



ANADARKO PETROLEUM CORPORATION

PRODUCED WATER SUSTAINABLE WATER RESOURCES ROUNDTABLE

Jill Cooper

HSE Manager Data, Advocacy &
Reporting

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Water as a Product



Oil was King

*natural gas was considered
a waste product from
an oil well*



Both Oil & Natural Gas

*became a profitable
commodity*

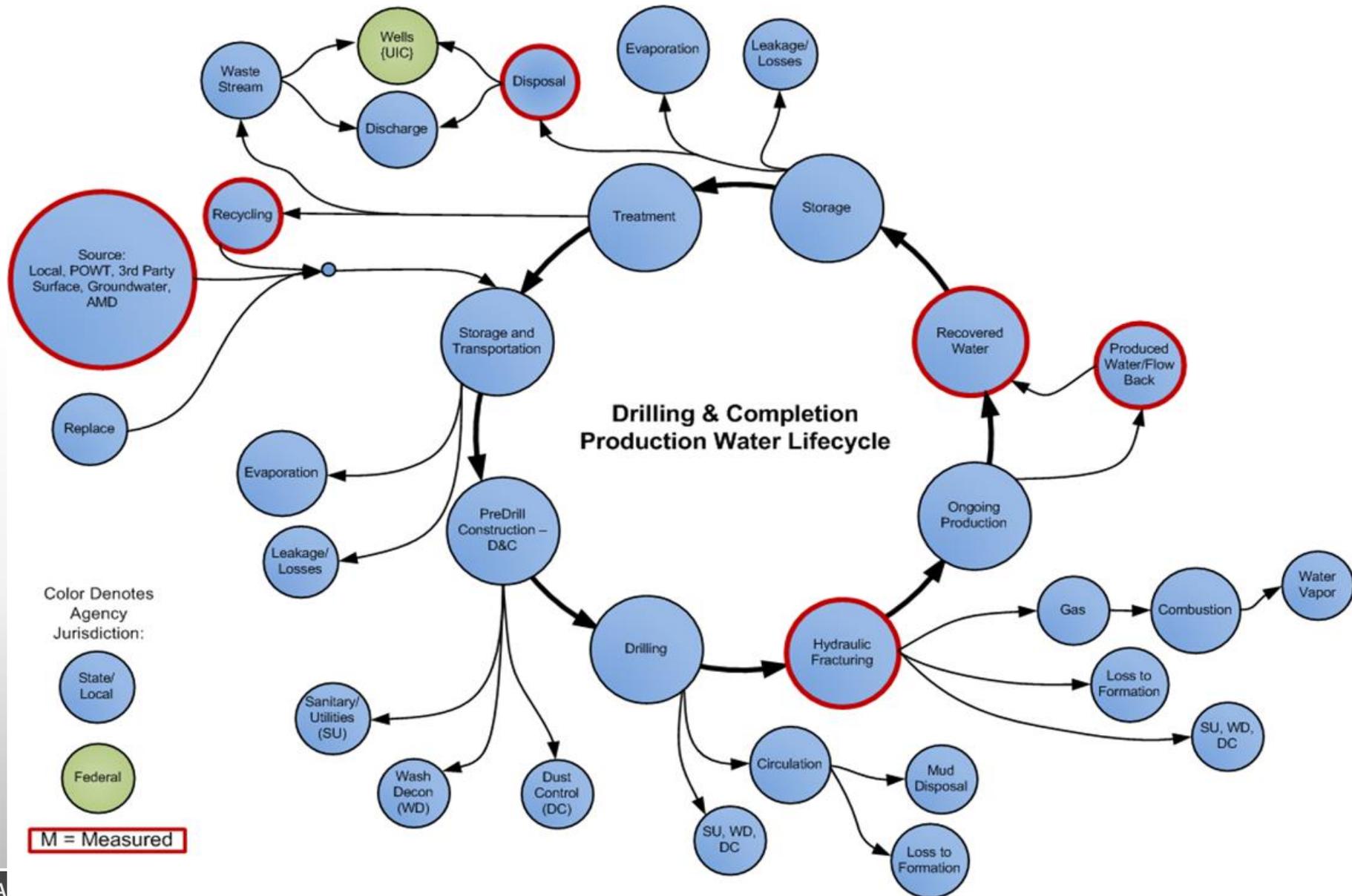


Produced or Formation Water

*can it also become a
useable by-product?*

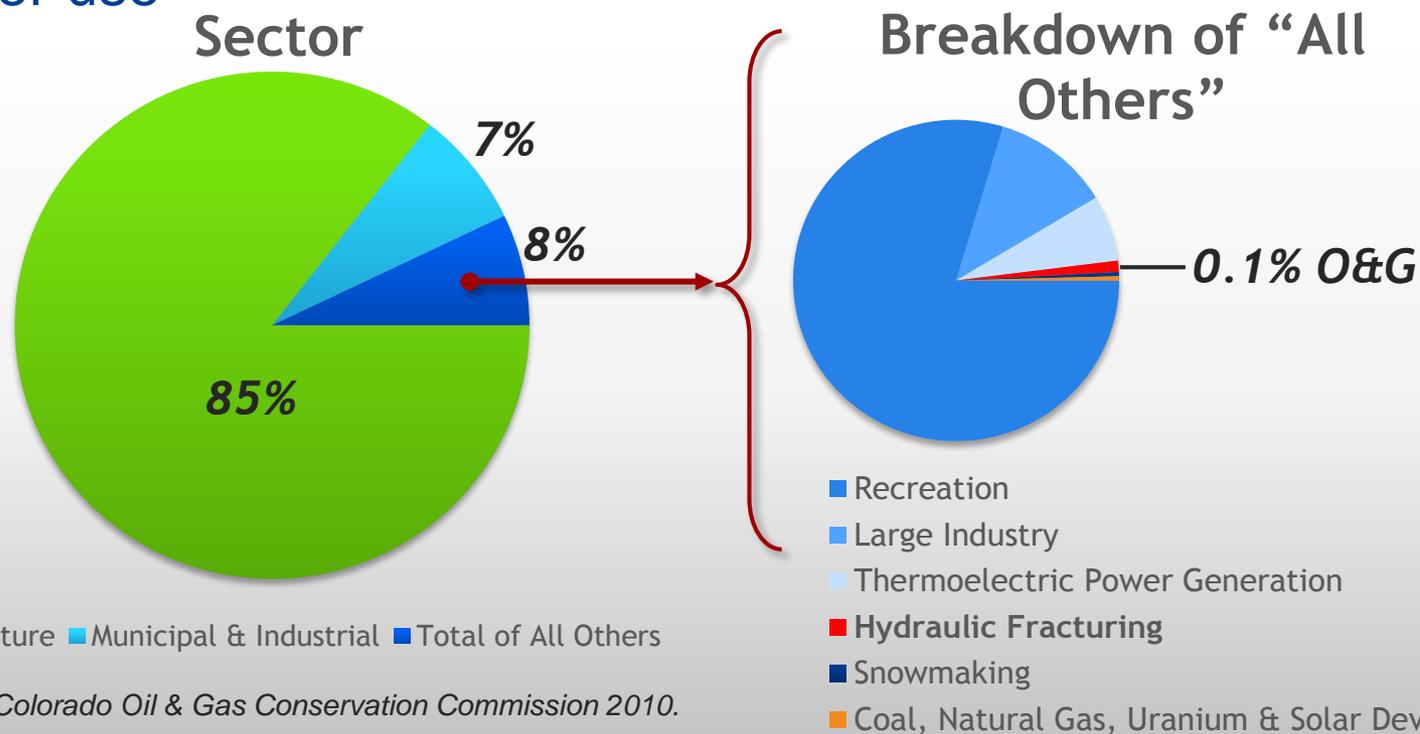


Life Cycle of Water in Upstream Operations



Putting Water Use in Context

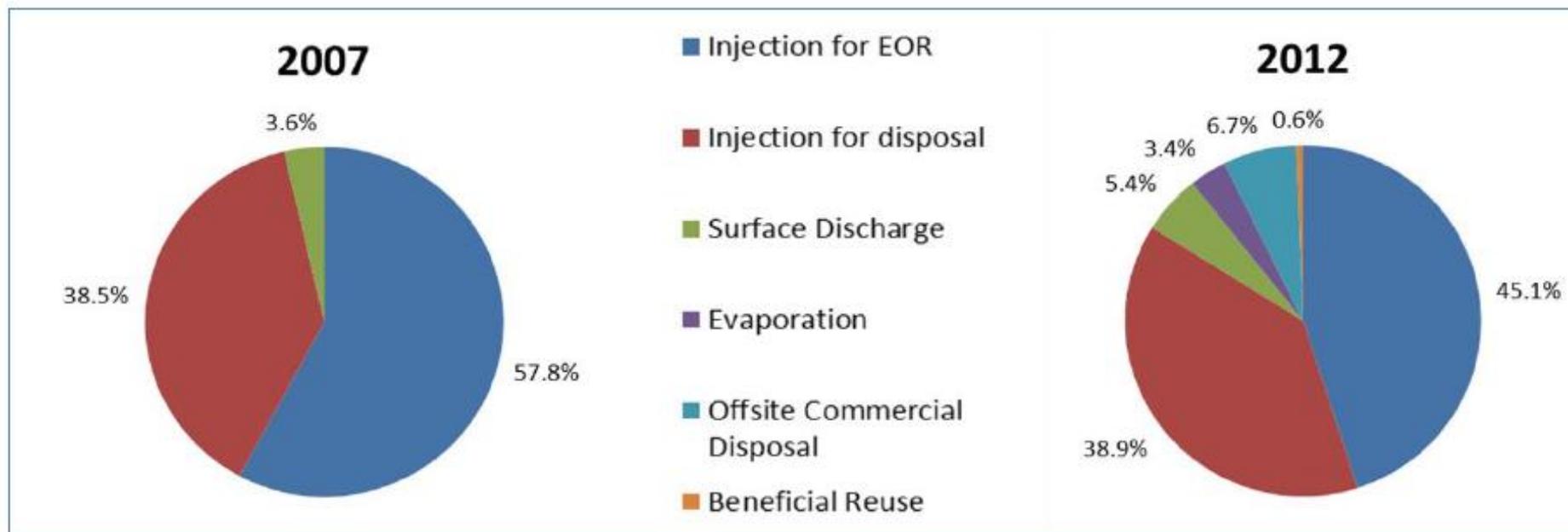
- Wells will typically produce energy for 30 years
- Colorado OGCC projected that water usage for oil and natural gas is about 0.08% of total water use in Colorado
- US EPA projected nationwide upstream water use is >1% of total water use



