

Produced Water Recycling Considerations

Farm Foundation Round Table

Ed Cowsar

Family Farm Alliance Advisory Board Member



January 9, 2014



Is it Energy vs. Agriculture for Water?

Business

San Antonio Express-News

Rancher: Oil and gas boom is requiring more water than we have. Period.



Image 10 out of 11

Here is the Energy Water Solutions containerized produced water recycling unit being prepared for mobilization to a well site, by a rigger connecting cables to the container. Mobilization of the containerized system is made easier by its skid mounted and containerized design, making it easy to flange up directly to the production pad of an oil and gas producer and recycle the produced water for the next frac job.

By Jennifer Hiller

December 15, 2013

In the heart of South Texas, where the muted grayish green of live oak and the slender leaves of the thorny mesquite dominate a landscape burdened by drought, hydraulic fracturing used more than 14 billion gallons of water last year.

Confidential

TUESDAY
Aug. 13, 2013
Mostly sunny
85/49
Page A8

Herald and News

empowering the community | www.heraldandnews.com — Klamath Falls, Oregon — 75 cents

KLAMATH COUNTY FAIR 4-H AND FFA ROTARY LIVESTOCK AUCTION

Emotional and rewarding: Grand Champion steer gavel in at just over \$10,000 at auction

By STEVEN SILON
HN Staff Photographer

Sunday's auction left hundreds of kids with teary eyes and big checks. The 77th annual 4-H and FFA Rotary Livestock Auction featured the usual steer, sheep and swine as well as hucks, rabbits, turkeys and goats. After auctioning off Charab Speagle's prize-winning ducks, the Grand Champion steer took center

stage. Veronica Turner's 1,285-pound steer sold for \$7.25 per pound for a staggering total just over \$10,000.

"I feel awesome," said Turner. "At first I was a little sad, but after hearing how much I got how can you be sad?"

Turner said she had invested a little more than \$1,000 in her steer between feed and other expenses, but the real cost came in sweat. Working for nearly a full year, Turner put in

five hours every day over the summer getting ready for her moment in the John Hancock Event Center.

This was Turner's seventh year showing steer and first Grand Champion after taking the Reserve Grand Champion title last year. Turner said she's already looking forward to next year. "I really love showing cows and it's what I want to keep doing."

See AUCTION, page A3



HN photo by Steven SILON

Winning bids: 4-H and FFA Rotary Livestock auctioneer Stan Daupree takes bids at Sunday's auction at the Klamath County Fairgrounds.

INSIDE:

Picture perfect: Grand champion and reserve champion winners take to the auction ring, see A3.

No water, no cattle

Shipping out: Cattle moved from Modoc Point



Without water, ranchers cannot feed cattle in the upper Basin

By SAMANTHA TIPLER
HN Staff Reporter

On Aug. 1 and 2, Marc Bourdet had to send 11,000 head of cattle off his family's ranch on Modoc Point to greener pastures. It took 17 truckloads to move the cattle to better grazing ground north, in the Klamath Marsh area.

"I can't believe this is happening," he said as what kept rolling through his

to run cattle "on the gain." That means someone else owns the cattle, but while they graze on Bourdet's land they gain weight. Bourdet is paid for the pounds the cattle gain.

Usually the cattle ship out in early October. This year it happened two months early. The Bourdet and Long family's water was turned off June 26. Without irrigation the grass doesn't grow, the cattle don't eat and they don't gain weight.

INSIDE:

Adaptation, calls for water, water shutoffs, a rancher rally, court argument, task force meetings and more have marked the 2013 irrigation season, A5.

By the truckload: Marc Bourdet was forced to

Suspect in kidnapping shot at FBI

Teen informed of deaths of mother and brother

SAN DIEGO (AP) — A close family friend suspected of abducting a 16-year-old girl after killing her mother and younger brother fired his rifle at FBI agents before they killed him deep in the Idaho wilderness, authorities said Monday.

Hannah Anderson didn't know her mother and brother were dead until she was rescued from 40-year-old James Lee DiMaggio, San Diego County Sheriff Bill Gore said.

"I can't make it any clearer: She was a victim in this case. She was not a willing participant," Gore said at a news conference with Hannah's father, Brett Anderson.

During a shootout with the FBI, DiMaggio fired at least once and perhaps twice, the sheriff explained.

Reunited

Hannah Anderson reunited with family in San Diego to begin what her father said would be a slow recovery. He then had the horseback riders who reported seeing the pair near an alpine lake, saying the search might have taken much longer without them.

"She has been through a tremendous, horrific ordeal," said Brett Anderson, who declined to answer questions and pleaded for privacy.



