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Injection Capacity Challenges and Opportunities in the Permian Basin Region

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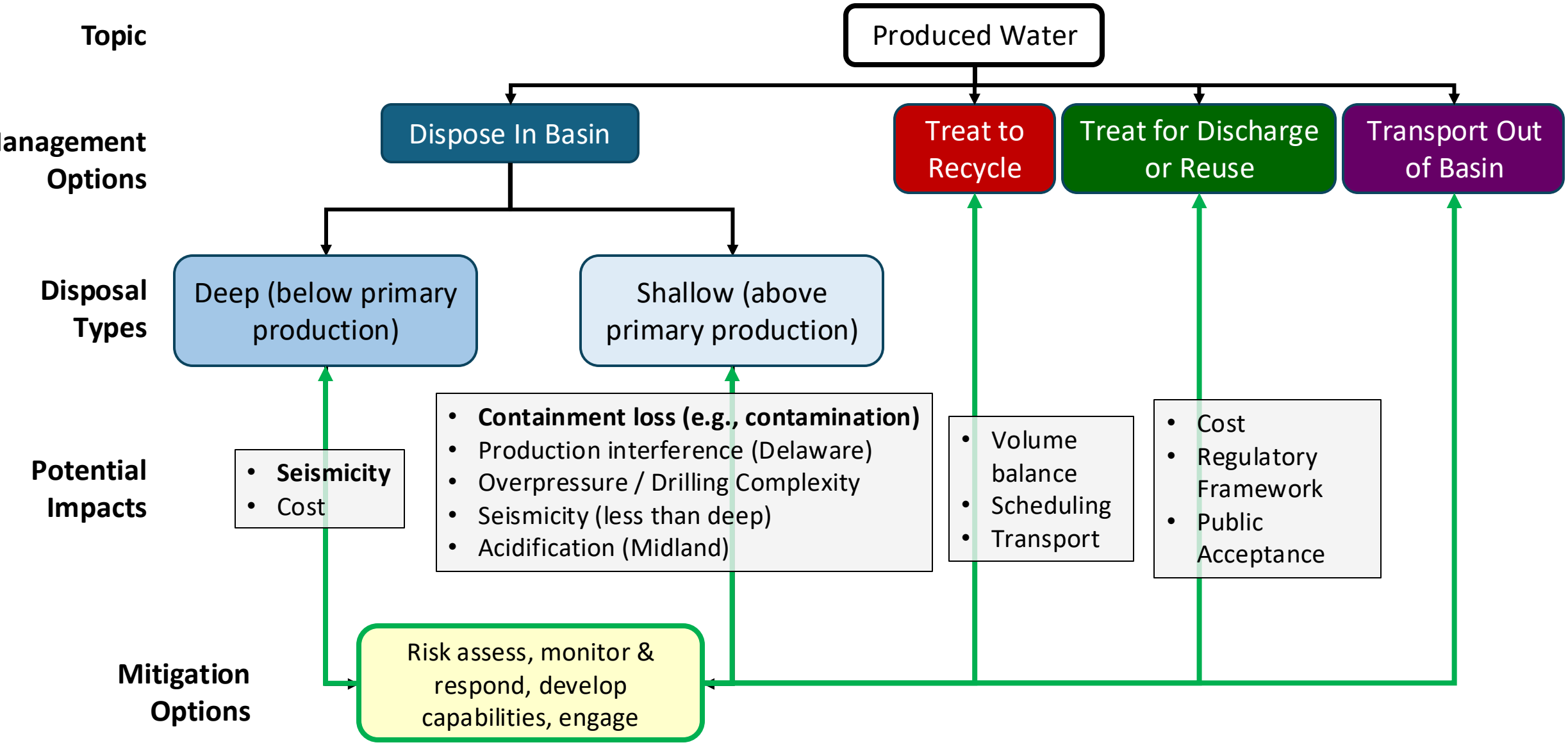
Permian Basin Water in Energy Conference

