

NM Produced Water Data Portal

Mike Hightower – NMPWRC

Tara Gross – Ground Water Protection Council

Dr. Pei Xu – NMSU/NMPWRC

**NM Produced Water Research Consortium - Year-end Meeting
December 1-2, 2021**



“SEIZE THE OPPORTUNITIES”

What is the New Mexico Produced Water Data Portal?

- A free and publicly accessible data base of all currently available produced water quality and quantity data in New Mexico.
- Includes data from the Oil Conservation Division, the USGS, the Petroleum Recovery Research Center at NM Tech, and other verified data sets collected and compiled by universities, and midstream and production companies.
- Designed to provide more user-friendly and convenient access to produced water information by the public, engineers, analysts, planners, and users, than having to query several different data bases of produced water quantity and quality information.
- Designed as a national template for state produced water data bases in collaboration with the Ground Water Protection Council.

Data Portal Web Page Contents

New Mexico Produced Water Data Portal



<http://nm.waterstar.org>

- The Produced Water Data Portal can be accessed at <http://nm.waterstar.org>
- Frequently asked questions (FAQs) and a User Guide are available on the site to assist users in learning how to navigate through the portal and select and highlight different produced water information
- The portal is compatible with a Chrome web browser and is extremely fast
- The navigation icons provide access to drop down information selection menus to personalize user information goals quickly and displayed on summary dashboards.

“SEIZE THE OPPORTUNITIES”

Data Portal Web Page Contents

[FAQ/Fact Sheet](#)

[Dataset Description](#)

[User's Guide Documentation](#)

Quick Start User Guide Video (x minutes) – **Coming Soon**

[New Mexico Produced Water Data Portal](#)

Contributive efforts and support for development of the WaterSTAR: Produced Water Data Portal has been supplied by:



Support questions on the WaterSTAR application can be sent to: WaterSTAR@gwpc.org.

“SEIZE THE OPPORTUNITIES”

