Water for 2060

Produced Water & Related Issues

Owen Mills

January 21, 2020

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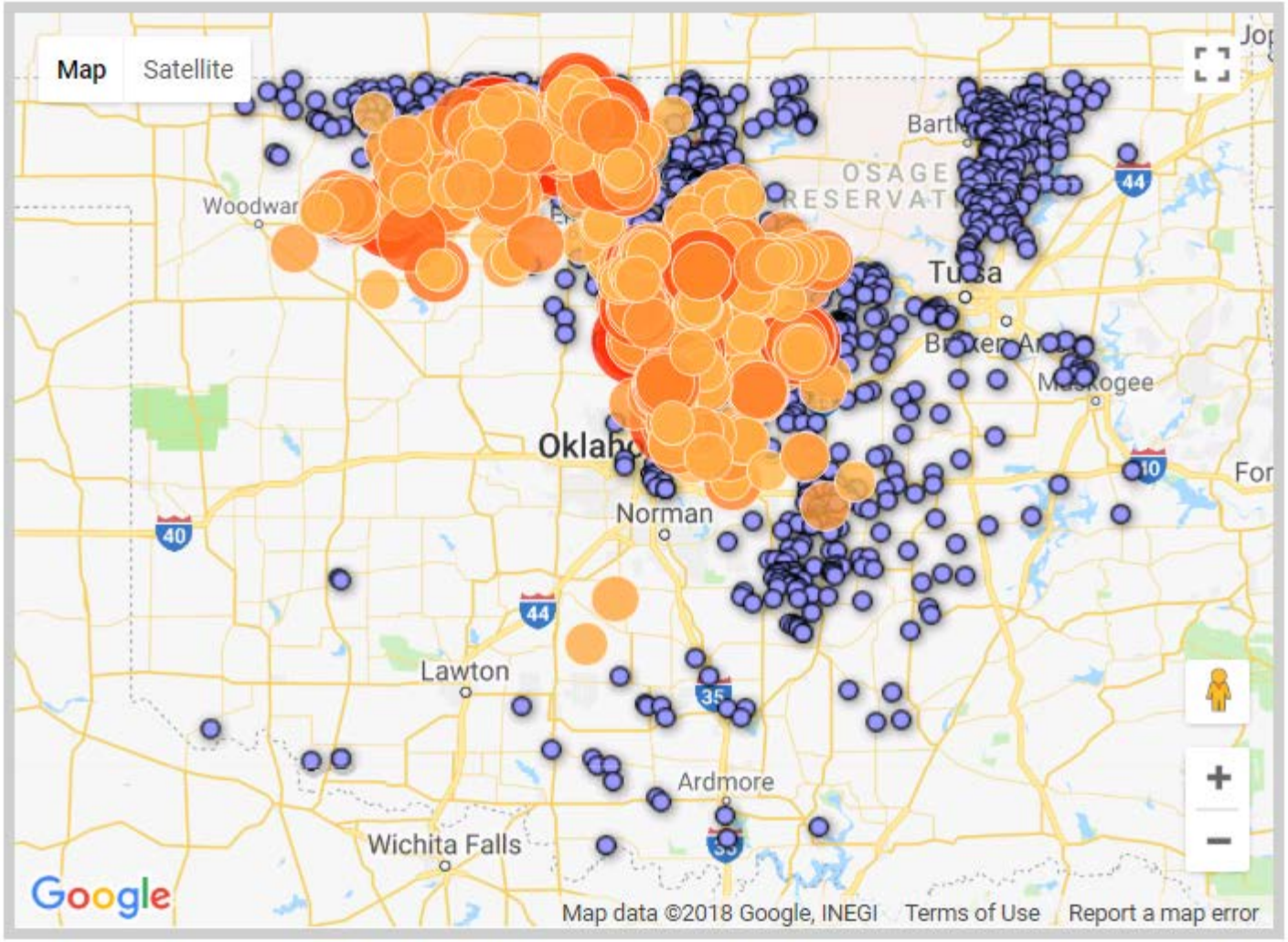
Earthquake Map – SWD Wells



Sour

Note: Only Earthquakes with a magnitude of 3.0 and higher are displayed.