Produced Water Management Options



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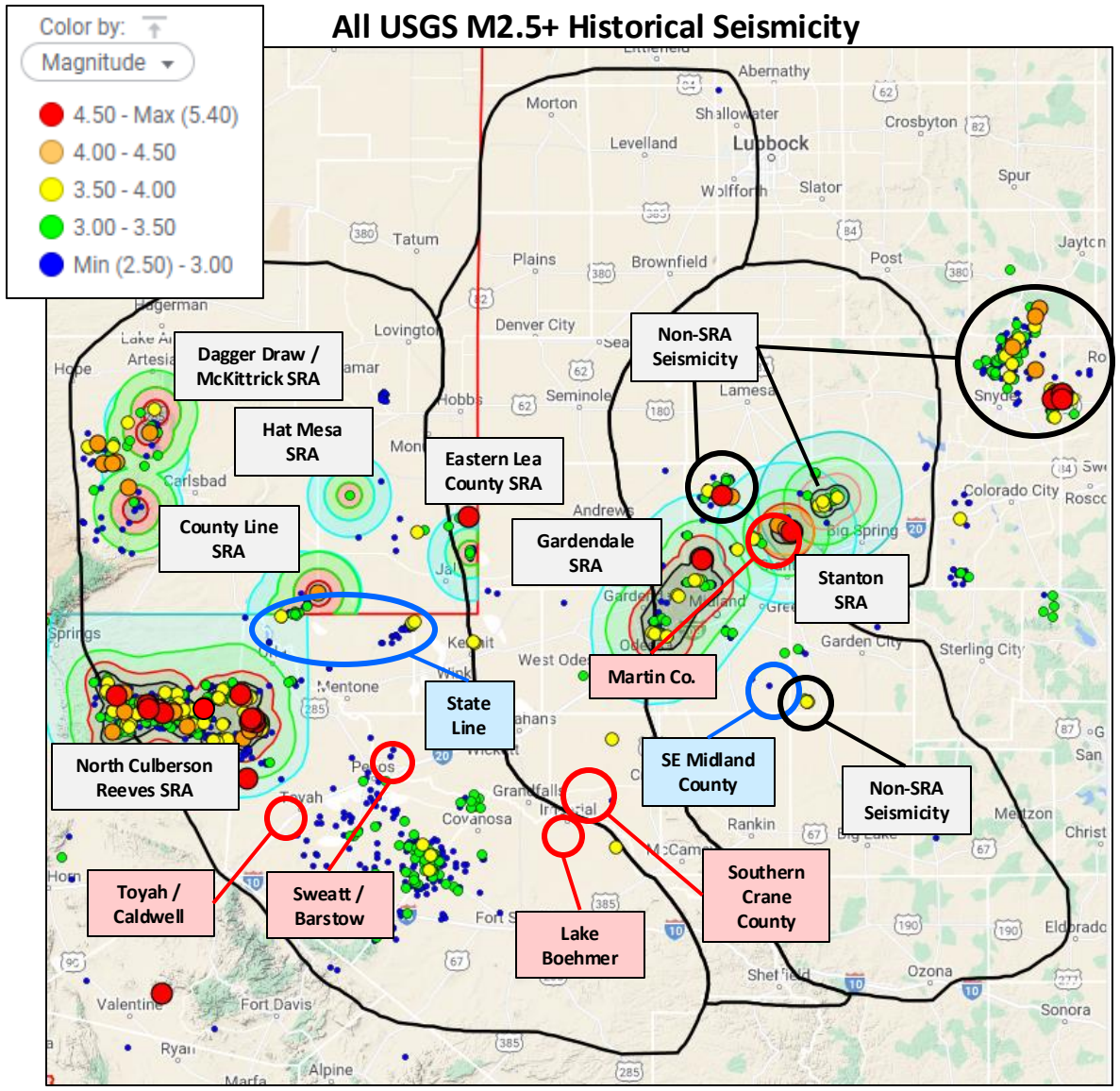
Subsurface Disposal Issues in the Permian



