STATE OF NEW MEXICO
DEPARTMENT OF ENERGY, MINERALS AND NATURAL RESOURCES
OIL CONSERVATION COMMISSION

APPLICATION OF LUCID ENERGY DELAWARE, LLC FOR AUTHORIZATION TO INJECT, LEA COUNTY, NEW MEXICO. **Case No. 20779**

LUCID ENERGY DELAWARE, LLC'S NOTICE REGARDING HEARING EXHIBITS

Lucid Energy Delaware, LLC ("Lucid") has determined that a table on page 39 of Lucid Exhibit No. 3 was inadvertently omitted due to a file conversion and that there was a typographical error on page 16 of Lucid Exhibit No. 6. As a result, Lucid is attaching corrected copies of those exhibits. Lucid Exhibit No. 6 also includes final slides that may be used as reference materials. Counsel for the Oil Conservation Division was contacted and does not object to the submission of these exhibits.

Respectfully submitted,

HINKLE SHANOR LLP

/s/ Dana S. Hardy
Dana S. Hardy
P.O. Box 2068
Santa Fe, NM 87504-2068
Phone: (505) 982-4554
Facsimile: (505) 982-8623
dhardy@hinklelwafirm.com

Counsel for Lucid Energy Delaware, LLC

CERTIFICATE OF SERVICE

I hereby certify that on this 2nd day of September, 2020 I served a true and correct copy of ***Lucid Delaware Energy, LLC's Notice Regarding Hearing Exhibits*** on the following counsel of record by electronic mail:

Eric Ames
Assistant General Counsel
New Mexico Energy, Minerals and
Natural Resources Department
1220 South St. Francis Drive
Santa Fe, NM 87505
eric.ames@state.nm.us

Counsel for the Oil Conservation Division

/s/ Dana S. Hardy
Dana S. Hardy

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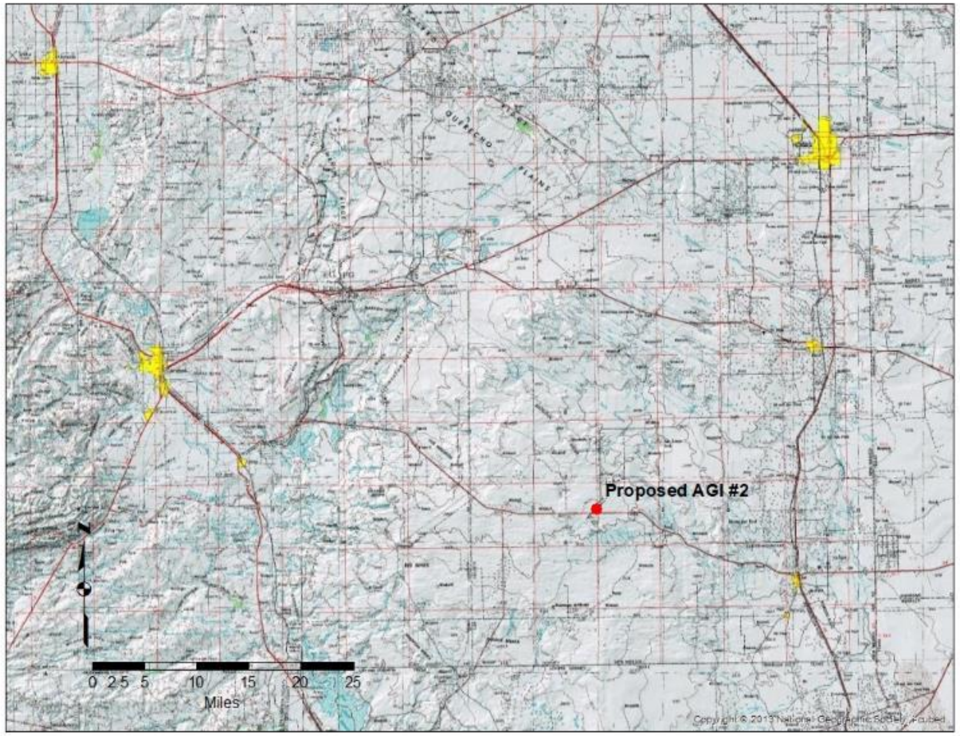
APPLICATION FOR AUTHORIZATION TO INJECT

C-108 Application for Lucid Energy Delaware, LLC



Red Hills Gas Processing Plant
Red Hills AGI #2

Presented in Hearing Before the
New Mexico Oil Conservation Commission
Case #20779

September 3, 2020

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LUCID
Exhibit 3

Application prepared by:
Geolex, Inc.®
500 Marquette Ave NW, #1350
Albuquerque, NM 87102
(505)842-8000

LUCID ENERGY DELAWARE, LLC WITNESSES

- **MATTHEW EALES** – Lucid Energy Delaware, LLC

- **ALBERTO A. GUTIÉRREZ, R.G.** – Geolex, Inc.®
  - M.S. Geology (UNM 1980)
  - Registered geologist in 21 states; 40 years experience
  - Petroleum geology and hydrogeology expert
  - Expert in permitting, design, construction, and operation of AGI wells

- **DAVID A. WHITE, M.S.** – Geolex, Inc.®
  - M.S. Geology (UNM 2018)
  - Extensive project management experience and geologic support for AGI projects
  - Permitted, designed, and installed AGI wells in Permian Basin
  - Expert in petroleum geology, seismic interpretation, and fault-slip probability modeling

- **WILLIAM AMPOMAH, Ph.D. – New Mexico Tech**
  - PhD. Petroleum Engineering (NMT 2016)
  - Direct research as head of REACT Group, PRRC – New Mexico Tech
  - Expert in reservoir characterization, numerical modeling, geomechanics, and optimization

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PRESENTATION TOPICS FOR EACH WITNESS

- **Matthew Eales** – Describe overall history and benefits of Lucid's Red Hills Gas Processing Plant and role of AGI project in gas plant operations

- **Alberto A. Gutiérrez, R.G.** – Describe relevant site geology and hydrogeology, system design, operation, analyses of effect on injection zone, and all components of C-108 application

- **David A. White, M.S.** – Describe induced-seismicity risk assessment, assessment of local subsurface pressure conditions to assess reservoir containment potential, and volumetric determinations of resultant acid gas plume

- **William Ampomah, Ph.D.** – Describe Petrel/Eclipse injection simulations completed to assess the impact of acid gas injection on the target Siluro-Devonian reservoir

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KEY ELEMENTS OF LUCID'S C-108

- The AGI project has substantial environmental benefits of greenhouse gas reduction due to sequestration of CO_2, which otherwise would be released to atmosphere

- AGI project reduces waste and air emissions by eliminating flaring of acid gas or operation of a sulfur recovery unit as sulfur-control measures

- Nearby oil and gas wells, nearby water wells and surface water are protected by well design and geologic factors

- Overlying freshwater resources, nearby SWD, and producing wells will all be protected by the accurate delineation of the reservoir obtained in our evaluation of available data and the specific well design proposed

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KEY ELEMENTS OF LUCID'S C-108 (CONT.)

- Lucid's C-108 application details the full information needed to approve the installation of AGI #2 well
- Revised H_2S Contingency Plan for the Red Hills plant will be prepared, submitted, and approved by OCD prior to initial injection in the AGI #2
- Adjacent operators, NMOCD and the BLM prefer the deeper Devonian reservoir over expanding the use of the Delaware reservoir
- Operators and surface owners have received proper notice and there are no objections to the AGI project

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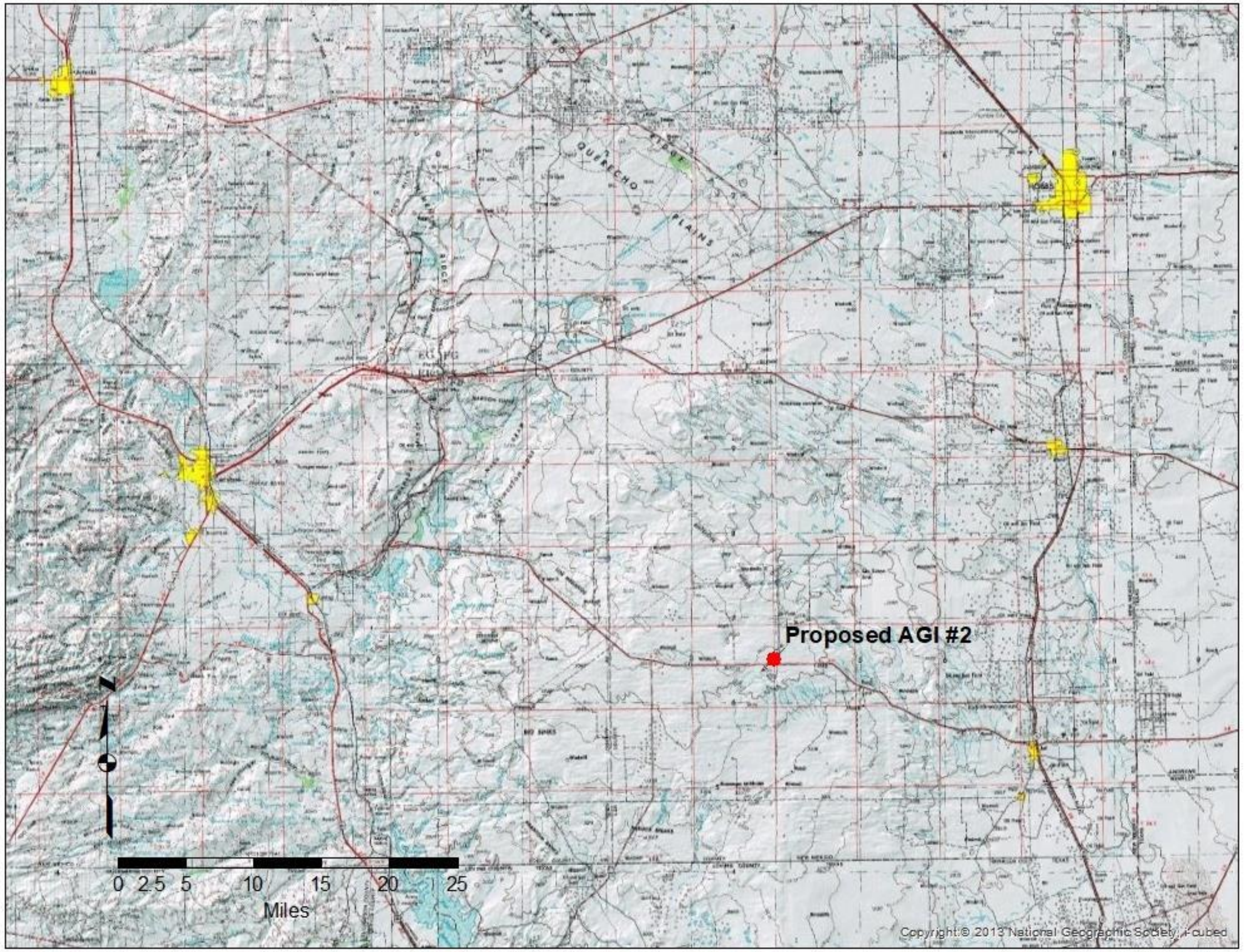
LOCATION AND BACKGROUND

- The proposed AGI well is designed to support the operations of Lucid's Red Hills Gas Plant
- The plant is located in Section 13, Township 24 South, Range 33 East in Lea County, New Mexico (see location map on next slide)
- When fully operational, the Red Hills complex will have the ability to process nearly 1.4 billion cubic feet (bcf) of natural gas per day
- The production will provide additional new revenue to the State of New Mexico



Location of Lucid Energy Proposed AGI #2

PLANT SITE DETAILS

- The overall site encompasses approximately 370 acres (see annotated map on next slide)
- All lands involved are owned by Lucid
- Field gas will be "sweetened" by amine units, and the TAG will then be compressed and piped to the AGI wells
- The proposed well and all surface equipment will be contained within the plant area

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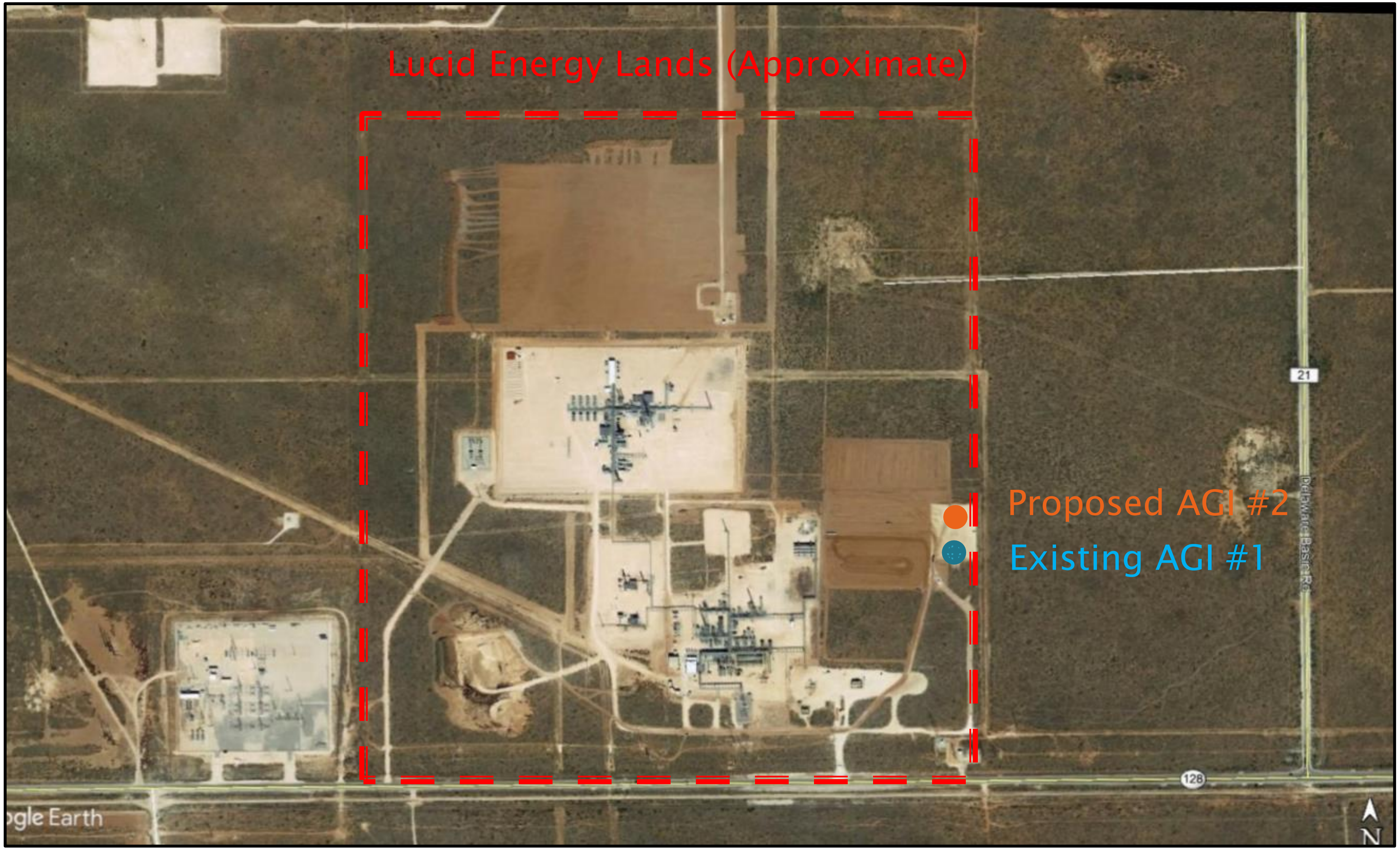

Lucid's Red Hills Plant layout, AGI #1, and proposed AGI #2

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LEGAL DESCRIPTIONS OF PROPOSED WELL

- The Lucid Red Hills AGI #2 well will be drilled at 1,800' from the south line (FSL) and 150' from the east line (FEL) of Section 13, Township 24 South, Range 33 East

- The AGI #2 well will be drilled as a vertical well from this surface location, and completed in the Siluro-Devonian formations

- The new well location is approximately 200 feet north of the existing AGI #1 well

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SCHEMATIC WELL AND PLANT DESIGN

- The treated acid gas (TAG) will be transmitted from the sweeteners to the compressors via low-pressure pipelines (see diagram on next slide)

- The TAG will be compressed to approximately 1,800 psig and 90 degrees Fahrenheit prior to injection

- An automatic subsurface safety valve (SSSV) will be placed in the injection tubing at approximately 250 feet below the surface

- The annulus will be filled with corrosion-inhibited diesel fluid

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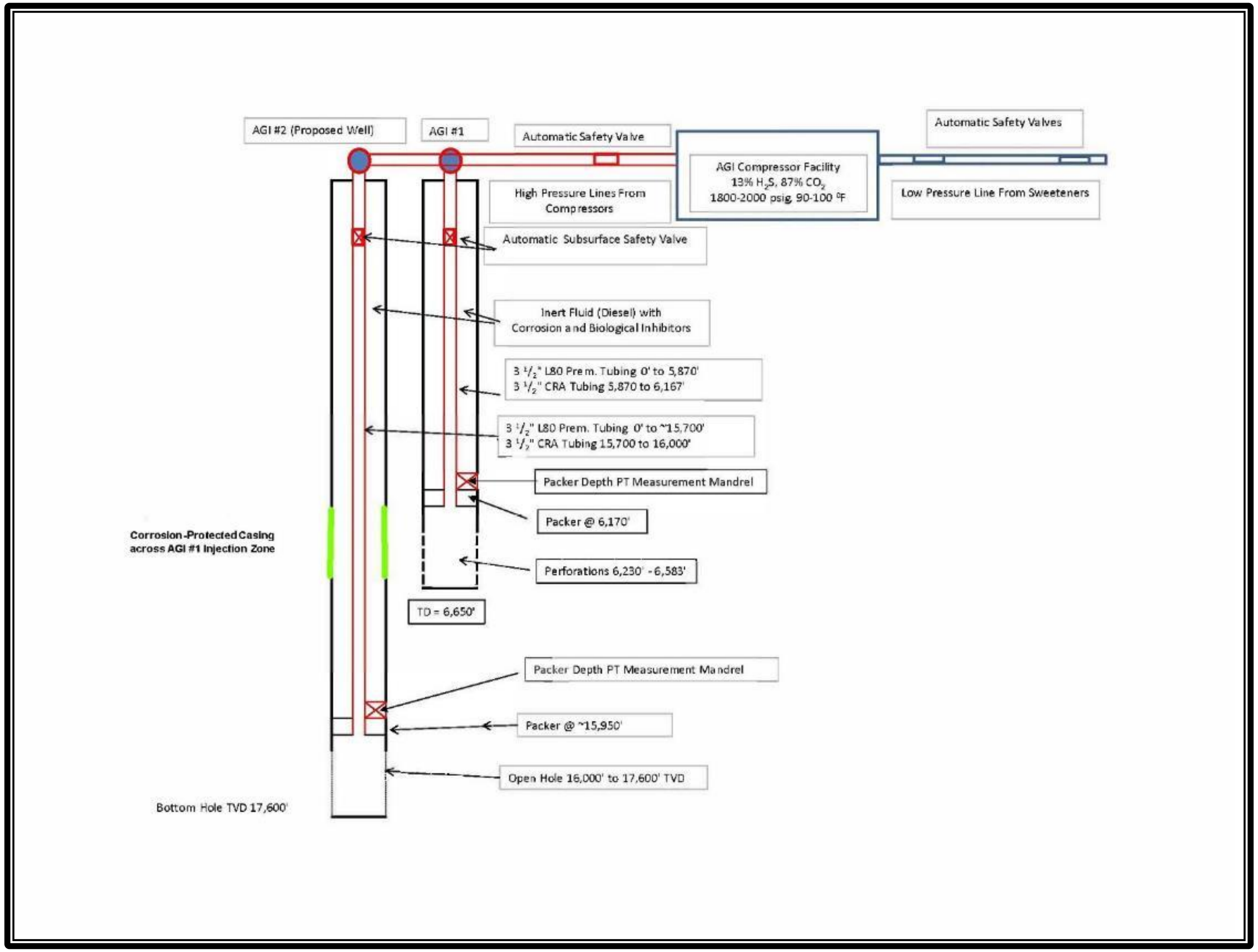
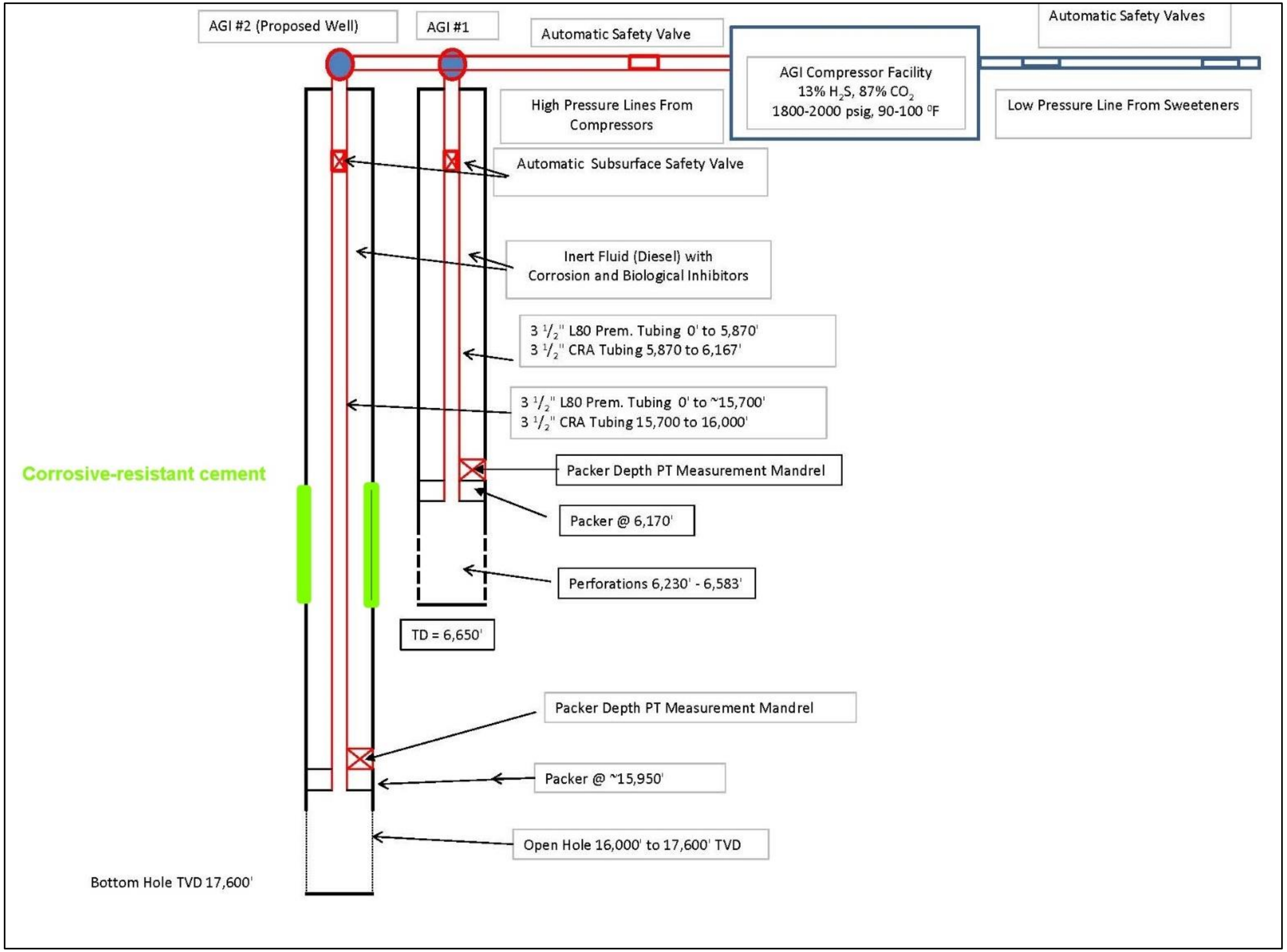


Schematic of Surface Facilities and Wells, Lucid Red Hills Gas Plant



Schematic of surface facilities and wells – Lucid Red Hills Gas Plant

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DESIGN OF RED HILLS AGI #2

- As seen in the following slides, two design options for AGI #2 are being considered. The first, a four-string design utilizing 3 strings of casing and one liner and a four-string design with all casing strings being run to surface.

- Since the well will penetrate the injection zone of the existing Red Hills AGI #1, considerations must be made for each design option to assure the integrity of the AGI #2 well is maintained.

- For the liner hanger design option, a 500-foot segment (6,200' to 6,700') of the second intermediate casing will be constructed of corrosion-resistant alloy (CRA) casing, or equivalent corrosion-protected casing (CPC) to prevent damage to the well by the TAG injected by the AGI #1

- For the four-string design with all strings being run to surface, corrosion-resistant cement (e.g. Halliburton WellLock Resin, or equivalent) will be utilized over the same 500-foot interval from 6,200' to 6,700'

- In all designs, CRA materials will be utilized in the lower 300 feet of the 7" liner (15,700 to 16,000'), and in the last 300 feet (15,700' to 16,000') of the 3-1/2" production tubing

- Acid-resistant cement will also be used adjacent to the CRA/CPC segments of the second intermediate casing and the liner

- Temperature and pressure sensors will be installed in the tubing immediately above the packer to provide continuous monitoring on injection parameters at the top of the reservoir

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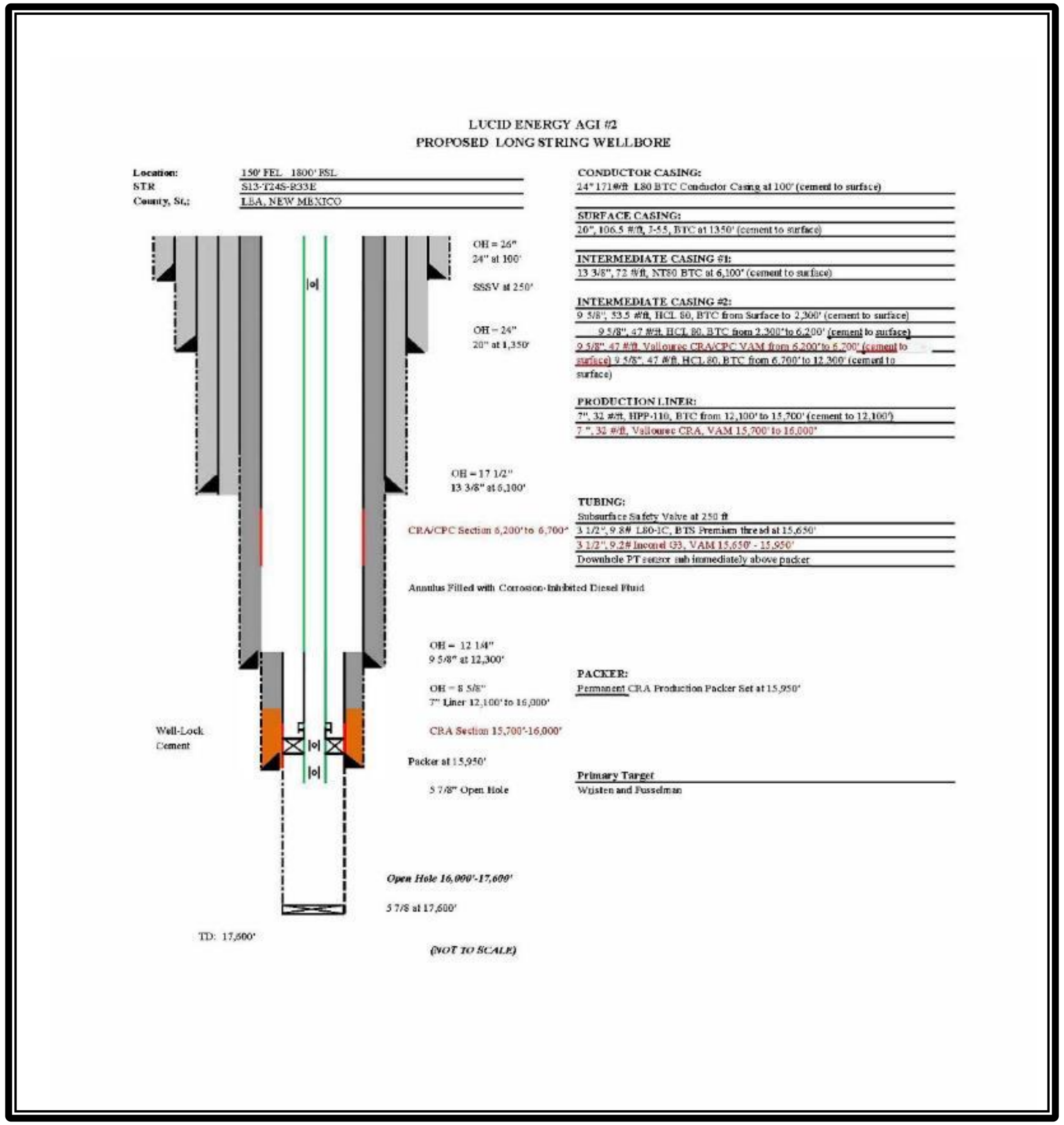

