



Status Update

Residents out of homes
347 days—11 months, 12 days

July 16, 2013
Napoleonville

07.02.2013 15:44



- 3D Seismic
- Updated conceptual model
- Oxy 3 cavern update
- Sinkhole changes
- Gas area and venting update
- CPT investigation
- Indoor air quality



Independent Interpretation of 3D Seismic Data

- Status
 - Preliminary analysis of the TBC processed data presented today
 - DNR reprocessing all of the 2013 3D seismic data, to be delivered by end of July 2013
 - Interpretation of reprocessed data end of August
- Preliminary Findings
 - Interpretation based on 3D seismic data *and* oil and gas well logs
 - Have determined that a **disturbed rock zone (DRZ) does exist** along western side of Napoleonville Salt Dome adjacent to Oxy 3 collapsed cavern;
 - Shape not like we have previously presented
 - Hourglass shape: Wide at bottom → Narrow near salt overhang → Wide at top
 - **Identified several probable and possible gas sands below MRAA**
 - Using conventional geologic data interpretation methods (**not** 3D seismic data) interpreted MRAA gas accumulation horizon and four shallow sand units where gas from MRAA can potentially accumulate
- Site conditions (sinkhole, cavern, gas) are still dynamic

- 3D seismic is **NOT** like and X-ray or MRI. ***3D seismic must be processed and integrated with other data to interpret the geology***
- 3D seismic generated over 6 million records that have to be processed and interpreted using very complicated mathematical computer programs to understand geology
- TBC cited concerns over confidentiality of 3D seismic data which led to delay in data being sent to DNR.
- Don Marlin has been working on the reinterpretation of the TBC processed data since he received it.
- Given the unique and very complex nature of the geology surrounding Oxy 3 cavern , detailed seismic data analysis required to generate viable results of current conditions
- Because more refined and sophisticated processing techniques are available, DNR is reprocessing the raw seismic data with these methods to give a more certain picture of the geology down to 8,000 feet. Results by end July.

Interpretation of TBC 3D Seismic Data by Marlin

1. Evaluation of sinkhole

A cone of disturbance to ~ 1200' is interpreted below the sinkhole on March data

2. Definition of edge of salt over time

Salt in basically the same position as 2007, but higher resolution March 2013

3. Structural overview—faults near Oxy 3 cavern

Observed faults commonly found in vicinity of Louisiana / Gulf Coast salt domes

4. Evaluation of what was believed to be Big Hum horizon

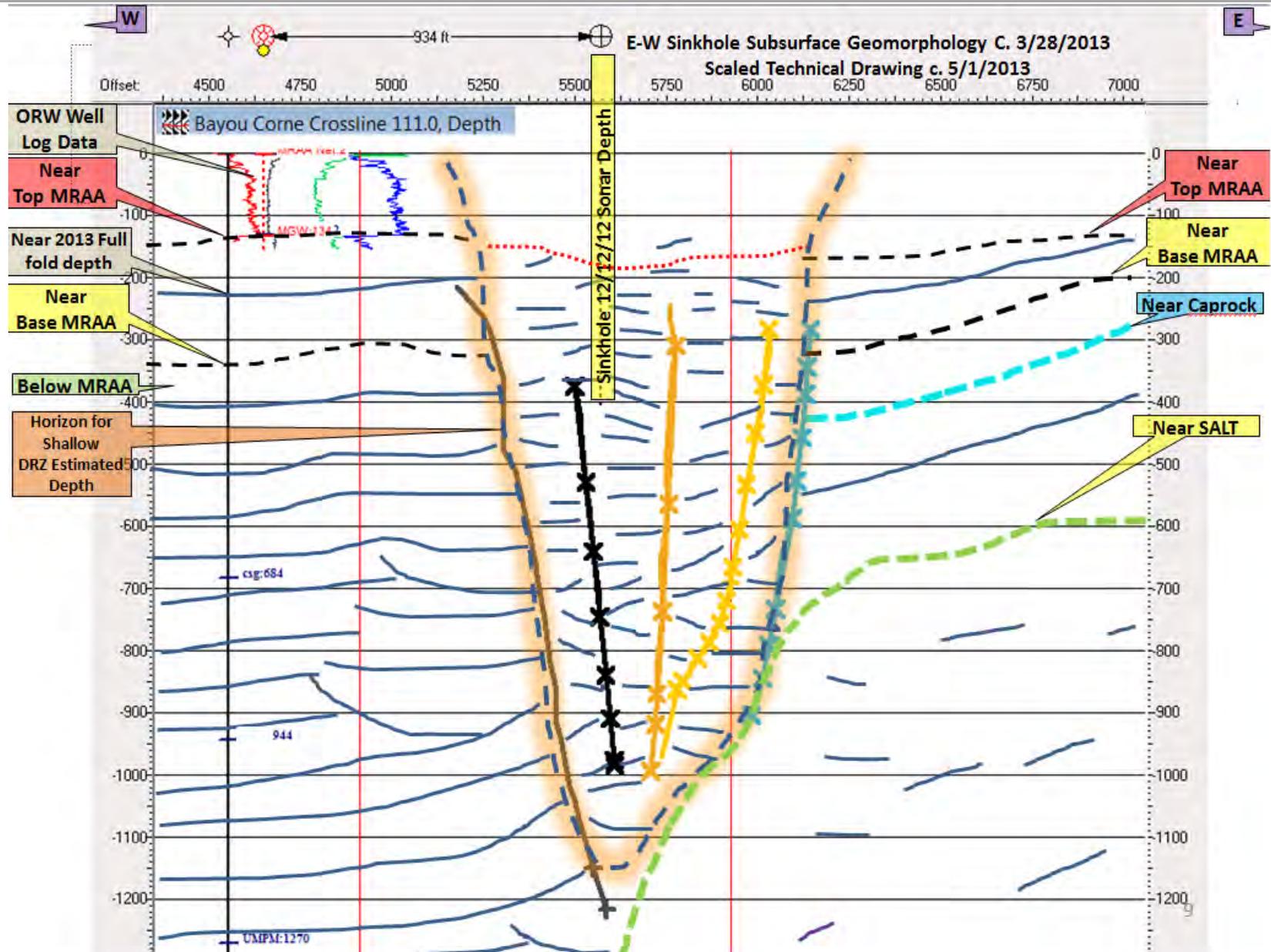
Synthetic model suggests event was from base of calcareous zone

5. Identification of probable and possible horizons that, as of March 2013, may be contributing gas to the surface through a possible DRZ “hourglass”

We know gas is liberating upward through 1 of 3 forms of a DRZ via a sidewall breach.

6. Path forward for interpretation of reprocessed 3D seismic data

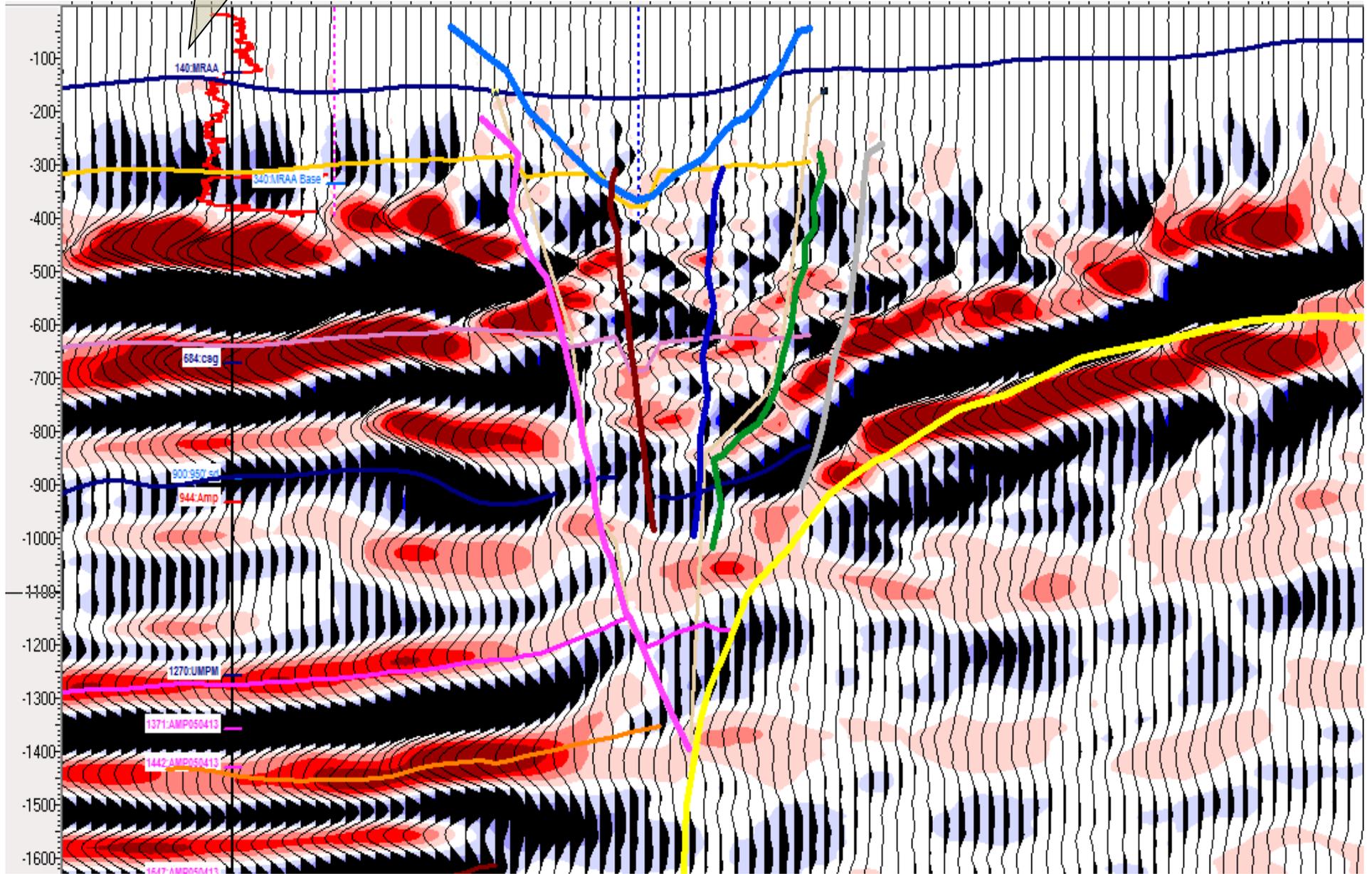
1. 05/01/2013 Upper DRZ "Cone of Disturbance"



7/17/2013

Upper Disturbed Rock Zone (DRZ) Seismic Display

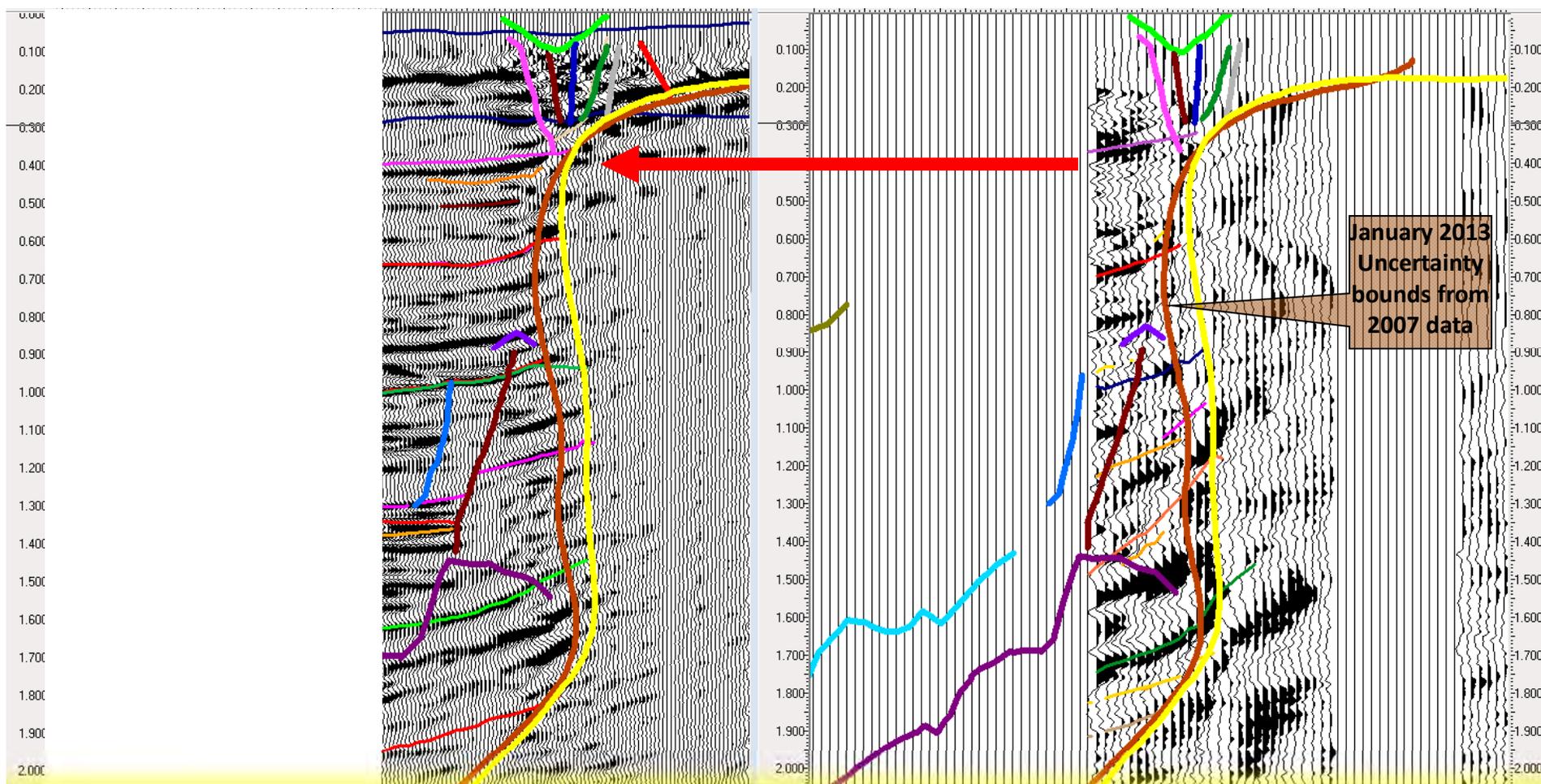
Top MRAA / Aquitard:
Requires PDK logs to map accurately



