Understanding Hydrologic Soil Groups

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What's a Hydrologic Soil Group (HSG)?

That thing I input into TR-55!

Generalized Assessment of how a soil drains

Developed in the 1950's

Intended use was for sizing road culverts on farms

Hydrologic Soil Groups

There are ~20,000 Soil Series in the U.S.

All Soils are grouped as A, B, C, D

- A – soils that readily drain
- D – soils that very slowly drain

If impervious surfaces are being added…

- A – a lot of stormwater must be attenuated
- D – less stormwater must be attenuated

This is the most-searched feature on the Web Soil Survey.

Hydrologic Soil Groups

HSG A

HSG D

HSG Guidance

USDA-NRCS National Engineering Handbook
Chapter 7, Part 630

Soils with no Water Impermeable layer to 40 inches

Depth to Water Impermeable Layer (in)	Depth to Redoximorphic Features (in)	Infiltration Rate in Least Permeable Layer (in/hr)	HSG
>40	>40	>1.42	A
20-40	24-40	>0.57	B
20-40	24-40	>0.06	C
<20	<24	< 0.06	D

HSG Guidance

USDA-NRCS National Engineering Handbook
Chapter 7, Part 630

Soils with a Water Impermeable Layer between 20 and 40 inches

Depth to Water Impermeable Layer (in)	Depth to Redoximorphic Features (in)	Infiltration Rate in Least Permeable Layer (in/hr)	HSG
20-40	24-40	>5.67	A
20-40	24-40	>1.42	B
20-40	24-40	>0.14	C
20-40	24-40	< 0.14	D

HSG Determination

Soils were originally assigned to hydrologic soil groups based on measured rainfall, runoff, and infiltrometer data (Musgrave 1955). Since the initial work was done to establish these groupings, ***assignment of soils to hydrologic soil groups has been based on the judgment of soil scientists****.*

So…we are basing our detailed calculations on an estimate???

HSG Guidance

USDA-NRCS National Engineering Handbook
Chapter 7, Part 630

IT IS AN HSG D SOIL IF:

- You have a fragipan, bedrock, or urban dense horizon within 20 inches of the soil surface

- You have evidence of a seasonal high water table within 24 inches of the soil surface.