☐ Earthquakes - Past 7 days ☐ Earthquakes - 2012 ☑ Arbuckle Waste Water Disposal Wells

PW Working Group
* In a Nutshell *

- **17 Members from Industry, Regulators, NGO's, Municipal, Academia, Users…**

Regulatory and Legal Challenges

- **Commercial treatment higher bonding $**
- **NPDES discharge – barriers and timing**
- **PW ownership – “taking” issues**
- **Right-of-way and landowner negotiations**
- **Cooperative water/infrastructure liability**

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- **2017 Hi-Level Pilot Study – Assess Options**

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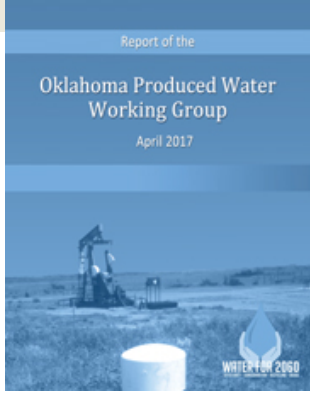
Pilot Study on Reuse



1. Transportation Costs not included in Cases 1 & 2
2. Re-use Costs less than sourcing and disposing!
3. New transfer lines could make O&G re-use grow.

New Case	Case Description	Total Capital ($Millions)	Capacity BWPD	County	Assumed Wtr TDS (mg/L)	Normalized $/BW
1	Typical Source and Dispose - STACK & SCOOP	NA	NA	Central OK	NA	1.09
2	**Oil and gas re-use (treatment cost only)**	**NA**	**NA**	**State-wide**	**NA**	**0.57**
3	Clean Brine Transfer & treatment	208	200,000	Alfalfa	213,000	1.63
4	Evaporation - low TDS (SCOOP & STACK)	NA	20,000+	Blaine	17,000	1.66
5	Evaporation - high TDS (Miss. Lime)	NA	20,000+	Alfalfa	213,000	1.79
6	Desalination for Surface Discharge	22	15,000	Beckham	9,000	3.58
7	Desalination for Power Use	88	130,000	Pawnee	125,000	4.37
8	Desalination for Power Use	95	230,000	Seminole	180,000	4.43
9	Desalination for Industrial Use	35	30,000	Grant	227,000	7.41
10	Desalination for Surface Discharge	38	30,000	Grant	227,000	7.49

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- **2018 – Phase 2 – USBR Feasibility Study on Phase 1 findings**

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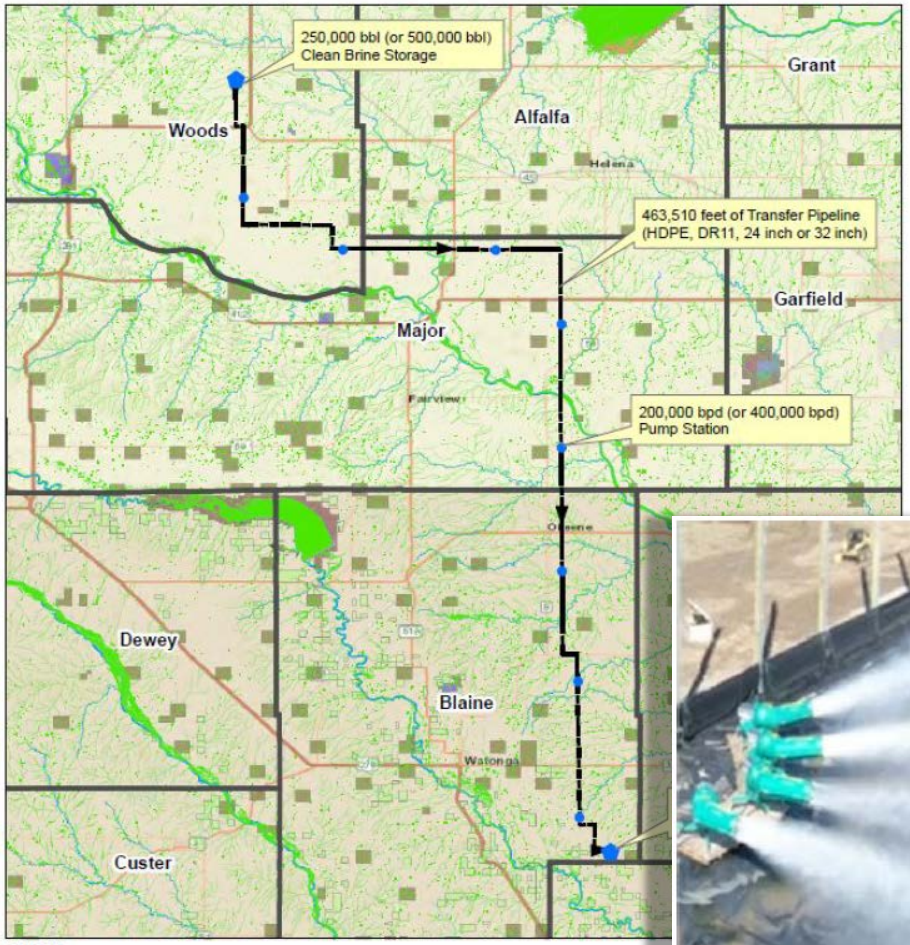
PHASE 2 : TRANSFER PIPELINE OF CLEANED BRINE AND EVAPORATION TECHNOLOGIES