Schematic of Proposed AGI #2 Wellbore (option 1)

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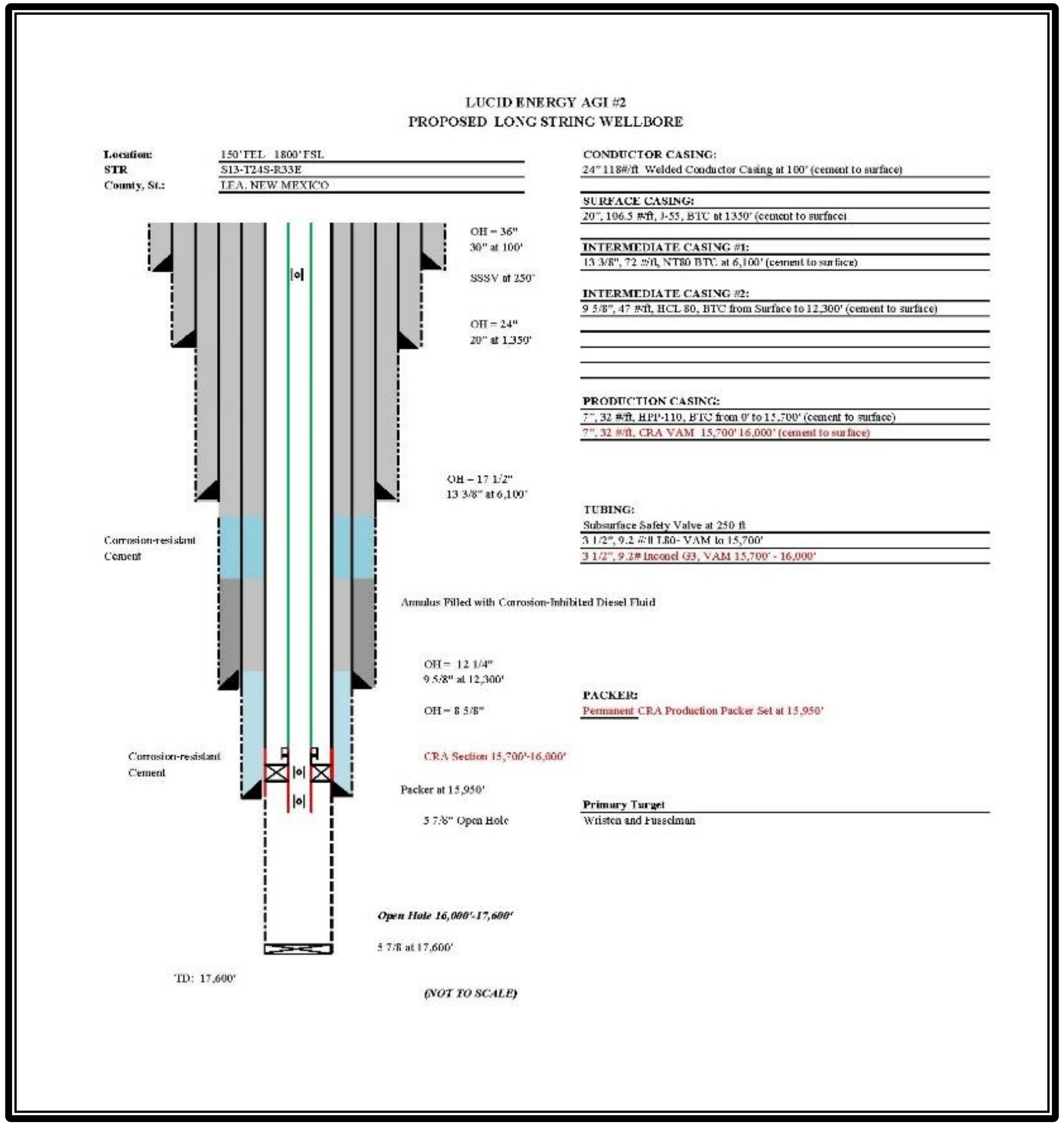

Schematic of Proposed AGI #2 Wellbore (option 2)

INJECTION FLUID VOLUME, COMPOSITION, AND MAOP CALCULATIONS FOR RED HILLS AGI #2

- The table on the following slide summarizes the reservoir temperatures, volumes, and Maximum Allowable Operating Pressure (MAOP)

- Maximum combined injection rate for system is approximately 13 MMSCFD

- Injected fluid composition is 12% H_2S, 87% CO_2, and traces of light hydrocarbons (C_1–C_8)

- Injected fluid compatibility is determined through nearby injection experience and formation fluid analysis

- The Maximum Allowable Operating Pressure (MAOP) requested was calculated per NMOCD guidelines to be 4,838 psig at the surface

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ACID GAS VOLUME CALCULATIONS

- At the anticipated reservoir conditions of 225 °F and 7,500 psig, each MMSCF of TAG will occupy a volume of 2,282 cubic feet (406 barrels)
- At the anticipated maximum operational capacity of 13 MMSCFD, the compressed TAG will occupy 5,285 barrels per day
- Independent investigations were completed by Geolex and New Mexico Tech to estimate the resultant acid gas plume after 30 years of operations at the maximum anticipated injection rate of 13 MMSCF per day
- From these evaluations, the resultant AGI plume is investigated utilizing volumetric-determination methods, as well as, Petrel/Eclipse modeling and simulation platforms to thoroughly evaluate the extent and characteristics of the injection plume after 30 years
- These evaluations will be further discussed in the testimony of David White (Geolex) and Dr. William Ampomah (New Mexico Tech)

PROPOSED INJECTION STREAM CHARACTERISTICS

TAG Gas vol MMSCFD	H_2S conc. mol %	CO_2 conc. mol %	H_2S inject rate lb/day	CO_2 inject rate lb/day	TAG inject rate lb/day
13	12	87	148079	1386338	1534418

CONDITIONS AT WELL HEAD

Well Head Conditions		TAG							
Temp F	Pressure psi	Gas vol MMSCFD	Comp CO_2:H_2S	Inject Rate lb/day	Density[1] kg/m^3	SG[2]	density lb/gal	volume ft^3	volume bbl
90	1800	13	87:12	1534418	779.00	0.78	6.50	31537	5617

CONDITIONS AT BOTTOM OF WELL

Injection Zone Conditions					TAG				
Temp F	Pressure[3] psi	$Depth_{top}$ ft	$Depth_{bottom}$ ft	Thickness[4] ft	Density[1] kg/m^3	SG[2]	density lb/gal	volume ft^3	volume bbl
225	7500	16000	17600	1600	828.00	0.83	6.91	29671	5285

CONDITIONS IN RESERVOIR AT EQUILIBRIUM

Injection Reservoir Conditions					TAG				
Temp[5] F	Pressure[3] psi	Ave. Porosity[6] %	Swr	Porosity ft	Density[1] kg/m^3	SG[2]	density lb/gal	volume ft^3	volume bbl
225	7500	3.5	0.17	46.48	828.00	0.83	6.91	29671	5285

CONSTANTS

	SCF/mol	
Molar volume at STD	0.7915	
	g/mol	lb/mol
Molar weight of H_2S	34.0809	0.0751
Molar weight of CO_2	44.0096	0.0970
Molar weight of H_2O	18.015	0.0397

[1] Density calculated using AQUAlibrium software
[2] Specific gravity calculated assuming a constant density for water
[3] PP is extrapolated using successful Drill Stem Tests at nearby wells
[4] Thickness is the average total thickness of porous units in the reservoir zone
[5] Reservoir temp. is extrapolated from bottomhole temp. measured at nearby wells
[6] Porosity is estimated using geophysical logs from nearby wells

CALCULATION OF MAXIMUM INJECTION PRESSURE LIMITATION

SG_{TAG}	0.8035	
$PG = 0.2 + 0.433\ (1.04\text{-}SG_{TAG})$	0.3024	psi/ft
IP_{max} = PG *Depth	4838	psi

Where: SG_{TAG} is specific gravity of TAG; PG is calculated pressure gradient; and IP_{max} is calculated maximum injection pressure.

CALCULATION OF 30 YEAR AREA OF INJECTION

Cubic Feet/day (5.6146 ft^3/bbl)	29671	ft^3/day
Cubic Feet/30 years	325114745	ft^3/30 years
Area = V/Net Porosity (ft)	6994723	ft^2/30 years
Area = V/Net Porosity (ft) (43560 ft^2/.	160.6	acres/30 years

Summary of Reservoir Volume and Area Calculations

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ADJACENT OPERATORS AND SURFACE OWNER NOTIFICATION AND NOTICES

- Lucid's complete C-108 application was sent to adjacent operators and surface owners within the one-mile radius of the proposed wells via Certified Mail, return receipt requested

- Notice of the application and the Commission hearing were published in the local newspaper by NMOCC

- There are no outstanding objections to Lucid's application

- Adjacent operators support the AGI project, which will:
  - Allow increased throughput and production capacity
  - Increase royalties paid to the State of New Mexico
  - Protect freshwater resources and correlative rights
  - Reduce operator concerns about additional injection in the current Delaware injection zone

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REVIEW OF IDEAL CHARACTERISTICS OF A RESERVOIR FOR PERMANENT DISPOSAL OF ACID GAS (CO_2/H_2S)

- Geologic seal to permanently contain injected fluid
- Isolated from any fresh groundwater
- No effect on existing or potential production
- Laterally extensive, permeable, good porosity
- Excess capacity for anticipated injection volumes
- Compatible fluid chemistry

✓LUCID'S PROPOSED AGI #2 MEETS ALL OF THESE CRITERIA

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IDENTIFICATION & CHARACTERIZATION OF WELLS, STRATIGRAPHY, & GEOLOGIC STRUCTURE IN THE PROJECT AREA

- Thirteen wells were identified in the one-mile radius of the proposed AGI location, one of which was identified to penetrate the proposed injection interval

- The closest well penetrating the proposed injection zone (EOG Resources 30-025-25604) was drilled to 17,635 feet and lies approximately 0.72 miles from the proposed AGI well (see following slide)

- This well was plugged and abandoned in December of 2004. During the initial drilling and completion of the well in May 1978, the well was plugged back to 14,590 feet, isolating the deeper Devonian zone (top Devonian at 15,853')

- Analysis of existing data indicates adequate porosity in Devonian section of sufficient extent to accommodate proposed injection

- A review of the plugging and completion reports indicates that the injection zone is properly isolated by all wells within the anticipated areas impacted by the proposed AGI well

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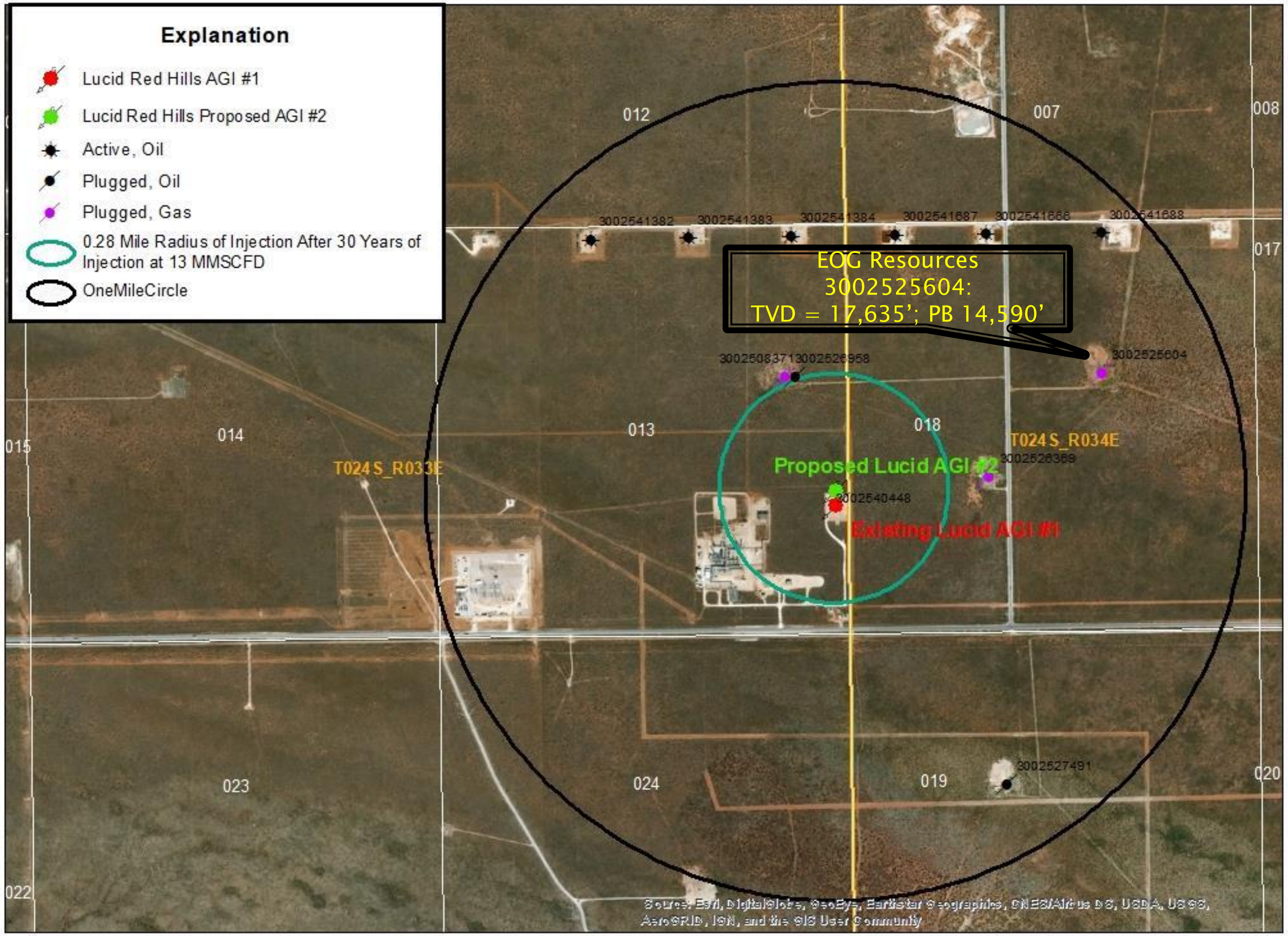

Wells of interest within One Mile of Proposed Lucid Red Hills AGI #2

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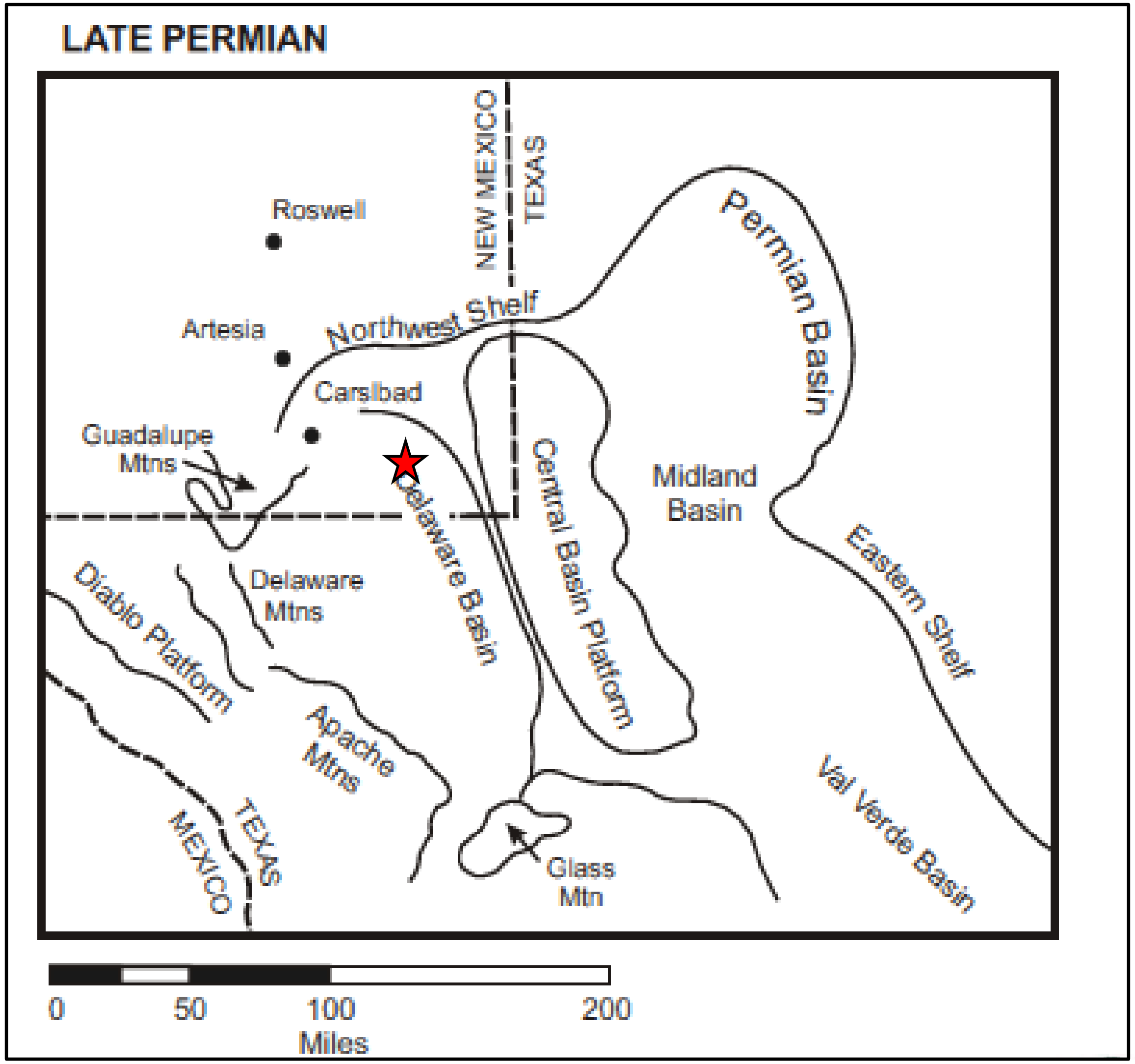
STRATIGRAPHY OF THE PROPOSED INJECTION ZONE

- The proposed well will be located on the northeastern segment of the Delaware sub-basin of the Permian Basin (see map in the next slide)

- The Siluro-Devonian formations are carbonate units that are variously dolomitized (and sporadically porous), and are contained above and below by low-permeability limestones and shales

- The proposed injection zone is capped with the very low permeability Woodford Shale, which in this area is approximately 225 feet thick (see interpreted well log in the slide following the map)



Structural features of the Permian Basin during the Late Permian

Location of the proposed Lucid AGI #2 well is shown by the red star.

(Modified from Ward, et al (1968))

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Stratigraphy and generalized lithologies of the subsurface formations underlying the proposed AGI #2 location. Zones with active pay within the radii of investigation are shown by the red stars. The interval shown by the blue bar includes the Devonian (Thirtyone Formation), and Silurian Wristen and Fusselman Formations, which contain intervals of karst-related solution-enlarged and fracture porosity in dolomites that alternate with tight, dolomitic limestones. These formations are sufficiently isolated from the active pay zones by over 1,300 feet of tight, Mississippian (Chester through upper Woodford) limestones and shales.

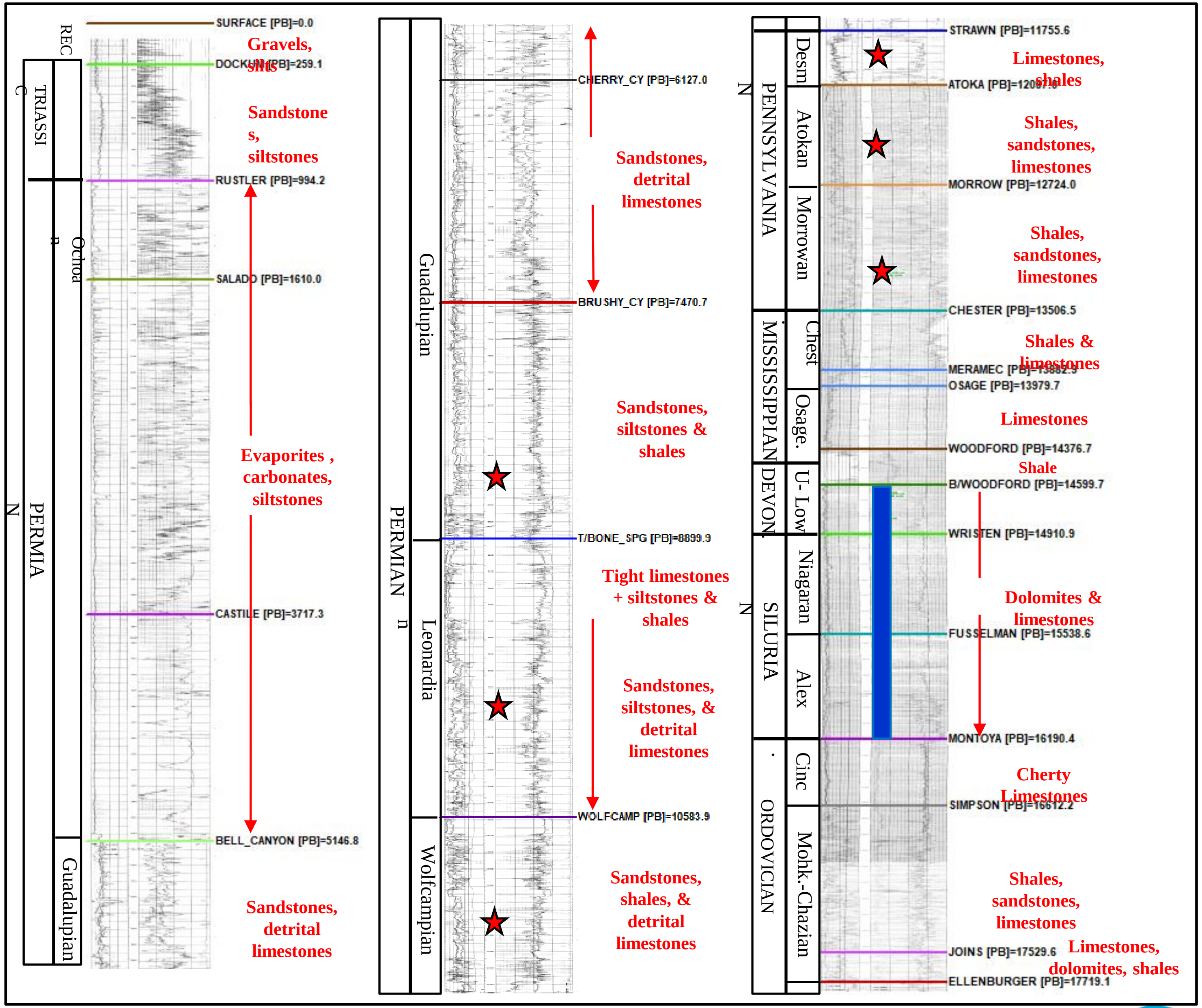

Figure 7: Stratigraphy and Pay Zones Proposed AGI#2 Well Site Vicinity

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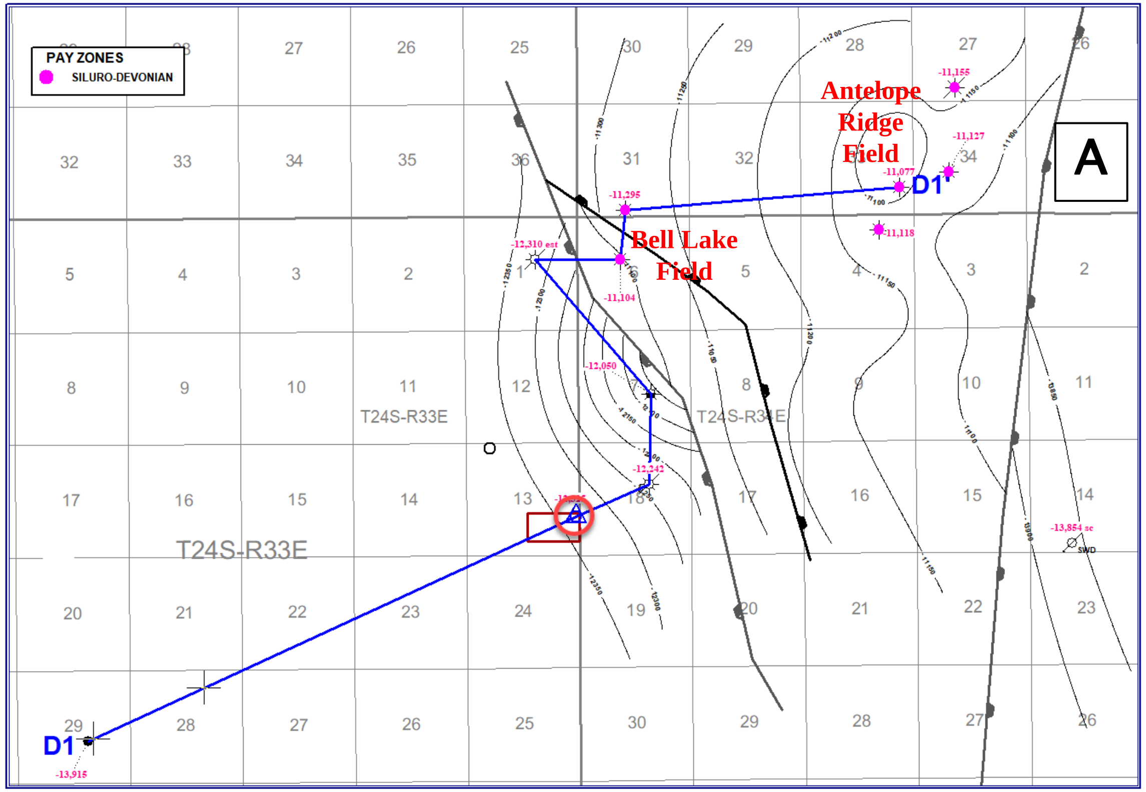
STRUCTURAL GEOLOGY OF THE INJECTION AREA

- The map on the following slide shows the elevations of the top of the Devonian in the project area (Panel A)

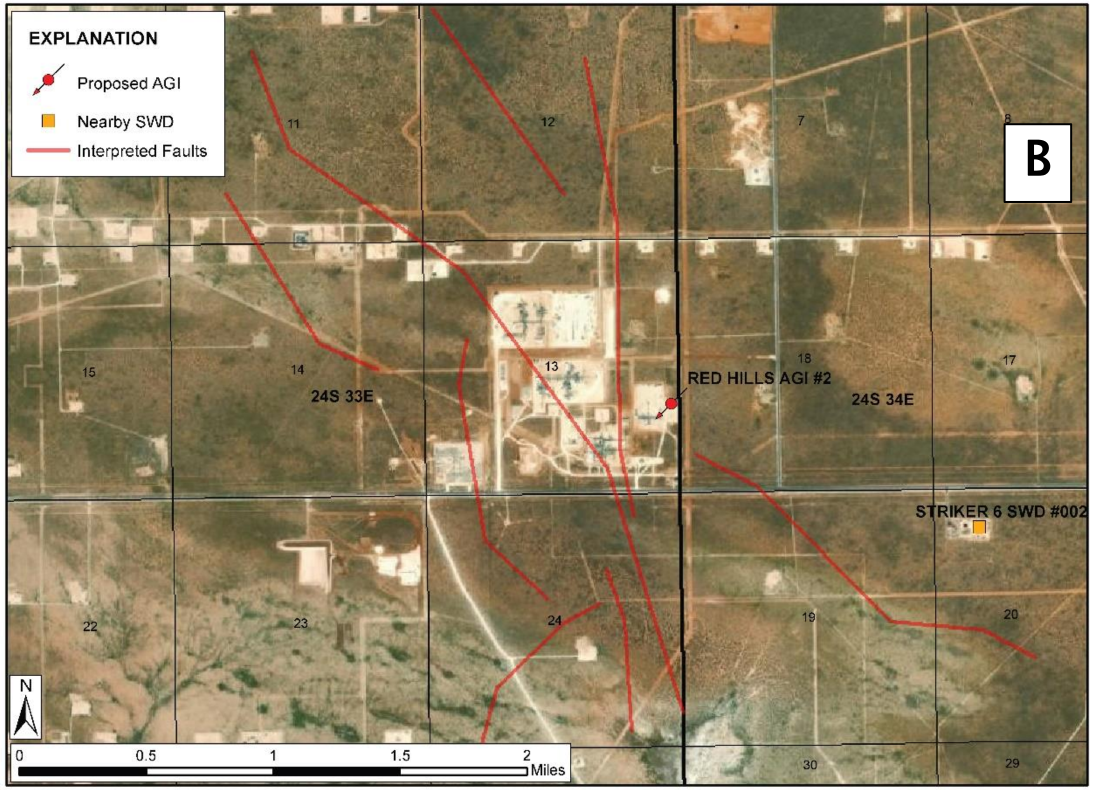
- The Devonian surface at the AGI location dips steeply to the southwest, and is broken by several northerly normal faults, with displacements of several hundreds of feet east of the well location (see structural map in the next slide, also showing the line of the following cross section)

- Nearby operators interpret additional faulting in the immediate area of the proposed Red Hills AGI #2. General locations of these interpreted features are shown in fault-trace map included in the following slide (Panel B)

STRUCTURAL GEOLOGY OF THE INJECTION AREA



Panel A. Devonian structure and location of cross section D1-D1'. Map includes identified northwest-southeast trending faults located approximately 1.25 miles east of the proposed AGI location



Panel B. Fault-trace map illustrating additional faulting in the immediate area of the proposed AGI #2 injection well

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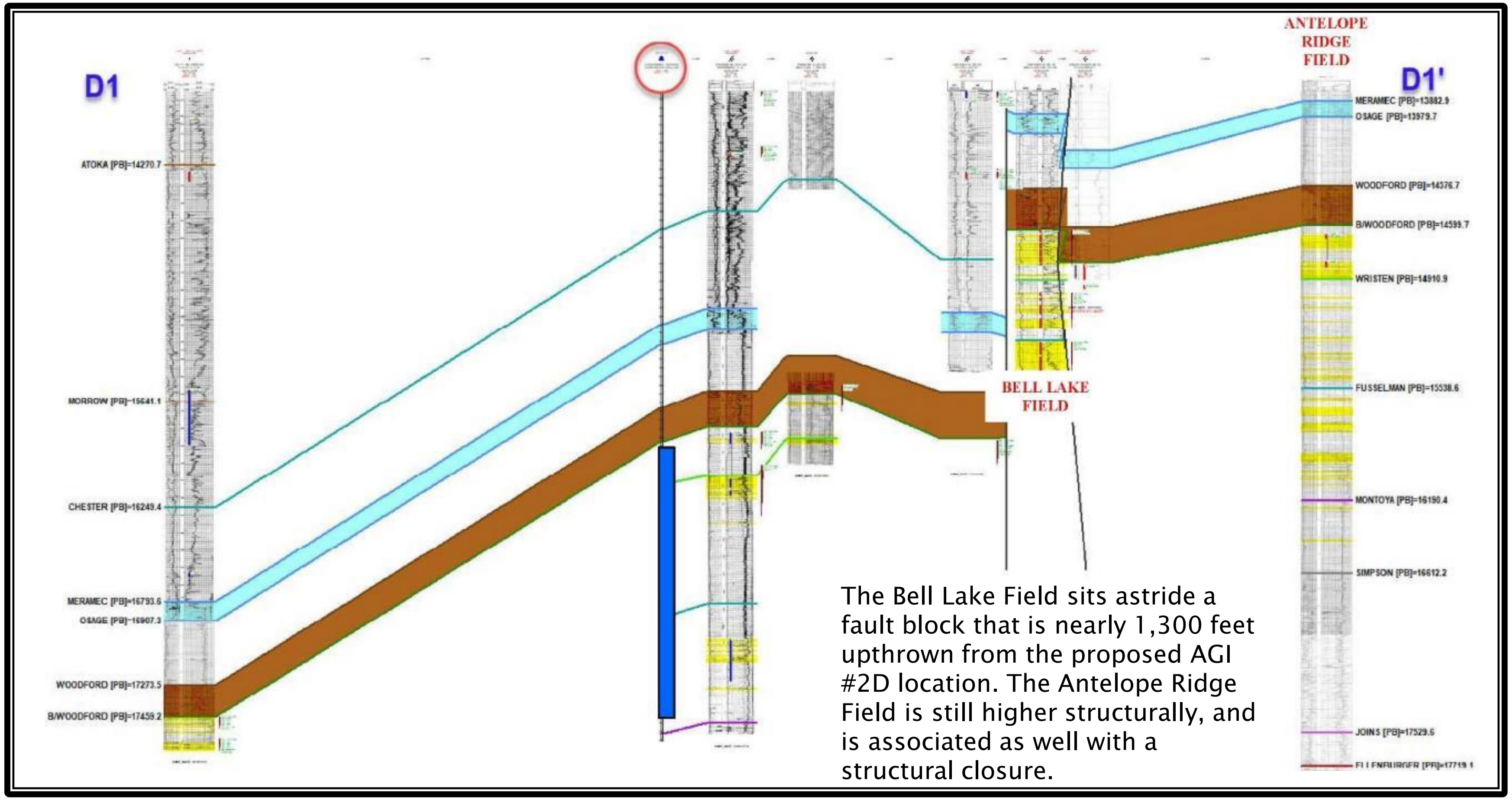
STRUCTURAL GEOLOGY OF THE INJECTION AREA

- The following cross section shows the relative geometry of the subsurface
- The previous structural map, and the cross section, show that the proposed injection zone is in a porous area of the Devonian, dipping steeply to the southwest
- The westernmost fault effectively isolates the reservoir from the Bell Lake Field to the northeast of the proposed well site



Yellow shading denotes porosity in the Siluro-Devonian section of 5% or greater, where it could be determined from porosity logs. Porosity is present in thin to thickly-bedded sequences that are separated by tight and/or fractured carbonates. The proposed injection interval (blue bar) would extend to the base of the Fusselman. The Siluro-Devonian interval is approximately 1,200 feet below the closest producing formation (Morrow) in the area, although *there are no active producing Morrow wells within or immediately outside the one-mile radius around the proposed well.*

Structural Cross-Section Through the Deeper Horizons Across the Red Hills Plant Site

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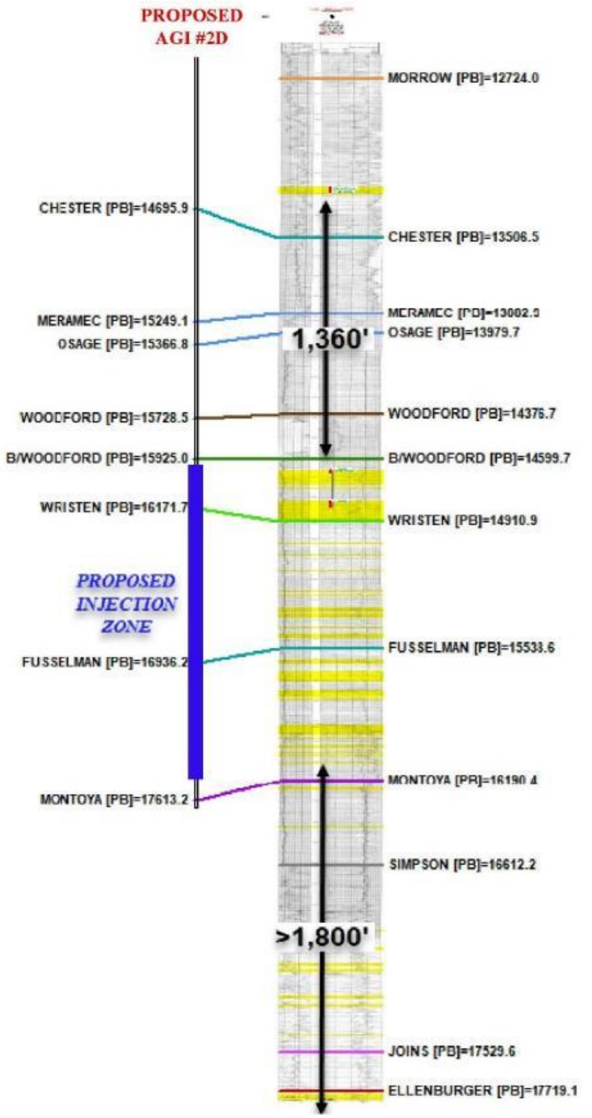
POROSITY OF THE PROPOSED INJECTION INTERVAL AND OVERLYING CAPROCK

- The following interpreted log shows the porous zones of the injection interval
- Good porosity is observed in the Wristen and Fusselman
- The overlying Woodford, Osage, and Chester form an excellent reservoir seal, or caprock
- The proposed injection zone is approximately 1,800 feet above the basement

Porosity Profile Above and Below Injection Zone

Section is hung on base of the Woodford Shale. Yellow shading shows porosity; no shading indicates tight rock. The closest producing zone to the injection target within the area of investigation is over 1,300 feet above in the Morrow. Between the Devonian and Morrow is primarily tight limestones and shales. There are no producing horizons below the Fusselman in this area. The basement is over 1,800 below the base of the proposed injection zone.

The lack of any porosity between the top of the proposed injection zone and the nearest Morrow producing zone demonstrates that there is adequate caprock above the intended injection interval, and there is more than adequate tight rock between the base of the injection interval and the basement.



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GROUNDWATER CONDITIONS IN THE AREA OF REVIEW

- Based on the New Mexico Water Rights Database from the New Mexico Office of the State Engineer, there are 15 freshwater wells located within a two-mile radius of the proposed Lucid AGI #2 (see next slide)

- All wells within the two-mile radius are shallow, collecting water from about 250' to 350' depth, in the Triassic redbeds

- These water-bearing zones will be protected by the surface casing of Lucid AGI #2, which will extend to approximately 1,300 feet, well below the Triassic redbeds

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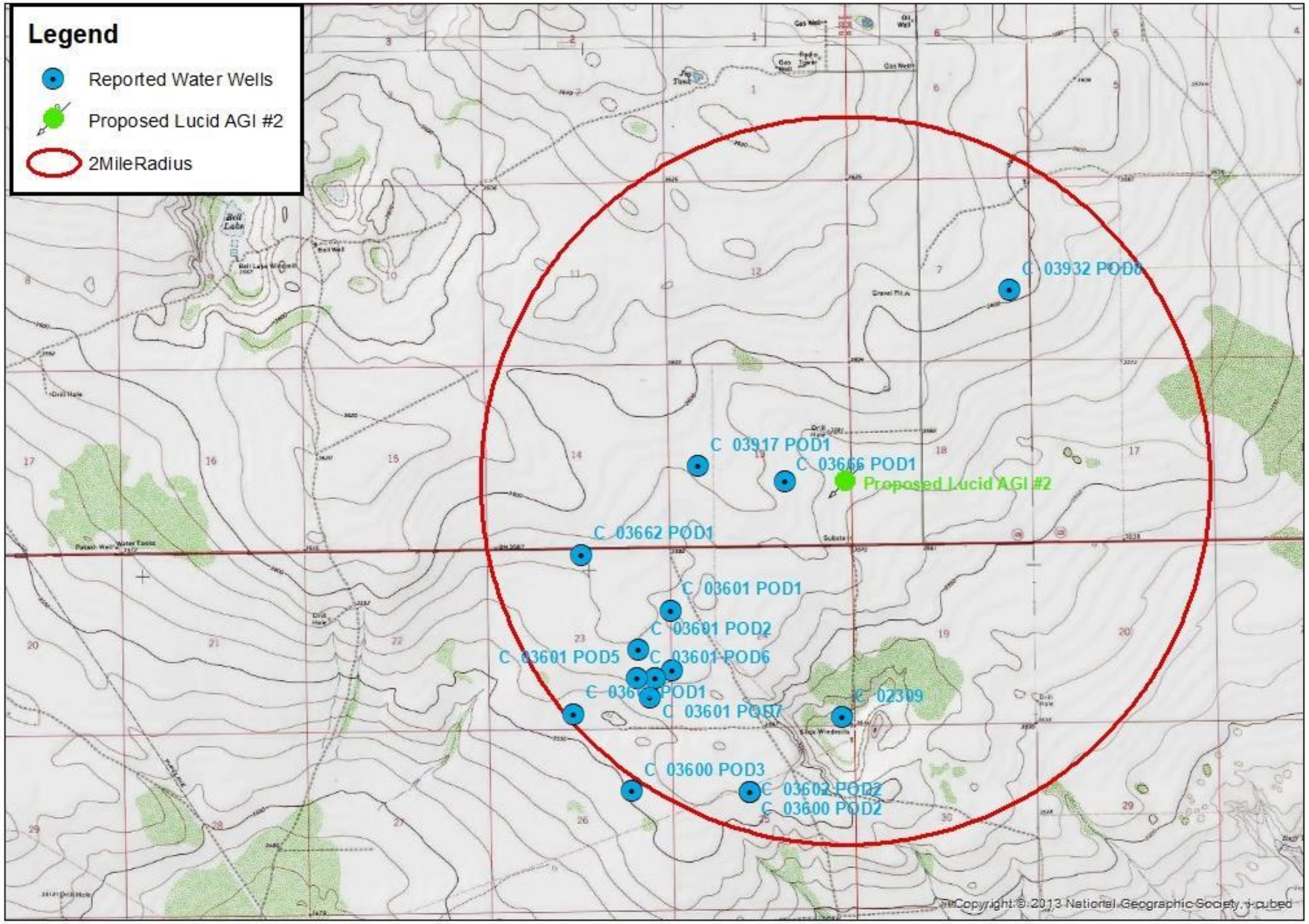

Reported Water Wells within Two Miles of Proposed Lucid AGI #2

SUMMARY OF GEOLOGIC FACTORS ASSURING INTEGRITY AND SAFETY OF PROPOSED LUCID AGI #2

- No wells penetrating the injection zone are closer than 0.72 miles and are not anticipated to contact the resultant acid gas plume
- Caprock is low porosity, impermeable rock which is an effective barrier above the injection zone
- Injection zone is vertically isolated from adjacent production zones
- All freshwater zones isolated by conductor and surface casing
- Proposed injection pressure is well below fracture pressure of reservoir and caprock
- Logs and other geological and geophysical analyses demonstrate a closed system

EVALUATING FAULT-SLIP POTENTIAL

To evaluate the potential for seismic events in response to injected fluids, Geolex conducted an induced-seismicity risk assessment in the area of the proposed Red Hills AGI #2

- Assessment completed utilizing the Stanford Fault Slip Potential (FSP) model and includes the following components:

  1. Hydrologic simulation of a multi-well injection scenario for a period of at least 30 years of acid gas injection (16 wells within 10 miles of the proposed AGI)

  2. Prediction of the fault-slip probability associated with the simulated injection scenario utilizing Monte-Carlo simulation methods

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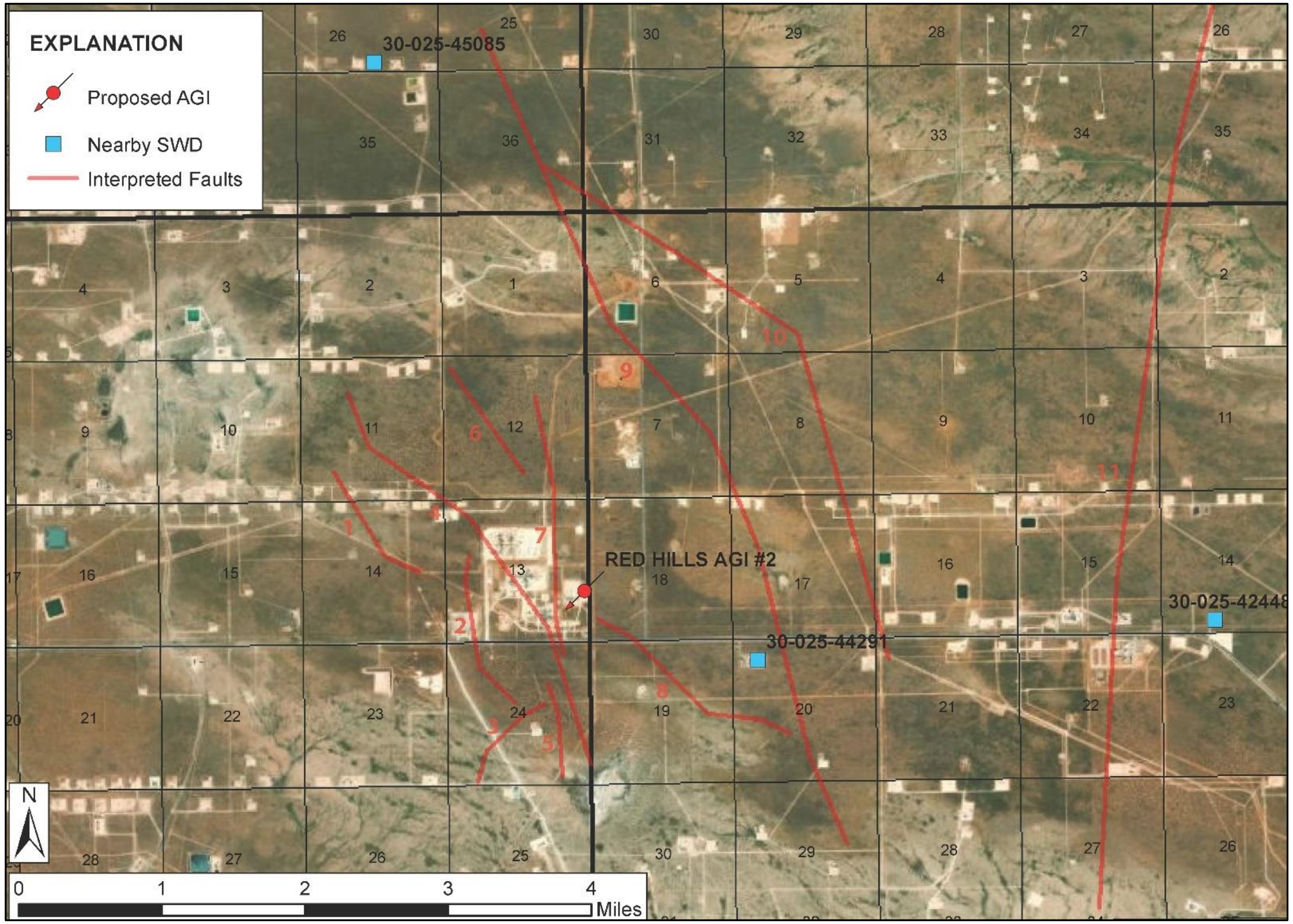
MODELED SUBSURFACE FEATURES

- Eleven (11) potential faults generally trending NW-SE identified and interpreted to be present within the target injection reservoir
- Multiple simulations completed varying fault dip angles to address uncertainty regarding true orientation of structures
- Sensitivity analyses test the effect on potential fault angles from 60° to 90°
- Nearest faults to the AGI are located at a distance of approximately 0.25 miles



Location map illustrating known and interpreted faults in the area of the AGI well

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MODELED SUBSURFACE FEATURES

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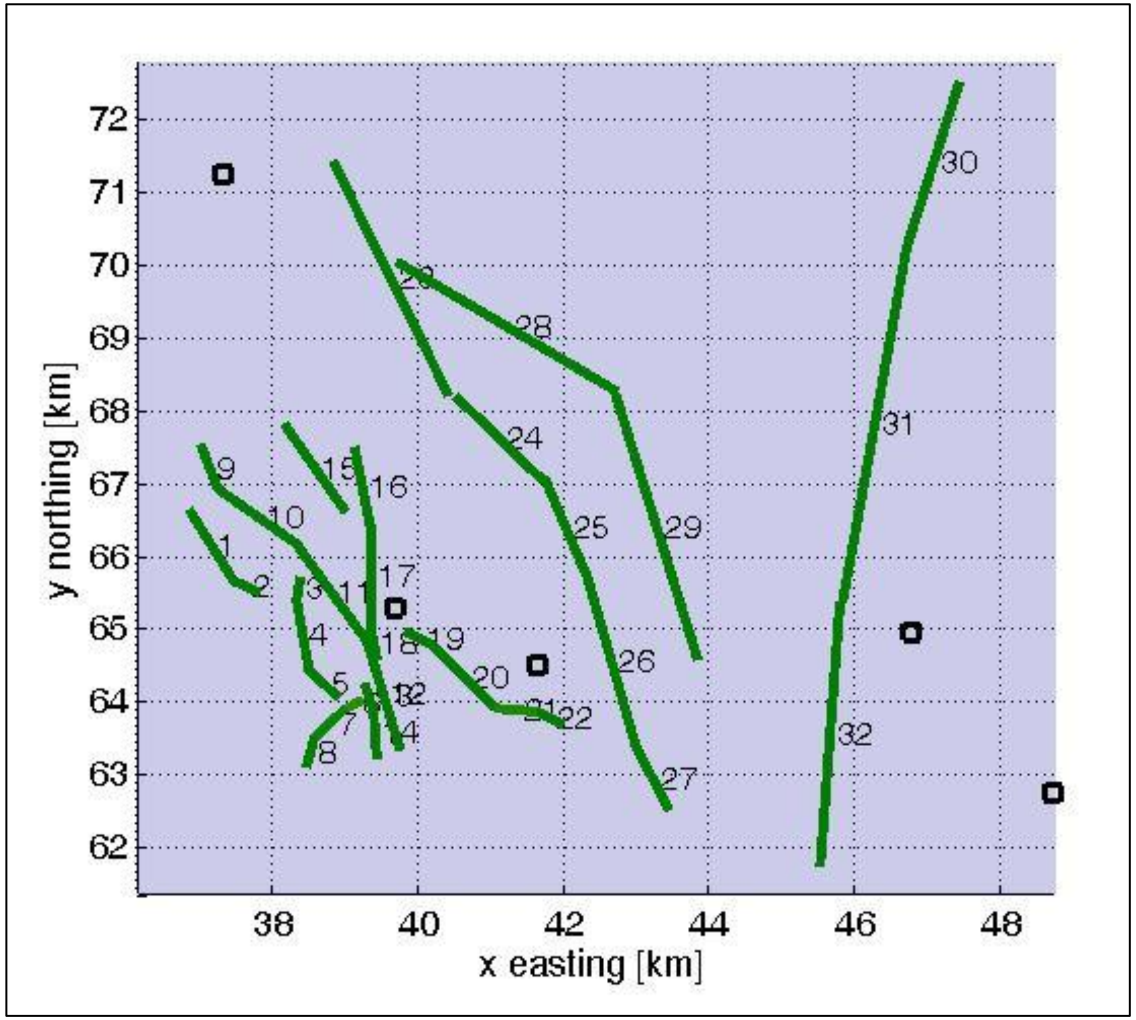

Eleven interpreted faults comprised of 2 fault segments in FSP injection simulations

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REQUIRED CONDITIONS TO INDUCE FAULT SLIP

- Faults in the area of review were divided into 32 fault segments to more accurately characterize their non-linear expression
- The FSP model first utilizes input parameters describing fault geometry, orientation, and local stress conditions to estimate the required pressure increase to induce motion along each feature (right)

Modeled Parameter	Input Value	Variability (+/-)	UOM	Source
Stress				
Vertical Stress Gradient	1.05	0.105	psi/ft	Nearby well estimate
Max Horizontal Stress Direction	N75E	5	Deg	Lund Snee & Zoback, 2018
Reference Depth	16800		ft	Nearby well evaluation
Initial Res. Pressure Gradient	0.43	0.043	psi/ft	Lund Snee & Zoback, 2018 Nearby well evaluation
A_ϕ Parameter	0.6	0.06	-	Lund Snee & Zoback, 2018
Reference Friction Coefficient (μ)	0.6	0.06	-	Standard value
Hydrologic				
Aquifer Thickness	1600	0	ft	Nearby well evaluation
Porosity	3.5	0.35	%	Nearby well evaluation
Permeability	35	3.5	mD	Nearby well evaluation
Faults				
Dip Angle	Multiple	10	Deg	-
Material Properties				
Density (Water)	1040	20	Kg/m^3	Standard value
Dynamic Viscosity (Water	0.0008	0.0001	Pa.s	Standard value
Fluid Compressibility (Water)	3.6×10^{-10}	0	Pa^{-1}	Standard value
Rock Compressibility	1.08×10^{-9}	0	Pa^{-1}	Standard value
Acid Gas Properties @ 6,700 psi & 210 ºF				
Density	811.00	-	kg/m^3	AQUAlibrium™
Dynamic Viscosity	0.0000787	-	Pa.s	AQUAlibrium™

Input parameters and source material for FSP model simulations

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REQUIRED CONDITIONS TO INDUCE FAULT SLIP

- Faults in the area of review were divided into 32 fault segments to more accurately characterize their non-linear expression

- The FSP model first utilizes input parameters describing fault geometry, orientation, and local stress conditions to estimate the required pressure increase to induce motion along each feature (right)

Segment #	ΔPP Required to Slip (PSI)	ΔPP Required to Slip (PSI)	ΔPP Required to Slip (PSI)	Segment #	ΔPP Required to Slip (PSI)	ΔPP Required to Slip (PSI)	ΔPP Required to Slip (PSI)
ALL CASES	DIP = 80° ± 10	DIP = 75° ± 10	DIP = 70° ± 10	ALL CASES	DIP = 80° ± 10	DIP = 75° ± 10	DIP = 70° ± 10
1	5414	5351	5311	17	5698	5619	5563
2	1513	1418	1363	18	7093	6838	6646
3	4270	4245	4249	19	1707	1636	1603
4	6939	6718	6547	20	3589	3572	3587
5	3458	3442	3458	21	1166	800	506
6	1340	823	422	22	1707	1636	1603
7	1147	938	776	23	6211	6092	5998
8	3589	3572	3587	24	3465	3448	3464
9	6842	6640	6481	25	6587	6425	6295
10	2406	2376	2382	26	7180	6902	6699
11	4839	4799	4785	27	6025	5922	5843
12	7146	6877	6679	28	1985	1935	1923
13	7023	6784	6602	29	7137	6870	6673
14	6246	6124	6027	30	3241	3224	3241
15	4983	4938	4918	31	4237	4212	4216
16	7023	6784	6602	32	5089	5040	5016

FSP model-derived pressure increase required to induce slip along simulated fault features

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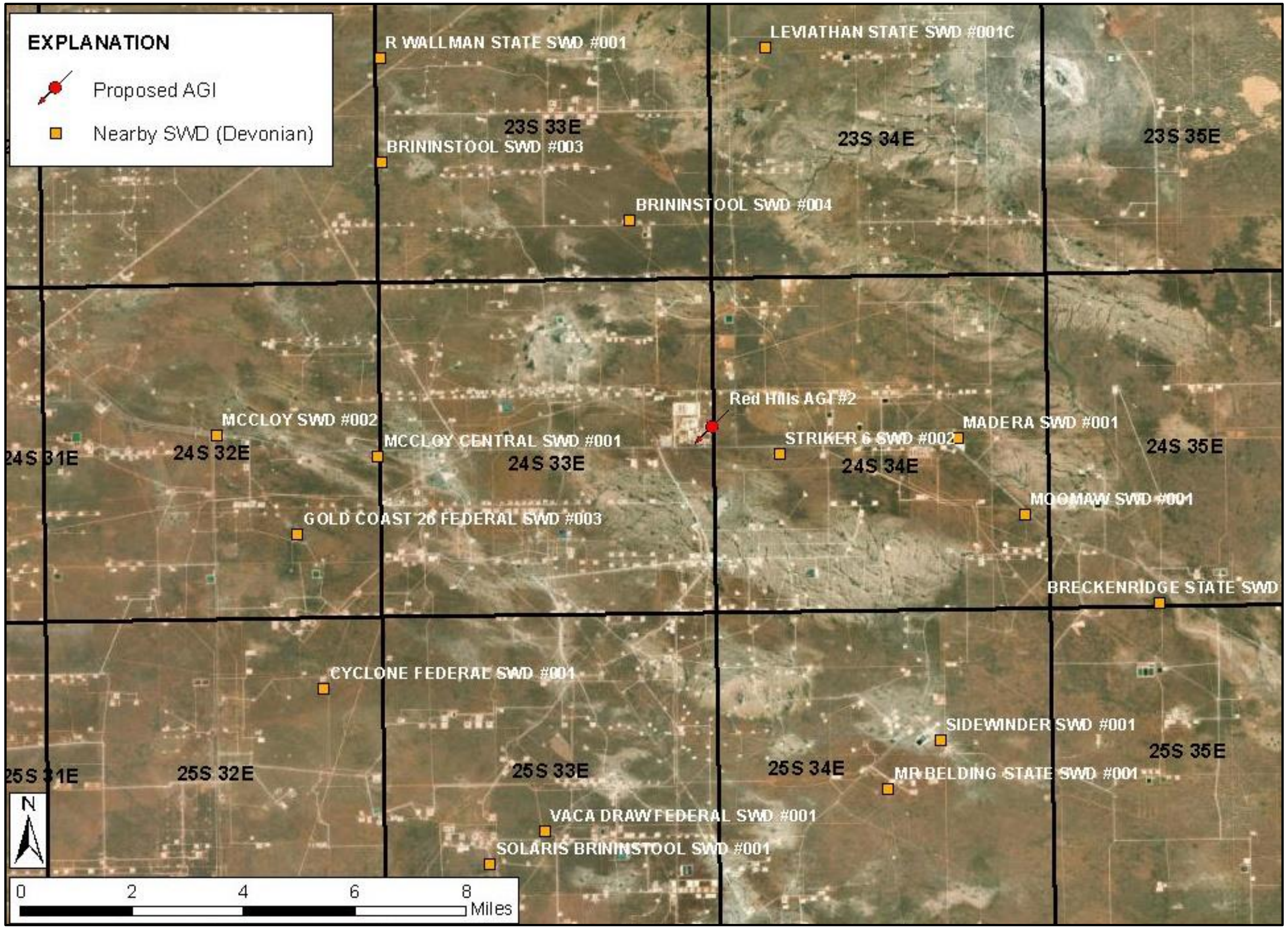
INJECTION WELLS IN THE VICINITY OF THE PROPOSED AGI

