New Mexico Legislative Finance Committee: I&W Brine Well History and Draft Remediation Plan

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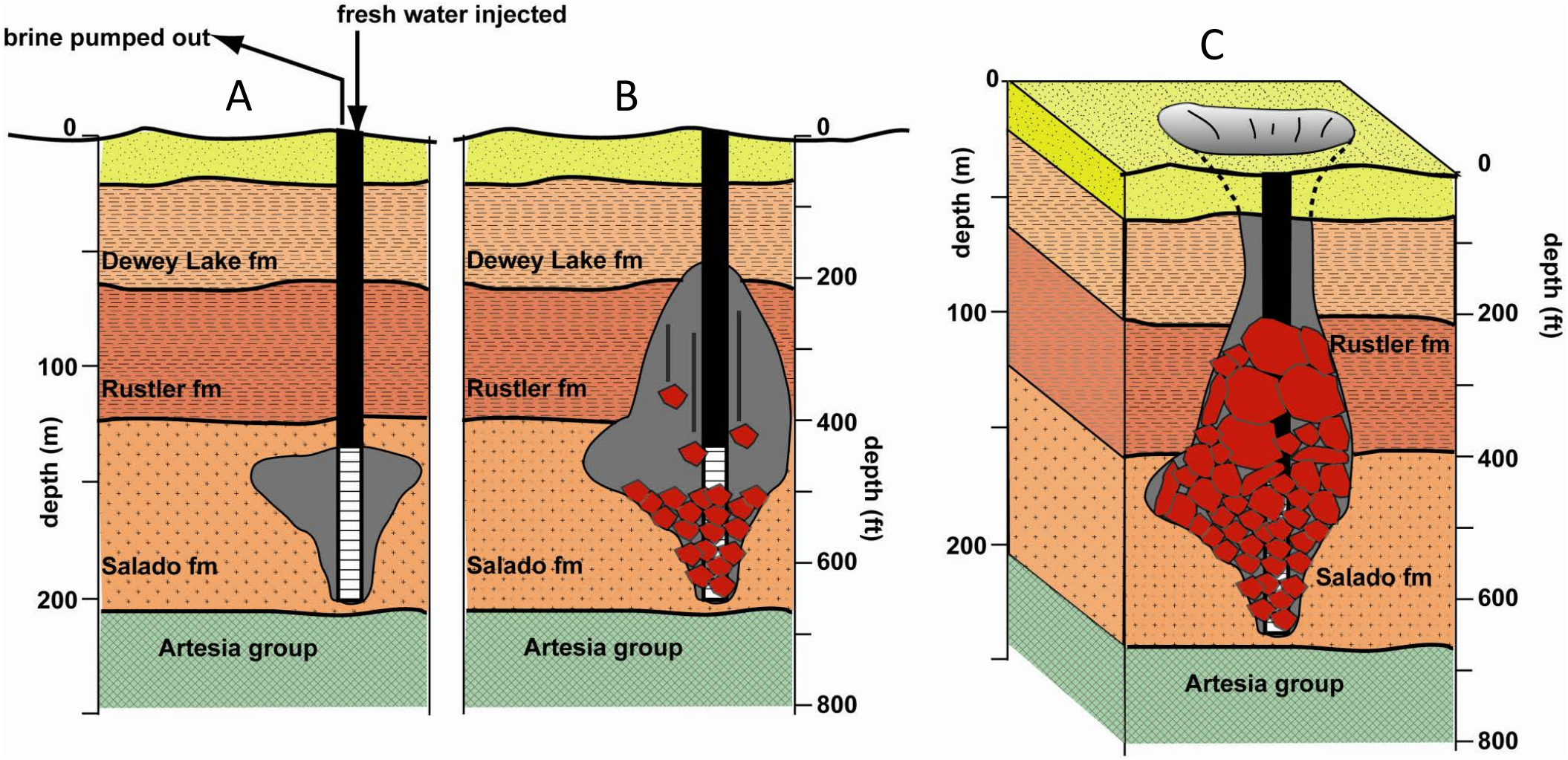
What is a Brine Well and How Does it Collapse?

