

# **Observed Impacts of Chlorides in Baltimore County**

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# Topics to be Covered

- **What are Chlorides?**
- **Health Effects and Concerns**
- **Chlorides in the Environment**
- **Management Options**
- **Recommendations for the Future**

# What are Chlorides?

- Chloride is the negatively charged ion formed from the element Chlorine.
- It is one of the two components of rock salt (sodium chloride)
- Not Naturally Occurring in the Region

# Sources of Chlorides

- Road Salt
- Brine Waste from Water Softeners
- Septic System Effluent
- Disinfectants & Cleaners
- Fertilizers
- Agricultural Runoff



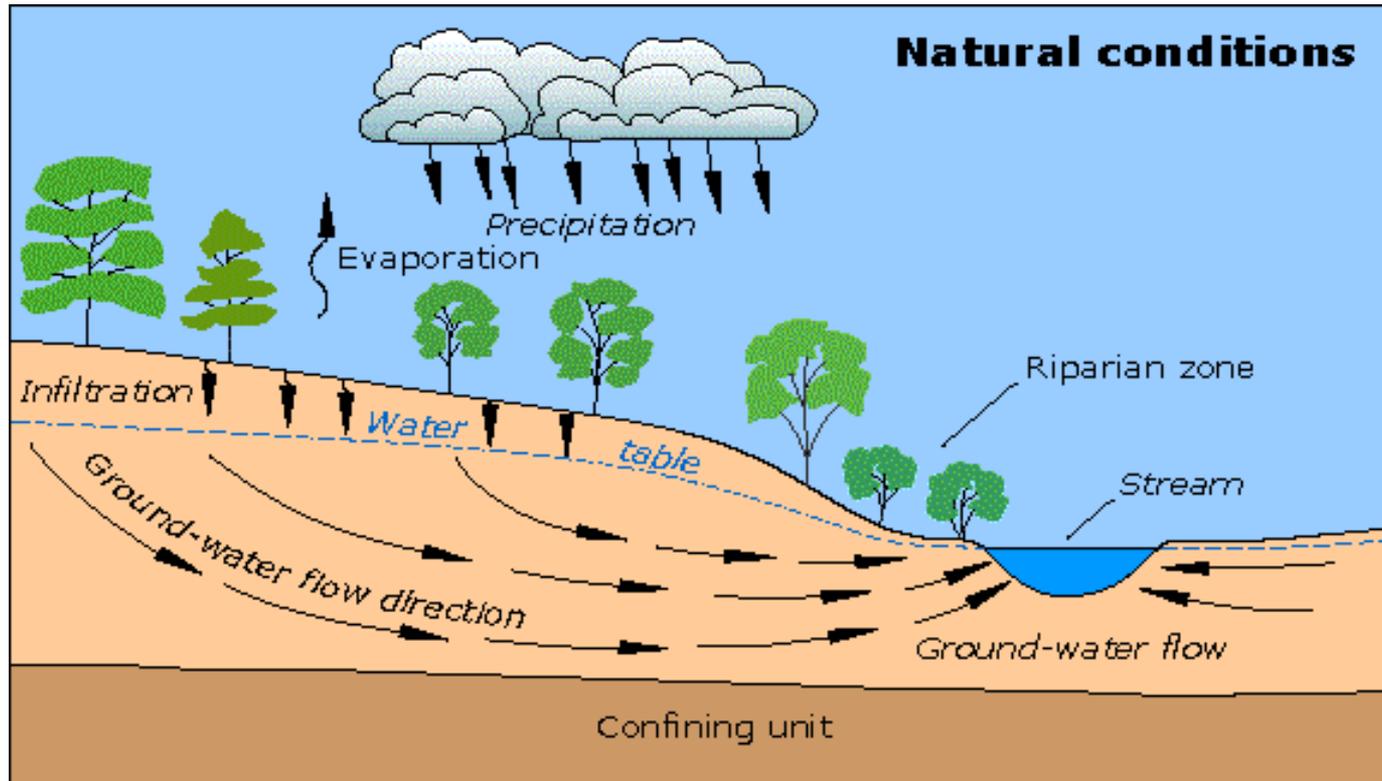
# Human Health Effects

- Chlorides are not regulated as a health concern in drinking water
- USEPA recommends chlorides remain below 250 mg/l in drinking water due to the unpleasant taste it may cause
- USEPA recommends that Sodium (commonly associated with Chlorides) remain below 20 mg/l especially for infants and individuals with heart and kidney disease