- Including the proposed Red Hills AGI #2, sixteen (16) active and permitted SWD wells were simulated in the induced-seismicity evaluations
- All permitted and active SWD wells within ten (10) miles of the proposed AGI were included in fault-slip potential simulations
- Striker 6 SWD #2 is the nearest SWD operating in the area and is located approximately 1.3 miles from the proposed AGI



Location map illustrating the sixteen (16) proposed and active injection wells included in the Red Hills AGI #2 induced-seismicity evaluation

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MODELED INJECTION SCENARIO

- Total simulation length increased to 34 years to incorporate contributions of nearby SWD operating prior to 2020
- For simulation, all SWD and proposed AGI were operated at their maximum anticipated daily injection rate, as recorded in their respective C-108 applications
- Daily injection volumes of nearby SWD range from 20,000 to 50,000 barrels per day
- It should be noted that the proposed volume of the Red Hills AGI #2 well represents less than 1.2% of the total from existing and permitted SWD wells

Well #	API	Well Name	Volume (bbls/day)	Start (year)	End (year)
1	-	Red Hills AGI #2	6000	2020	2050
2	3002544291	Striker 6 SWD #2	32500	2018	2050
3	3002545085	Brininstool SWD #4	31500	2020	2050
4	3002542448	Madera SWD #1	20000	2016	2050
5	3002544661	Moomaw SWD #1	30000	2019	2050
6	3002546109	McCloy Central #1	50000	2020	2050
7	3002545427	Sidewinder SWD #1	50000	2019	2050
8	3002545363	Mr Belding State #1	40000	2020	2050
9	3002544000	Brininstool SWD #3	25000	2020	2050
10	3002545514	Gold Coast 26 Fed #3	25000	2020	2050
11	3002523895	Vaca Draw Fed #1	40000	2017	2050
12	3002546685	Cyclone Fed #1	50000	2020	2050
13	3002545151	Breckinridge State #1	40000	2020	2050
14	3002543908	Solaris Brininstool #1	25000	2020	2050
15	3002542947	McCloy SWD #2	20000	2017	2050
16	3002545605	R Wallman State #1	45000	2020	2050

Summary of injection wells included, and parameters utilized in FSP simulations

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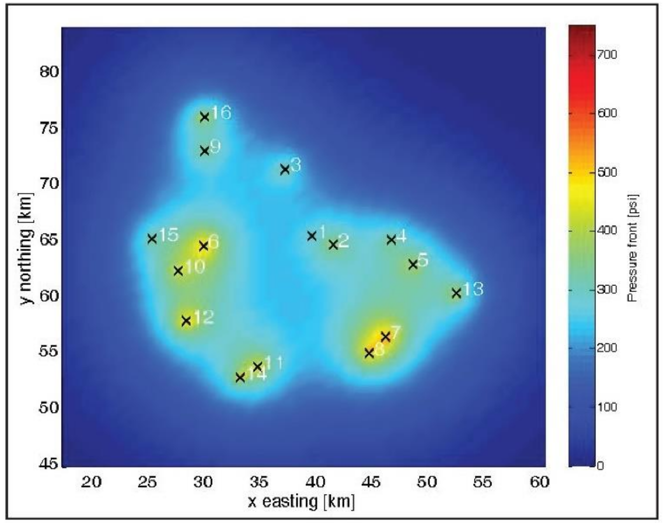
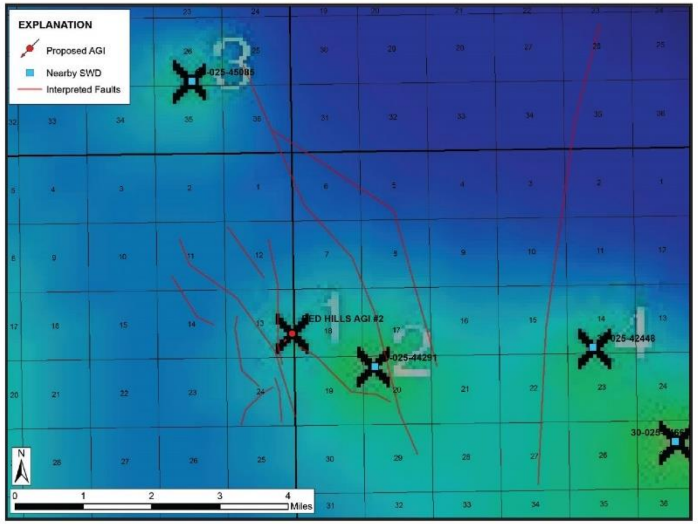
INJECTION SIMULATION RESULTS

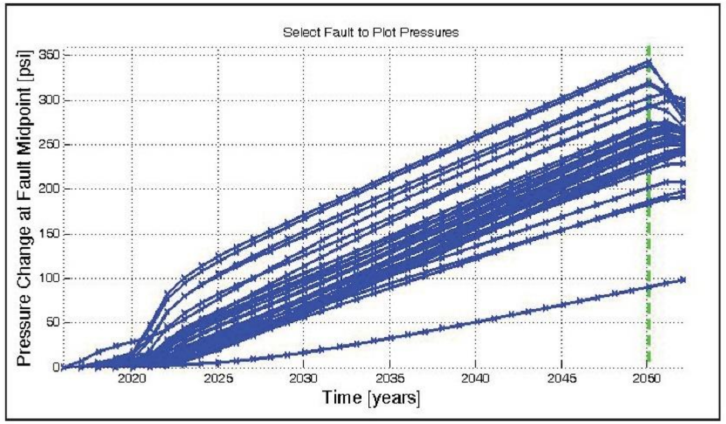
- Proposed Red Hills AGI #2 located such that it is relatively isolated from significant pressure influence of nearby high-volume SWD
- Of the 16 injection wells simulated, 13 are located approximately 6 miles or greater from the proposed AGI
- After 30 years of simulated injection, model-estimated pressure conditions at faults range from 90 to 343 psi



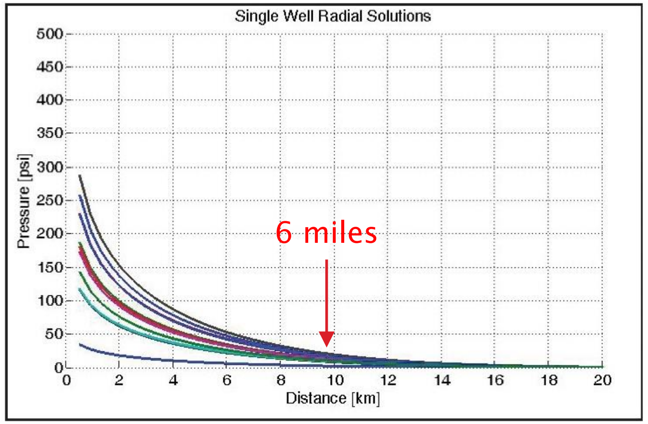
Panel A. Resultant pressure front after 30 years of injection operations at the maximum anticipated injection rates



Panel A. Resultant FSP predicted pressure conditions georeferenced to illustrate relationship to proposed faults in the area of interest



Panel C. Single well radial pressure solutions, as determined by the FSP model



Panel D. Model-predicted pressure change through time at the midpoint of each fault segment included in FSP simulation

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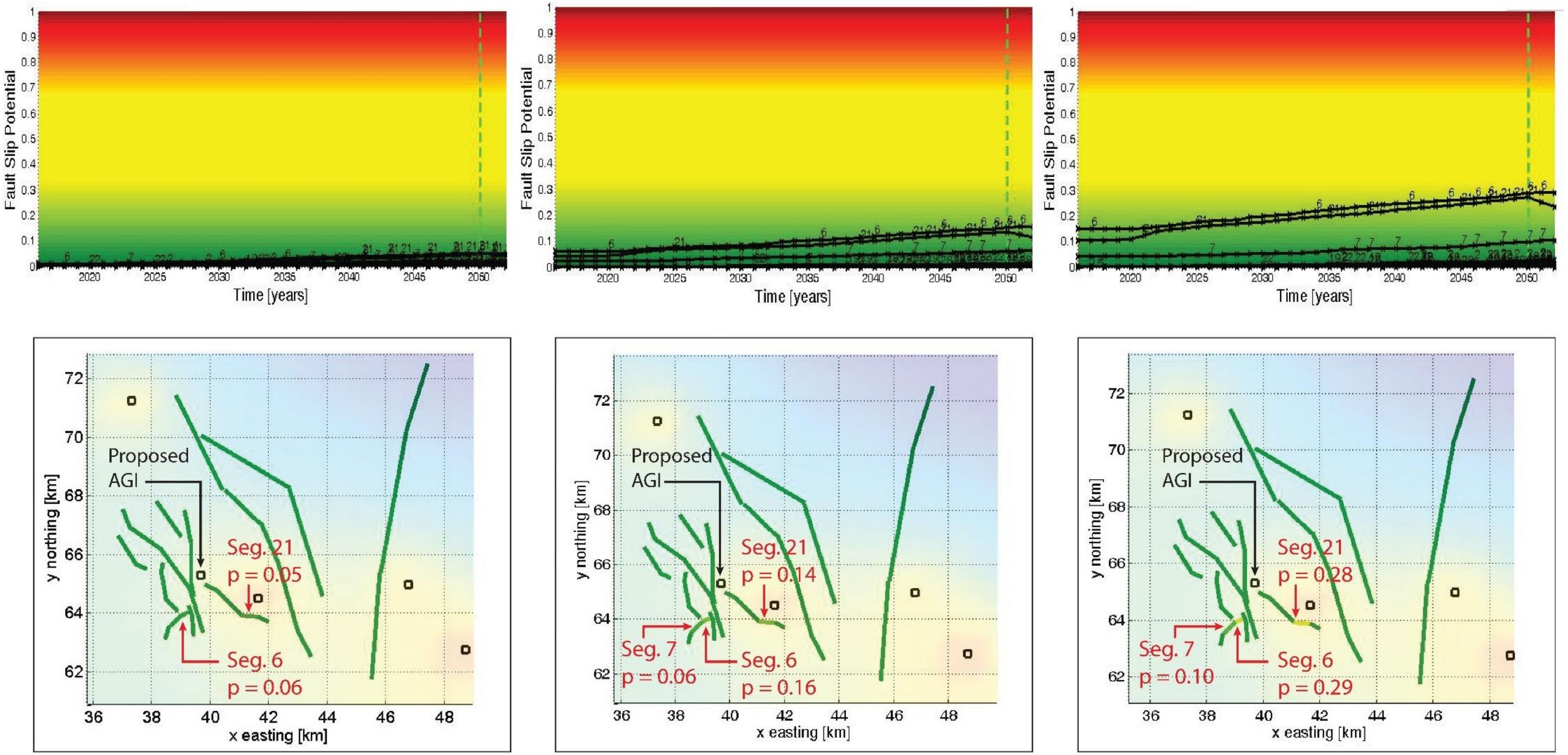
FSP SIMULATION RESULTS

CASE 1 - Fault Dip 80° +/- 10

CASE 2 - Fault Dip 75° +/- 10

CASE 3 - Fault Dip 70° +/- 10



Summary of model-determined fault-slip probabilities throughout the total injection period. Three case simulations were completed in which dip angles were systematically varied to address uncertainty in orientation.

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FSP SIMULATION RESULTS

Segment #	Predicted ΔPP (PSI)	Predicted ΔPP NO AGI (PSI)	ΔPP Required to Slip (PSI)	Probability of Slip	Probability (No AGI)	ΔPP Required to Slip (PSI)	Probability of Slip	Probability (No AGI)	ΔPP Required to Slip (PSI)	Probability of Slip	Probability (No AGI)
ALL CASES			CASE #1 DIP = 80° ± 10			CASE #2 DIP = 75° ± 10			CASE #3 DIP = 70° ± 10		
2	234	216	1513	0.01	0	1418	0.02	0.02	1363	0.03	0.03
6	259	238	1340	0.05	0.04	823	0.16	0.15	422	0.29	0.27
7	250	231	1147	0.03	0.02	938	0.06	0.07	776	0.10	0.10
19	293	260	1707	0.01	0	1636	0.01	0.01	1603	0.01	0.02
21	343	326	1166	0.06	0.05	800	0.14	0.14	506	0.28	0.23
22	339	324	1707	0.01	0.01	1636	0.02	0.02	1603	0.03	0.02
28	186	176	1985	0	0	1935	0	0	1923	0	0.01

- Generally, faults considered in this assessment exhibit increasing potential for slip as dip angles becoming increasingly more shallow
- Considering all case simulations, maximum slip probability values estimated by the FSP model range from 0.06 to 0.29, with the majority of fault segments exhibiting zero probability for injection-induced slip
- Subsequent model simulations excluding the contributions of the Red Hills AGI #2 demonstrate that operation of the proposed AGI produce only a minimal increase to slip probabilities estimated by the FSP model

SUMMARY – FAULT SLIP POTENTIAL

- Operation of the proposed Red Hills AGI #2 is not predicted by the FSP model to contribute significantly to the total risk for injection-induced slip
- Multiple case simulations were completed to address uncertainty of fault-dip magnitudes and demonstrate that slip potential increases as dip angles become more shallow
- Maximum slip probabilities of high-angle fault conditions range from 0.03 to 0.06 and the shallowest fault conditions exhibit a probability range of 0.10 to 0.29
- Though simulated at their maximum anticipated daily injection rate to assure a conservative assessment of slip probability, the most proximal Striker 6 SWD #2 and Red Hills AGI #2 well are not anticipated to operate at this capacity for the full 30-year injection duration
  - Striker 6 SWD #2 – Average reported daily injection volume of approximately 7,500 bpd
  - Red Hills AGI #2 – Intended to split total 13 MMSCFD with existing Red Hills AGI #1
- **In summary, operation of the proposed Red Hills AGI #2 is not anticipated to contribute significantly to the total potential for injection-induced fault slip and the historic volume contributions of relevant SWD combined with the anticipated operational parameters of the proposed AGI demonstrate that acid gas can be injected as proposed while maintaining minimal risk of induced seismicity**

RESERVOIR IMPACT OF RED HILLS AGI #2

- To understand the impact operation of the proposed Red Hills AGI #2 would have on the target Siluro-Devonian reservoir, Geolex, Inc.® completed a multi-phase evaluation to further assess the targeted injection reservoir and estimate the resultant AGI plume

1. **Reservoir Characterization** – Geolex completed a detailed review of available subsurface data (e.g. geophysical logs, drill-stem and injection tests, etc.) to identify and estimate reservoir characteristics underlying the proposed well location

2. **Injection Plume Characterization** – Utilize volumetric determination methods to approximate resultant plume footprint and distribution within the target reservoir under radial-dispersion and preferential up-dip dispersion regimes

3. **Addressing Matador and EOG's previous concerns** – Concerns expressed by Matador and EOG are addressed in this section. After review of all injection simulation results and local subsurface conditions, Lucid proposes moving forward with the originally planned AGI well location.

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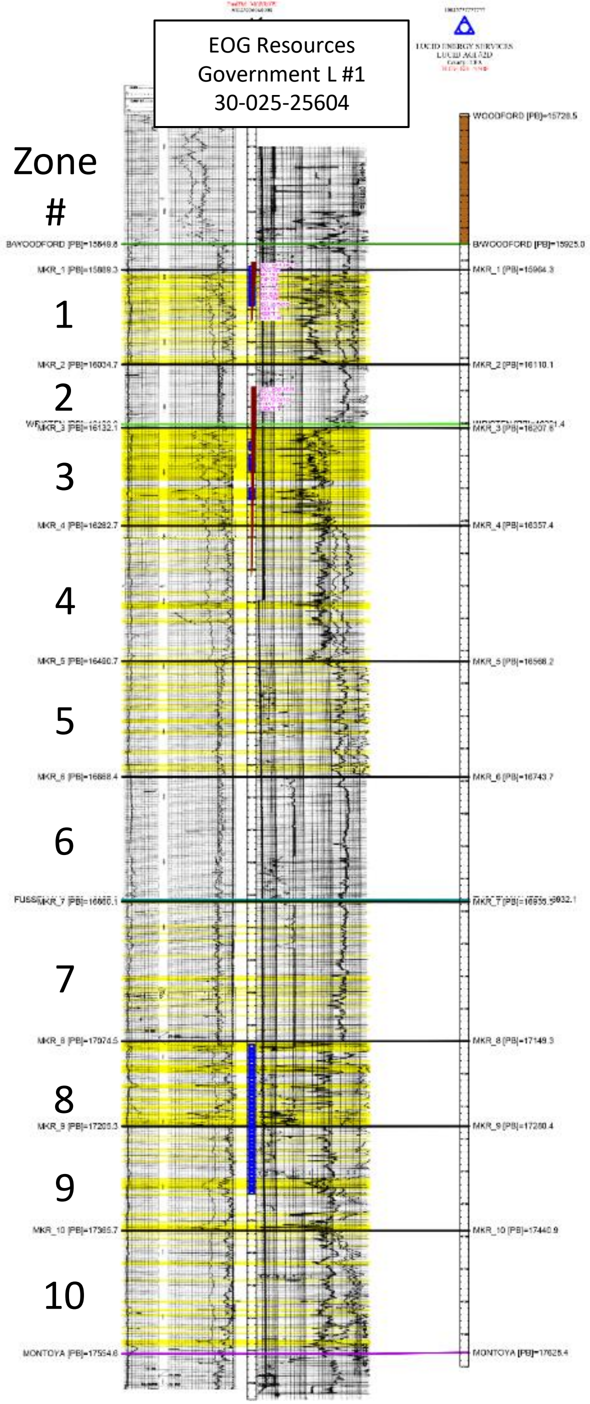
RESERVOIR CHARACTERIZATION

- Proposed injection interval subdivided into ten (10) discrete zones based on observed porosity and permeability characteristics
- Eight zones identified to be comprised of usable intervals of porous strata
- Interpreted porosity types include:
  - Solution-enhanced primary porosity (SEP)
  - Solution-enhanced fracture porosity (SEF)
  - Small fracture porosity
- Average porosity estimates made for each zone based on available well-log data
- Archie equation was utilized to determine water saturation (S_w), from which, estimates of the total volume available for sequestration within each zone could be made



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INJECTION RESERVOIR CHARACTERISTICS

- Interval porosity determinations range from 1-14% within identified porous zones
- Average total injection zone porosity of 3.5%
- Average permeability values estimated where DST, injection test, or adequate resistivity log data were available
- Permeability estimates further informed by dolomite permeability studies of Lucia et al. (1995)

Siluro-Devonian injection reservoir parameters and volumetric potential

ZONE #	TOP (FT)	BASE (FT)	THICKNESS (FT)	Φ TYPE	AVG Φ	TOTAL Φ (FT)	AVERAGE K	AVERAGE RT	F*	S_w**	1-S_w	BWE	BWE/DAY
1A	15964	16020	56	SEP	7%	3.92	80	125	250	0.14	0.86	52642101	4807
1B	16020	16110	90	FX	1%	0.90	0.75	n/d	-	-	-	-	-
2	16110	16208	98	TIGHT	0%	0.00	0.15	-	-	-	-	-	-
3	16208	16357	149	SEP	10%	14.90	150	80	118	0.1	0.9	208502511	190441
4A	16357	16464	107	FX	1%	1.07	0.4	n/d	-	-	-	-	-
4B	16464	16566	102	SEP	7%	7.14	30	210	250	0.08	0.92	102097048	9324
5	16566	16744	178	FX	1%	1.78	0.5	n/d	-	-	-	-	-
6	16744	16936	192	TIGHT	0%	0.00	0.15	-	-	-	-	-	-
7	16936	17149	213	FX	2%	4.26	0.25	n/d	-	-	-	-	-
8A	17149	17194	45	SEP+SEF	8%	3.60	250	100	189	0.13	0.87	48770468	4454
8B	17194	17215	21	FFX	1%	0.21	0.3	n/d	-	-	-	-	-
8C	17215	17280	65	SEP	14%	9.10	400	100	57	0.04	0.96	136193225	12438
9A	17280	17360	80	FX	1%	0.80	0.2	n/d	-	-	-	-	-
9B	17360	17441	81	SEF+FX	8%	6.48	50	100	188	0.13	0.87	87856499	8023
10	17441	17628	187	FX	2%	3.74	0.5	n/d	-	-	-	-	-

*$F = 0.85/Por^{2.14}$

**$S_w = F(R_w@BHT/RT)$

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CHARACTERIZING RESULTANT AGI PLUME

- Utilizing identified reservoir characteristics, the resultant AGI plume was estimated utilizing a porosity- and permeability-based volumetric determination to predict the resultant plume footprint in the target Siluro-Devonian reservoir

- Proposed Red Hills AGI #2 injection scenario:

  - Maximum injection rate: 13 MMSCF per day (5,285 bbl eq.)
  - Requested injection duration: 30 Years
  - Anticipated TAG composition: 87% CO_2, 12% H_2S, 1% trace C_1–C_7 and N

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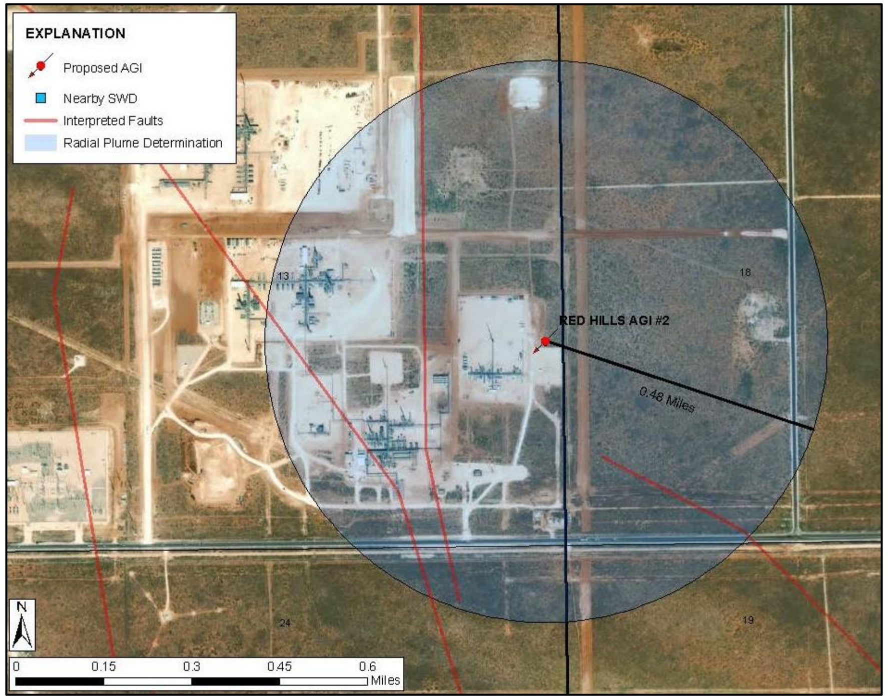
VOLUMETRIC DETERMINATION

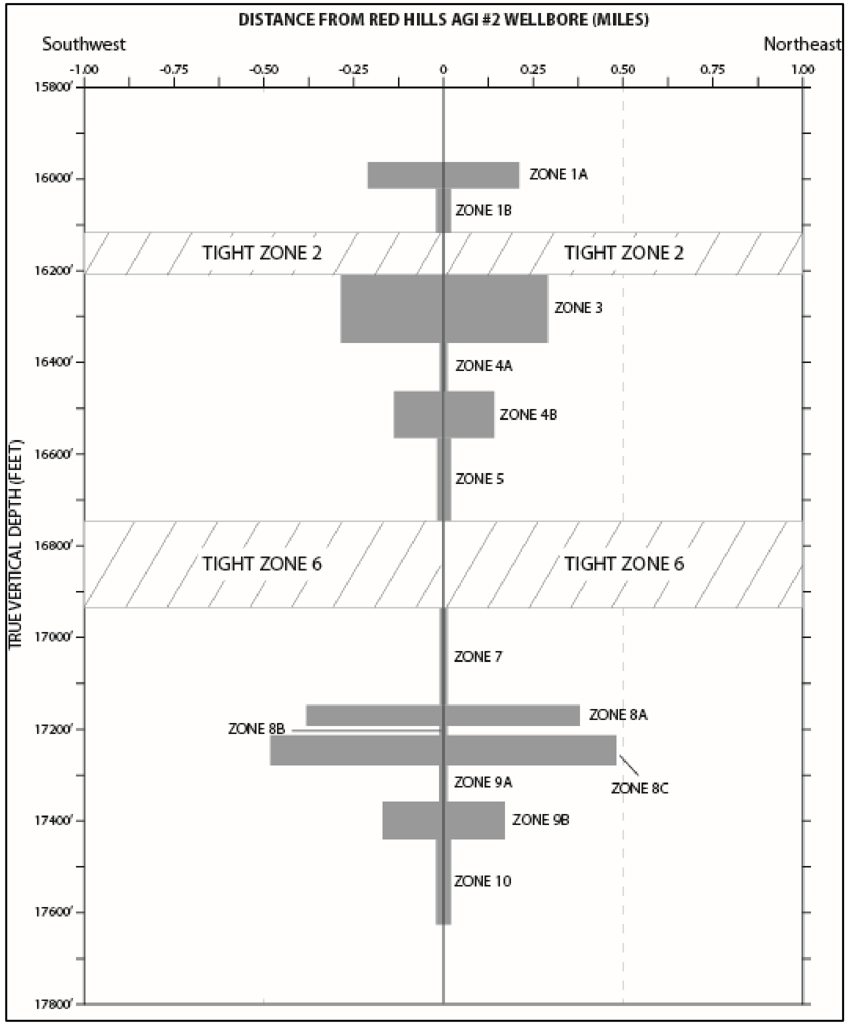
- Provides estimate of plume footprint based on available porosity and permeability potential characterizing injection reservoir
- Target total injectate volume (13 MMSCF per day) first fractionated based on available porosity within each identified zone
- Fractions subsequently scaled according to average permeability values estimated for each identified interval
- Injectate fractions were then utilized to calculate the resultant acid gas footprint under radial dispersion conditions and preferential up-dip dispersion, representing conditions where nearby faults are transmissive or non-transmissive of fluids

VOLUMETRIC DETERMINATION (Transmissive Faults)

- With scaled injectate fraction informed by porosity and permeability properties, dimensional characteristics after 30 years of injection can be estimated
- Under a radial dispersion regime, Zone 8A exhibits the farthest radial dispersion distance of approximately <u>0.48 miles</u>
- Plume anticipated to extend across planes of interpreted faults near AGI #2 location
- **Combined with an understanding of local structure, volumetric determinations can be utilized to better predict plume migration pattern**



Estimated radial dispersion pattern of acid gas after 30 years of injection



Cross-sectional view of acid gas distribution within each of the eight identified porous reservoir zones