2. EDGE OF SALT 2013 VERSUS 2007

3. CRESTAL AND RADIAL FAULTS COMMON TO OTHER GULF COAST DOMES

2013 TBC filtered and scaled migration versus 2007 3D "Far offset" traces (~near-mid volume)



SALT IN SIMILAR POSITION BUT BETTER RESOLUTION IN 2013; UNCERTAINTY REDUCED

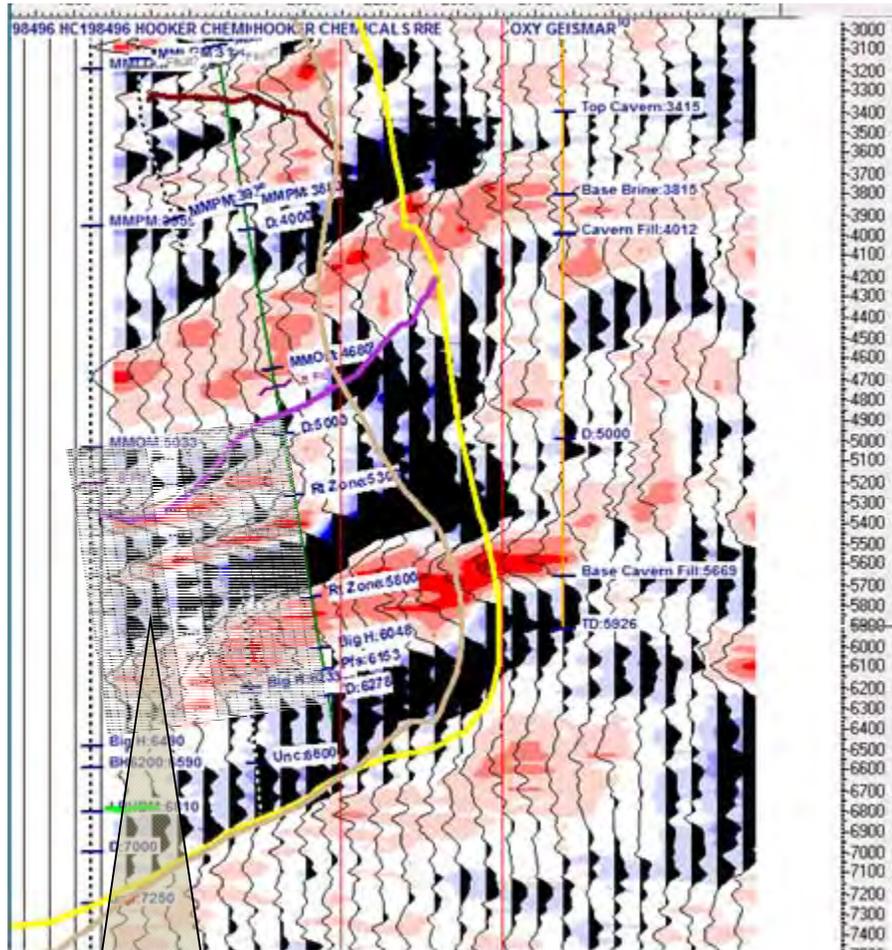
SURFACE GAS SOURCES REVISED WITH 2013 DATA

7/17/2013

Gas presence in 2007 not conclusive with 1/3 sqmi DNR subset

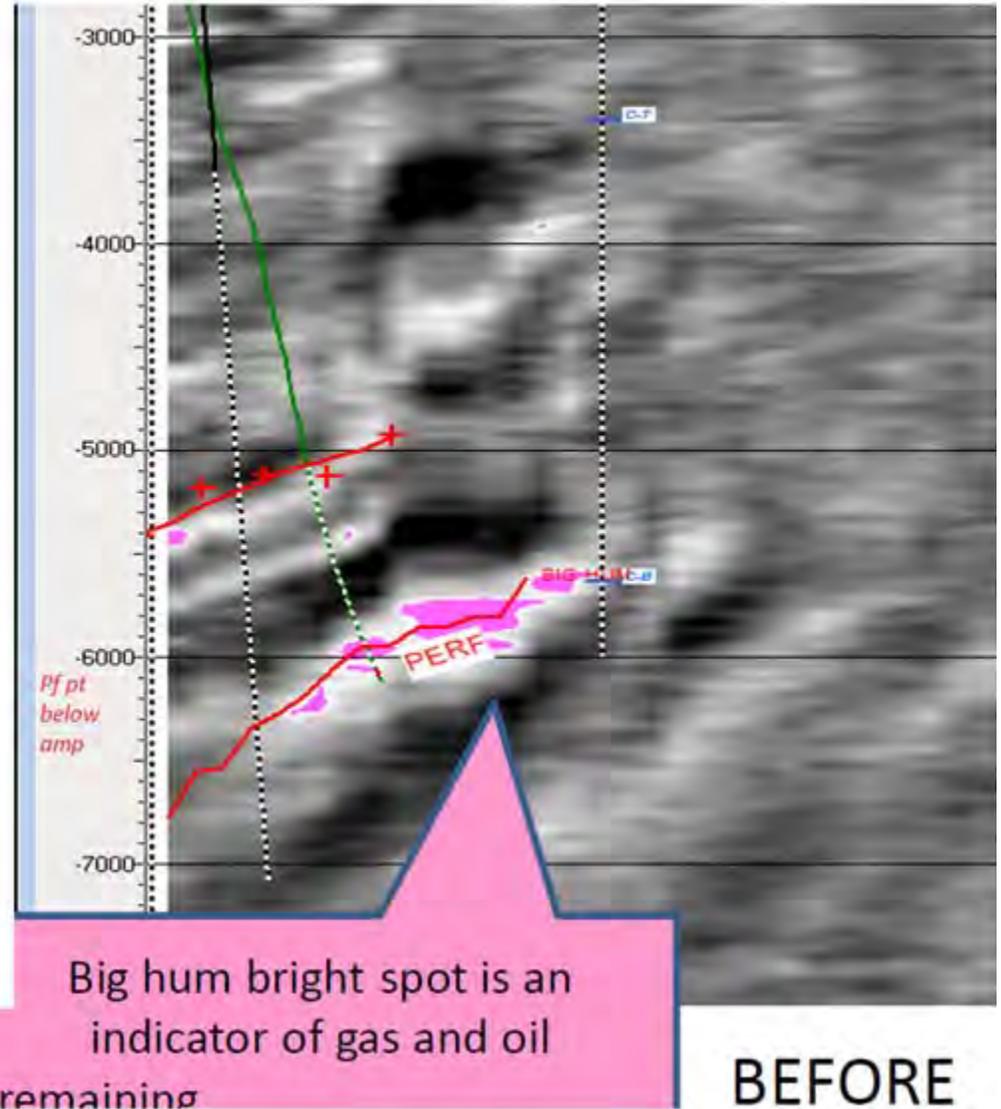
4. Bigenerina humblei zone “Big Hum” – not a hydrocarbon culprit

Arbitrary Line A, AmplitudesDepth "Far offset trace" subset 2007



Mapped the event overlying the perforations = resistive carbonates base

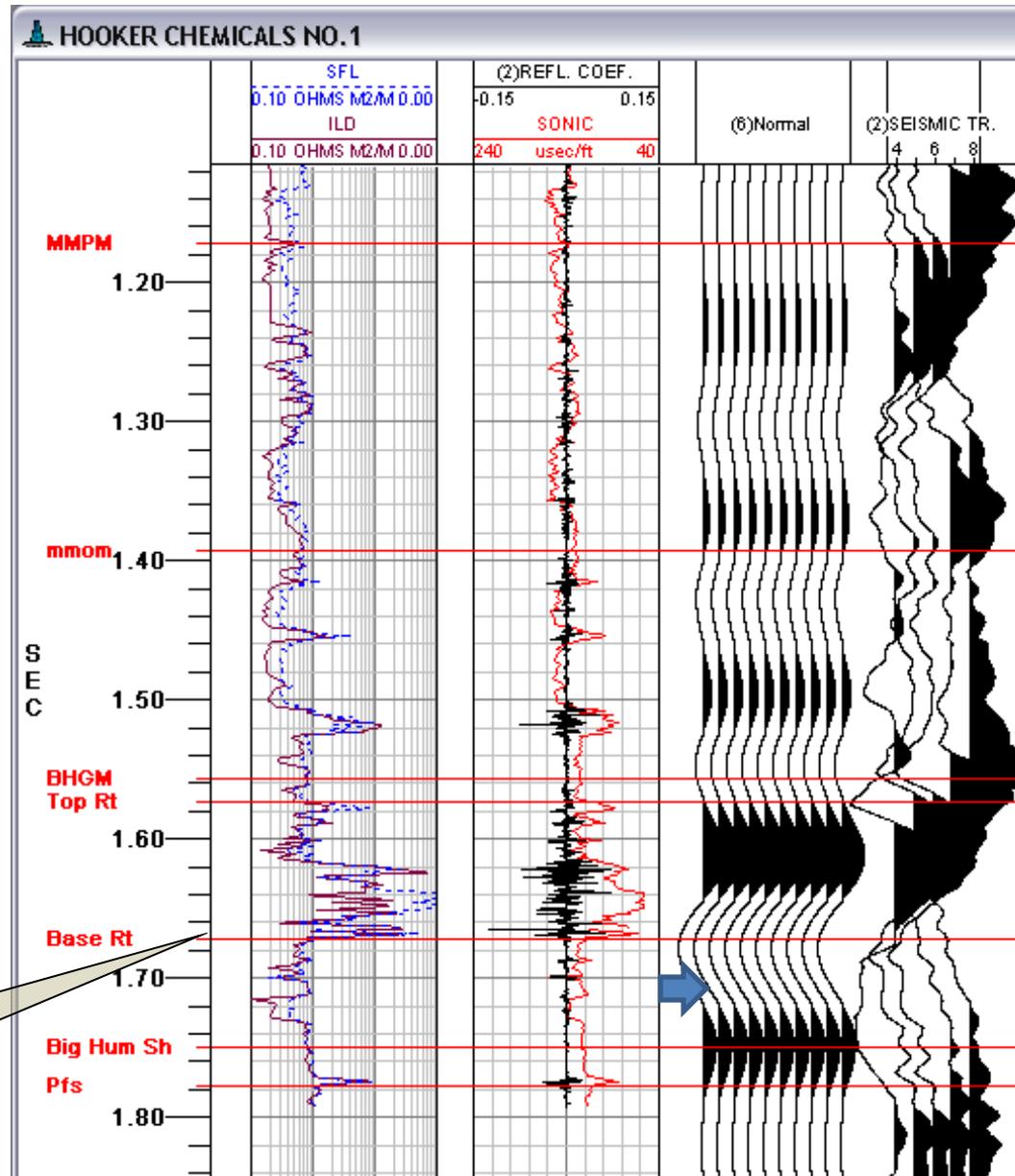
TBC Summary of Key findings
4/20/2013 page 14 of 17.