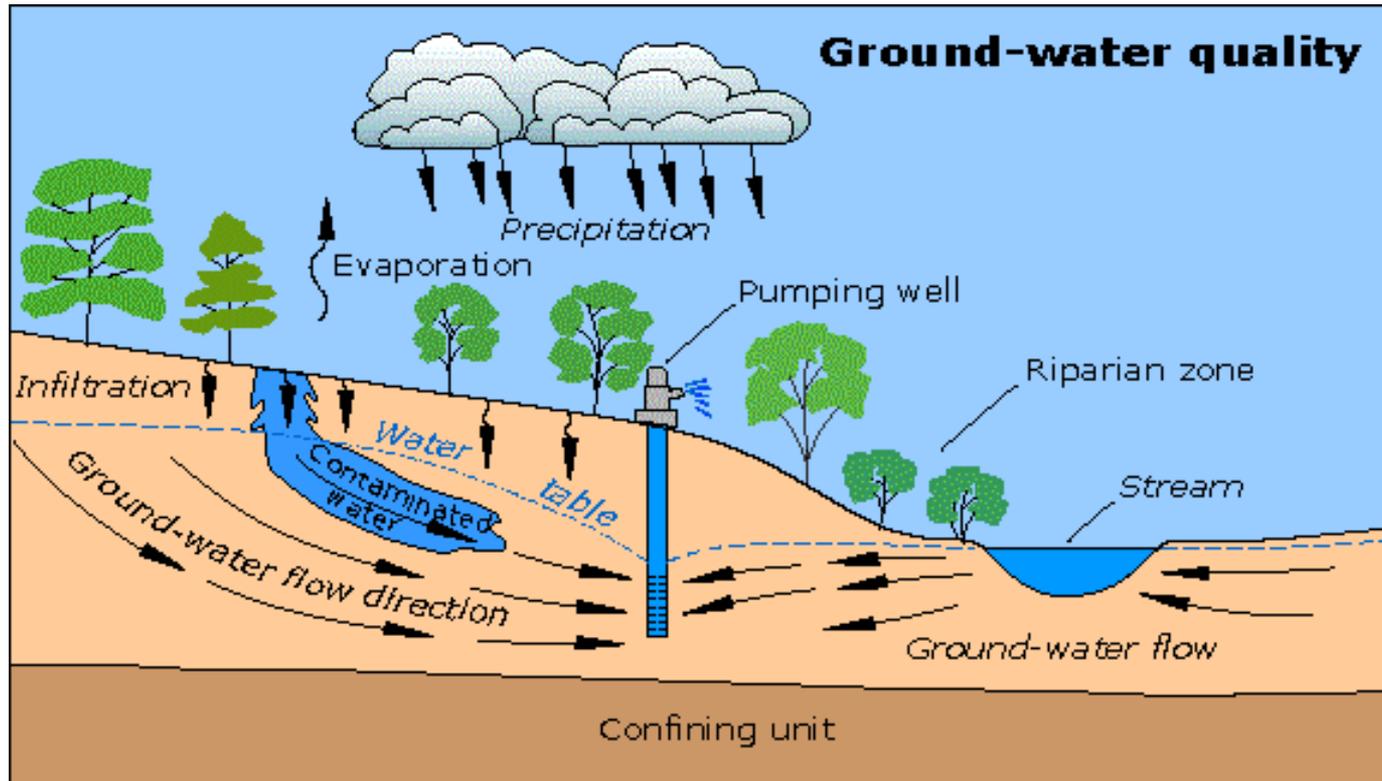
# Other Concerns

- **Reported Skin Irritation (Dryness)**
- **Increase in Corrosion of Plumbing and Fixtures**
- **Reduced Effectiveness of Water Softeners**
- **Toxic to Vegetation and Fresh Water Organisms**