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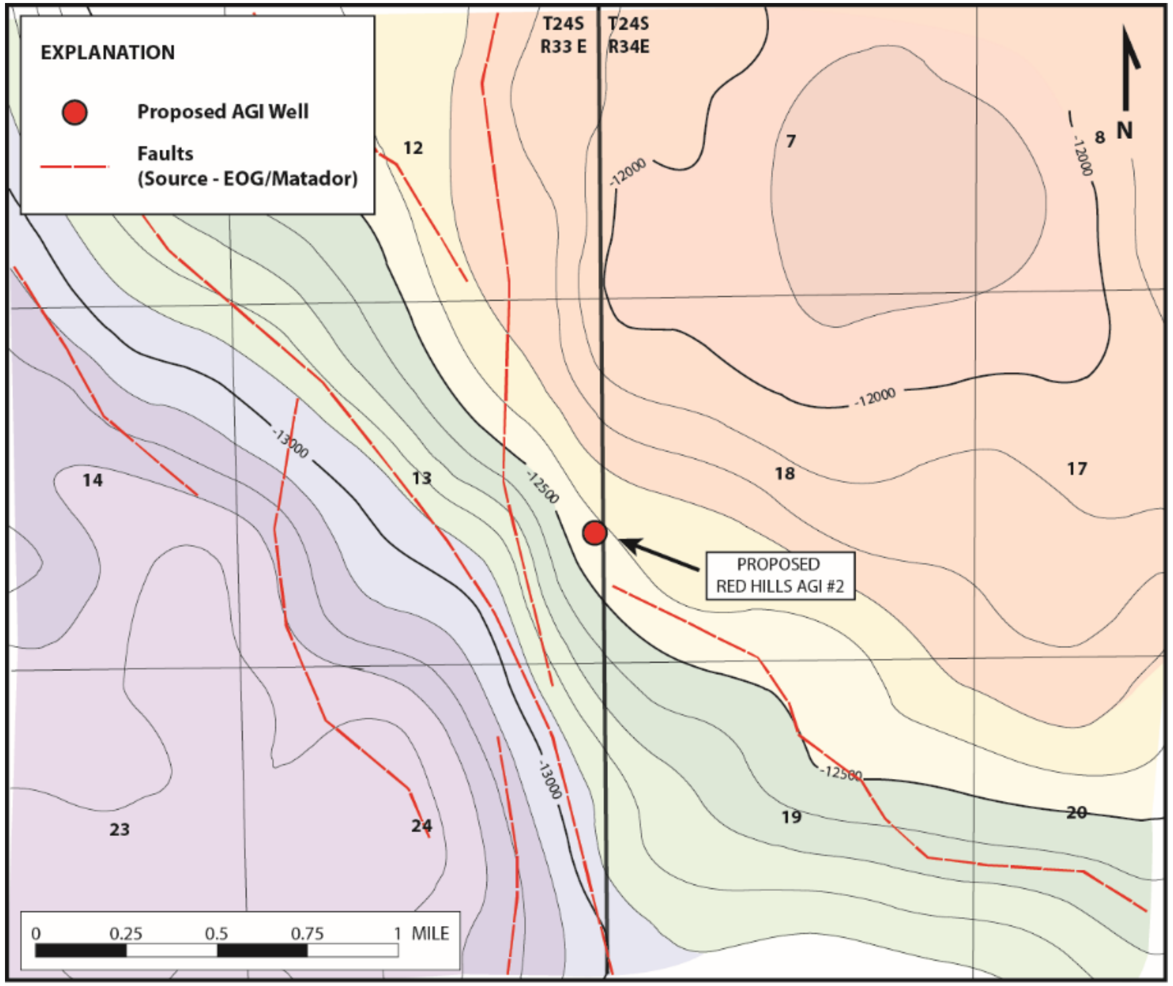
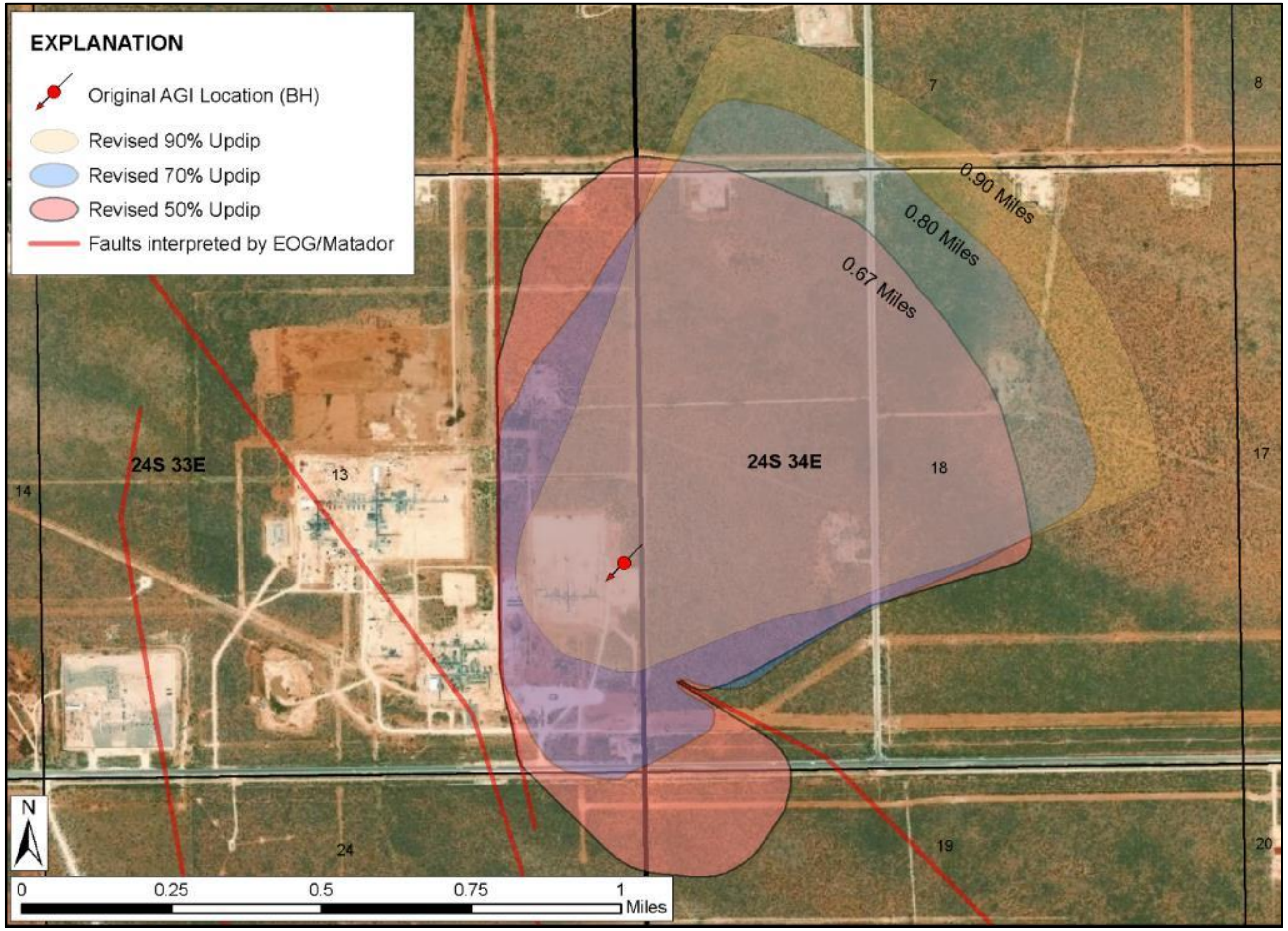
SUBSURFACE CONSTRAINTS ON AGI PLUME

- Proposed Red Hills AGI #2 located downdip of a structural high to the northeast
- Based on local structure and acid gas characteristics (SG = 0.85), injectate would be expected to preferentially disperse NE toward local high
- To estimate the resultant TAG plume footprint while incorporating identified subsurface features, three additional determinations were made in which varying flow regimes were defined
- Parameters include conditions when 90%, 70%, and 50% of acid-gas injectate migrates in the up-dip direction

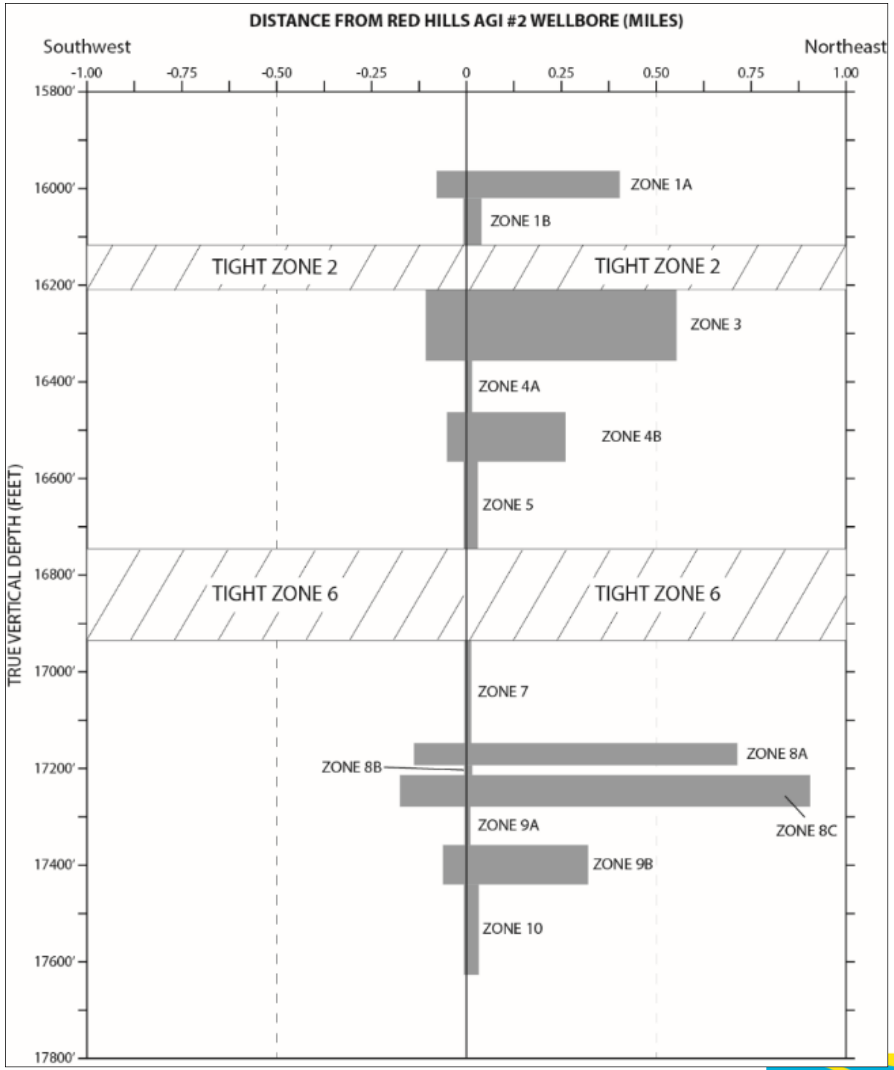


Structure-contour map illustrating the top of the proposed Siluro-Devonian injection reservoir

VOLUMETRIC DETERMINATION (Sealed Faults)



Approximated dispersion pattern of varying flow regimes



Plume migration distance by zone when
90% of TAG disperses in up-dip direction

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RESULTANT AGI PLUME – CONCLUSIONS

- Detailed review of the target injection reservoir identified ten (10) discrete zones, of which, eight (8) were identified to contain intervals of porous strata
- Zones 1, 3, and 8 exhibit the greatest porosity and permeability potential of the ten zones identified within the reservoir
- Under radial dispersion conditions, the resultant acid gas plume after 30 years is anticipated to extend a maximum of **0.48 miles** from the AGI well bore
- When acid gas preferentially migrates up dip due as a results of local structure combined with acid gas density characteristics, the resultant plume is anticipated to extend between **0.67 to 0.9 miles**, based on the fraction of acid gas allowed to migrate up dip
- Results do not consider potential for vertical communication within identified porous zones, which may contribute to a reduction in the maximum predicted TAG dispersion distance as injectate may migrate to over- and underlying intervals within the target reservoir

POTENTIAL FOR VERTICAL MIGRATION

NEARBY OPERATORS (EOG, MATADOR) INITIALLY EXPRESSED CONCERN THAT INTERPRETED FAULTS IN THE AREA WILL RESULT IN THE UPWARD MIGRATION OF ACID GAS INTO OVERLYING PRODUCING ZONES CAUSING WASTE AND RISK TO OPERATORS

- To evaluate and address these concerns, Geolex has completed a detailed review of available drilling fluid reports and relevant Delaware Basin studies characterizing pressure conditions in the area of the proposed AGI
- Additionally, a preliminary drilling-fluids program was prepared by Artesia Lumber Co./Buckeye, Inc. for the Red Hills AGI #2 to identify specific mud requirements for a Siluro-Devonian well drilled at the proposed location
- **It should be noted that after consultation with Lucid and their technical team, Matador and EOG have withdrawn their previous objections to this proposed AGI well**

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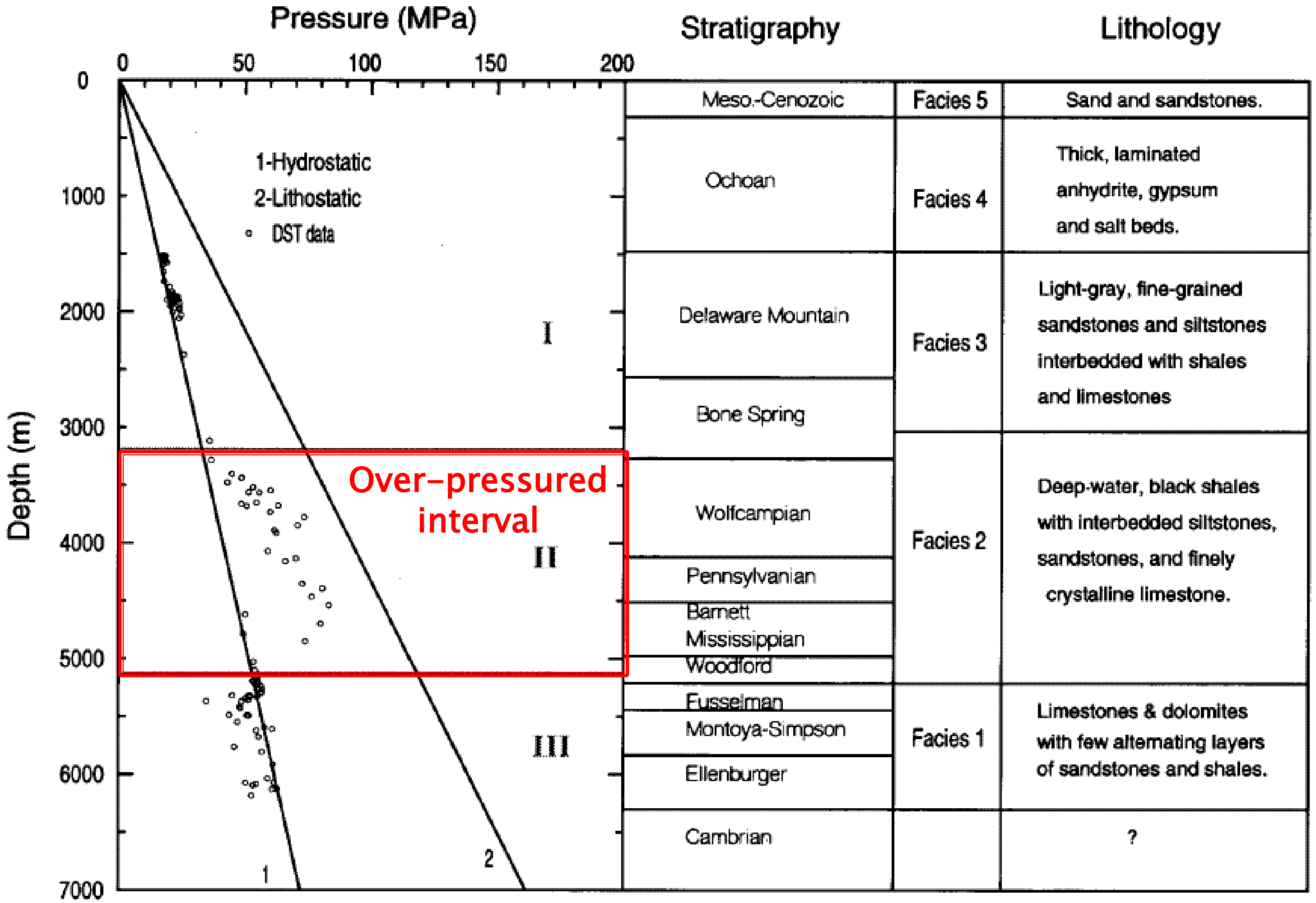
OVERPRESSURE CONDITIONS IN THE DELAWARE BASIN

- Over-pressured system covering 6 counties in Texas and New Mexico (Luo et al., 1994)
- Lower Bone Springs to Woodford Formation strata comprise the range of the over-pressured interval
- Interval mainly comprised of deep-water shales with some sandstone and limestone beds
- Lower pressure conditions characterize underlying carbonate intervals (**proposed injection zone**)



Correlation of fluid pressure, stratigraphy, and lithology in the War-Wink field area of the Luo et al. (1994) study

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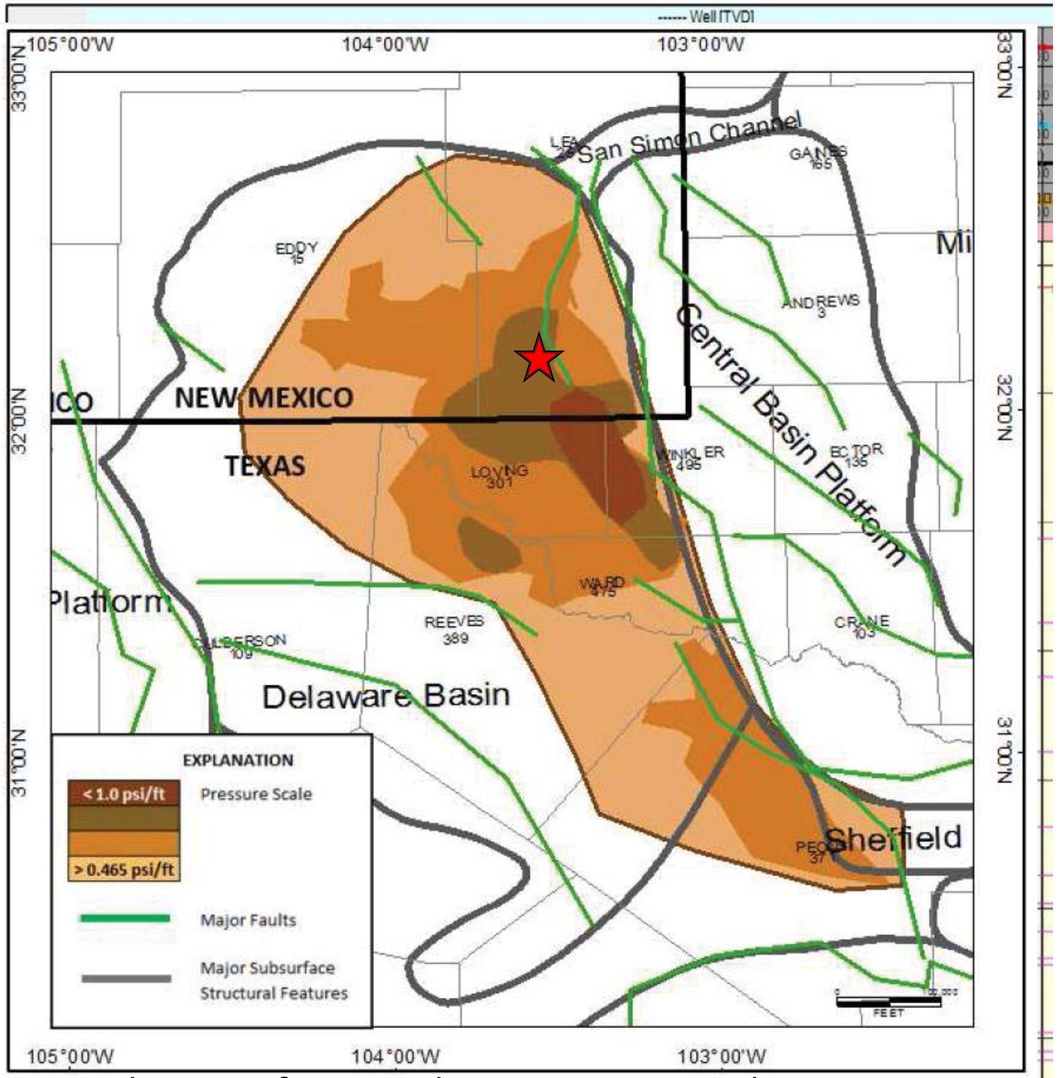
OVERPRESSURE CONDITIONS IN THE DELAWARE BASIN

- Regional pore-pressure model of Delaware Basin generated by Rittenhouse et al. (2016)
- Pore-pressure model informed by:
  - > 23,700 mud weight recordings
  - > 4,000 DST and fracture injection tests
- Increase in pore-pressure gradient beginning in lower Bone Springs and remaining elevated until base of Woodford Shale
- Mud records indicate higher-density fluids necessary from Lower Wolfcamp to base of Woodford Shale
- Normal pressure system below Woodford Shale (proposed Red Hills AGI #2 injection interval)



Mapped extent of present day overpressure in the Delaware Basin (Rittenhouse et al., 2016). Proposed AGI well location shown with red star.

Example log response illustrating stratigraphic onset of over-pressured intervals and associated drilling-fluid densities

DRILLING FLUID PROPERTIES

- To evaluate the potential for vertical migration of acid gas out of the target reservoir, Geolex reviewed available documentation on drilling fluid properties in the area of the proposed AGI

- Well data (shown right) illustrates significantly high fluid densities required while drilling through Atoka through Mississippian intervals
  - Mud Density Range – 9.9 to 15.0 ppg
  - Average Fluid Density – 12.4 ppg

- Nearby wells drilling into Devonian adjust fluid density to approx. 8.8 ppg prior to penetrating zone

Annotated map illustrating drilling fluid densities utilized in zones overlying the Siluro-Devonian reservoir in the immediate area of the proposed AGI well

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RED HILLS AGI #2 – FLUID PROGRAM

12,300' – 16,000'

Fluid Type	Brine water / Xanthan Gum / Barite / Pac LV
Potential Hazards	Seepage / lost circulation / abnormal pressure / well bore cleaning

12,300' – 16,000'.
Drill an 8 5/8" well bore and set 7" liner from 12,100' to 16,000'.

Drilling Fluid Recommendations

Interval Depth (feet) (MD TVD)	Fluid Density (Ppg.)	Viscosity (sec/quart)	Plastic Viscosity (cps)	Yield Point (lbs/100 ft.^{2})	pH	Filtrate - API (Cm3/30 min.)	Drill Solids (% volume)	Chloride (mg/l)
12,300' – 13,000'	10.0 – 11.0	36 – 40	10 – 15	8 – 10	10.5	10 – 12	< 5	165k – 185k
13,000' – 16,000'	12.4 – 12.9	40 – 45	12 – 18	10 – 15	10.5	8 – 10	< 5	165k – 185k

(*) Chlorides as NaCl⁻

16,000' – 17,600'

Fluid Type	Cut brine / Xanthan Gum / Pac LV / *Acid Soluble LCM*
Potential Hazards	Severe lost circulation

16,000' – 17,600'.
Drill a 5 7/8" well bore for open hole completion

Drilling Fluid Recommendations

Interval Depth (feet) (MD TVD)	Fluid Density (Ppg.)	Viscosity (sec/quart)	Plastic Viscosity (cps)	Yield Point (lbs/100 ft.^{2})	pH	Filtrate - API (Cm3/30 min.)	Solids (% volume)	Chloride (mg/l)
16,000' – 17,600'	9.0 – 9.2	32 – 34	6 – 10	4 – 8	10.5	10 – 15	< 5	40k – 90k (*)

(*) Chlorides as NaCl⁻

- Shown above is a preliminary mud program generated by Artesia Lumber Co./Buckeye, Inc. for the proposed Red Hills AGI #2
- Recommendation includes utilization of 12.4 to 12.9 ppg drilling fluids in zones overlying target injection interval in anticipation of high-pressure conditions through these intervals
- Fluid density reduced to 9.0 to 9.2 ppg in Siluro-Devonian reservoir and hazards include potential for "severe lost circulation"

VERTICAL MIGRATION POTENTIAL

BASED ON THESE OBSERVATIONS, OPERATION OF THE PROPOSED AGI IS NOT ANTICIPATED TO PRESENT ANY RISK FOR VERTICAL MIGRATION OF ACID GAS OUT OF THE TARGET RESERVOIR AND INTO OVERLYING PRODUCTIVE ZONES

- Records of drilling-fluid characteristics, drilling-fluid programs generated for the proposed AGI, and published literature support the presence of over-pressured conditions overlying the proposed Siluro-Devonian injection reservoir

- Pressure differential between target injection reservoir and overlying strata will act as a barrier restricting vertical migration, even along potentially-open fluid conduits

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C-108 APPLICATION EXECUTIVE SUMMARY

1. Lucid is requesting authority to inject acid gas into a deep, vertical well:
   - Into Devonian and upper Silurian Wristen and Fusselman formations, at depths of approximately 16,000 to 17,600 feet
   - At a maximum injection rate of 13 MMSCFD and maximum operating surface pressure of 4,838 psig
2. Independent evaluations (completed by Geolex and New Mexico Tech) to predict the maximum lateral dispersion distance estimate the resultant plume will extend between approximately 0.48 miles to 0.9 miles from the point of injection
3. There is no current or anticipated production in the Siluro-Devonian formations within at least three miles of the proposed injection site
4. Only one well penetrates the injection zone within the one-mile radius area of review, which is a plugged Morrow (Lower Pennsylvanian gas producer, located 0.72 miles from the proposed Red Hills AGI #2

C-108 APPLICATION EXECUTIVE SUMMARY (CONT.)

5. The single well penetrating the proposed injection zone is properly plugged and abandoned, such that the proposed injection zones are well isolated from producing and freshwater zones

6. The proposed injection zone is capable of permanently containing the injected fluid due to low porosity and permeability of caprock above and below the injection zone

7. Modeling methods were utilized to evaluate the potential for induced-seismic events in response to the proposed injection scenario, which indicate that the proposed Red Hills AGI #2 can be operated without causing significant increased risk for induced seismicity

8. A review of regional Delaware Basin pressure conditions, compiled drilling-fluid records, and recommended drilling procedures for the proposed AGI, demonstrate that the targeted injection reservoir will be relatively under-pressured with respect to overlying strata. As such, this provides added assurance that injected acid gas will be contained as the pressure differential will hinder and prevent vertical migration

LUCID'S REQUEST FROM THE NMOCC

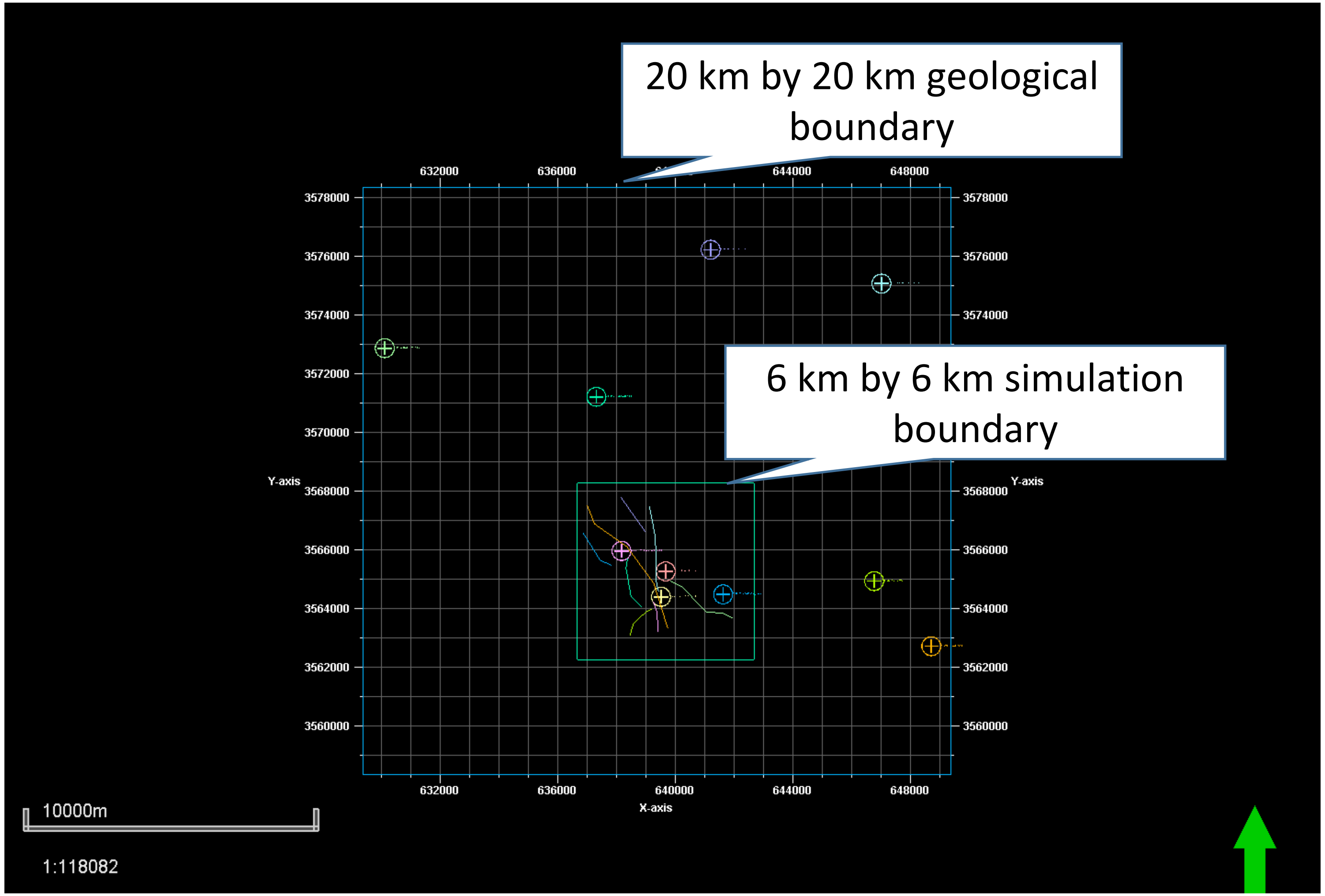
- Permission to drill, test, complete, and operate Red Hills AGI #2 as specified in Lucid's C-108 application at the location identified in Section 13, T24S, R33E at the Red Hills Gas Plant
- Lucid requests permission to inject acid gas (CO_2, H_2S, trace HC) into the well at MAOP of 4,838 psig and maximum average injection rate of 13 MMSCFD for at least 30 years
- As proposed, this well will enhance the reliability of the plant and the AGI system and the project is supported by adjacent producers
- This proposed well will dispose of acid gas safely and effectively and assures protection of surface and groundwater resources and correlative rights