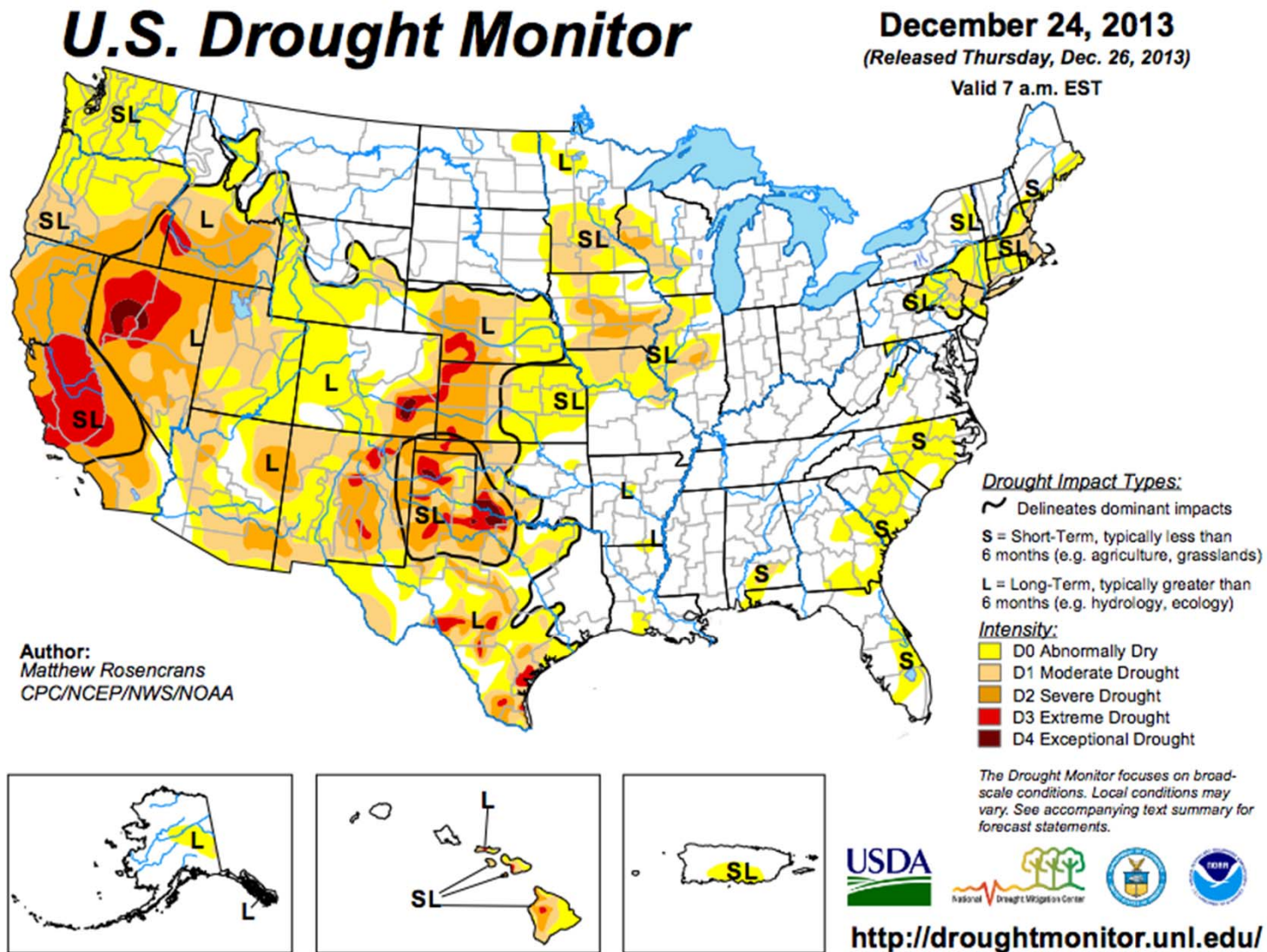
DiMaggio



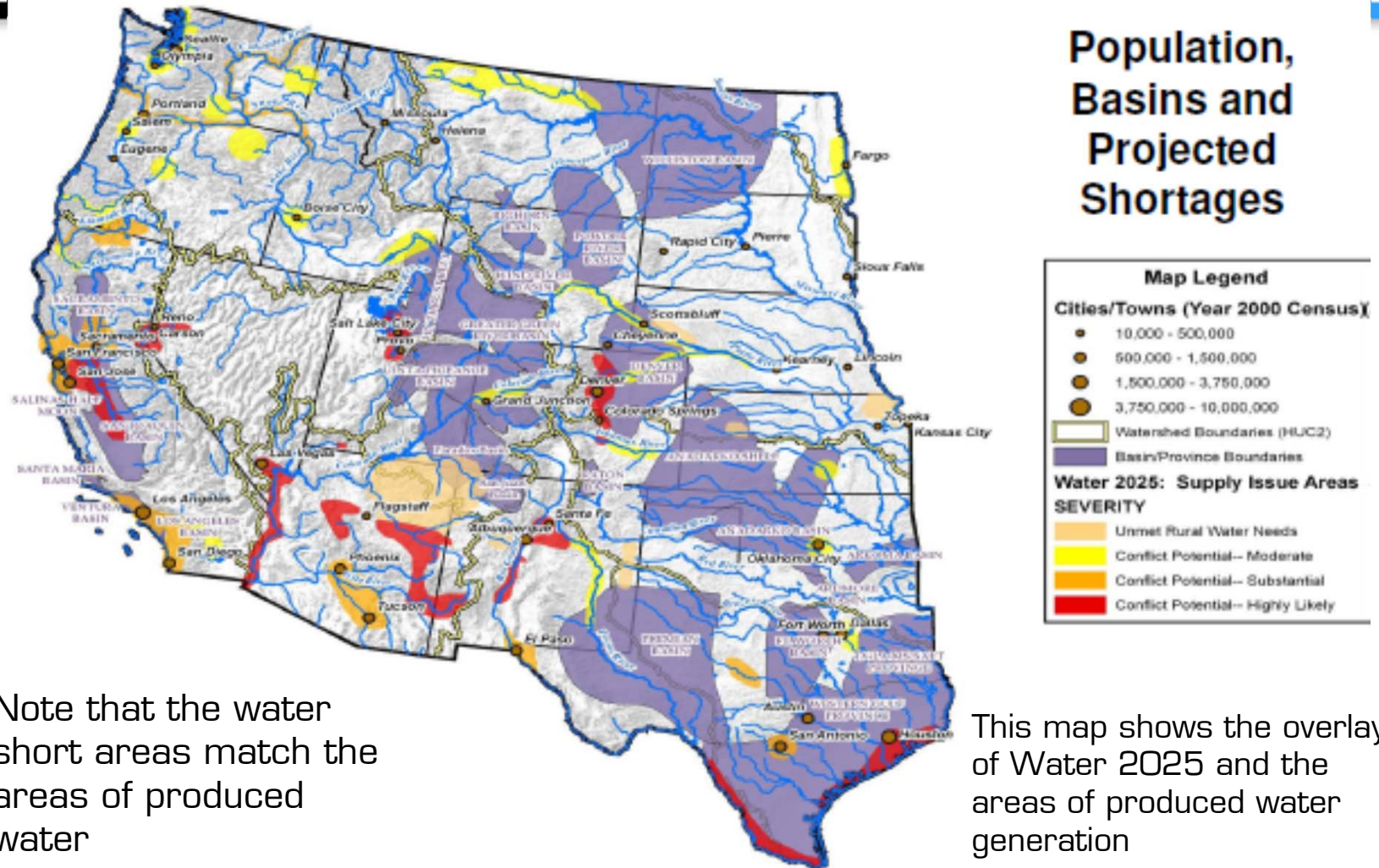
Anderson



Increased Temperatures Cause Drought

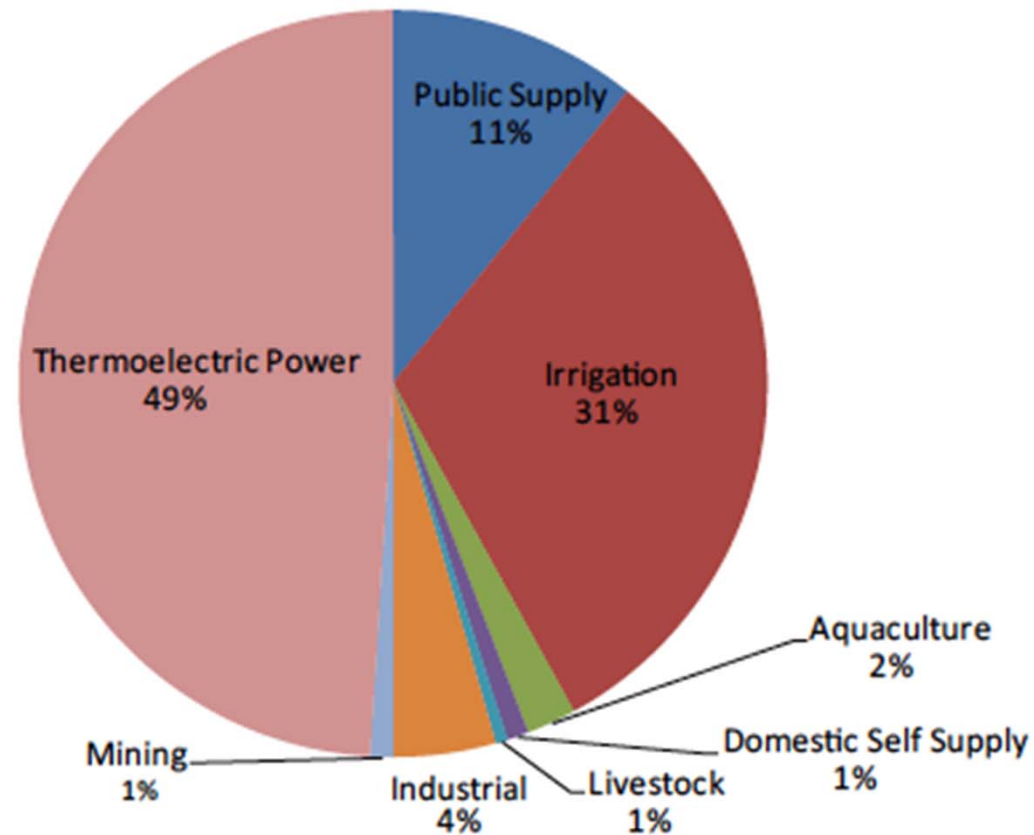


Projected Water Shortages



Water Use Categories

**Estimated Total U.S. Water Withdrawals by Category
(in million gallons per day)**