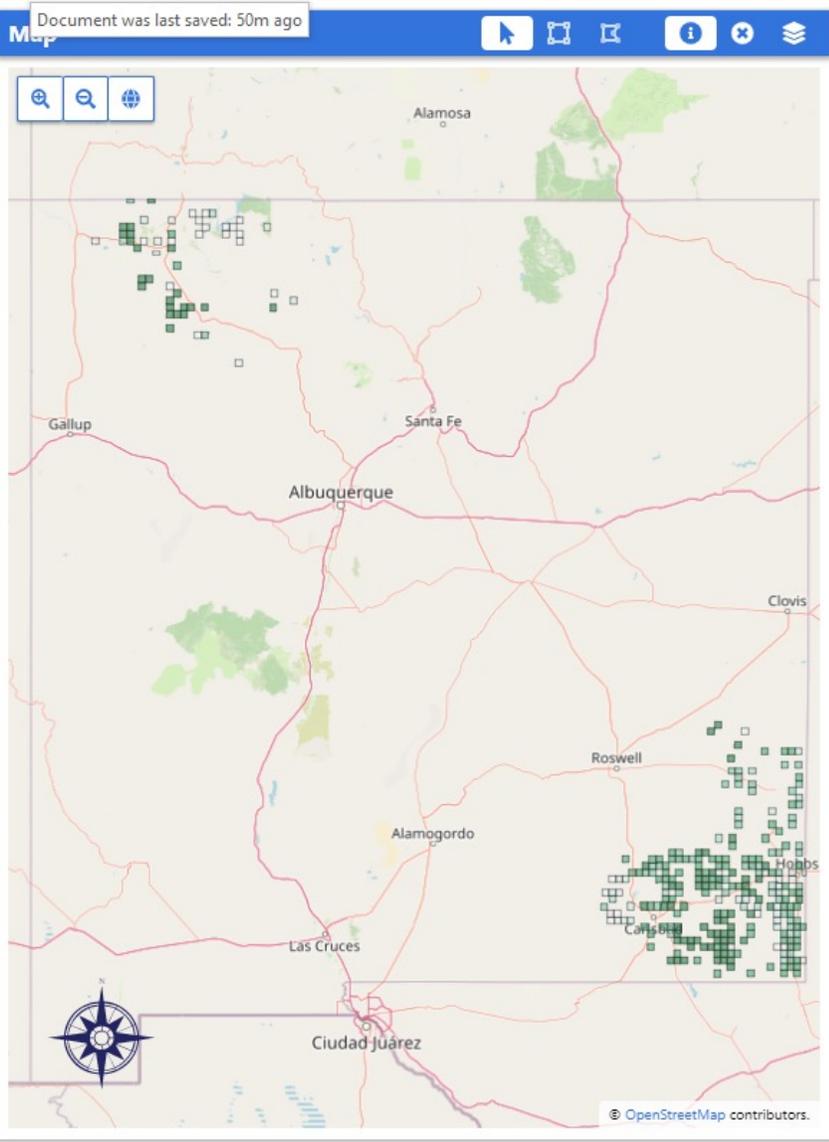


NM Produced Water Data Portal Highlights

- The Data Portal development was a joint effort between Consortium members, including NM Tech, NMSU, and the Ground Water Protection Council. The GWPC's WATER STAR water data format was used as the framework for the portal.
- The portal includes a graphical user interface to enable the user to more easily visualize and find produced water production, use, and disposal information within a geographic map of New Mexico.
- Focus is on produced water disposal wells, which is produced water available for reuse.
- Dashboards and navigation icons help the user sort for specific data by quarter township, quantity by month and year, and quality by constituent, etc. that can then be downloaded.



Reset All Filters



Quarter Township Explorer

Applied Filters:

ID	Quantity Last Year (BBL)	Quantity Last Five Years (BBL)	Quantity Well Count
008S 033E NE		9131	1
010S 032E NE	64548	259725	1
011S 033E NE	0	129751	1
011S 034E NE	130	1368792	1
012S 032E NE	2050342	9784393	3
012S 033E NE	2637744	10255692	2
012S 034E NE	1555	30169	4
014S 033E NE	76802	477097	1
015S 033E NE	1062950	5336320	3
015S 037E NE	7094794	46457787	4
016S 032E NE	437152	2892652	2
016S 033E NE	7520	260977	1
017S 029E NE	3213337	23152566	7
017S 031E NE	198779	1002584	3
017S 036E NE	3380979	21397731	4
017S 038E NE	1342179	13892090	2
018S 027E NE	6585503	47355896	7
018S 028E NE	1342671	10661504	6
018S 032E NE	171590	660821	1
018S 034E NE	84363	1011925	2
018S 035E NE	237488	1337058	1