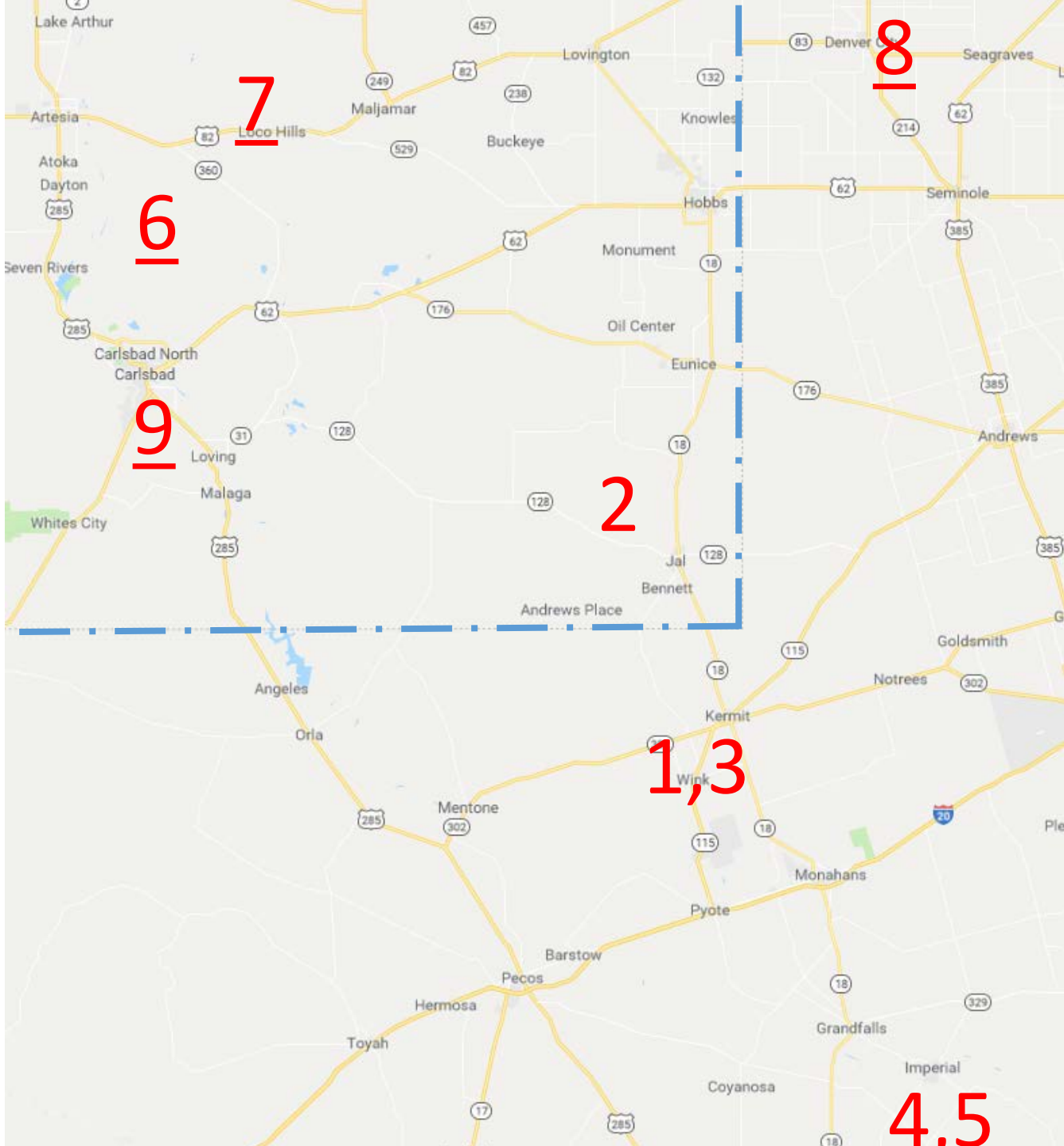
A: Fresh water is put down a well into deep, natural salt beds to create salt water, creating a cavity.
B: The brine is pumped out for use, more fresh water is injected, and the cavity grows.
C: If cavity growth is not controlled carefully, it becomes too large to support its roof, which collapses.

