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**How many disposal wells does PA need and where can they be located?**

**Shale Network 2017 Workshop  
Penn State University**

**Dale E. Skoff, PG**

**May 19, 2017  
State College, Pennsylvania**



# Introduction

- EPA classifies brine disposal wells (aka saltwater injection or saltwater disposal wells) as UIC Class IID Wells
- Regulated under the Safe Drinking Water Act
- Approximately 30,000 UIC Class IID wells
- Approximately 280 such wells in Marcellus and Utica Shale Play area with most in OH (~220)



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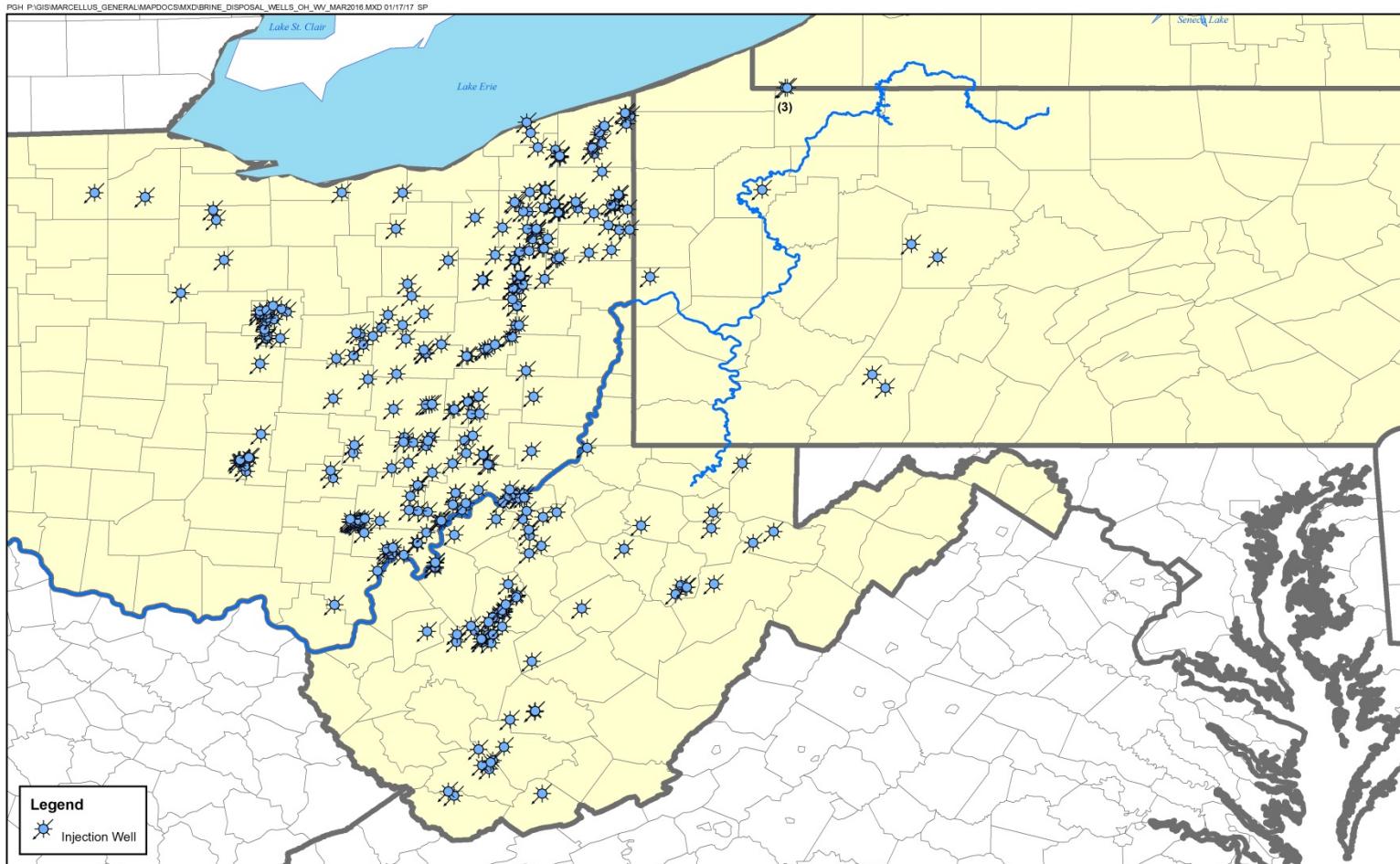
# Introduction

- Both Marcellus Shale Play and conventional operators need these wells
- Currently vast majority of non-recycled brine shipped to OH resulting in extra cost and truck traffic
- EPA and State approved disposal method
- Over the past few years, concern over induced seismicity has increased