7/17/2013

What we thought was Big Hum appears to really be a carbonate layer (oyster shells)

4. *Bigenerina humblei* zone “Big Hum” – not a hydrocarbon culprit



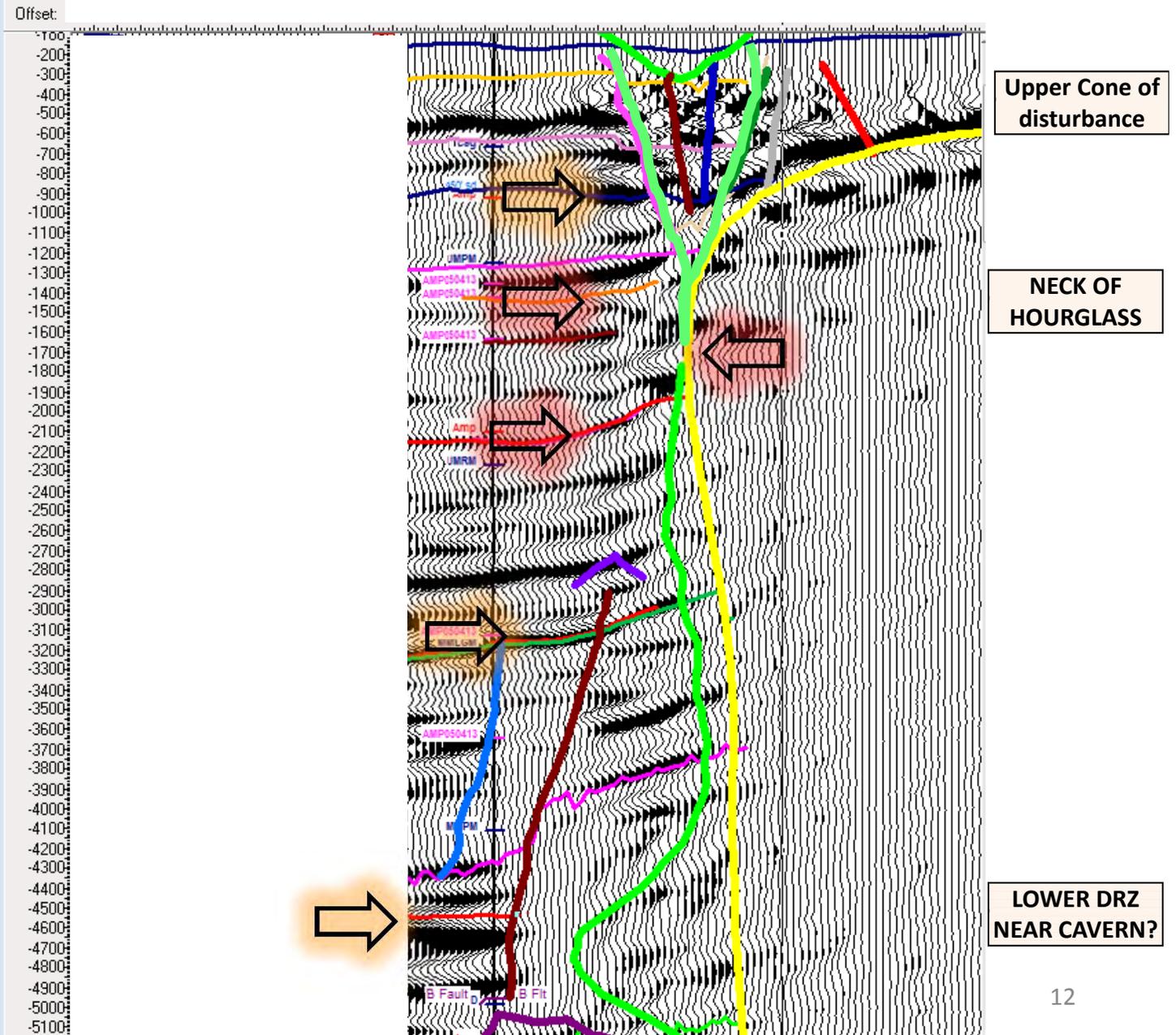
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7/17/2013

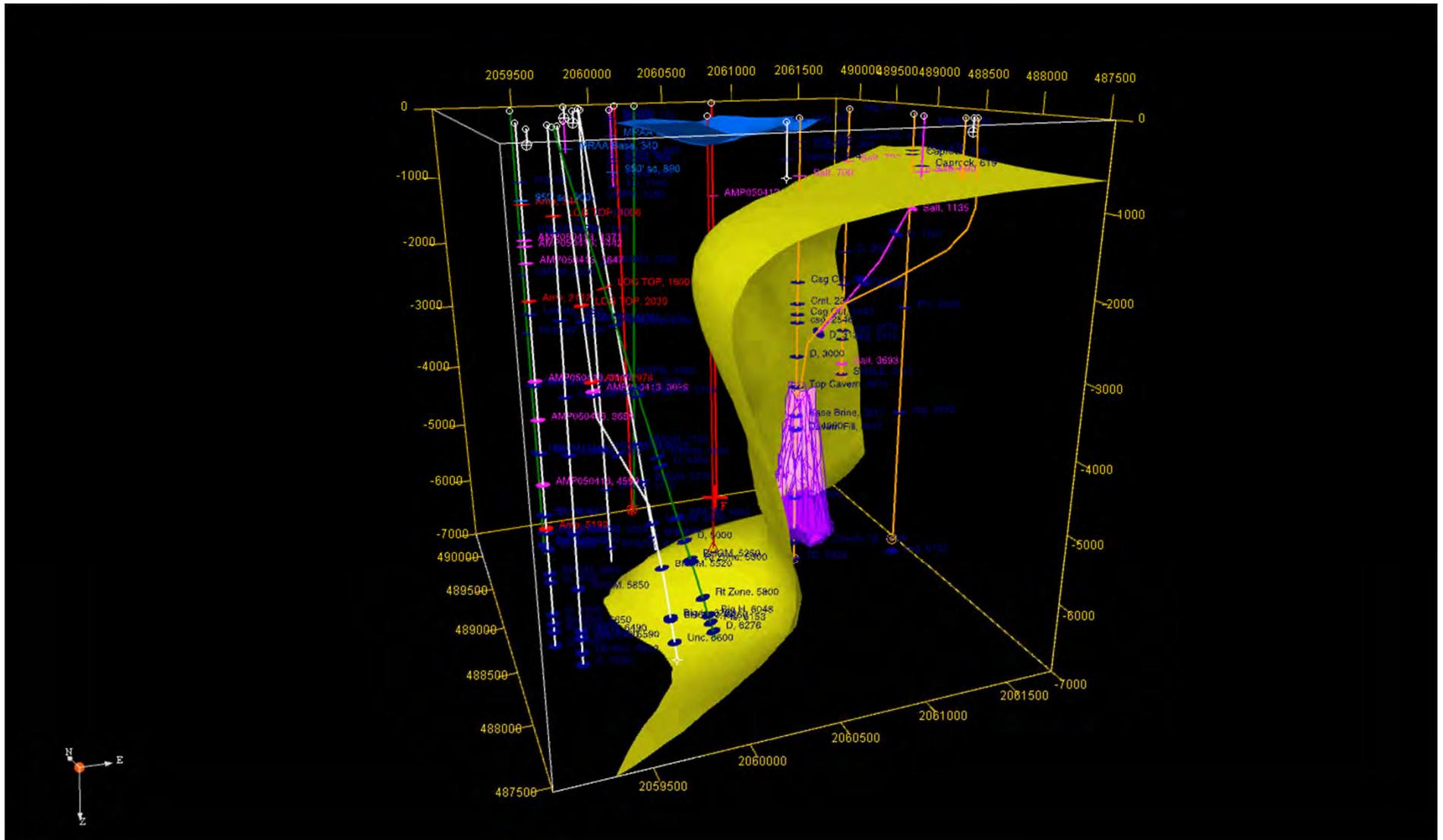
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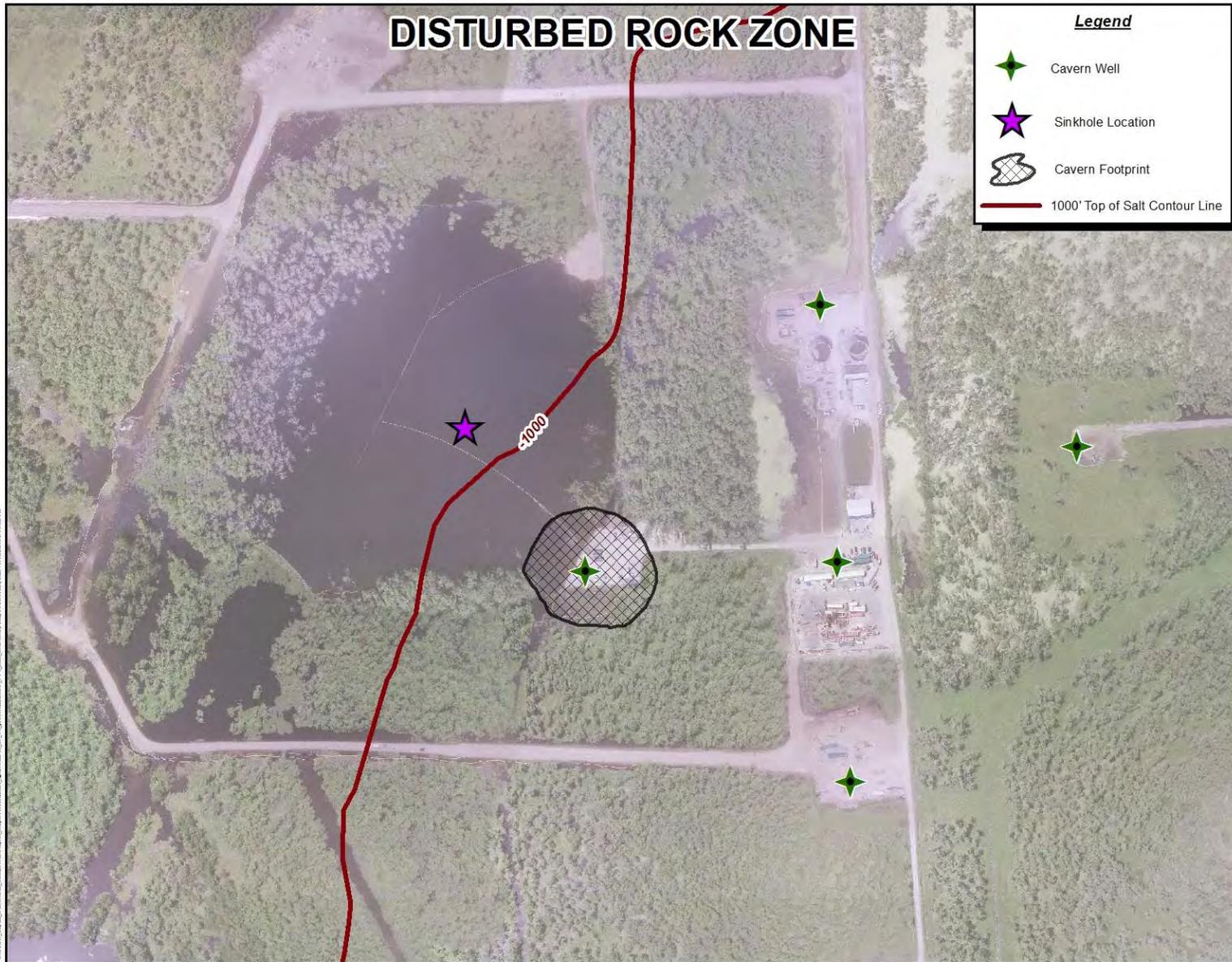
5. Probable and Possible Gas Source Horizons versus the DRZ (March 2013)

