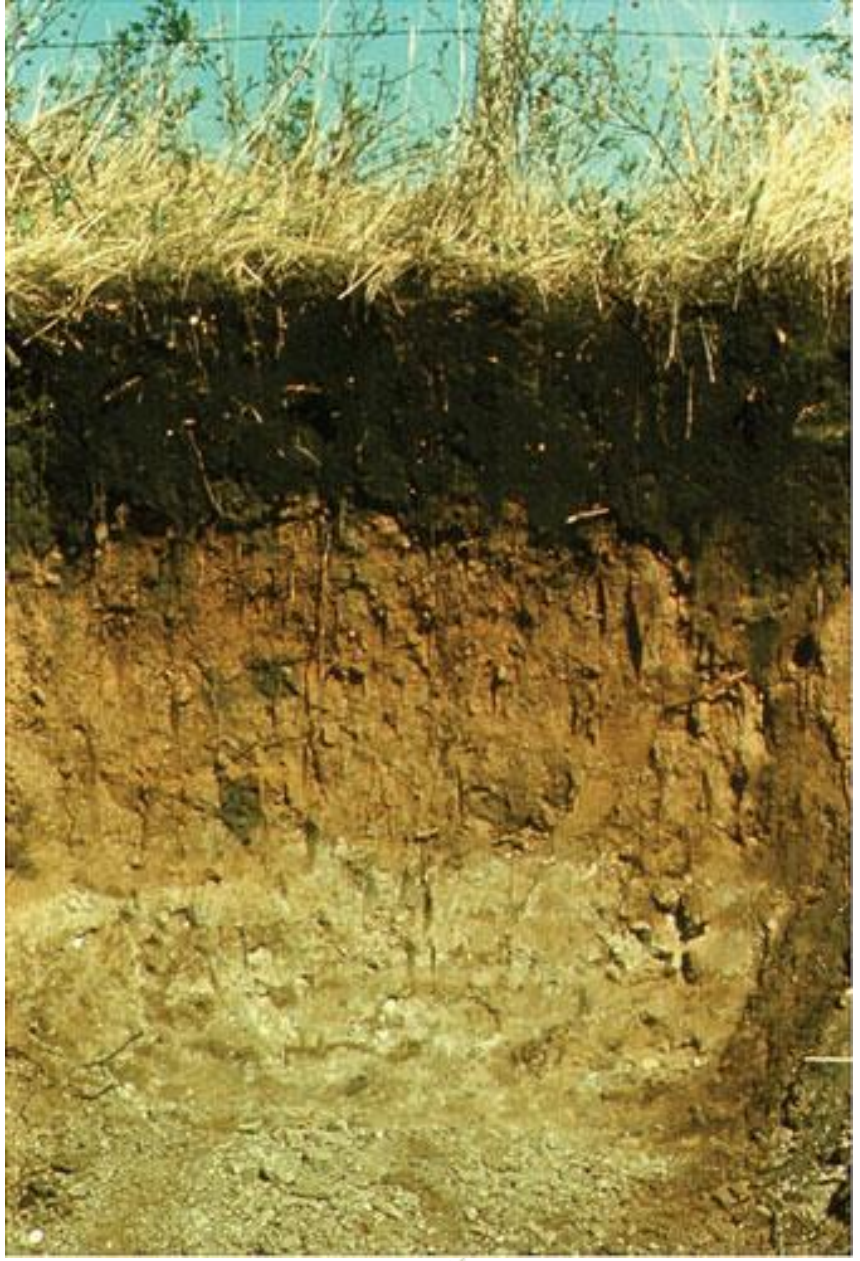
PARK FOREST TOPSOIL PRESERVATION BMP PROVISIONS

David P. Albers, P.E.
Senior Project Engineer



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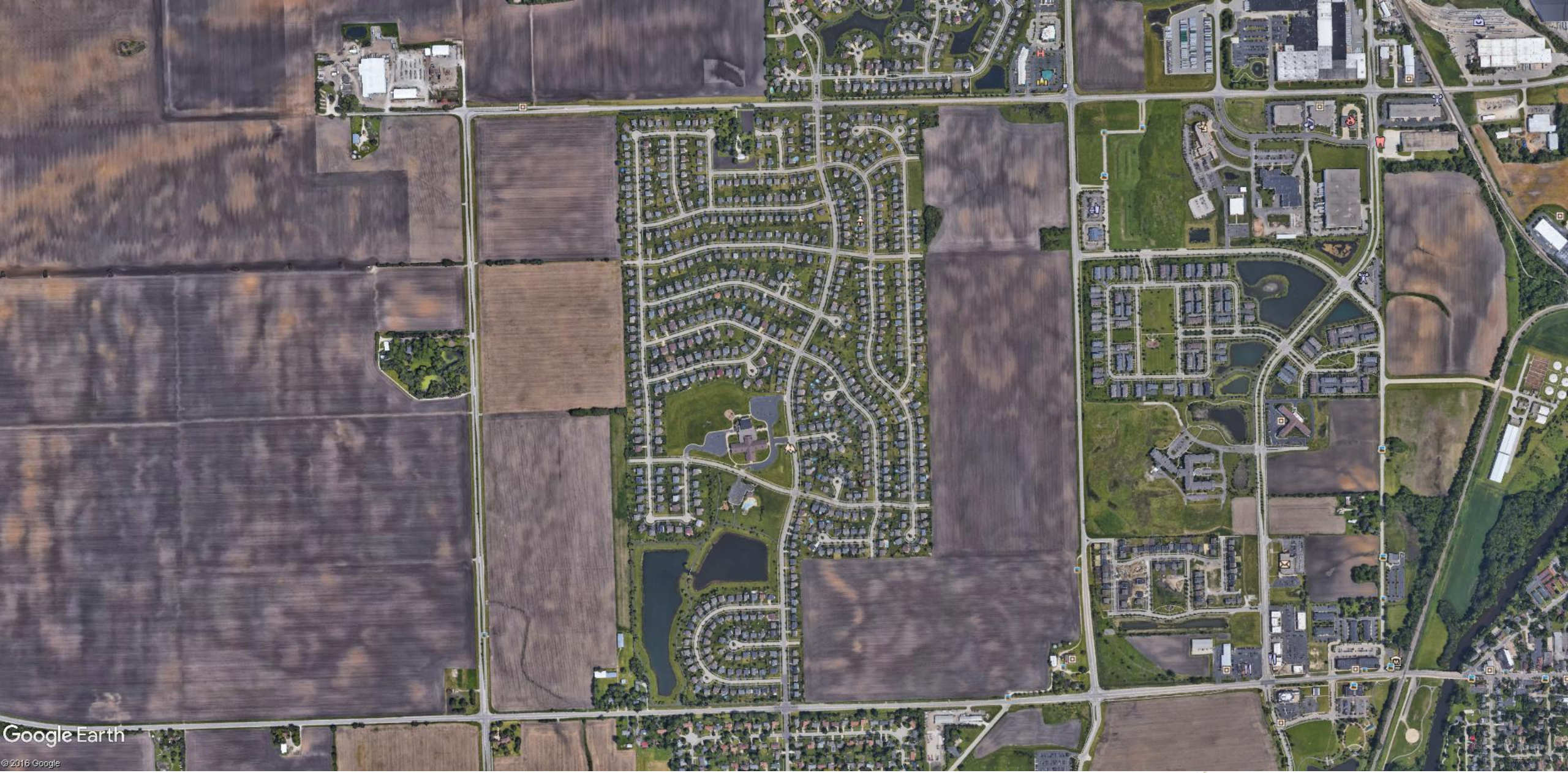
OBJECTIVES

