Why Soil Health Matters to Stormwater Runoff

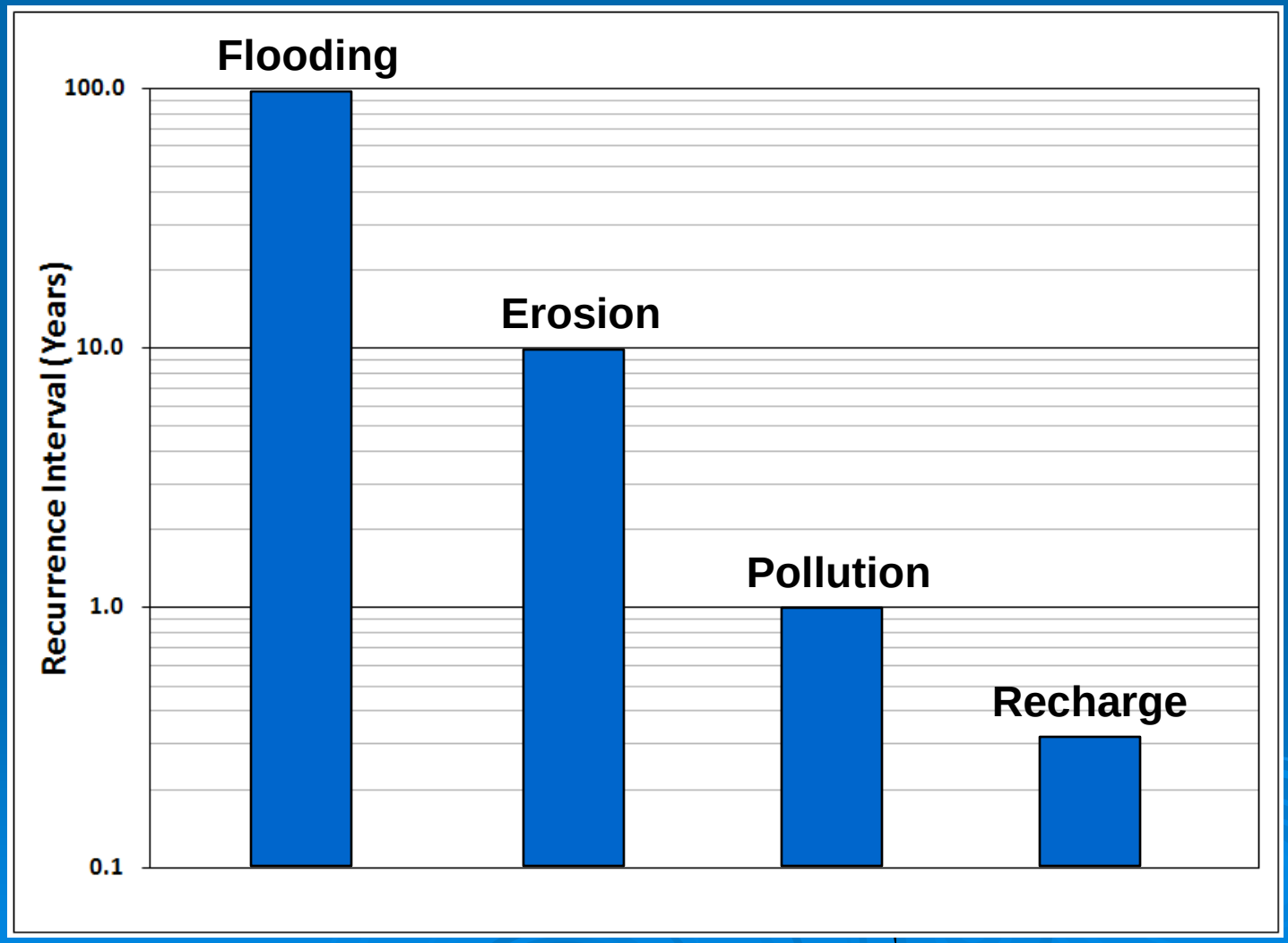
First Annual Soil Health Conference

March 9, 2010

Stormwater Management Goals

- Pre-1970 - Drainage
- 1970s - Flood and Erosion Control
- 1980s - Watershed Planning
- 1990s - NPS Pollution Control
- 2000s - Groundwater Recharge
- 2010s - Soil Health?