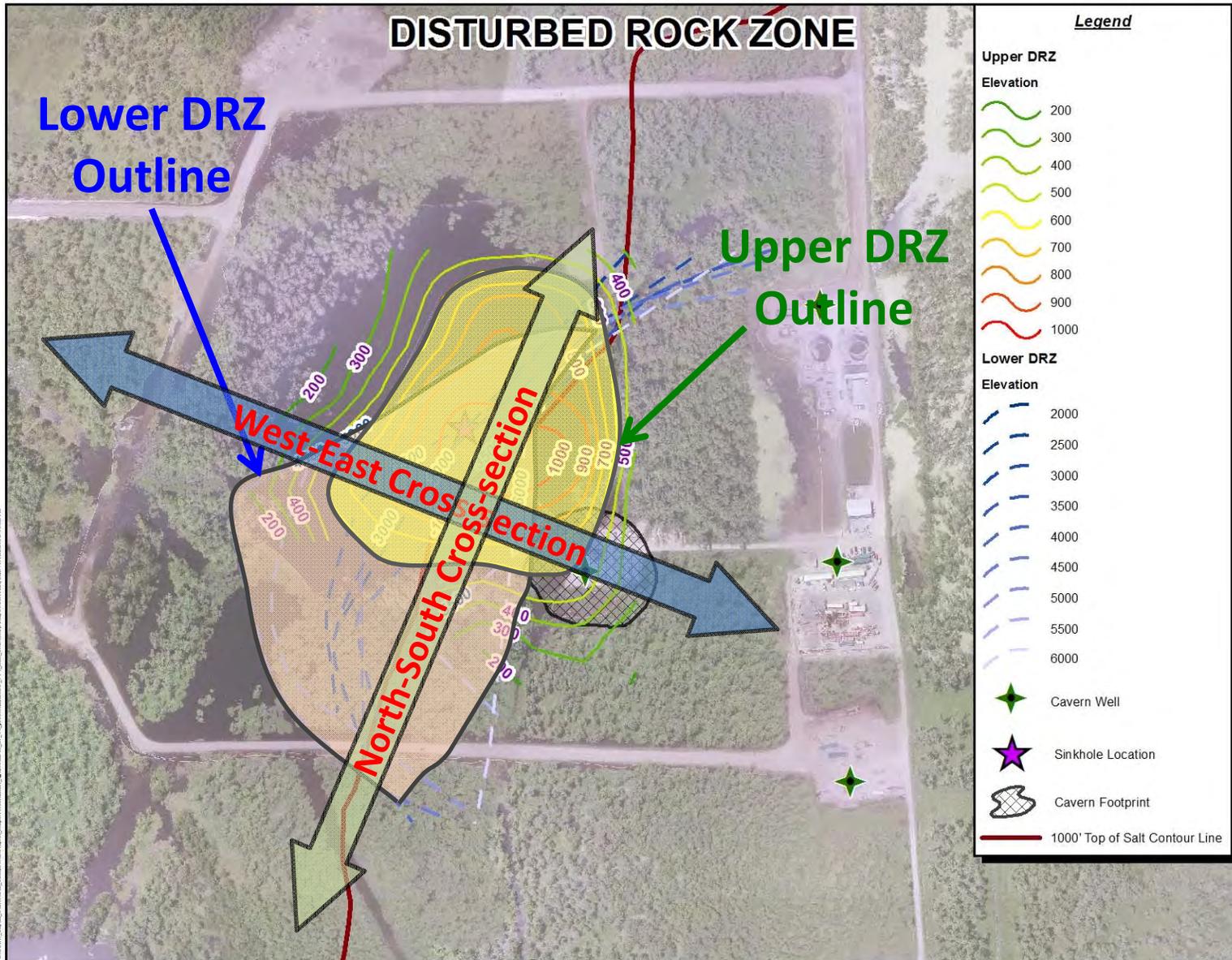
Red: Probable
Orange: Possible
Yellow: Salt
Light Green:
 Possible DRZ in
 uncertainty area

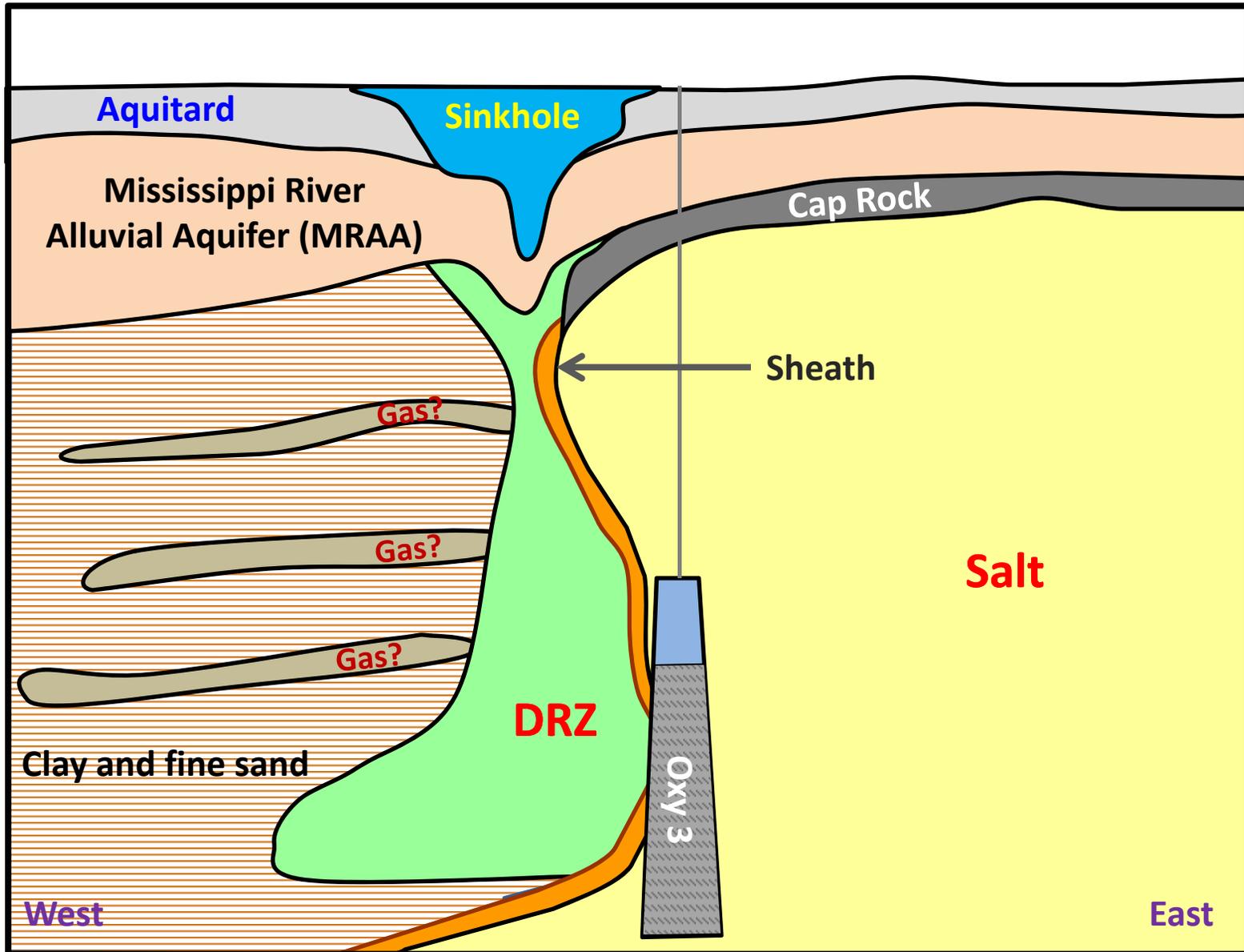


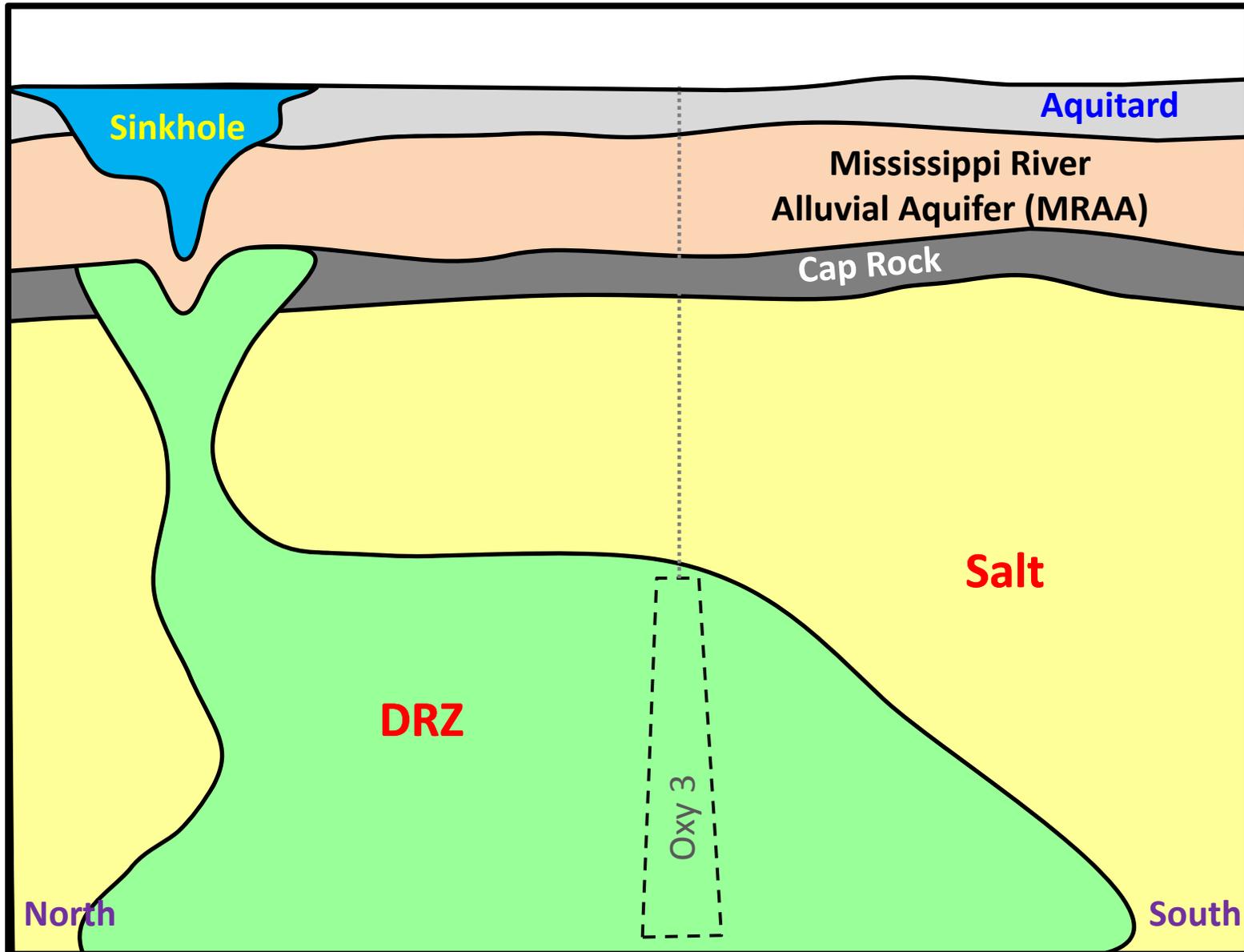
Three-dimensional video of TBC data interpretation