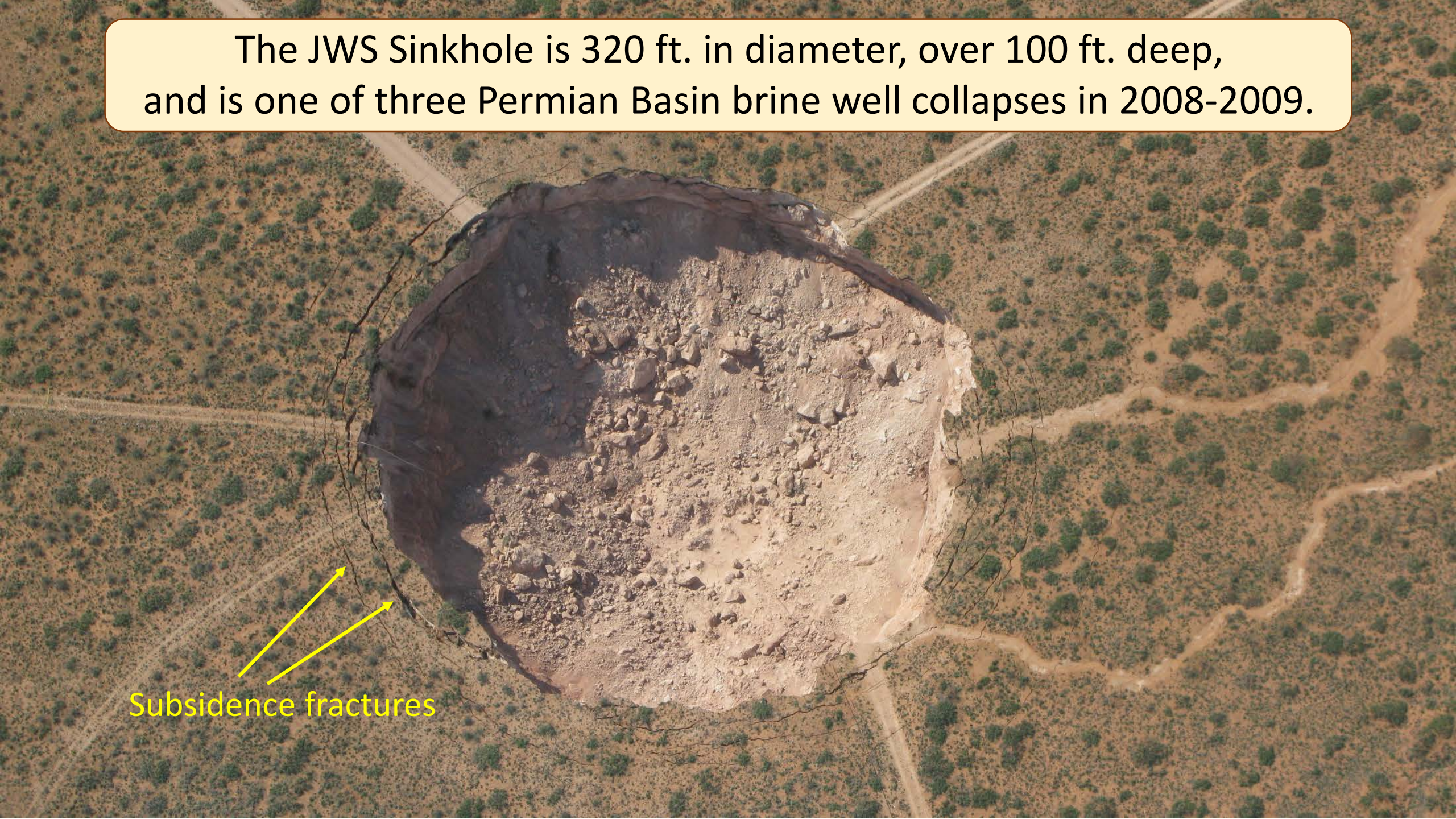


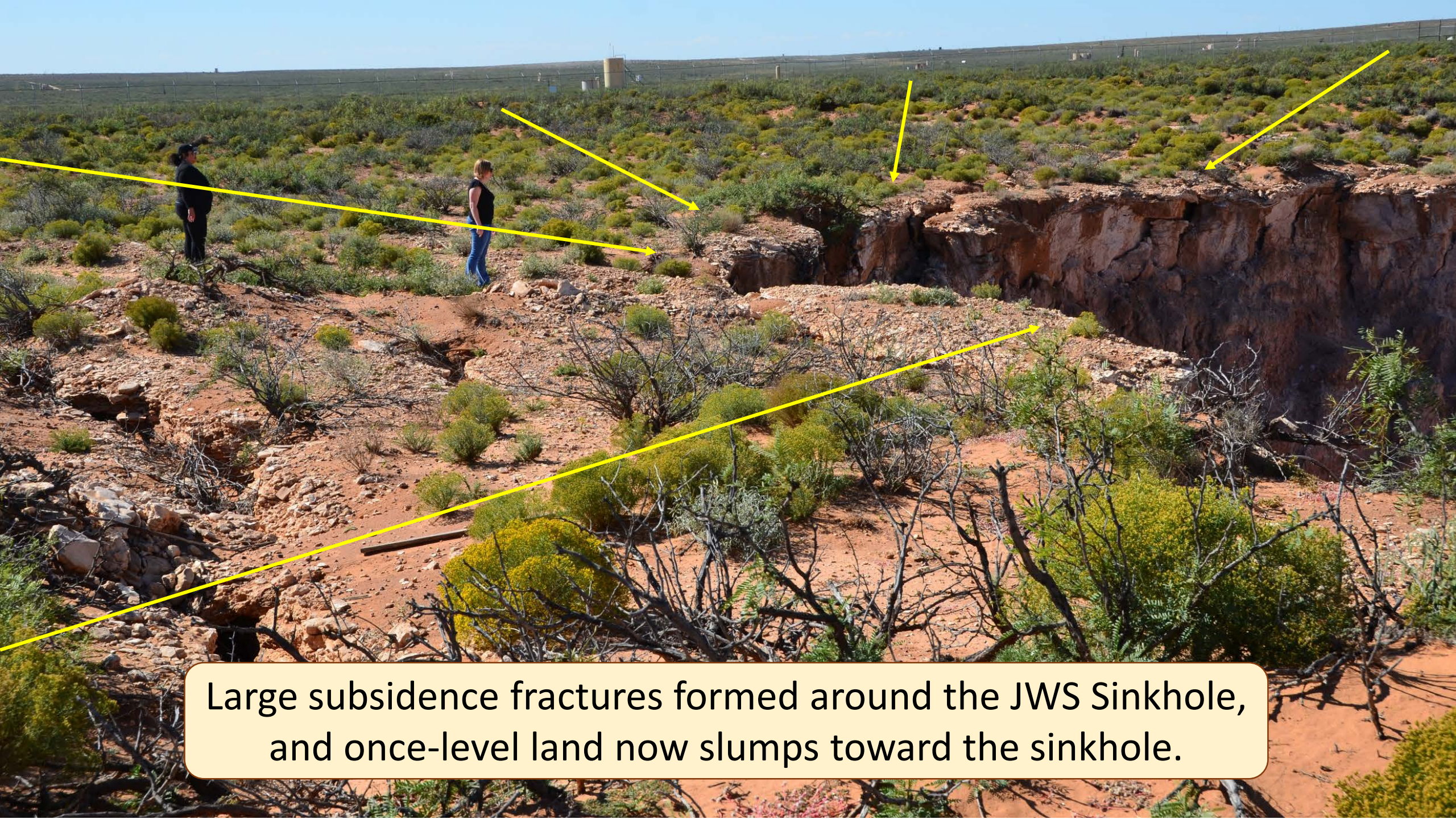
Brine Well and Potentially Related Collapses in the Permian Basin

1) Wink Sink 1, Wink, Texas, June 1980
2) Jal Sinkhole, Jal, NM, September 1998
3) Wink Sink 2, Wink, Texas, May 2002
4) Boehmer Lake Sinkhole, Imperial, Texas, 2003
5) Imperial Sinkhole, Imperial, Texas 2008
6) JWS Sinkhole, Eddy County, NM, July 2008
7) Loco Hills Sinkhole, Loco Hills, NM, November 2008
8) Denver City Sinkhole, Denver City, Texas, July 2009
9) I&W Brine Well, Carlsbad, NM, estimated to collapse 2021-2036.

