



Douglas A. Ducey
Governor

State of Arizona
Oil and Gas Conservation Commission

1110 W. Washington Street, Phoenix, AZ 85007
602-771-4501
www.azogcc.az.gov
Dennis L. Turner, Oil and Gas Administrator

Commissioners:
Frank Thorwald, Chair
J. Dale Nations, Ph.D., Vice Chair
Stephen R. Cooper
William C. Feyerabend

**NOTICE OF COMBINED PUBLIC MEETING AND POSSIBLE EXECUTIVE SESSION
ARIZONA OIL AND GAS CONSERVATION COMMISSION**

Pursuant to A.R.S. § 38-431.02, notice is hereby given to the members of the Arizona Oil and Gas Conservation Commission (AOGCC or Commission) and to the general public that the AOGCC will hold a meeting open to the public on **March 1, 2019, 10:00 a.m. in Room 145**, first floor of the Arizona Department of Environmental Quality, at 1110 W. Washington St., Phoenix, AZ.

AGENDA:

1. Call to order
 - Establish a quorum
 - Conflicts of interest
2. Discussion, consideration and possible vote by the AOGCC on the Minutes of:
 - January 18, 2018 Public Meeting
 - January 18, 2018 Cobalt Public Hearing
3. "Caverns 101" presentation by Mr. Michael Olesko, Manager, Cavern Integrity, Plains Midstream Canada: the basics of design, operation and maintenance of typical salt caverns used for LPG storage.
4. Report by the Oil and Gas Administrator. The Administrator will discuss the following:
 - Dale Nations' suggested additions to the AOGCC web site
5. Report by the AOGCC Chairman
6. Legislation affecting the Arizona Oil and Gas Conservation Commission
7. Call to the public: Members of the public may address the Commission during this Call to the Public. Pursuant to A.R.S. § 38-431.01(H), the Commission members may not discuss or take legal action on matters raised during an open call to the public unless the matters are properly noticed for discussion and legal action. Therefore, action taken as a result of public comment will be limited to directing staff to study the matter or scheduling the matter for further discussion and decision on a future agenda.
8. Review and Consider Future Agenda Items
9. Announcements
10. Executive Session. The Commission may convene an Executive Session to discuss current legislation.
11. Adjourn

Members of the Arizona Oil and Gas Conservation Commission will attend either in person or by telephone. The public may also attend a Commission meeting either in person or by telephone. Please contact the Oil and Gas administrator at least 48 hours before the scheduled meeting to make arrangements for a member of the public to attend by telephone. In cases where an emergency meeting is called by the Commission and 48 hours' notice is not possible, a minimum 24 hours' notice from the public is required.

The public may be afforded an opportunity to comment on any item on the agenda; however, by ruling of the Arizona Oil and Gas Conservation Commission, any member of the public wishing to speak at this meeting shall be limited to three (3) minutes (see Note 2). Note that agenda items may be taken out of order at the discretion of the Commission.

NOTE 1: The Arizona Oil and Gas Conservation Commission may vote to hold an Executive Session, pursuant to AR.S. § 38-431 .03(A)(3) or (4), which will not be open to the public, to consult with its attorney and receive legal advice with respect to any regular agenda item listed on this agenda.

NOTE 2: Any comments provided by the public at the Call to the Public shall not exceed three (3) minutes per speaker. For any comments made during the Call to the Public on any specific issue the overall comment period shall not exceed ten (10) minutes per side. The Commission shall have the authority to end any public discussion that exceeds ten (10) minutes per side or twenty (20) minutes in total.

For additional information about this meeting, contact Dennis L. Turner, Oil and Gas Program Administrator, ogcc@azdeq.gov or (602) 771-4501. At least 24 hours prior to any meeting, a copy of the agenda will be available for public inspection at the Arizona Department of Environmental Quality (ADEQ), 1110 W. Washington Street, Phoenix, AZ 85007, or online at <http://www.azdeq.gov/ogcc-notices>. After approval by the Commission, the meeting minutes and background material provided to Commission members (with the exception of material relating to possible Executive Sessions) shall be made available at <http://www.azogcc.az.gov/meetings>.

ADEQ will take reasonable measures to provide access to department services to individuals with limited ability to speak, write or understand English and/or to those with disabilities. Requests for language interpretation, ASL interpretation, CART captioning services or disability accommodations must be made at least 48 hours in advance by contacting Ian Bingham, Title VI Nondiscrimination Coordinator at 602-771-4322 or Bingham.Ian@azdeq.gov. Teleprinter services are available by calling 7-1-1 at least 48 hours in advance to make necessary arrangements.

ADEQ tomará las medidas razonables para proveer acceso a los servicios del departamento a personas con capacidad limitada para hablar, escribir o entender inglés y / o para personas con discapacidades. Las solicitudes de servicios de interpretación de idiomas, interpretación ASL, subtítulos de CART, o adaptaciones por discapacidad deben realizarse con al menos 48 horas de anticipación contactando a Ian Bingham, Coordinador de Anti-Discriminación del Título VI al 602-771-4322 o Bingham.Ian@azdeq.gov. Los servicios de teleimpresores están disponibles llamando al 7-1-1 con al menos 48 horas de anticipación para hacer los arreglos necesarios.



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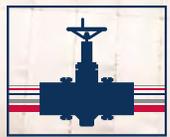
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Public Meeting of the Arizona Oil & Gas Conservation Commission
10:00 a.m., March 1, 2019, Room 145

Name / Organization – please print	email	phone
DENNIS TURNER, AOGCC ADMIN.		
DONALD WILDHAUSER Plains LPG Services		
GREG PARKER PLAINS LPG SERVICES		
Mike Olesko Plains Midstream	mike.olesko@plainsmidstream.com	463-862-1472
NOA BRUHIS ASU	NOA.BRUHIS@ASU.EDU	
Bill Feyerabend OGC		
FRANK THORWALD OGCC		
Joe Dixon - AZ State Land Dept. (last mtg)		
Rich Zeise	Rich.Zeise@azogcc.gov	(602) 542-8553
Edmund Slade ADEQ Admin Counsel	slade.edmund@azdeq.gov	802 771 2242
Stephen Cooper - OGCC		
Madeline Greenbaum ADEQ		
DALE NATIONS, via phone - AOGCC		

Underground Storage in Salt Caverns Overview

PRESENTED BY: Mike Olesko, Manager, Cavern Integrity
DATE: March 1, 2019 to the Arizona Oil and Gas Conservation Commission



PLAINS
MIDSTREAM
C A N A D A



We commit to conducting our operations in a manner that protects the safety and security of the public, our employees and contractors; the safety, security and integrity of all PMC assets, including property; and the protection and stewardship of the environment. – PMC Operations Policy

Company Overview

- Plains Midstream Canada (PMC) is a Calgary-based, Canadian subsidiary of Plains All American Pipelines (NYSE:PAA).
- PMC owns, operates, acquires and develops a diversified portfolio of complementary midstream energy assets.
- Our extensive network of pipeline transportation, terminals, storage and gathering assets are strategically located in key crude oil and NGL producing basins, transportation corridors, and at major market hubs in Canada and the United States.
- Our mission is to connect our network of people and assets to safely deliver exceptional results.
- At the core of our mission is a clear, aligned and process-driven Operations Management System. We use this framework to reach our goals and achieve Operational Excellence.
- PMC employs over 1,400 people across Canada and the U.S.



Agenda

- The Purpose of Underground Storage in Caverns
- The Locations of Plains' Caverns
- Cavern development Overview
- Cavern Maintenance Overview
- Roles and Responsibilities of Plains Cavern Integrity
- Questions and Answers



Cavern Storage – What is it, Why do we have it?