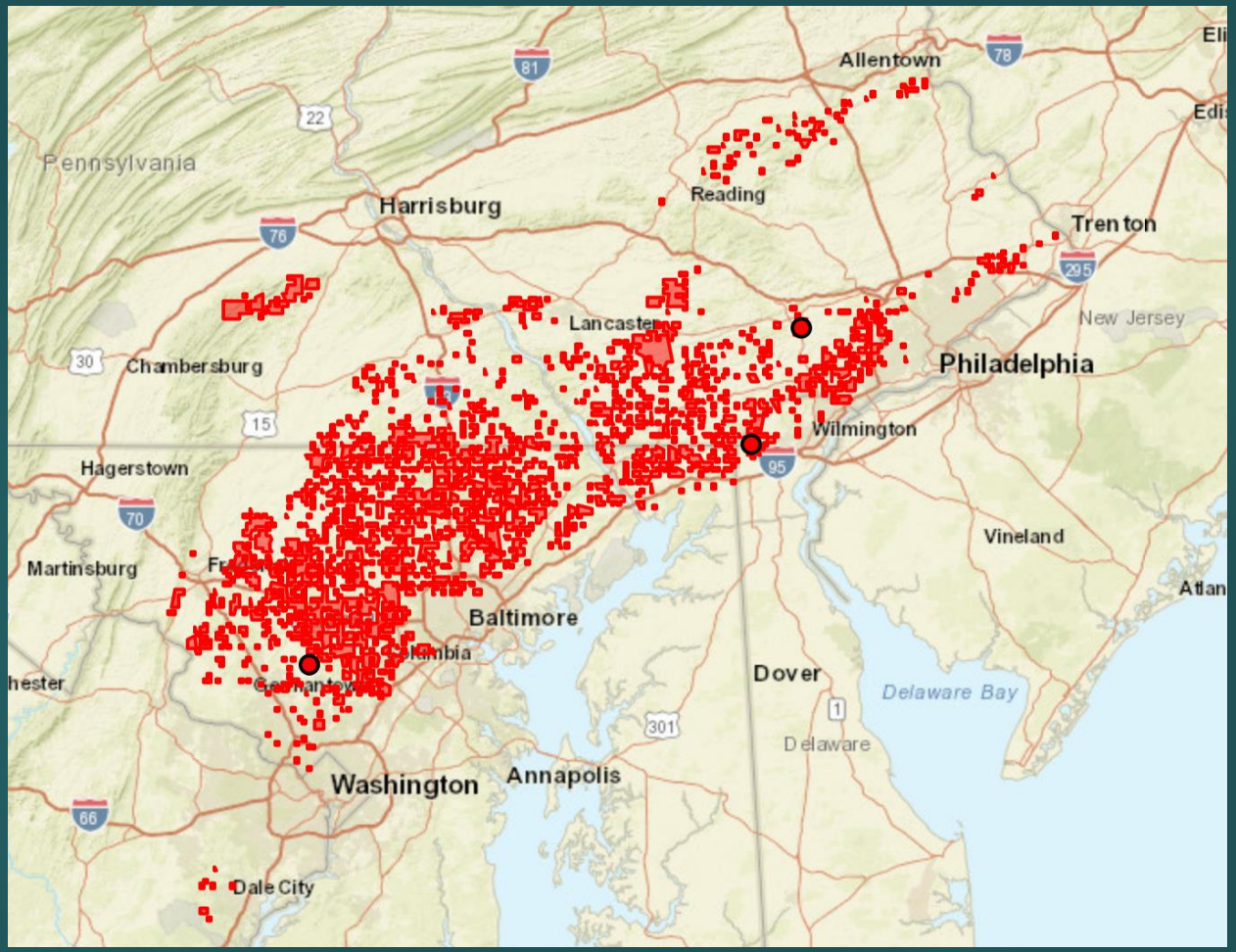
HSG Variability Within Soil Series

Range in Characteristics:

Depth to Water Impermeable Layer: 18-36" (C or D)

Depth to REDOX: 6-36" (C or D)