Simulation to Support Lucid's Proposed AGI Well Permit Application

William Ampomah
New Mexico Tech – PRRC

LUCID
Exhibit 6

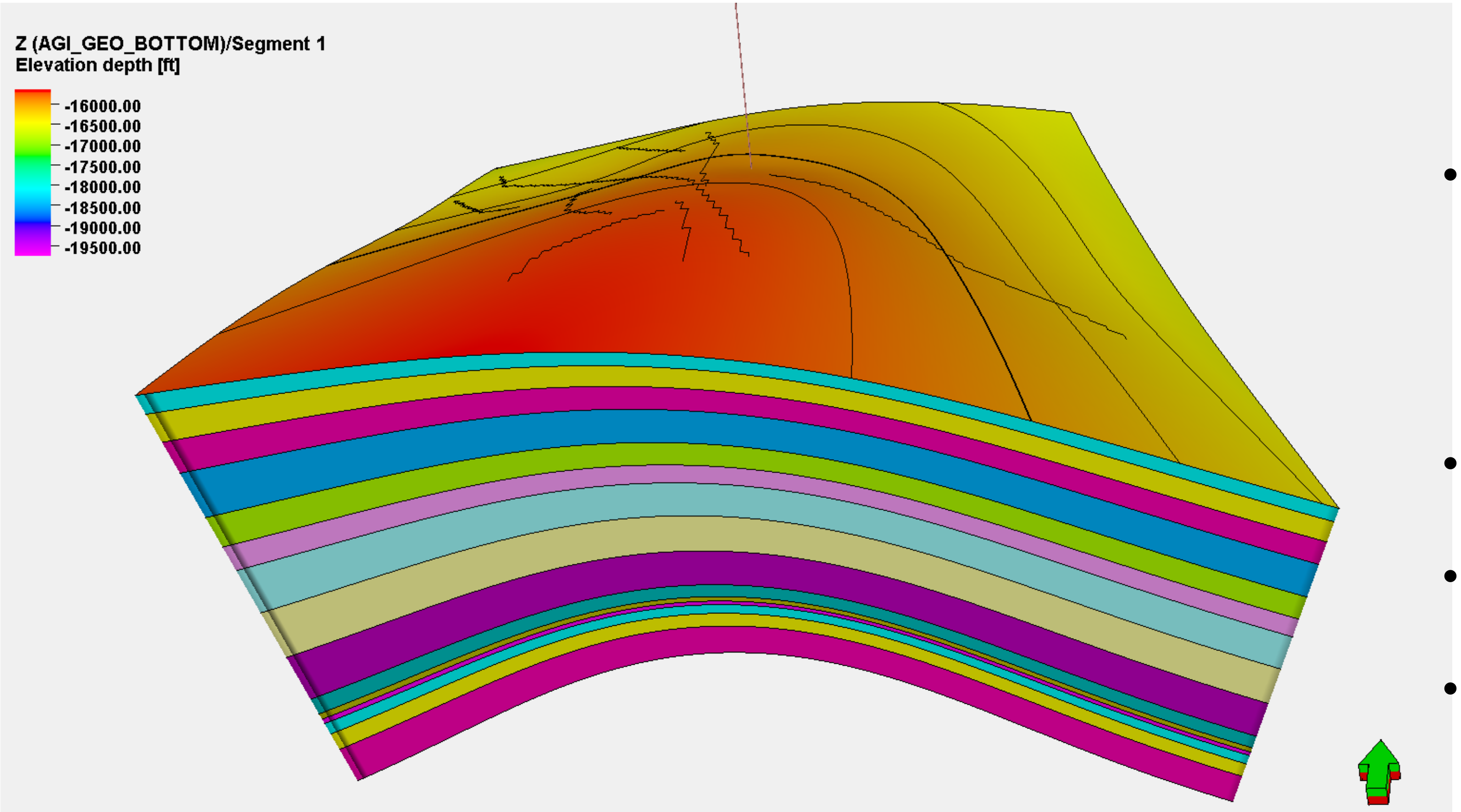
Geological model: Study boundaries



Top view of the studied area that structures the geological model

- A geological model is structured using the well top and bottom data within the 20 km by 20 km area.
- With all the faults are identified, a (6km by 6 km) simulation boundary is used to study the injection activity around the proposed AGI well.
- In the simulation boundary, three SWD wells: Trident, Striker 6 and Deep Thirsty are included, but only Striker 6 is injecting waste water

Structural Modeling



- A 3D view of the model is displaced to illustrate the structure of the formation
- Grid Cells: 119 * 119 *15
- Total Grid Cells: 212415
- Grid Dimensions: 50ft * 50ft

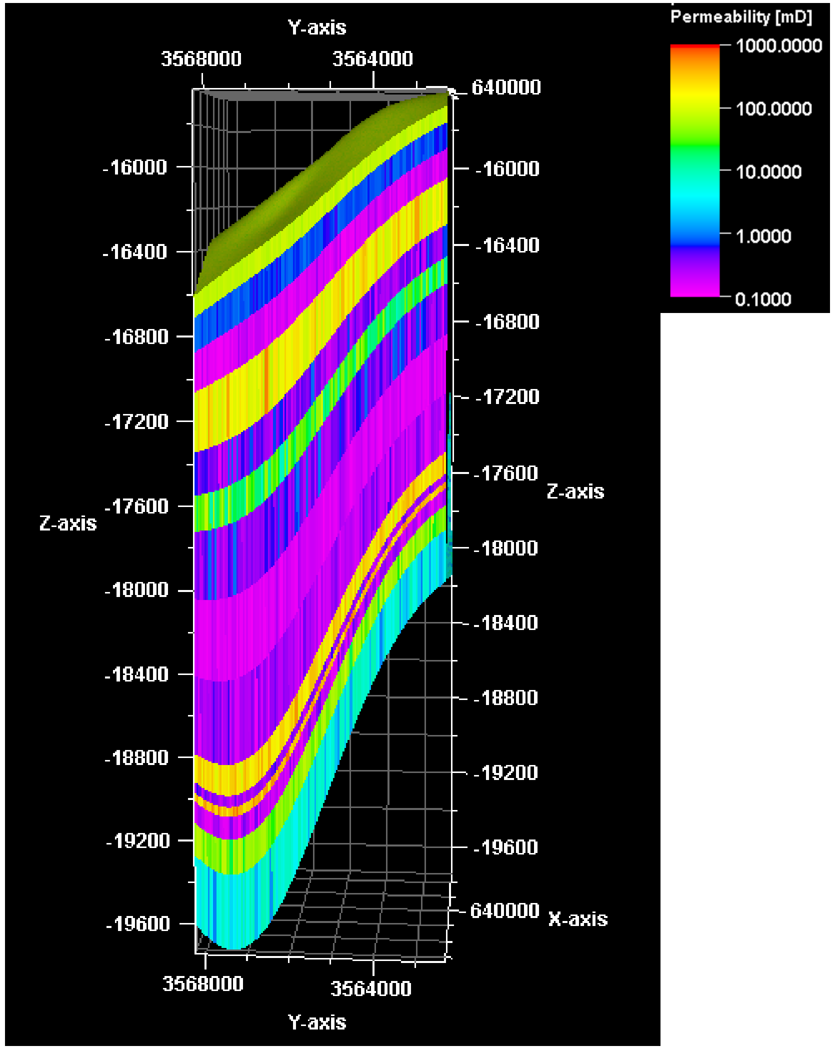
Spatial property distributions

Geological zones and ranges of the properties

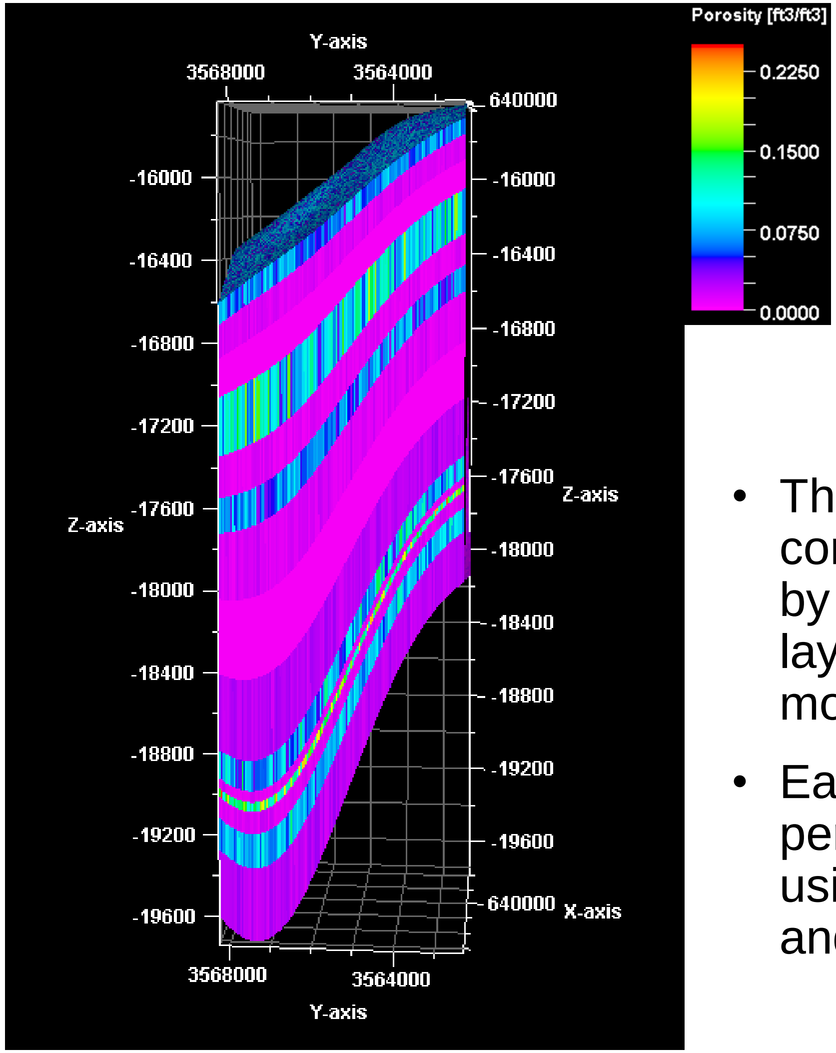
Zone	Depth, ft	Porosity, %		Permeability, md	
		Range	Mean	Range	Mean
ZONE 1	A. 15964 - 16020	1-10%	7%	1-100 md	80 md
	B. 16020 - 16110	0-2%	1%	0.1- 1.0 md	0.75 md
ZONE 2	16110 - 16208	0-0.5%	0%	0.1-0.3 md	0.15 md
ZONE 3	16208 - 16357	4-20%	10%	75-700 md	150 md
ZONE 4	A. 16357- 16464	0-2%	1%	0.1 to 1 md	0.4 md
	B. 16464 - 16566	0-10%	7%	1-100 md	30 md
ZONE 5	16566 - 16744	0-2%	1%	0.1-1 md	0.5 md
ZONE 6	16744 - 16936	0- 0.5%	0%	0.1 to 0.3 md	0.15 md
ZONE 7	16936 - 17149	0-3%	2%	0.1 to 5 md	.025 md
ZONE 8	A. 17149 - 17194	0-15%	8%	10- 700 md	250 md
	B. 17194 - 17215	0-2%	1%	0.1 to 1 md	0.3 md
	C. 17215 - 17280	10-25%	14%	100-700 md	400 md
ZONE 9	A. 17280 - 17360	0-2%	1%	0.1 to 0.5 md	0.2 md
	B. 17360 - 17441	2 -14%	8%	1.0 to 100 md	50 md
ZONE 10	17441 - 17628	0 - 3%	2%	1 to 10 md	0.5 md

- In the table, the mean values and ranges of the porosity and permeability distributions are listed.
- Pseudo-random numbers are generated following log-normal distributions to populate the spatial porosity and permeability distributions of the zones.
- It can be identified that Zone 8C is the most permeable and porous layer for injection activities.

Geological model:



(a)



(b)

- The geological model is structured considering the 10 zones suggested by Geolex and a total of 15 simulation layers are included in the simulation model.
- Each zone is assigned with different permeability and porosity distributions, using the recommended mean, min and max values.

A 3D view of GMV2 shown as permeability (a) and porosity (b) distributions

Hydrodynamic model: fluid properties

- The reservoir is initially saturated with 100 % of brine and exhibit hydrostatic equilibrium.
- The injection gas has two components of H_2S and CO_2 with molar fractions of 17% and 83%, respectively.
- Both two acid gas compositions are able to dissolve into aqueous phase.
- An irreducible water saturation of 0.17 is used to generated the relative permeability curves for gas/water system.

Hydrodynamic model: Boundary conditions

- The external boundary conditions are specified to be open boundary.
- The simulation work starts from October 2018 when Striker 6 SWD came online, and stop until the end of 2050 for 30-year of acid gas injection simulation.
- The gas injection well injects acid gas at a rate specification of 13 MMSCF/Day.
- The SWD wells inject water using injection history from Oct. 2018 to Feb. 2020. Then, three salt water injection rates are considered in this work:
    1. q_1 = 32,500 STB/day which is the maximum volume of water injection rate
    2. q_2 = 15,000 STB/day which is the medium volume of water injection rate
    3. q_3 = 7,472 STB/day, the minimum volume of water injection rate which is calculated from the average value of the injection history.
- Bottomhole pressure gradient of 0.629 psi/ft calculated from formation Shmin gradient are imposed to all of the injectors.

Simulation Scenarios

This work runs extensive simulation scenarios considering the combination fault characterizations, and SWD injection rates.

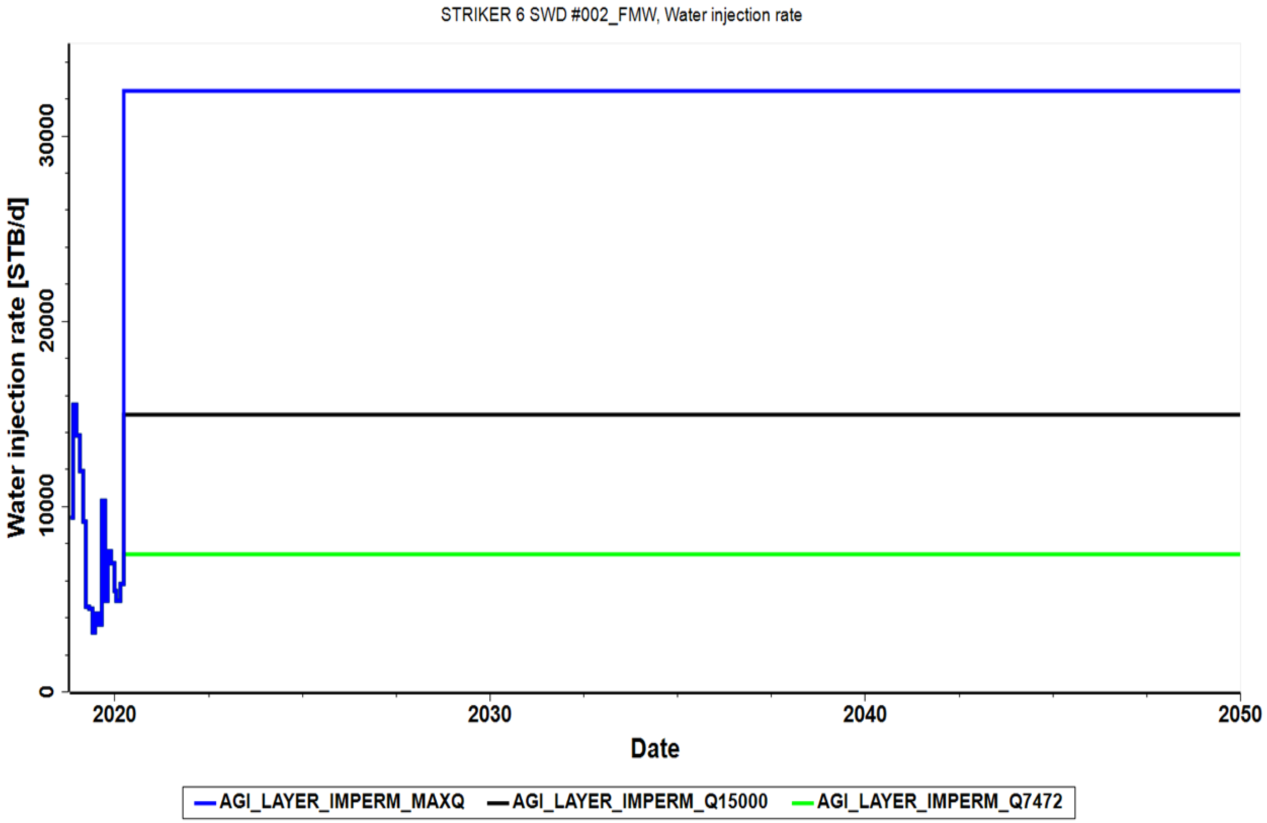
- Fault characterizations:
  1. Simulation run ignoring the impact of the faults (the transmissibility multiplier of faults are 1).
  2. Simulation run considering the faults are impermeable barriers. (the transmissibility multiplier of faults are 0).
- SWD injection rates
  1. q_1 = 32,500 STB/day
  2. q_2 = 15,000 STB/day
  3. q_3 = 7,472 STB/day

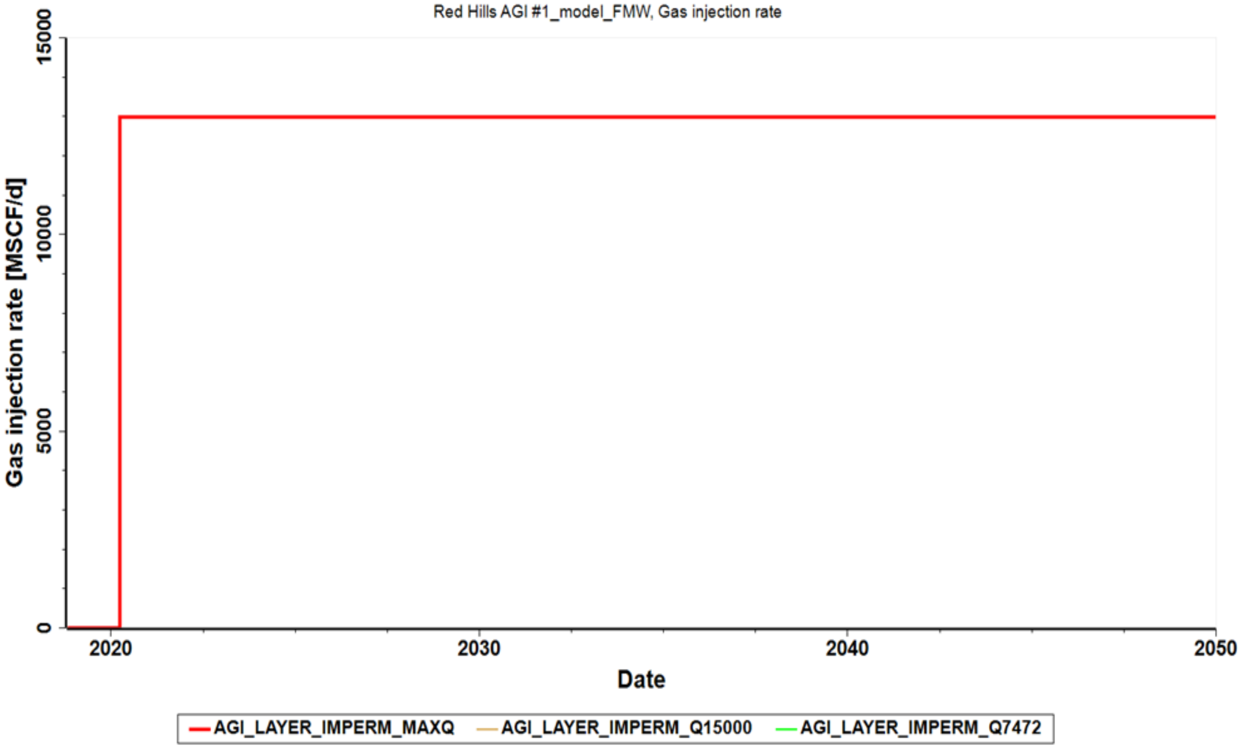
Simulation Results:

- The simulation results will be presented based on:
  1. For the close fault cases
  2. For the open fault cases
- Each fault characterization case will simulate different SWD injection rates.
- The gas plume displayed in the results are the furthest lateral extend of the gas saturation stacking all the layers.
- The pressure surface distribution are the pressure impact observed at the top layer, where the AGI well plays the most important role.

Simulation Results: with the faults closed

Well performance

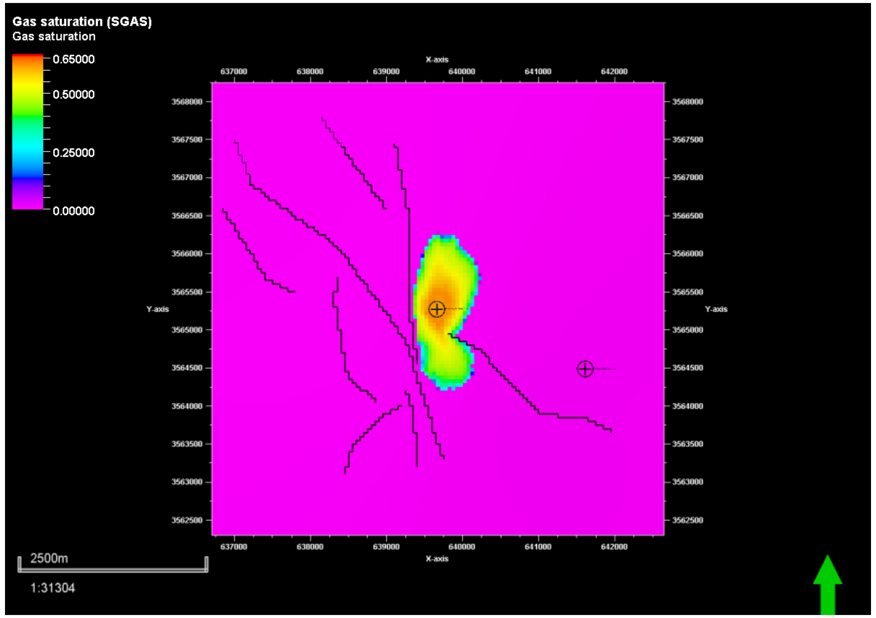




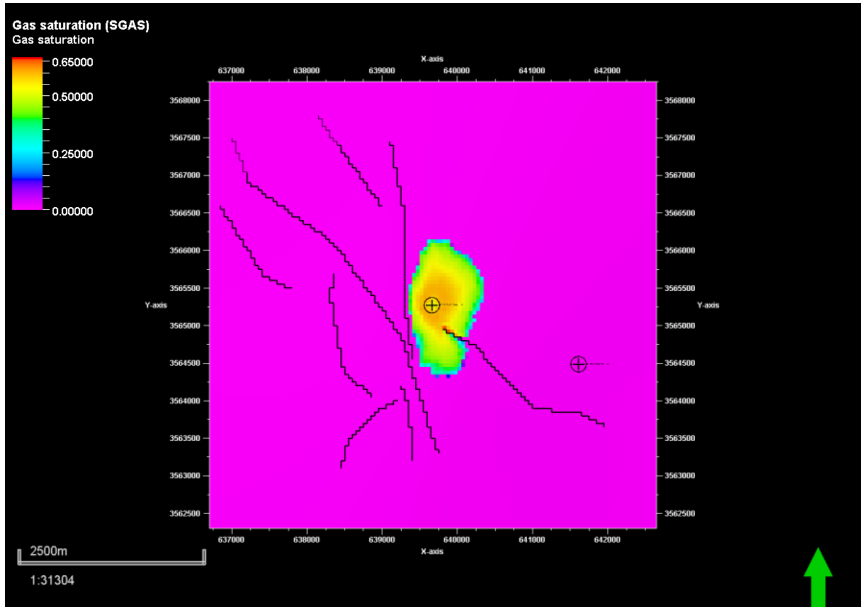
SWD well injection rates

AGI well injection rates

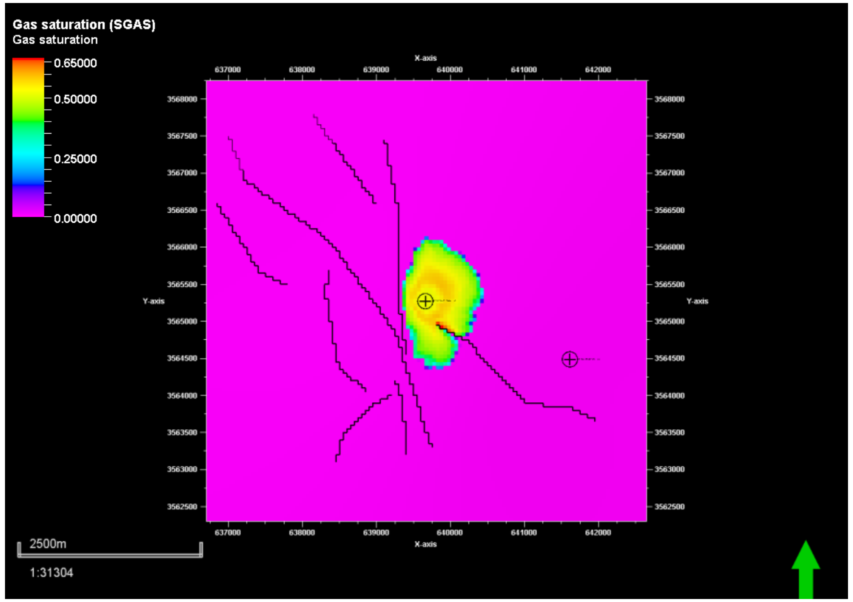
Simulation Results: with the faults closed



Acid gas plume when qw=32,500 STB/day



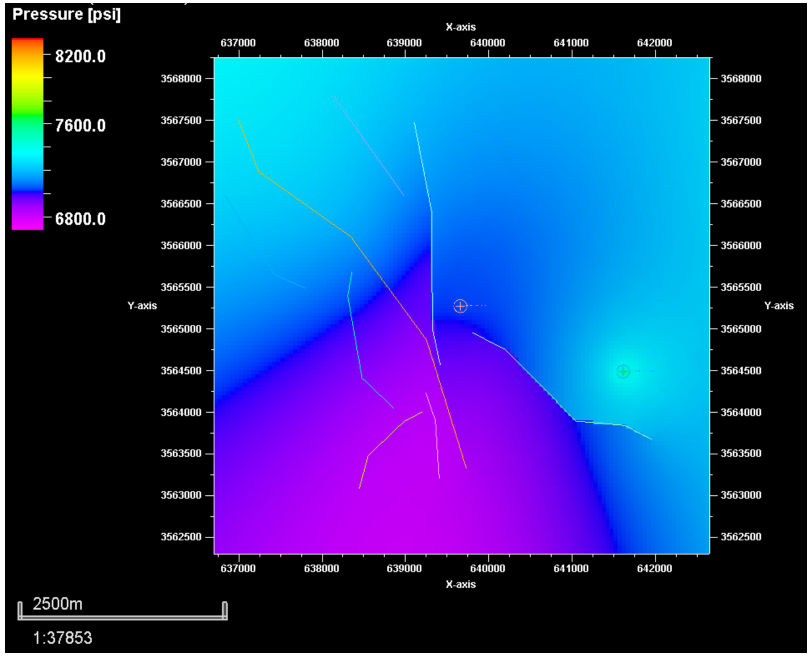
Acid gas plume when qw=15,000 STB/day



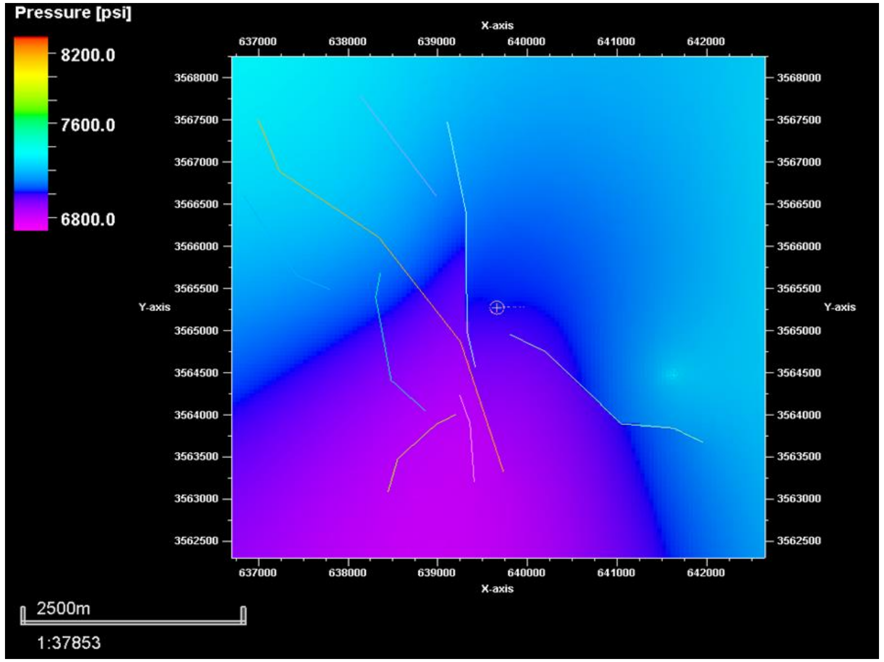
Acid gas plume when qw=7,472 STB/day

- The acid gas plume distributions after 30-year of acid gas injection are shown for different SWD injection rates.
- Also, it can be illustrated that the gas plume is still far from reaching the edge of the 6 km by 6 km area.