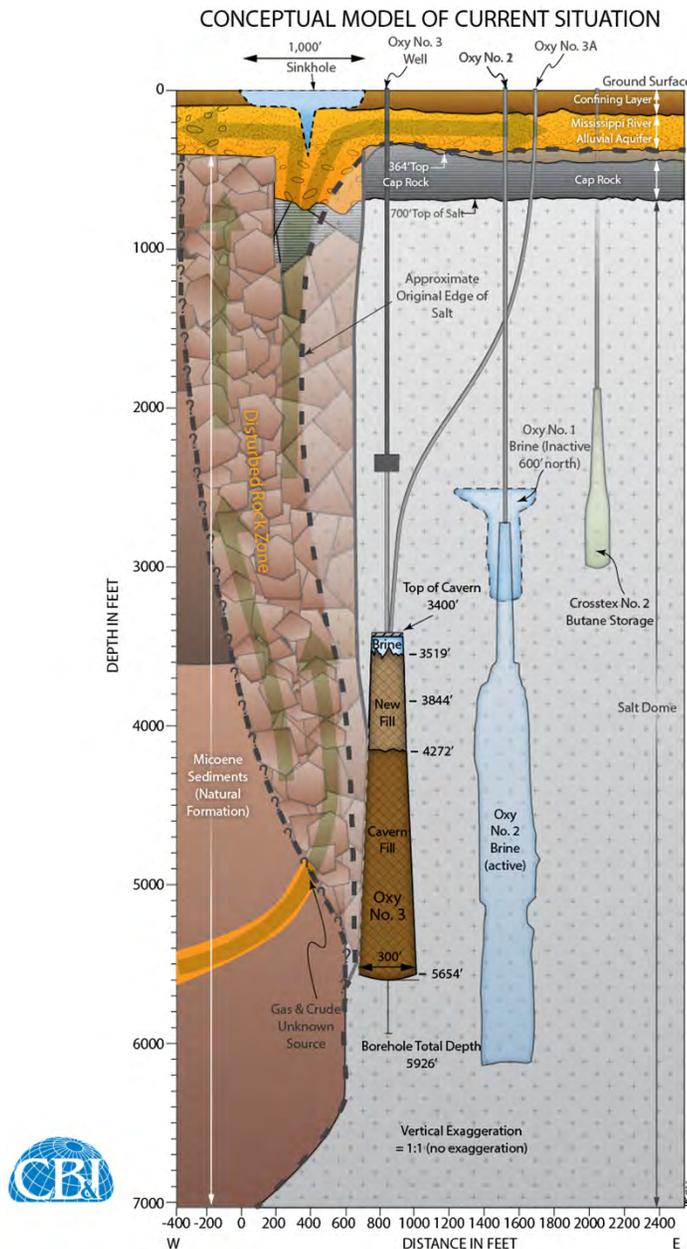




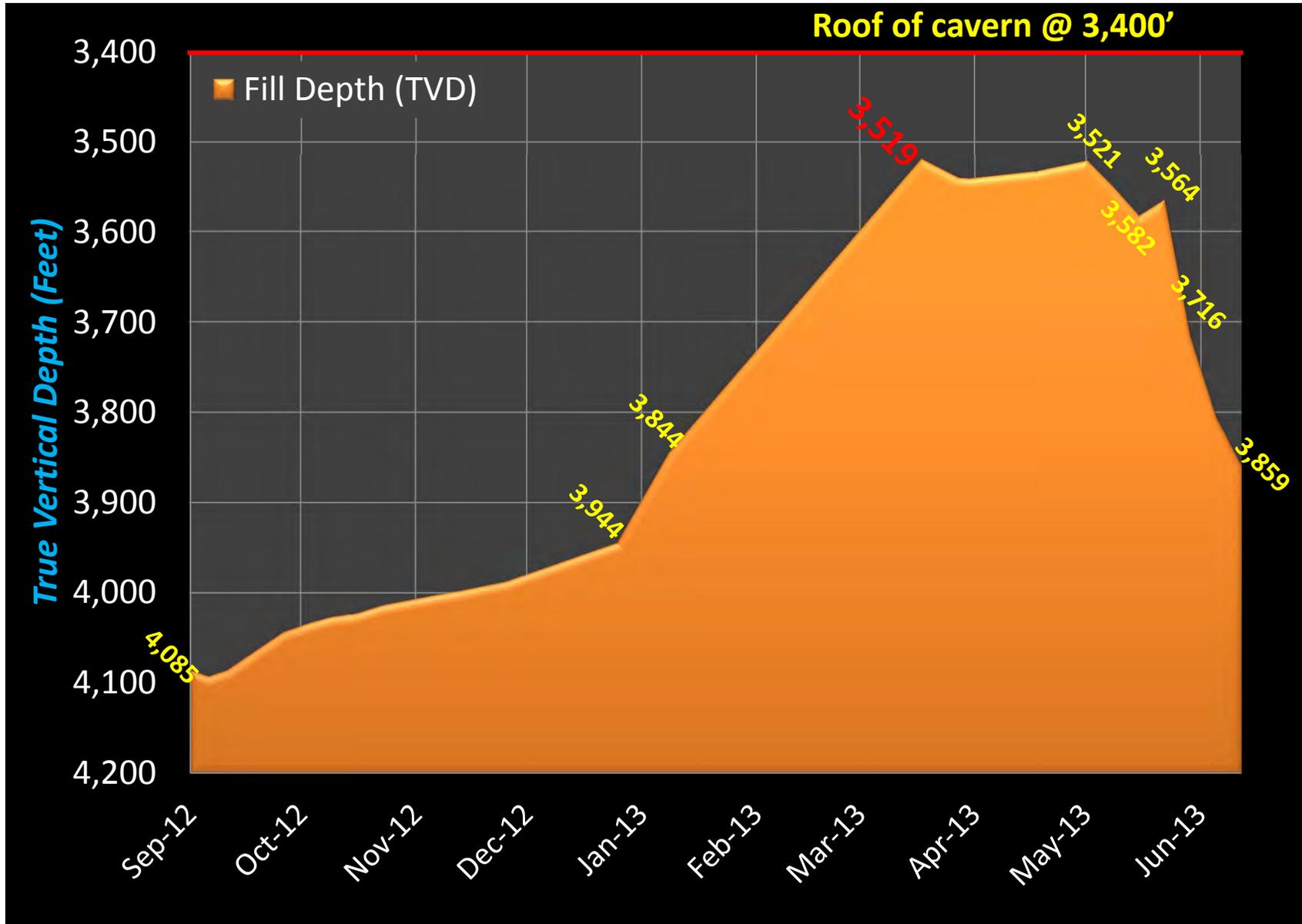








- Cavern bottom tags show fluctuations of several hundred feet
- BRC experts working on what may be causing cavern bottom to fluctuate—no obvious explanation at present
- Multiple sinkhole burp events reflected in cavern pressures and MRAA
- Cavern pressures have increased to around 600 psi

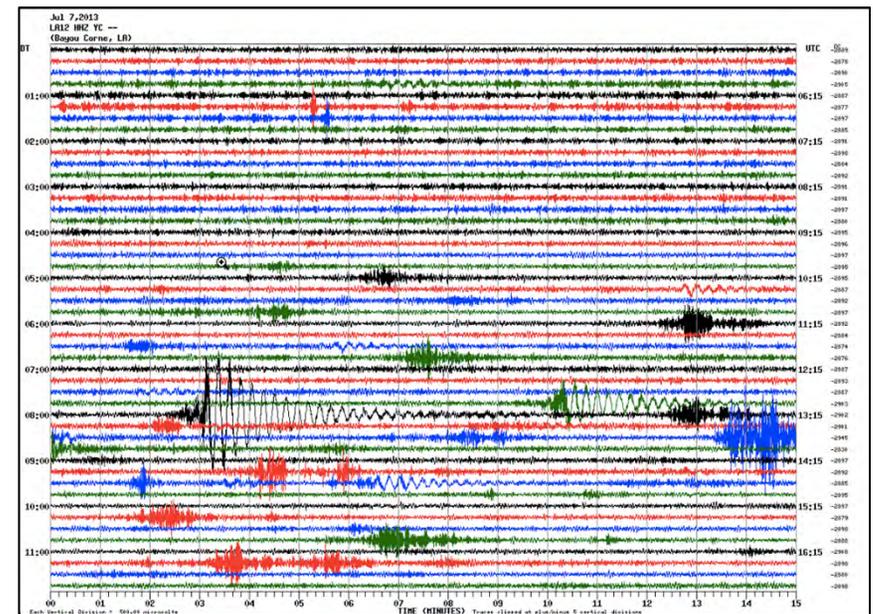
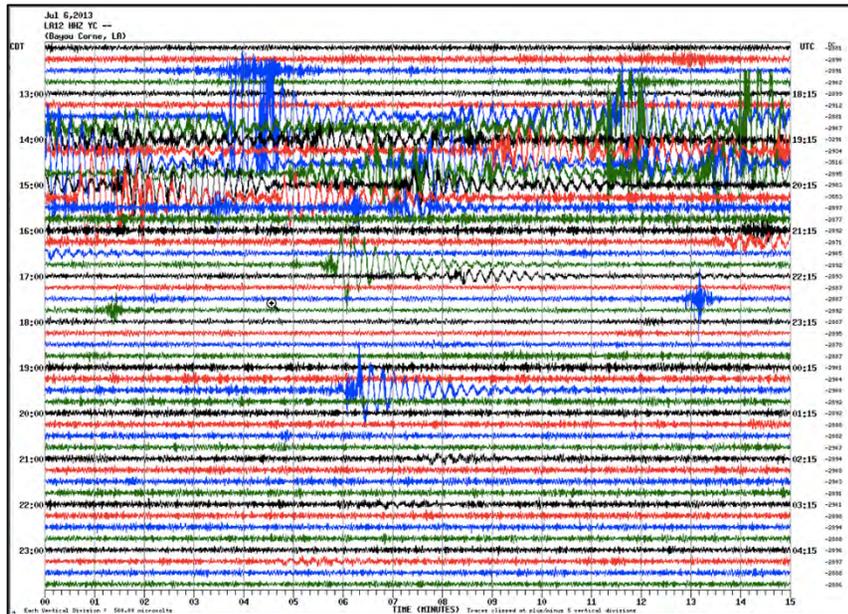




July 6-7, 2013 Seismic Events—LA12 Station

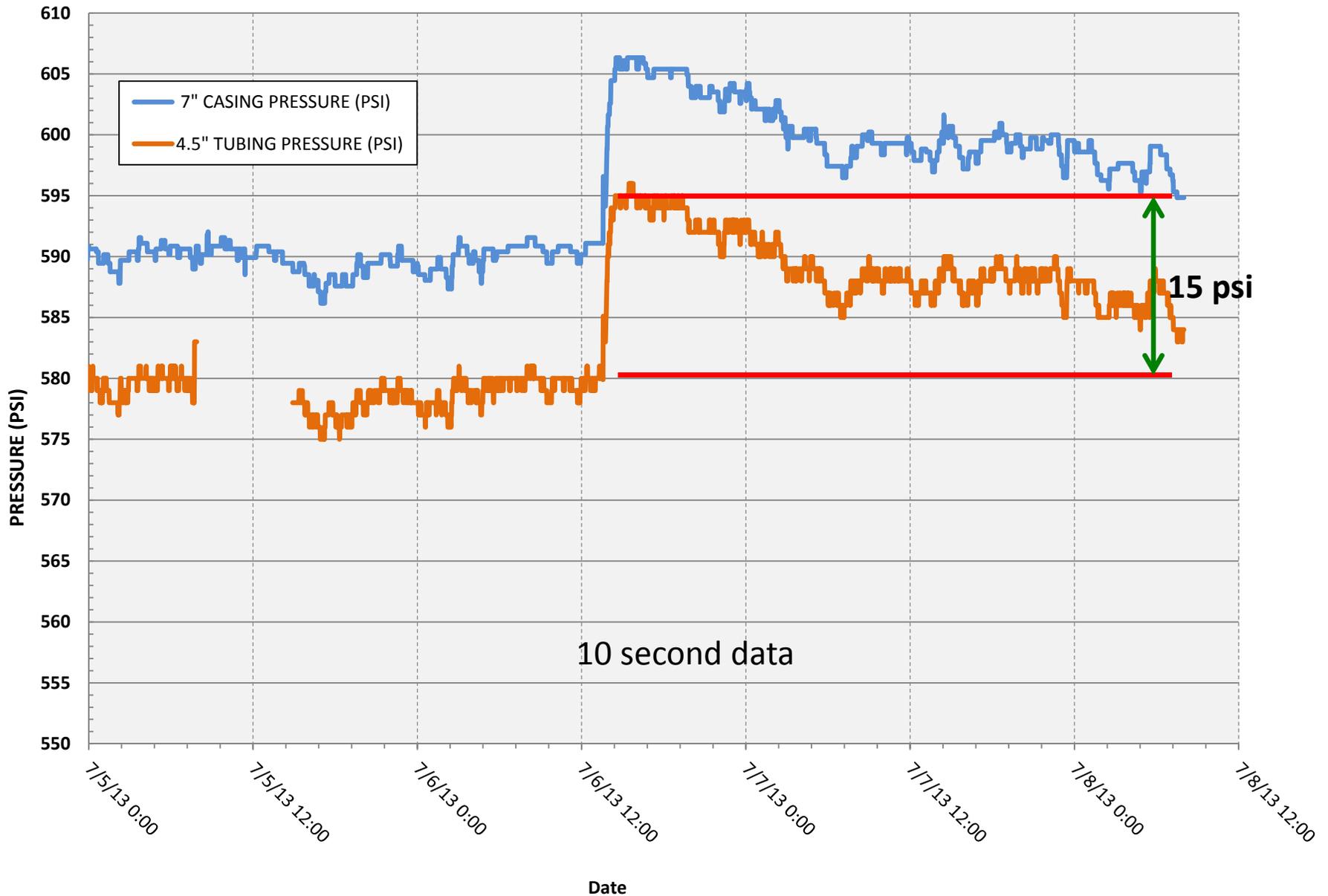
July 6, 2012

July 7, 2013





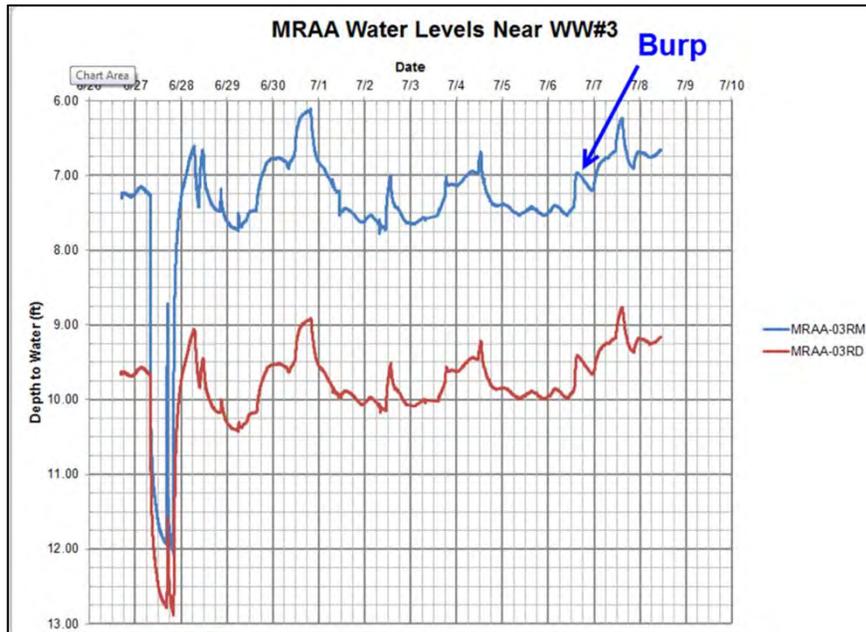
OXY 3 CAVERN PRESSURE - JULY 6, 2013 BURP EVENT