GLENVILLE SOIL SERIES



HSG Variability Within Soil Map Units

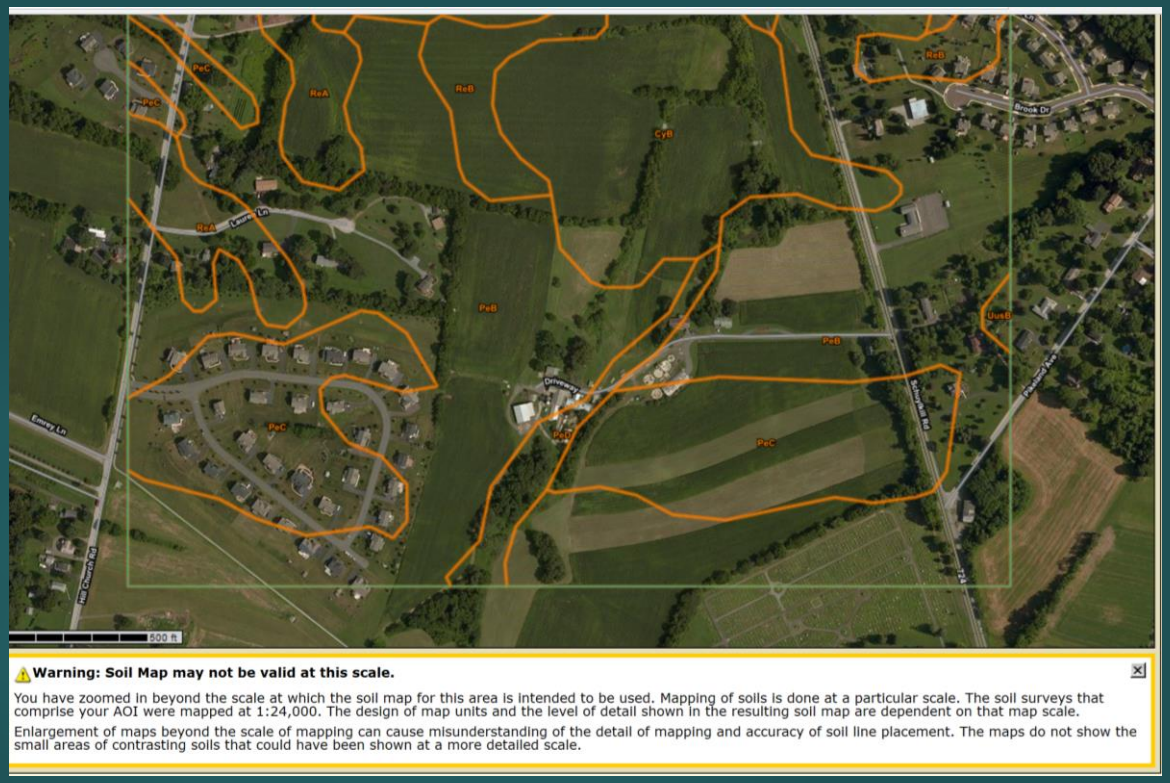
Chester County, PA

100-acre property

Soils developed in red shale of Brunswick Formation

Majority HSG of B (purple)

IS THE MAP EVEN ACCURATE???



Warning: Soil Map may not be valid at this scale.

You have zoomed in beyond the scale at which the soil map for this area is intended to be used.

Mapping of soils is done at a particular scale. The soil surveys that comprise your AOI were mapped at 1:24,000. The design of map units and the level of detail shown in the resulting soil map are dependent on that map scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Soil Survey Reliability

28 test pits investigation

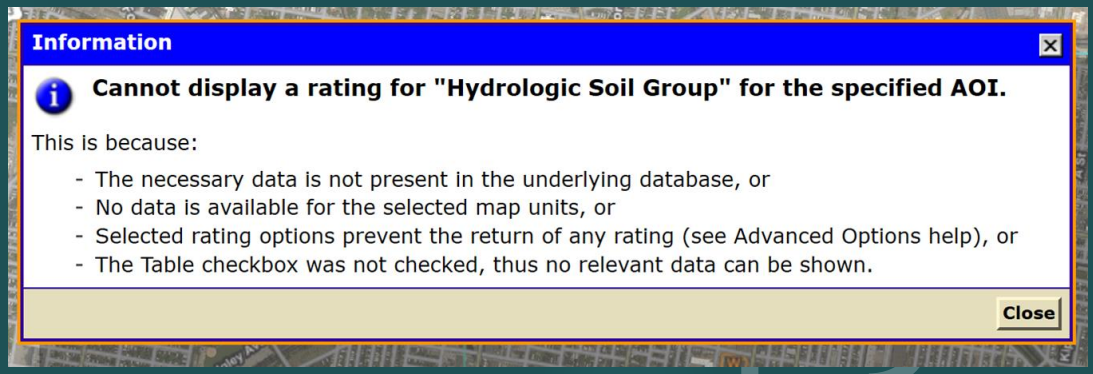
Classification matched in 3 of 28 test pits

1963 Soil Survey did not recognize wind-blown silts (loess) in soils

Majority of HSG is actually D, not B

Test Pit #	Soil mapped as	Hydrologic Soil Group	Soil classified as	Hydrologic Soil Group
1	Penn	B	Abbottstown	D
2	Penn	B	Chalfont	D
3	Penn	B	Penn	B
4	Penn	B	Penn	B
5	Penn	B	Doylestown	D
6	Penn	B	Doylestown	D
7	Penn	B	Chalfont	D
8	Penn	B	Chalfont	D
9	Penn	B	Chalfont	D
10	Penn	B	Chalfont	D
11	Penn	B	Lawrenceville	D
12	Penn	B	Lawrenceville	D
13	Penn	B	Lawrenceville	D
14	Penn	B	Penn	B
15	Penn	B	Reaville	D
16	Penn	B	Reaville	D
17	Penn	B	Reaville	D
18	Croton	D	Lawrenceville	D
19	Croton	D	Lawrenceville	D
20	Croton	D	Lawrenceville	D
21	Croton	D	Lawrenceville	D
22	Croton	D	Lawrenceville	D
23	Croton	D	Lawrenceville	D
24	Croton	D	Bucks	B
25	Readington	C	Lawrenceville	D
26	Readington	C	Lawrenceville	D
27	Readington	C	Lawrenceville	D
28	Readington	C	Reaville	D

What do we do about Urban Land???