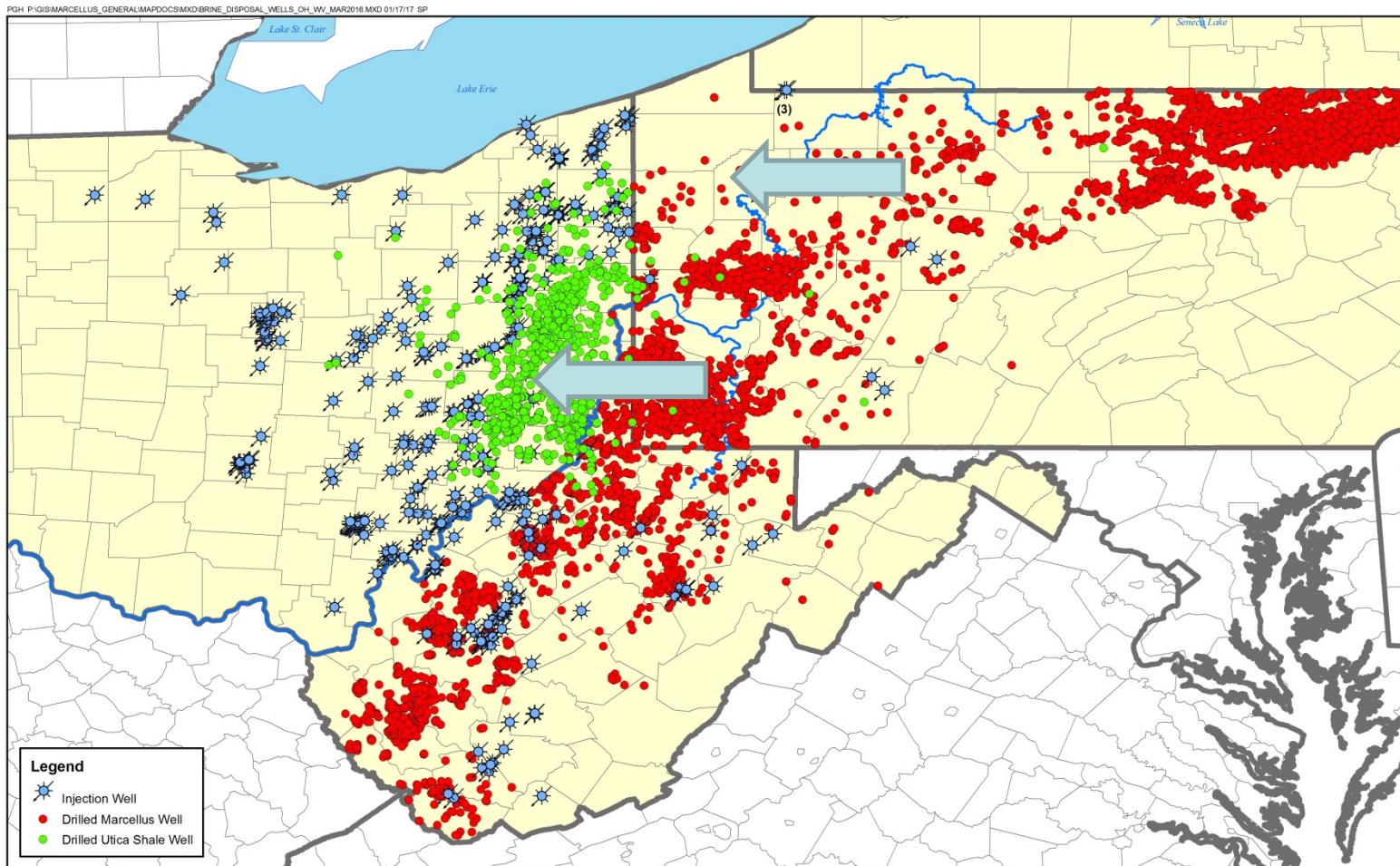
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# OH and WV Have Many More Brine Disposal Wells Than PA



Source: OH DNR, WVDEP and USEPA Region 3 UIC Class IID well databases.