- Overview of topsoil functions
- Examine topsoil composition
- Recognize the absorption potential of good functioning topsoil
- Review how changes of CN affect runoff volume
- Discover the impacts of diminished topsoil quality
- Realize the benefits and limitations of compost-amended topsoil
- Park Forest's topsoil preservation BMP provisions



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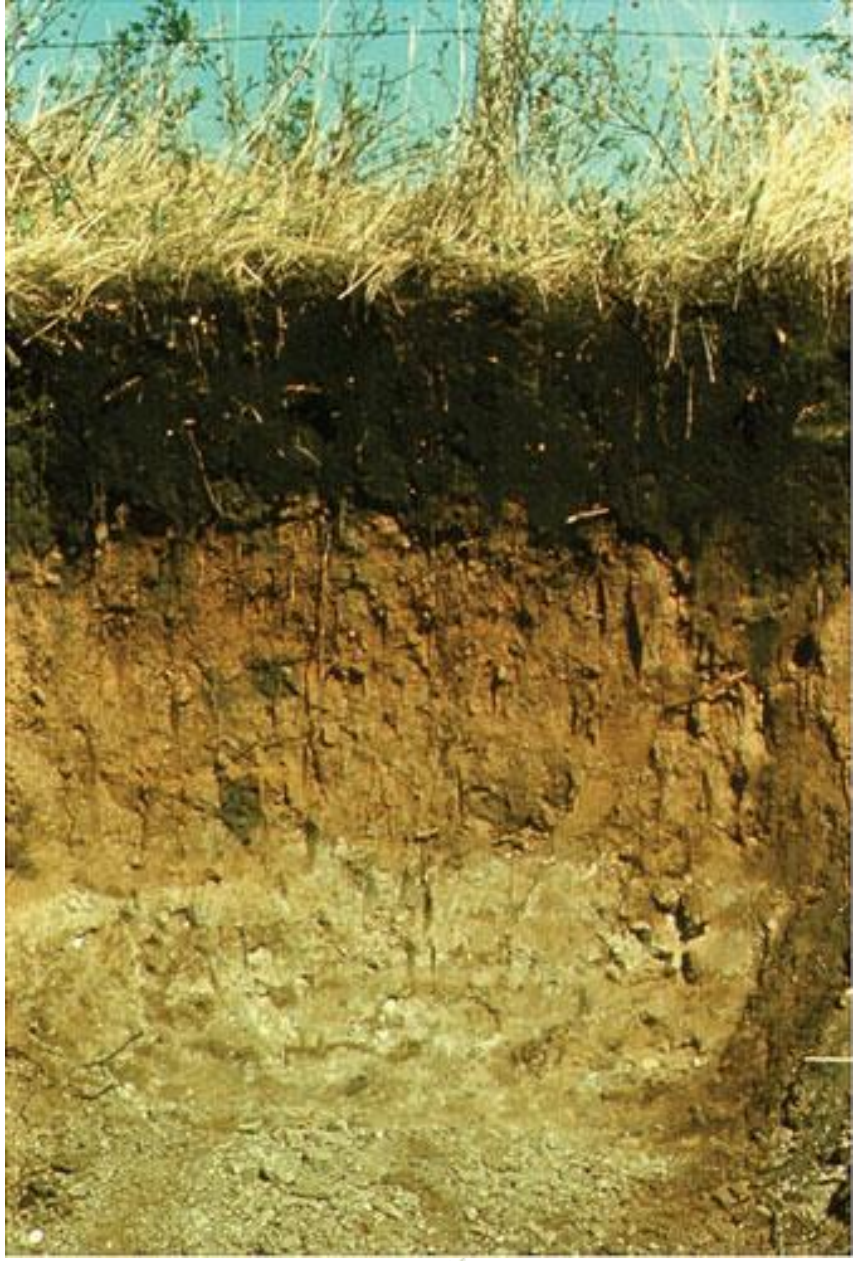
TYPICAL TOPSOIL DEPTHS IN OUR "PRAIRIE STATE"

RANGE FROM 10" TO 12"



WHAT HAPPENS TO THE STRIPPED TOPSOIL?

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Google Earth

HAVE YOU EVER GIVEN THOUGHT TO THE IMPACTS OF THE MISSING NATURAL TOPSOIL?

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TOPSOIL FUNCTIONS

1) Nutrient Cycling
2) Water Partitioning
3) Soil Respiration Enablement
4) Filtering and Buffering
5) Physical Stability and Support

WATER PARTITIONING FUNCTION

Well-Functioning Soil:

- Facilitates Infiltration
- Accommodates Water Storage
- Promotes Percolation Flow
- Enables Plant Transpiration
- Enhances Groundwater Recharge

The partitioned water carries with it dissolved solutes such as nitrogen, phosphorus, pesticides, and other nutrients or chemical compounds for use by plants and subsurface inhabiting animals.