Produced Water Flowing Today Aligns with Ag Requirements

in major oil & gas shale plays

1 Eagle Ford, South Texas

2 Bakken, North Dakota and Montana

3 Niobrara, Wyoming, Colorado,
South Dakota and Nebraska

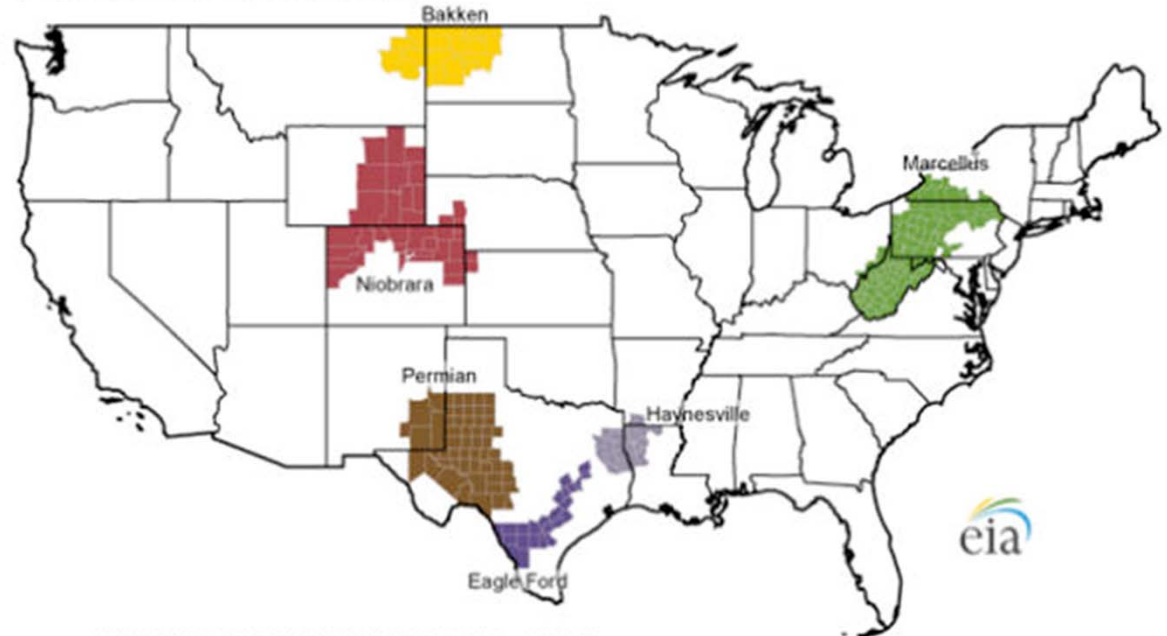
4 Marcellus, N Appalachian Basin,
PA, NY OH, WV, VA, TN, MD, KY, TN

5 Haynesville, Arkansas, Louisiana,