Source: Colorado Oil & Gas Conservation Commission 2010.

Produced Water Management

- Produced water is generated from most actively producing oil and natural gas wells in the United States
- Cost of managing the water is a key consideration
- Every play has a different “water profile”
- We “get what nature gives us”



Source: Ground Water Protection Council (April 2015)

Oil & Natural Gas – Part of the Water Solution

■ Opportunities

- Water sourcing, management and disposal
- Not a significant user of water compared to other sectors
- Can bring “trapped water” to the surface – net gain to the system
- Collaboration is important to achieve progress

■ Actions necessary to maximize opportunities

- Invest in improvements in water treatment technologies
- Reduce the cost of water treatment
- Support laws and regulations that allow the beneficial reuse of water
- Identify entities interested in accepting the treated water
- Educate the general public around water in general

■ Energy Water Initiative

Energy Water Initiative (EWI)

- EWI is a collaborative effort to study, communicate and improve lifecycle water use and management in onshore oil and natural gas exploration and production
 - Technology and knowledge-sharing
 - Recommended management practices and technologies
 - Fact-based information to stakeholders
 - Follows API's anti-trust provisions during all meetings and discussions

Anadarko Petroleum Corp.

Apache Corporation

BG Group

BP Plc

Chesapeake Energy

Chevron Corporation

ConocoPhillips Co.

Devon Energy

Hess Corporation

Marathon Oil Corporation

Newfield Exploration Co.

Noble Energy

Pioneer Natural Resources Co.

QEP Resources, Inc.

Royal Dutch Shell Plc

Southwestern Energy

Talisman Energy USA, Inc.

XTO Energy, Inc.

Energy Water Initiative (EWI) 2015 Case Study Findings

INDUSTRY TRENDS

BENEFITS

Improving Fracturing Chemistry



Increasing use of non-fresh water

Innovation in Treatment Technology



Increasing feasibility of produced water reuse

Increasing Water Conveyance Systems



Reducing truck traffic

New Water Storage Designs



Provides flexibility and reliability when using non-fresh water

Increasing Transparency



Improves relationships with stakeholders

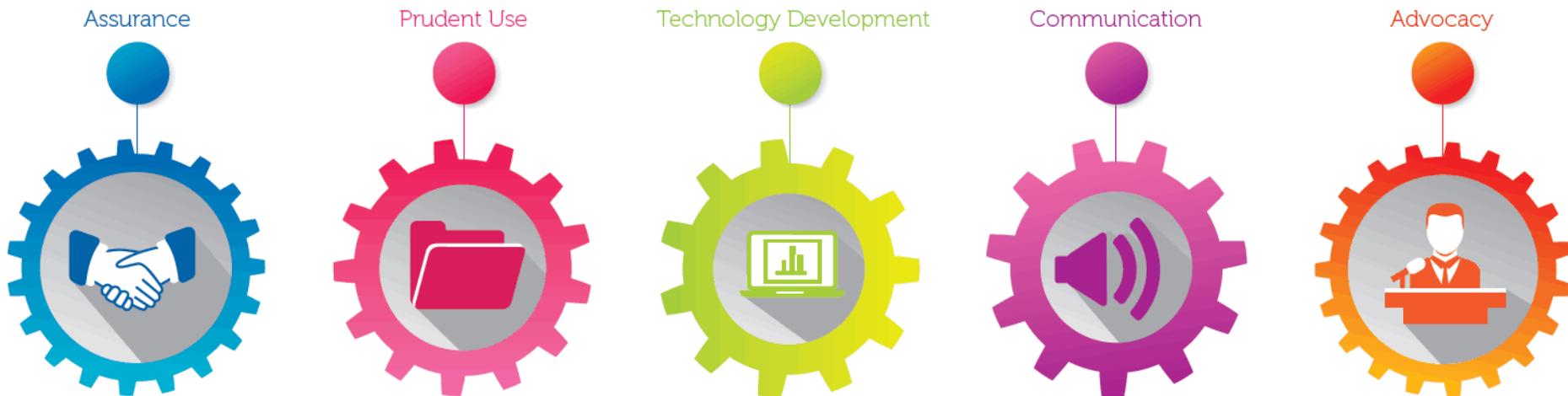
Dedicated Water Staff



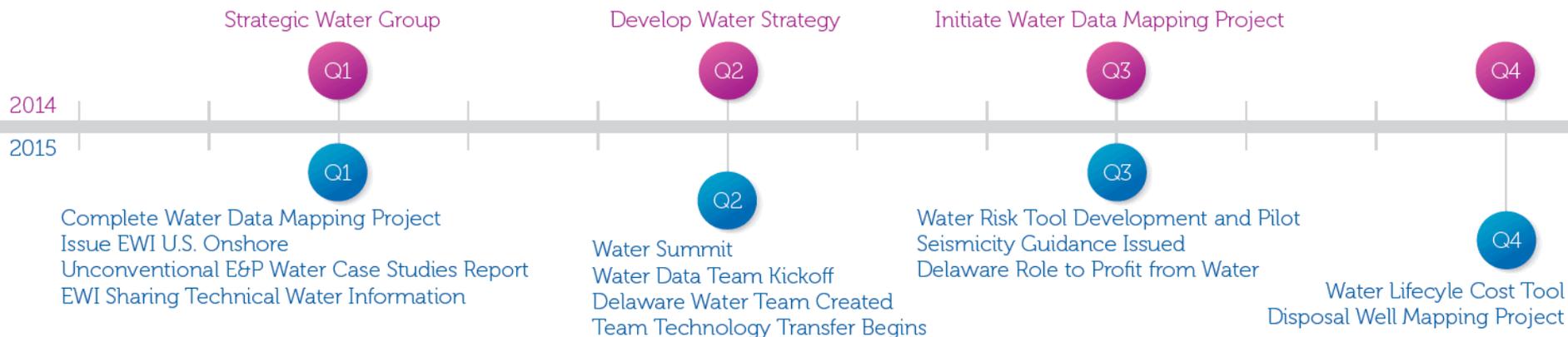
Improves water management, planning technical support and performance