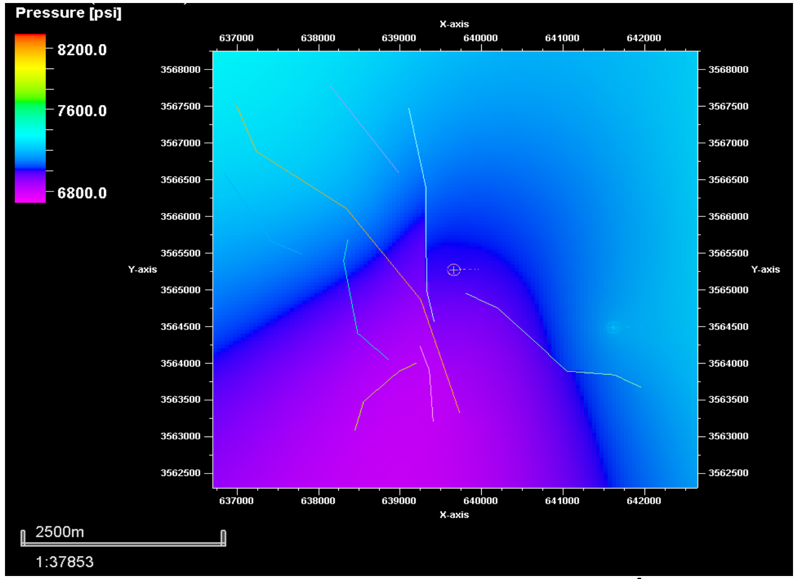
Simulation Results: with the faults closed



Pressure distribution when qw=32,500 STB/day



Pressure distribution when qw=15,000 STB/day

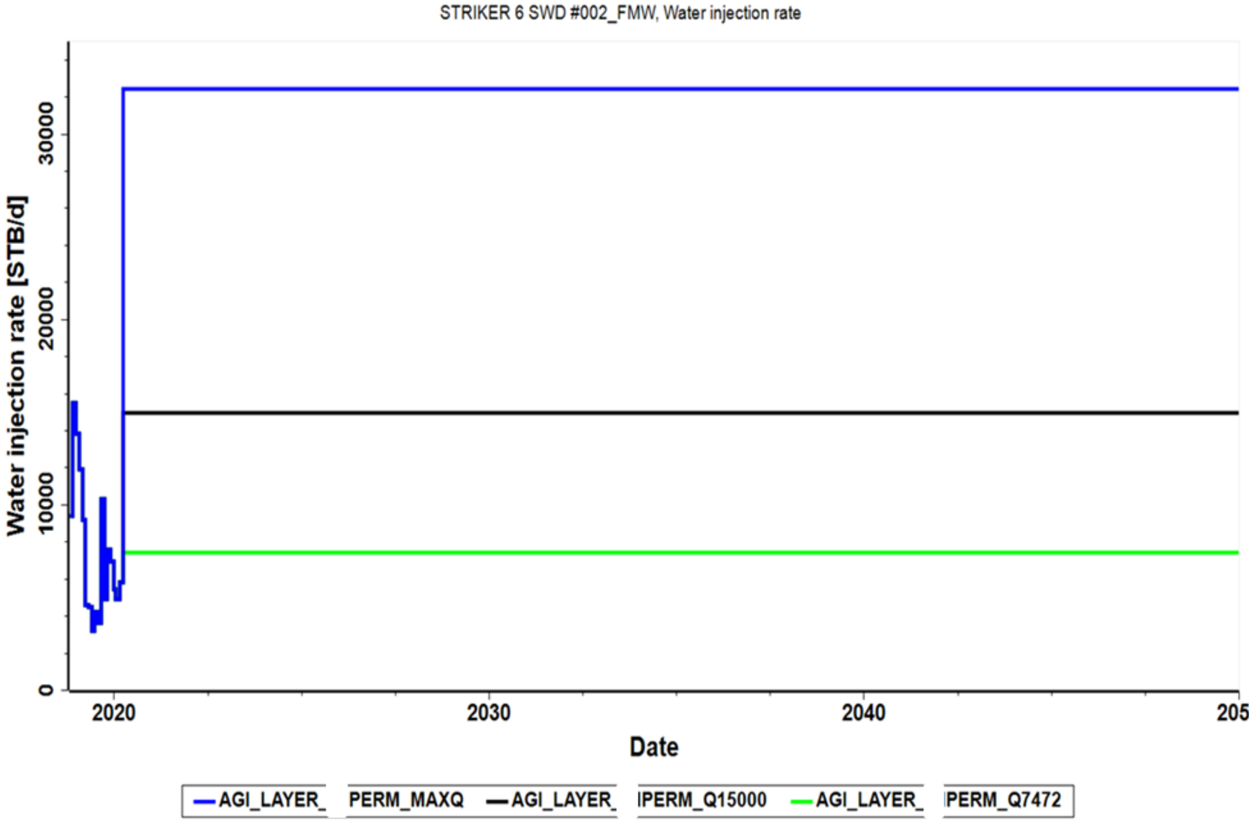


Pressure distribution when qw=7,472 STB/day

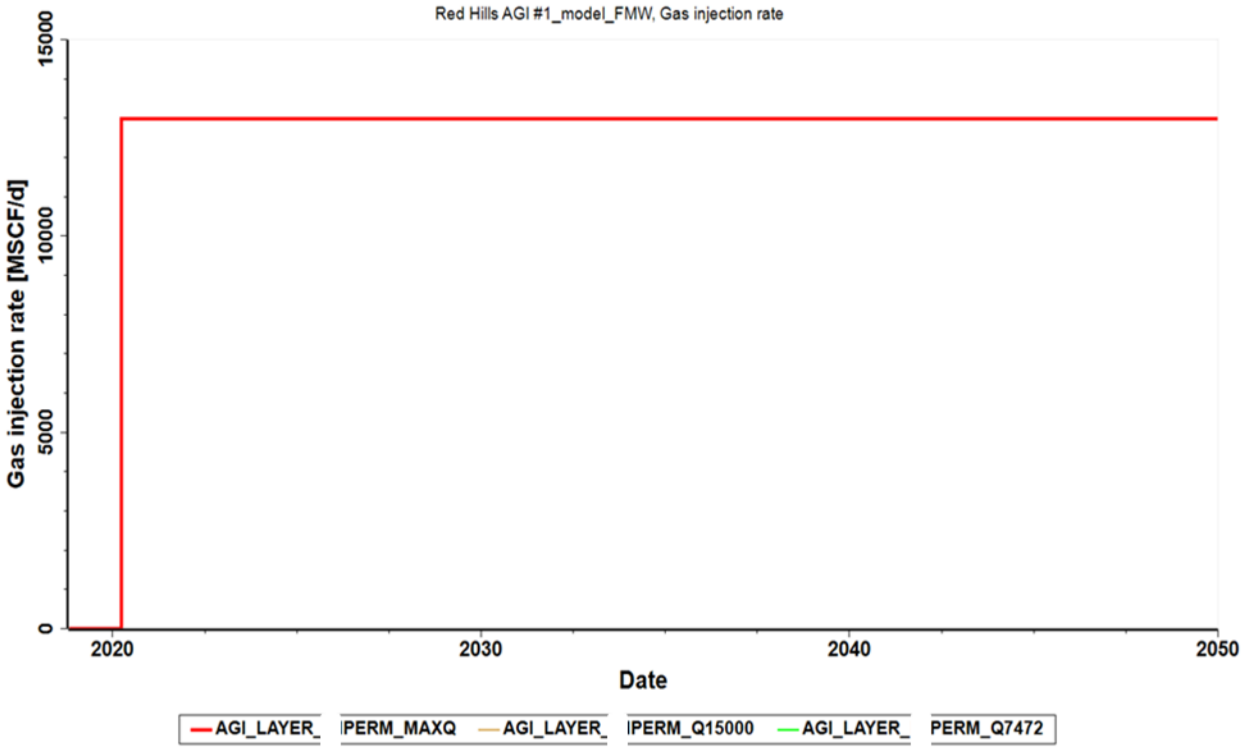
- The pressure distributions after 30-year of acid gas injection are shown for different SWD injection rates.
- It can be observed that the SWD introduces much more severe pressure increments to the system than the AGI well.

Simulation Results: with the faults open

Well performance

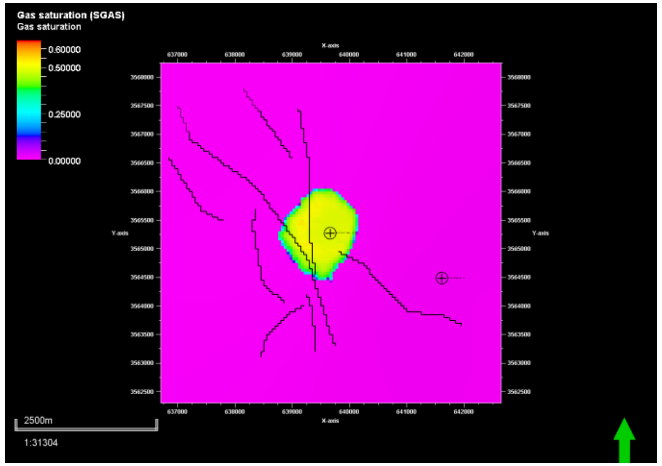


SWD well injection rates

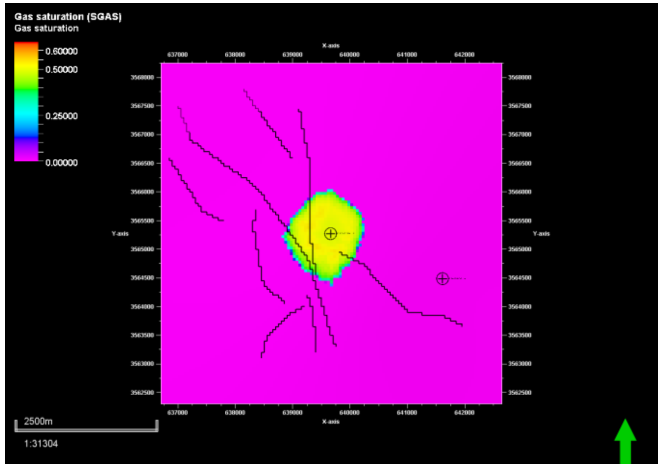


AGI well injection rates

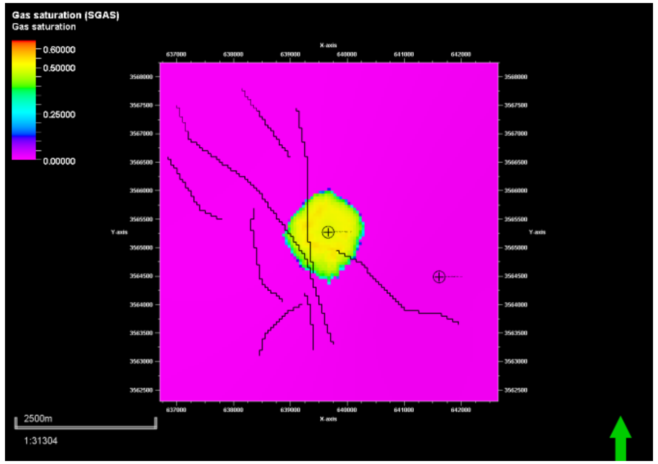
Simulation Results: with the faults Open



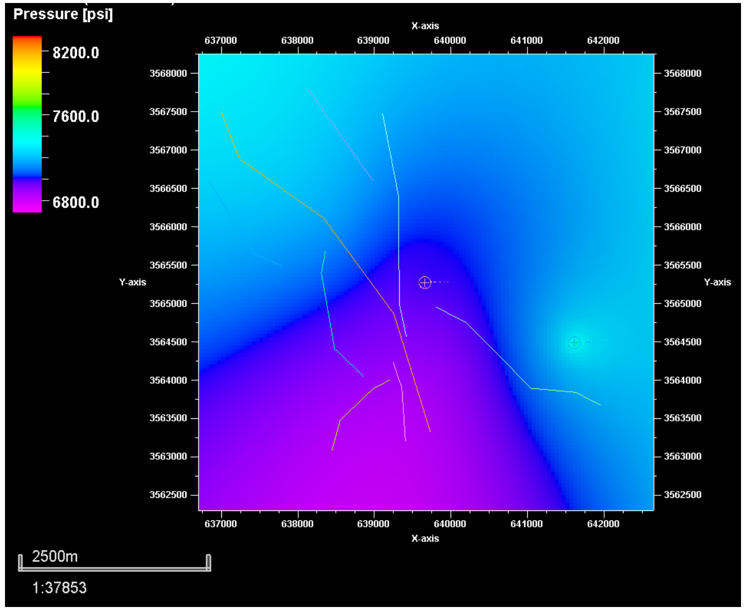
Acid gas plume when qw=32,500 STB/day



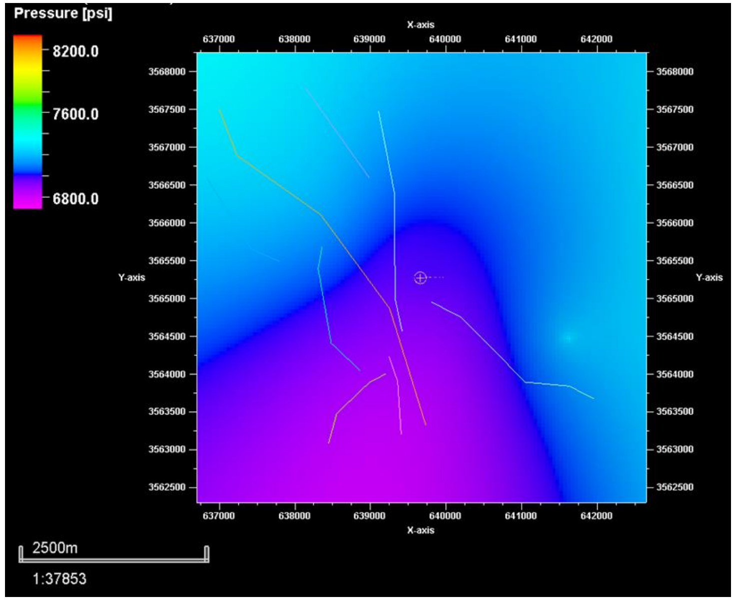
Acid gas plume when qw=15,000 STB/day



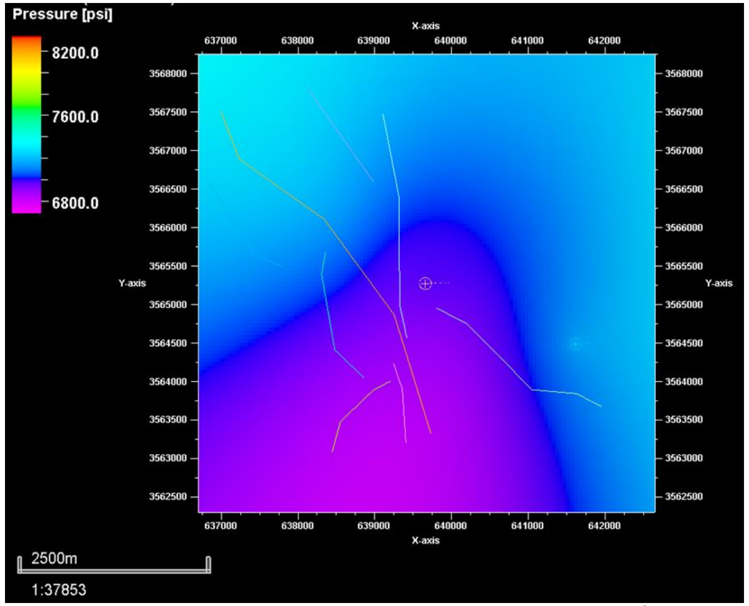
Acid gas plume when qw=7,472 STB/day



Pressure distribution when qw=32,500 STB/day



Pressure distribution when qw=15,000 STB/day



Pressure distribution when qw=7,472 STB/day

Geomechanical model Setup

The following elastic properties are assign to the rock materials

- For the injection zone:
  - Young's Modulus 1.5×10^{7} kpa
  - Poisson Ratio: 0.25
  - Rock density, 2650 kg/m^3
- For the cap/base rocks and side burdens
  - Young's Modulus 3.6×10^{7} kpa
  - Poisson Ratio: 0.2
  - Rock density, 2550 kg/m^3

Also, the Mohr-Coulomb is selected as the yield criteria.

Geomechanical model – Boundary Condition

Density-based condition

Normal faulting Regime [Sv > SHmax > Shmin]

Vertical Stress gradient = 1.05 psi/ft

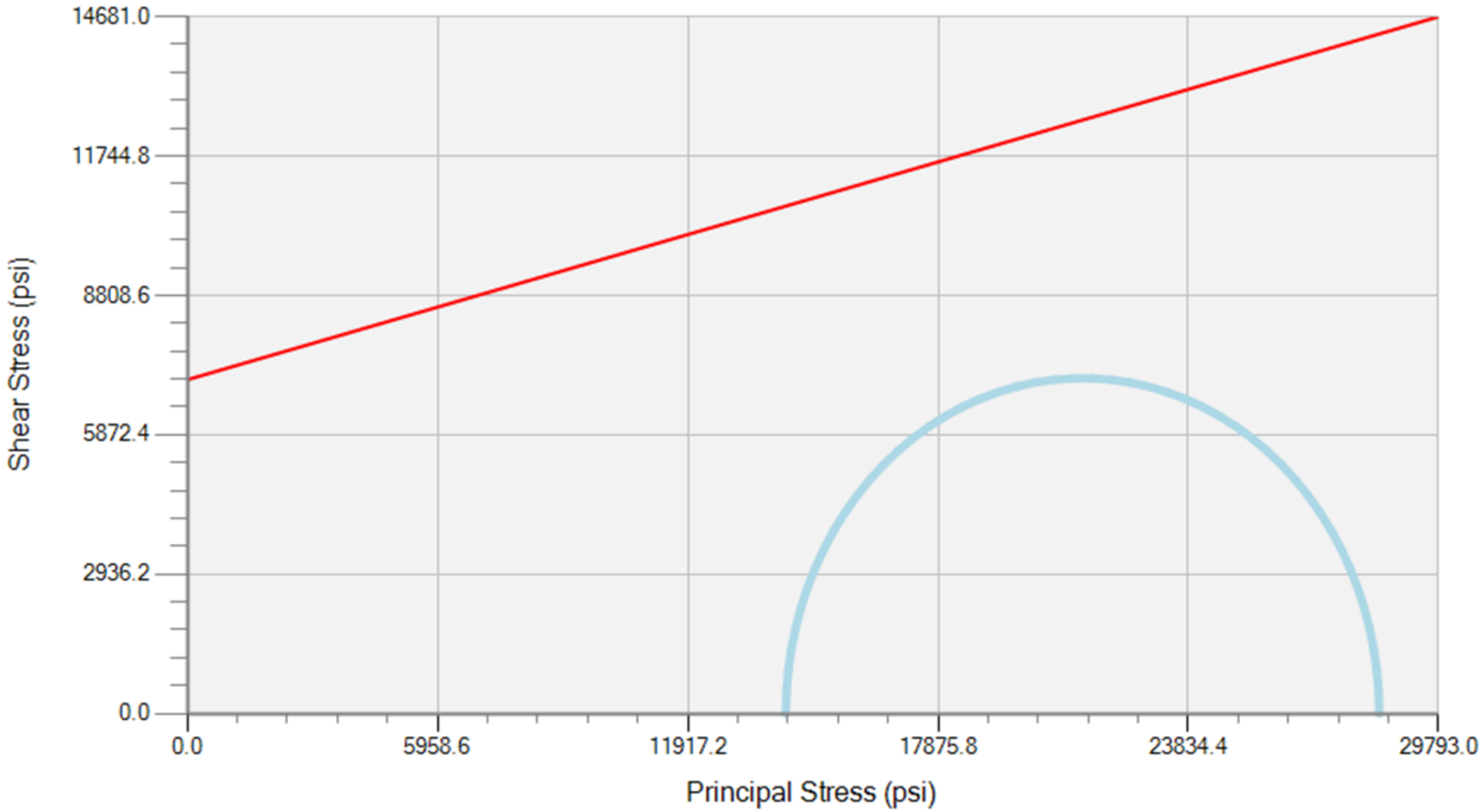
Minimum Horizontal Stress gradient= 0.629 psi/ft

Maximum Horizontal Stress gradient = 0.882 psi/ft

Shmin Azimuth = 95 degrees

SHmax Azimuth= 5 degrees

Simulation Results: Geomechanical effects



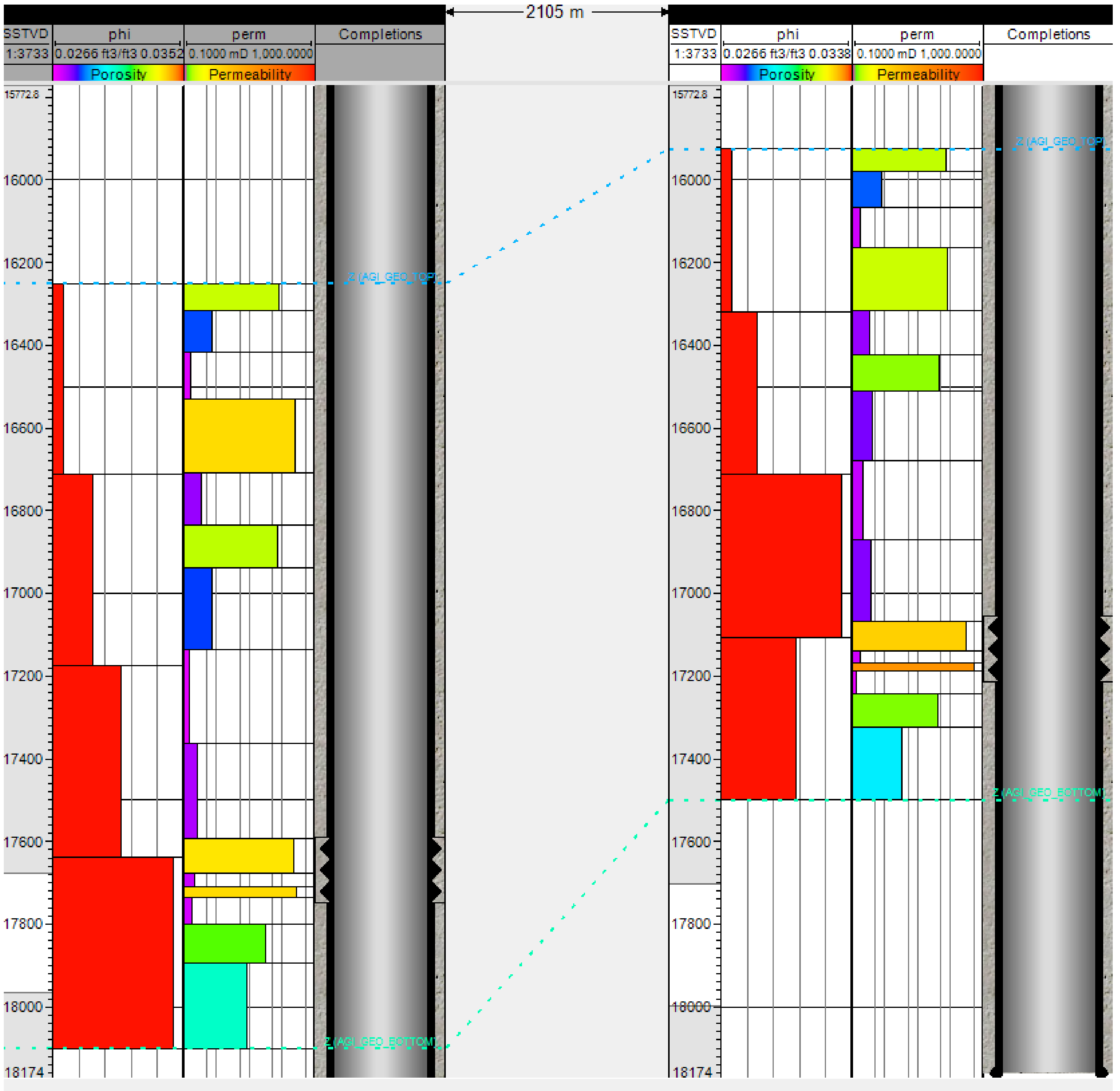
Mohr Circles at the AGI well

- Moreover, a coupled geomechanical simulation is processed based on the impermeable fault case with maximum SWD well injection rate is performed to investigate the impact of the injection activity to the tectonic stability of the reservoir.
- The Mohr circles sampled at the injection well location of different time-steps are shown.
- Although the size of the Mohr circles becomes larger as the injection processes, the impact brought by the AGI well is still far from meeting the mechanical failure criteria, which confirms a mechanical safety of the AGI project.