and East Texas

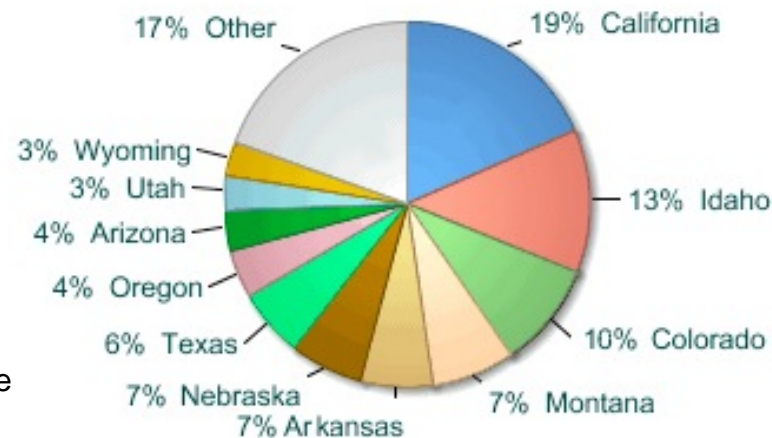
6 Permian, West Texas

7 Monterrey Shale, California
ramping up

Key tight oil and shale gas regions



Irrigation Water Withdrawals, 2005



USGS, Irrigation by State

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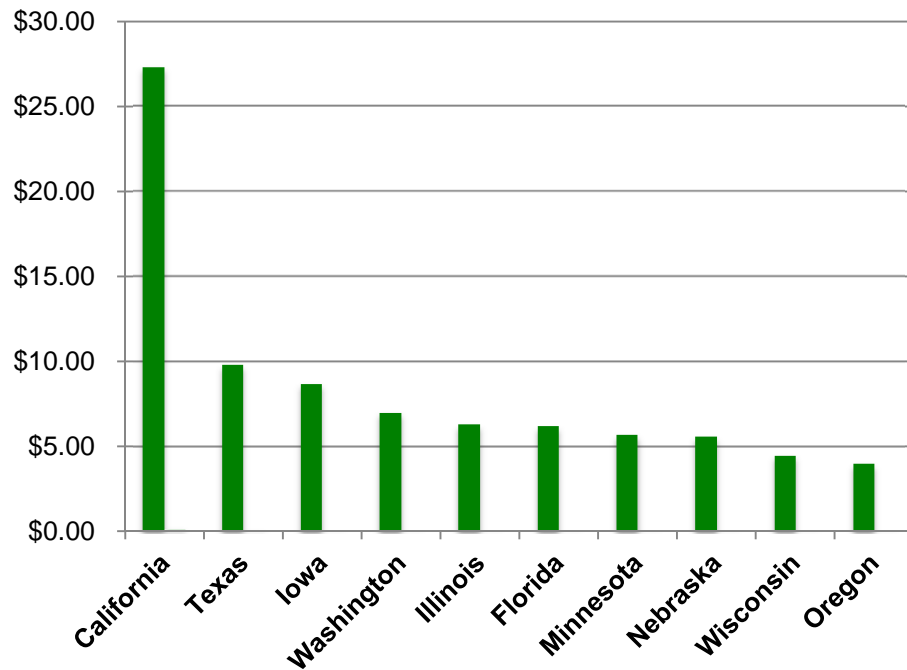
energywater
SOLUTIONS