Plus 32 brine wells in southeast New Mexico



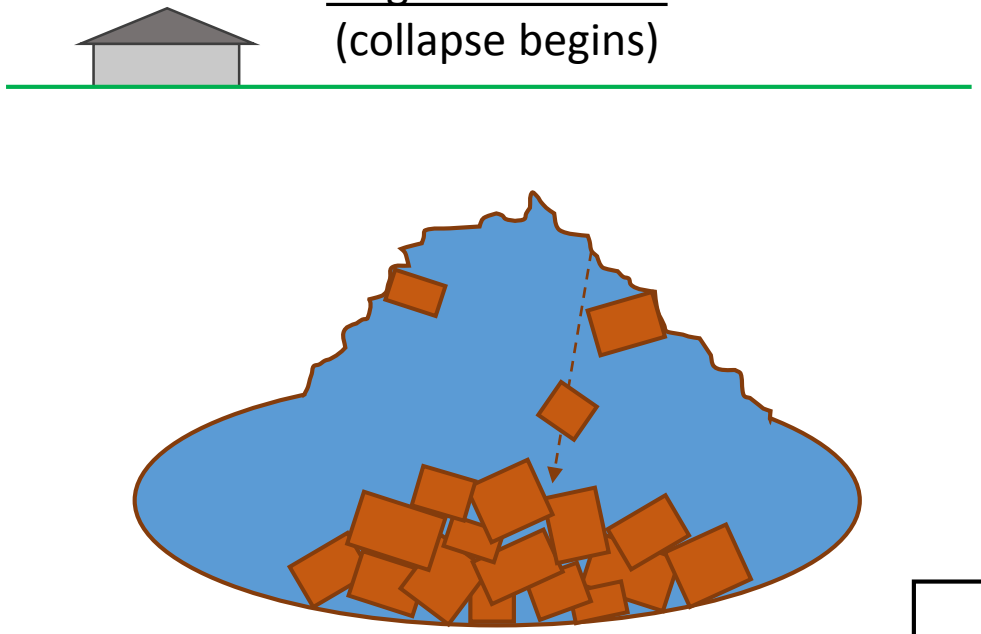

The JWS Sinkhole is 320 ft. in diameter, over 100 ft. deep,
and is one of three Permian Basin brine well collapses in 2008-2009.
Subsidence fractures



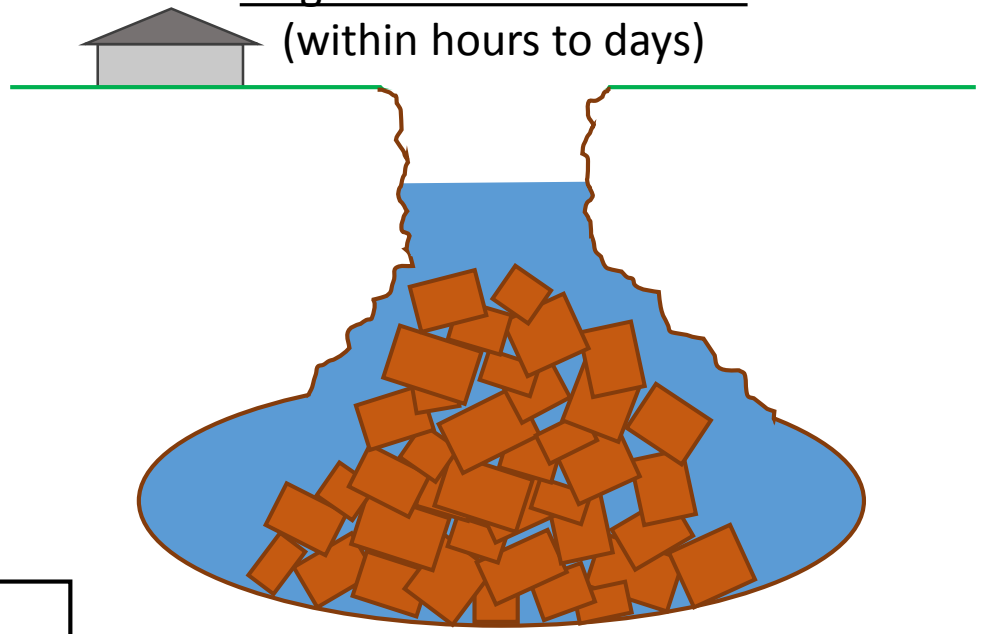
Large subsidence fractures formed around the JWS Sinkhole, and once-level land now slumps toward the sinkhole.