<< < > >> 299 Total Results | Page 1 of 6

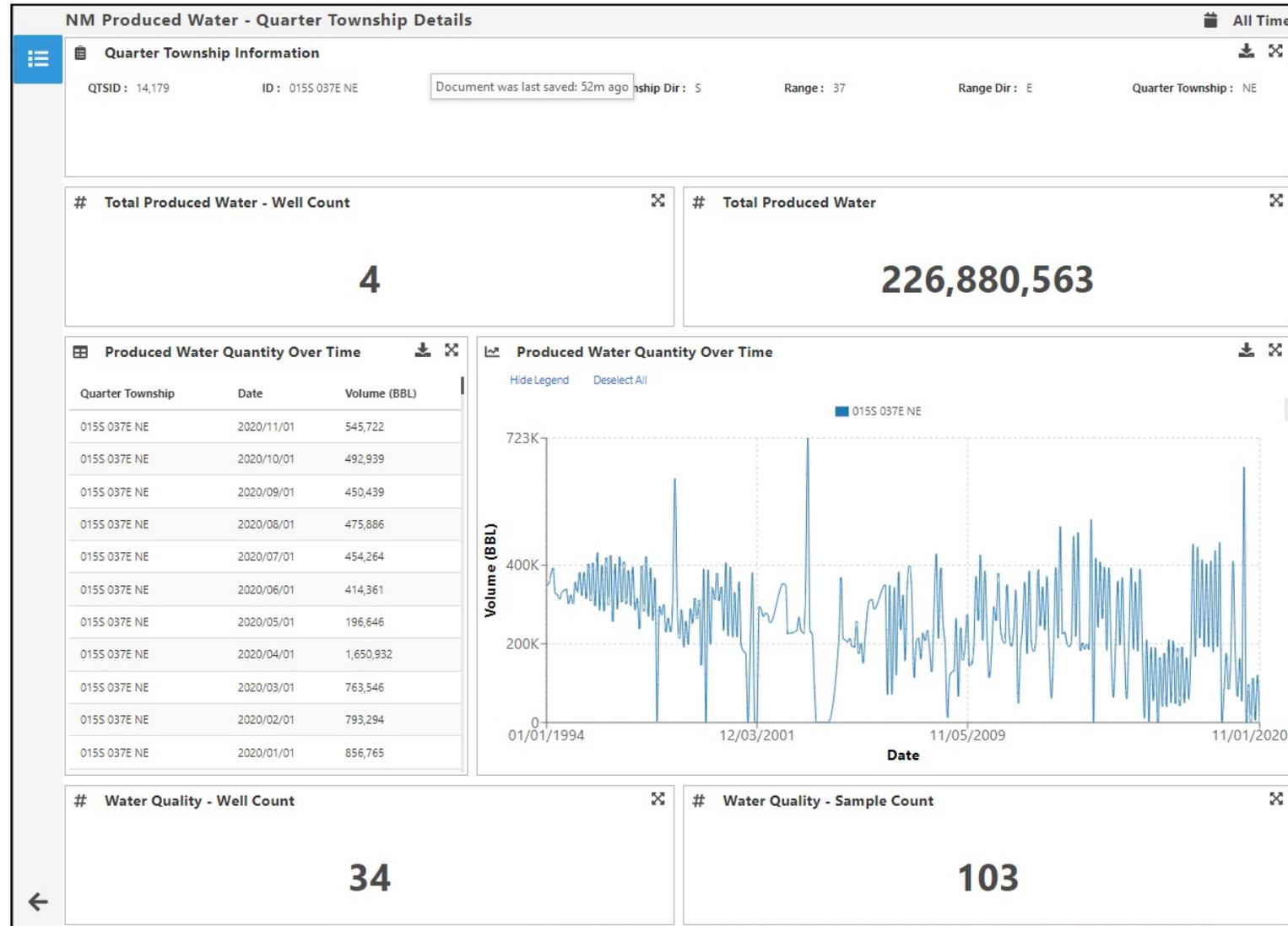
| Go to page: Show 50



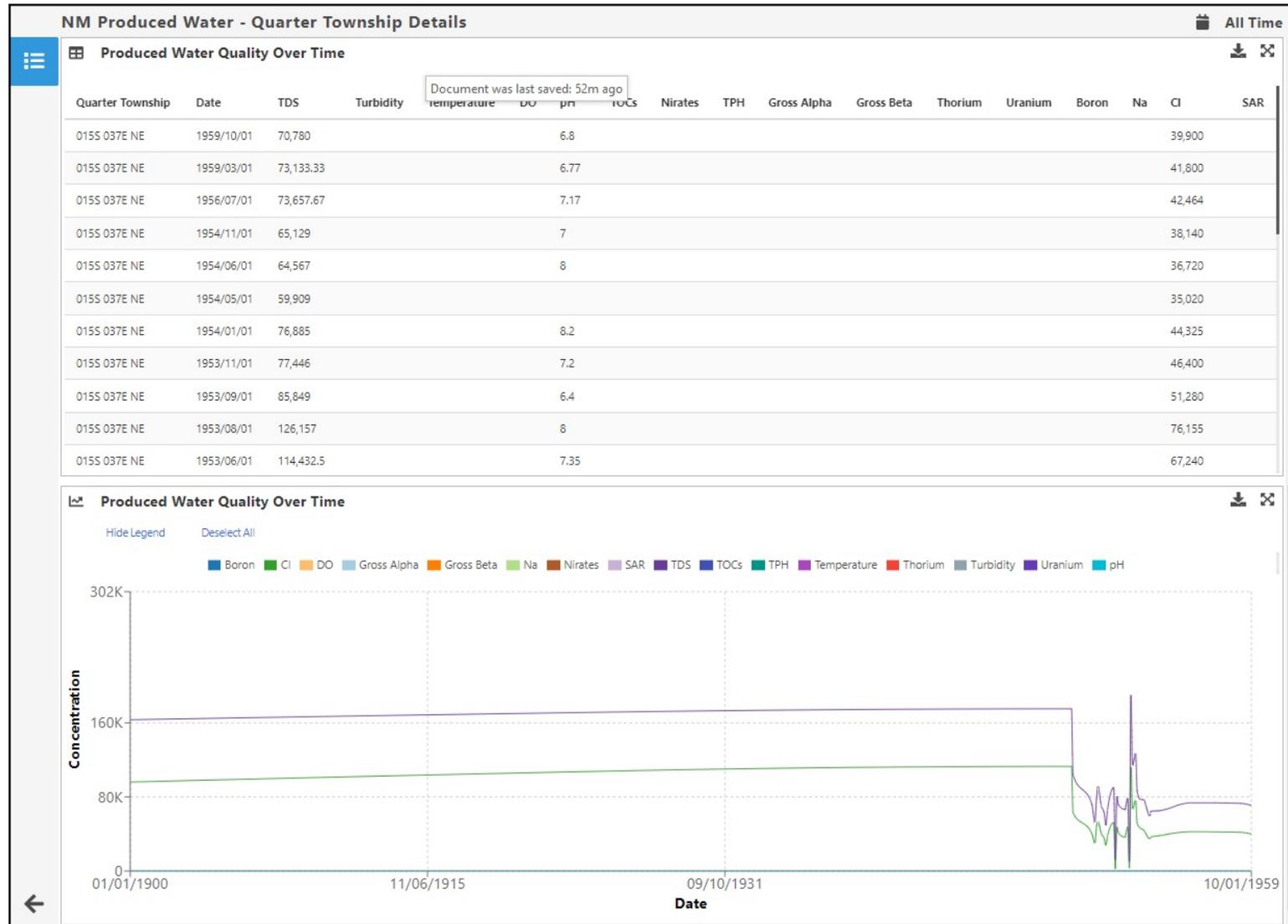
“SEIZE THE OPPORTUNITIES”



Upper Dashboard – Quantity Data



Lower Dashboard – Quality Data



Current Capabilities and Future Upgrade Needs

- The data portal is designed to support four levels of data availability
 - Tier 1 - General publicly available data and information
 - Tier 2 – General summary data graphs/tables of public data for download- including regional/local produced water generation, disposal, reuse, quality, etc. trends
 - Tier 3 – Advanced Applications available for data mining, projections, etc.
 - Tier 4 – Regulatory Access with need to know (NTK) of business confidential information - such as proprietary fracking chemicals, etc.
- Tier 1 capabilities are currently available, with Tier 2-4 capabilities to be added in 2022 and 2023 as funding becomes available.
- While quantity data is updated monthly through OCD, we need additional produced water quality data. NMSU recently added information on ~ 40 SWD wells in the Permian. That means slightly over 14 % of SWD have up-to-date water quality data.