Rainfall Focus



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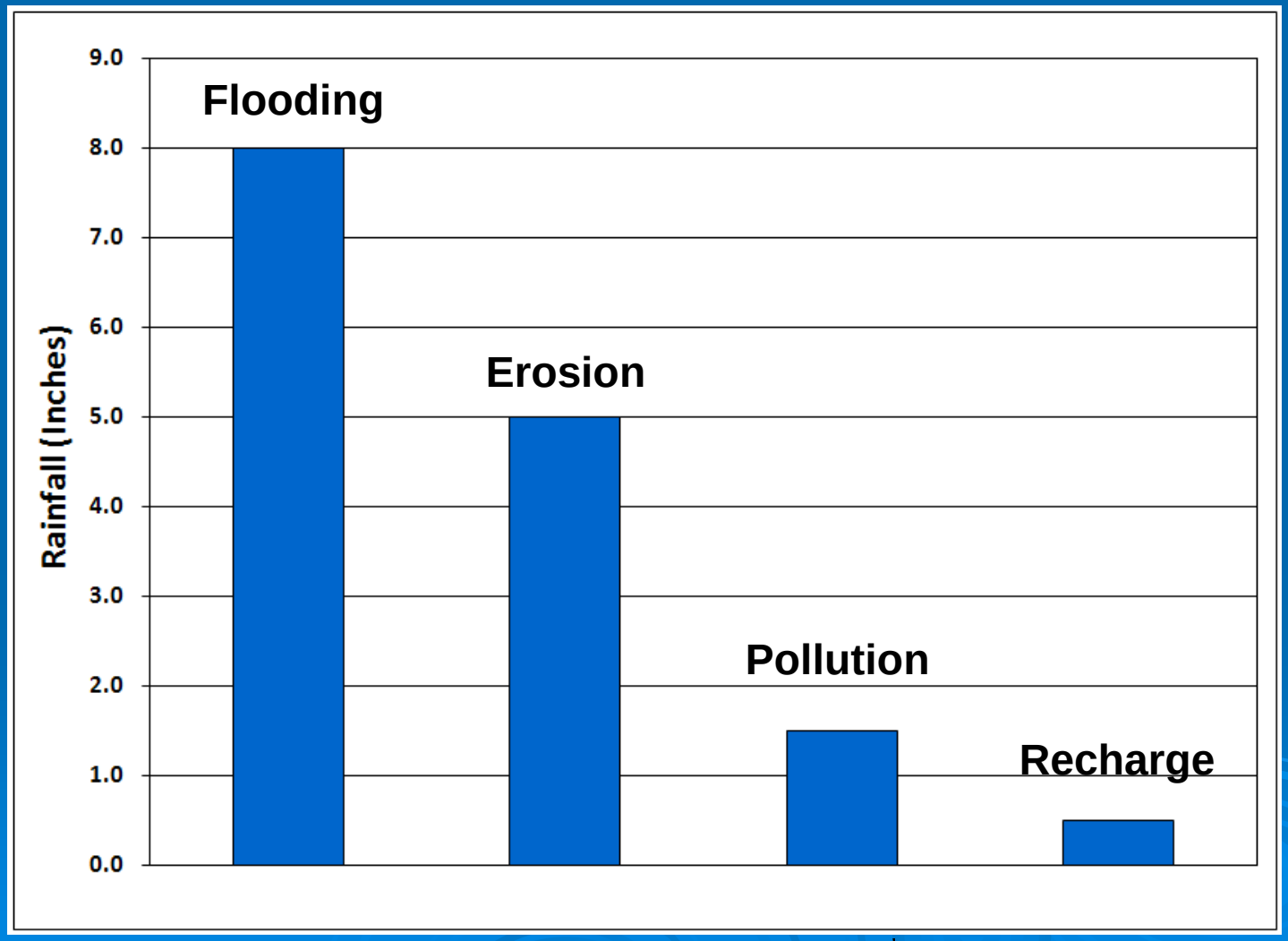
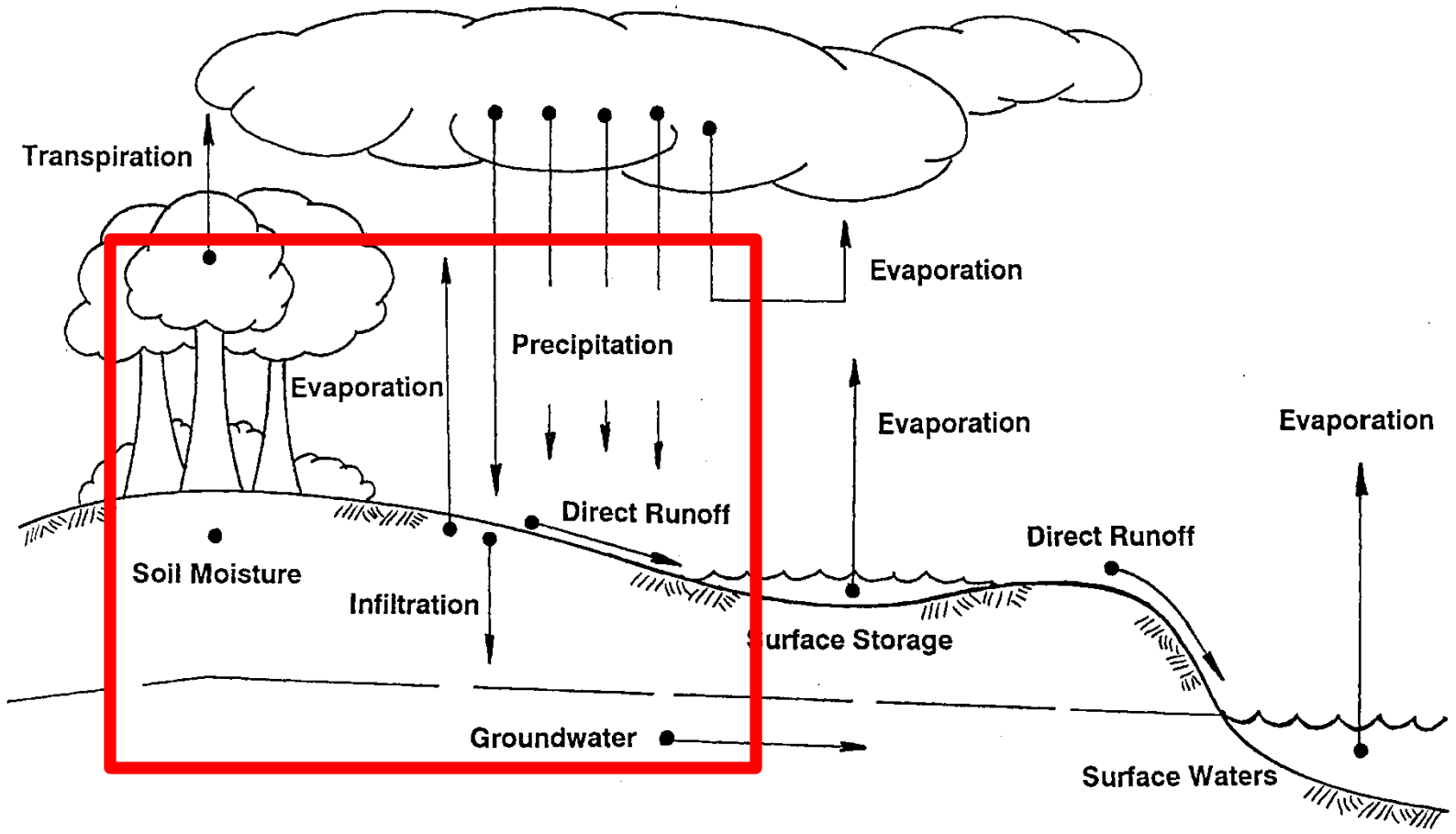