Anadarko's Water Strategy

Strategic Water Committee – Five-part strategy

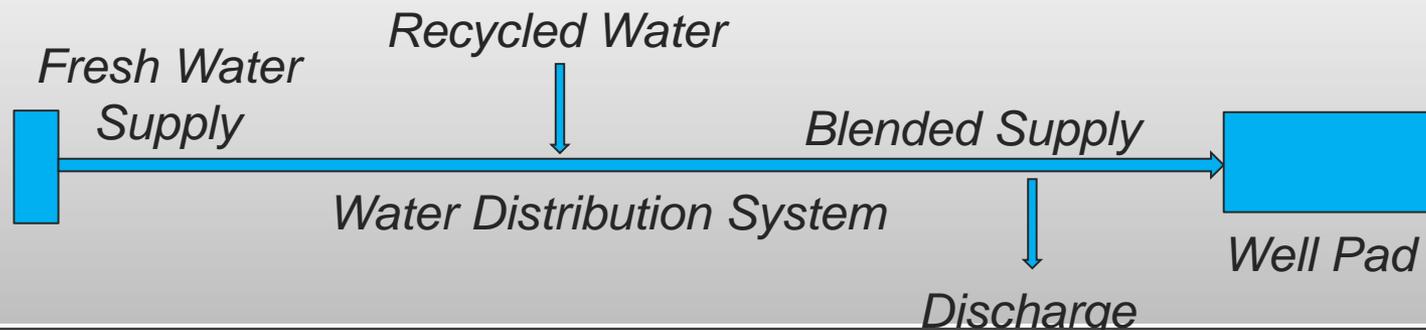


Time Line of Water Strategy



Anadarko Water Management Objectives: Wattenberg, Colorado

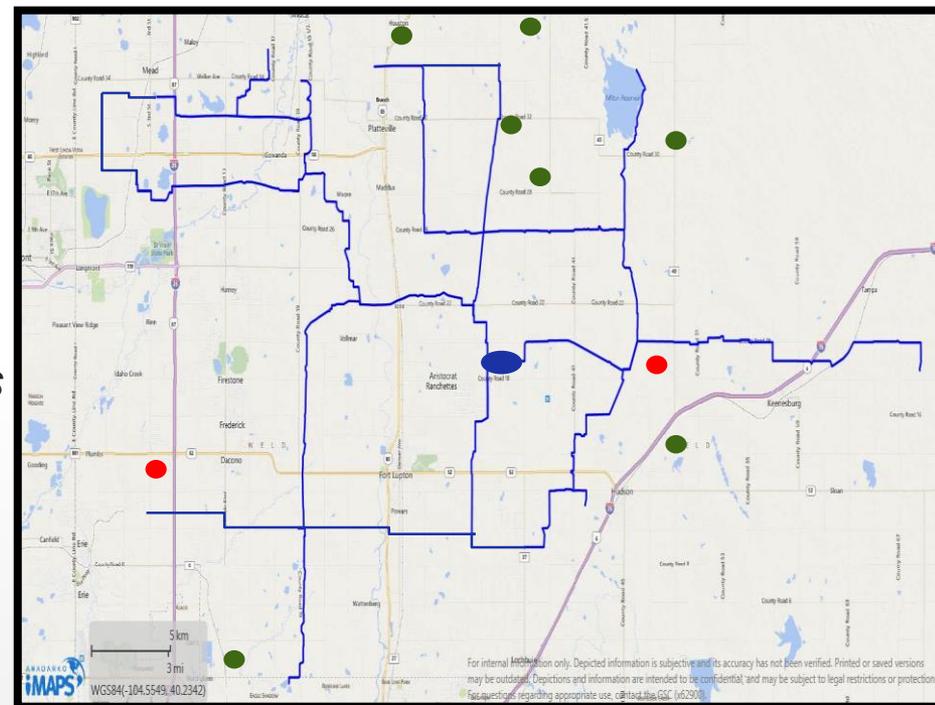
1. Make responsible use of flowback and produced water
2. Ensure water management issues do not impact oil production
3. Decrease dependence on saltwater disposal (UIC) wells
4. Reduce demand for fresh water supplies
5. Reduce trucking traffic
6. Reduce COGCC reportable spills
7. Maximize use of existing field infrastructure
8. Improve stakeholder relationships within the region



Anadarko's Wattenberg, Colorado Field Infrastructure

- Using > 150 miles of permanent water pipeline
- Have a 500,000 bbl double-lined storage pond
- Serving up to 4 frac crews simultaneously
- Using up to 10 different commercial water sources
- Eliminating > 2,000 truck trips per day through piping
- Avoiding > 10,000,000 truck miles
- Avoiding use of > 2,000,000 gallons of diesel and associated emissions
- Reducing well pad water storage tanks (from > 100 to around 20)