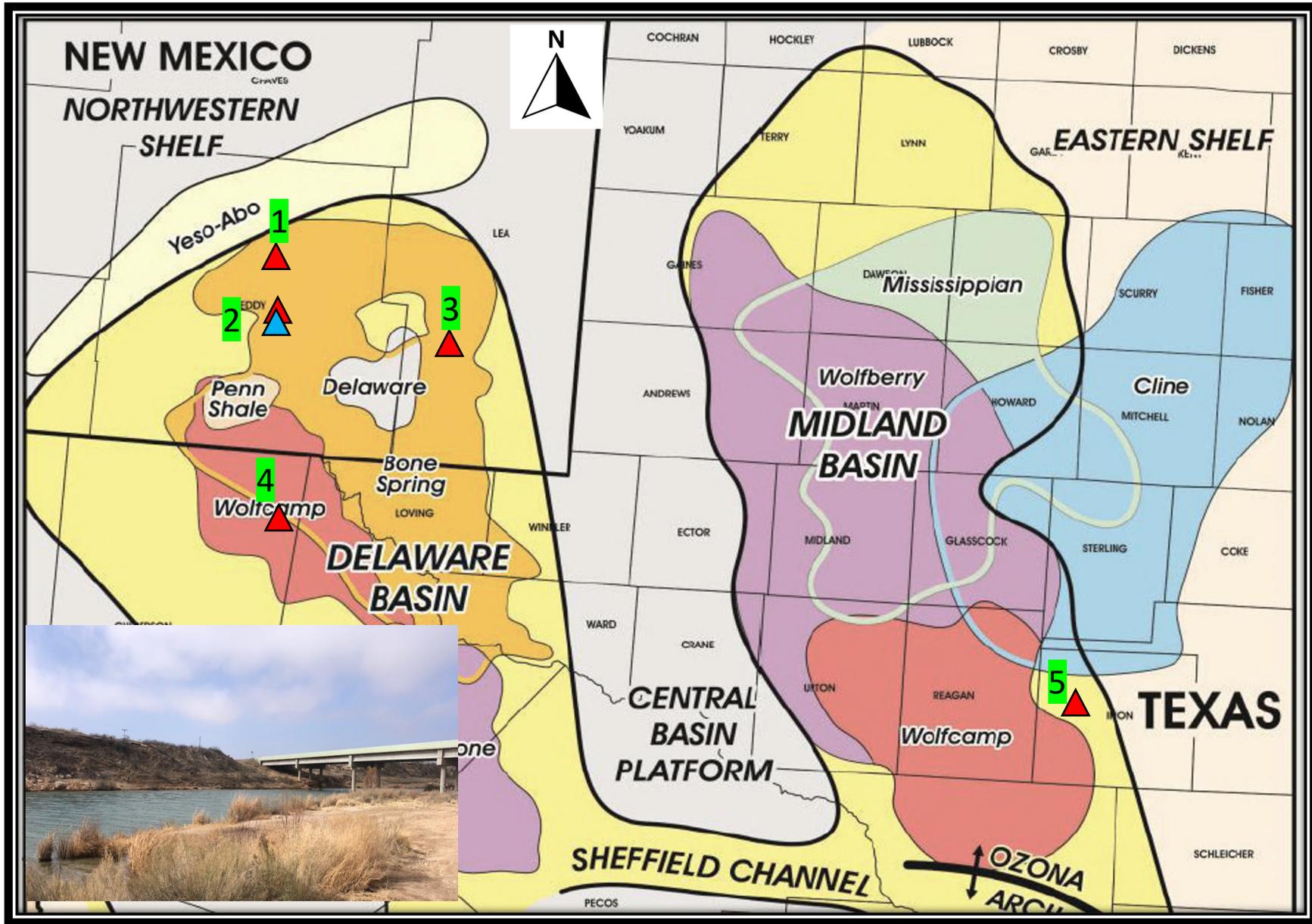
Needs of Comprehensive Characterization of Produced Water Quality

- Major groups of constituents of concern in produced water:
 - Suspended solids, oils, and grease
 - Salts (referred to as dissolved solids)
 - Dissolved organics (e.g., petroleum hydrocarbons, volatile and semi-volatile compounds)
 - Metals
 - Dissolved gases (e.g., H_2S , NH_3)
 - Naturally occurring radioactive material (NORM)
 - Chemical additives for hydraulic fracturing
 - Microorganisms

Major constituents in produced water from different formations

(min-max/average, in total ~3800 samples)