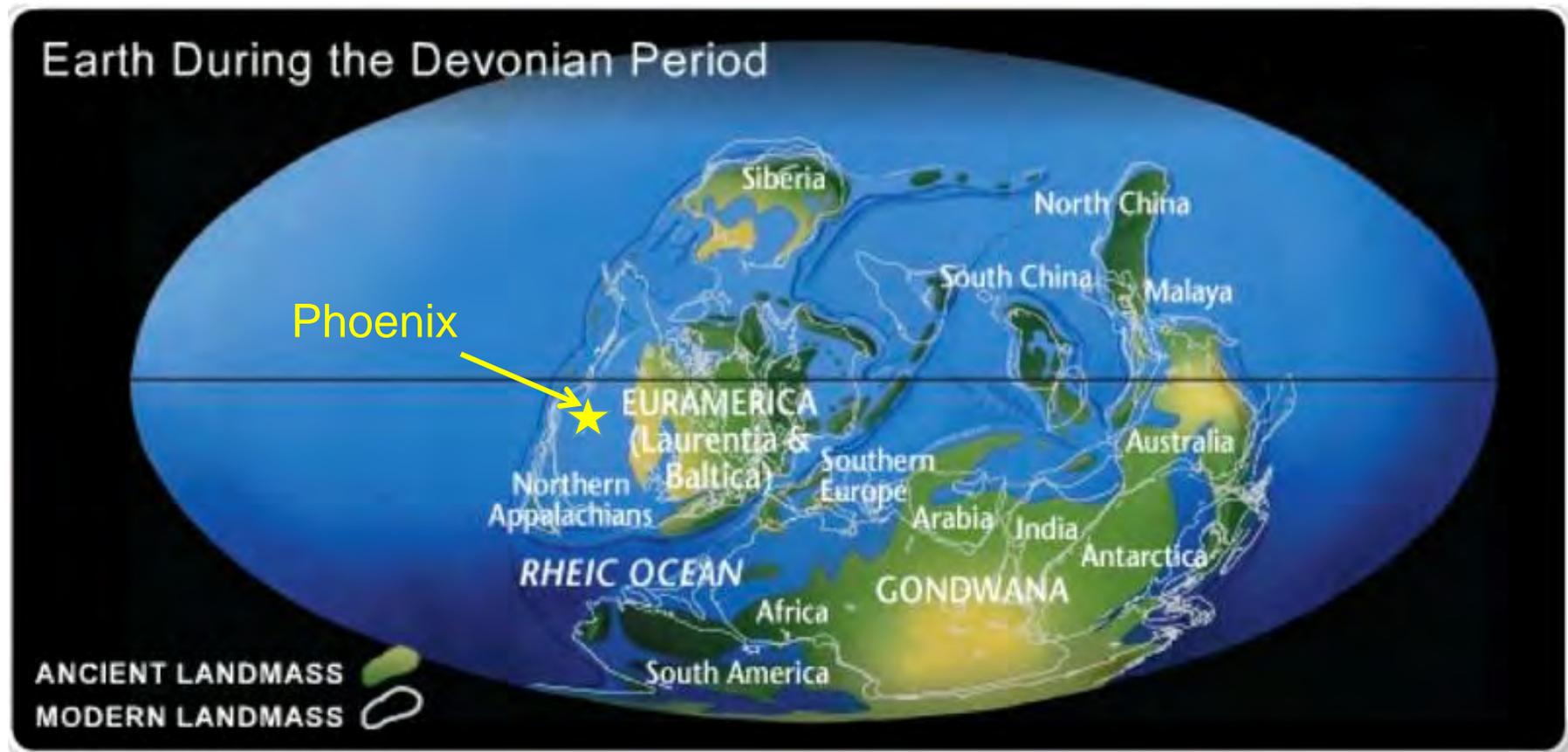
- Caverns are essentially **large voids deep underground** that work like storage tanks.
- Caverns require the **right geology** in the **right place**.
- Salt is a pseudo-solid - essentially impermeable and self-healing.
- The large associated volume and the generally minimum surface impact make cavern storage attractive for:
 - Hedging and Peak Shaving – leveling loads during times of peak demand
 - National Security – US Strategic Petroleum Reserves (outcome of the OPEC Crisis)
 - Low Surface Impact – wellhead and associated infrastructure is all that is visible