- **Seismicity**
  - **New Mexico SRAs:** Deep equity SWD wells impacted
  - **Gardendale (TX):** Shallow SWD wells impacted
  - **North Culberson / Reeves SRA (TX):** Others' deep SWD wells impacted
  - **Stanton SRA (TX):** 3rd party and equity deep SWD wells impacted
  - **Non-SRA Seismicity:** Deep SWD wells voluntarily curtailed
- **Drilling Issues**
  - **State Line (2020 -):** Water flow while drilling & surface breaches at/near pads resulting in P&A, remediation, & shut-in of nearby SWD wells
  - **SE Midland Co. (2024):** Water flow while drilling resulted in temporary cessation while nearby SWD(s) shut-in
- **Containment**
  - **Lake Boehmer (2003 -):** Surface release of disposed water in water well
  - **Southern Crane County (2021-2022):** Surface breaches P&A'd; technical studies in '24 showed significant horizontal transport of produced water
  - **Martin Co. (2024):** InSAR data showed surface uplift at a shallow SWD; volumes directed to other SWD wells
  - **Sweatt / Barstow** and **Toyah / Caldwell Blowouts (2024)**

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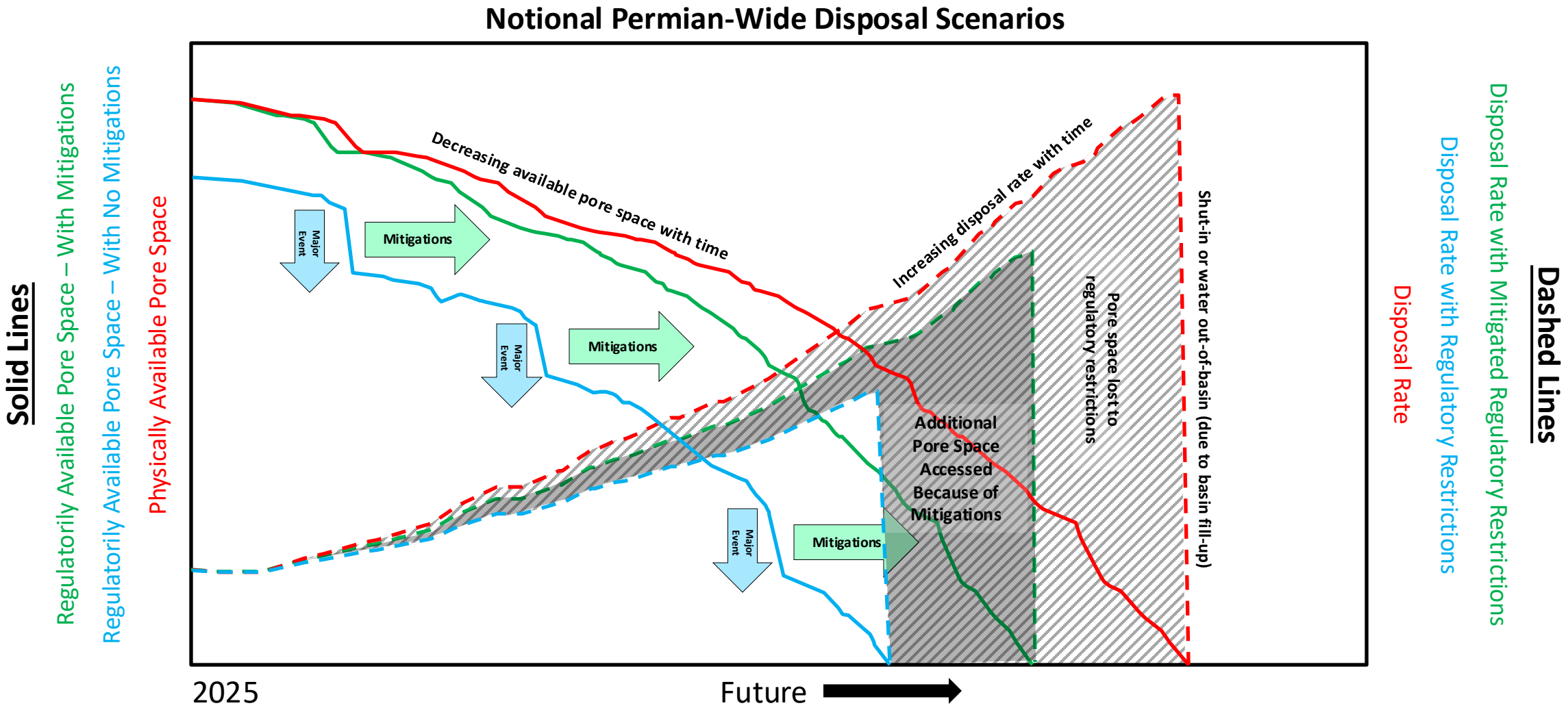
The Effect of Mitigation