	Permian Basin	Wolfcamp Formation	Delaware Formation	Artesia Formation	Yeso Formation	Bone Spring Formation	San Andres Formation
TDS (mg/L)	10,048-384,963/ 118,253	12,136-249,459/ 95,096	12,708-360,545/ 185,433	10,050-384,963/ 94,584	10,818-381,108/ 123,784	10,048-255,451/ 105,569	10,026-391,007/ 118,879
pH	0.5-11.7/6.8	4.5-8.6/7.0	4.8-8.9/6.9	4.6-9.7/7.1	0.5-8.8/6.7	6.3-7.1/6.8	0.6-11.7/6.9
Mg (mg/L)	3-27,910/ 1,901	84-5,965/ 1,103	3-10,800/ 2,509	12-18,400/ 1,593	12-18,980/ 2,281	54.4-3396.6/ 760	2.7-27,910/ 2,087
Ca (mg/L)	24-60,073/ 6,051	211-40,800/ 6,358	24-46,346/ 12,992	87-25,315/ 3,205	235-40,420/ 6,996	174.5-21,720/ 3347	107-60,073/ 6,952
Cl (mg/L)	40-245,700/ 71,224	3,951-151,900/ 56,362	2,460-225,612/ 113,116	3,794-222,596/ 56,580	2,350-237,245/ 74,606	4,076-156,699/ 60,184	40-245,700/ 70,738
Na (mg/L)	209-143,086/ 71,224	2,625-54,068/ 29,045	5,253-109,024/ 51,113	209-128,175/ 37,470	1,529-107,396/ 35,948	1,982-80,469/ 30,723	1,123-143,086/ 35,479
K (mg/L)	14-33,962/ 861	97-742/ 362	79-1,454/ 548	65-4,620/ 505	14-1,570/ 472	109.8-1,232/ 365	8-33,962/ 1,622
Sulfate (mg/L)	18-12,320/ 2,131	84-12,080/ 1,753	84-6,280/ 1,523	18-11,900/ 2,294	35-11,800/ 2,211	111-5,250/ 1,420	22.4-12,320/ 2,362
Br (mg/L)	10-1,064/ 430	10 - 756/ 390	NA	NA	240-963/ 481	152-1,065/ 382	17-517/ 153
HCO3 (mg/L)	5-7,440/ 731	5-4,204/ 619	5-5,558/ 376	9-7,440/ 878	5-3,851/ 645	5-891/ 390	7-3,960/ 663
TOC (mg/L)	53-184/123	86-184/138	NA	NA	NA	119	NA



- ▲ Produced water sampling point
- ▲ Pecos River water sampling point

Water Quality Characterization

Statistical results of general quality parameters of the 46 PW samples collected from the Delaware and Midland Basins

		Mean	Max	Min	25th percentile	50th percentile	75th percentile
Alkalinity	mg/L as CaCO ₃	272	870	100	128	207	336
Ammonia	mg/L	432	750	320	330	400	495
COD	mg/L	1,626	3,100	930	1,250	1,400	1,950
pH	SU	6.6	8.1	3.9	6.3	6.7	7.0
TDS	mg/L	128,641	201,474	100,830	113,441	122,280	134,525
TOC	mg/L	103.5	248.1	2.4	28	90.6	173.3
TSS	mg/L	342.9	790	85	142.5	375	422.5
Turbidity	NTU	116.4	200	23	36	110	200
MBAS	mg/L	1.10	2.1	0.047	0.92	0.97	1.33

For 9 produced water samples collected in 2020, 91 analytes were detected and 218 analytes were not detected (309 in total)

For 9 Pecos River samples collected in 2020, 67 analytes were detected and 242 analytes were not detected (309 in total)

Water Quality Characterization

Produced Water		Average	Max	Min
Radionuclide				
Gross Alpha	pCi/L	1105.6	1630	660
Gross Beta	pCi/L	874.6	1230	456
Radium-226	pCi/L	43.92	111	0.736
Radium-228	pCi/L	151.27	291	2.56

Pecos River water		Average	Max	Min
Radionuclide				
Gross Alpha	pCi/L	24.6	39.8	7.7
Gross Beta	pCi/L	14.1	24.2	1.4
Radium-226	pCi/L	3.56	29.9	0.1
Radium-228	pCi/L	0.42	0.8	0.2

Water Quality Characterization

Produced Water		Average	Max	Min
VOCs				
Benzene	ug/L	2611	4900	1900
Ethylbenzene	ug/L	112	160	72
Toluene	ug/L	2533	3700	1700
Xylenes, Total	ug/L	1185.56	1600	710

No VOCs detected in Pecos River (9 samples)