Legend

- Pump Station
- Impoundment
- Quaternary Fault and Fold
- Transfer Pipeline
- County Boundary
- Environmental System
- Federally Recognized Tribal Entity
- National Wildlife Refuge
- Recreation Reservoir
- Research and Educational Land

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- **2020 – Phase 3 – Academic Studies**

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Testing PW In The Lab – NPDES Discharge

Dr. T. Quan, Boone Pickens Geology - OSU

1,000's of compounds - "*Unknown Unknowns*"

Expected Outcomes

- Characterization at the Compound-Class level
- Inorganics presence, sources and concentration
- ID Organics to functional groups
- Standardize analytical methodologies
- Establish Detection Limits
- Quantification techniques
- Resolution limits

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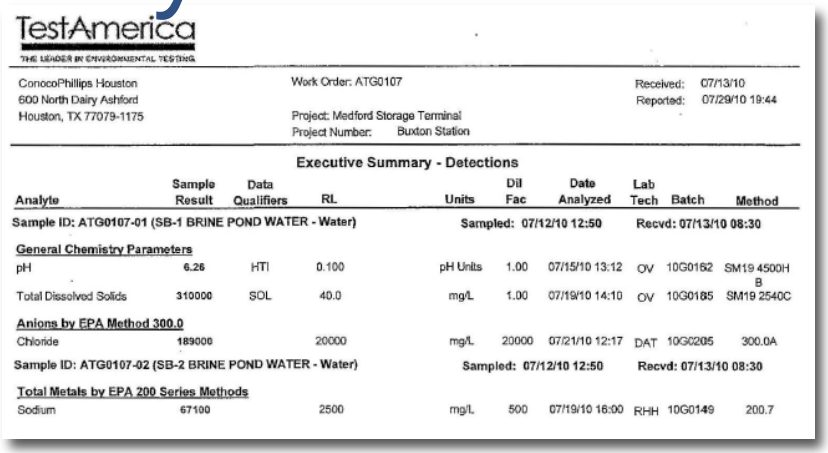
PW OCC-UIC Water Quality -Database

Dr. K. Murray, OGS



TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

ConocoPhillips Houston
600 North Dairy Ashford
Houston, TX 77079-1175

Work Order: ATG0107
Project: Medford Storage Terminal
Project Number: Buxton Station

Received: 07/13/10
Reported: 07/29/10 19:44

Executive Summary - Detections

Analyte	Sample Result	Data Qualifiers	RL	Units	Dil Fac	Date Analyzed	Lab Tech	Batch	Method
Sample ID: ATG0107-01 (SB-1 BRINE POND WATER - Water)					Sampled: 07/12/10 12:50			Recvd: 07/13/10 08:30	
General Chemistry Parameters									
pH	6.26	HTI	0.100	pH Units	1.00	07/15/10 13:12	OV	10G0162	SM19 4500H B
Total Dissolved Solids	310000	SOL	40.0	mg/L	1.00	07/19/10 14:10	OV	10G0185	SM19 2540C
Anions by EPA Method 300.0									
Chloride	189000		20000	mg/L	20000	07/21/10 12:17	DAT	10G0205	300.0A
Sample ID: ATG0107-02 (SB-2 BRINE POND WATER - Water)					Sampled: 07/12/10 12:50			Recvd: 07/13/10 08:30	
Total Metals by EPA 200 Series Methods									
Sodium	67100		2500	mg/L	500	07/19/10 16:00	RHH	10G0149	200.7

Expected Outcomes

- > 2,000 sites statewide
- GIS Spatial database of PW samples taken from OCC UIC applications.
- Total Dissolved Solids concentration
- Formation of origin
- Useful for many investigations and able to integrate with 3D aquifer and geo maps/models

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PW - Future Academic Investigations?