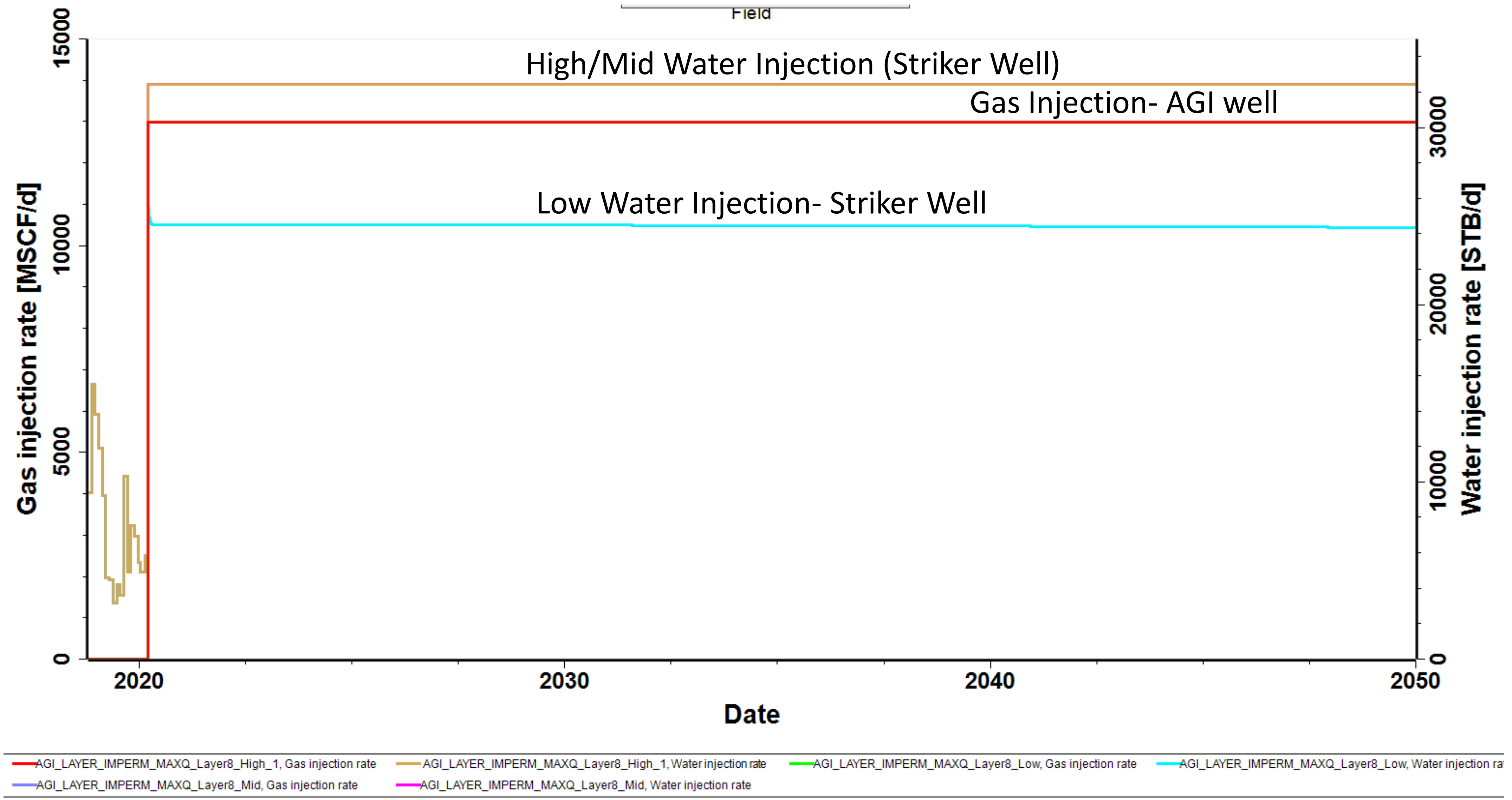
Other Scenarios: Sensitivity analysis of BHP

Completed Zone 8 to study effects of imposed BHP on injection

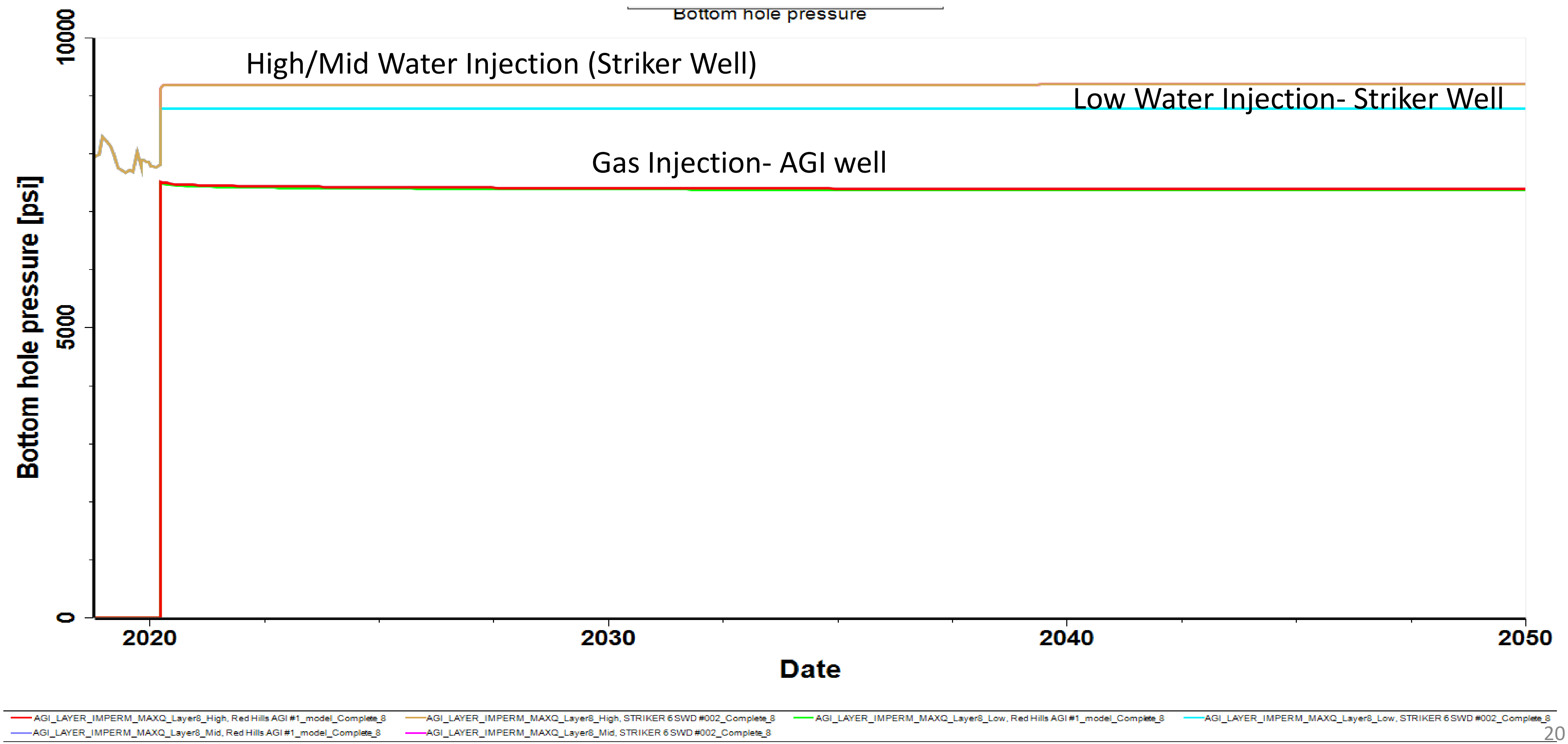
- High = 0.88 psi/ft
- Mid = 0.63psi/ft
- Low = 0.5 psi/ft



Injection Profile @ Various Injection BHP Constraint



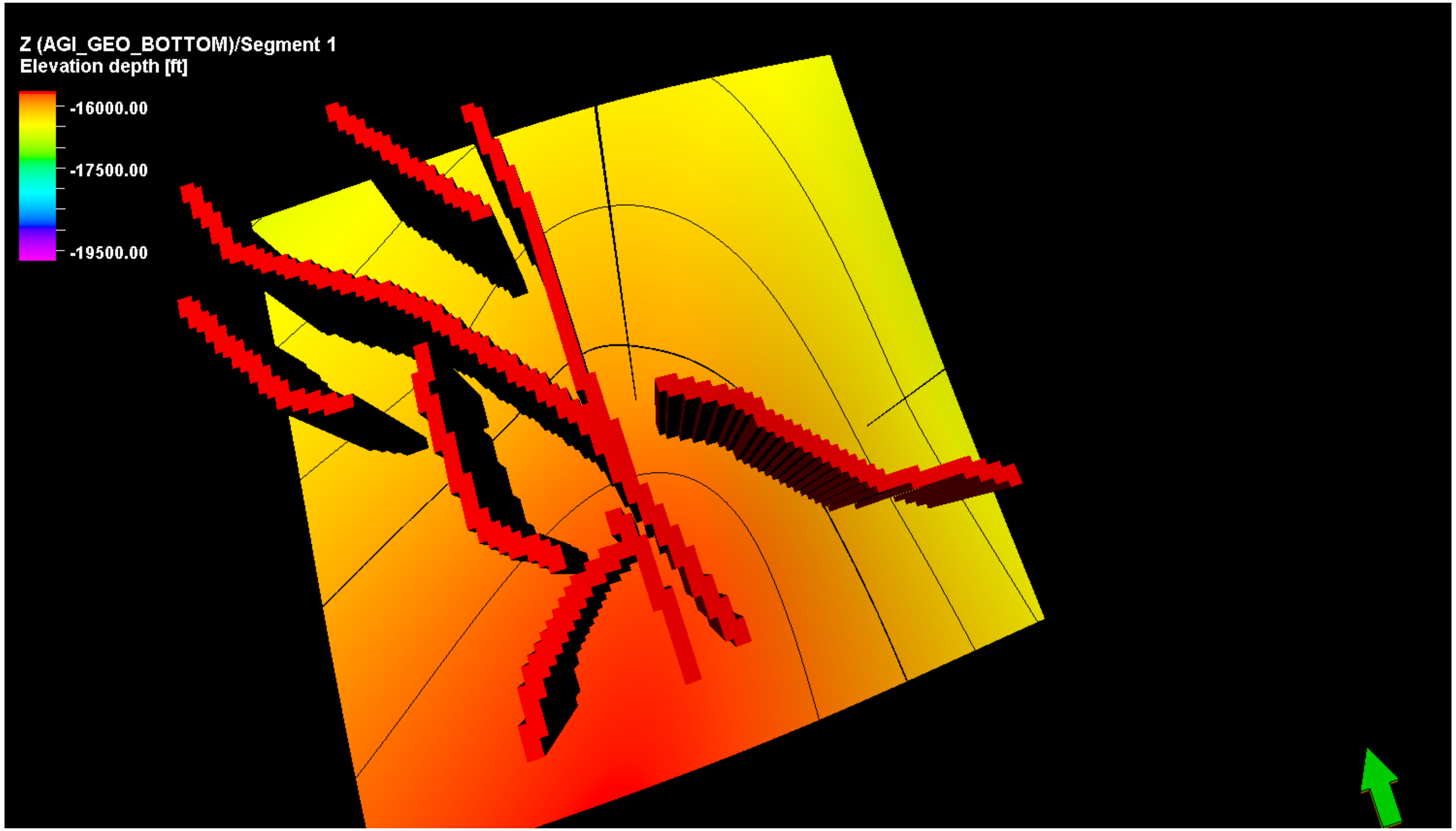
Pressure Profile @ Various Injection BHP Constraint



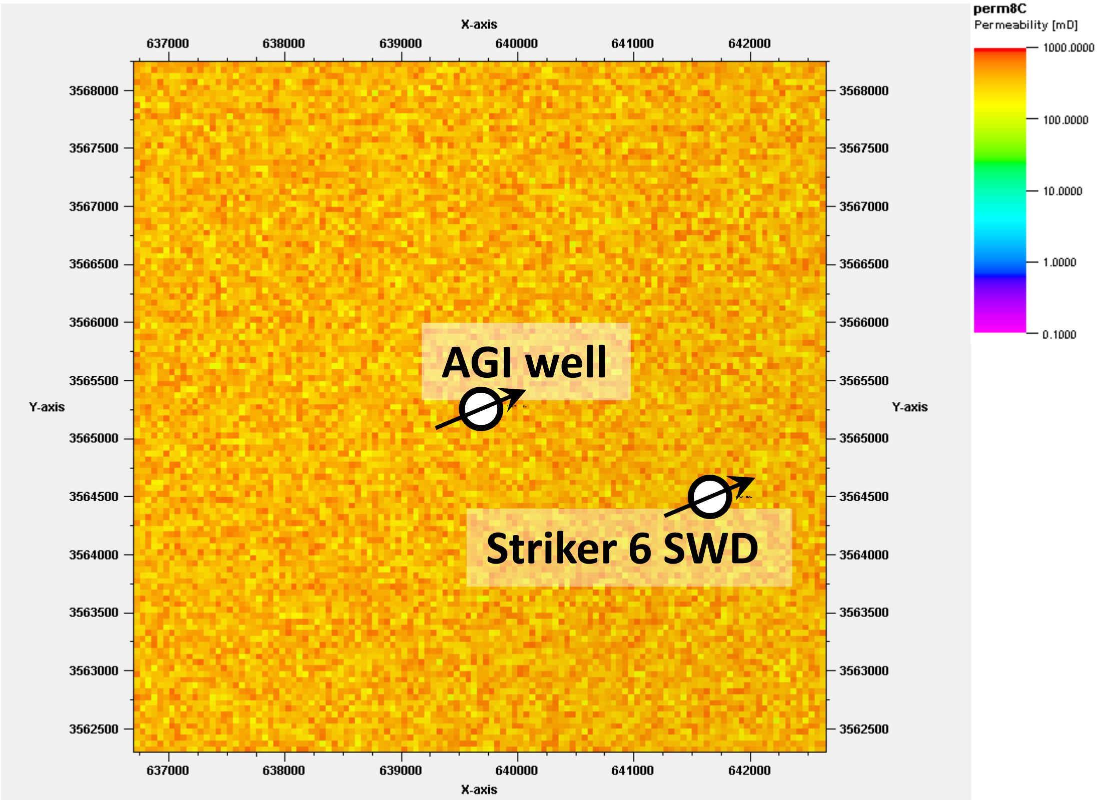
Summaries

- The hydrodynamic model confirms the proposed injection volume of 13MM scf/Day of acid gas over a 30-year of injection period.
- The nearby SWD wells would bring more significant pressure increments than the acid gas injection.
- The AGI project would bring no impact to the current hydrocarbon production wells. Both the acid gas plume and the pressure front of the AGI injection activities would not reach to the producer.
- The lateral extends of the gas plume is constrained within a safe region, which confirms that the Devonian formation is a good candidate for fluid disposal.
- Different injection and completion schemes support safe injection and containment of injected acid gas

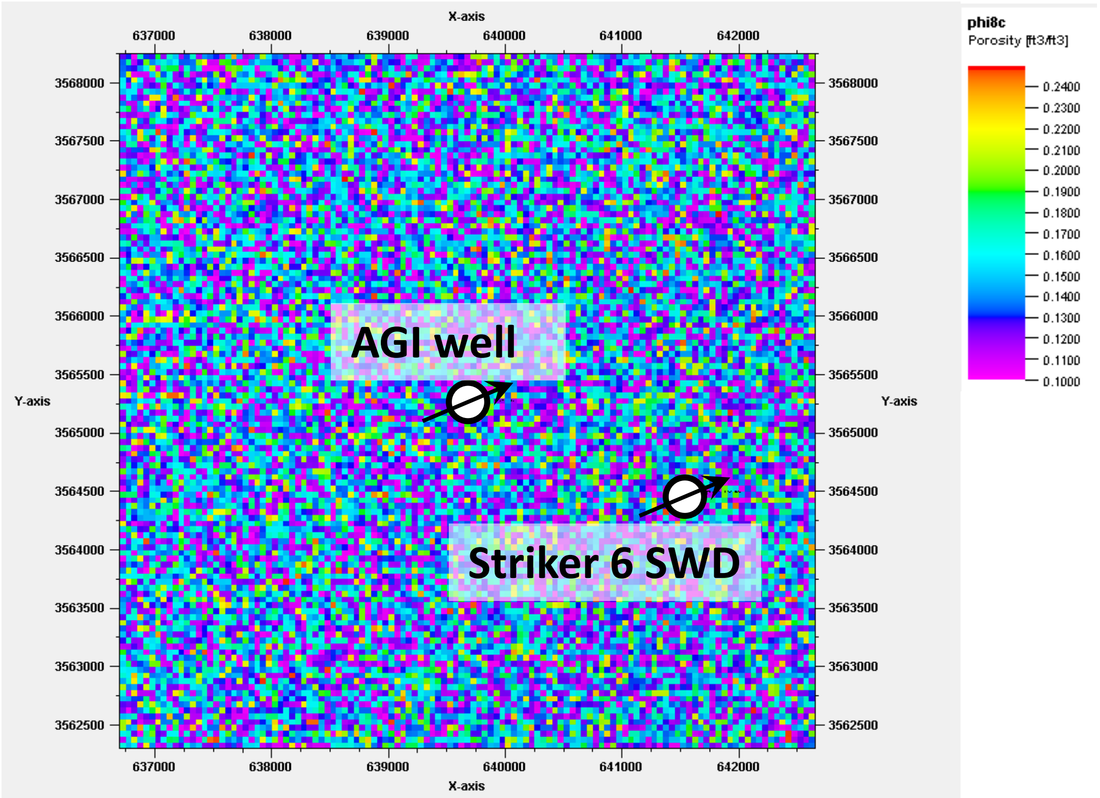
3D Fault Mapping



Spatial property distributions

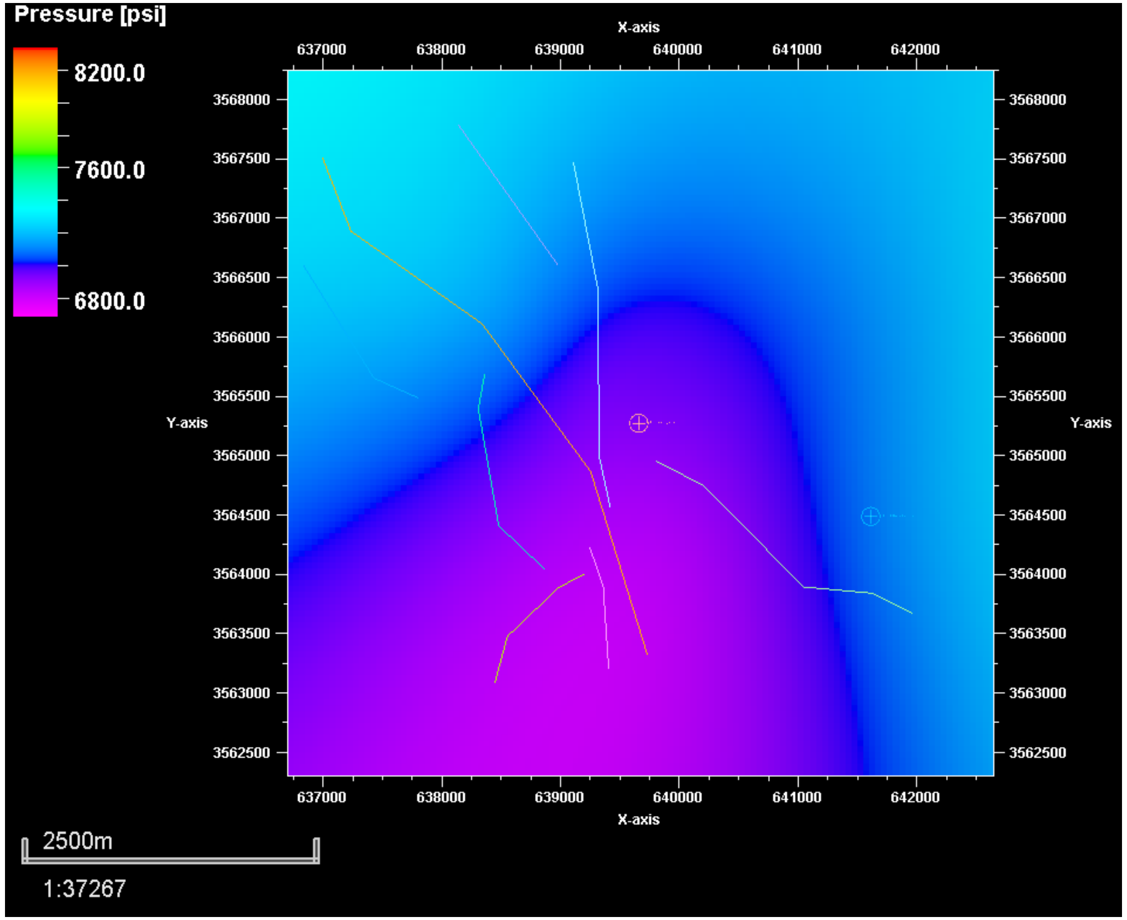


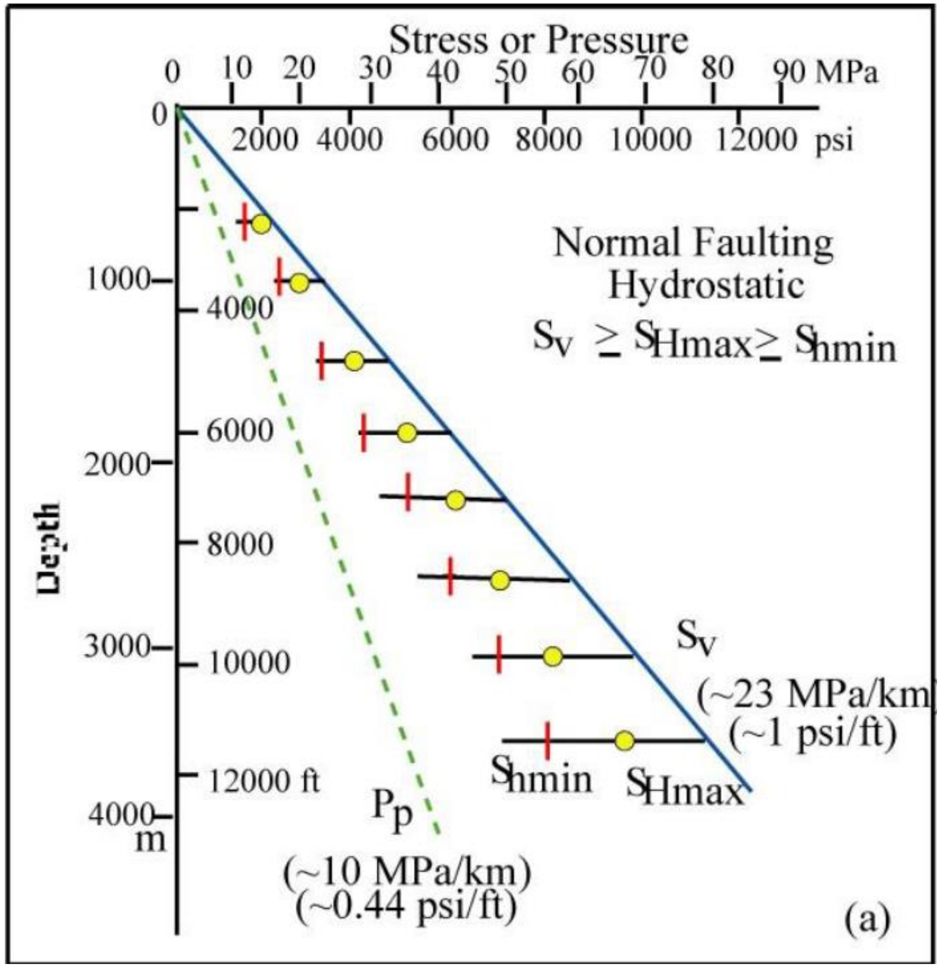
Permeability spatial distribution of Zone 8C



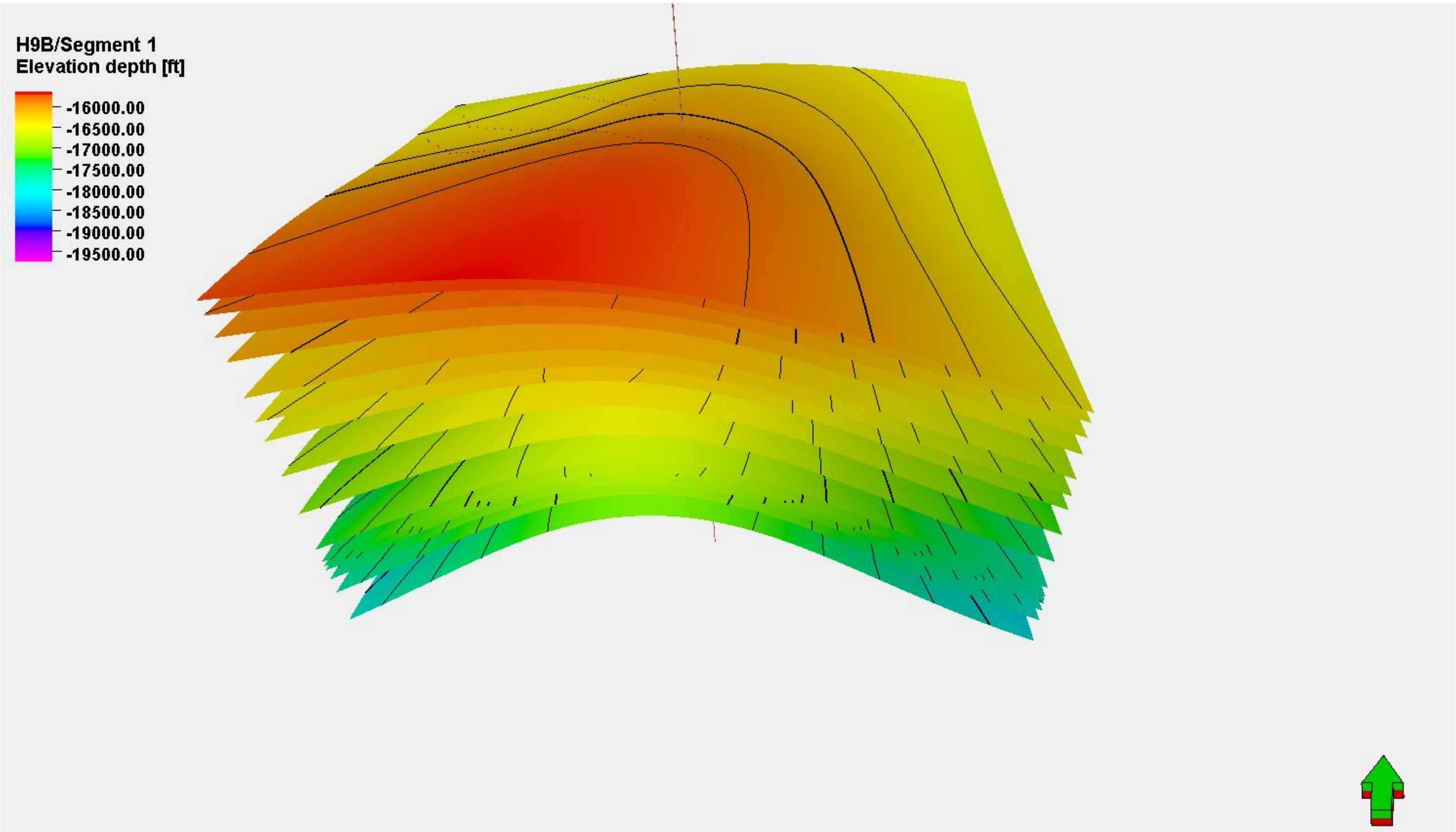
Porosity spatial distribution of Zone 8C

Pressure@ Initial condition

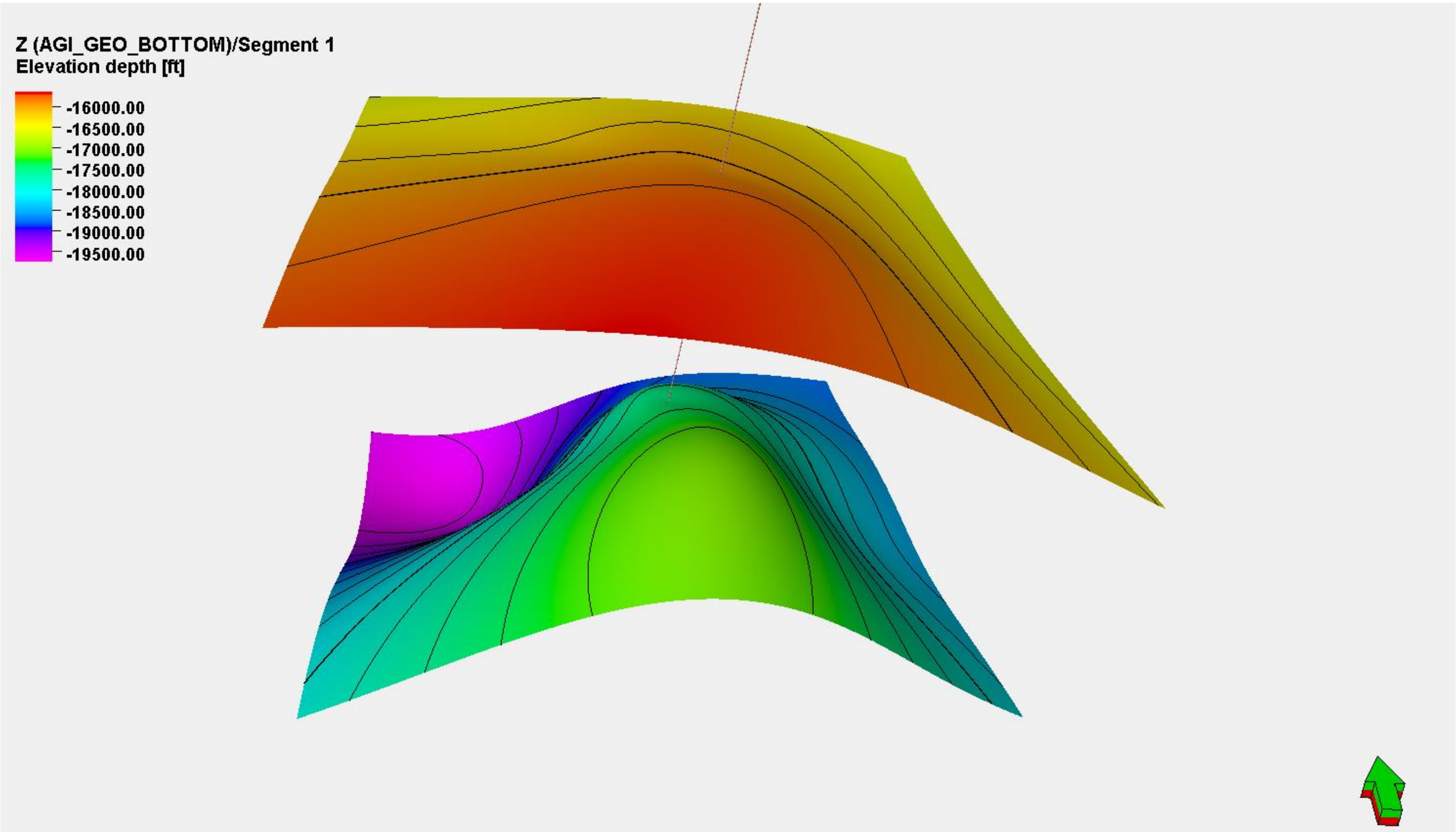




Structural Modeling



Structural Modeling



Relative Permeability curve