NA Salt Storage Deposits and Plains' Cavern Locations



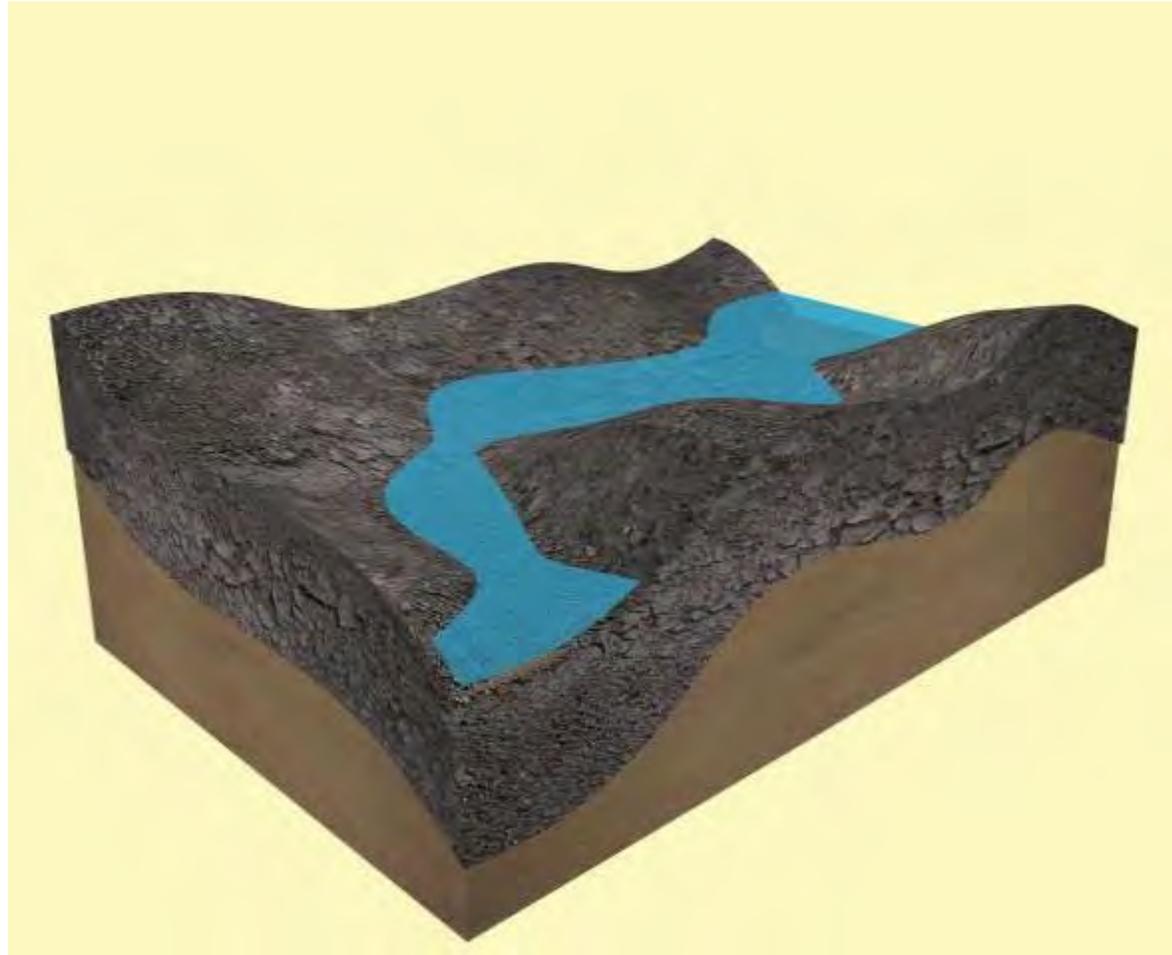
Salt Caverns – How They are Made



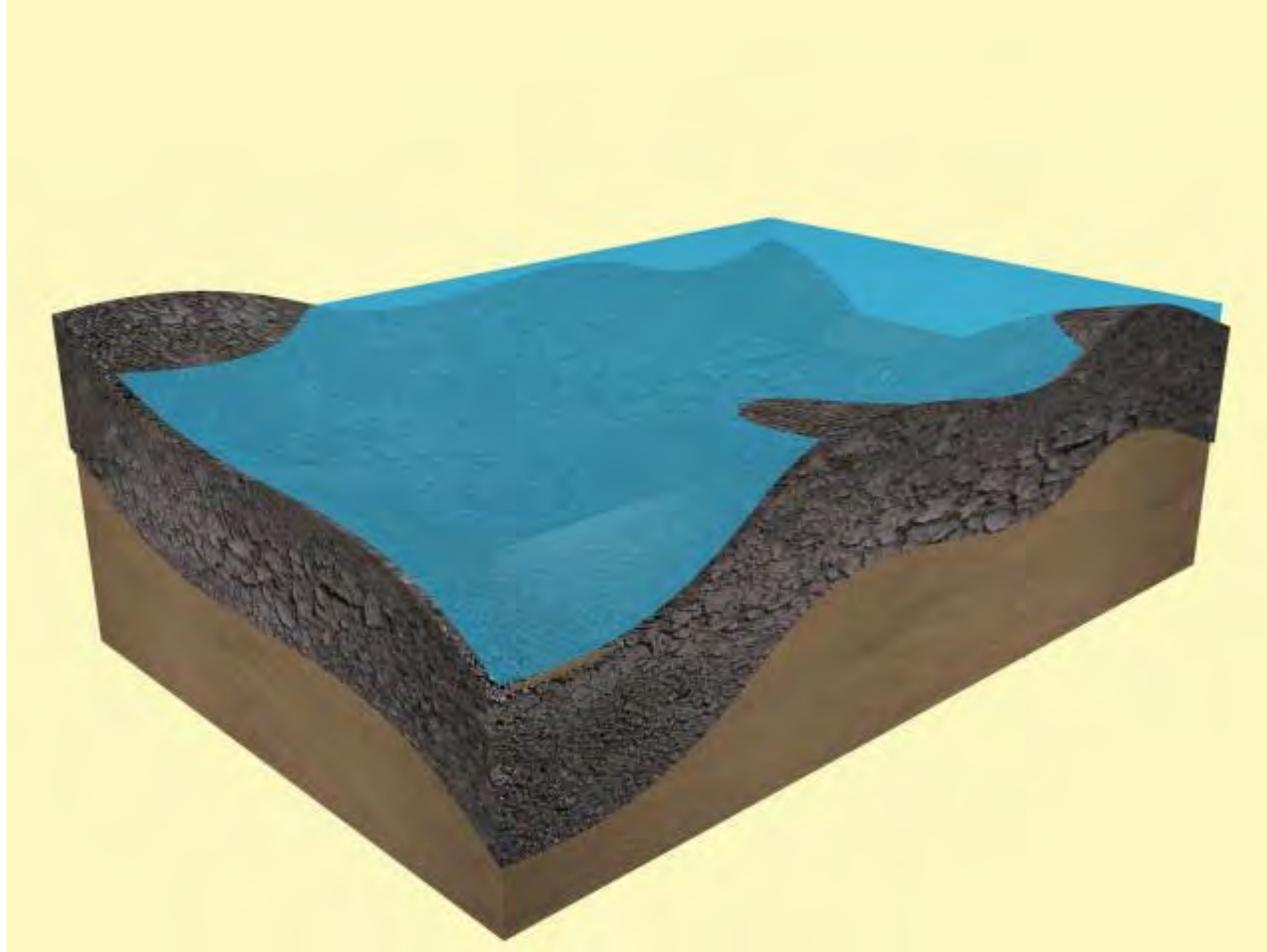
Scotese, C.R., *Paleomap Project*, Worldwide Web, Date Unknown

~400 Million Years Ago
Devonian Period - “Age of the Fish”