Water Quality Characterization

Produced Water Samples		Average	Max	Min
Oil and Others				
Diesel Range Organics (C10-C20)	ug/L	45750	130000	22000
Gasoline Range Organics [C6 - C10]	ug/L	21625	46000	13000
Motor oil/lube range organics (MRO) (C20-C34)	ug/L	32444	97000	12000
Tributyl phosphate	ug/L	34.6	74	3.3
Tentatively Identified Compound	ug/L	531	1000	280

Pecos River water samples		Average	Max	Min
Oil and Others				
Gasoline Range Organics [C6 - C10]	ug/L		54	ND
Motor oil/lube range organics (MRO) (C20-C34)	ug/L	230	310	180
Tributyl phosphate	ug/L	3.6	5.7	1.7
Tentatively Identified Compound	ug/L	-	55	-

Water Quality Characterization

Produced water		Average	Max	Min
Organic - SVOC - General		Average	Max	min
1,1'-Biphenyl	ug/L	5.9	8.5	3.8
1,4-Dioxane	ug/L		21	ND
1-Methylnaphthalene	ug/L	23	36	15
2-Methylnaphthalene	ug/L	38	65	26
2-Methylphenol	ug/L	82	98	68
2,4-Dimethylphenol	ug/L	34	42	29
Ethylene glycol	mg/L		27	ND
Methylphenol, 3 & 4	ug/L	90	110	72
Phenol	ug/L	203	250	170
Pyridine	ug/L	238	300	120

Not detected in Pecos River (9 samples)

Water Quality Characterization

Produced Water		Average	Max	Min
Organic - SVOC - Pesticides/Herbicides				
alpha-BHC	ug/L	0.018	0.027	0.0088
Endosulfan I	ug/L	0.855	0.98	0.73
Endrin	ug/L		0.0038	ND

Pecos River water		Average	Max	Min
Organic - SVOC - Pesticides/Herbicides				
Endosulfan I	ug/L	0.00405	0.0042	0.0039
4,4'-DDD	ug/L		0.01	ND
4,4'-DDT	ug/L		0.0057	ND

Water Quality Characterization

Produced Water		Average	Max	Min
Organic - SVOC - PAH				
Anthracene	ug/L		1.1	ND
Naphthalene	ug/L	15.44	24	11
Phenanthrene	ug/L	3.76	6.6	2.7
Fluorene	ug/L	4.35	5.6	3.1

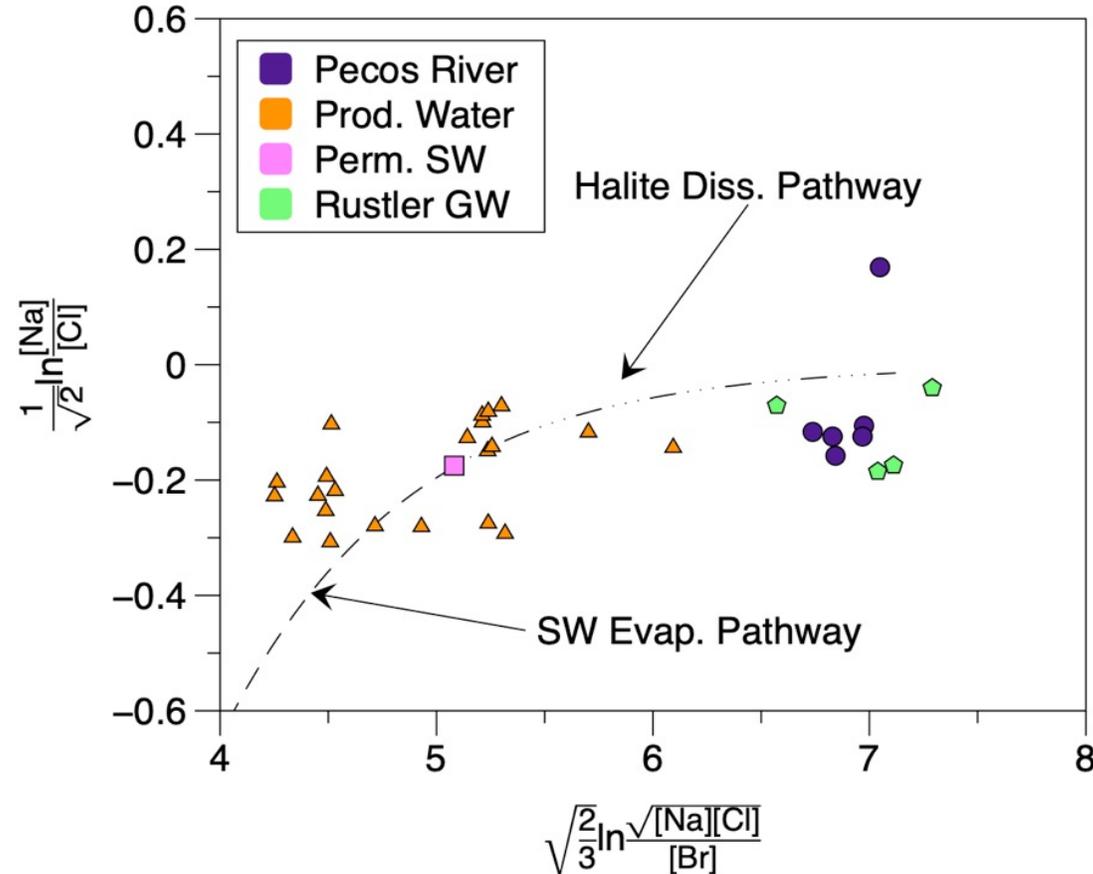
Pecos River water		Average	Max	Min
Organic - SVOC - PAH				
Naphthalene	ug/L		6	ND
Fluorene	ug/L		1.2	ND