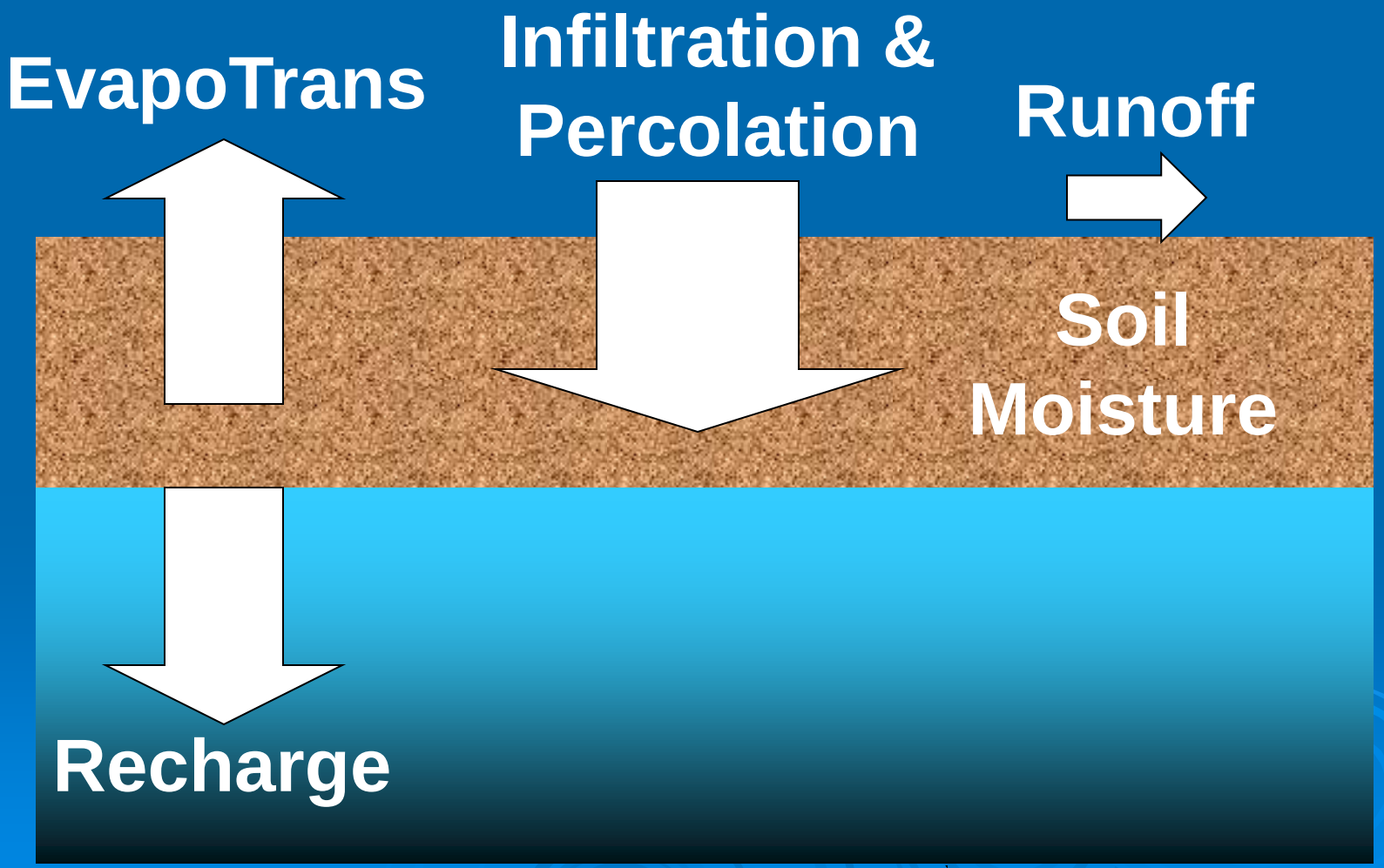
Why Soil Health Matters

Hydrologic Cycle

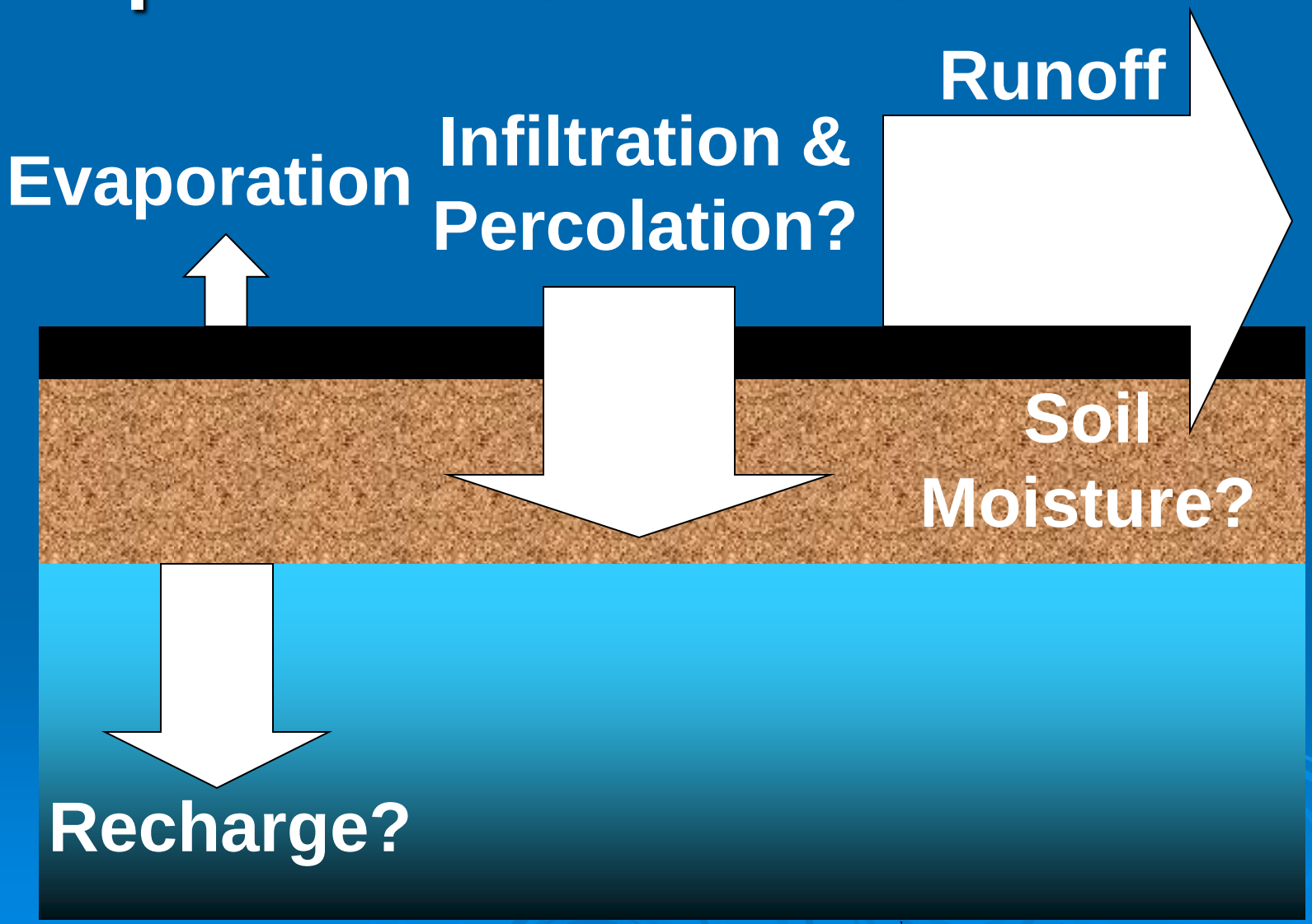


Source: NJDEP Stormwater BMP Manual

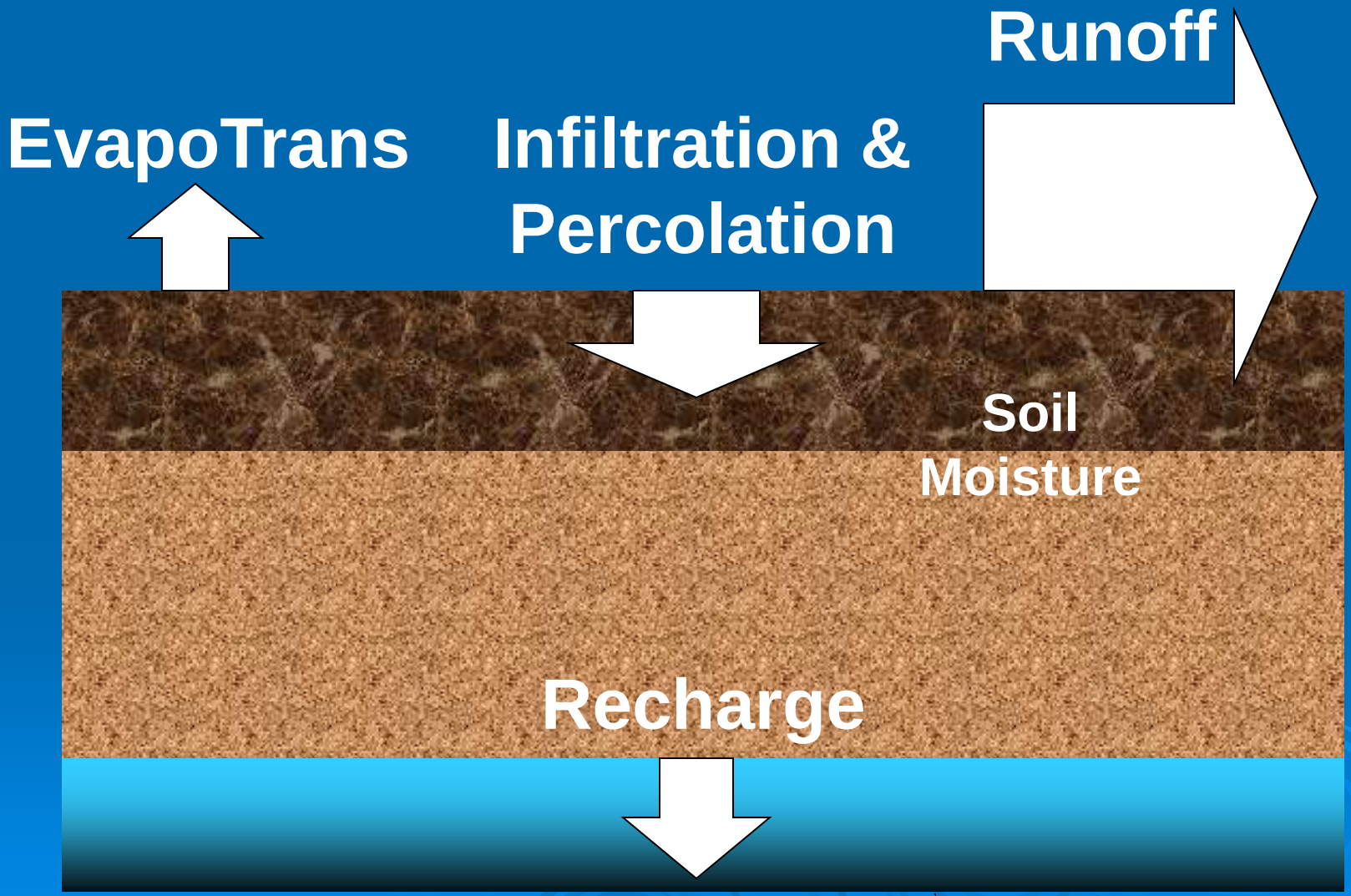
Pervious Soil Conditions



Impervious Surface Conditions



Compacted Soil Conditions



