

OWRB Produced Water Group - Options to Produced Water Disposal

March 3, 2016



Defining the Problem

- Too much produced water compared to underground injection capacity (disposal)
- Oil and Gas - economic pressure from low prices
- Cutbacks to produced water injection may impact companies, jobs and the state's revenue
- What are the economically viable alternatives?

Conversions for Consideration

Various water group sectors use different water quantity metrics:

1 barrel of water (BW) = 42 Gallons

1,000 BW = 42,000 Gallons

10,000 BWPD = 0.42 Million Gallons per Day (MGD)

10,000 BWPD = 40.1 Cubic Feet per Second (CFS)

10,0000 BW = 1.29 Acre-Feet (AF)

1,000 Gallons = 23.8 BW

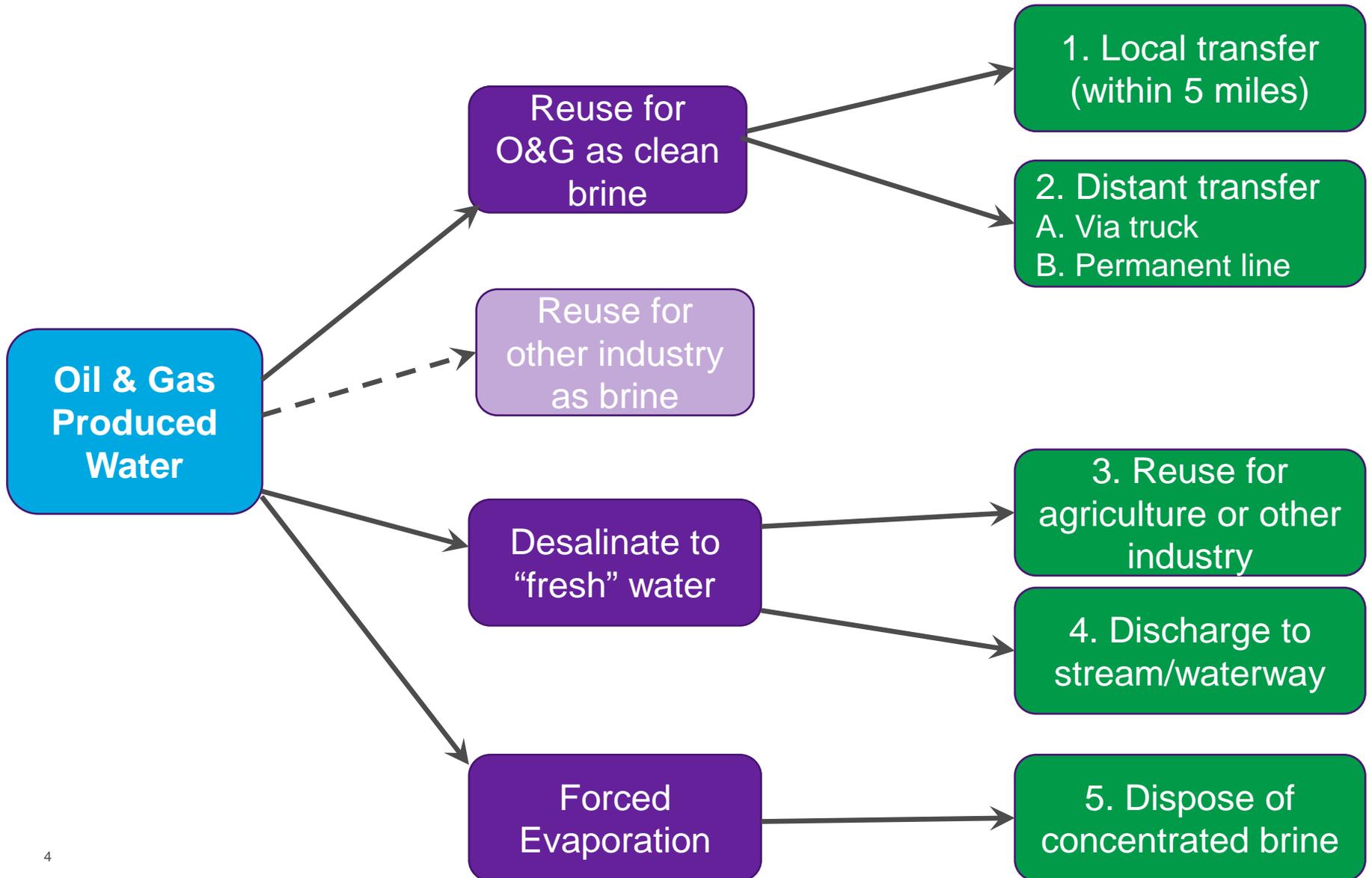
1,000 Gallons per day = 1,858 CFS

100,0000 gallons = 0.309 AF

1 Ton of water = 1 Ton of cotton



Options Overview



1. O&G Reuse within 5 miles

Process

- Treat water for-purpose (clean brine)
- Transfer water via temporary line on surface
- Store water at well site
- Total cost: \$2 to \$4/BW*

Viability

- Limited to rig activity within about 5 miles
- This is already being done where possible

*Disclaimer: All costs are conceptual and for internal comparison only. More detailed analyses needed.



2A. O&G re-use - Distant Transfer via Truck

Process

- Treat water for-purpose (clean brine)
- Transfer water via truck
- Store water at well site
- Total cost: \$4 to \$10/BW

Viability

- Costly due to treatment and trucking
- More trucks on roads create other problems