Preliminary PFAS Results of 1 Produced Water Sample and 1 Pecos River Sample

Perfluoroalkyl substances (PFAS)		Produced Water	Pecos River
Perfluorobutanesulfonic acid (PFBS)	ng/L	0.17	2
Perfluorobutanoic acid (PFBA)	ng/L	0.31	1.3
Perfluorodecanesulfonic acid (PFDS)	ng/L	ND	ND
Perfluorodecanoic acid (PFDA)	ng/L	ND	ND
Perfluorododecanesulfonic acid (PFDoS)	ng/L	ND	ND
Perfluorododecanoic acid (PFDoA)	ng/L	ND	ND
Perfluoroheptanesulfonic Acid (PFHpS)	ng/L	ND	ND
Perfluoroheptanoic acid (PFHpA)	ng/L	ND	0.35
Perfluorohexanesulfonic acid (PFHxS)	ng/L	0.25	1
Perfluorohexanoic acid (PFHxA)	ng/L	ND	1.2
Perfluorononanesulfonic acid (PFNS)	ng/L	ND	ND
Perfluorononanoic acid (PFNA)	ng/L	ND	ND
Perfluorooctanesulfonamide (FOSA)	ng/L	ND	0.54
Perfluorooctanesulfonic acid (PFOS)	ng/L	ND	1.2
Perfluorooctanoic acid (PFOA)	ng/L	ND	1
Perfluoropentanesulfonic acid (PFPeS)	ng/L	ND	0.24
Perfluoropentanoic acid (PFPeA)	ng/L	ND	1.8
Perfluorotetradecanoic acid (PFTeA)	ng/L	0.24	ND
Perfluorotridecanoic acid (PFTriA)	ng/L	ND	ND
Perfluoroundecanoic acid (PFUnA)	ng/L	ND	ND

Based on FracFocus database, no PFAS were used in HF chemical additives in the Permian Basin.

Water Quality Characterization



Strongly overlapping data of these conservative relationships suggest that shallow brines from evaporite mineral dissolution is the dominant source of salinity to the Pecos River samples.

Isometric log-ratio Na-Cl-Br plot showing data from Permian Basin PW, Pecos River, and Rustler aquifer groundwater samples against modeled pathways for ancient (late Permian) seawater evaporation and halite mineral dissolution.

Future Research in 2022

- We need more data to better understand produced water quality and the spatial and temporal variability, which is critical to develop appropriate treatment and management technologies and to protect environment and public health
- We will characterize the quality of produced water and treated water, including non-target analysis of “unknown” constituents in PW.