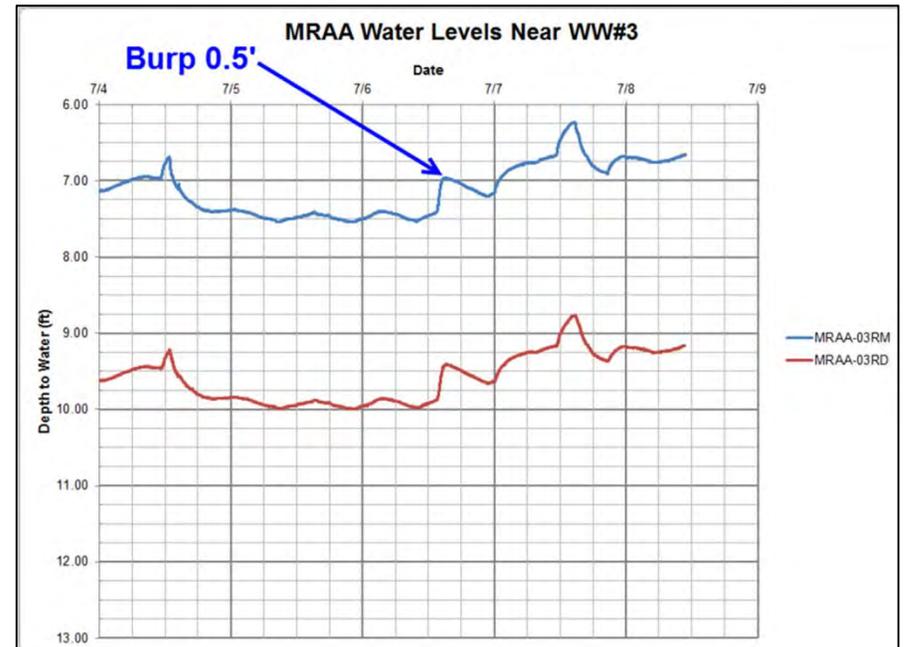


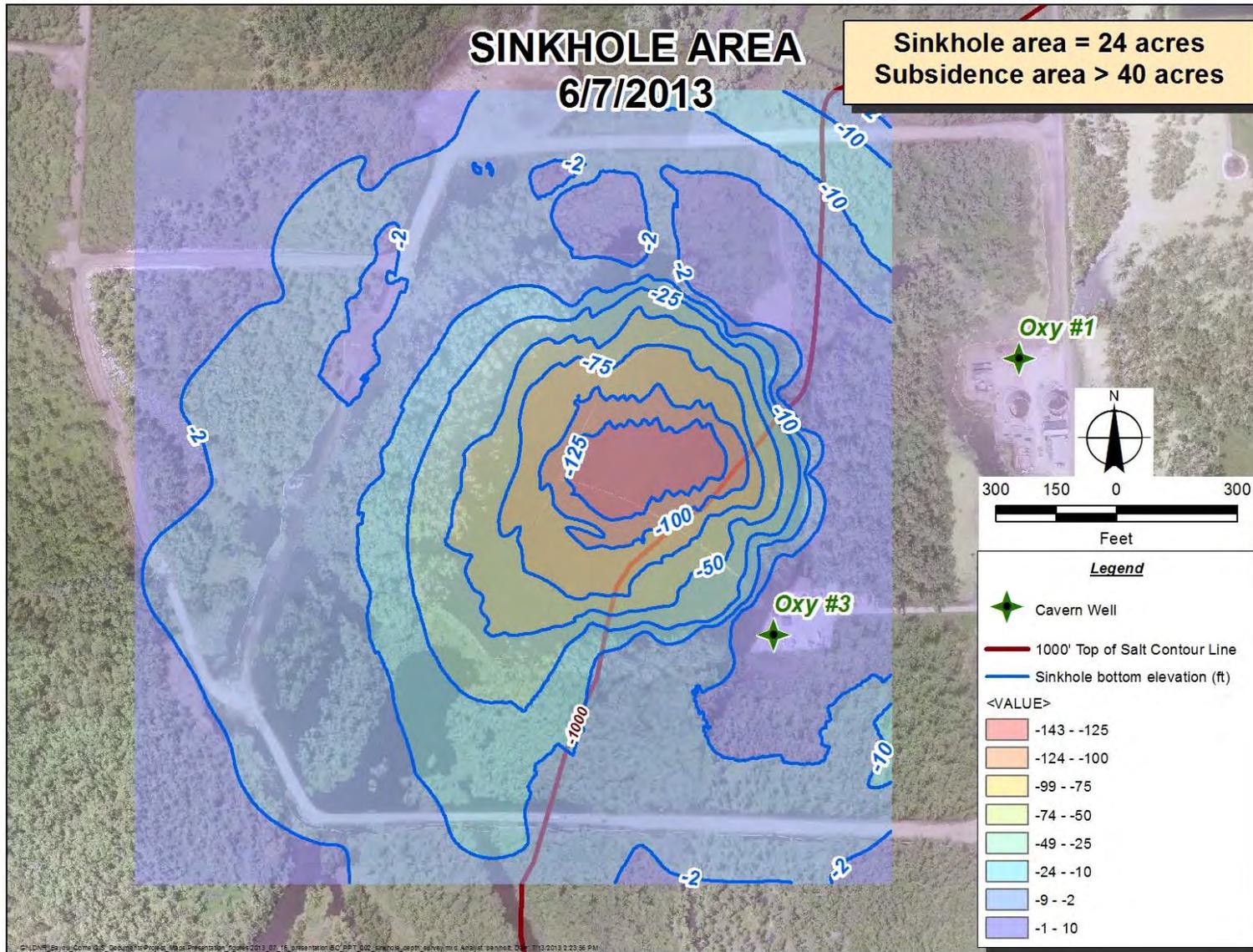
MRAA Water Levels Near WW#3 During Burp Event

MRAA Well Hydrographs



Details of Saturday 7/6/13 Burp

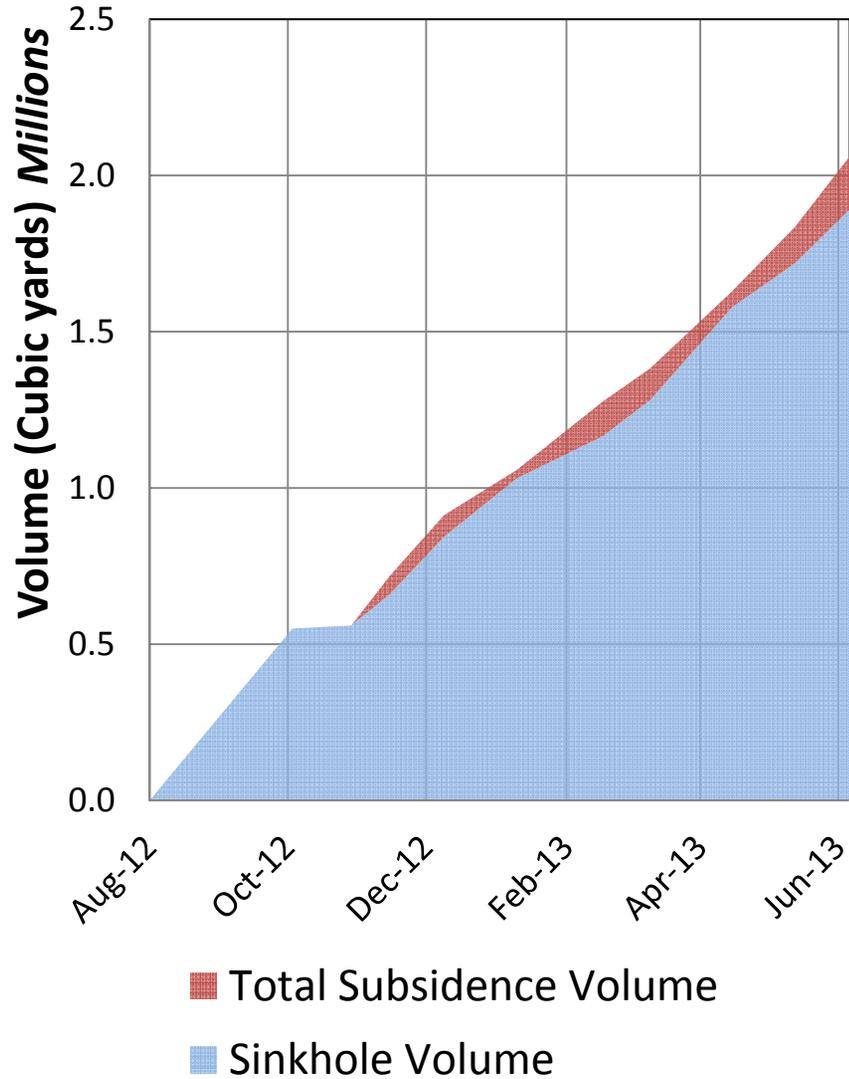




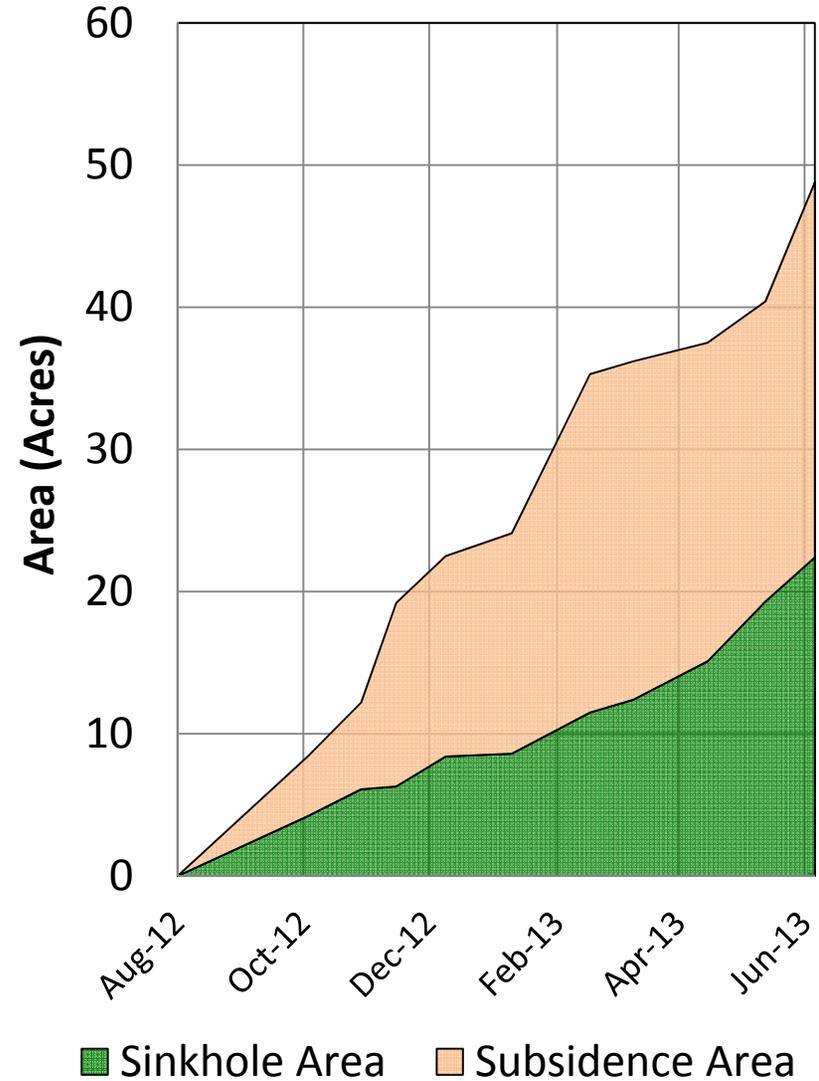


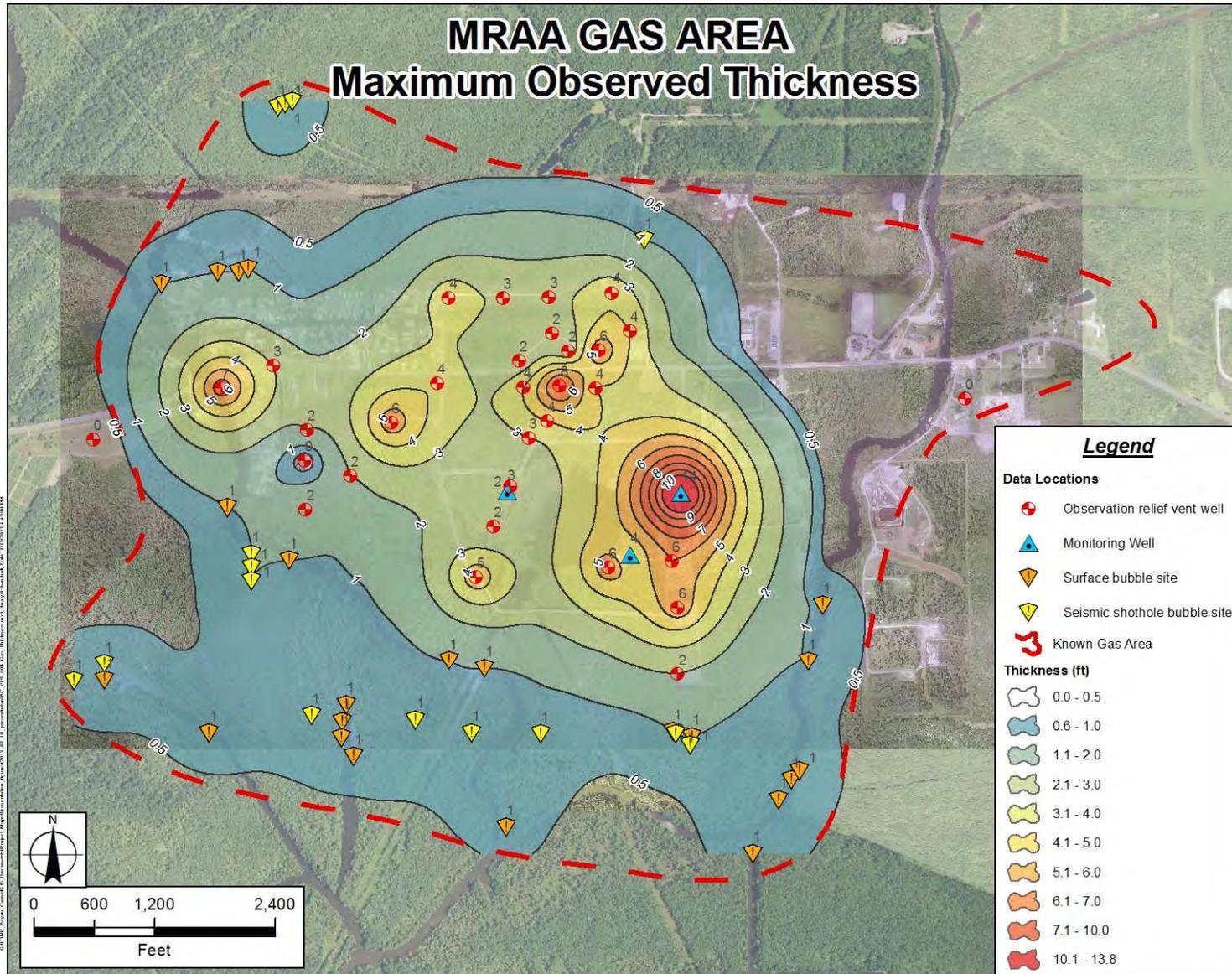
Sinkhole & Subsidence Area Volume and Area