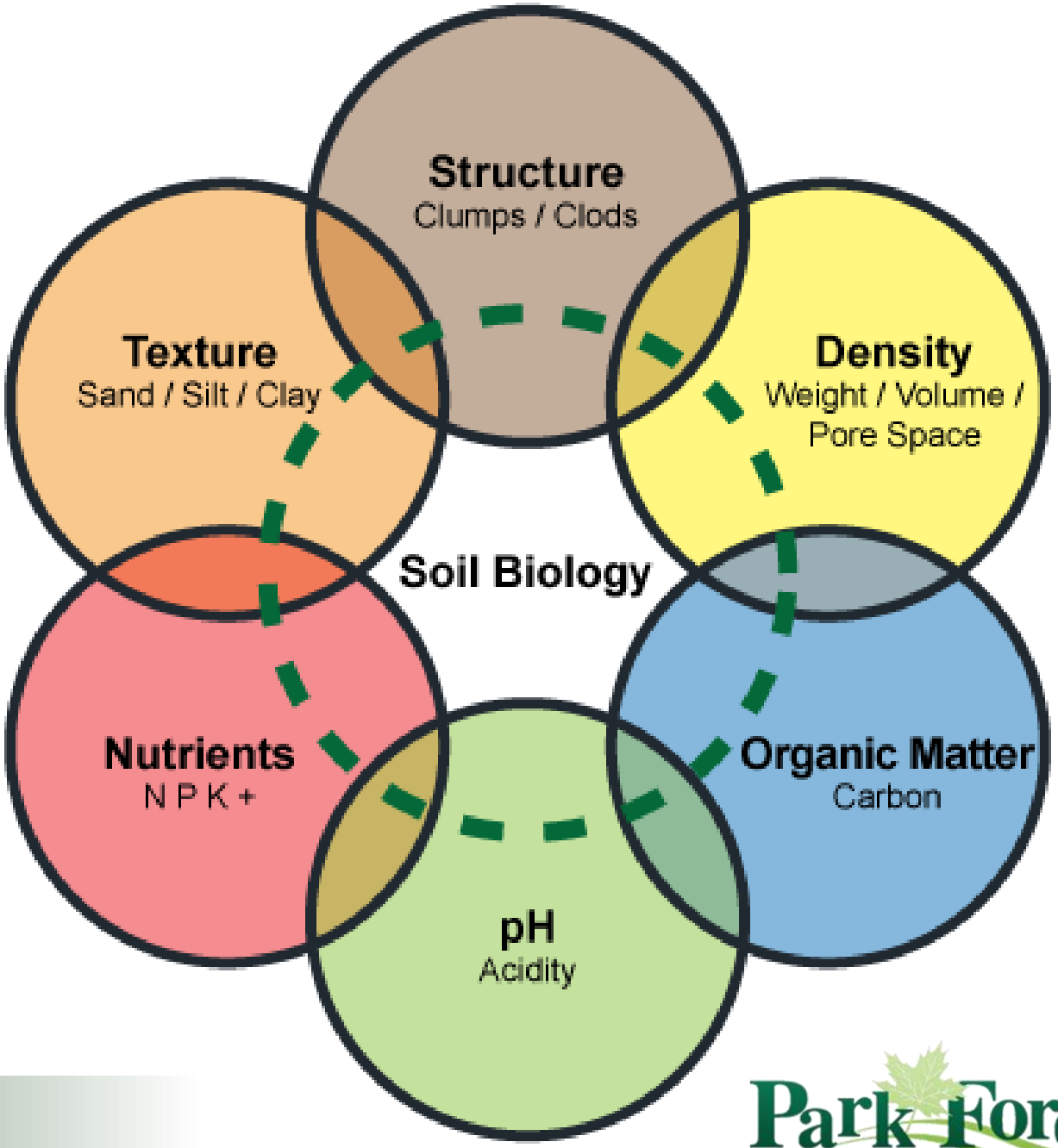
EFFECTS OF SHALLOW TOPSOIL

Shallow Topsoil:

- Inhibits soil respiration
- Limits nutrient storage potential
- Limits rainfall infiltration
- Reduces water storage potential
- Inhibits vegetative root growth
- Inhibits thriving vegetation
- Requires more irrigation to support functions
- …

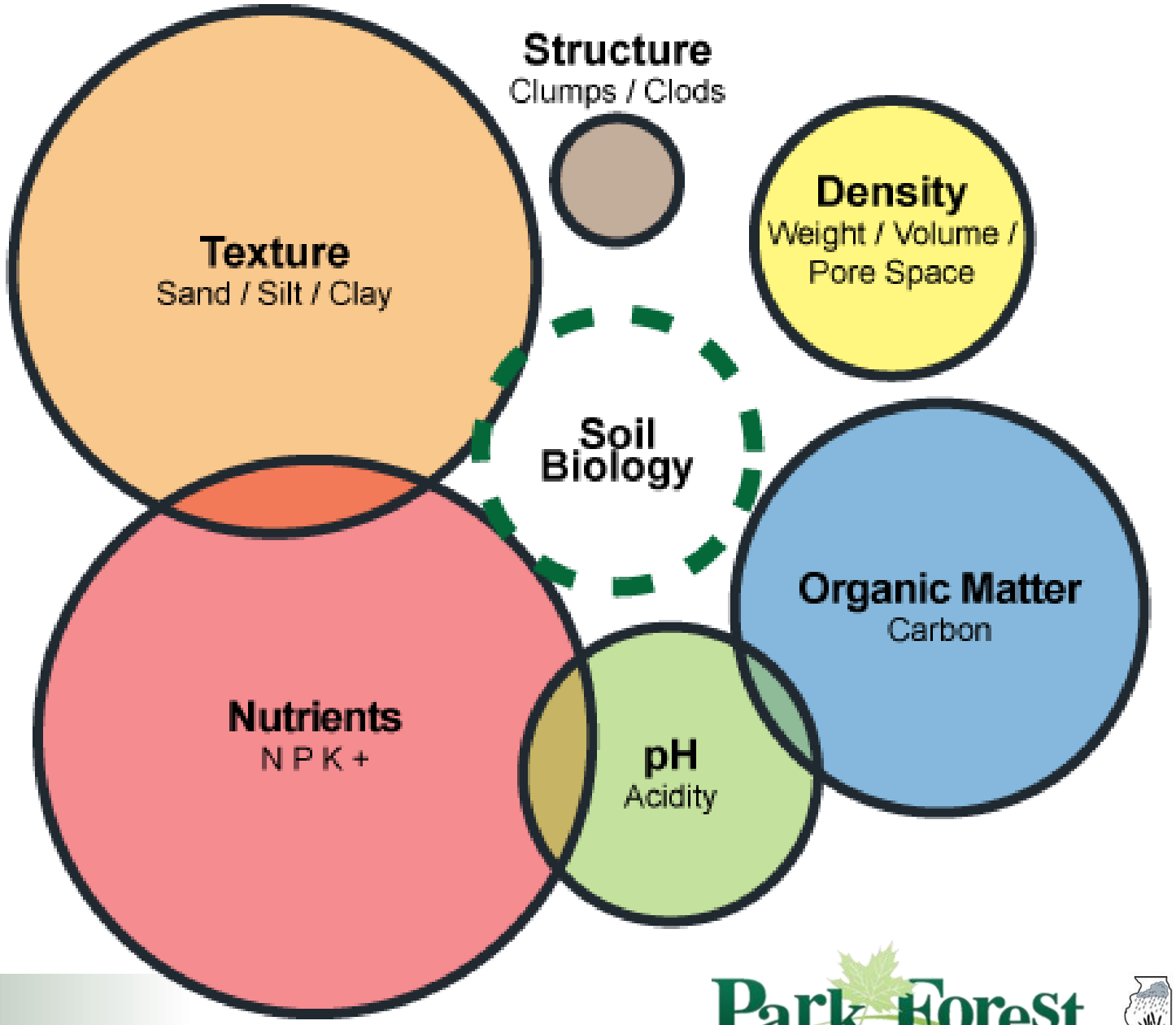
CRITICAL ASPECTS OF SOIL:

WHAT MAKES GOOD SOIL?



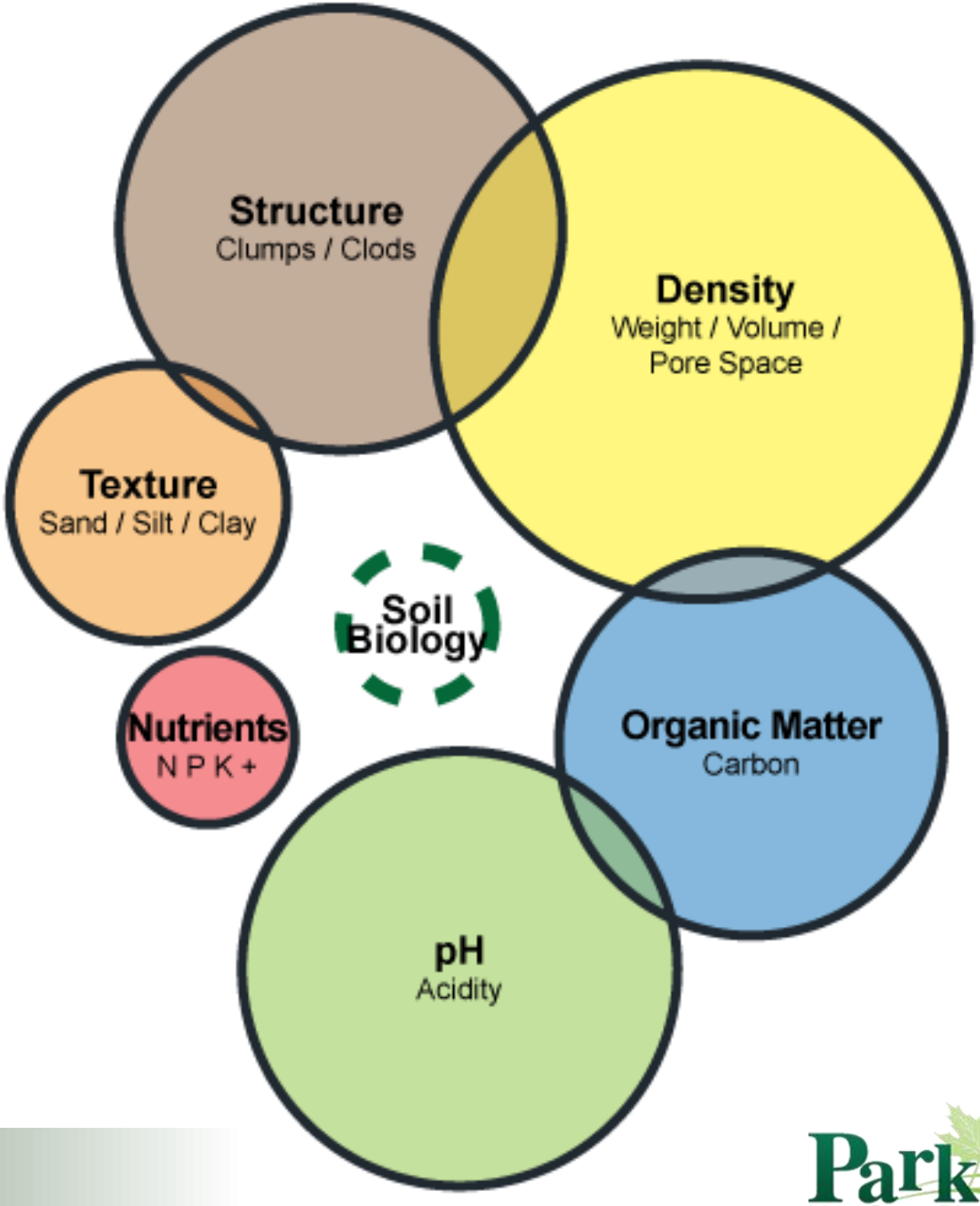
CRITICAL ASPECTS OF SOIL:

TRADITIONAL LEVELS OF IMPORTANCE



CRITICAL ASPECTS OF SOIL:

PROPOSED LEVELS OF IMPORTANCE

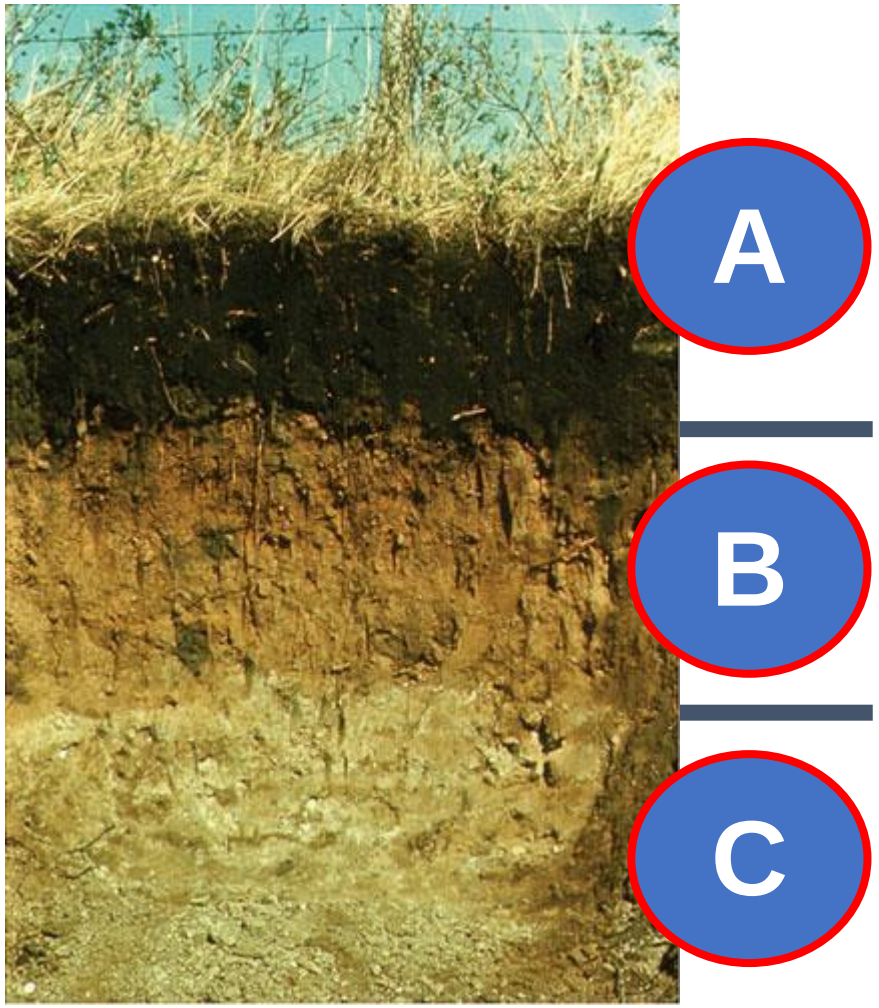


HYDROLOGIC SOIL CLASSIFICATION

- Based on minimum infiltration rate through a soil's full 5-foot deep NRCS soil horizon after prolonged wetting

- Based on soil composition and soil properties – not vegetative cover

Soil Surface Intake Rates



Subsurface Permeability

SOIL BULK DENSITY

- Foundational soil property defining growth capability

$$\text{Soil Bulk Density grams/cm}^3 = \frac{\text{Dry Soil Weight grams}}{\text{Total Soil Volume } (V_T)\ \text{cm}^3}$$

SOIL POROSITY

- Ratio of volume of voids to total volume of soil

$$\text{Soil Porosity} = \frac{\text{Soil Void Volume } (V_V)}{\text{Total Soil Volume } (V_T)}$$

$$\text{Soil Porosity} = 1 - \frac{\text{Soil Bulk Density}(g/cm^3)}{2.65\ g/cm^3}$$

Where 2.65 is the default soil bulk density of most rock

OPTIMAL AGRICULTURAL SURFACE SOIL CONTENT (SILT - LOAM)

- 50% Solids
  - 45%+ Soil Particles
  - < 5% Organic Matter

- 50% Pore Space
  - 25% +/- Water
  - 25% +/- Air

Soil Bulk Density = 50% x 2.65 g/cm^3 = 1.33 g/cm^3)

COMPARATIVE SOILS BULK DENSITY & POROSITY (Vv/Vt)

SOIL TEXTURE	IDEAL BULK DENSITIES FOR PLANT GROWTH (grams/cm^3)	IDEAL PLANT GROWTH POROSITIES (Vv/Vt)	BULK DENSITIES THAT AFFECT ROOT GROWTH (grams/cm^3)	AFFECTED ROOT GROWTH POROSITIES (Vv/Vt)	BULK DENSITIES THAT RESTRICT ROOT GROWTH (grams/cm^3)	RESTRICTED ROOT GROWTH POROSITIES (Vv/Vt)
SANDS, LOAMY SANDS	< 1.60	> 0.396	1.69	0.362	> 1.80	< 0.321
SANDY LOAMS, LOAMS	< 1.40	> 0.472	1.63	0.385	> 1.80	< 0.321
SANDY CLAY LOAMS	< 1.40	> 0.472	1.60	0.396	> 1.75	< 0.340
OPTIMUM SILT LOAM (50% SOLIDS, 50% VOIDS)	1.33	0.5	1.60	0.396	> 1.75	< 0.340
SILTS, SILT LOAMS	< 1.40	> 0.472	1.60	0.396	> 1.75	< 0.340
SILT LOAMS, SILTY CLAY LOAMS	< 1.40	> 0.472	1.55	0.415	> 1.65	< 0.377
SANDY CLAYS, SILTY CLAYS, CLAY LOAMS	< 1.10	> 0.585	1.49	0.438	> 1.58	< 0.403
CLAYS (>45% CLAYS)	< 1.10	> 0.585	1.39	0.475	> 1.47	< 0.445

LOOSE SURFACE SOILS **COMPACTED INORGANIC SOILS**

NOTE HOW MUCH OF THE SOIL VOLUME CONSISTS OF PORE SPACE, Vv/Vt
RECOGNIZE THE SIGNIFICANT REDUCTION OF POROSITY DUE TO COMPACTION

Source: NRCS Soil Bulk Density

APPLIES TO THE DESIGN AND CONSTRUCTION OF ALL DETENTION FACILITIES!
APPLIES TO MOST PERVIOUS AREAS OF SITE CONSTRUCTION
OBSERVE THE SIMILARITY OF POROSITIES FOR PREDOMINANT TOPSOIL TEXTURES

COMPARATIVE SOILS NORMAL MOISTURE CONTENT

NRCS SOIL TEXTURE	IDEAL BULK DENSITIES FOR PLANT GROWTH (grams/cm^3)	IDEAL PLANT GROWTH POROSITIES (Vv/Vt)	BULK DENSITIES THAT AFFECT ROOT GROWTH (grams/cm^3)	AFFECTED ROOT GROWTH POROSITIES (Vv/Vt)	BULK DENSITIES THAT RESTRICT ROOT GROWTH (grams/cm^3)	RESTRICTED ROOT GROWTH POROSITIES (Vv/Vt)
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LOOSE SURFACE SOILS **COMPACTED INORGANIC SOILS**

