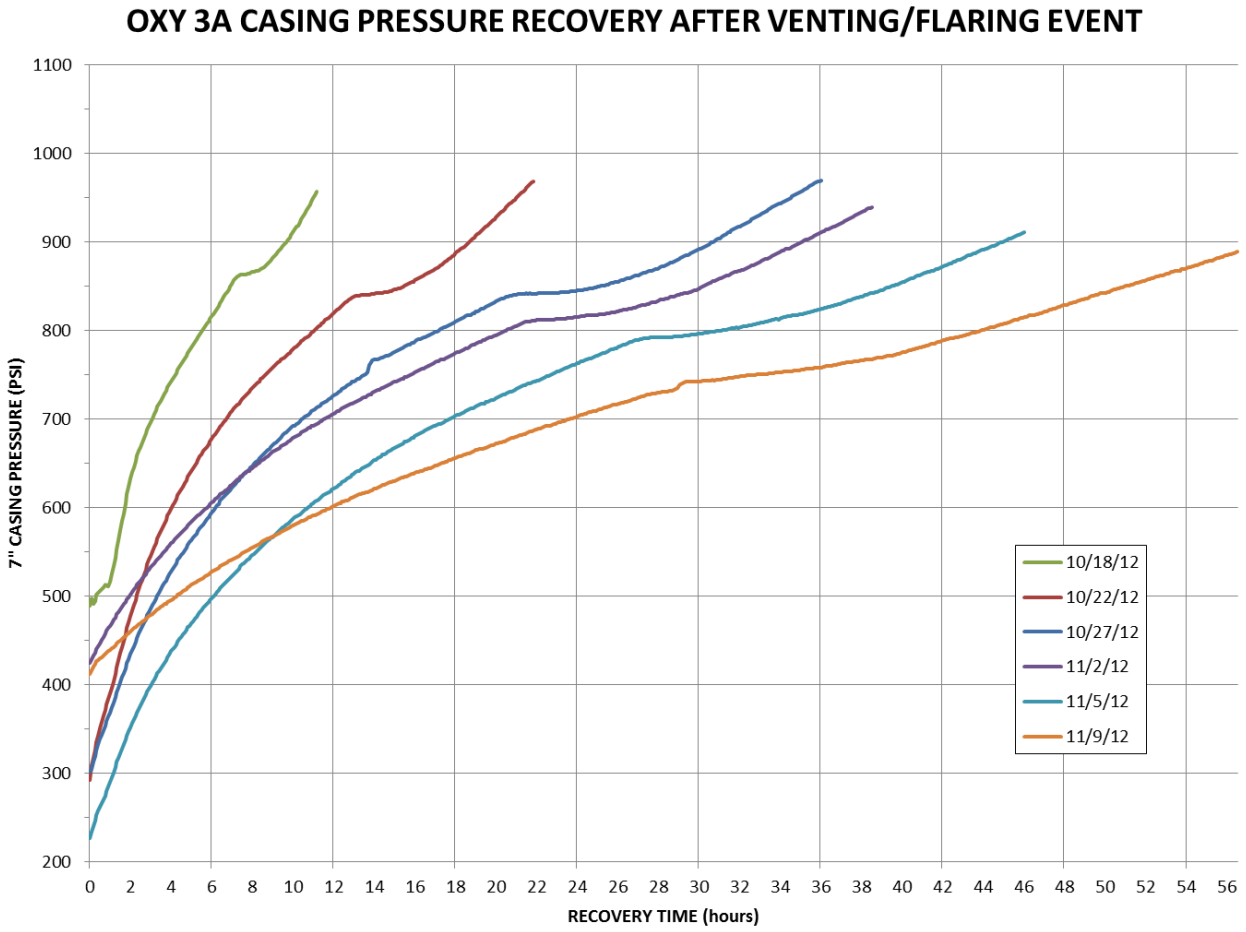
Data collected by Texas Brine and evaluated by Shaw