Stages of Sinkhole Collapse

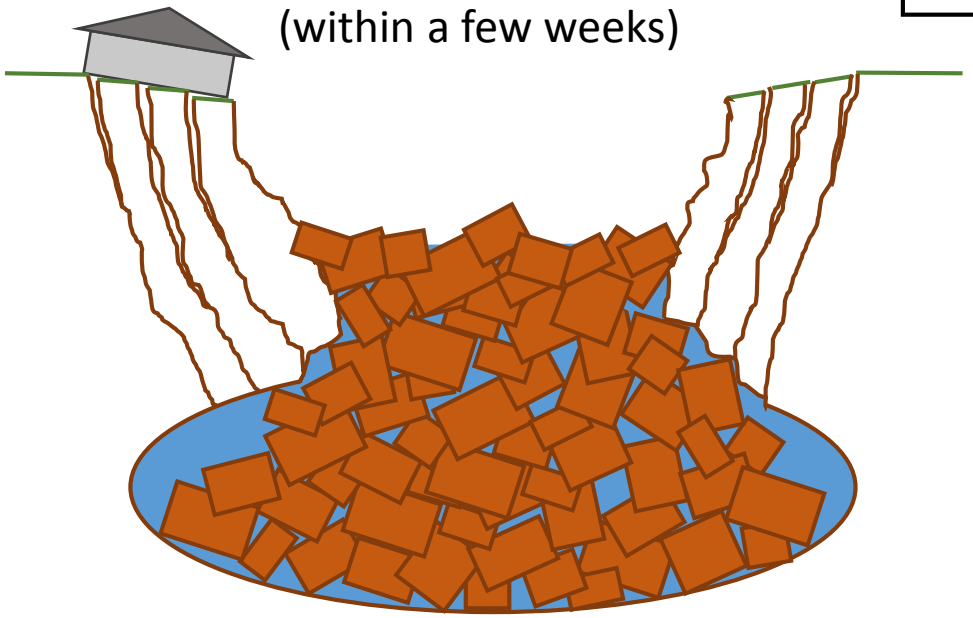
Stage 1: Initiation
(collapse begins)



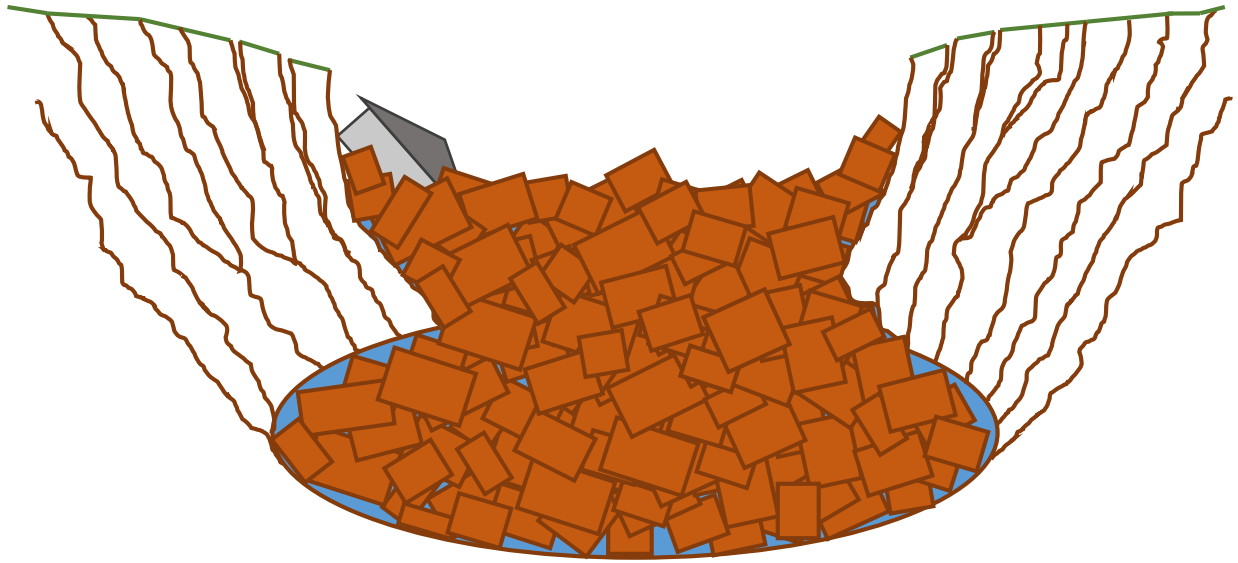
Stage 2: Breach of Surface
(within hours to days)