2B. O&G Re-use Distant Transfer via Permanent Line

Process

- Treat water for-purpose (clean brine)
- Transfer water via buried line
- Store water at well site
- Total cost: \$2 to \$6/BW

Viability

- Large volumes needed to make permanent lines pay out
- Multi-company network could improve economics with larger volumes



3. Desalinate – Use for Ag or Other Industries

Process

- Desalinate to “fresh” water standard
- Transfer water via temporary or permanent line
- Total cost: \$4 to \$10/BW

Viability

- Plant cost is high, or per barrel treatment high
- Generates solid waste removed from brine
- Regulatory issues?
- Commercial complexity



Top Industries in Oklahoma*

1. Energy – 20% Oil & Gas; Wind energy
 - A. Refinery at Ponca City
2. Information & Finance – 70+ Data Centers, Software
3. Transportation & Distribution – Railroads, airports...
4. Agriculture & Bioscience – Food manufacturing, R&D, fertilizer manufacturing
 - A. Koch fertilizer plant in Enid
5. Aerospace & Defense –
 - A. Tinker Air Base (OKC),
 - B. American Air in Tulsa
 - C. Vance Air Base near Enid
6. Other –
 - A. OSU in Stillwater



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4. Desalinate and Discharge to Waterway

Process

- Desalinate to “fresh” water standard
- Discharge to waterway (NPDES permit)
- Total cost: \$4 to \$8/BW

Viability

- Plant cost is high, or per barrel treatment high
- Generates solid waste removed from brine
- Removes transport to user, but also removes value due to no water buyer