Ag and Oil Production

more in common

Top ten states Ag Production comparison

* GDP In Billions



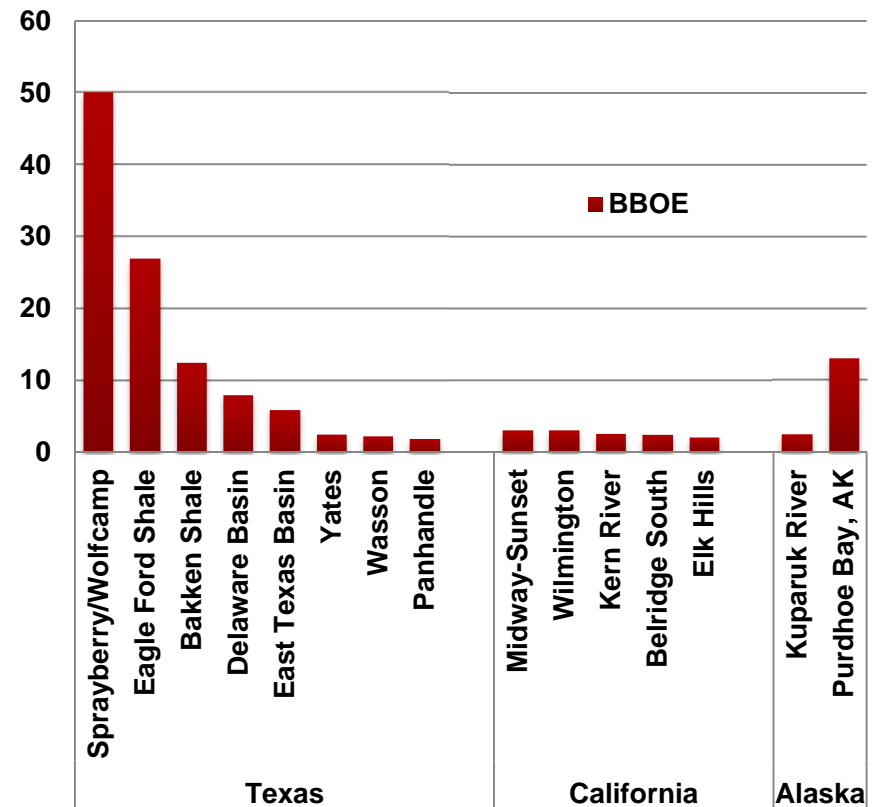
**Ag producing states can benefit from significant
Produced Water Recycling**