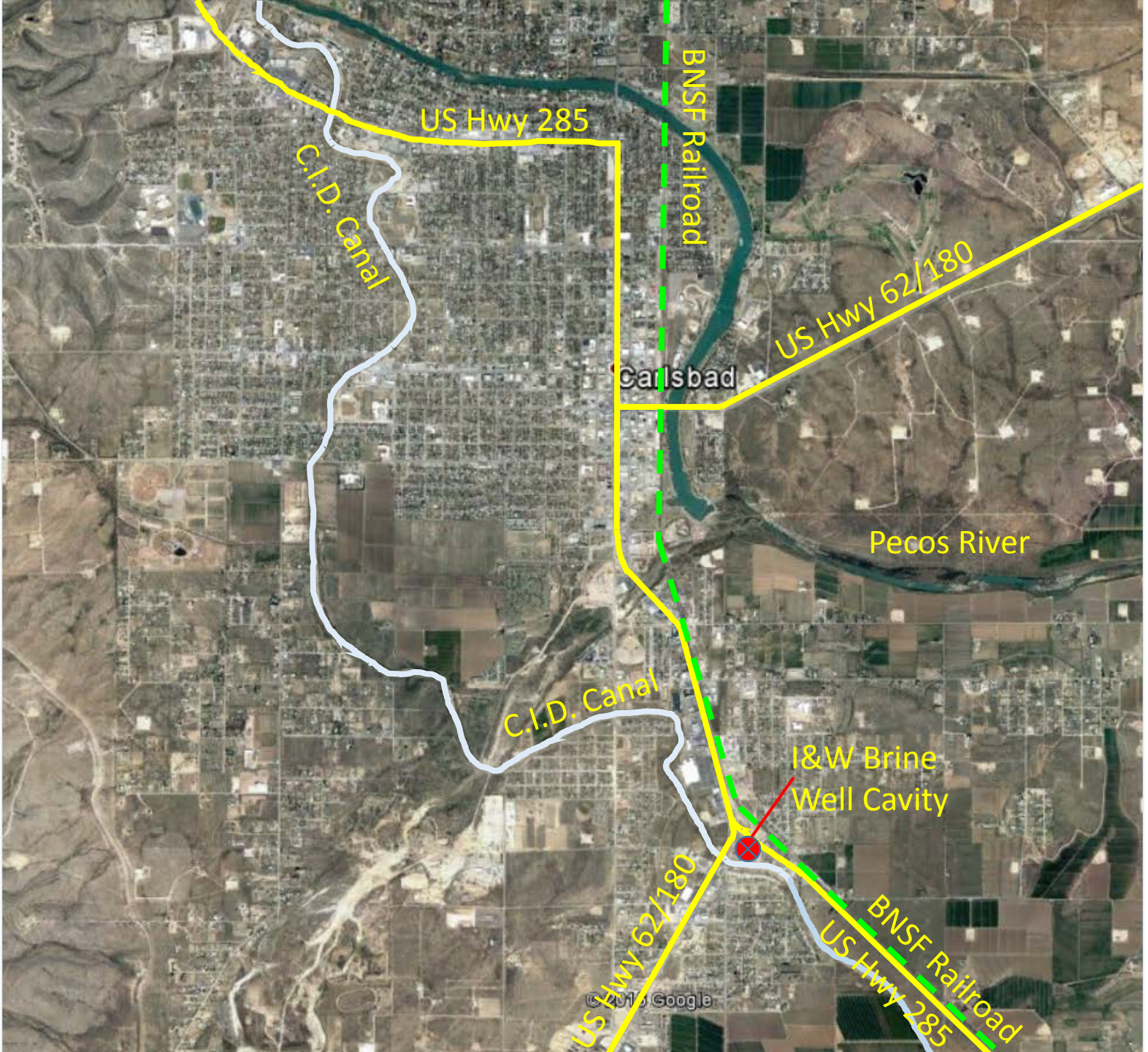


Stage 3: Initial Subsidence
(within a few weeks)



Stage 4: Advanced Subsidence
(continues for decades)





Google Earth Aerial Image of Carlsbad

The I&W Brine Well Cavity was identified as very similar in geology and production history to the collapsed wells. Brine production ceased and monitoring began.

It is located at Carlsbad's "South Y," the most crucial junction of major infrastructure in the city:

- Intersection of 2 of the 4 highways into the city;
- Carlsbad Irrigation District Canal, the primary source of water for agriculture in south Eddy County;
- BNSF railroad, the critical transportation route for Mosaic Potash mines.


Brine Well Cavity:
Estimated Collapse Zone
and Potential Zone of
Subsidence for Decades
0
400
feet
Hotel
Restaurant
Bank
BNSF Railroad
C.I.D. Canal
Homes
US Hwy 285
Warehouse
Restaurant
Feed
Car
Dealer
Church
Gas
BNSF Railroad
Elementary
School
Gas
US Hwy 62/180
Bank
Gas
Gas
Gas
Mobile Home Park
Gov.
Offices
C.I.D. Canal
US Hwy 285
Homes
Google earth

Site History

- Salt mining from early 1900's to 1998
- Solution mining – Permian basin salt deposit
- 121 brine wells over ~ 350 acres
- Salt deposit at ~ 400 feet bgs (approx. 300 ft thick)
- Four sinkholes have occurred (see next slide)

From: Mosaic (2017)

