

Greetings NMED,

Let me first compliment your agency for giving the public an opportunity to have their voices heard on such an important topic. Having once been an elected official overseeing large departments and receiving Green Awards, I know how important the environment, especially water, is to our future generations. By saving and reusing water, studies show you are reducing greenhouse gases, conserving, and cutting energy costs to your communities. Leaving a legacy is something I always tried to achieve during my years of public service. I have no doubt that, due to your agency's forward thinking and leadership, by requesting public involvement, you're not only leaving a legacy but setting a standard for other agencies around the country to follow. Thank you for your commitment to our communities and our environment.

I am attaching two tests that were performed on Produced Water from the Permian Basin using the CleanWater Solutions Wastewater Reclamation System to demonstrate the ability to remove the various isotopes that were present and the quality of the resulting water per existing standards in Texas.

If there are any questions regarding the testing or technologies utilized to achieve the following results, please do not hesitate to reach out to zscott@cleanwatersolutions.us and we would be happy to answer any questions.

Background and Objective

In mid-2019 a test was performed to prove the CleanWater Solutions Wastewater Reclamation System can remove both suspended and dissolved solids from production water of an oilfield. The wastewater selected was from an oil well in the Permian Basin of western Texas. The goal of the test was to demonstrate that the CWSWRS can clean the production water to a level that meets or exceeds the Environmental Protection Agency discharge requirements for the state of Texas.

The results of the test were validated by a certified third-party lab analysis of the reclamation process completed samples. A full report was published on the results of the test and is available by following the protocol to obtain other proprietary and confidential information referred to but not included in this White Paper.

Test Criteria

The oil well owner furnished Clean Water Solutions a 125-gallon sample of their selected waste stream (the production water from one of their oil wells) to the Clean Water Solutions Demonstration and Research Laboratory located in Columbus, Georgia.

Clean Water Solutions then processed the Permian Basin waste stream according to its protocol and following all safe practices and procedures used throughout the industry. There was no chemical treatment of the Permian Basin waste stream to aid or alter the results of the Clean Water Solutions testing process and subsequent test results.

The Processing

Upon receipt of the Permian Basin Waste Stream, four 1-liter samples were collected and sent to an independent laboratory in California for preliminary analysis. This preliminary analysis data was used to establish the baseline testing parameters for the Permian Basin Waste Stream.

Waste Stream TDS: 103,000 PPM

Waste Stream TSS: Calculated: 166 PPM Measured: 220 PPM

Test Flow Rate: 5 GPM

Test Sample:

Test 1: 60 Gallons

Test 2: 60 Gallons

Results

The chart below shows the results from the water being processed by the CWSWRS.

Analyte Identifier	Pre-Test	Post-Test	Unit	Percent Change
Total Alkalinity	500	<10	mg/l	-98.0%
Bicarbonate (HCO ₃)	500	<10	mg/l	-98.0%
Carbonate (CO ₃)	<10	<10	mg/l	0.0%
Hydroxide (OH)	<10	<10	mg/l	0.0%
Fluoride	47	0.21	mg/l	-99.6%
Total Dissolved Solids	103,000	<10.0	mg/l	-100.0%
Total Suspended Solids	220	9	mg/l	-95.9%
Phosphate (as PO ₄)	6	<0.30	mg/l	-95.2%
Bromide	120	<0.10	mg/l	-99.9%
Chloride	67,000	1.5	mg/l	-100.0%
Sulfate (as SO ₄)	1,100	<0.50	mg/l	-100.0%
Hardness (as CaCO ₃)	6,500	<2.0	mg/l	-100.0%
Silica (SiO ₂)	<200	<4.0	mg/l	-98.0%
Strontium	310	<0.10	mg/l	-100.0%
Calcium	1,580	<0.0500	mg/l	-100.0%
Magnesium	311	<0.0500	mg/l	-100.0%
Potassium	300	<0.50	mg/l	-99.8%
Sodium	47,000	<7.0	mg/l	-100.0%
Diesel Range Hydrocarbons	16.6	<3.62	mg/l	-78.2%
Gasoline Range Hydrocarbons	0.262	<0.050	mg/l	-81.3%
Motor Oil Range Hydrocarbons	19	22.8	mg/l	20.0%

October 2019 Permian Basin Oilfield Test

In late October of 2019 additional testing was performed on the Permian Basis Oilfield by another potential client. The same protocol was followed for pre-testing and comparative analysis as the former described testing for the Permian Basin wastewater.