A Former Foundry

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
PeD	Penn silt loam, 15 to 25 percent slopes	1.8	5.7%
UdtB	Udorthents, shale and sandstone, 0 to 8 percent slopes	29.2	93.9%
W	Water	0.1	0.4%
Totals for Area of Interest		**31.0**	**100.0%**

A Former Foundry

HSGs in Urban Soils

USEPA Office of Research and Development
Cleveland, OH Slavic Village Project

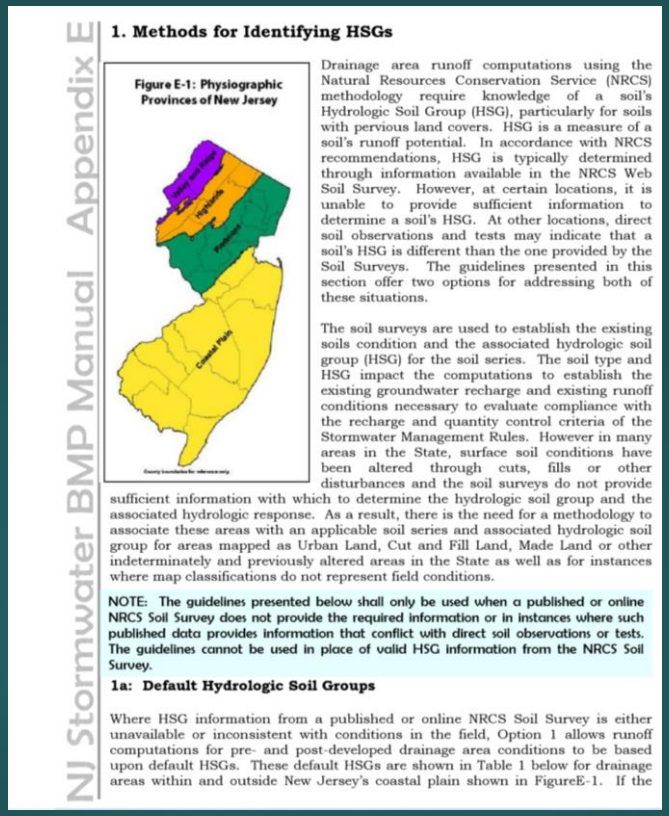
Land Use Type	Surface Permeability Rate (in/hr)	Subsurface Permeability Rate (in/hr)
Fill Area	0.20	0.13
Native Area	0.36	0.04

How do you determine HSG?

- Dig a hole/boring
- Identify least permeable layer
- Measure permeability rates

- <u>Is this more accurate than an estimate made in an office?</u>

How do you determine HSG?



NJ Stormwater BMP Manual Appendix E

1. Methods for Identifying HSGs

Figure E-1: Physiographic Provinces of New Jersey

Drainage area runoff computations using the Natural Resources Conservation Service (NRCS) methodology require knowledge of a soil's Hydrologic Soil Group (HSG), particularly for soils with pervious land covers. HSG is a measure of a soil's runoff potential. In accordance with NRCS recommendations, HSG is typically determined through information available in the NRCS Web Soil Survey. However, at certain locations, it is unable to provide sufficient information to determine a soil's HSG. At other locations, direct soil observations and tests may indicate that a soil's HSG is different than the one provided by the Soil Surveys. The guidelines presented in this section offer two options for addressing both of these situations.