RECOGNIZE THAT 50% OF PORE SPACE IS OCCUPIED BY WATER
TYPICAL MOISTURE CONTENTS
- **LESS THAN 10% FOR SAND**
- **15% TO 25% FOR SANDY LOAMS, SANDY CLAY LOAMS, SILT LOAMS, AND SILTY CLAY**
- **OFTEN GREATER THAN 30% FOR CLAYEY SOILS**

Source: NRCS Soil Bulk Density

REMAINING PORE SPACE IS POTENTIALLY AVAILABLE FOR TEMPORARY STORAGE
NOW THINK IN TERMS OF THE VOLUME OF STORED WATER LOST WHEN 8 INCHES OF NATURAL TOPSOIL IS HAULED OFF-SITE – NO LONGER AVAILABLE FOR RAINFALL ABSORPTION AND PLANT RESPIRATION
AND WHEN THE REMAINING 4 INCHES OF REPLACED NATURAL TOPSOIL IS COMPACTED PRIOR TO SODDING

COMPARATIVE SOILS AVAILABLE VOID STORAGE

NRCS SOIL TEXTURE	IDEAL BULK DENSITIES FOR PLANT GROWTH (grams/cm^3)	IDEAL PLANT GROWTH POROSITIES (Vv/Vt)	BULK DENSITIES THAT AFFECT ROOT GROWTH (grams/cm^3)	AFFECTED ROOT GROWTH POROSITIES (Vv/Vt)	BULK DENSITIES THAT RESTRICT ROOT GROWTH (grams/cm^3)	RESTRICTED ROOT GROWTH POROSITIES (Vv/Vt)
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LOOSE SURFACE SOILS **COMPACTED INORGANIC SOILS**

THE REMAINING PORTION OF NATURAL SPACE IS FOR AIR SPACE POTENTIALLY AVAILABLE TO STORE INFILTRATING RAINFALL

Source: NRCS Soil Bulk Density

NOW THINK IN TERMS OF THE NATURAL VOLUME OF TOPSOIL THAT WAS THEORETICALLY AVAILABLE TO STORE INFILTRATING RAINFALL – UNTIL IT WAS HAULED AWAY

FROM NEW IMPERVIOUS SERVICES **(22% TO 32%) X 12” = 2.64” TO 3.84”**
FROM STRIPPED PERVIOUS AREAS **(22% TO 32%) X 8” = 1.76” TO 2.56”**
ADD 8% X 4” = 32” DUE TO SOIL COMPACTION
ADD ADDITIONAL VOID LOSS DUE TO COMPACTION OF UNDERLYING SOIL

SOIL VOID STORAGE CAPACITY LIMITATIONS

- High water table
- Antecedent moisture condition
- Dense compaction

INCREASED RUNOFF FROM URBAN DEVELOPMENT IS DUE TO LOST TOPSOIL VOID STORAGE

- Primarily Topsoil Removal
- Secondarily Soil Compaction
- Diminished Organic Content of Installed Topsoil

TOTAL 5-DAY ANTECEDENT RAINFALL (INCHES)

AMC	Dormant Season	Growing Season	Moisture Condition
I	Less than 0.5	Less than 1.4	Dry wilting point, but above normal
II	0.5 – 1.1	1.4 – 2.1	Normal
III	Over 1.1	Over 2.1	Saturated

Adjustment of Curve Numbers for Dry (Condition I) and Wet (Condition III) Antecedent Moisture Conditions

I	II	III
100	100	100
87	95	99
78	90	98
70	85	97
63	80	94
57	75	91
51	70	87
45	65	83
40	60	79

Seasonal rainfall limits (left) and CN adjustment (right) for antecedent moisture conditions (McCuen, 2004)

CHANGE IN RUNOFF VOLUME VS. CHANGE IN CN

	Change in Runoff Volume (%)								
	-50%	-25%	-10%	-5%	Base	+5%	+10%	+25%	+50%
% CHANGE IN CN	-17%	-8%	-2%	-1%	0%	+1%	+2%	+7%	+13%
CHANGE IN CN	58.1	64.4	68.6	69.3	70	70.7	71.4	74.9	79.1

Source: *Win-TR-20 Sensitivity to Input Parameters*

COMPARATIVE RUNOFF AND INFILTRATION FOR WILL CO., IL RAINFALL EVENTS

FREQUENCY	24-HOUR RAINFALL INCHES	CN = 65 RUNOFF INCHES	INFILTRATE INCHES	CN = 70 RUNOFF INCHES	INFILTRATE INCHES	CN = 75 RUNOFF INCHES	INFILTRATE INCHES	CN = 80 RUNOFF INCHES	INFILTRATE INCHES	CN = 85 RUNOFF INCHES	INFILTRATE INCHES
2-YR	3.16	0.59	2.57	0.78	2.38	1.07	2.09	1.36	1.80	1.73	1.43
Infiltrate Red				0.19		0.29		0.29		0.37	
Av Red per CN				0.038		0.058		0.058		0.074	
5-YR	4.05	1.06	2.99	1.35	2.70	1.73	2.32	2.07	1.98	2.47	1.58
Infiltrate Red				0.29		0.38		0.34		0.40	
Av Red per CN				0.058		0.076		0.068		0.08	
10-YR	4.90	1.59	3.31	1.94	2.96	2.37	2.53	2.77	2.13	3.27	1.63
Infiltrate Red				0.35		0.43		0.40		0.50	
Av Red per CN				0.07		0.086		0.08		0.10	
50-YR	6.98	3.05	3.93	3.57	3.41	4.13	2.85	4.66	2.32	5.20	1.78
Infiltrate Red				0.52		0.56		0.53		0.50	
Av Red per CN				0.104		0.112		0.106		0.10	
100-YR	8.34	4.14	4.20	4.73	3.61	5.33	3.01	5.92	2.41	0.12	1.82
Infiltrate Red				0.59		0.60		0.60		0.59	
Av Red per CN				0.118		0.12		0.12		0.118	

RUNOFF INCREASE IS DUE TO INFILTRATION DECREASE AS CN INCREASES

FOR 50 YR STORM EVENT,

INFILTRATION DECREASES BY APPROXIMATELY 0.10 INCH PER EACH INCREASED CN VALUE

Source: TR-55
Bulletin 70 Rainfall

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UNCOMFORTABLE TRUTHS ABOUT TOPSOIL QUALITY

- The Runoff Curve Numbers used today were developed in 1954
- The organic content of crop field soils is greatly diminished
- The weight of farm equipment used today causes greater soil compaction