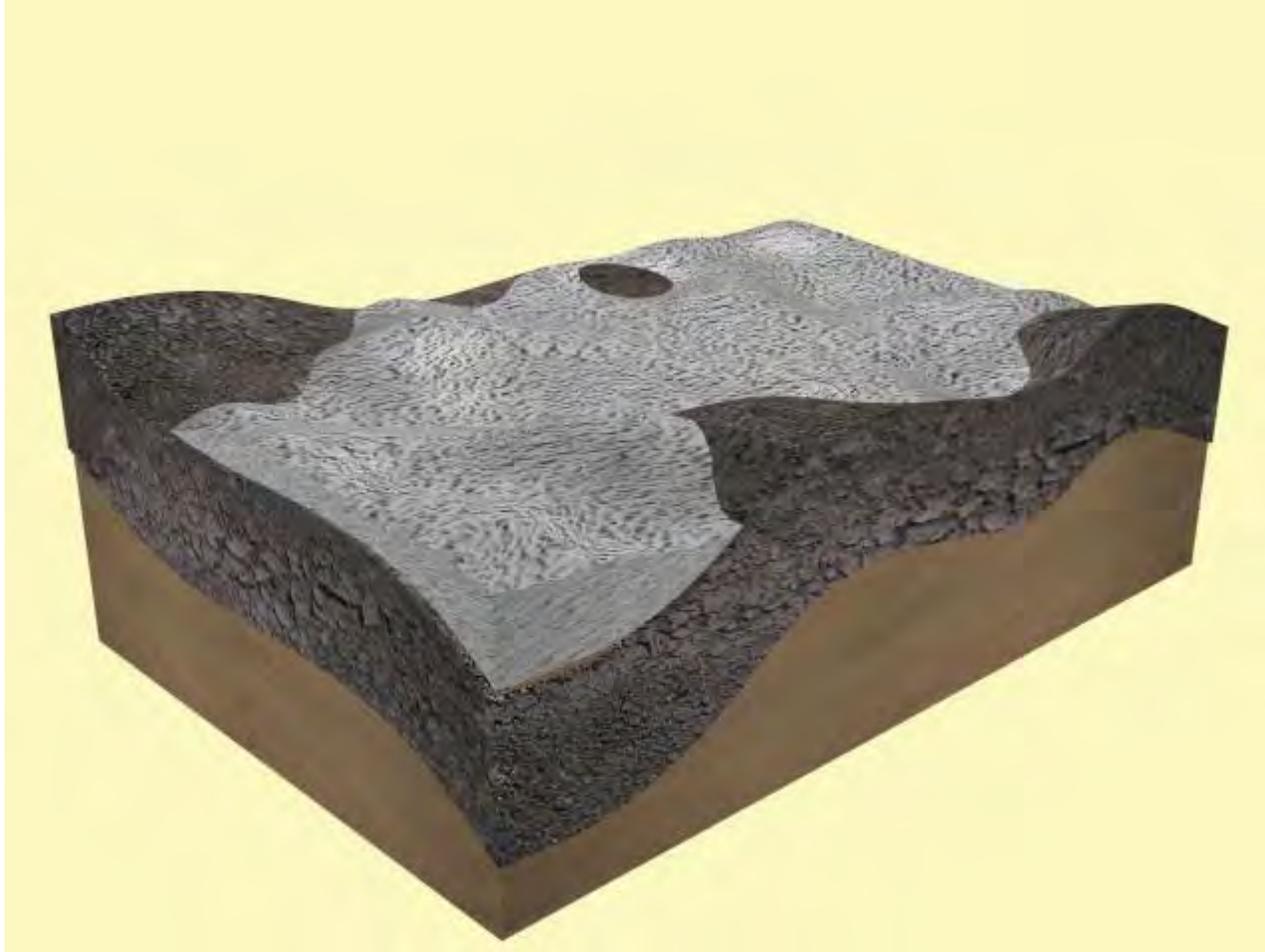
Salt Bed Formation



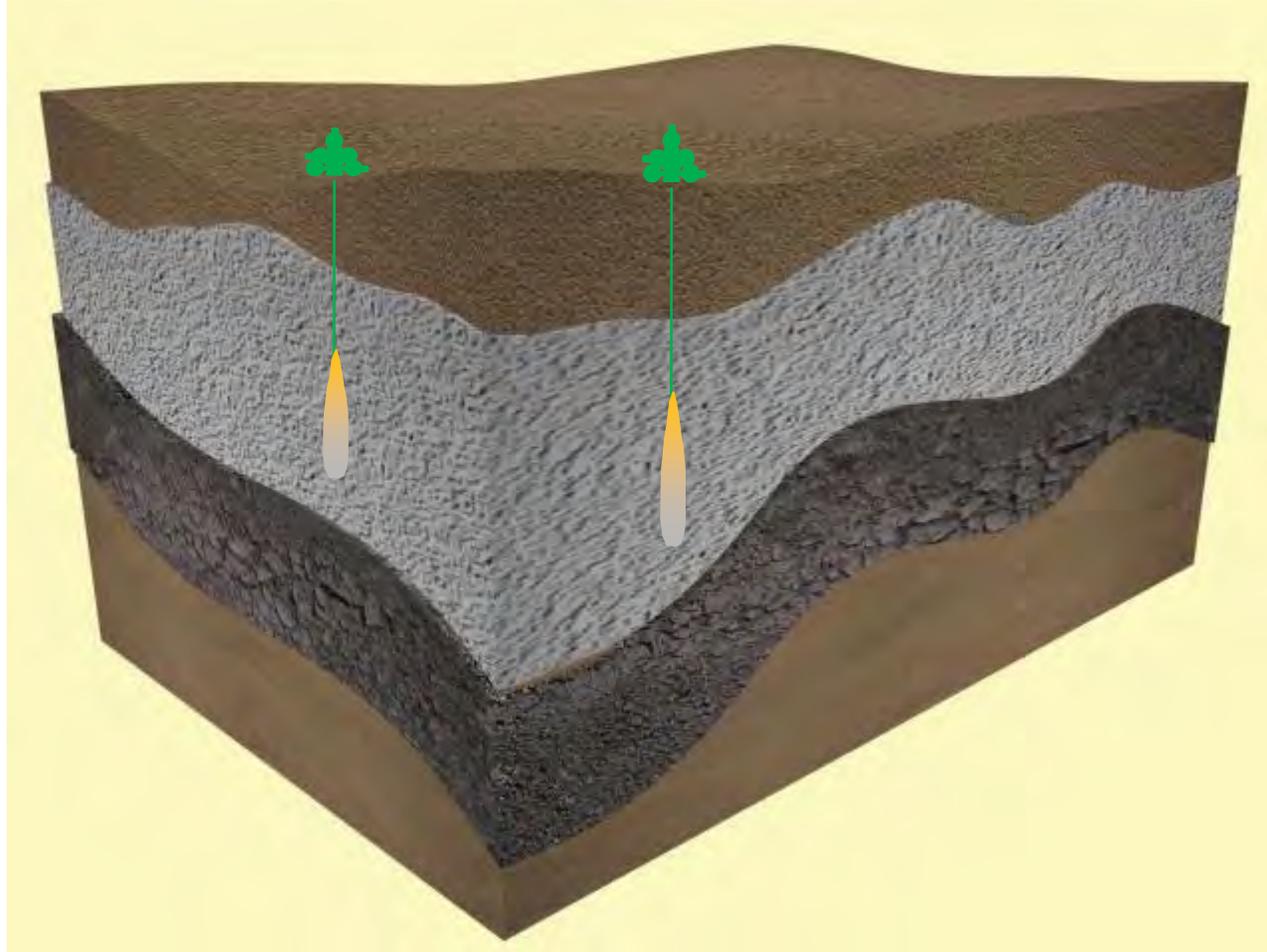
Salt Bed Formation



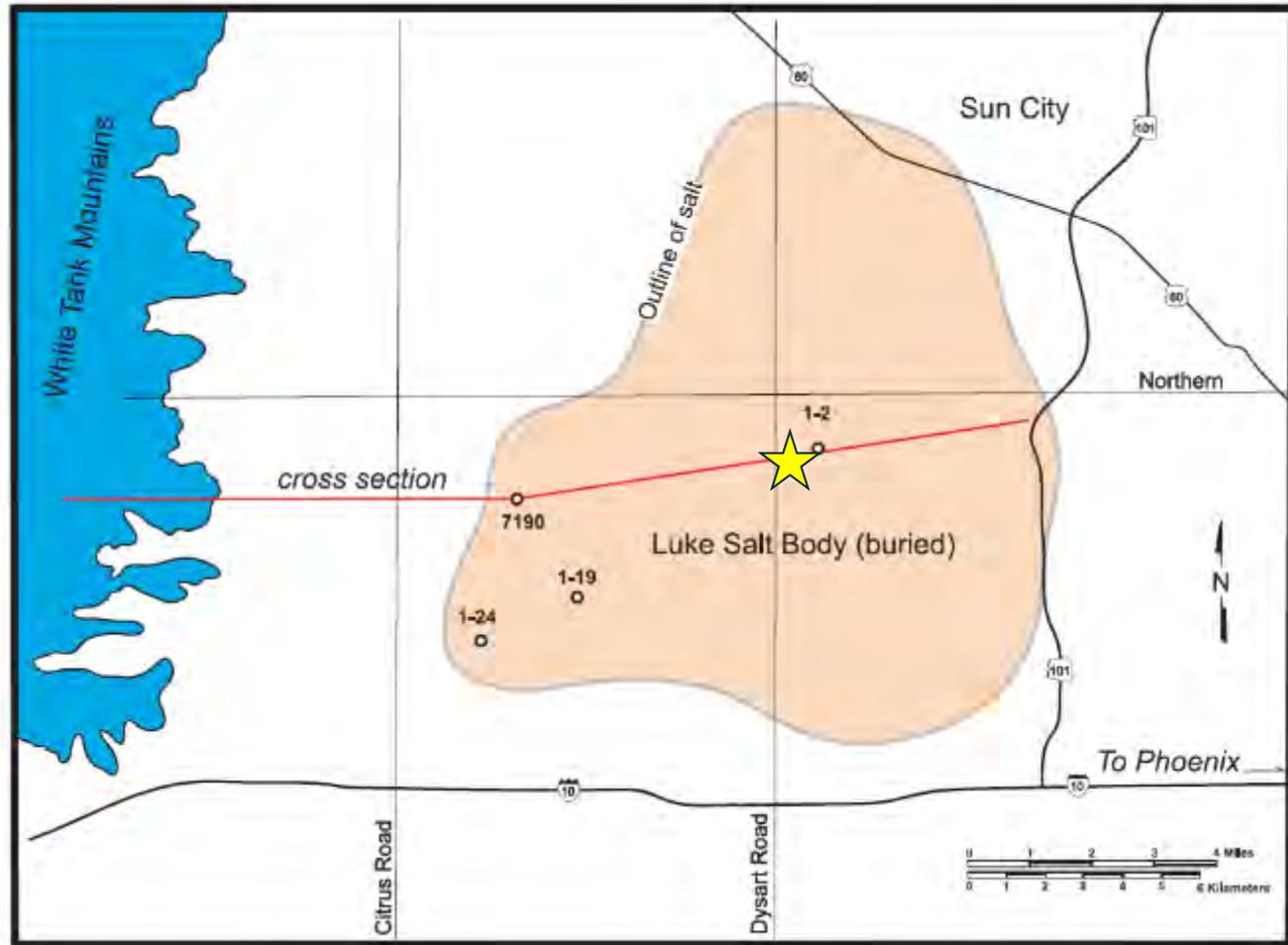
Salt Bed Formation



Salt Bed Formation

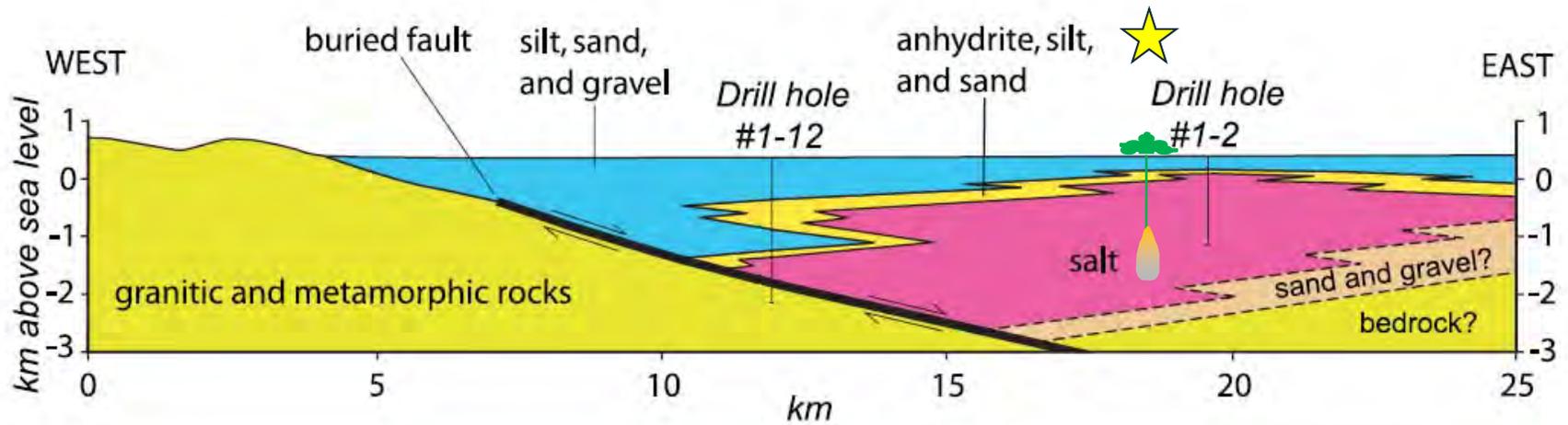