5. Forced Evaporation & Concentrated Brine Disposal

Process

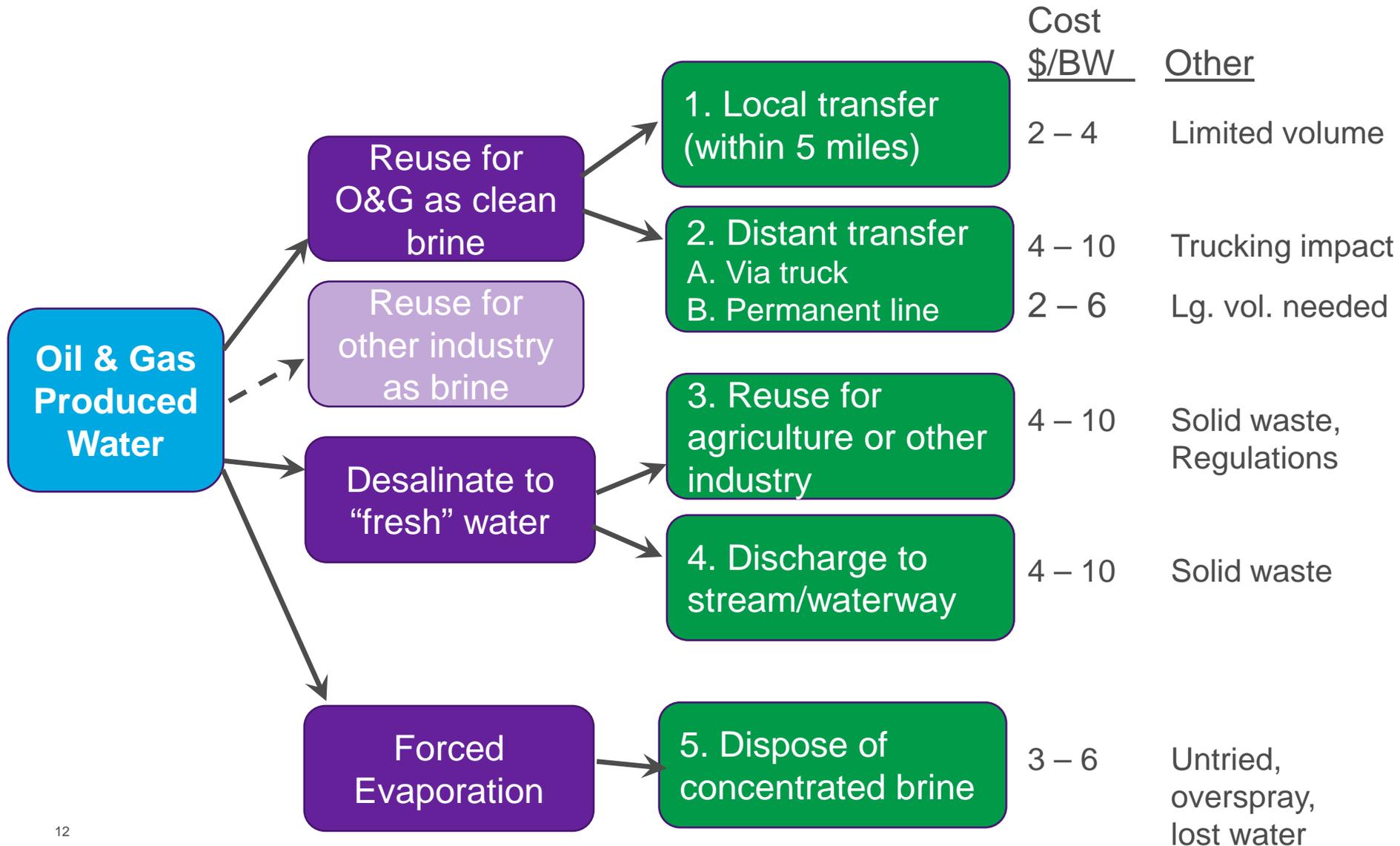
- Forced evaporation reduces volume
- Significant storage area needed
- Concentrated brine still must be disposed
- Total cost: \$3 to \$6/BW

Viability

- Has not been performed on large scale
- Overspray of produced water is hazard
- No value generated from evaporated water



Options Overview



Information Needed for Assessment

1. Water quantity & quality available from O&G
2. Industries in north central OK that could use water
 - A. Quantity and quality needed
3. Costs for permanent pipe volumes and distances
4. Costs for trucking and temporary lines
5. Assessment of regulatory and legal issues



How can the State help?

1. Help gather basic data
2. Assessment of state and national oil & gas water management
3. Bring companies together for opportunities
4. Regulatory framework

Thank You

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Types of produced water treatment