# Overall Brine Movement is Westward

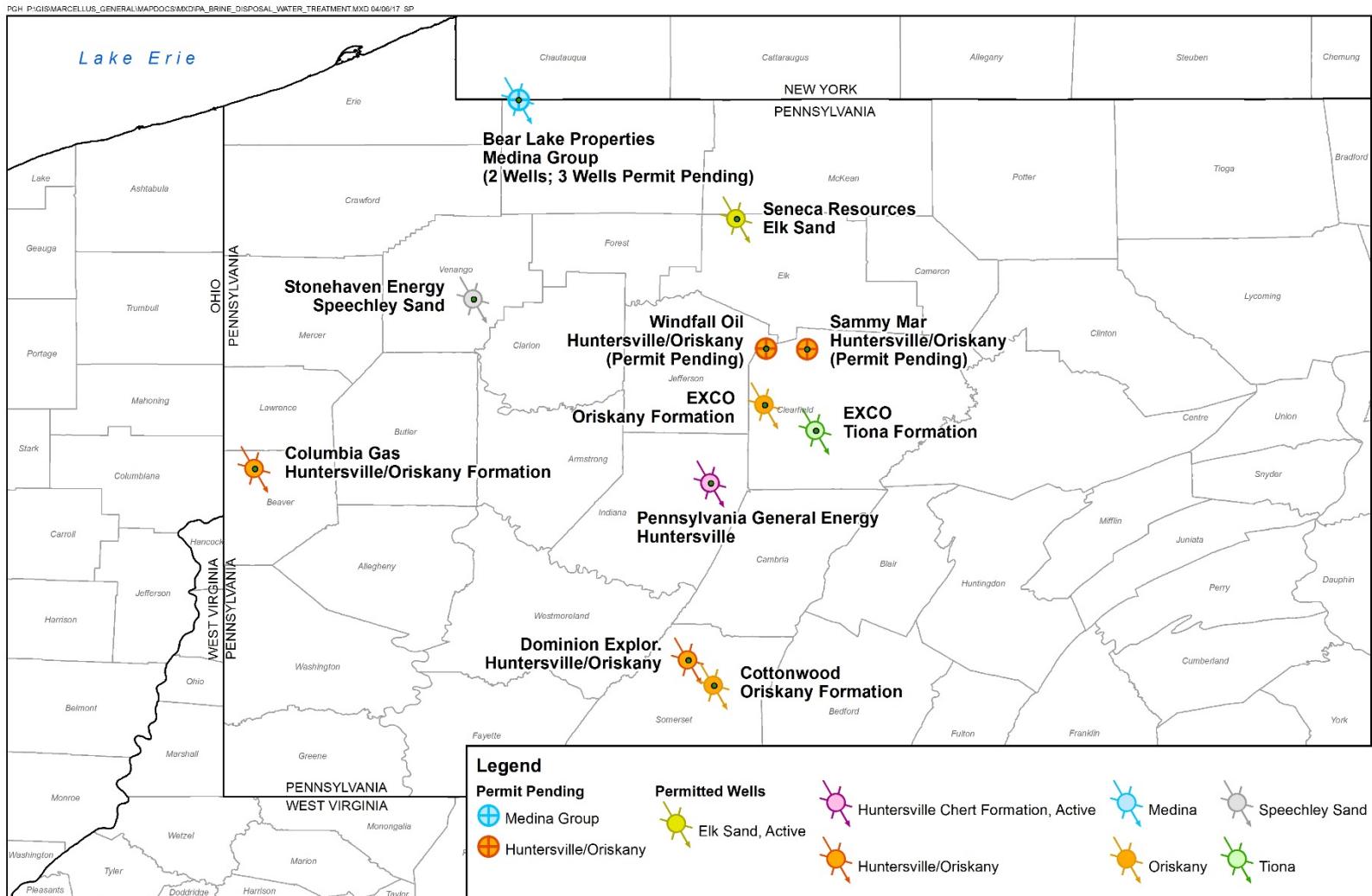


Source: OH DNR, WVDEP and USEPA Region 3 UIC Class IID well databases.

# Brine Disposal Wells Pennsylvania

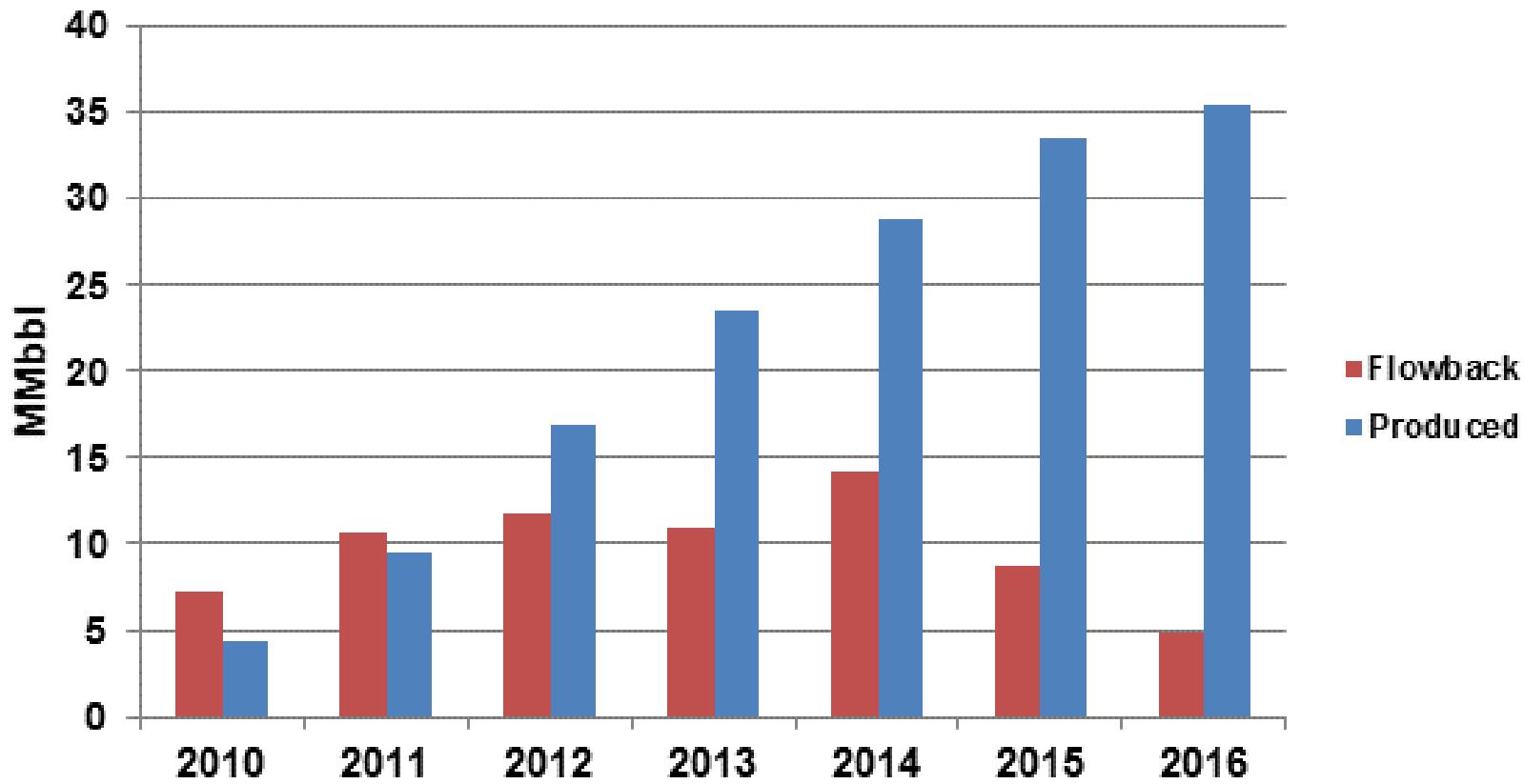
- Total: 10 permitted by both EPA and PADEP
- Only one commercial facility (in NW PA)
- Formations
  - Upper Devonian (Tiona, Speechley and Elk Sands)
  - Huntersville Chert – Oriskany Sandstone
  - Medina Sandstone
- Depth – 1900 to 8900 ft.
- EPA has primacy for permitting
- PADEP approval now also required via new UIC Well approval program.

