



Water is vital to all life and scarce in the West. Its use and management is critical to our industry stakeholders. The primary use for water in modern oil and gas development is in the drilling and completion phases. During drilling, water is used to cool the drill bit and provide a mechanism to bring drill cuttings to the surface. Water is also used for hydraulic fracturing, which pumps water down the wellbore under high pressure to create hairline fractures to release oil and gas.

The water used in drilling and hydraulic fracturing can come from a variety of places. It may be:

- Purchased or leased from municipal supplies.
- Transferred as water rights, such as agriculture water rights.
- Fully consumable water,
  - Leased or purchased effluent.
  - Denver Basin non-tributary groundwater.
- Produced water (non-tributary).

All water used by Colorado's oil and gas industry must be obtained legally under Colorado water law.

## Water Use

The amount of water used in oil and gas operations depends largely upon the type of well being drilled. Vertical and directional wells use less water than horizontal wells because they are not as long.

Water used in different Colorado basins varies depending on the type and depth of well. Average well depth in some Colorado basins are as follows:

- Raton Basin: 2,000 – 2,500 feet
- DJ Basin: 7,000 – 8,000 feet
- Piceance Valley: 7,000 – 8,000 feet
- Piceance Mesa: 11,000 – 12,500 feet

A typical horizontal shale well requires a maximum of 600,000 gallons of water for drilling.<sup>1</sup> Like drilling, water use in hydraulic fracturing is also dependent on the type of well.

- Vertical and directional wells: 100,000 - 1,000,000 gallons
- Horizontal wells: 2 – 5 million gallons, depending largely upon the length of the lateral portion of the well and the number of fracture stages

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### Note to Readers:

COGA welcomes feedback and corrections on our fact sheets. Please email [Travis@coga.org](mailto:Travis@coga.org).

<sup>1</sup> "Water Use in Niobrara Deep Shale Gas Exploration" Chesapeake Energy. Online at: [http://www.chk.com/Media/Educational-Library/Fact-Sheets/Corporate/Water\\_Use\\_Fact\\_Sheet.pdf](http://www.chk.com/Media/Educational-Library/Fact-Sheets/Corporate/Water_Use_Fact_Sheet.pdf)



## What is 5 million gallons (15.3 acre feet)?

Drilling and hydraulically fracturing a well is a one-time use of water. Here are some ongoing Colorado water uses that help put 5 million gallons of water in perspective:

- A day's water used by Denver's Cherokee coal-fired plant; 12 hours during peak loads
- Yearly water use for about 30 Denver-area homes

## Water Use vs. Energy Use

It is interesting to compare the water required to produce energy and that household's domestic water use.

- The average annual household consumption in Colorado is 8,244 kilowatt hours.<sup>2</sup>
- The average natural gas power plant consumes 190 gallons of water per megawatt hour<sup>3</sup> and requires 7.28 thousand cubic feet of gas to provide one megawatt hour in an average Colorado combined cycle natural gas plant.
- Thus, the average home consumes 1,566 gallons and 60 thousand cubic feet of natural gas for electricity use per year.
- The average Denver home uses 166,600 gallons of water per year.<sup>4</sup>

## Colorado Water Usage Statewide

It's important to review water used for oil and gas development within the context of other state water uses. Over 90 percent of all Colorado's water is used for agriculture and 6 percent is used for public supply. Below we have estimated what Colorado's oil and gas water use could be at maximum build out.

	<b>Million gallons/Day</b>	<b>Billion gallons/Year</b>
Irrigation (crop)	12,321.85	4497.5
Irrigation (golf course)	40.64	14.8
Public-supply	864.17	315.4
Domestic	34.43	12.6
Industrial	142.44	52
Livestock	33.06	12
Mining	21.42	7.8
Thermo-electric	123.21	45
<b>Total withdrawals</b>	<b>13,581.22</b>	<b>4957.1</b>

Source: USGS 2005 *Estimated Withdrawals and Use of Water in Colorado, 2005*

### Information Sources:

<sup>2</sup> "How Much Electricity Does the Average U.S. Home Use?" U.S. Energy Information Agency. Online at: <http://205.254.135.24/tools/faqs/faq.cfm?id=97&t=3>

<sup>3</sup> Mantell, Matthew E. "Deep Shale Natural Gas: Abundant, Affordable, and Surprisingly Water Efficient" Ground Water Protection Council. Online at: [http://www.energyindepth.org/wp-content/uploads/2009/03/MMantell\\_GWPC\\_Water\\_Energy\\_Paper\\_Final.pdf](http://www.energyindepth.org/wp-content/uploads/2009/03/MMantell_GWPC_Water_Energy_Paper_Final.pdf)

<sup>4</sup> "Residential End Uses of Water" AWWA Research Foundation. 1999. Online at: [http://www.waterrf.org/ProjectsReports/PublicReportLibrary/FRF90781\\_1999\\_241A.pdf](http://www.waterrf.org/ProjectsReports/PublicReportLibrary/FRF90781_1999_241A.pdf)



At an estimated maximum build out for Colorado wells for 2012, oil and gas development would only use 0.13% of all of Colorado's 2005 water use (that is 13/100 of 1 percent). Estimated 2012 water use:

- 1,500 Vertical/Directional wells x 1,000,000 gallons<sup>5</sup>
- 1,000 Horizontal wells x 5 million gallons<sup>6</sup>
- Total 2012 gallons: 6,500,000,000
- $6,500,000,000 \div 4,957,000,000,000 = 0.13\%$

Colorado's oil and gas industry is committed to minimizing our water use and maximizing our recycling. We are investing in these efforts across the state.



## Recycling Water

Flowback and produced water can both be recycled for use in future operations. Water must be treated to render the water reusable. These processes involve removing suspended solids, bacteria, and iron sulfides, and lowering toxic metals such as barium and strontium. Calcium and magnesium levels are also reduced, softening the water, and the pH level is adjusted to neutral level.

Several factors affect a company's ability to recycle water:

- The maturity of the oil and gas play: A lot of scientific information must be known to allow for effective water treatment.
- The infrastructure in place: Water treatment requires water transportation and available electricity generation.
- The requirements for water use: Depending upon the use of the water, treatment requirements will vary.

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### Information Sources:

<sup>5</sup> Total number of vertical/directional wells in 2009 (2001 wells), 2010 (2232 wells), 2011 (1887 wells as of 10/31/11)

<sup>6</sup> Total number of horizontal wells in 2009 (18 wells), 2010 (95 wells), 2011 (182 wells as of 10/31/11)