20 miles



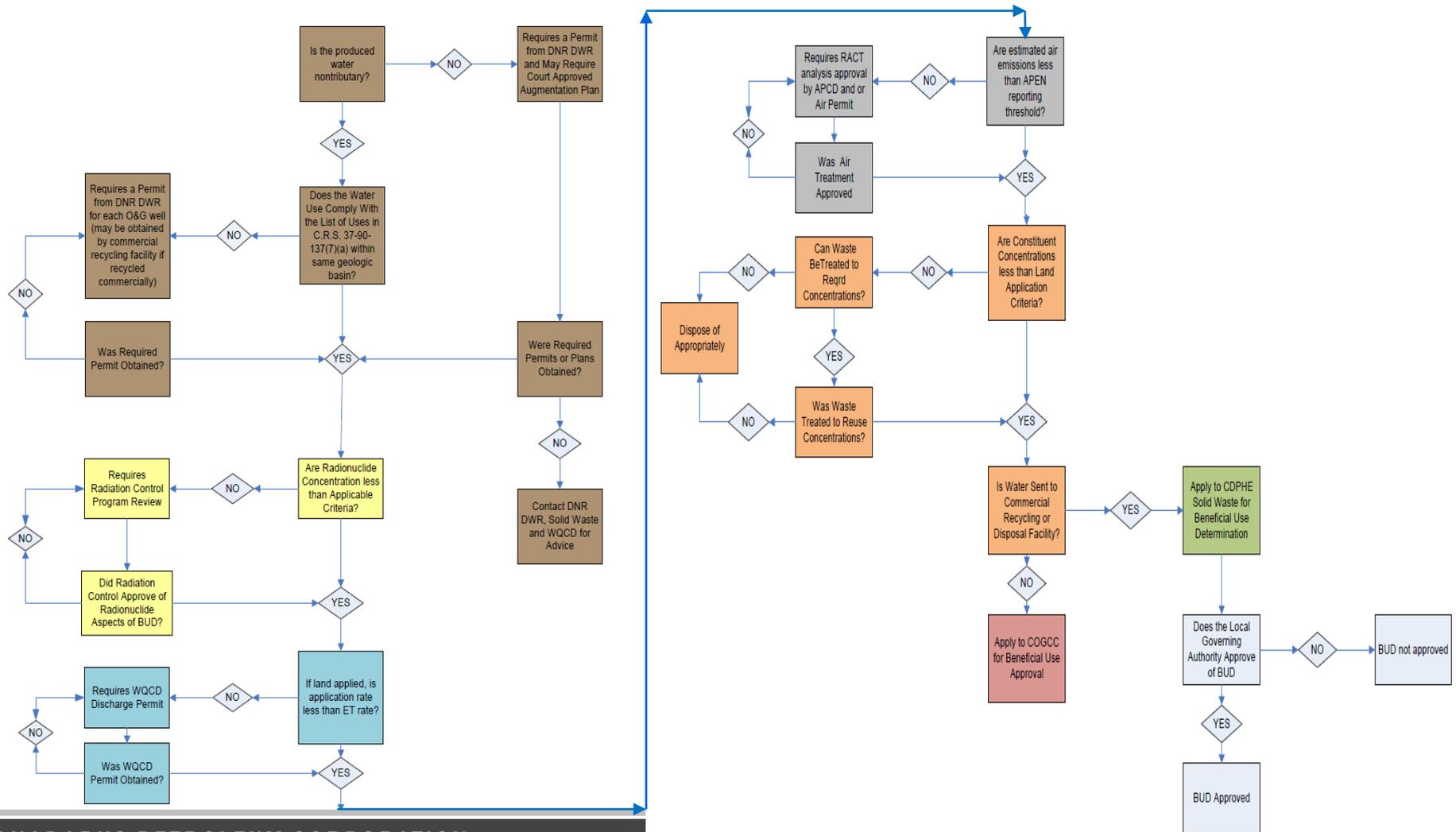
30 miles

- **KMG/APC SWD Facilities (18,000 bpd)**
- **3rd Party SWD Facilities (35,000 bpd)**
- **APC system water storage**

Produced Water Recycling Regulatory Process: Process Depiction Created by CDPHE

PRODUCED WATER RECYCLING FLOW CHART

CDPHE/HMWMD Informal Guidance-February 2016



Water Programs Can Include:

- Outreach to build stakeholder confidence
- Collaboration with other operators, universities, and agencies
- Building infrastructure improvements to meet partner needs
- Innovating for regional water benefits
- Recycling and using produced water to conserve and maximize fresh water
- Building efficient redundancy and reliability into the system



Questions