# Brine Disposal Wells in PA



# Trend in Unconventional Brine Generation in PA

Unconventional Produced/Flowback Water  
Generated in Pennsylvania



## Est. UIC Class IID Wells Needed in PA Based on 2016 Disposed Volumes

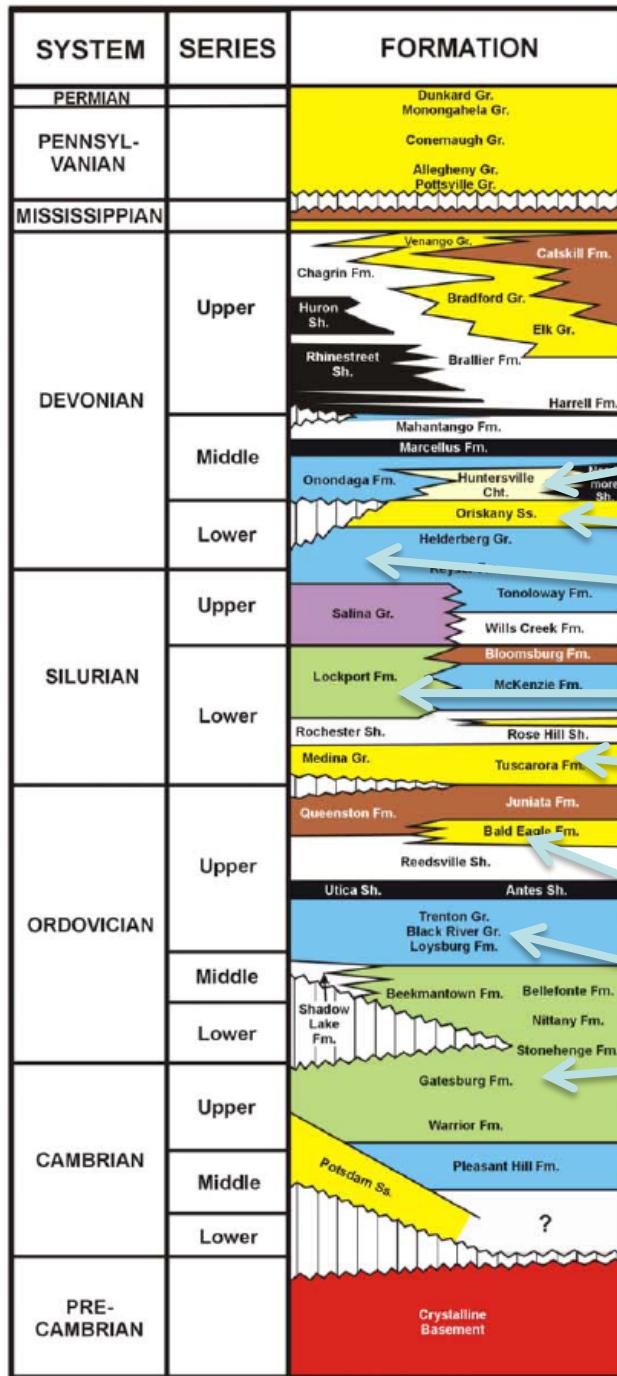
|   |                            |
|---|----------------------------|
| <b>Total Unconventional Brine to UIC Wells (Bbls)</b>       | <b>6,300,000</b>           |
| <b>Total Unconventional Brine to UIC Wells in PA (Bbls)</b> | <b>300,000</b>             |
| <b>Total Not Disposed in PA (Bbls)</b>                      | <b>6,000,000</b>           |
| <hr/>   |                            |
| <b>Injection Rate - Avg Barrels / Day</b>                   | <b>No. of Wells Needed</b> |
| 250   | 69                         |
| 500   | 34                         |
| 750   | 23                         |
| 1000  | 17                         |