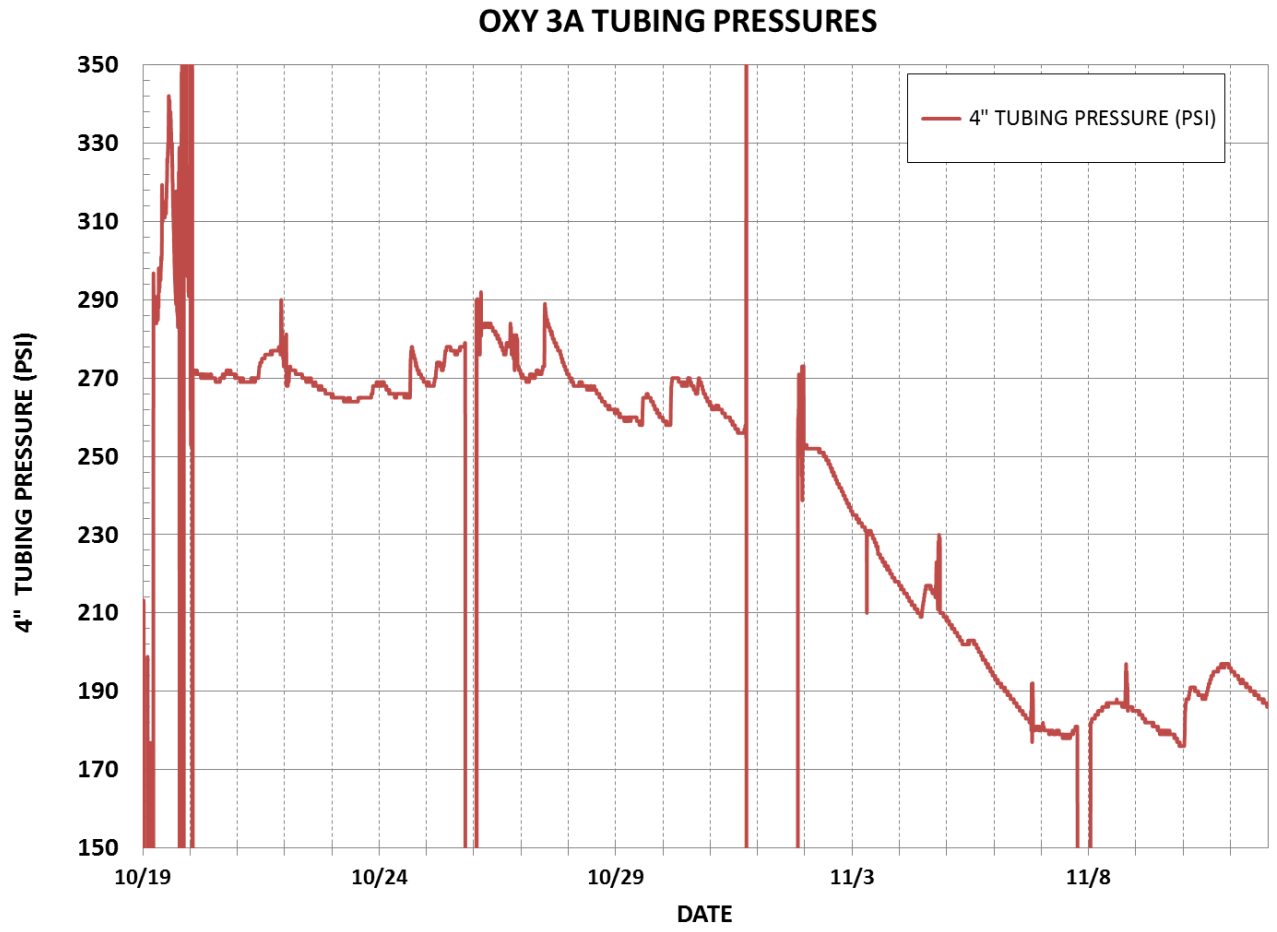
Cavern Gas Flared

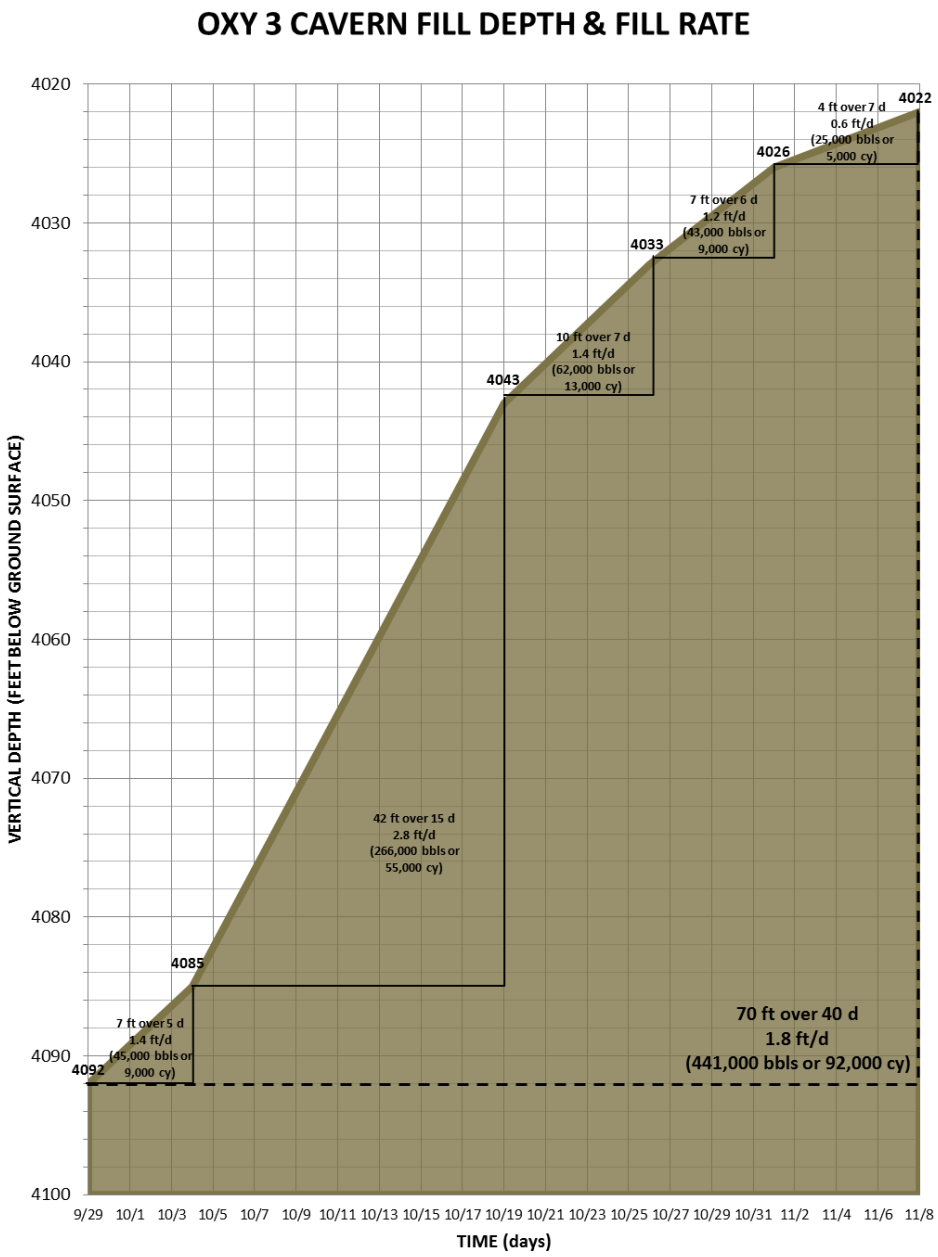


Cavern Gas Recovery Rate Slowing



Cavern Pressure Data Lower but No Substantial Concern





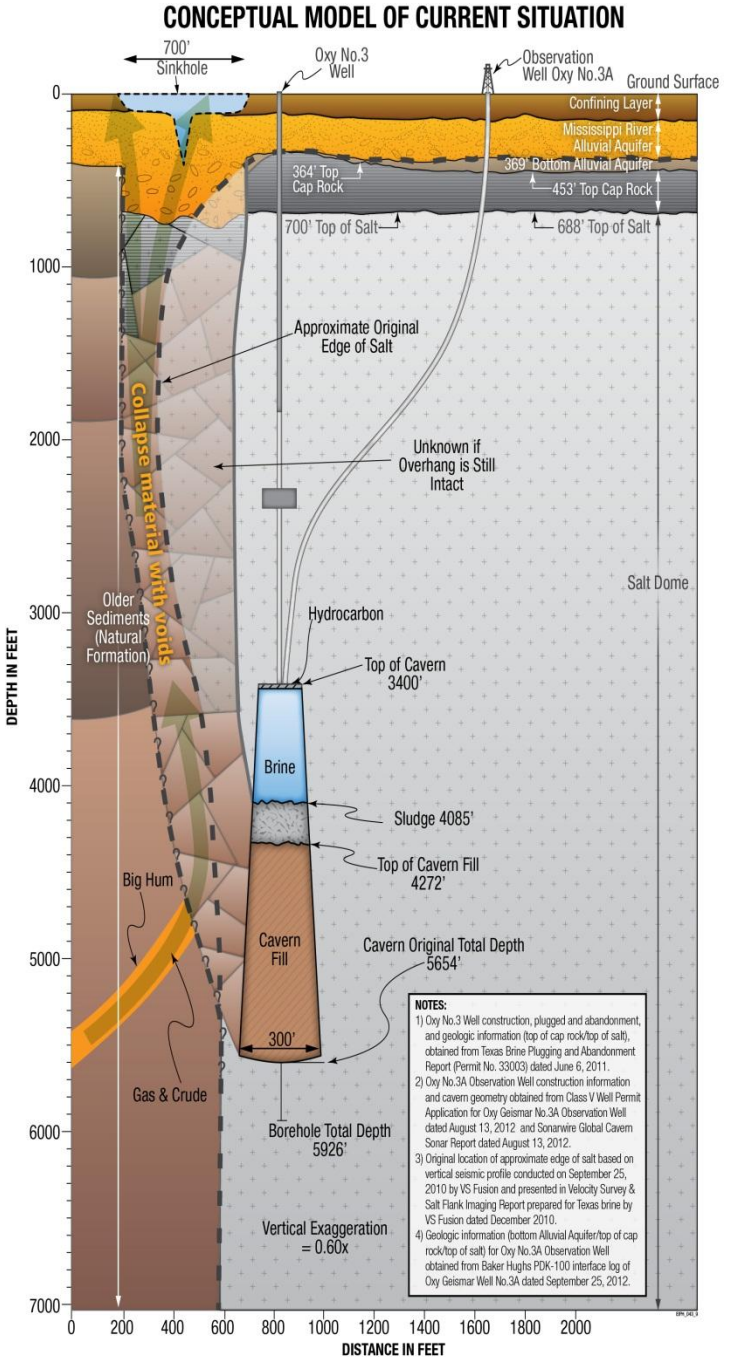
Cavern In-Filling Rate

- Vertical depths plotted (not measured depths)
- Rate of in-filling slowing
- Roof of cavern at 3400 vertical depth

Cavern Summary

- Hydrocarbon and gas inflow declining over time
- Cavern brine pressure stabilizing over time
- Cavern reaching stability
- Stability of collapse zone still uncertain

Stability of Collapse Zone and Future Gas Migration



Itasca Added to Shaw Team

- World-recognized experts in rock mechanics modeling and collapse stability analysis