Salt Cavern Stratigraphy in Arizona



Spencer, J.E., Rauzi, S.L.; *Arizona Geology*, Vol. 35, No. 3, Fall 2005

Salt Cavern Stratigraphy in Arizona

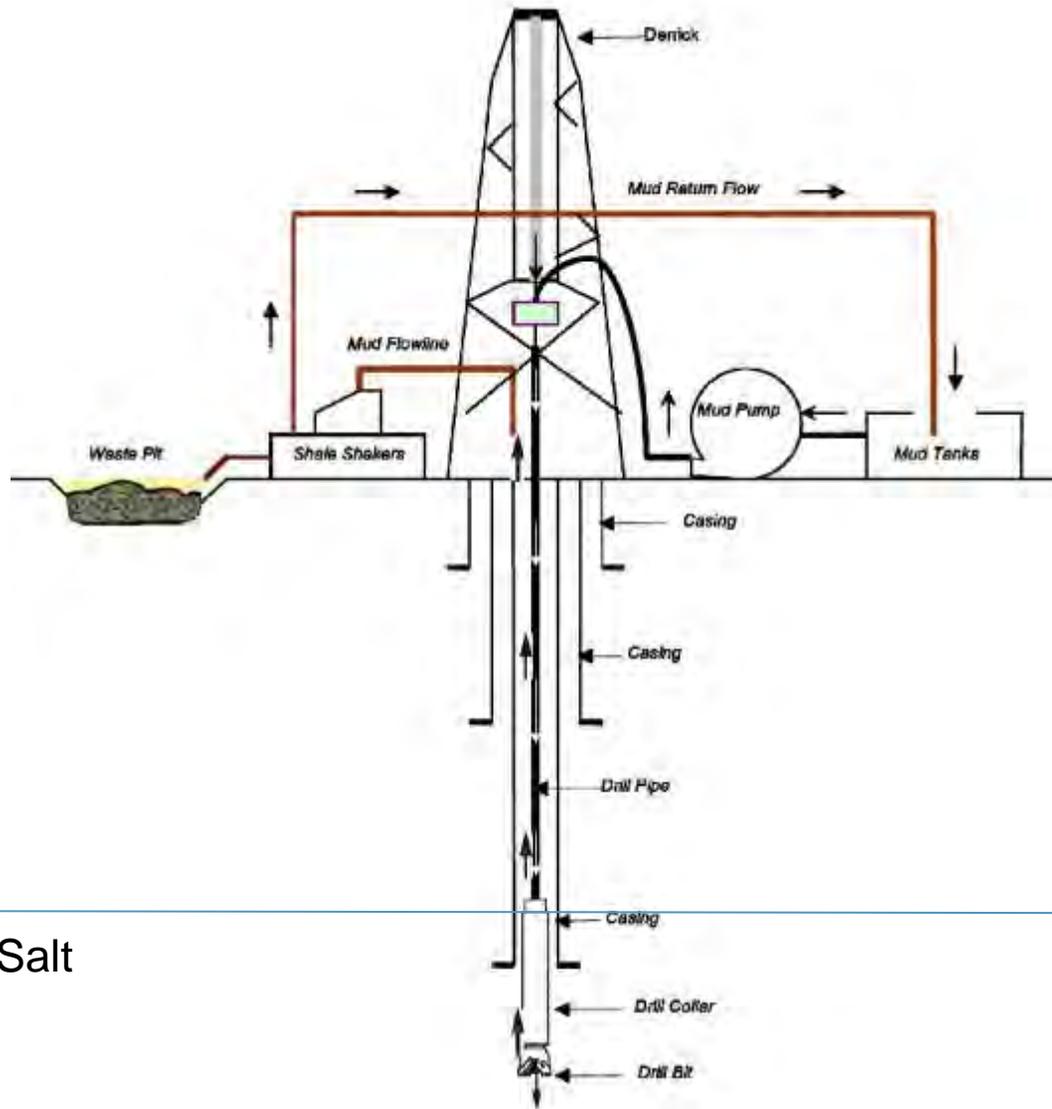


Spencer, J.E., Rauzi, S.L.; *Arizona Geology*, Vol. 35, No. 3, Fall 2005