IMPACTS OF DIMINISHED ORGANIC SOILS CONTENT

- Limited pore development
- Reduced absorption capacity
- Surface crusting of clay and sand in soil mix during drought conditions

INCREASED RUNOFF

INCREASED TOPSOIL EROSION

REDUCED TOPSOIL DEPTHS

GREATER INCREASED RUNOFF

REALITY CHECK

- The increased flooding of our rivers experienced today is not just due to climate change, it is a result of organic losses in crop field soils

- Both the stockpiled topsoil of a development site and much of the imported topsoil is typically sourced from poorly managed farmed soil

DRAINAGE ADVANTAGES OF COMPOST-AMENDED TOPSOIL

- **Organic vs. Inorganic Clay Soils**
  - 70% to 230% more voids
  - Approximately 27% improved porosity
  - 2 to 5 times more permeable
- **Organic vs. Inorganic Silty Clays**
  - 80% to 320% more voids
  - Approximately 40% improved porosity
  - 10 times more permeable

- **Added Organics Generate Crumby Soil**
  - Take in water faster through additional pores
  - Absorbs more water into increased void space
  - Reduce runoff
  - Limit soil erosion
  - Facilitate plant respiration and evapo-transpiration

LIMITATIONS OF COMPOST-AMENDED TOPSOIL

- Excessive organic content causes topsoil to hold onto moisture
- Excessive moisture content for prolonged periods impedes soil aeration and cause root suffocation

PARK FOREST'S TOPSOIL PRESERVATION BMP PROVISIONS

1. ESTABLISH MINIMUM TOPSOIL PRESERVATION AND INFILITRATION BMP MEASURES

Minimum Topsoil Depths

Required for Development Sites Subject to Stormwater Management Permit

Landscape Type/Area	Minimum Topsoil Depth
Lawn Areas and Parkways	6 inches of amended topsoil
Perennial/Groundcover Areas	8 inches of amended topsoil
Shrub Areas	18 inches (10 inches amended)
Tree Areas	30-36 inches for rootball depth and 18 inches for remaining root zone (10 inches amended topsoil)
Landscape Islands	24 inches for plantings; 36 inches for trees

2. REQUIRES COMPACTION MINIMIZATION MEASURES DURING DESIGN AND CONSTRUCTION

1. Establish soil protection zones
2. Scarify subgrade soils of excavated stormwater management sites
   - Beneath aggregates of underground storage facilities
3. Rototill the initial 2 inches of topsoil into the upper 4 inches of the compacted soil or “B” soil horizon beneath it
4. Limit compaction of proposed landscaped islands during construction
   - Requires installation of either underdrains or mini drywells to help drain trees placed in landscape islands
5. Topsoil compaction ≯ 88% standard proctor density

3. REQUIRES USE OF COMPOST-AMENDED TOPSOIL

- For on-site stockpiled topsoil:
  - Requires added compost equivalent to 8% of the depth of installed topsoil computed only up to a 9” maximum topsoil depth (1/2” per 6” depth; 3/4” per 9” or greater depth)
  - Requires placement of compost to the required depth on top of the topsoil prior to roto-tilling it into the topsoil
- For imported topsoil:
  - Requires certification that imported topsoil has at least 6% organic content by weight, or;
  - Requires added compost equivalent to 4% of the depth of installed topsoil computed and installed as above

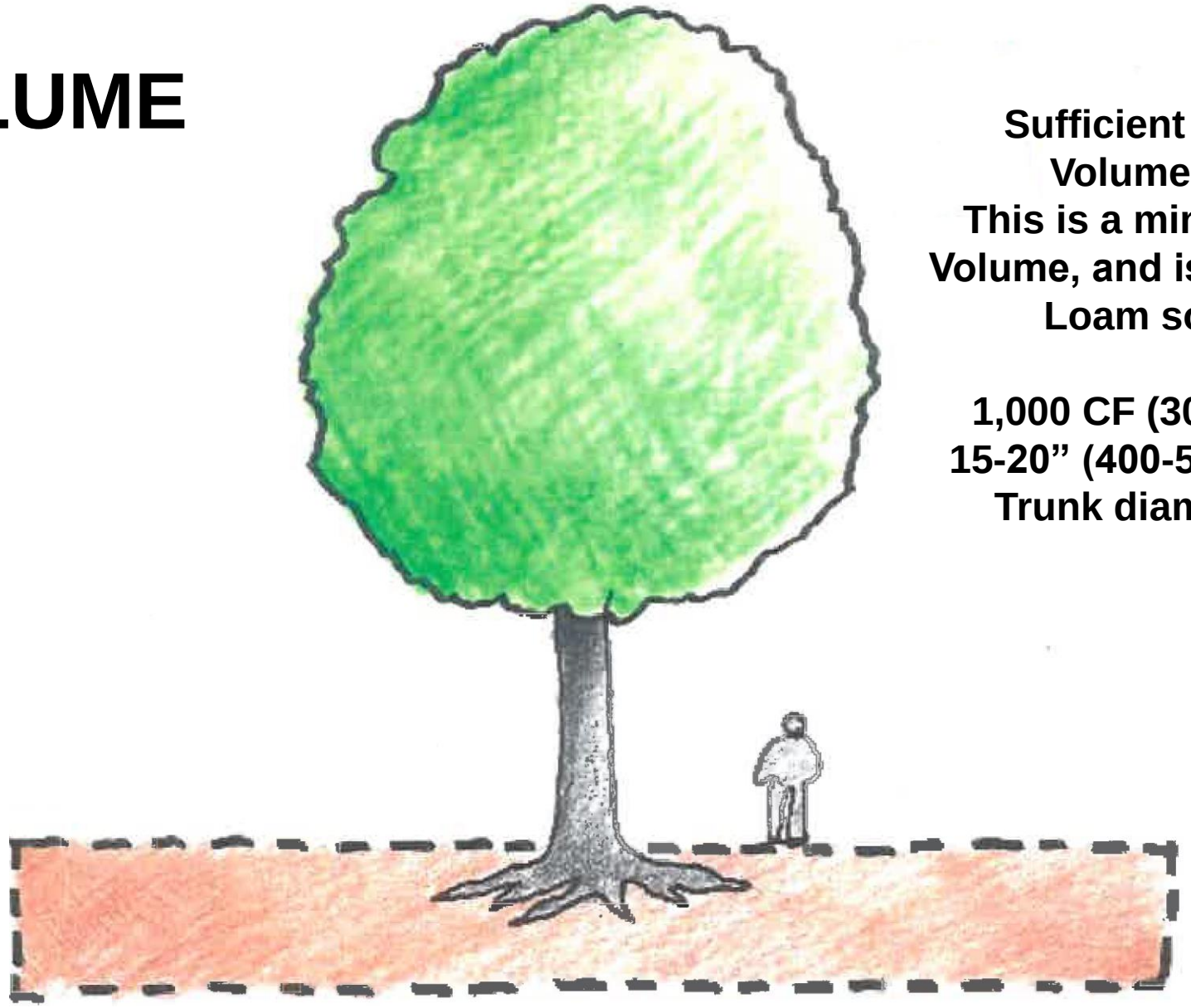
4. REQUIRES MINIMUM VOLUMES OF TOPSOIL FOR TREES