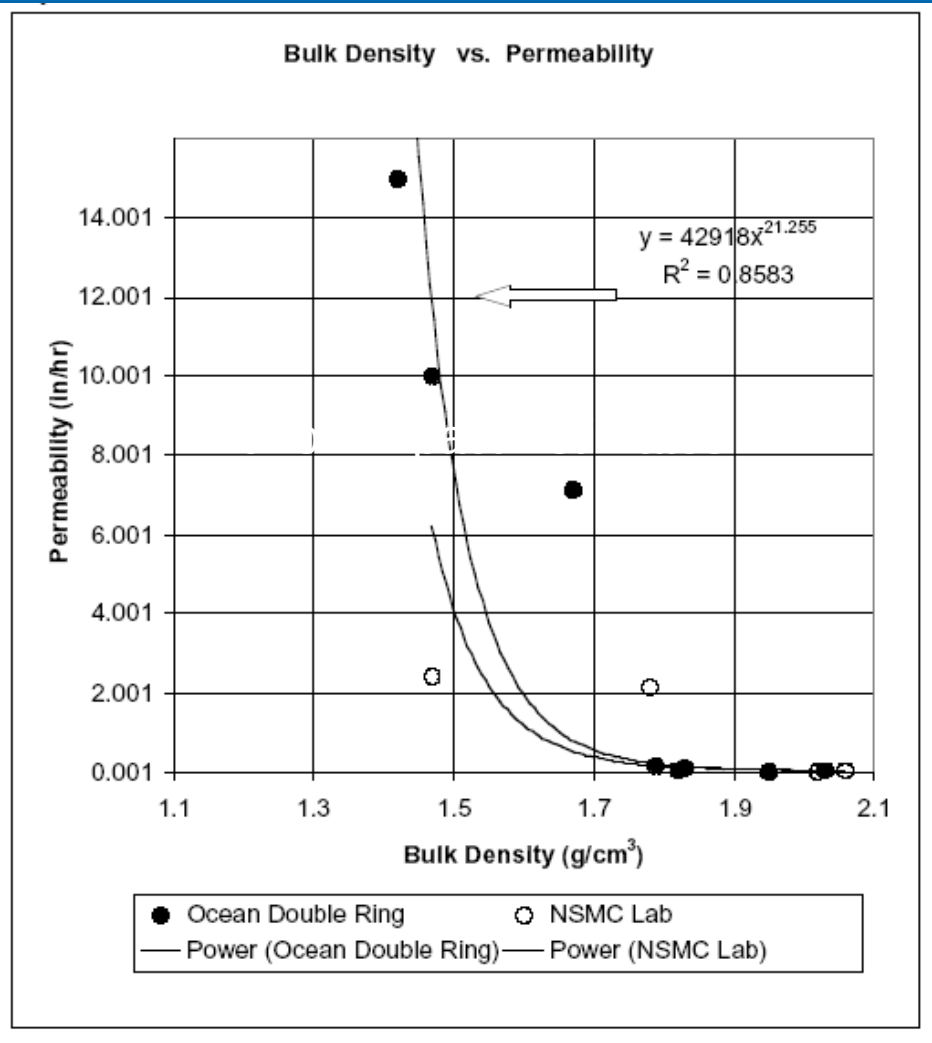
Runoff Impact Estimates

- NRCS Runoff Equation
- Hydrologic Soil Groups
  - A - Sandy - High Permeability
  - B - Loamy - Moderate Permeability
  - C - Silty - Low Permeability
  - C - Clayey - Very Low Permeability
- Vegetated Cover Condition
  - Good - Fair - Poor