# Where to Find the Disposal Capacity?

- A common myth is that Pennsylvania geology not conducive to siting injection wells
- In general, geology does require more “surgical” approach than in certain other states (e.g., Texas)
- There is great opportunity to “recycle” depleted oil and gas wells/fields for safe disposal
- In some areas, potential also exist for drilling new wells to access favorable formations
- Site wells based on geologic conditions and proximity to producing areas, while being sensitive to public concerns (e.g., regarding residential areas, truck traffic, etc.)

## Where to Find the Disposal Capacity? (Cont'd)

- Finding the needed lateral extent, porosity, permeability and thickness can depend on
  - Trend of individual sand interval (e.g., many Upper Devonian Sandstones)
  - Structural position (e.g., Oriskany Sandstone and Huntersville Chert)
- Site wells to avoid faults and reduce the risk of induced seismicity
- Beware of poorly plugged wells to target depth
- Injectivity testing can help confirm viability of candidate wells/intervals



## Potential Injection Targets - PA

Upper Devonian Sandstones\*

Huntersville Chert\*

Oriskany Sandstone\*

Bass Island

Lockport Dolomite

Medina – Tuscarora Sandstones\*

Bald Eagle Sandstone

Trenton – Black River

Gatesburg Formation\*

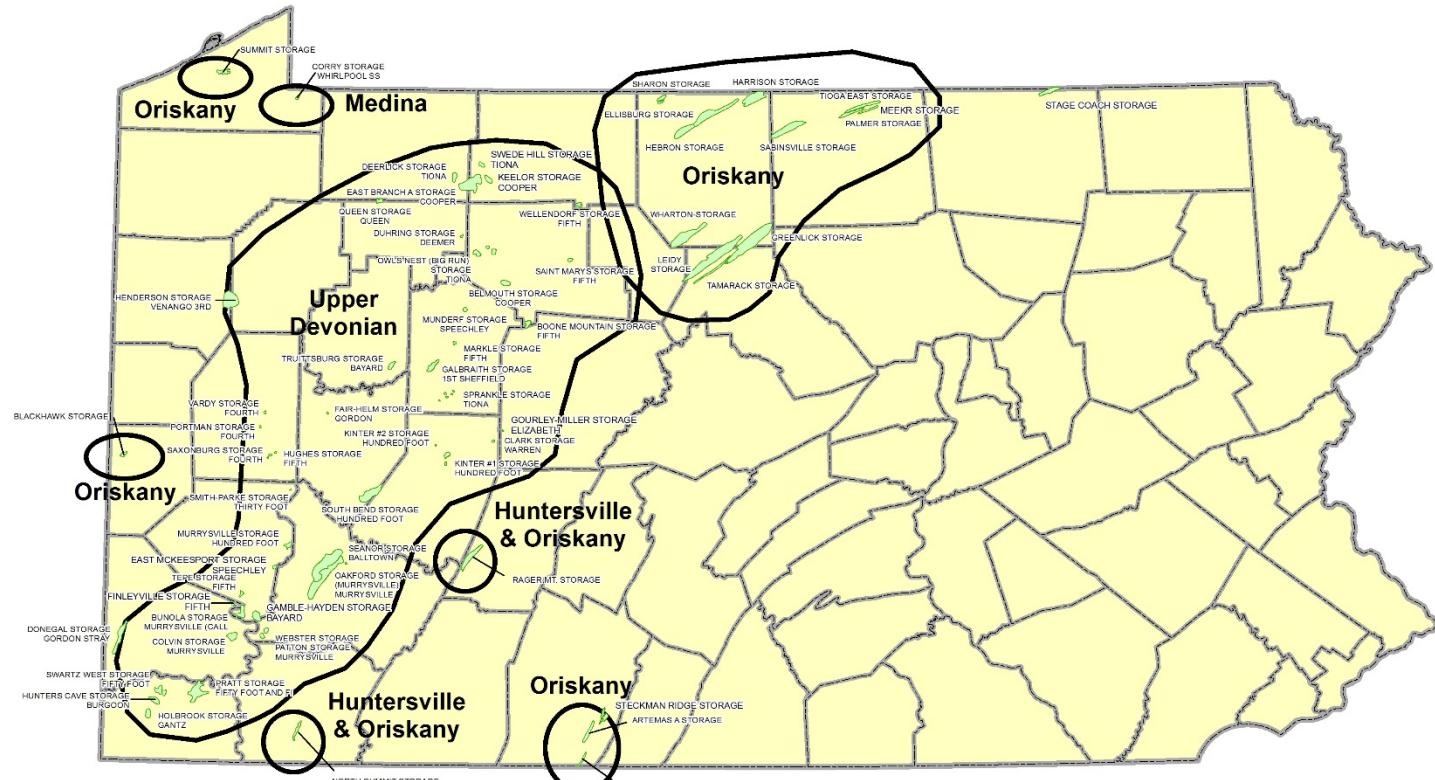
\*Existing injection well in PA

Source: Stratigraphic Column from PADNR

# Natural Gas Storage Fields

PGH\_PGISMSC\_UICMAPDOCSIMDPA\_GAS\_STORAGE\_FIELDS\_V1.MXD 05/16/17 JN

Data from WIS, 2009



25 0 25 Miles

## Legend

- Natural Gas Storage Area
- Storage Field Formation

## NATURAL GAS STORAGE FIELDS IN PENNSYLVANIA

MARCELLUS SHALE COALITION  
UIC WELL STUDY

DRAWN BY: S. PAXTON 06/13/13  
CHECKED BY: D. SKOFF 5/16/2017  
APPROVED BY:  
CONTRACT NUMBER: 112C05292



FIGURE 2-5

REVISION  
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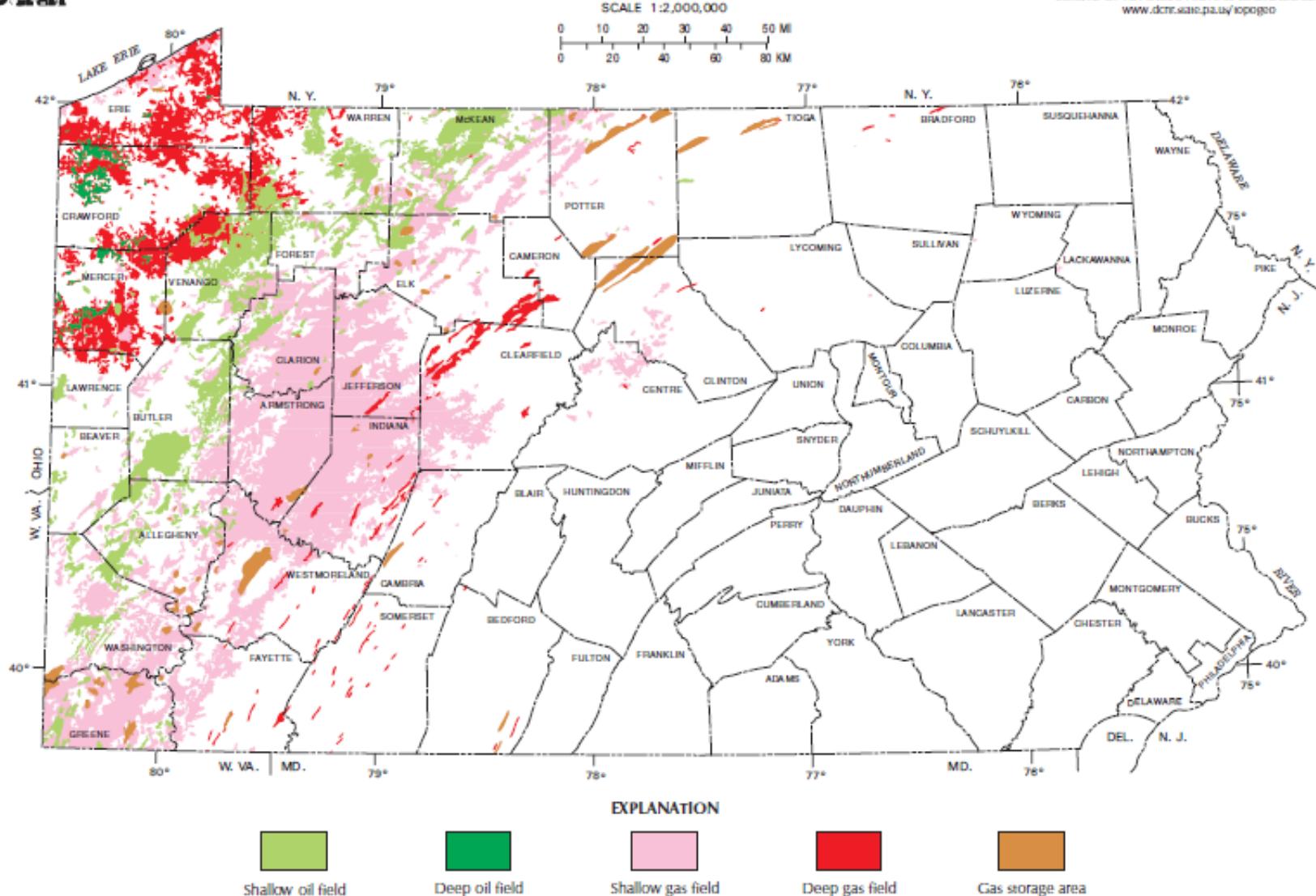
# Certain Depleted O&G Wells/Fields Can Be “Recycled” For Brine Disposal