* US Dept of Commerce

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Cumulative Oil Production

** Estimates in Top Shale Plays



** DOE & Pioneer Resources

energywater
SOLUTIONS

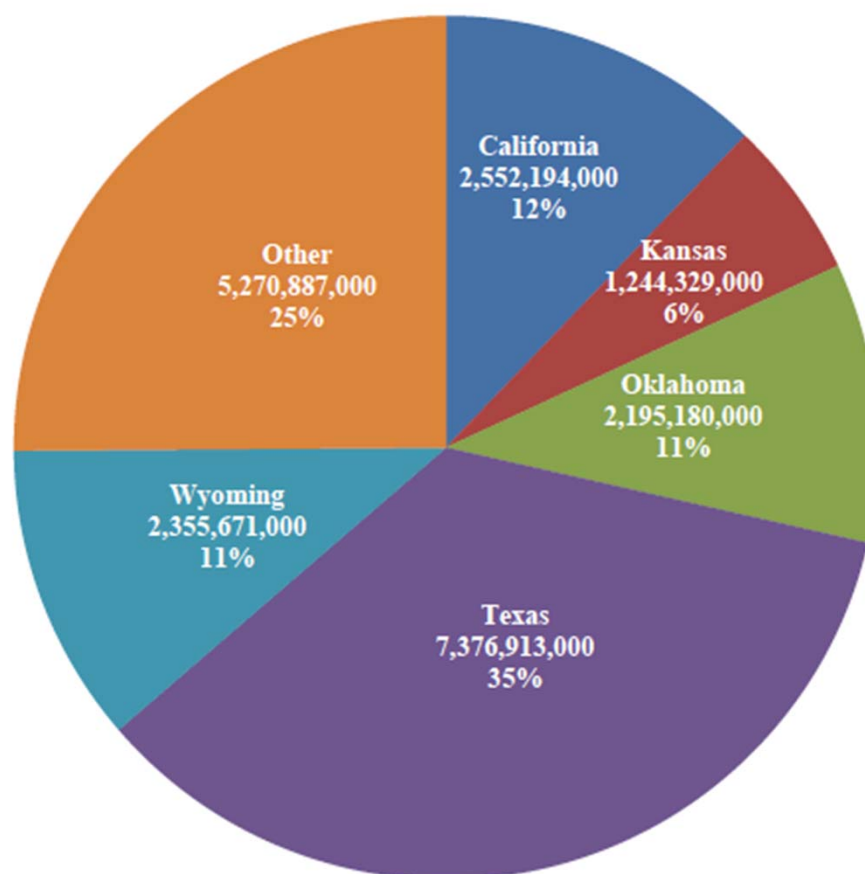
U.S. Produced Water Generation

State	Crude Oil (bbl/year)	Total Gas (Mmcf)	Produced Water (bbl/year)	Data Source ^a
Alabama	5,028,000	285,000	119,004,000	1
Alaska	263,595,000	3,498,000	801,336,000	1
Arizona	43,000	1,000	68,000	1, 2
Arkansas	6,103,000	272,000	166,011,000	2, 3
California	244,000,000	312,000	2,552,194,000	2, 3
Colorado	2,375,000	1,288,000	383,846,000	1, 3
Florida	2,078,000	2,000	50,296,000	1
Illinois	3,202,000	No data	136,872,000	1, 5
Indiana	1,727,000	4,000	40,200,000	1, 2
Kansas	36,612,000	371,000	1,244,329,000	1, 2
Kentucky	3,572,000	95,000	24,607,000	1, 3, 6
Louisiana	52,495,000	1,382,000	1,149,643,000	1
Michigan	5,180,000	168,000	114,580,000	1, 3
Mississippi	20,027,000	97,000	330,730,000	1
Missouri	80,000	No data	1,613,000	1
Montana	34,749,000	95,000	182,266,000	1
Nebraska	2,335,000	1,000	49,312,000	1
Nevada	408,000	0	6,785,000	1, 2
New Mexico	59,138,000	1,526,000	665,685,000	1
New York	378,000	55,000	649,000	2
North Dakota	44,543,000	71,000	134,991,000	2, 4
Ohio	5,422,000	86,000	6,940,000	1, 2
Oklahoma	60,760,000	1,643,000	2,195,180,000	2, 6
Pennsylvania	1,537,000	172,000	3,912,000	3
South Dakota	1,665,000	12,000	4,186,000	1, 2
Tennessee	350,000	1,000	2,263,000	4, 6
Texas	342,087,000	6,878,000	7,376,913,000	3, 4
Utah	19,520,000	385,000	148,579,000	1
Virginia	19,000	112,000	1,562,000	1, 4
West Virginia	679,000	225,000	8,337,000	1
Wyoming	54,052,000	2,253,000	2,355,671,000	1, 4
State Total	1,273,759,000	21,290,000	20,258,560,000	
Federal Offshore	467,180,000	2,787,000	587,353,000	1
Tribal Lands	9,513,000	297,000	149,261,000	2, 6
Federal Total	476,693,000	3,084,000	736,614,000	
U.S. Total	1,750,452,000	24,374,000	20,995,174,000	

^a 1 = provided directly to Argonne by state agency; 2 = obtained via published report or electronically; 3 = obtained via electronic database; 4 = obtained from website in form other than a published report or electronic database; 5 = obtained from EIA; 6 = produced water volumes are estimated from production volumes.

Total U.S. produced water generated (barrels) in 2007 by state (five states with the greatest produced water generation are shown) 1 Acre-foot to Barrels = 7758.3673

20.26 Billion Barrels = 26,1118,89 acre feet



Movable Recycling Units

EWS Mobilizes Recycling



Re-engineered:

From fixed plant to transportable



Movable units easily get closer to well head than central plants:

Ruggedized for oil field based via containerized modules



Movable units:

Securely and quickly connect to well pad



Facts to Consider

Eagle Ford Example

Water vol/well: approx 6 million gals (O&GJ July '12 PDittrick quote Pres of Breitling O&G)

Number of Wells in Eagle Ford Shale:

- 3500 permitted in 2013 to date (EFS.com)
- 11,000 wells permitted since '08 (Fuelfix Sept 19, '13 JHiller)
- 85,000 more will be drilled in EFS (per Drillinginfo CEO in Fuelfix 9/19/13 article)

Truck traffic: 500-1500 trips per well; TxDot reports 1184 truck trips/well
(EFS Task Force RRC Study Chap 2, p24 Study)

Water truck traffic variables:

volume of well, piping, recycling, reuse, logistics, storage, SWD injection

SWD's: Injection well volume (EWS results show 80-95% reductions)