Developing a Salt Cavern - Drilling



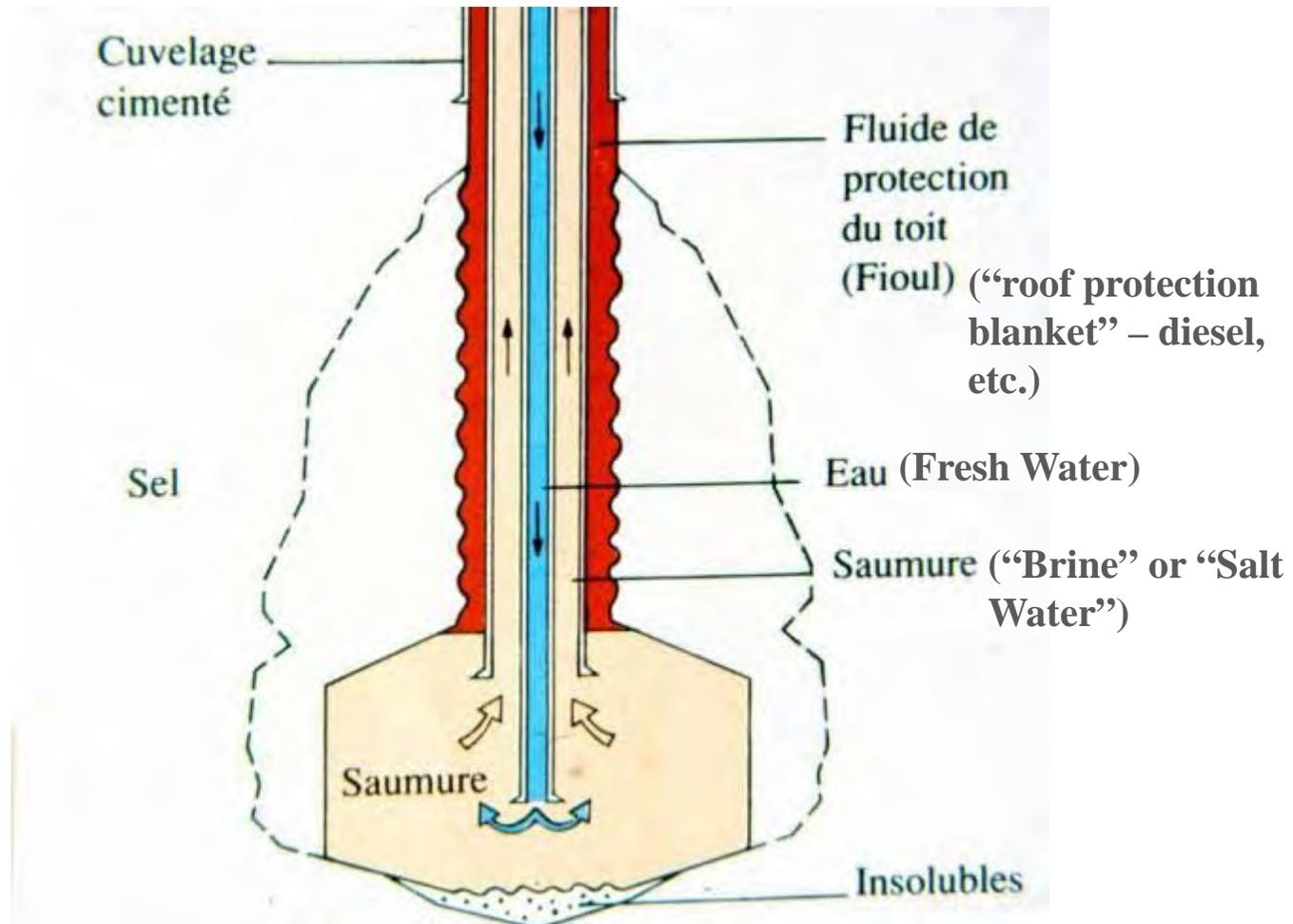
Building a Salt Cavern - Drilling



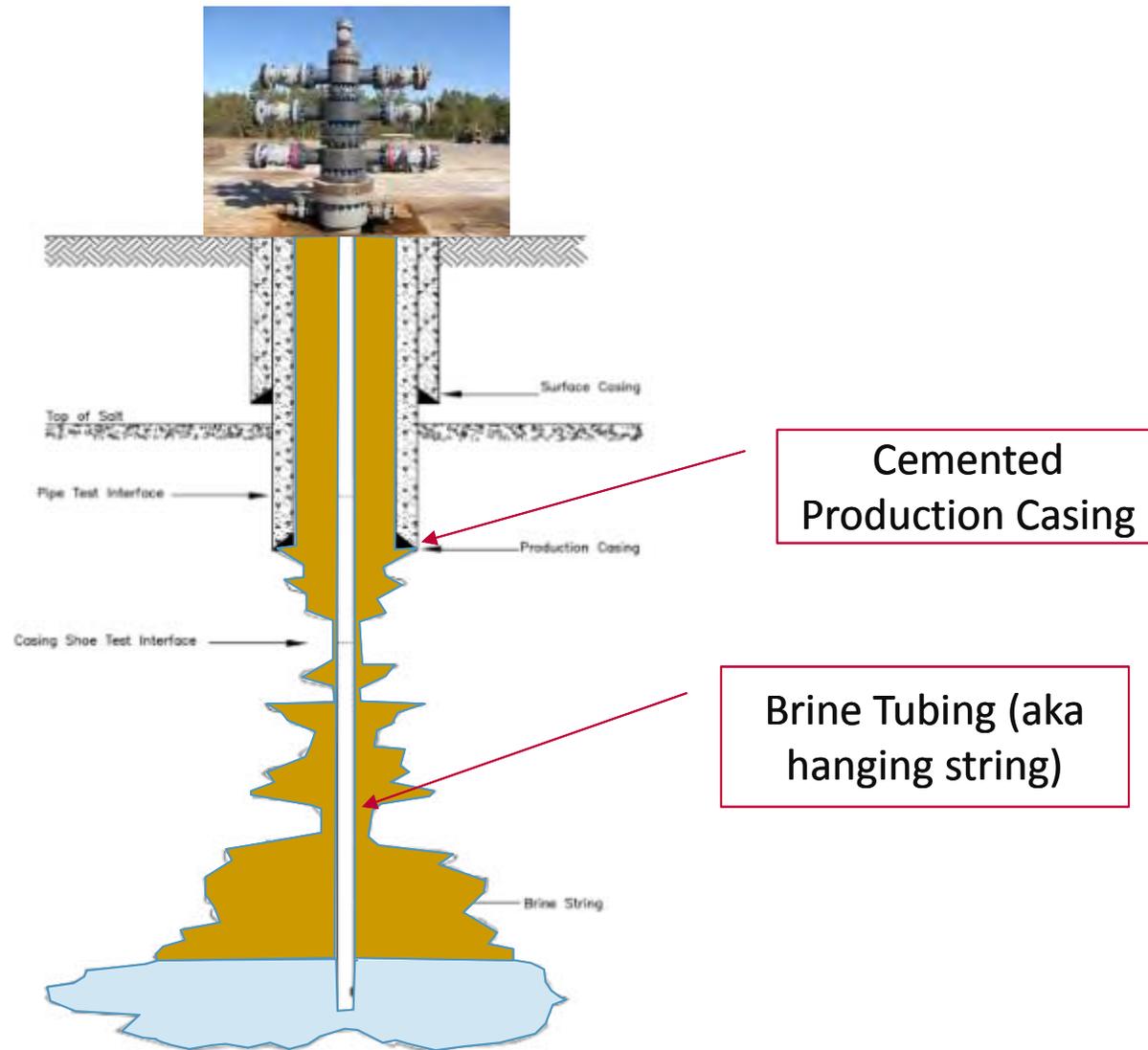
New “Washing” Wellhead



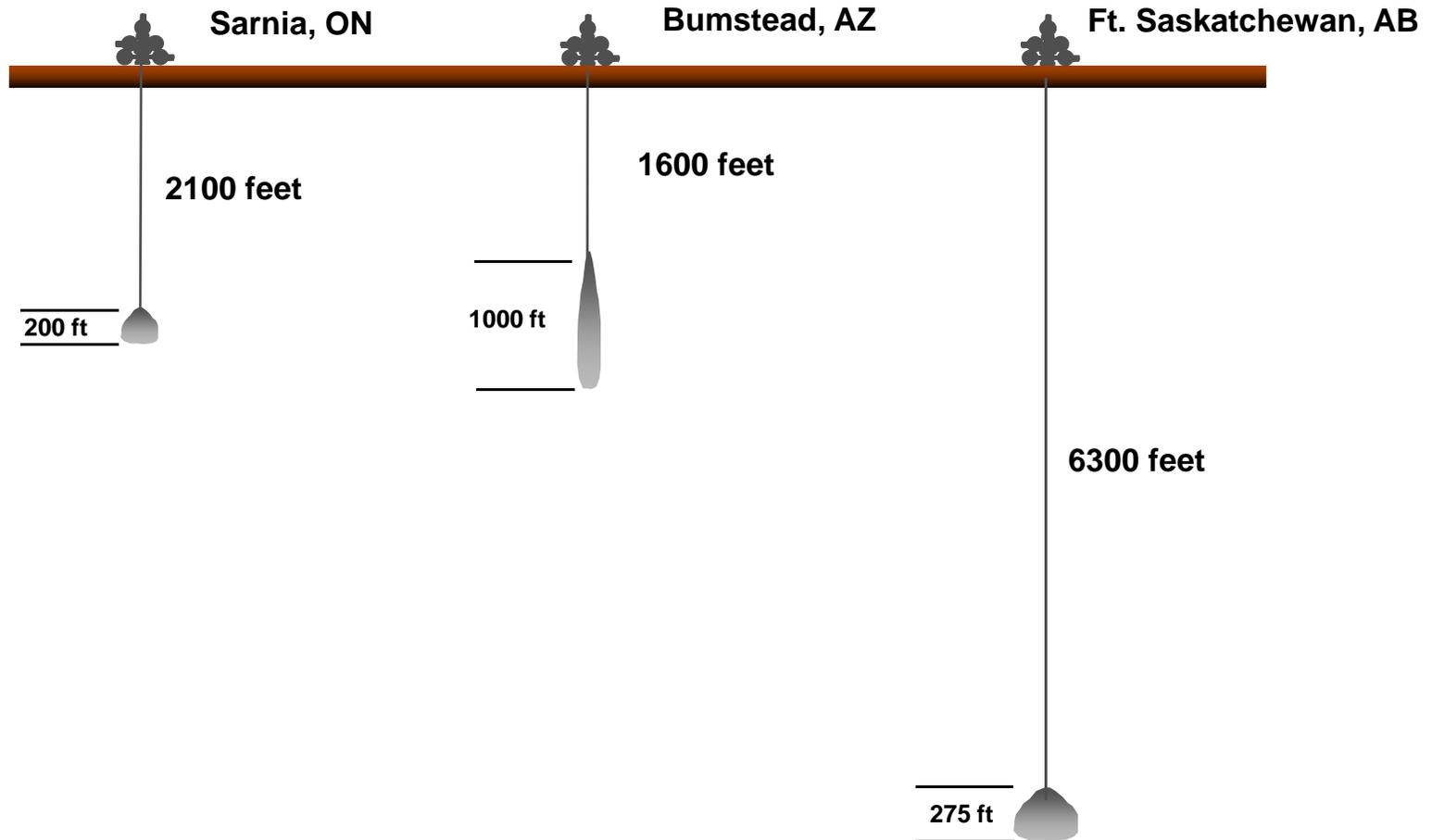
Developing the Cavern in the Salt – Solution Mining