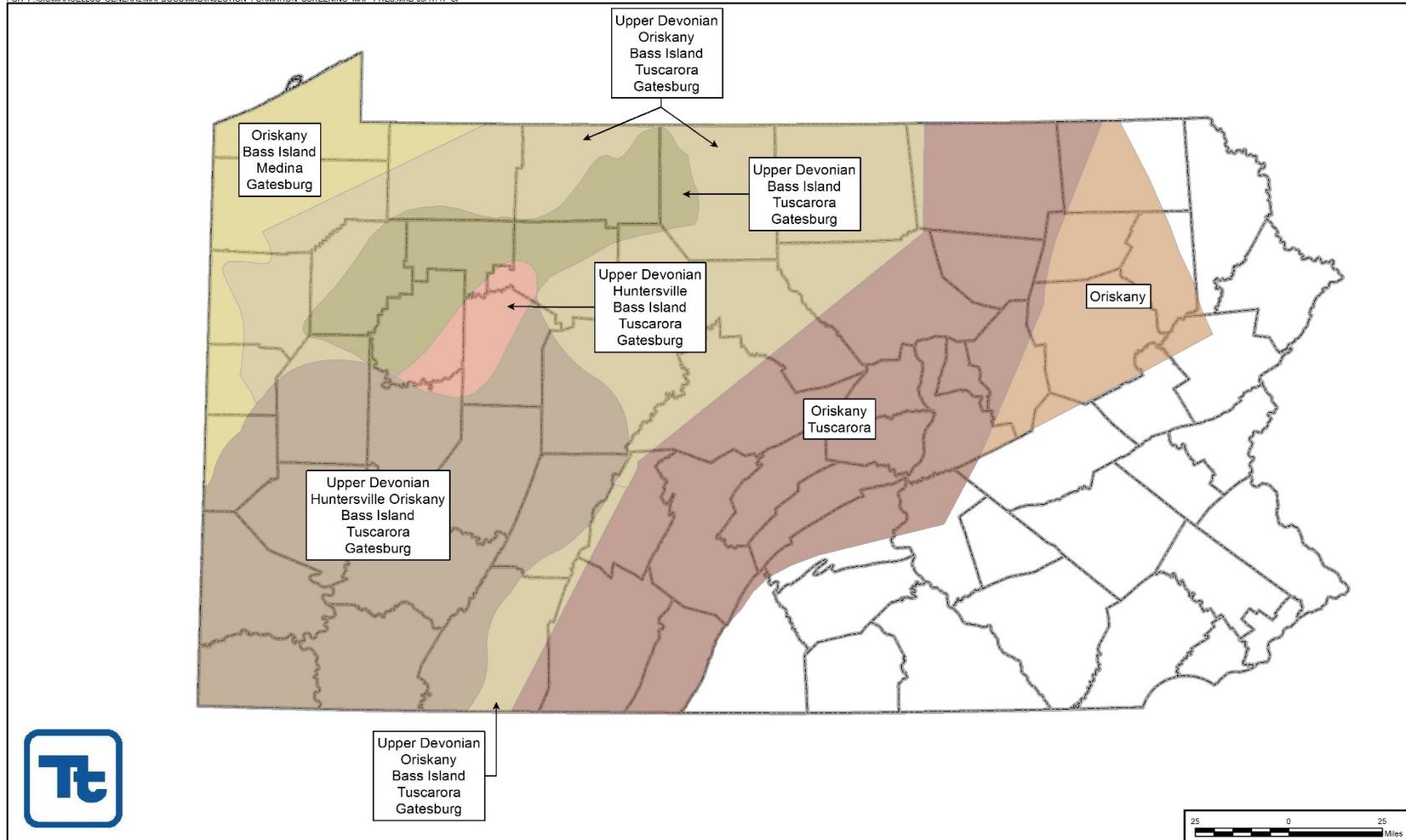
MAP 10



## OIL AND GAS FIELDS OF PENNSYLVANIA

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF  
CONSERVATION AND NATURAL RESOURCES  
BUREAU OF TOPOGRAPHIC AND GEOLGIC SURVEY  
[www.dcnr.state.pa.us/ctopogeo](http://www.dcnr.state.pa.us/ctopogeo)





25 0 25 Miles

| Formation                             | Analog Field   | Volumetric (Net Ft Porosity / Areal Extent) Approach (Million bbls) |
|---------------------------------------|--|---|
| Upper Devonian Sandstone Formations   | Council Run (Fifth Elk), Centre and Clinton Counties | 45  |
| Onondaga Limestone                    | Cyclone, McKean County                               | 2.5   |
| Oriskany Sandstone                    | Meade Gas Storage, Erie County                       | 5   |
| Oriskany Sandstone                    | Ulysses, Potter County                               | 30  |
| Oriskany Sandstone/Huntersville Chert | Strongstown, Indiana County                          | 302   |
| Bass Island Carbonates                | Greenley, Erie County                                | 12  |
| Lockport Dolomite                     | Wolf Creek – Kilgor Mercer County                    | 4   |
| Medina/Whirlpool Sandstone            | Lake Shore, Warren and Erie Counties                 | -   |
| Tuscarora Sandstones                  | Devils Elbow, Centre County                          | 46  |
| Bald Eagle Sandstone                  | Grugan Field, Clinton and Lycoming Counties          | 109   |
| Trenton – Black River                 | Gloades Corner, Steuben County, NY                   | -   |