Aquifer: water usage reduced with "life of field" Recycling

Recycling Math

Ag benefit scenario

Eagle Ford Example

3500 permitted wells in Eagle Ford Shale

6 Million gallons of Water to Frac a well

Recycle 20% Flow Back & Produced Water

So you can Recycle the entire Frac Job of 1 in 5 wells

$3500 \times .20 = 700$ wells fully recycled

700×6 Million gallons recycled

4.2 Billion gallons saved on existing permitted wells

100 Million Barrels of Water not pulled from the aquifer

One Million truck trips on roads to injection wells may be eliminated

12,889 acre feet of water not pumped from the aquifer for frac jobs

46 bushels of wheat/acre foot of water

So that is water for 592,908 bushels of wheat

Worth over \$4.5 Million at \$7.602 per bushel

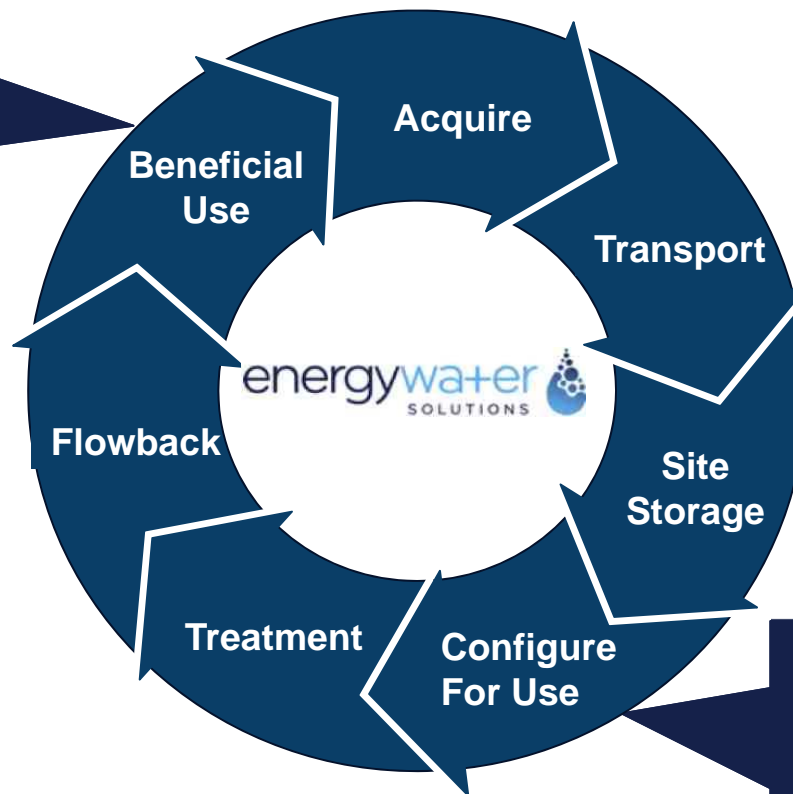
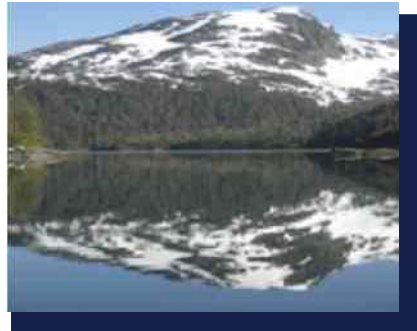
Energy Water Solutions Eagle Ford Example

[Sprinklers Crop and Water Use by Craig Paulson Sanpete County Agent Utah State Univ Research](#)



Mobilizing Recycling

planning *for lowered costs*



Consistent water quality
via plant control systems

- 💧 Movable in field
- 💧 Central field depot
- 💧 Optimum placement
- 💧 Close to wells
- 💧 Limit trucking
- 💧 Lower risk & opex

Modular units scale:
1250 to over a million BPD



Public Policy Initiatives

Improved Legislation & Permitting

💧 Wellington Water Works

- 💧 Colorado Water Court Approval 2007



💧 HB and Senate Bill in Colorado enabling ground discharge

- 💧 Over 7.5 M Barrels of recycled water released

💧 United States Patents for design and process

- *6,348,154* Methods to remove heavy metals from water
- *11/784,569* – Purification of oil field water for beneficial use
- *12/421,462* – Beneficial use of produced water (pending)



💧 Texas Railroad Commission mobile permit

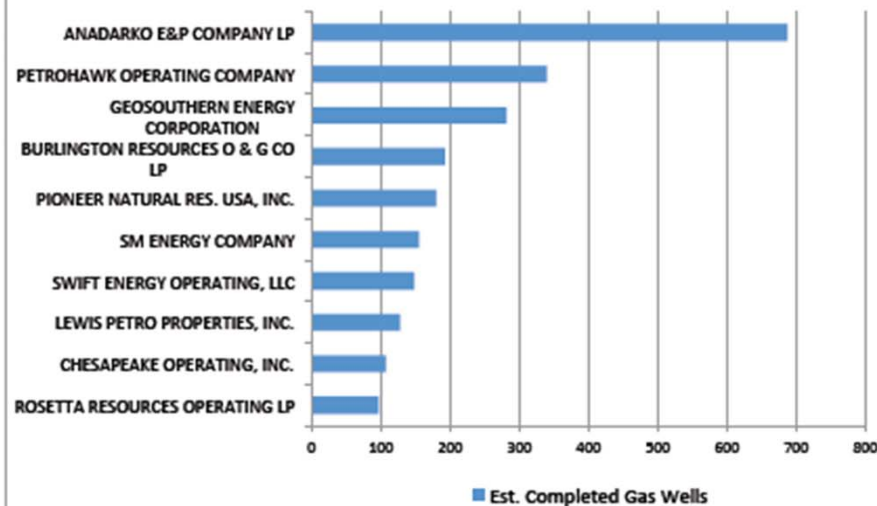
- 💧 Five additional bills proposed in Texas in 2013 Session
- 💧 SWD tariff, recycling mandate, discharge of fresh...