Runoff Impact Estimates

- Research Indicates Compaction Can:
  - Reduce HSG B Permeability to HSG D
  - Reduce Good Cover to Poor
- Research Includes:
  - Pitt, Lantrip, & Harrison (1999)
  - Ocean County SCD & Schnabel (2001)
  - Gregory, Dukes, Jones, & Miller (2006)

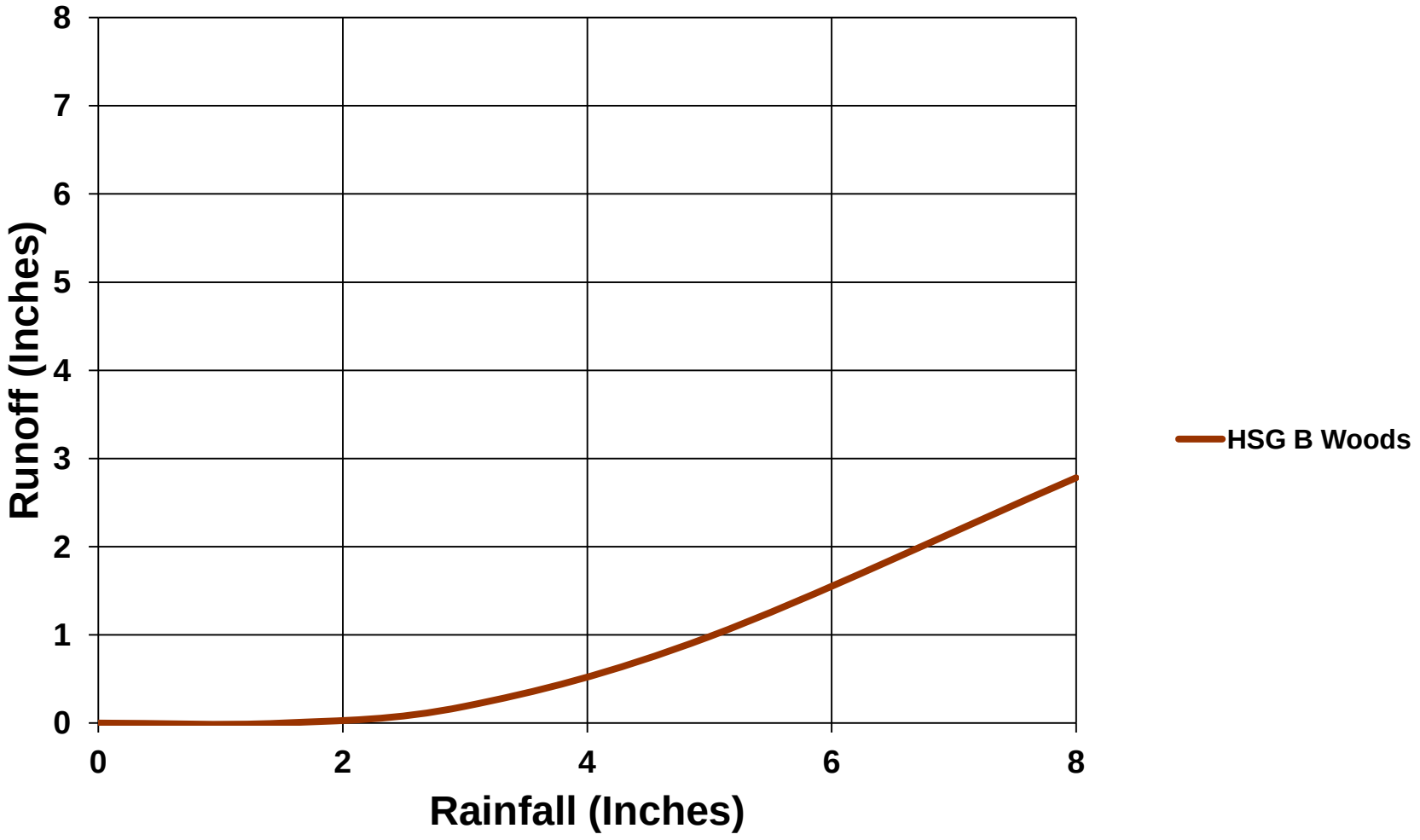
From Ocean County SCD & Schnabel



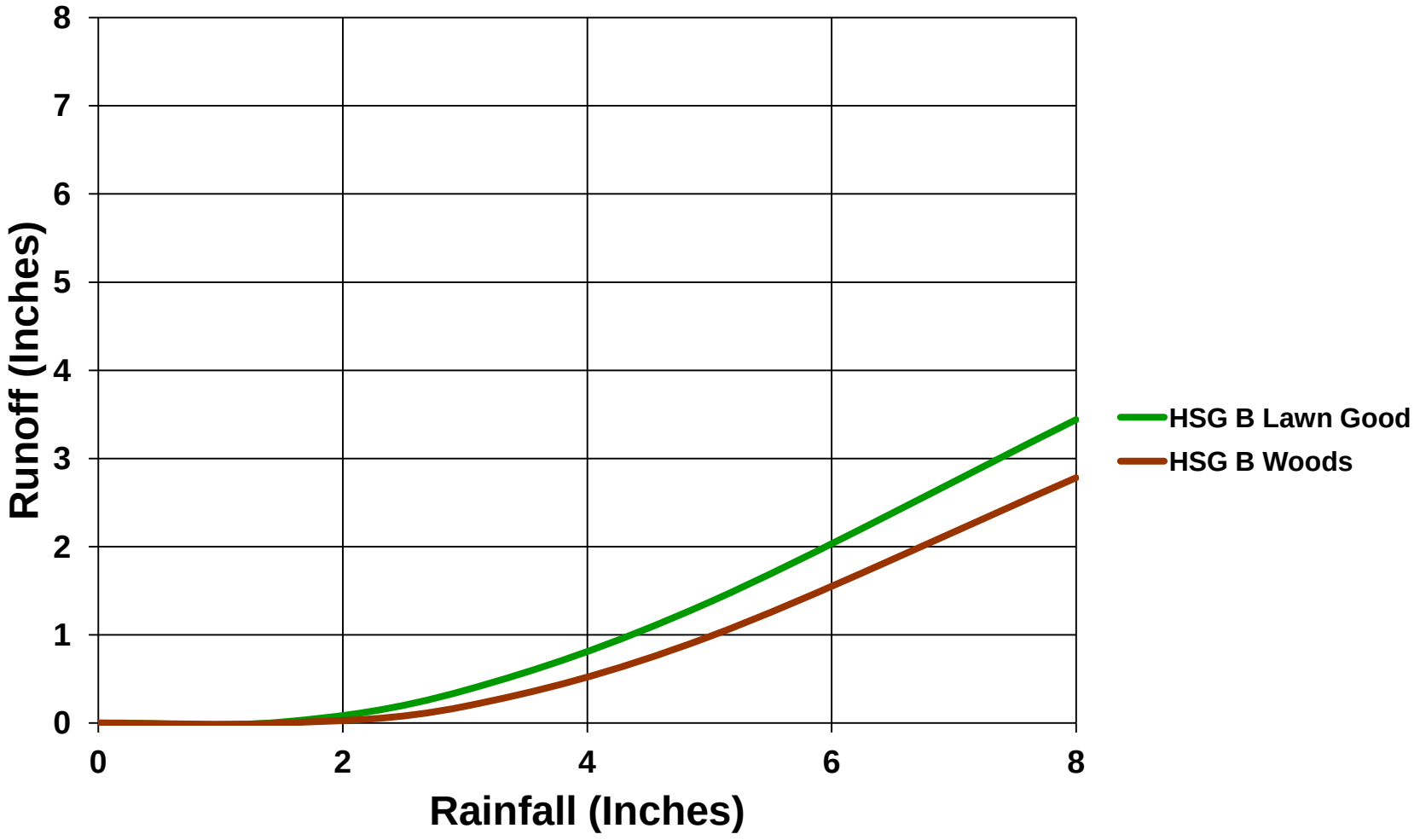
Runoff Impact Estimates

1. Woods with HSG B Soils
2. Lawn with HSG B Soils and Good Cover
3. Lawn with HSG D Soils and Good Cover
4. Lawn with HSG D Soils and Poor Cover
5. Impervious Cover