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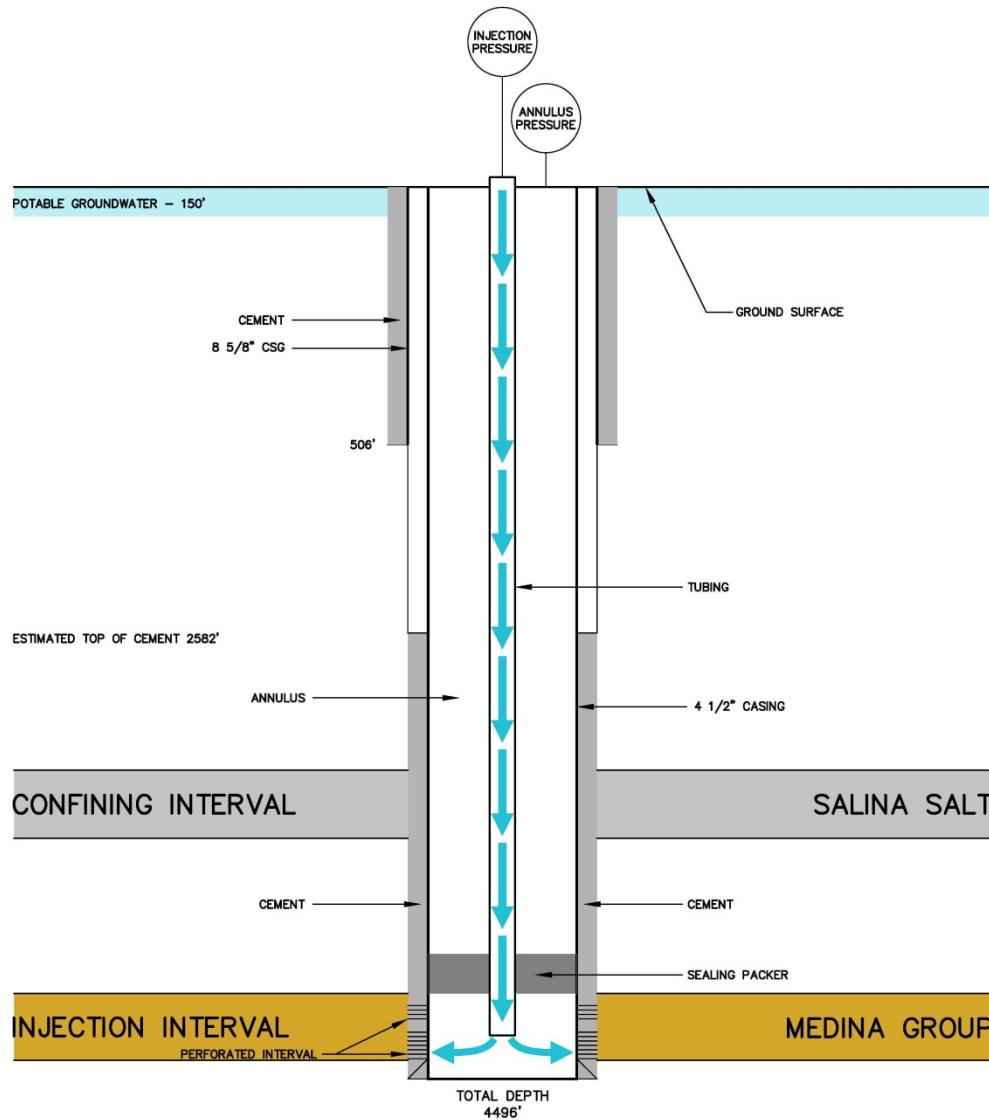
# Bear Lake Properties Brine Disposal Well Permits

## Warren County, PA

- Depleted Medina Group (Grimsby and Whirlpool) gas well field
- Over 11,000 acres
- Approx. 20 wells potential conversion to injection
- Existing wells permitted for approx. 1,000 bbls/d
- 2 wells operational
- 3 wells pending
- Only commercial brine disposal wells in PA



# Bear Lake Properties - Well Construction



# Summary

- There is substantial need in PA for more brine disposal wells on the order of 17 (at 1,000 bbls/d) to 34 (at 500 bbls/d) to meet current demands.
- Many existing O&G wells and fields have potential to be “recycled” for such use.
- Successfully siting such wells includes both considering geologic conditions and public concerns.
- Having more in-state wells can overall reduce truck traffic and help sustain the conventional and unconventional oil and gas business in PA.

# Contact Information

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