Introduction

Site Map – Former Brine Well Locations

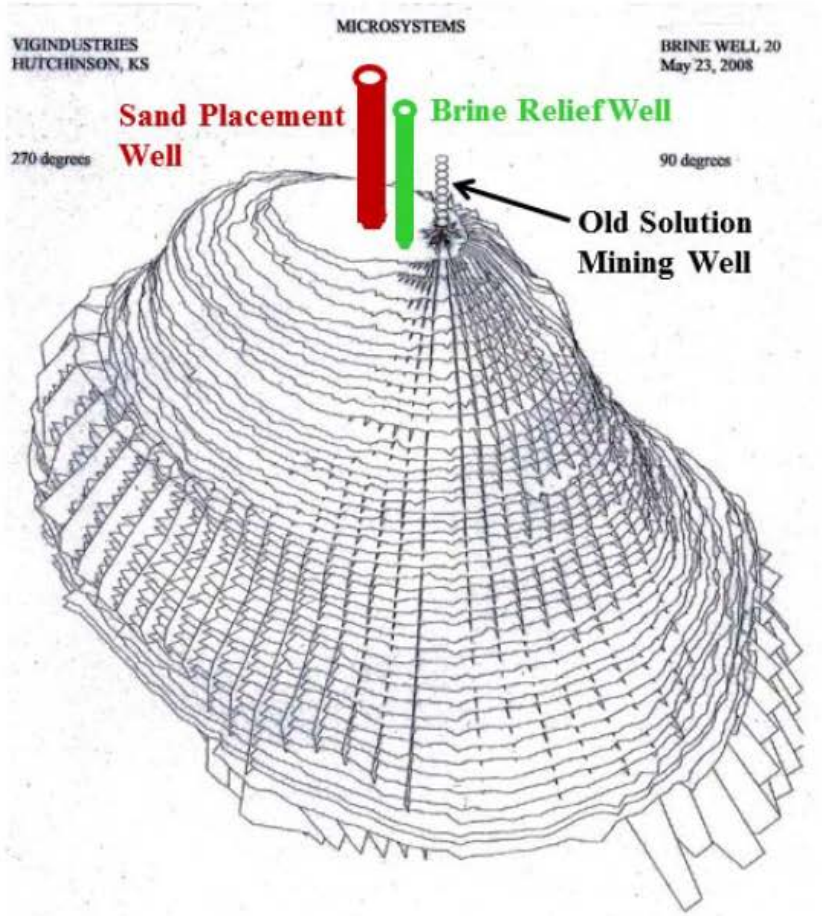
From: Mosaic (2017)

Cavern Void Remediation
Remedial Alternatives

- Three Caverns Needing Backfill
  - #20
  - #25-40
  - #33

From: Mosaic (2017)

Backfilling Project



Sonar: Well #20

Approx. 1.2 Tons/Minute

12 Hr / Day

5.2 M Gallons Brine Displaced @ 150 gpm

From: Mosaic (2017)

Summary comparison of Carlsbad to Hutchison

- Cavity geometries are different. Hutchison is a cone, which is easier to fill. Carlsbad is a pancake which is more complex to fill and requires many more drilled holes.
- Hutchison cavities don’t have all of the rubble that is present in Carlsbad. The rubble doesn’t provide a solid foundation for the grout and requires a more complex fill plan.
- Hutchinson has been monitored for 4 years with no evidence of subsidence to date, so the remediation appears to be successful.
- Hutchison did not need to maintain brine water pressure in the cavity, which is crucial in Carlsbad and adds cost to the remediation.
- The Carlsbad situation is different, but Hutchison is an example that such remediation has been done before.

Brine Well Authority's Technical Subcommittee Observations on the Draft Remediation Plan

- Wood recognizes that substantial rubble fills the cavity and that a two-stage fill plan is needed to stabilize the rubble.
- Wood recognizes that multiple holes are needed to effectively fill the cavity; 26 are proposed due to the pancake shape of the cavity.
- The draft plan is based on a very detailed examination of all data collected on the cavity, giving a high level of confidence that the plan is likely to be an effective solution to the problem.
- The draft plan lacks some details that will be important to the implementation of the final plan. The Subcommittee has submitted a list of those details to OCD and expects Wood to provide them in the final plan.
- Wood's final plan needs to cover a range of actual conditions that may be encountered during remediation, in terms of how to address those conditions and what the final project costs may be. The geophysical information is not conclusive on the rubble volume and distribution, and the volume of fill material could be substantially greater than the draft plan suggests.