- Lab Testing - further refinements (T. Quan)
- Industrial reuse potential
- Crop Irrigation – Crop types and effects
- Crop Irrigation – Soil effects long-term
- PW instream effects (NPDES)
- *PW treatment?*
- Others to come…

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- **2017 Hi-Level Pilot Study – Assess Options**
- **2018 – Phase 2 – USBR Feasibility Study on Phase 1 findings**
- **2020 – Phase 3 – Academic Studies**
- **2021 – Spinoff – Brackish Water Sources?**

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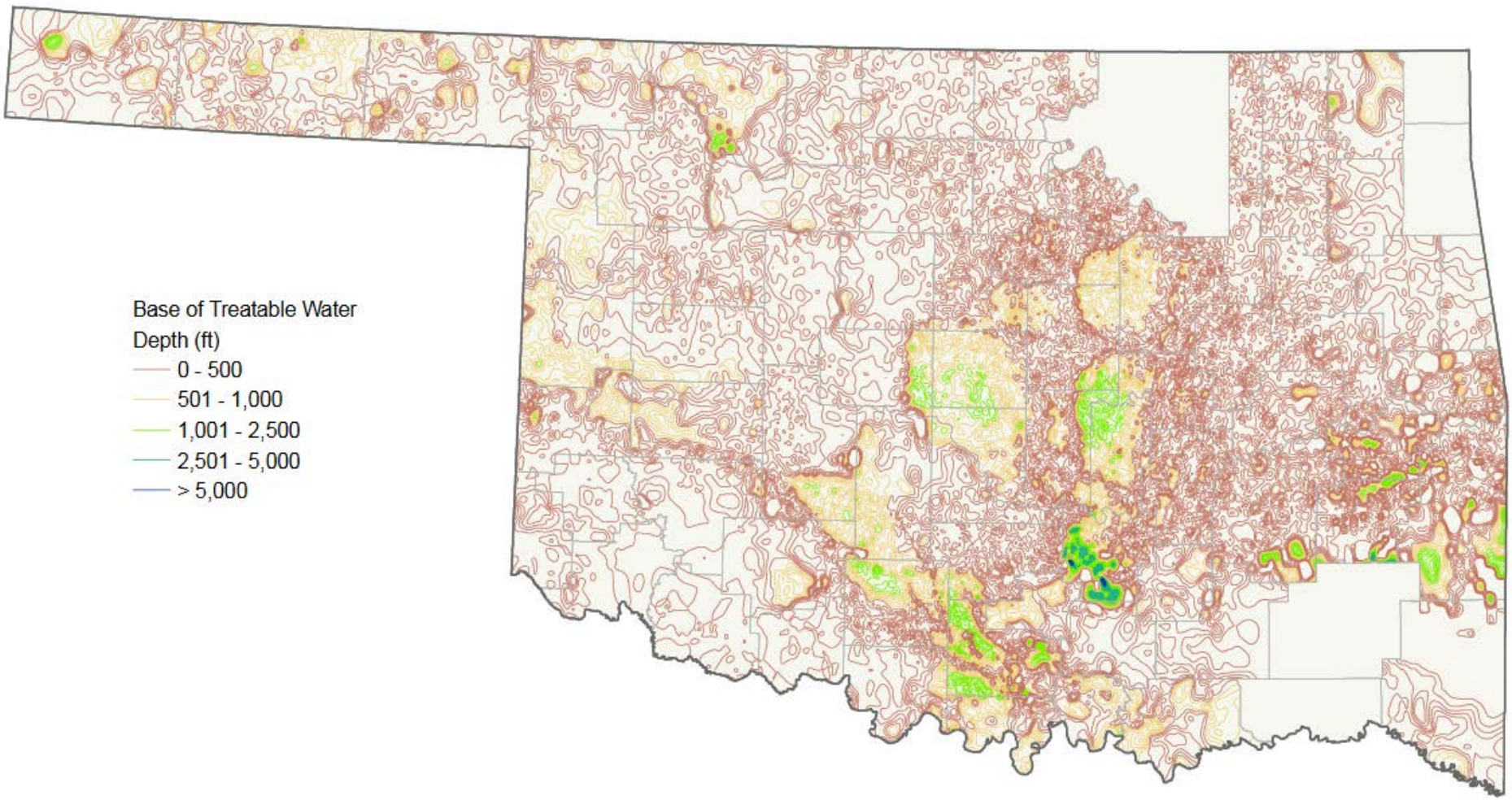
Mapping Brackish Groundwater



Mapping Brackish Groundwater

2018: New authority to permit wells up to 10,000 ppm TDS

- **Future Drinking Water Sources?**
- **O&G use now**

DECEMBER 10, 2019 WORKSHOP:

Pilot Study of 1 to 3 Counties:
Develop spatial database contour map of:

- **TDS by contours – something like:**
  - **1,000-3,000 ppm**
  - **3,000-10,000 ppm**
  - **>10,000 ppm (BTW)**

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Thank You!

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