Note: If alternate water management options are able to manifest at scale, the dashed red line could have a lower slope, and would therefore delay the point at which there is no remaining pore space

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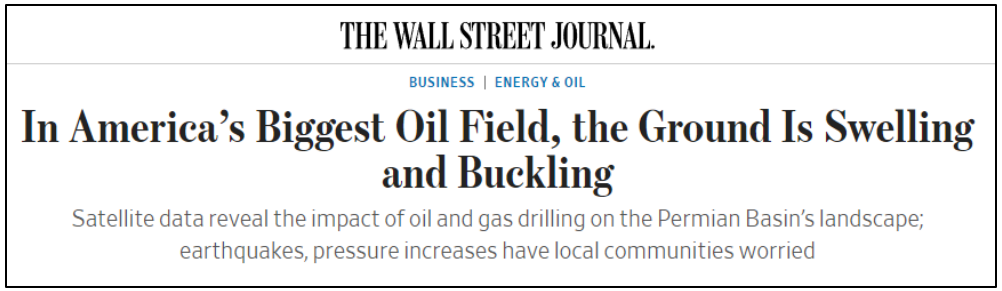
It’s All About Pressures

- Seismicity is part of a broader family of injection-related pressure consequences that are developing as pore space for produced water disposal becomes less available
  - Seismicity (commonly associated with deep disposal)
  - Vertical containment loss to water table or surface
  - Production interference in disposal or adjacent formations
  - Cost/tractability of drilling through overpressured formations



THE WALL STREET JOURNAL.

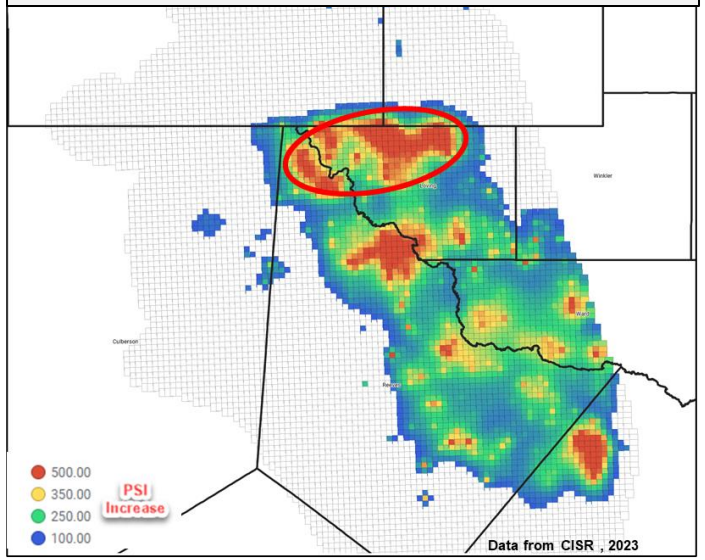
BUSINESS | ENERGY & OIL

In America’s Biggest Oil Field, the Ground Is Swelling and Buckling

Satellite data reveal the impact of oil and gas drilling on the Permian Basin’s landscape; earthquakes, pressure increases have local communities worried

- Understanding the evolution of available pore space, and managing the full suite of subsurface risks is critical to managing water and, by association, asset development in the Permian

Models show shallow disposal formation increasing 800+ psi in spots over a few years



- Produced water optionality is paramount to supporting long-term development in the Permian
- Managing the associated risks is one of largest challenges for the industry in the Permian, if not the largest

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