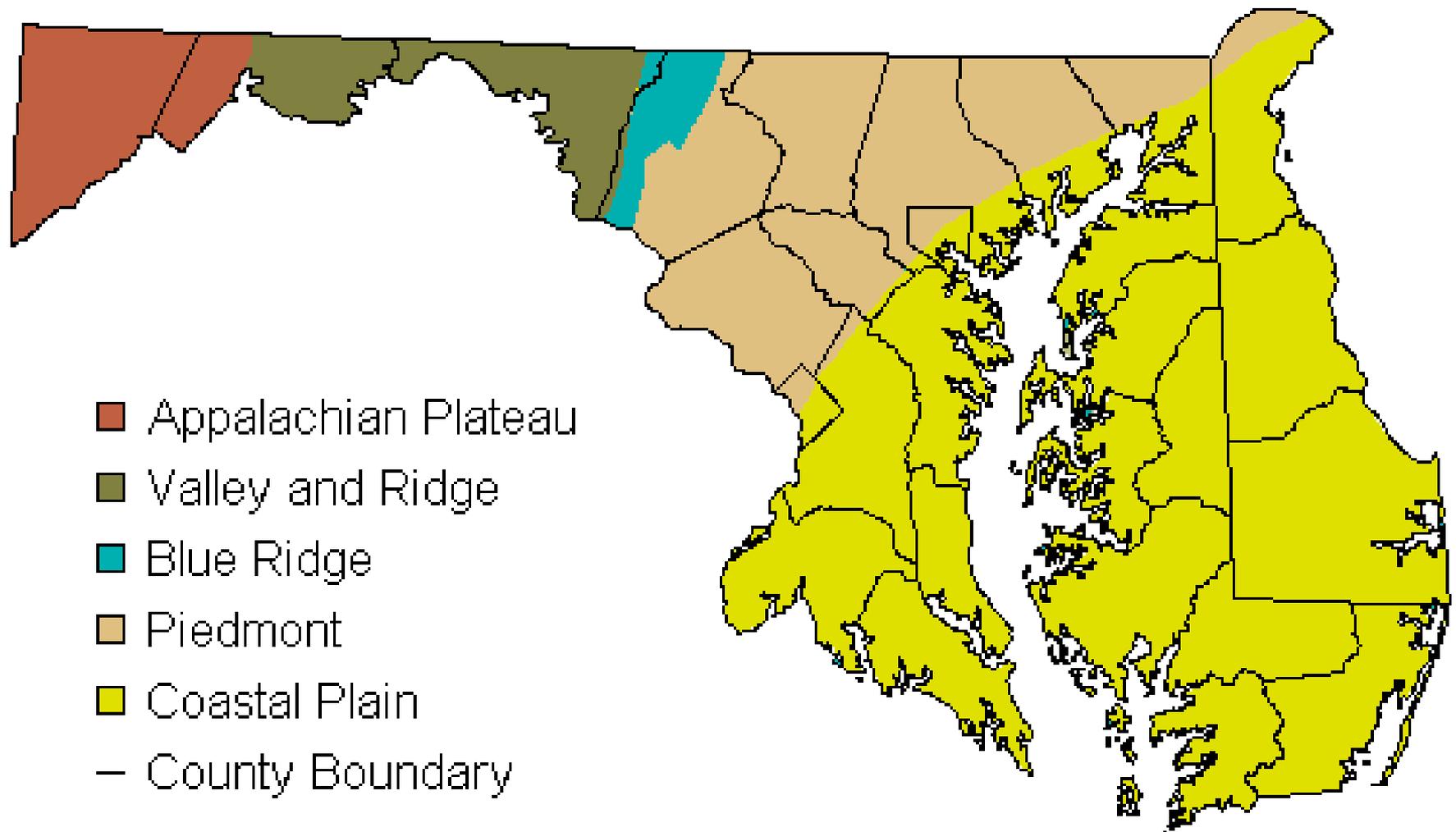
# The Hydrologic Cycle



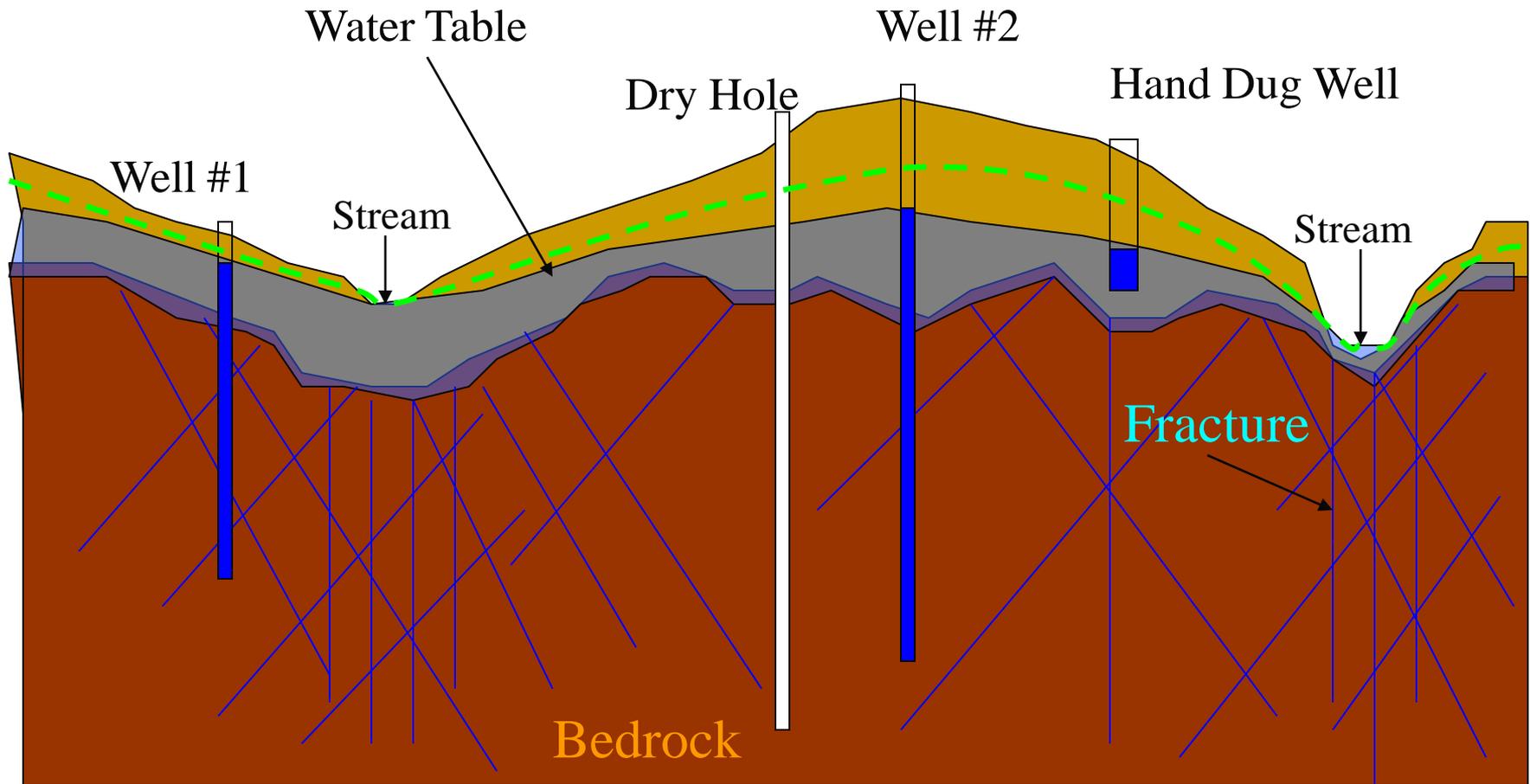
# The Hydrologic Cycle



# Physiographic Provinces of Maryland and Delaware



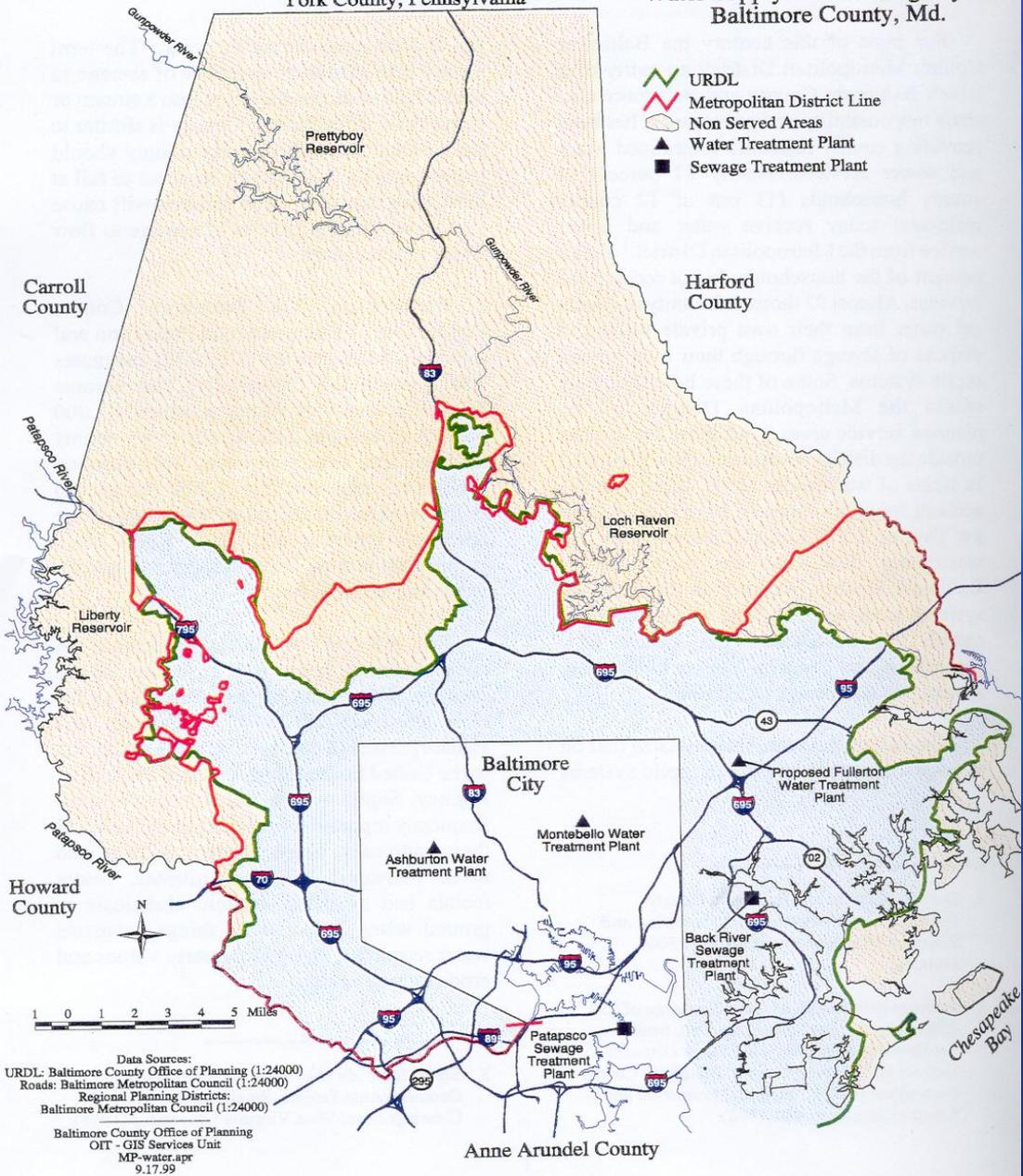
# Occurrence of Ground Water in the Piedmont



**Figure 1**

York County, Pennsylvania

Water Supply and Sewerage System  
Baltimore County, Md.



Roughly 10 % or  
80,000 Baltimore  
County Residents  
Rely on an Estimated  
30,000 Private  
Well Systems

# County-Wide Monitoring Program

- **Ground Water Management Strategy adopted in 1992**
- **1998 Water Quality Report completed for 100 wells**
- **2002 Follow-up Report completed for 50 wells**

# Water Quality Study Findings

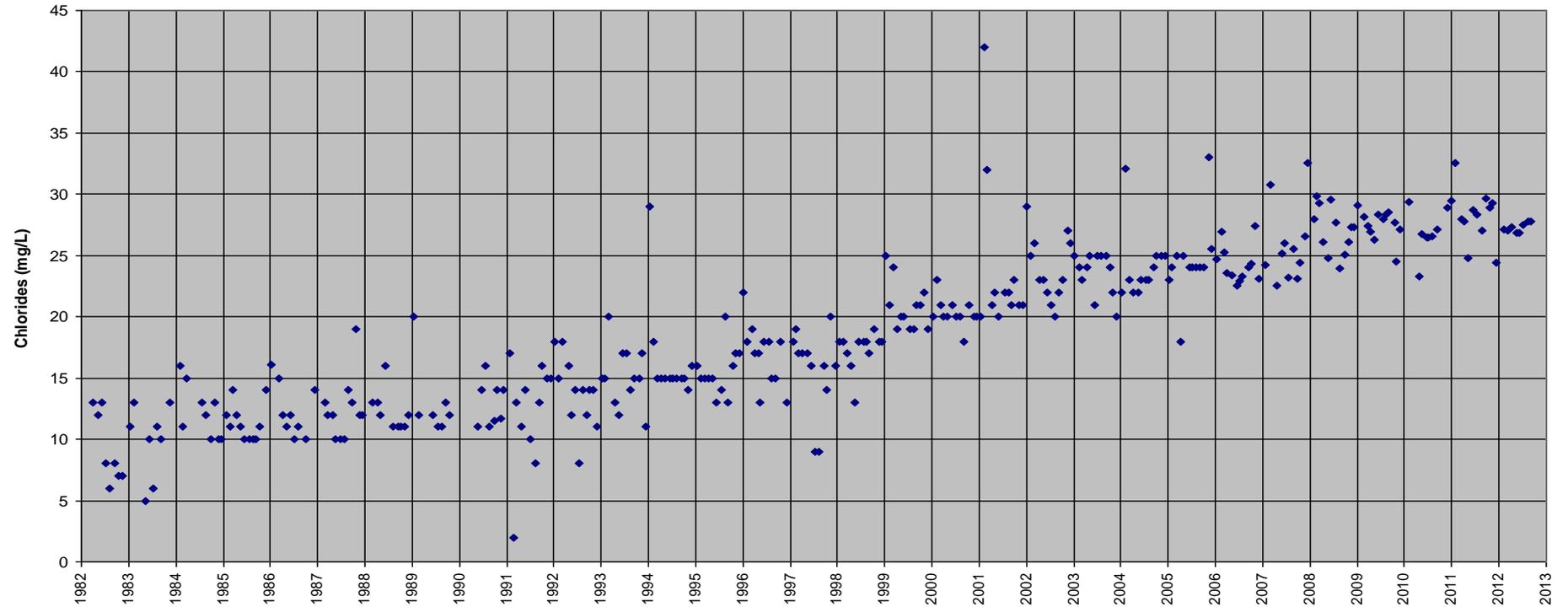
- **10% of Wells had chlorides levels that were  $> 50$  mg/l**
- **Positive Correlation between Distance to Road and Wells with Elevated Chloride Levels**
- **No significant seasonal variation**

# Baltimore City Data

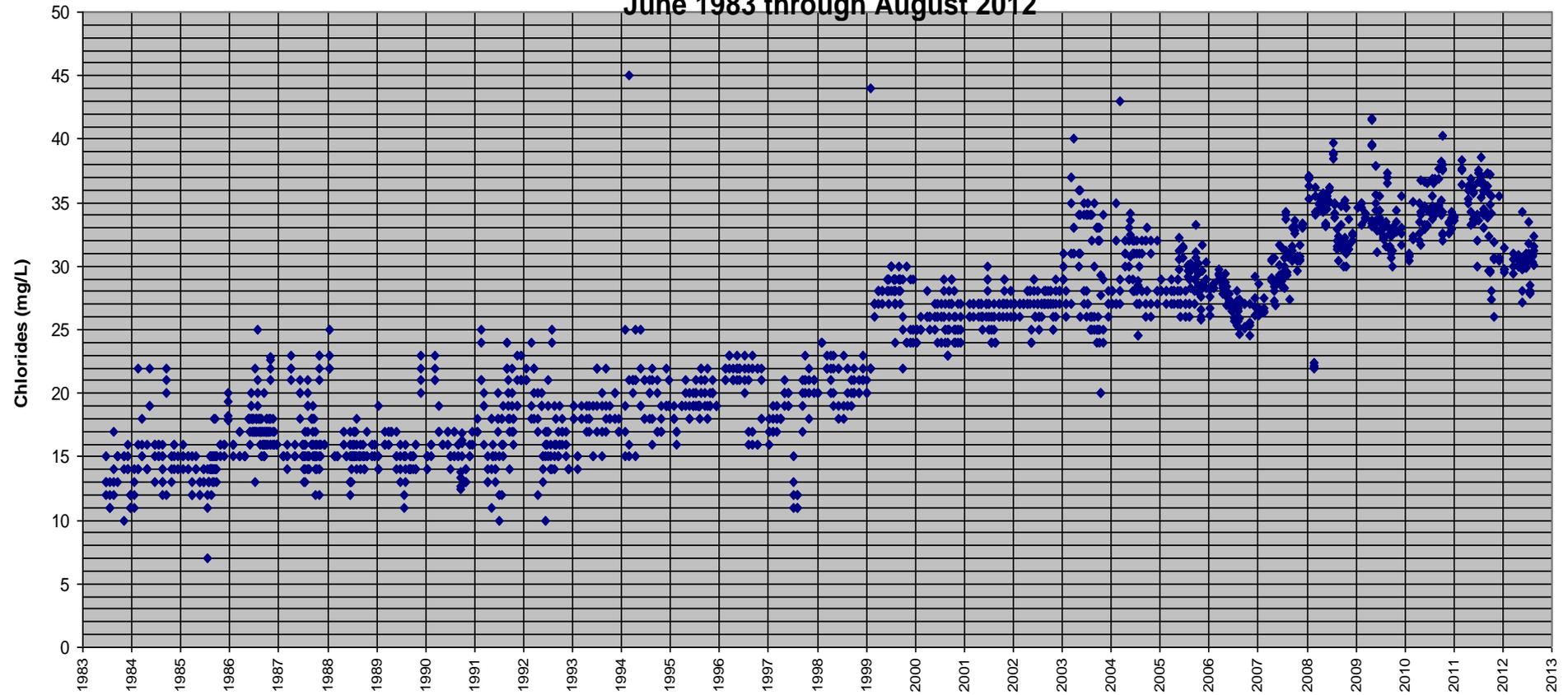
- **Concentrations of Chloride in Streams and Reservoirs Has Doubled Over The Last 30 Years**
- **Concentrations of Chlorides Peak During Winter Months, But Do Not Return to Baseline Levels in The Summer**
- **Since we Know Roughly 50% of Streamflow From Ground Water; Chlorides are Building Up in Ground Water System**

# Morgan Run (MOR0040) Dry Weather Samples Chlorides

## March 1982 through September 2012

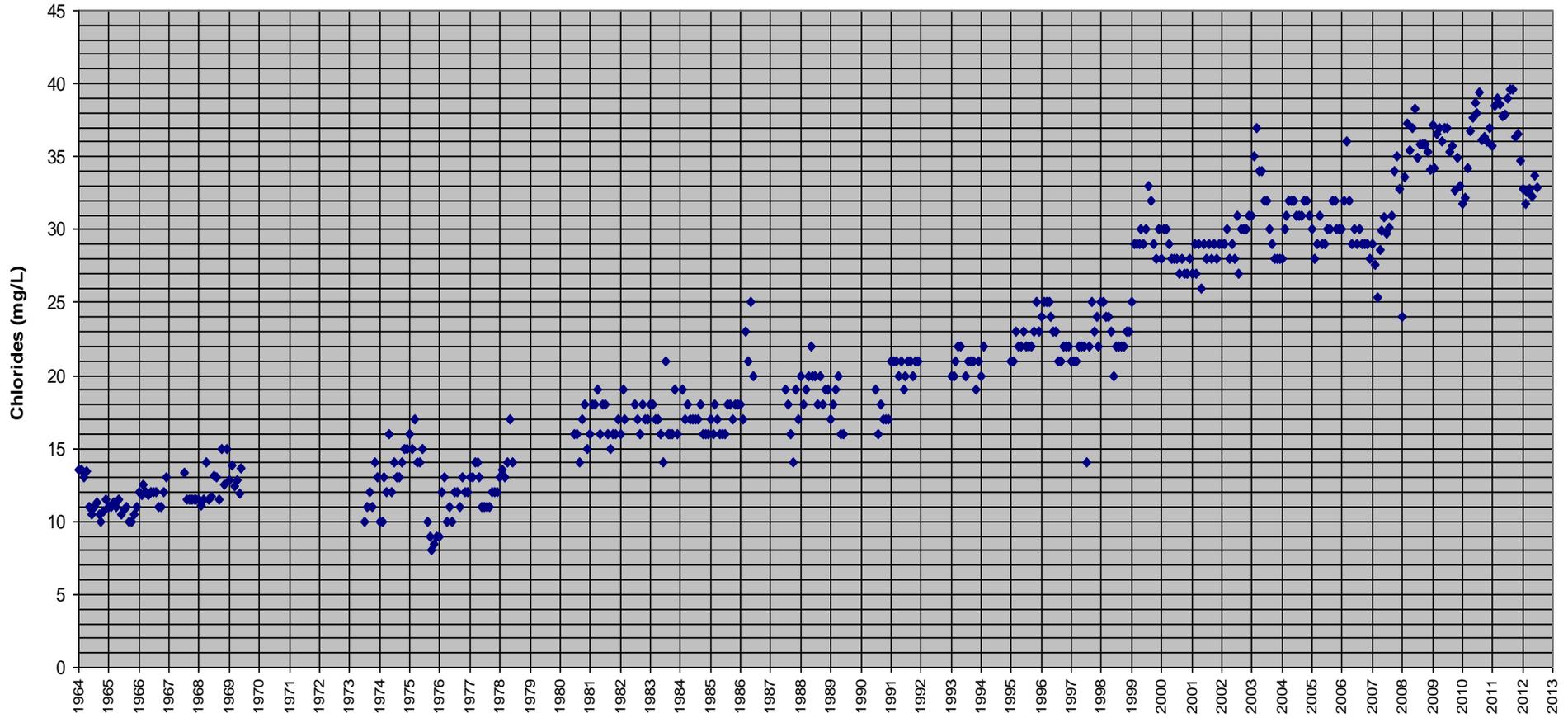


**Liberty Reservoir Station NPA0042 at the Gatehouse Chlorides**  
**All Depths (Generally 0, 10, near 55 & near 100 Each Date)**  
**June 1983 through August 2012**

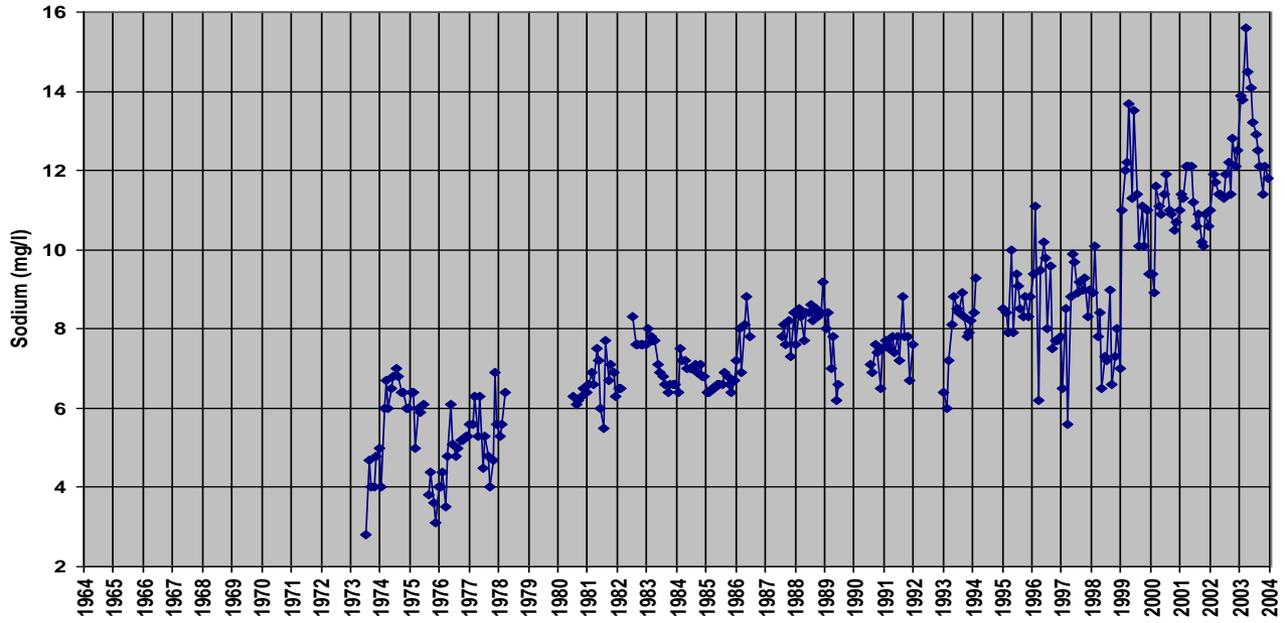


# Ashburton Water Treatment Plant Finished Water Chlorides

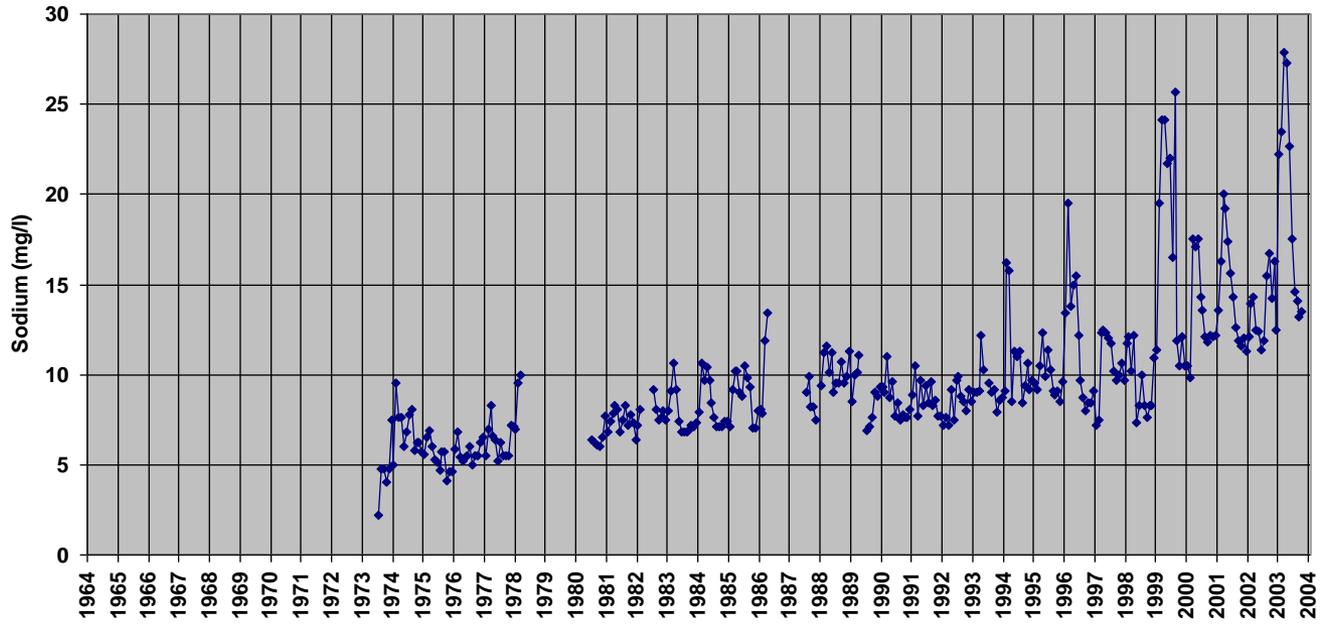
## January 1964 through July 2012



### Ashburton Finished Water Sodium

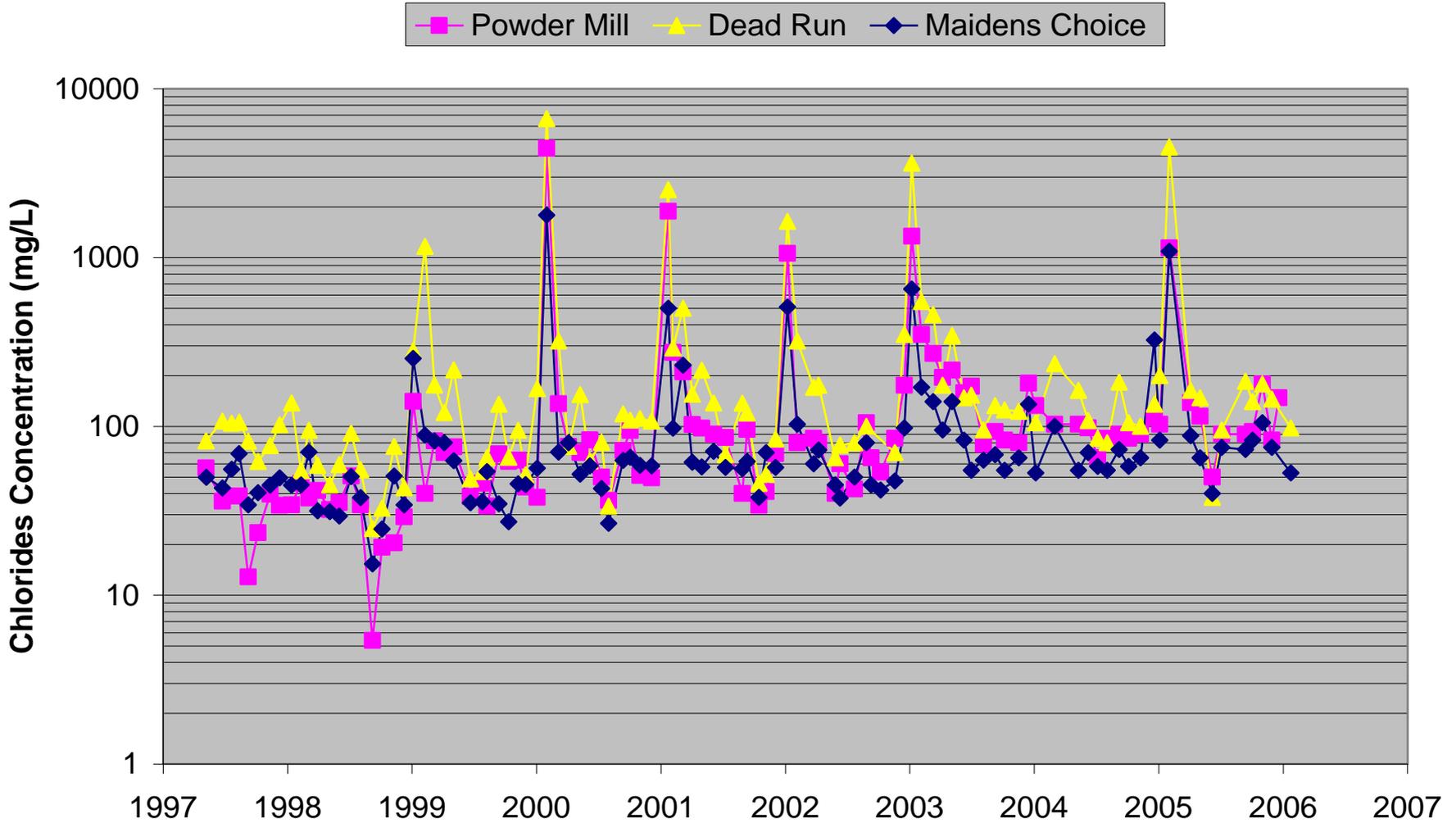


### Montebello Finished Water Sodium



# Urban Stream Systems

Chlorides Concentration Gwynns Falls Tributaries Dry Weather  
May 1997 through January 2006



# Choride Cases / Complaints (250 – 1000 mg/l)

→ 1980 – 1990 5 cases

→ 1990 – 2000 14 cases

→ 2000 – 2010 54 cases

→ 2010 – 2012 20 cases

# Example 1: Parkton Area

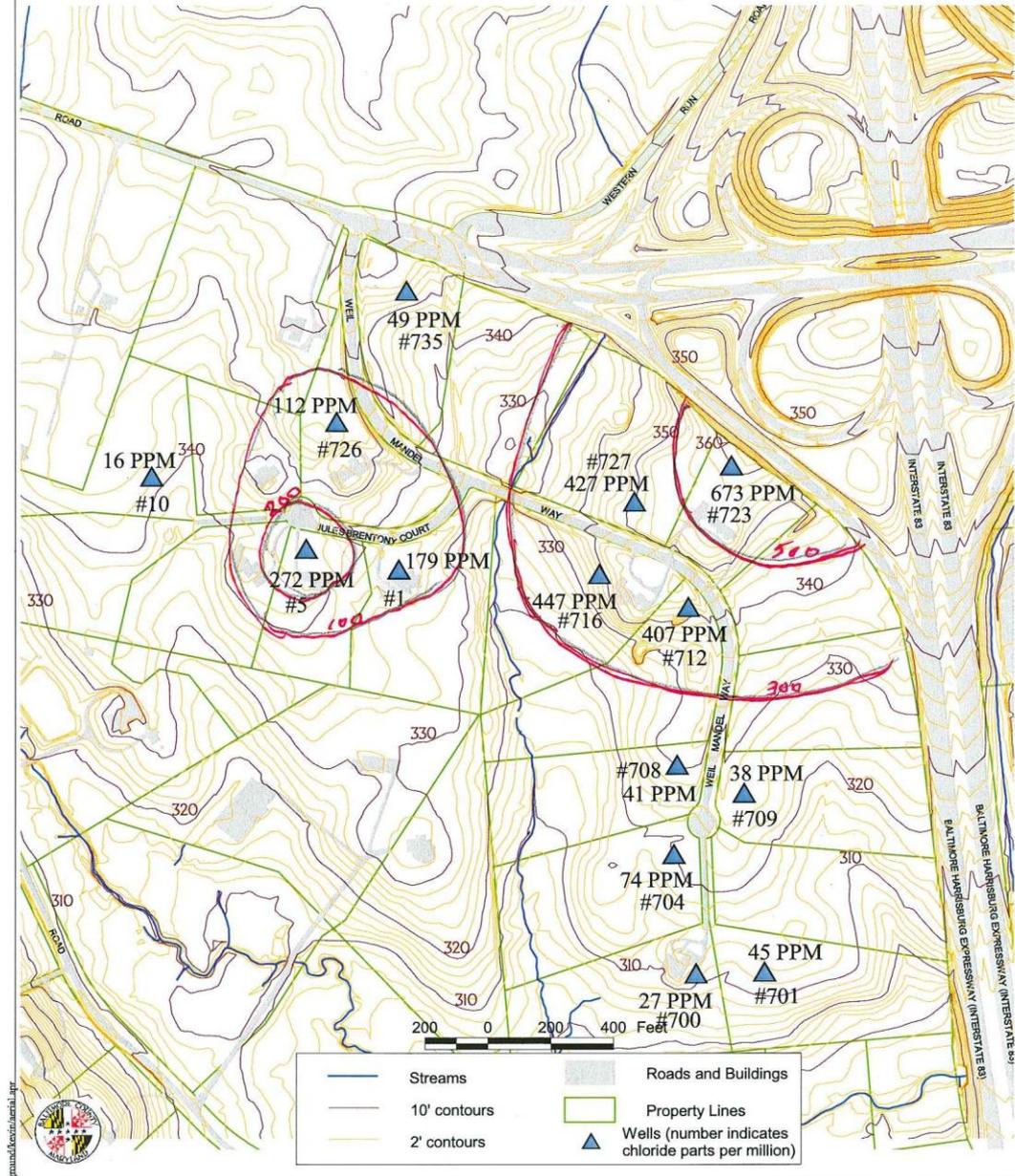
- **47 Residential Wells Are Offered Sampling Each Year for Landfill Monitoring**
- **Most wells are within 100 feet of either a State Rd (York Rd) or I –83. None downgradient of Landfill**
- **16 of 26 (60%) of Wells Sampled had Chlorides > 250 mg/l in 2006-2007. Highest level = 830 ppm**



## Example 2: Hunt Valley

- **14 wells sampled in 2003 based on a complaint**
- **28% had chloride levels > 250 ppm**
- **Highest concentrations at I-83 Interchange with Shawan Rd**

# SHAWAN AT HUNT VALLEY Baltimore County, Maryland



gmsand@mcwaters.com



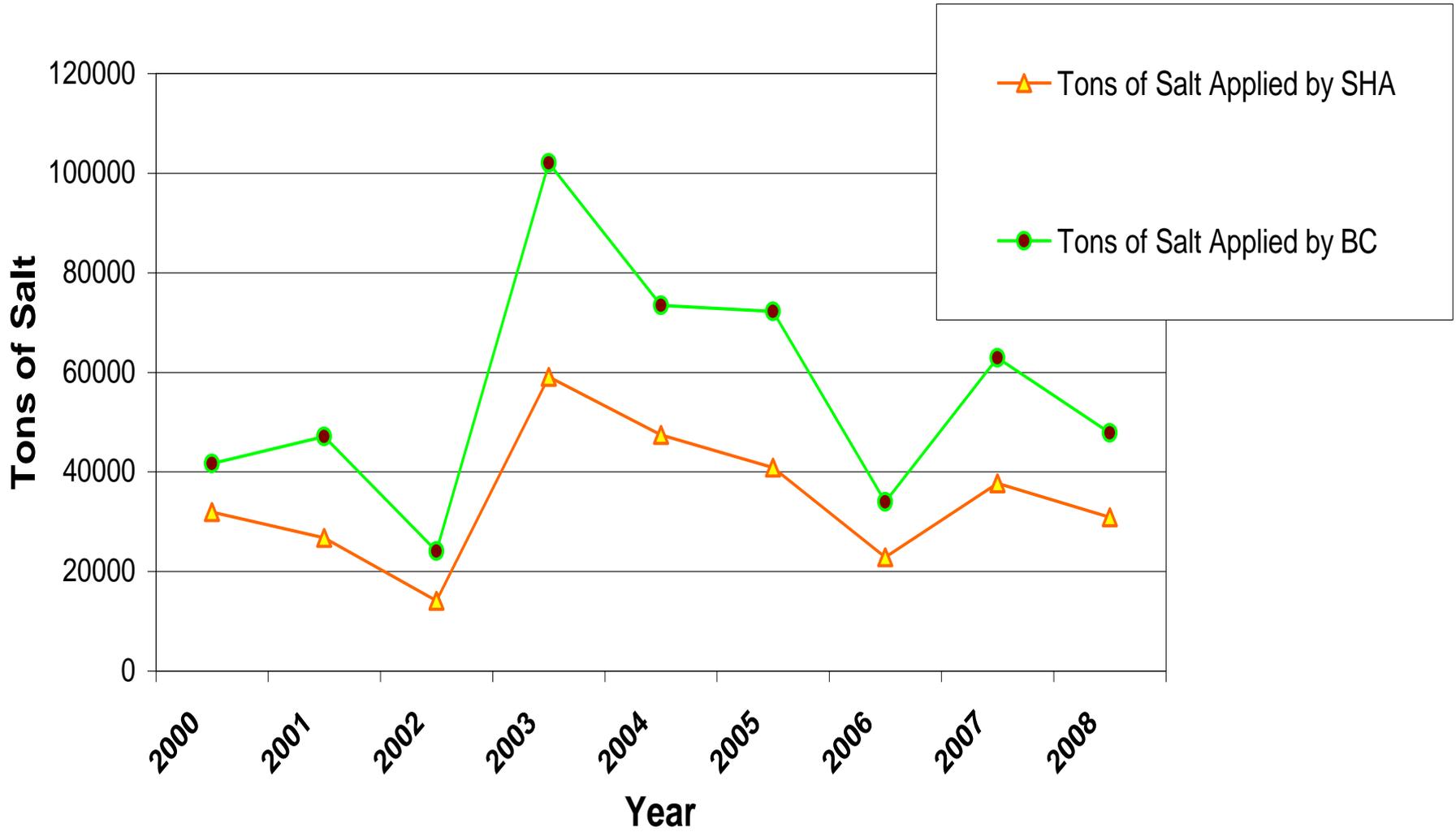
## Road Salt Usage in Baltimore County

Fiscal Year	Storm Events*	Est. Lane Miles Maintained by SHA	Tons of Salt			Est. Lane Miles Maintained by BC**	Tons of Salt	
			Tons of Salt Applied by SHA	Applied by SHA/Lane Mile/Event	Applied by BC		Applied by BC/Lane Mile/Event	
2000	6	1558	31931	3.4	6400	41668	1.1	
2001	6	1558	26741	2.9	6430	47051	1.2	
2002	2	1561	14128	4.5	6465	24105	1.9	
2003	15	1561	59054	2.5	6517	102042	1.0	
2004	10	1561	47420	3.0	6537	73380	1.1	
2005	10	1561	40804	2.6	6567	72232	1.1	
2006	4	1561	22878	3.7	6587	33947	1.3	
2007	7	1561	37697	3.4	6615	62858	1.4	
2008	7	1561	30901	2.8	6640	47806	1.0	
<b>AVE</b>	<b>7.44</b>		<b>34617</b>	<b>3</b>		<b>56121</b>	<b>1.2</b>	

\* According to SHA data

\*\* Lane Miles Estimated by Multiplying Linear Road Miles by 2.5

# Road Salt Applied in Baltimore County



# State vs. Baltimore County

→ State manages 20% of total lane miles

→ State uses nearly 3 x road salt/lane mile

→ Overall, State applies 60% of total (90,000 tons of road salt/yr)

# Water Softeners

→ Assuming 15,000 Systems in BC

→ Using 50 lbs Salt/Month

= 4,500 Tons of Salt/Year

= 5% of Total Road Salt Applied

# How to Manage Chlorides

- Remove From Water Using Reverse Osmosis (Very Inefficient)
- Drill New Well
- Educate Residents / Encourage Alternative Water Treatment Options

# Problems Related to R/O Treatment

- **High Cost (\$10 K - \$15 K)**
- **Very Inefficient (1-3 gallons of wastewater for each gallon of clean water)**
- **Poses Hydraulic Capacity Concern for Septic Systems**

# Challenges/ Needs for the Future

- **Initiate Study to Verify Extent of Chlorides Problems**
- **Look at Ways to Minimize Road Salt Usage**
- **Educate Residents / Encourage Alternative Water Treatment Options**