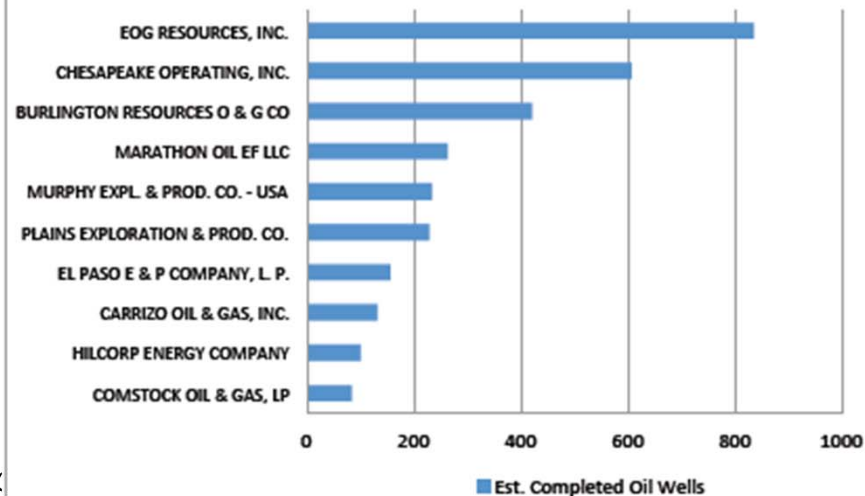
Balance of Benefits

for Oil & Gas & Ag Producer

Est. Completed Gas Wells for Top Ten Operators in 2012



Est. Completed Oil Wells for Top Ten Operators in 2012



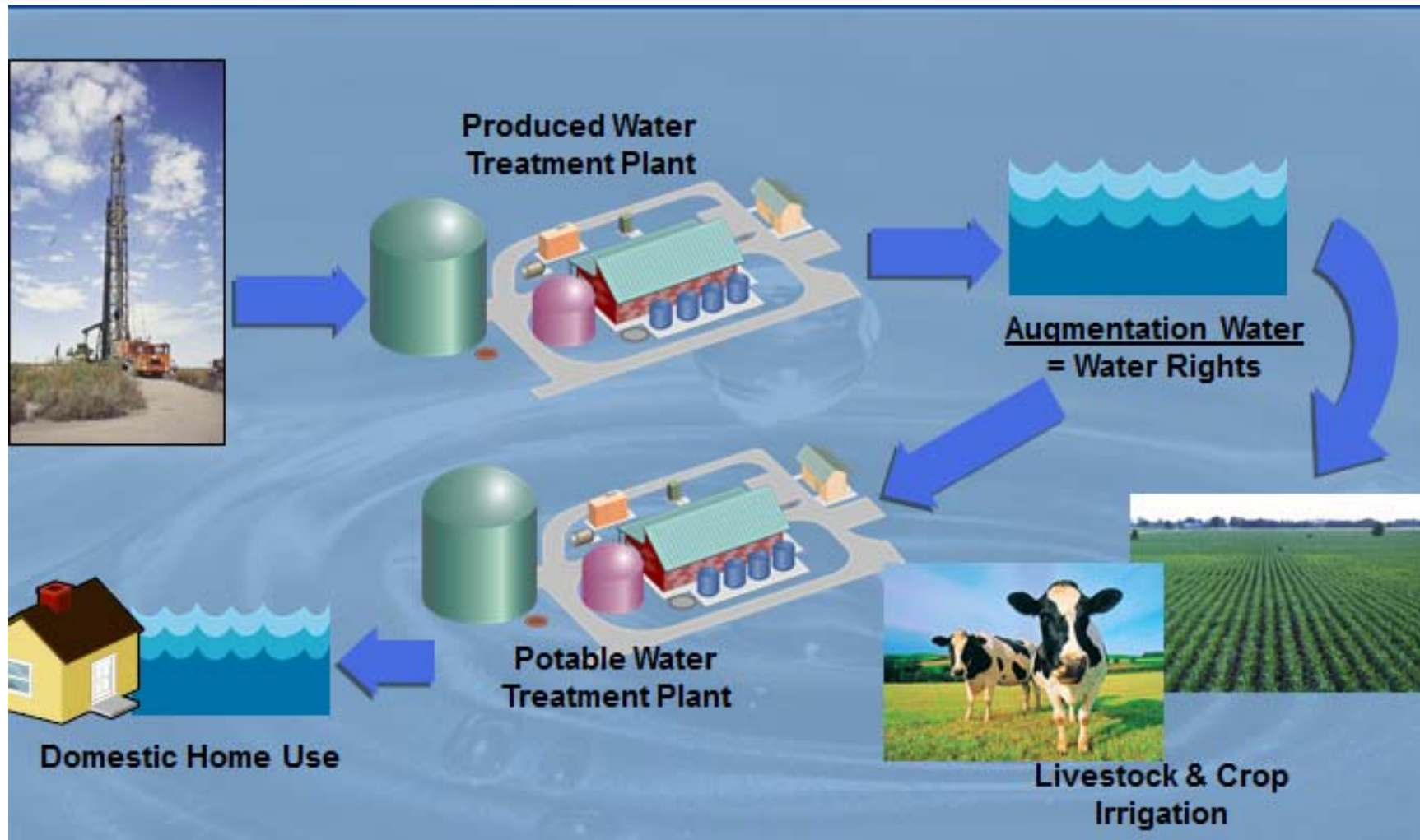
Beneficial Use of Produced Water

Energy Water Solutions technology has recycled millions of gallons of produced water that were permitted to be used in this field in Colorado to water corn.



Recycling Potential

Ag and Oil can all get along



Energy experts creating incremental water for beneficial use...

Energy Water Solutions

Eagle Ford Shale Operations
19725 Highway 85
Big Wells, Texas 78830



Energy Water Solutions

Headquarters & Manufacturing
9595 Six Pines Dr., Suite 8210
The Woodlands, TX 77380
USA
www.energywatersolutions.com

...lower costs and continuous improvement for operator
...lowering injection well usage, truck traffic & pressure on aquifers
...beneficial use includes recycling for ag use if permitted & frac jobs.

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