The Salt Cavern - Complete and Ready for Storage



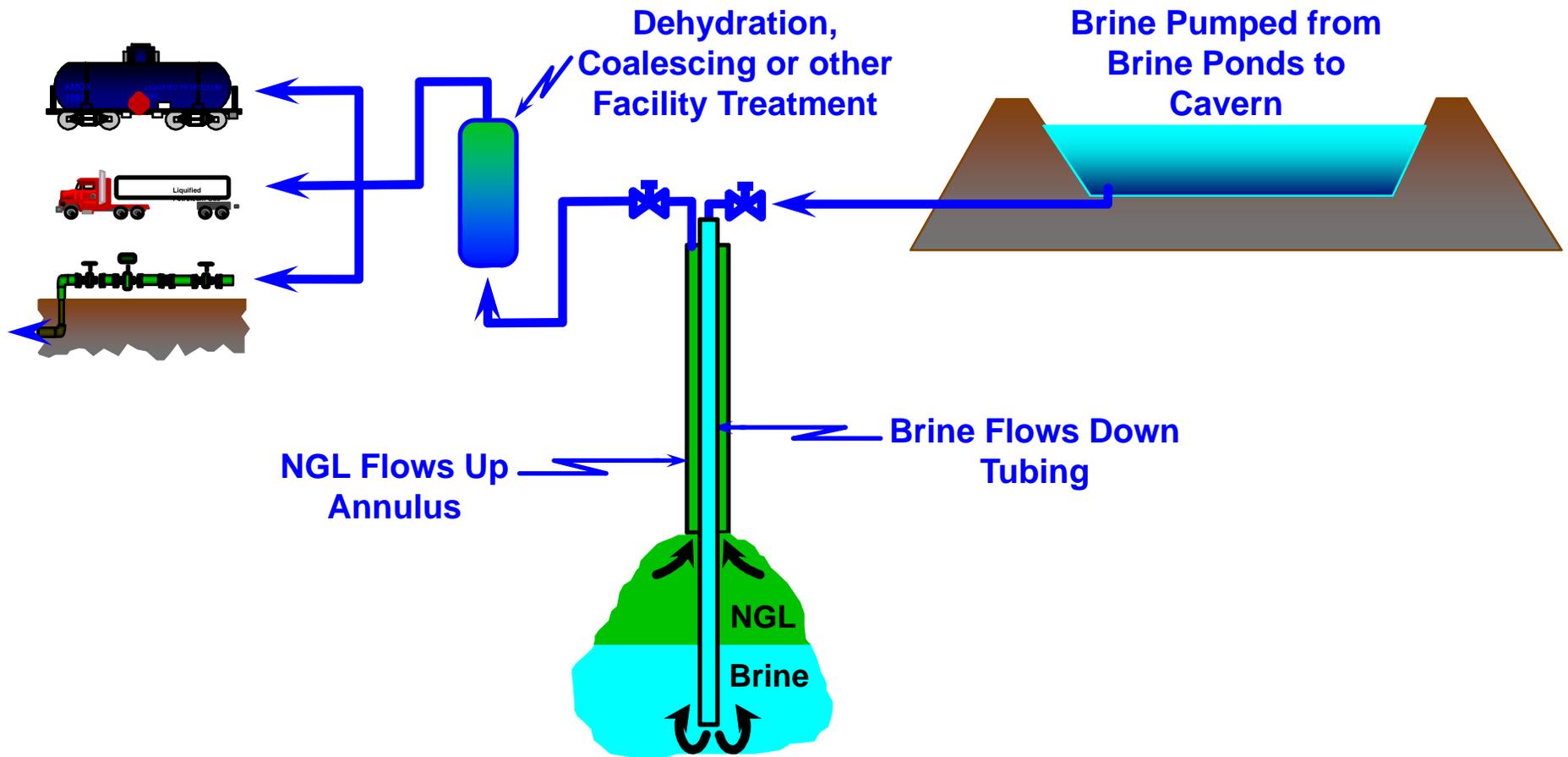
Plains' Storage Caverns to Scale



Brine Required for Product Displacement



Basic Brine Displacement Cavern Operation



Salt Cavern Storage: Brine Pond



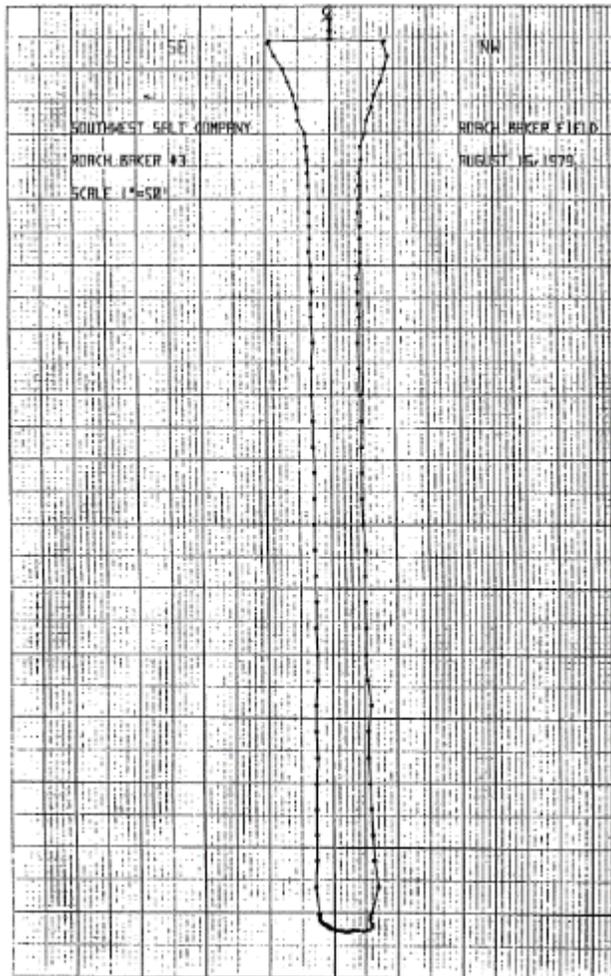
Regulatory Requirement - Workover

- Every 10 years, all storage wells need a workover (CSA Z.341.2):
 - Pull hanging string (brine tubing)
 - Refurbish the wellhead
 - Run casing inspection logs (corrosion, damage)
 - Cost: \$350K to \$1.5 MM