The total produced water processed by the CWSWRS was 60 gallons. It was processed through the system at the rate of 5 gallons per minute through 7 stages using the configuration shown in the diagram on the following page. The suspended solids were discharged in the rough filtration stage. The dissociated dissolved solids were captured in the various pulsed ion filters and the final stage ultra-filter.

Compared to EPA Drinking Water Standards Compared to Texas Health Drinking Water Standards

Parameters: mg/l	Pre-Filter	Mid-Run	Final Filter	Percent Change	EPA DW Limits	Pre-Filter Filter	Final Filter	TX DW Limits	Pre-Filter Filter	Final Filter
pH	7.80	4.01	4.03	-48.3%						
Bicarbonate (HCO3)	346	0	0	-100.0%						
Carbonate (CO3)	0	0	0	N/A						
Hydroxide (OH)	0	0	0	N/A						
Temperature (F)	75°	75°	75°	N/A						
Cations mg/l										
Arsenic	0.011	0.0029	0.0029	-73.6%	0.010	Exceeds Limit	OK		Exceeds Limit	OK
Calcium	1,680	1.00	0.99	-99.9%						
Chromium	0.004	0.0029	0.0029	-27.5%	0.010	OK	OK		Exceeds Limit	OK
Iron	14.57	0.0029	0.0029	-100.0%	0.300	Exceeds Limit	OK	0.300	Exceeds Limit	OK
Lead	0.016	0.0029	0.0029	-81.9%	0.015	Exceeds Limit	OK		Exceeds Limit	OK
Magnesium	146	2	0.99	-99.3%						
Potassium	2570	1	1	-100.0%						
Sodium	23,132	7	7	-100.0%						
Anions mg/l										
Chloride	42,600	20	11	-100.0%	250	Exceeds Limit	OK	300	Exceeds Limit	OK
Sulfate	312	0.99	0.99	-99.7%	250	Exceeds Limit	OK	300	Exceeds Limit	OK
Other mg/l										
Total Hardness as CaCO3	4,800	10	0.99	-100.0%						
Total Dissolved Solids	70,787	31	19	-100.0%	500	Exceeds Limit	OK	1000	Exceeds Limit	OK
Nitrate	5.70	0.80	0.65	-88.6%	10	Exceeds Limit	OK	10	Exceeds Limit	OK
Nitrite	0.96	0.0029	0.0029	-99.7%	1	Exceeds Limit	OK		Exceeds Limit	OK
Conductivity, µmhos/cm@77°F	75,500	159.9	89.2	-99.9%						

The volume of recovered water, dissolved solids and suspended solids were measured based on 60 gallons of the production water processed. Based on a daily processing rate of 7200 gallons per day the daily amount of recovered material was estimated. This estimate is preliminary and needs many more trials runs and measurements of mass and volume of the various streams to validate the results. However, for the purposes of this pilot project and best estimates available, the results are shown below.

Suspended Solids	0.828 gallons
Dissolved Solids	463.88 gallons
Clean Water	6735.29 gallons
Total	7200 gallons

This information is especially important to assess and calculate the economic value of the recovered materials. There needs to be additional analysis conducted to verify this information on a full production run of 7200 gallons and the material density of the solids and water need to be determined so the actual recovery can be reported in lbs. or tons. This is a project that will be conducted soon. In the meantime, generally accepted factors will be utilized to calculate the weight of the water and materials.