The soil surveys are used to establish the existing soils condition and the associated hydrologic soil group (HSG) for the soil series. The soil type and HSG impact the computations to establish the existing groundwater recharge and existing runoff conditions necessary to evaluate compliance with the recharge and quantity control criteria of the Stormwater Management Rules. However in many areas in the State, surface soil conditions have been altered through cuts, fills or other disturbances and the soil surveys do not provide sufficient information with which to determine the hydrologic soil group and the associated hydrologic response. As a result, there is the need for a methodology to associate these areas with an applicable soil series and associated hydrologic soil group for areas mapped as Urban Land, Cut and Fill Land, Made Land or other indeterminately and previously altered areas in the State as well as for instances where map classifications do not represent field conditions.

NOTE: The guidelines presented below shall only be used when a published or online NRCS Soil Survey does not provide the required information or in instances where such published data provides information that conflict with direct soil observations or tests. The guidelines cannot be used in place of valid HSG information from the NRCS Soil Survey.

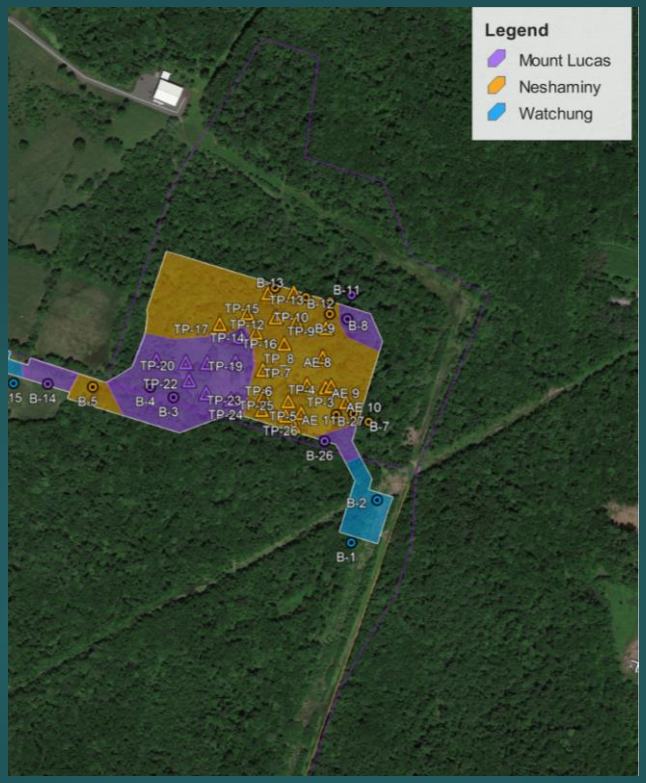
1a: Default Hydrologic Soil Groups

Where HSG information from a published or online NRCS Soil Survey is either unavailable or inconsistent with conditions in the field, Option 1 allows runoff computations for pre- and post-developed drainage area conditions to be based upon default HSGs. These default HSGs are shown in Table 1 below for drainage areas within and outside New Jersey's coastal plain shown in FigureE-1. If the

- New Jersey DEP has a protocol on how to complete this investigation

- Several other states also allow for a site-specific investigations as they more accurately represent the soil conditions

It doesn't always work in your favor



- Site in New Jersey with Hydrologic Soil Group 'D' Soils mapped.

- Actual soils were re-classified as Neshaminy series, which is HSG 'B'.

CONCLUSIONS

- Hydrologic Soil Groups are being used beyond original intention
- Every Soil Series is either classified as A-D
- The assignment of HSG is based on the depth to restrictive layer and Redox features
  - Permeability ranges were assigned for each class.

CONCLUSIONS (Pt 2)

- Within Soil Series and Map Units, there are multiple HSGs that are applicable
- The scale of the map also impacts the accuracy of HSGs assigned to an area
- Site-specific soil investigations may yield different results, impacting stormwater management design and costs
- Site-specific soil investigations are essential in areas classified as Urban Land

CONCLUSIONS (Pt 3)

If our intention in stormwater management is to accurately reflect the Pre-condition and to account for stormwater resulting from new impervious surfaces, then an accurate assessment of Hydrologic Soil Groups is essential.

QUESTIONS?

THANK YOU!

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