- Evaluating the stability of the collapse zone using micro-seismicity data and rock mechanics modeling
- Addressing potential for large voids where gas potentially could accumulate

Stability Monitoring

- Cavern pressure, sinkhole water levels, subsidence in sinkhole area
- Monitoring for gas in community and vicinity of sinkhole
- Seismic monitoring system with real-time data analysis tied into alert system
- Seismic imaging of collapse zone to determine if large voids are present

Nov. 12, 2012 Compliance Order

- Homes
  - Ventilation improvements in unventilated, unoccupied, enclosed spaces
  - Gas monitors
- Install new vent wells
- Develop plan for mitigating problem over area
- Contain dissolved contamination from flowing to Bayou Corne

Ultimate Resolution of Methane Gas Problem

- Unprecedented problem
  - Complexity
  - Scope
- Vent well effectiveness being assessed
- Large area of gas accumulation
- Ongoing evaluations of viable options including reservoir size and geology
- Intercept Big Hum gas—very difficult
  - 200+ foot interval with multiple production horizons
  - Very difficult to determine gas production horizons
  - Other horizons may be flowing into collapse zone

Path Forward

- Getting people back home
  - Venting gas from aquifer
  - Need to have homes checked for gas accumulation
  - Ventilation of enclosed spaces
  - Methane monitors in homes
- Determining stability of collapse zone
  - Analysis of ongoing seismic events
  - Seismic imaging of collapse zone
  - Rock mechanics modeling

Questions?