Water Requirements for Shale Gas Activities in the Marcellus and Fayetteville Shale

John Veil
Veil Environmental, LLC
john@veilenvironmental.com
410-212-0950

Statistics on Water Requirements for Marcellus Shale

- Make estimate of maximum volume of water needed to meet Marcellus Shale fraccing needs
  - Estimate volume of water per well
  - Estimate maximum number of wells in a year

Pennsylvania Drilling Permits and Wells Drilled

Year	Marcellus Shale Drilling Permits Issued	Marcellus Shale Wells Drilled
2007	99	18 (July – December)
2008	519	196
2009	1,985	763
2010	1,398 (January – June)	564 (January - June)

Source: PA DEP website

- the number of wells actually drilled during the first six months of 2010 can be doubled to estimate a full year (1,128).
- The ratio of 2010 extrapolated drilled wells to 2009 drilled wells (1,128 to 763) = 1.48.
- Assuming the same 48% increase over the 2010 estimate for future growth, a hypothetical maximum is 1,128 x 1.48 = **1 ,669 wells.**

West Virginia Drilling Permits and Wells Drilled

Year	Marcellus Shale Drilling Permits Issued	Marcellus Shale Wells Drilled
2007	152	143
2008	400	274
2009	424	47
2010	176 (January – June)	1 (January – June)

Source: WV DEP website

- The ratio of drilled wells to drilling permits was 95% in 2007 and 69% in 2008.
- Applying the 2008 ratio to the total number of drilling permits in 2009 (0.69 x 424) gives an estimated hypothetical maximum of **293 wells**.

New York Drilling Permits and Wells Drilled

Year	Total Drilling Permits Issued (not necessarily Marcellus Shale)	Total Wells Drilled
2008	744	??
2009	552	??
2010	302 (January – August)	??

Source: presentation made by Jack Dahl, NY DEC, August 24, 2010

- New York has moratorium on Marcellus Shale wells
- No good way to predict maximum number of wells
- Chose to estimate maximum New York wells to be the same as maximum West Virginia wells = **293 wells**

Hypothetical Maximum Water Demand for Marcellus

State	Hypothetical Maximum Number of Wells Drilled in a Year	Annual Volume under Scenario 1: 1 MG of water needed per well	Annual Volume under Scenario 2: 2.8 MG of water needed per well	Annual Volume under Scenario 3: 3.9 MG of water needed per well	Annual Volume under Scenario 4: 5 MG of water needed per well
PA	1,669	1,669 MG	4,673 MG	6,509 MG	8,345 MG
WV	293	293 MG	820 MG	1,142 MG	1,465 MG
NY	293	293 MG	820 MG	1,142 MG	1,465 MG
Total	2,255	2,255 MG	6,314 MG	8,795 MG	11,275 MG

- Caveats
  - estimates of maximum wells drilled could significantly overestimate or underestimate the actual quantity
  - assumed maximum number in one state will not necessarily correspond to the maximum in each of the other states
  - As gas companies refine and improve their efforts to recycle and reuse flowback and produced water from wells already fracced, the water needed per well may decrease
  - if operators drill longer horizontal wells with more frac stages, the volume per well could increase

Actual Water Withdrawals for 2005 (in MGD)

Category	New York	Pennsylvania	West Virginia	Total
Public Supply	2,530	1,420	189	4,139
Domestic	140	152	34	326
Irrigation	51	24	<1	75
Livestock	30	62	5	97
Aquaculture	63	524	53	640
Industrial	301	770	966	2,037
Mining	33	96	14	143
Thermoelectric	7,140	6,430	3,550	17,120
Total	10,288	9,478	4,811	24,577

Source: USGS report (Kenny et al. 2009)

Comparison of Marcellus Shale Water Needs with Actual Withdrawal

	Volume	**Percentage Water Required for Shale Gas Production Compared to Total Withdrawal**
Water needed for shale gas	6.2 – 31 MGD	100%
Total water withdrawal	24,577 MGD	0.03% – 0.13%
Total water withdrawal excluding thermoelectric uses	7,457 MGD	0.08% – 0.42%

Arkansas Completions in the Fayetteville Shale

Year	Fayetteville Shale Completions
2007	411
2008	683
2009	839
2010	728 (January – October)
2010 – extrapolated to full year	874

Source: AR O&G Commission website

- **Assume 1,000 wells.**

Actual Water Withdrawals for 2005 (in MGD)

Category	Arkansas
Public Supply	266
Domestic	0
Irrigation	1,510
Livestock	23.3
Aquaculture	10.6
Industrial	113
Mining	1
Thermoelectric	2,000
Total	3,920

Source: USGS report (Kenny et al. 2009)

Comparison of Fayetteville Shale Water Needs with Actual Withdrawal

	Volume	**Percentage Water Required for Shale Gas Production Compared to Total Withdrawal**
Water needed for shale gas (assume 5 MG/well)	13.7 MGD	100%
Total water withdrawal	3,920 MGD	0.35%