Seak LANDSCAPING Pthe FOR WATER QUALITY

UNDERSTANDING AND ASSESSING SOIL CHARACTERISTICS FOR STORMWATER PRACTICES

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WHAT SOIL DOES – 5 ESSENTIAL FUNCTIONS

REGULATING WATER - SOIL HELPS CONTROL WHERE RAIN, SNOWMELT, AND IRRIGATION WATER GOES. WATER CARRIES PARTICULATES AND DISSOLVED SOLUTES OVER THE LAND OR INTO AND THROUGH THE SOIL.

SUSTAINING PLANT AND ANIMAL LIFE - THE DIVERSITY AND PRODUCTIVITY OF LIVING THINGS DEPENDS ON SOIL.

FILTERING AND BUFFERING POTENTIAL POLLUTANTS - THE MINERALS AND MICROBES IN SOIL ARE RESPONSIBLE FOR FILTERING, BUFFERING, DEGRADING, IMMOBILIZING, AND DETOXIFYING ORGANIC AND INORGANIC MATERIALS.

CYCLING NUTRIENTS - CARBON, NITROGEN, PHOSPHORUS, AND MANY OTHER NUTRIENTS ARE STORED, TRANSFORMED, AND CYCLED IN THE SOIL.

PHYSICAL STABILITY AND SUPPORT - SOIL STRUCTURE PROVIDES A MEDIUM FOR PLANT ROOTS TO ANCHOR THE PLANTS. SOILS ALSO PROVIDE SUPPORT FOR HUMAN STRUCTURES.





SOIL QUALITY DESCRIBES THE CAPACITY OF A SOIL TO PERFORM ITS ECOLOGICAL FUNCTIONS



PLANT-SOIL-WATER MATRIX

THE MOST EFFECTIVE LANDSCAPE STORMWATER SOLUTIONS DEPEND ON

- INFILTRATION
- VEGETATION



WHY USE PLANTS?

Plants slow runoff, allow particulates to settle out and increase infiltration Roots provide infiltration channels And help hold soils together, reducing erosion Together with soil microbes, can remove pollutants such as heavy metals

Roots absorb water and nutrients Roots exude chemicals that feed the soil microbes Leaves intercept rainfall, reduce energy Plants sequester carbon Add organic matter to soil Add aesthetic value Increase biodiversity Support wildlife and pollinators



IF SOIL QUALITY DESCRIBES THE CAPACITY OF A SOIL TO PERFORM ITS ECOLOGICAL FUNCTIONS AND THE MOST EFFECTIVE LANDSCAPE STORMWATER SOLUTIONS DEPEND ON

INFILTRATION

VEGETATION

THEN, WHAT PROPERTIES OF SOIL ARE MOST CRITICAL FOR THESE FUNCTIONS?

♣



UNDERSTANDING AND ASSESSING SOIL PROPERTIES



Soil quality depends on the integration of physical, chemical and biological conditions of the soil.





Soil Textural Triangle



Particle size distribution:		
% sand		
% silt		
% clay		



Video: Water Movement in Soils

Soil Textural Triangle



What are the texture classes of the following soils?

0% Clay; 10% silt; 90% sand:

<u>sand</u> 15% clay; 10% silt; 75% sand: <u>loamy sand</u> 20% Clay; 40% silt; 40% sand: <u>loam</u>

Which soil is most suitable for a stormwater installation such as a rain garden or vegetated swale? Why?

• SAND

- LOW WATER RETENTION
- LOTS OF AIR SPACE
- LEAST SUBJECT TO COMPACTION

• LOAM

• INTERMEDIATE

• CLAY

- HIGH WATER RETENTION
- LOW AIR SPACE
- POOR DRAINAGE
- EASILY COMPACTED

High infiltration rates (>0.8 inches/hr)

Infiltration rates 0.2-0.4 inches/hr

Low infiltration rates (0.04-0.2 inches/hr)



Figure 5. Comparative movement of water downward and outward in sandy and clayey soils. Source: Whiting and Wilson 2014, fig. 7. Univ of California, 2015. ANR Publication 8553





FIGURE 7-1 The effect of mixing increasing proportions of a coarse sand to a fine clay, each having 50% pore space (A and E



FIGURE 7-1 The effect of mixing increasing proportions of a coarse sand to a fine clay, each having 50% pore space (A and E). In this example, even when equal volumes of sand and clay are mixed (C), large pore space is 0 and small pore space has been reduced to 25%. Soil mix C has the poorest aeration; aeration improves as a higher proportion of sand is present. Soil mixes A and B can be easily compacted, whereas C, D, and E have better compaction resistance. (Adapted from Spomer, 1983.)









AGGREGATES ARE **GLUED TOGETHER** BY GLOMALIN, A **PRODUCT OF** LIVING ORGANIC MATTER

Compact Soils







CHEMICAL PROPERTIES OF SOIL





• MEASURES ACIDITY OR ALKALINITY BY MEASURING THE CONCENTRATION OF HYDROGEN IONS IN THE SOLUTION

• LOGARITHMIC SCALE FROM 0-14







Functions of Active Organic Matter



- Feeds the biomass (Carbon source)
- Releases nitrogen and other plant nutrients
- Promotes and stabilizes soil aggregation
- Creates pores and channels
- Sustains diversity and suppresses pathogens/pests

Functions of **Passive Organic Matter**



- Water holding capacity
- Cation exchange capacity
- Long term nutrient storage
- Protects soil structure







SOIL QUALITY ASSESSMENT



Make Observatio	ons: See, Smell and Feel	
Water Movement		
Crusting, Erosion		
Plant appearance		
Root growth		
Soil organisms		
Organic material		
Color, moisture, smell		
Soil Core:	Soil texture	
	Structure	
	Compaction	
	Rocks and debris	
Simple Tests:	pH and nutrient levels	
	Aggregate stability	
	Percolation test	
Use Resources:	NRCS www.nrcs.usda.gov	
	USDA Soil Survey	



SOIL CORES AND TEXTURE BY FEEL



http://soils.usda.gov/sqi/





PERCOLATION TEST

FOR A RAIN GARDEN, A MINIMUM INFILTRATION RATE OF .5" PER HOUR IS DESIRED



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Web Soil Survey (WSS) provides soil data and information produced by the National Cooperative Soil Survey. It is operated by the

Status Maps
 Official Soil Series
 Descriptions (OSD)
 Soil Series Extent
 Mapping Tool
 Geospatial Data
 Gateway
 eFOTG
 National Soil
 USDA Natural Resources Conservation Service (NRCS) and provides access to the largest natural resource information system in the world. NRCS has soil maps and data available online for more than 95 percent of the nation's counties and anticipates having 100 percent in the near future. The site is updated and maintained online as the single authoritative source of soil survey information.

Soil surveys can be used for general farm, local, and wider area planning. Onsite investigation is



I Want To...

- Start Web Soil
 Survey (WSS)
- Know Web Soil
 Survey
- Requirements
- Know Web Soil
 Survey
- operation hours
- Find what areas of the U.S. have soil data
- Find information by topic
- Know how to hyperlink from other
- documents to Web Soil Survey
- Know the
- SSURGO data structure

https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm