

# Groundwater Recharge Rates, Septic Density Recommendations & Impervious Impacts on Recharge

## All Part of the Watershed

State of the Hudson River Watershed  
Russell Urban-Mead, CPG, LEED AP®

The Chazen Companies

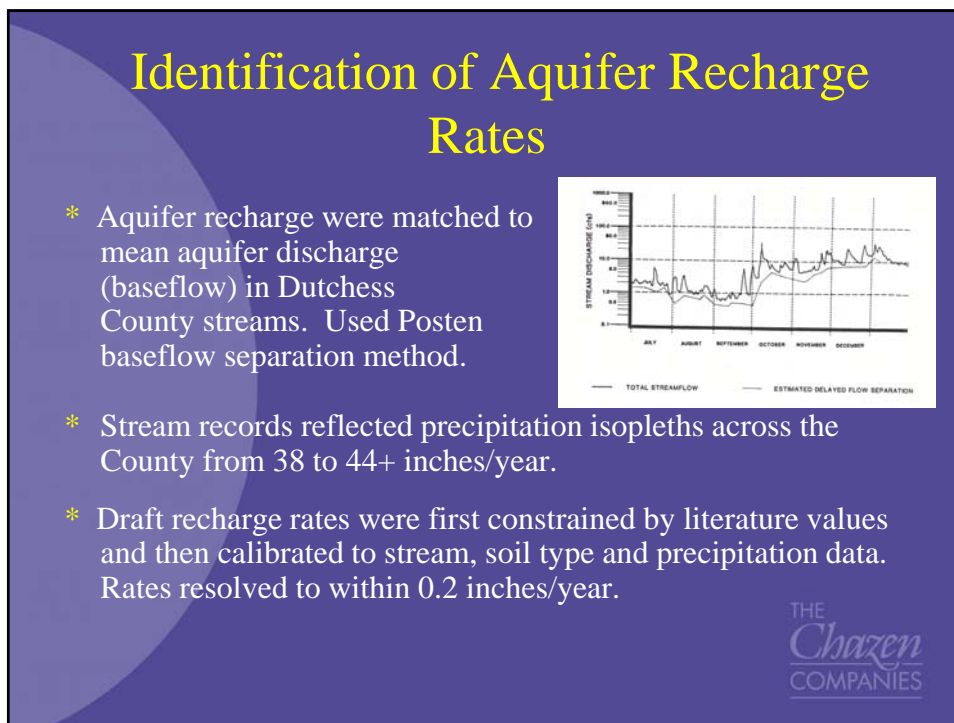
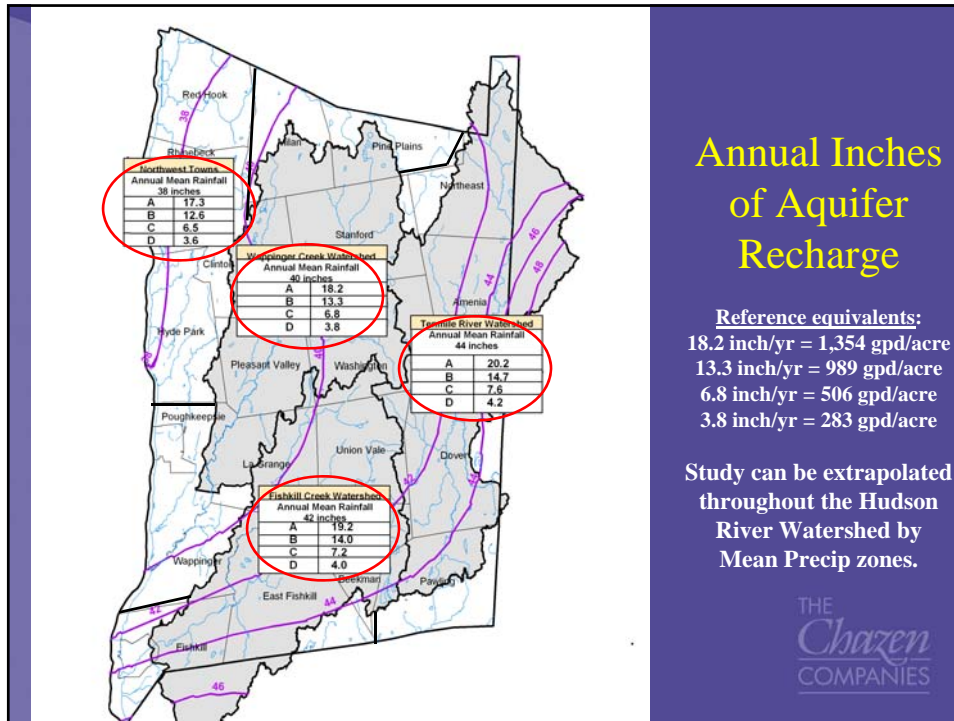
September 29, 2009

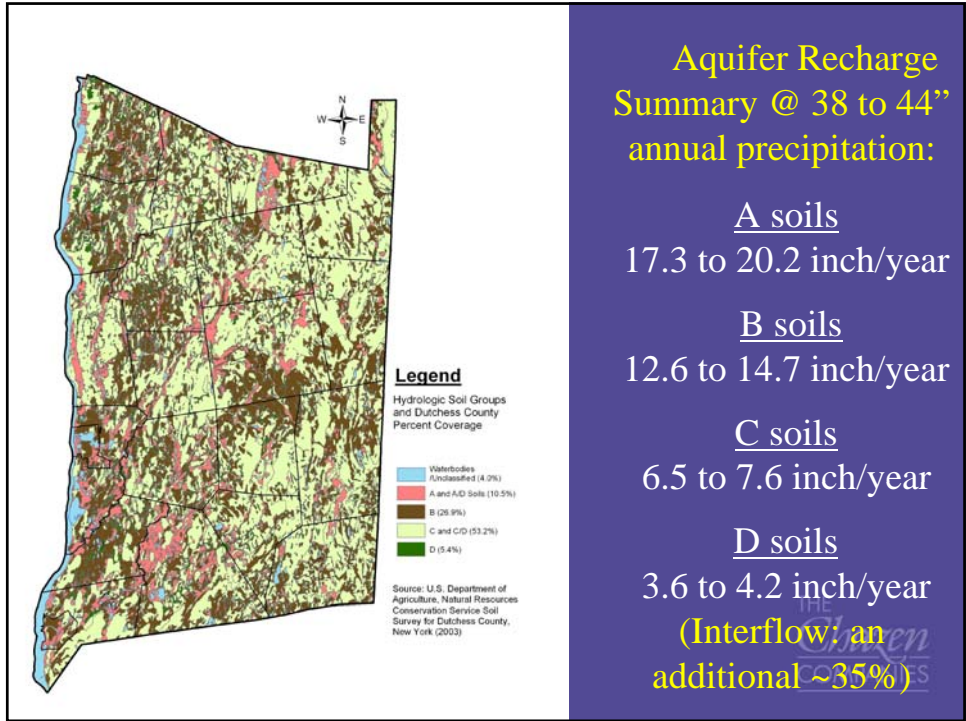


## DC Research on Aquifer Recharge, Sustainable Septic System Densities, Land Use Impacts on Aquifer Recharge

- **Aquifer Recharge Rate Study:** Critical to water supply budgets, ecological budgets and baseflow evaluations.
- **Application:** Sustainable septic system densities protective of public health & eco-resources.
- **Land Use Impacts on GW Recharge:** Impervious thresholds leading to aquifer recharge losses.







**Aquifer Recharge Summary @ 38 to 44" annual precipitation:**

A soils  
17.3 to 20.2 inch/year

B soils  
12.6 to 14.7 inch/year

C soils  
6.5 to 7.6 inch/year

D soils  
3.6 to 4.2 inch/year

(Interflow; an additional ~35%)

**Recharge Data are Useful for**

- \* Site or regional water balance studies
- \* Impact development analyses (along with impervious cover consideration)
- \* Streamflow studies (along with interflow adding ~35%).

**Example:** a 40 acre site in an area with 40 inches/precip per year with 25% HSG B and 75% HSG C would convey:

unit adjustment factor

$$10 \text{ acres at } 13.3 \text{ inch/year} \times 74.4 = 9,895 \text{ gpd}$$

$$30 \text{ acres at } 6.8 \text{ inch/year} \times 74.4 = 15,178 \text{ gpd}$$

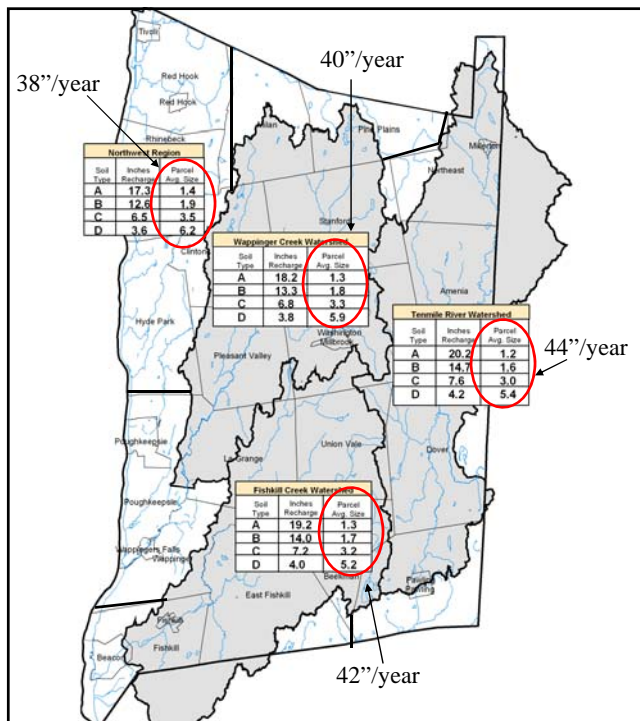
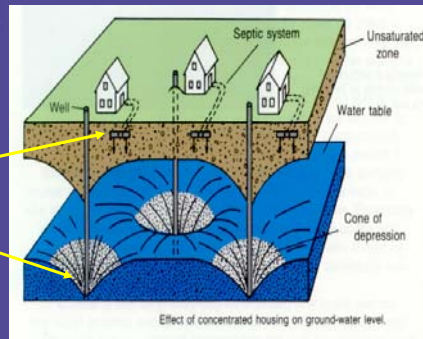
$$25,073 \text{ gpd (17.4 gpm)}$$



# Well and Septic Density Analysis

- Density recommendations for areas using domestic wells & traditional septic systems.
- A tool for community analysis.
- Nitrate GW model for persistent contaminants.

Recharge Dilutes Wastewater  
 Recharge Supports Wells



Minimum Average Recommended Parcel Sizes for areas with domestic wells and septic systems, based on different precipitation zones

Results can be applied throughout the Hudson River Watershed by Mean Precip. zones.



## Septic Density Calculations

Recharge dilutes wastewater and supports wells.

High recharge allows close wells and septics.

Low recharge warrants more separation.

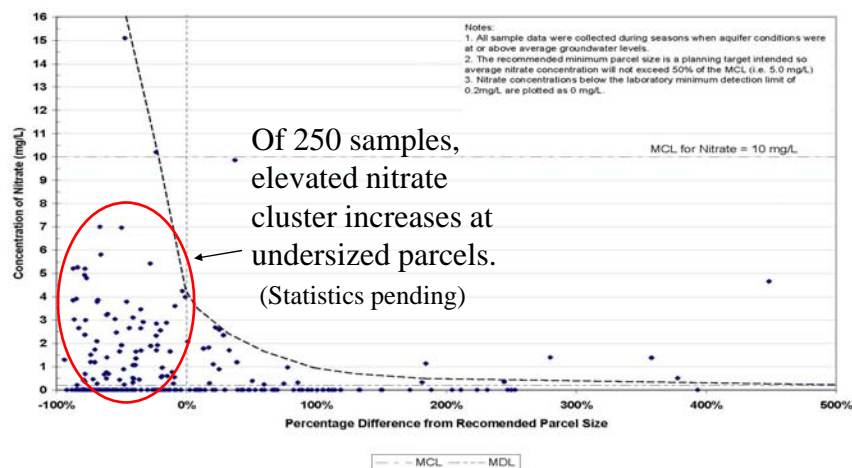
- Use new Aquifer Recharge rates. ( R )
- Wastewater nitrate target of 1/2 drinking standard (Cq)
- Adjust for occupancy levels. (H) (Default is 2.6 per household)
- Allowance for drained impervious roofs & driveways. (Isc) (default Isc is 0.1 acres per parcel)
- Assumes 10 lbs annual nitrogen release per capita (M)

$$A = I_{sc} + (4.4186)HM/CqR$$

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## Sampling Data and the Model

Figure 1: Nitrate Concentrations found in Well Water Throughout Dutchess County Compared to Percentage Difference Between Recommended Parcel Size and Actual Parcel Size.



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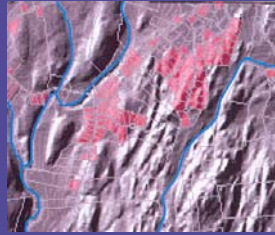
## Septic Minimum Density Data are Useful for

- \* Regional planning & zoning
- \* Determining central service needs
- \* Project & watershed sustainability

**Example 1:** the 40 acre site with 25% HSG B and 75% HSG C will sustain

$$\begin{aligned} 10 \text{ acres with } 1.8 \text{ acre/system} &= 5.6 \\ 30 \text{ acres with } 3.3 \text{ acre/system} &= \frac{9.9}{15 \text{ homes}} \end{aligned}$$

**Example 2:** Inventory where water & sewer may be needed in unserviced areas



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## Land Use and Aquifer Recharge

### Storms aside...

- Measurable Precipitation: 125 days/year
- 53 days/year with precip over ¼ inch
- Of the 53 days over ¼ inch:
  - median precip is 0.5 inches
  - average precip is 0.71 inches
- Only 15 days/year exceed ¾ inch of precip and only 7 days/year exceed 1.25 inches.

**The POINT: Most Rainfall is Modest**

Source: CIES data, Millbrook NY, 1996 to 2006 record

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## Land Use Impacts on Aquifer Recharge

### Next Points:

- TR-55 identifies negligible runoff increases for events up to 0.8 inches except “commercial” and “industrial” LUNR classes with >30 percent impervious.
- NJ Geologic Survey has found that 80% of total annual recharge occurs during precipitation events <1.25 inches.

**The POINT:** Little aquifer recharge is lost until large areas with connected impervious surfaces exceed +30%.

**This explains:** why drought stream flow reductions are not being observed in watersheds in spite of land use changes.

(This threshold differs from 10-20% imperv that accelerates stormwater damage.)

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## Resources

### Available free

- Aquifer Recharge Study and Septic Density Study
  - Model Aquifer Protection Ordinance

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### Also available free from Dutchess County website

[www.co.dutchess.ny.us](http://www.co.dutchess.ny.us)

*then* County Government

*then* Departments

*then* Water & Wastewater Authority  
to find report listed on left column

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