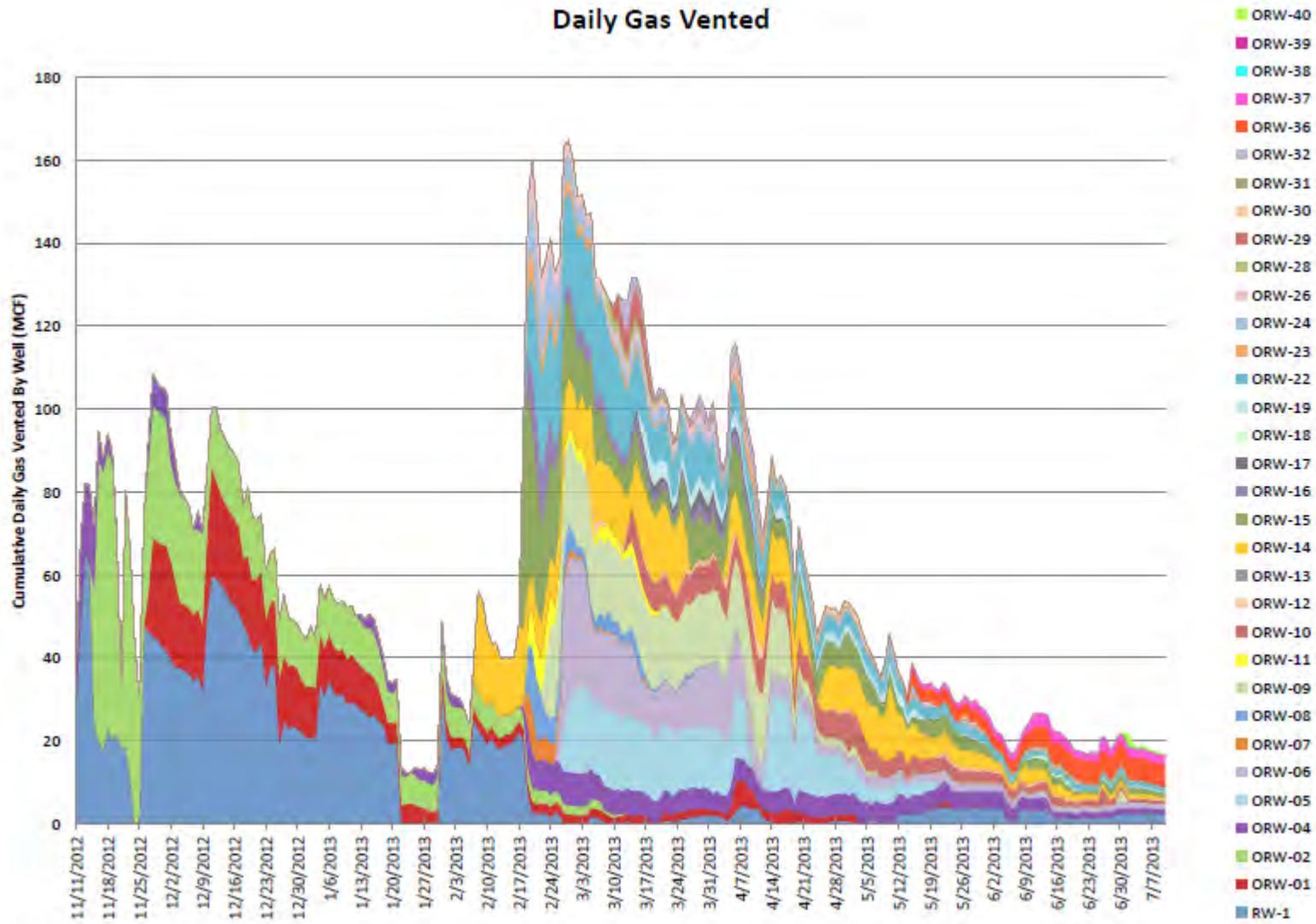
Volume

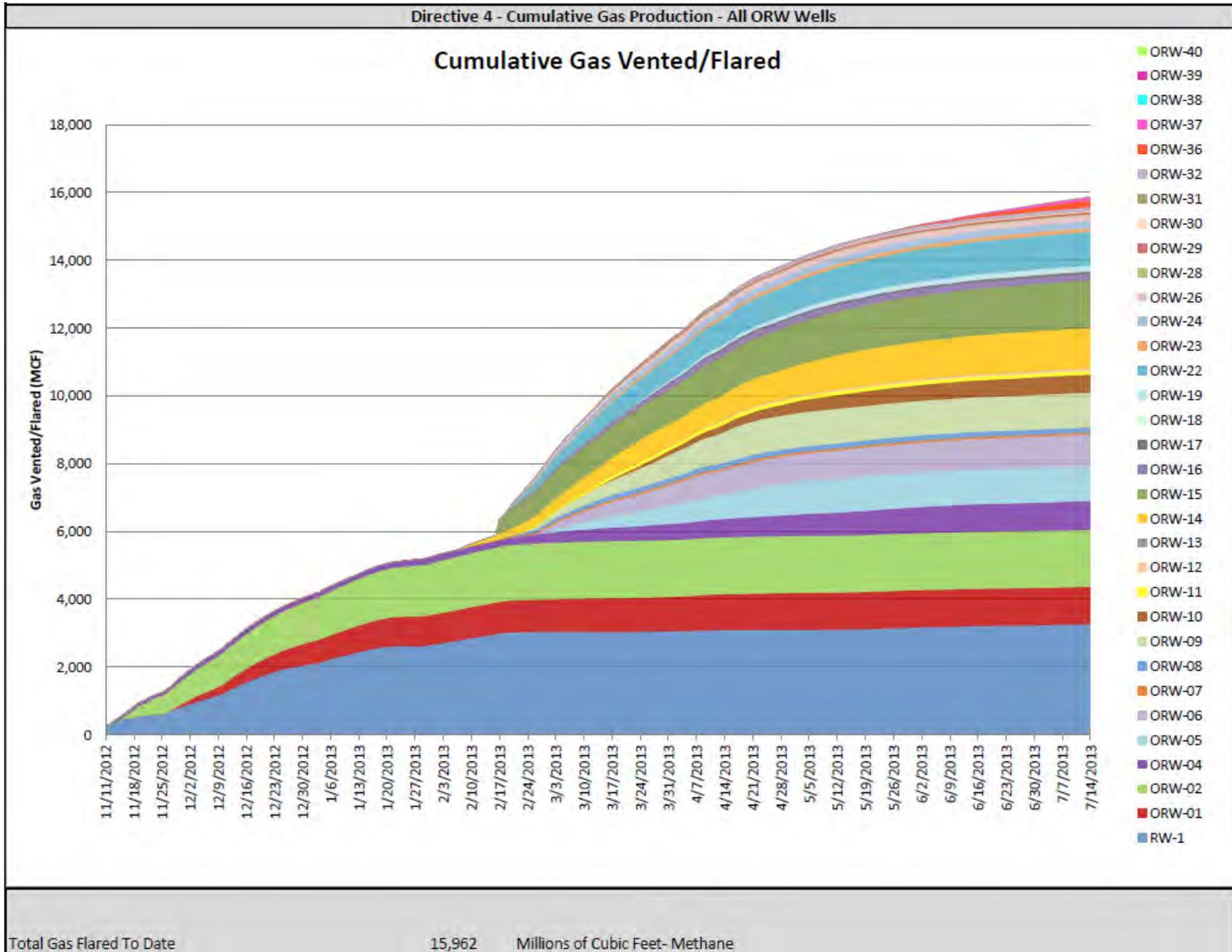


Area

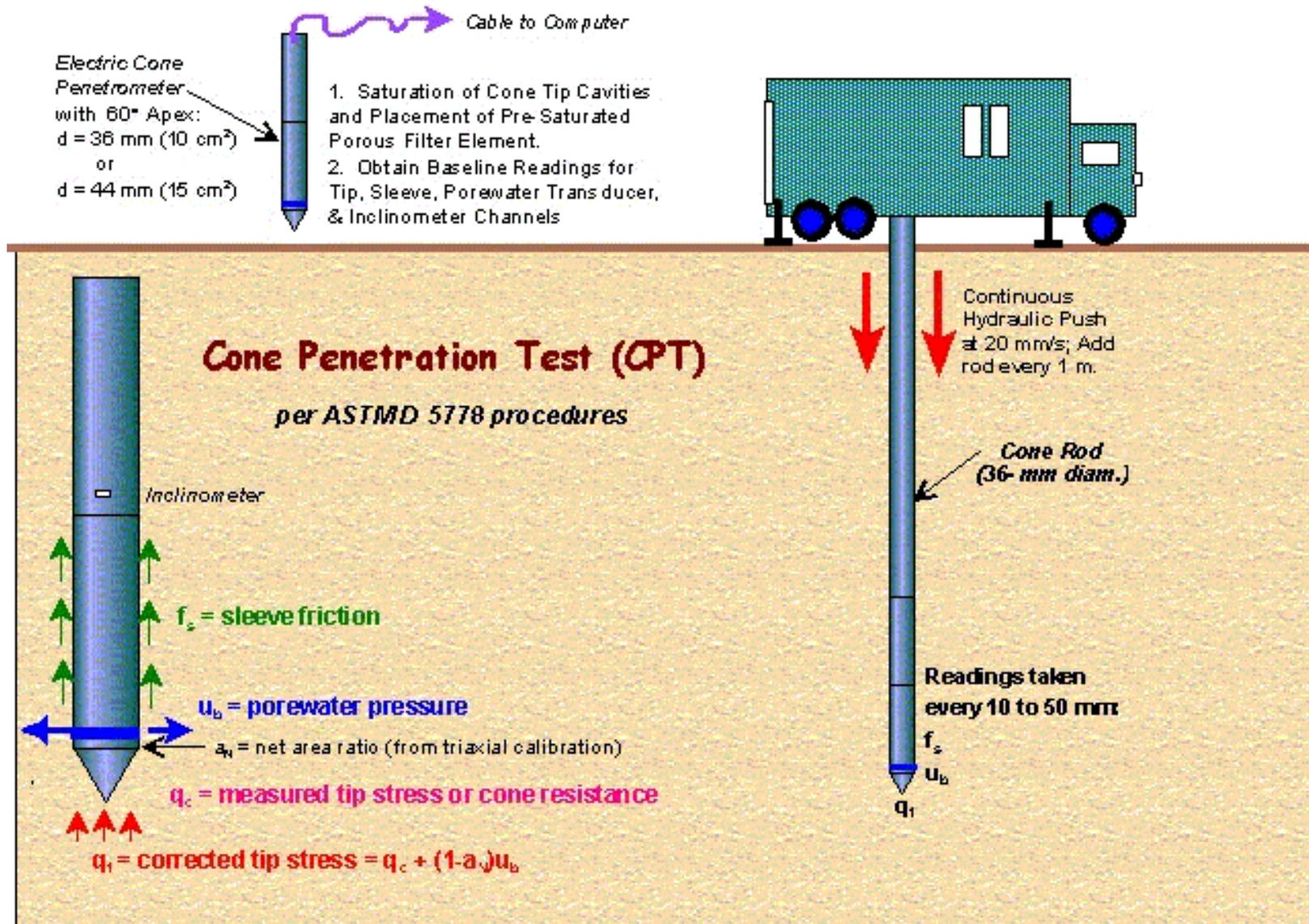








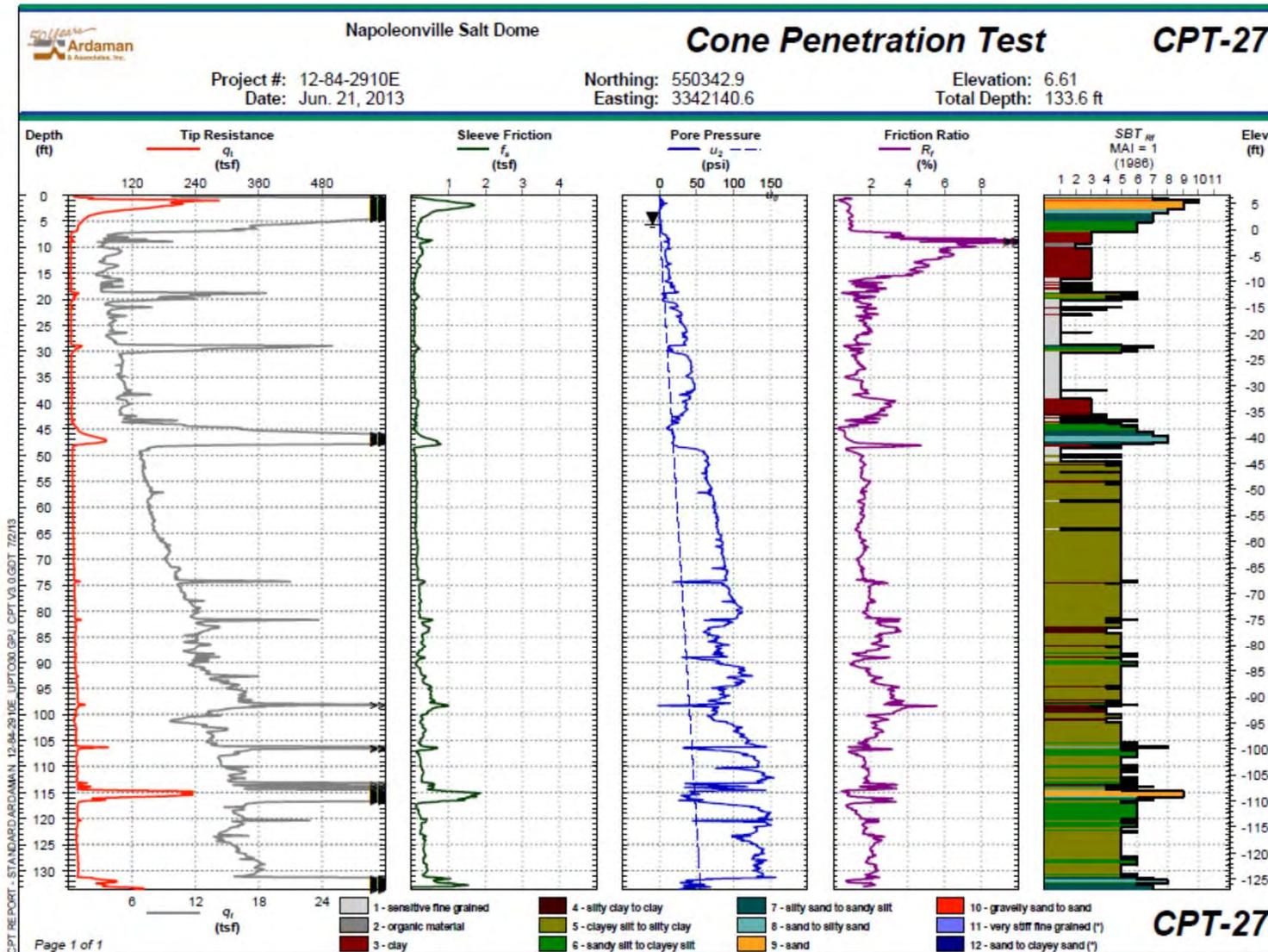
- Concerned about production of new ORW wells
 - Driven wells produced around 1,700 mcf
 - Sonic well produced 300 mcf
- Evaluating impact of potential formation damage during drilling on performance
- Water control appears to be an issue
- In June 2013, TBC modified vent well design
- DNR contracting gas well expert to advise on construction and operation of vent wells



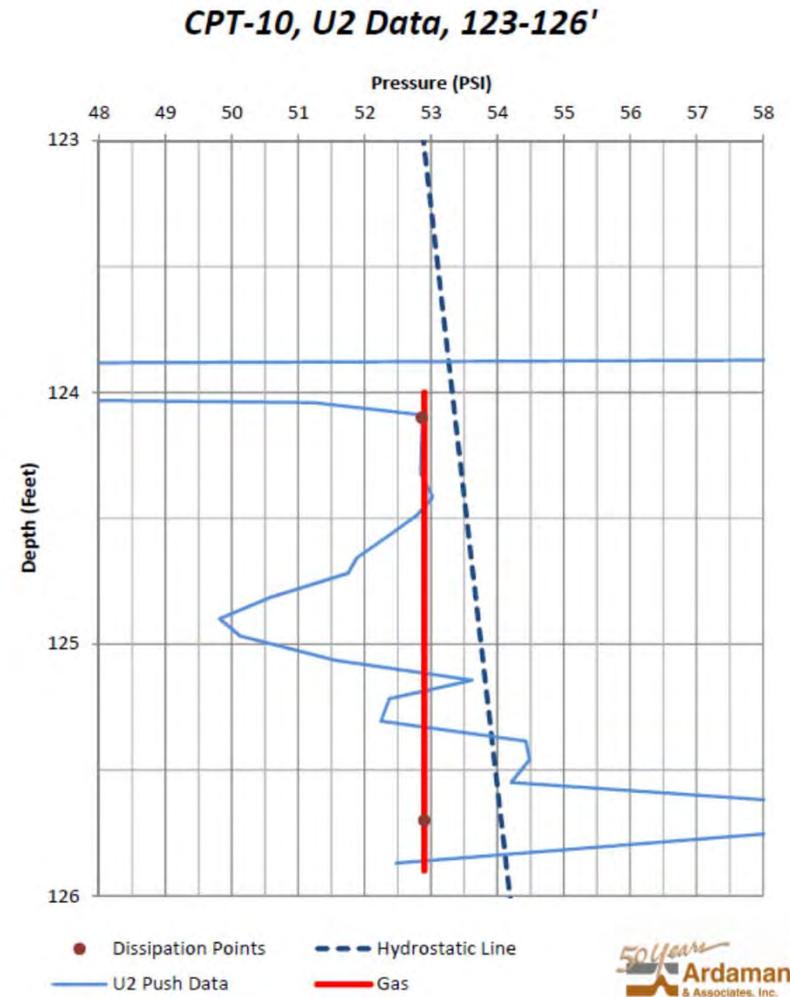
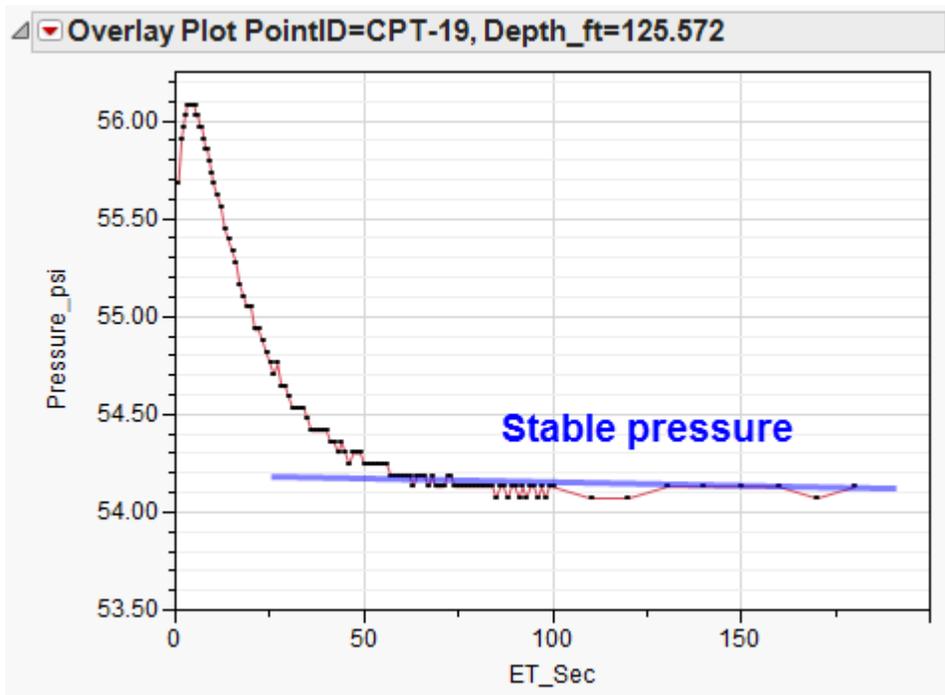




CPT Data—Excellent for Definition of Geology



- Use pressure dissipation tests to determine formation pressures
- Where pressures are equal, indicates gas
- Requires CPT pore pressure instrument that has high accuracy and precision



- Routine CPT data collected and processed according to several published ASTM standards.
- Technical meeting on July 24, 2013 with TBC to discuss details of gas determination procedure.
 - Defining gas with CPT experimental
 - CPT only able to penetrate a foot or so into MRAA sand
 - Likely not able to define MRAA gas thickness with CPT data
 - Questions/Concerns
 - Technical details for presence or absence of gas determination
 - Accuracy/precision of instruments used for collecting pressure data

- Tetra Tech recording subslab pressures at one port location
- Tetra Tech planning on ventilating one residence
- Methane detected below homes at LEL concentrations
- Hydrogen sulfide (H₂S) issue
 - DNR contracted with Dr. Saunders of Auburn University to advise on subsurface H₂S issues
 - H₂S concentrations between 3 and 24 ppm_v detected below floor slabs
 - H₂S detected in structures at 6 ppm with field instrument; waiting on lab results from sampling (rush turn around)
 - Probably related to swamp environment but still evaluating; currently no data indicating migration from Oxy 3 cavern or cap rock