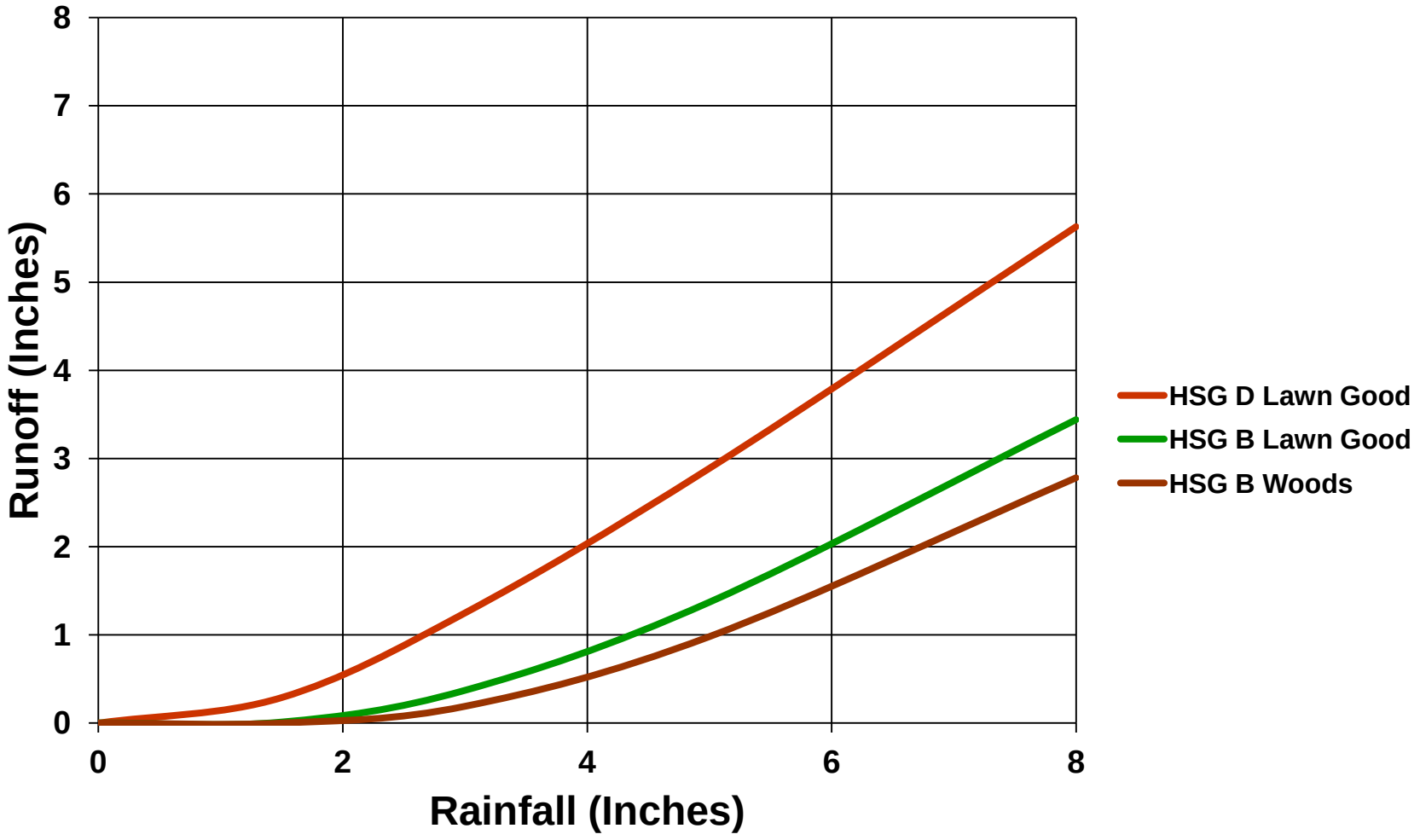
NRCS Runoff Estimates



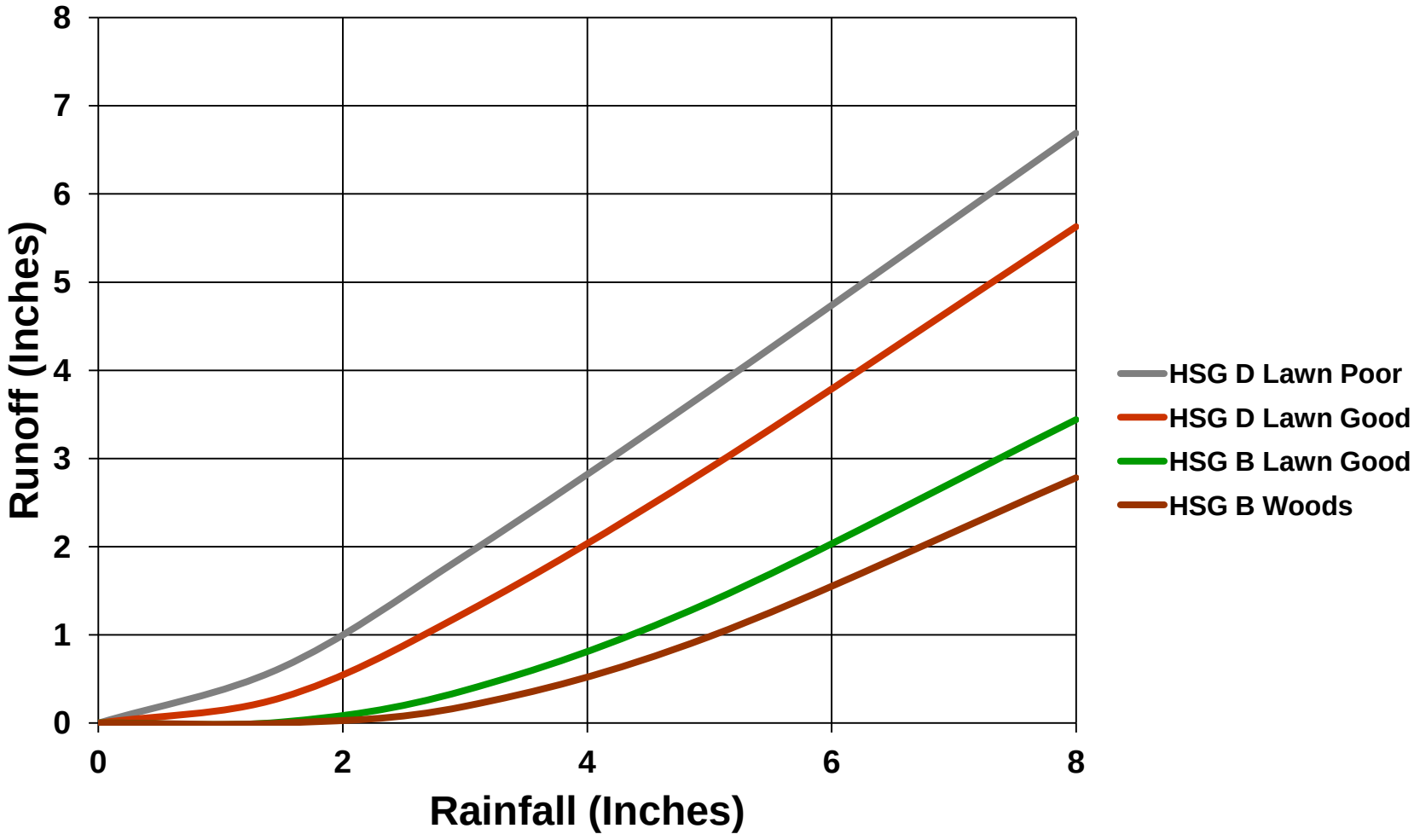
NRCS Runoff Estimates



