# Ground Water Use in the Shenandoah Valley 1982 - 2007

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## Outline

- Methodology
- Selected trends of reporting ground water users
- Domestic water use estimates
- Agricultural water use estimates
- Irrigation water use estimates
- Summary

Where are the large ground water withdrawals in the region? What is large? How has use changed with time? What is water being used for? GW vs. SW Which rock units? management decisions, informed drought response, modeling, and to direct field work.

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## VWUDS

Atari 800

Populated since 1982 because of Water Withdrawal Reporting Regulation (VAC 25-200-10 et seq.) Triggers: 10,000 GPD / 300,000 GPMonth / 1,000,000 **GPMonth** – Irrigators **Data Quality?** 

own with Amdek Color-1 monitor.)

The

0.00

100

### SWCB File Photo

-1982 -2007 time slice -Relational Database Issues

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## **VWUDS (lessons learned)**

Pretty good at capturing PWS and MAN Very little AGR reported in Valley IRR likely to be significantly underreported COM probably included in PWS MIN excludes dewatering activities No Residential Locational accuracies need work (field work)

### Reported Water Withdrawals in the Shenandoah Valley 1982 - 2007



### Reported Ground Water Withdrawals By Sector in the Shenandoah Valley 2007 (MG)



### Reported Ground Water Withdrawals in the Shenandoah Valley by Public Water Supplies and Manufacturing Sectors 1982 - 2007



### Use of Wells and Springs by the Public Water Supply Sector in the Shenandoah Valley 1982 - 2007



#### Top Ten Ground Water Users in The Shenandoah Valley in 2007



### Average Yearly Change in Ground Water Use for the Top Reporting Ground Water Users in the Shenandoah Valley 1982 -2007







40

Mile

### Approximate Aerial Extent of Major Rock Types in the Shenandoah Valley (Square Miles)





### 2007 Reported Ground Water Use in the Shenandoah Valley by Rock Type Grouping (Million Gallons)



~ 94% Carbonate Rocks



### **ESTIMATION**

"A calculated approximation useable even if input data may be incomplete or uncertain"

Needed to put reported water use in context

## Residential Estimates

Based on population estimates published by U.S. Bureau of the Census % of self-supplied users obtained from 1990 Census and extrapolated through to 2007 Water Use Coefficients based on USGS study in WV – 80 GPD per person. Assumes that most self supplied users rely on ground water. Estimates include all of Augusta

#### Comparison of Estimated Residential Demand to Various Reporting Ground Water Users in the Shenandoah Valley 1990 - 2007



## **Agricultural Water Use Estimates**

Reported withdrawals for Agricultural purposes in VWUDS is nearly unreported.



(Figure from National Agricultural Statistics Service, 1997)

### Livestock populations from USDA Census of Agriculture (2007, 2002, 1997, 1992, 1987, 1982)

Type of Livestock	Virginia DEQ Agricultural Program	USDA - Harrisonburg Ext.	NMSU Extension Paper D- 107	"Site Selection for Dairy Housing Systems - Virginia Cooperative Extension	"Livestock and Water" - NDSU Extension	USGS SIR 2009- 5041	Rates Used in This Report		
	gal/day	gal/day	gal/day	gal/day	gal/day	gal/day	gal/day		
Beef Cows (per head)	12	12			12	6.6 - 16	12		
Milk Cows (per head)	110	20	25	45	16	18 - 65	40		
Turkeys (per 1000 head)	17	170				50 - 220	100		
Chickens (1000 head)	54*	68				20 - 120	60		
Hogs and Pigs (per head)					2.5	2 - 8.1	3.5		
*from metered poultry houses in Rockingham County									

# Estimated Water Use by Livestock in the Shenandoah Valley 2007 (MG)



~2.4 **BG** 

~6.6 MGD

### Estimated Livestock Water Use in The Shenandoah Valley

Year	Cattle & Calves	All Poultry	Hogs & Pigs	Total Livestock Water Use (MG)	Total Livestock Water Use (MGD)	Estimated Ground Water Use @ 50% Total (MG)
1982	1907.66	301.73	137.70	2347.09	6.43	1173.54
1987	1742.81	394.50	106.42	2243.73	6.15	1121.87
1992	1862,08	539.80	65.49	2467.37	6.76	1233.69
1997	1825.90	689.75	34.25	2549.90	6.99	1274.95
2002	1907.61	685.78	15.19	2608.58	7.15	1304.29
2007	1777.67	628.54	18.37	2424.58	6,64	1212.29

#### Comparison of Estimated Residential and Livestock Ground Water Demands to Reporting Ground Water Users in the Shenandoah Valley 1982 - 2007



Irrigation Water Use Estimates Reported Irrigation in VWUDS looked spotty ■ 1,000,000 G/Month reporting trigger Irrigated Acres from Agricultural Census ■ 1" per week, 4/1 – 9/30 Adjusted with NOAA Station at Dale Enterprise, Rockingham County

#### **Precipitation During Growing Season vs. Acres Irrigated**



#### Reported Irrigation Water Use Vs. Estimated Irrigation Water Use in the Shenandoah Valley



#### Ground Water Use in the Shenandoah Valley By Reporting Sector Including Estimated Residential and Agricultural Demands 2007 (MG)



## Summary

- Ground water has become the dominant source for water in the Valley.
- Most ground water is withdrawn for Manufacturing and Public Water Supply Use
- Manufacturing ground water demand decreasing
- Public Water Supply demand increasing
- Top ground water users identified and should expect visits from me....

## Summary

 94% by volume from carbonate formations
~60% by volume from eastern Rockingham and Augusta Counties (B.R.T.O.S.)
~61% by volume from Cambrian Rome/Waynesboro and Elbrook formations.

## Summary

- Residential demand is several times that of agricultural demand and increasing.
- Agricultural estimates show signs of decline
- Irrigation estimates are highly variable but shows signs of increase.
- Irrigation and agricultural water use appear to be significantly under-reported.
- Paper should be available this spring

## **Thanks for Listening**

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