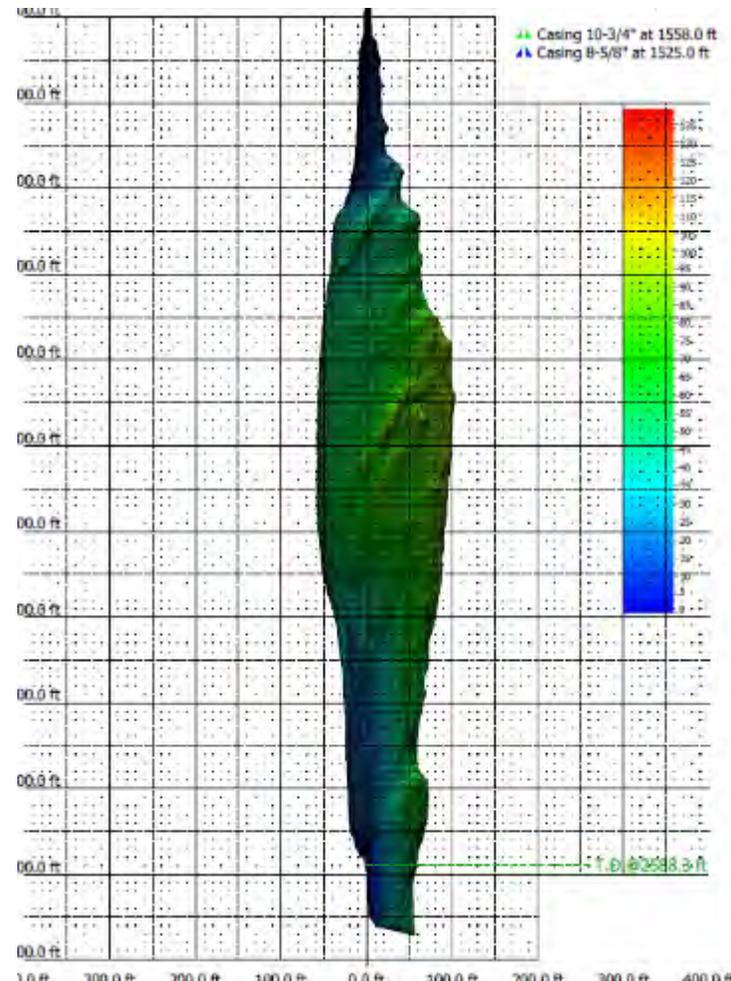


Improvements with Sonar over Time

Cavern 3: 1979



2018



Regulatory Requirement - MIT

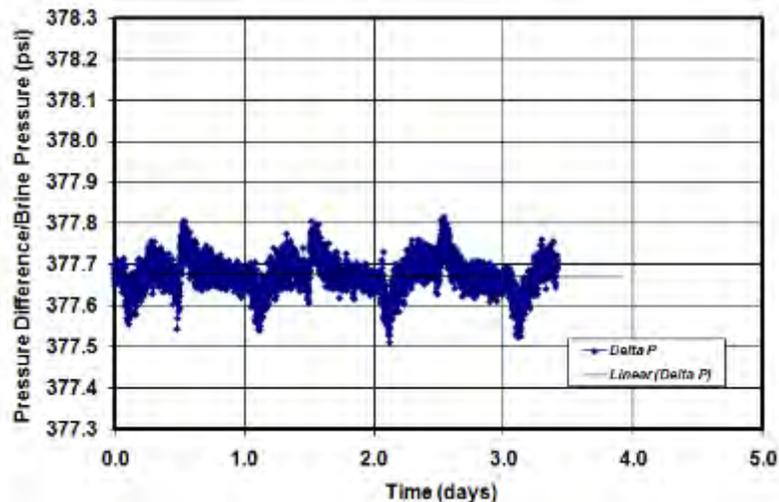
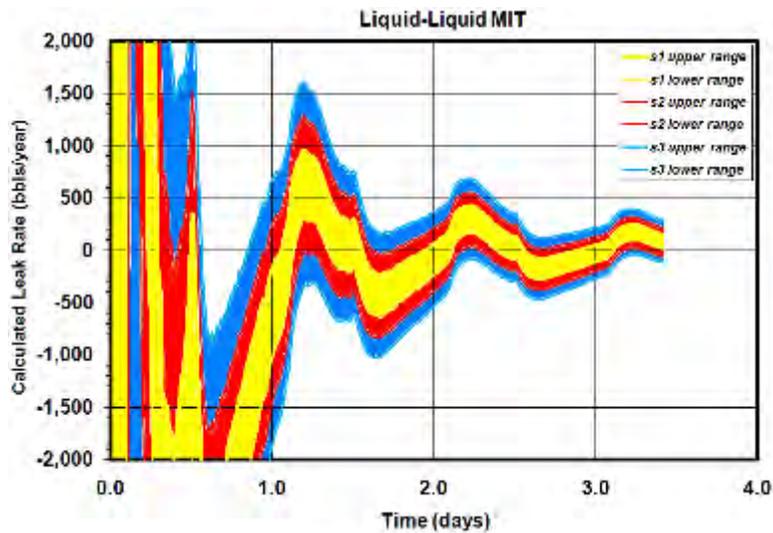
- MIT = Mechanical Integrity Test
- Various types of pressure testing of the well (cavern, wellhead and casing components)
- Required every 5 years in most jurisdictions based on Standards, State Law, or Industry Best Practice.
- Most MITs require the following:
 - Well to be pressured up to 1.1 x MOP
 - Injection of test fluid (nitrogen, product)
 - Wireline Logging (interface)
 - Pressure Measurements (and time)
 - Analysis
- Approximate cost: \$80k to \$900k



MIT - Nitrogen, Logging and Pressure Data



MIT – Calculations and Analysis



$$\sigma_{CLR} = \left[\frac{\sigma_{\Delta p}^2}{\sum (t_i - \bar{t})^2} \right]^{1/2} \frac{\partial V}{\partial y} \frac{1}{(\gamma_b - \gamma_p)}$$

Material Balance Summary Table			
Average Initial Calculations			
Pressure	2812.4	psia	
Temperature	66.7	deg F	
Zave	1.0		
Average Final Calculations			
Pressure	2813.4	psia	
Temperature	66.8	deg F	
Zave	1.0		
Volume Calculations			
	Volume	SCF	Date
	265910.0		4/14/2011
	265995.8		4/14/2011
Delta Volume =	-85.8	SCF	
(negative number = influx)	-0.5	cu. Ft per	0.2 day Test
	-0.083	bbbls per	0.2 day Test
	-0.435	bbbls per	day
Leak/Influx	-158.8	bbbls per year	
MDLR = ±	72.6	bbbls per year	

Spot Pad	5570.50	feet
Initial Pressure	2543.37	psig
Final Pressure	2544.17	psig
Initial Interface	5565.88	feet
Final Interface	5567.19	feet
Test Length	4.50	hours
Tool Resolution	0.82	feet
Average Test Parameters		
Pressure	2543.77	
Temperature	66.78	
Z	1.04	
Casing Shoe	6121.04	ft
CS Pressure	3057.49	psig
Test Gradient	0.4995	psiff
<i>Double Check Gradient</i>		
	3072.19	psia

Cavern Integrity Maintenance



The Cavern Integrity Group

- **4 team members.** Manage the maintenance programs (workovers, MIT's) for all of PMC's NGL caverns and wells in North America: **77 Caverns, 115 Wells.**
- Includes Cavern wells, Class 1 and 2 (brine) disposal wells, Fresh Water Wells.
- Hydraulic and pressure simulations, wash modeling and programs, geomechanical studies.
- Active participation in industry groups and standards (CSA, API, SMRI, PRCI, etc.).
- Other responsibilities and services with respect to caverns and wells.
 - Regulatory reporting and dialogue with Regulators (PMC Regulatory, PAA Regulatory)
 - Operations – trouble shooting issues if a well or cavern is part of the puzzle
 - Manage solution mining program and well conversions
 - Business Development – Water usage, cavern rate, product conversions, disposal wells
 - Commercial Needs – Product swaps, hydraulics, contamination.
 - Industry Committee Involvement: Changing Regulatory Landscape in US and Canada



QUESTIONS?