NRCS Runoff Estimates



NRCS Runoff Estimates



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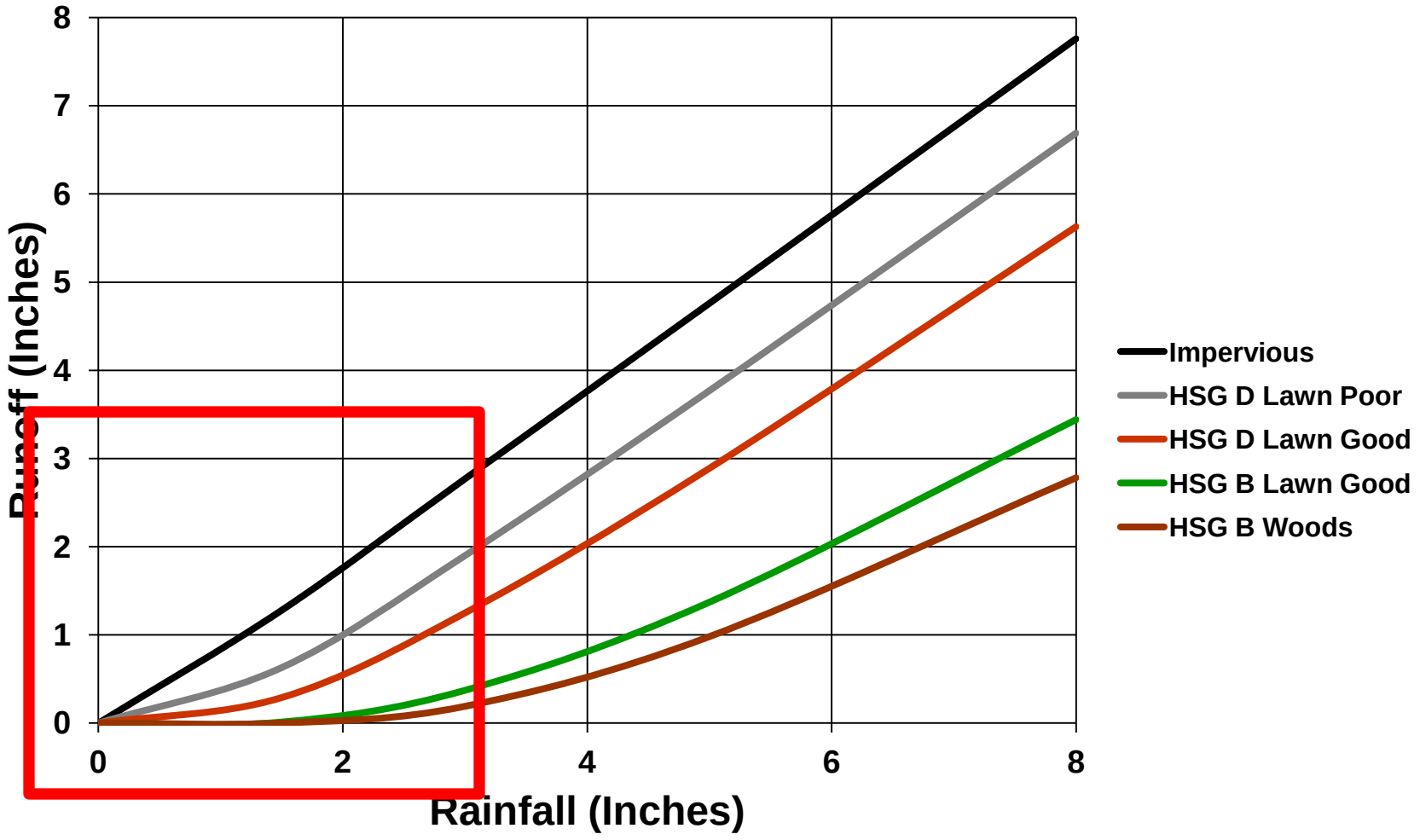

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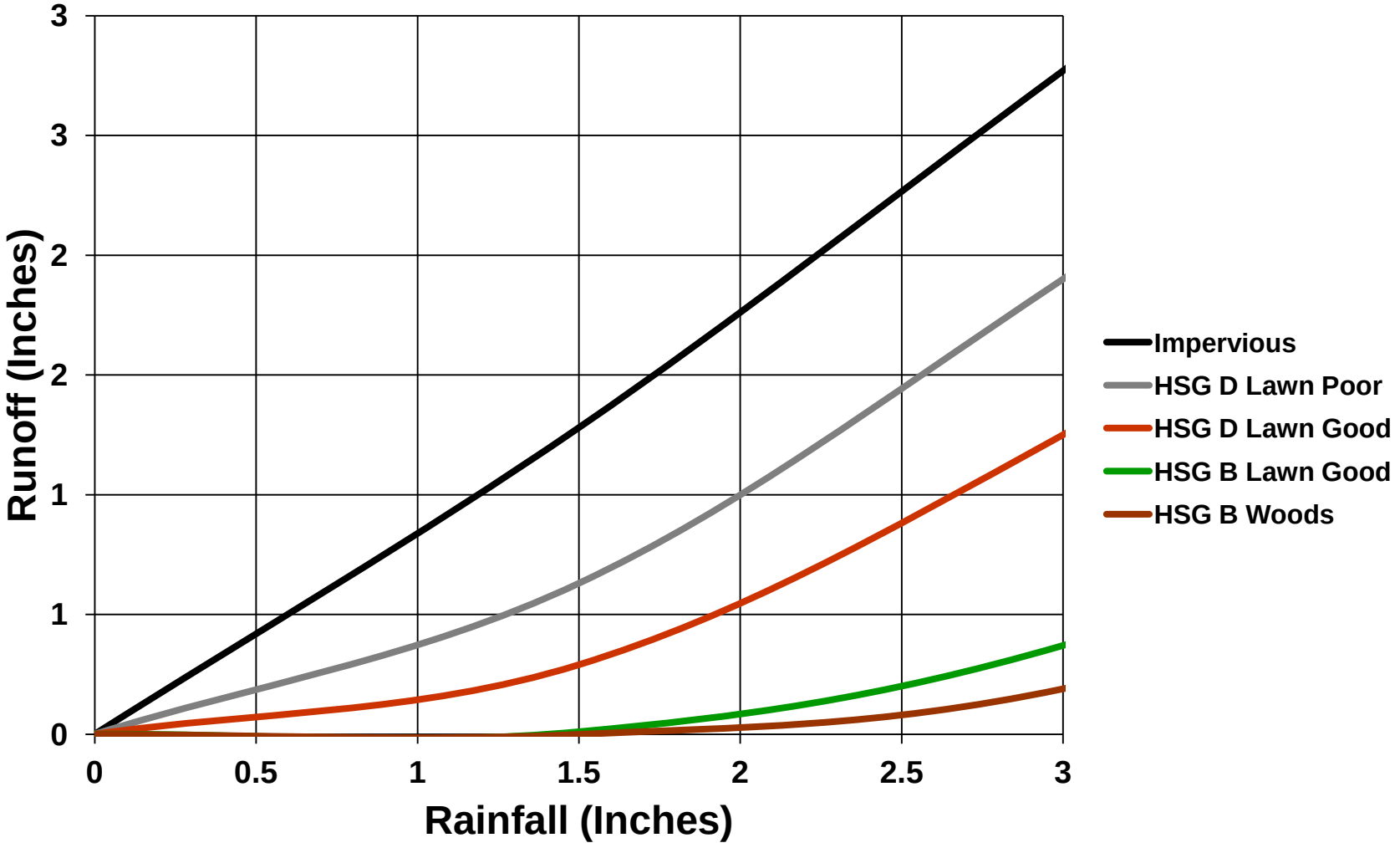

Rainfall Focus

- From New Jersey Rainfall Data Research by USGS:
  - On Average, 3 Inches of Rain is Largest Daily Rainfall in One Year
  - Approximately 75% of All Rains in One Year are 1.5 Inches or Less
- Therefore, Extreme Runoff Impacts of Compaction on Virtually All Rainfalls

Runoff Impact Estimates

- Research by Horner and May Indicate that for Up to 40% Watershed Impervious Cover, Majority of Environmental Damage to Water Resources Caused by Increased Runoff Volume, Not Runoff Pollutants
- Therefore, Control of Compaction Vital to All Our Stormwater Management Goals

Conclusions

- Healthy Soils have Greater Permeability than Unhealthy Soils
- Compaction Alters Healthy Structure and Reduces Permeability
- Reduced Permeability = Increased Runoff
- Increased Runoff = Increased Damage

Still To Solve

- Knowledge and Communication Gap Between Soil Scientists and Stormwater Engineers
  - Quantifying Impacts
  - Restoration Techniques
- Compaction Impacts on Runoff Largely Unregulated
  - NJDEP Nonstructural Strategies

References

- Robert Pitt, Ph.D., Janice Lantrip, and Robert Harrison, Infiltration Through Disturbed Urban Soils and Compost-Amended Soil Effects on Runoff Quality and Quantity, USEPA, 1999.
- Ocean County Soil Conservation District, Schnabel Engineering Associates, Inc., and USDA Natural Resources Conservation Service, The Impact of Soil Disturbance During Construction on Bulk Density and Infiltration in Ocean County, New Jersey, 2001.
- J. H Gregory, M.D. Dukes, P.H. Jones, G.L. Miller, Effect of Urban Soil Compaction on Infiltration Rate, Journal of Soil and Water Conservation, May 1, 2006.
- Natural Resources Conservation Service, Technical Release 55 - Urban Hydrology for Small Watersheds, June 1986.
- New Jersey Department of Environmental Protection, Stormwater Best Management Practices Manual, April 2004

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