- 750 CF for trees with medium crown spread
- 1,000 CF for trees with large crown spread
- Allows 25% of tree separation distance for overlapping of roots
- Provides for use of modular suspended pavement systems to allow topsoil extensions beneath sidewalks

When typically applied in narrow parkways, the Parkways will have 18” of topsoil for growth support of the trees

SOIL AND VOLUME

A Wine Glass on a Dinner Plate



Sufficient Soil Volume –
This is a minimum Volume, and is 'Good' Loam soil

1,000 CF (30m^3) =
15-20" (400-500mm) Trunk diameter

5. PROVIDES CN REDUCTION INCENTIVES FOR BMP TOPSOIL INSTALLATION

- 1.75 CN reduction for each inch of topsoil installed at depths greater than 6” up to a maximum of 10”
- Each inch of topsoil can absorb between 0.30 and 0.35 inches of runoff for a mid-range antecedent moisture condition
- In theory, these added topsoil voids could support CN reductions up to 2.2 per inch of topsoil
- 1.75 CN/inch rate is appropriate for 60% void occupation
- Incentifies use of deeper than minimum topsoil depths
- Allows use of Type C hydrologic soil classification on development sites having natural Type C soils where compaction prevention is applied and where topsoil depths in excess of 6 inches in locations without fill are included in the landscaping and grading plan documents

RUNOFF CURVE NUMBERS FOR URBAN AREAS

Cover Type and Hydrologic Condition	C	D
Fully Developed Urban Areas (Vegetation Established)		
Impervious Areas (Roads, Roofs, Sidewalks, etc.)	98	98
Pervious Area (Open Space, Mostly Grassy Areas)	74	80
Wooded Area (Undisturbed Soil Texture)	70	77
Gravel (Railroad Yards, Roads, Parking Lots)	89	91
Water Surface	100	100
Newly Graded Areas (Pervious Areas Only, No Vegetation)	91	94
Native Plantings	70	77
Wetlands	91	94
Synthetic Turf Fields	91	91

Cover Type and Hydrologic Condition	C	D
Green Infrastructure		
Non-Compacted Gravel Area	89	91
Porous/Permeable Pavement	89	91
Bioswale	63	70
Rain Garden	63	70
Topsoil Preservation BMP Incentive Values		
6-Inch Amended Topsoil	74.00	80.00
7-Inch Amended Topsoil	72.25	78.25
8-Inch Amended Topsoil	70.50	76.50
9-Inch Amended Topsoil	68.75	74.75
10-Inch Amended Topsoil	67.00	73.00

RESPONSIBLE STEWARDSHIP DEMANDS TOPSOIL PRESERVATION

FOLLOW PARK FOREST'S EXAMPLE

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THANK YOU!

PROPOSED CN REDUCTION TOPSOIL PRESERVATION BMP INCENTIVE BASIS

FREQUENCY	RAINFALL	RUNOFF	INFILTRATE	RUNOFF	INFILTRATE	RUNOFF	INFILTRATE	RUNOFF	INFILTRATE	RUNOFF	INFILTRATE
	INCHES	INCHES	INCHES	INCHES	INCHES	INCHES	INCHES	INCHES	INCHES	INCHES	INCHES
2-YR	3.16	0.59	2.57	0.78	2.38	1.07	2.09	1.36	1.80	1.73	1.43
Infiltrate Red				0.19		0.29		0.29		0.37	
Av Red per CN				0.038		0.058		0.058		0.074	
5-YR	4.05	1.06	2.99	1.35	2.70	1.73	2.32	2.07	1.98	2.47	1.58
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FOR 50 YR STORM EVENT,

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PROPOSED CN REDUCTION TOPSOIL PRESERVATION BMP INCENTIVE:

FOR LOAMY TOPSOILS WITH POROSITY = 0.472

AND 25% MOISTURE CONTENT

Va = 0.472 - 0.25 = 0.22

0.22/0.10 = 2.2

=> JUSTIFIABLE CN REDUCTION OF 2.2 PER INCH OF ADDED TOPSOIL

OLD SLIDES DELETE

WHEN DONE

COMPARATIVE SOILS NORMAL MOISTURE CONTENT

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SANDY CLAY LOAMS, CLAY LOAMS	<1.40	>0.472	1.60	0.396	>1.75	<0.340
OPTIMUM SILT LOAM (50% Solids, 50% Voids	1.33	0.5	1.60	0.396	>1.75	<0.340
SILTS, SILT LOAMS	<1.40	>0.472	1.60	0.396	>1.75	<0.340
SILT LOAMS, SILTY CLAY LOAMS	<1.40	>0.472	1.55	0.415	>1.65	<0.377
SANDY CLAYS, SILTY CLAYS, CLAY LOAMS	<1.10	>0.585	1.49	0.438	>1.58	<0.403
CLAYS (> 45% CLAYS)	<1.10	>0.585	1.39	0.475	>1.47	<0 .445

LOOSE SURFACE SOILS

COMPACTED INORGANIC SOILS

RECOGNIZE THAT A PORTION OF PORE SPACE IS OCCUPIED BY WATER

REMEMBER TOPSOIL FUNCTIONS LIKE A SPONGE

LESS THAN 10% FOR SAND

15% TO 25% FOR SANDY LOAMS, SANDY CLAY LOAMS, SILT LOAMS, AND SILTY CLAY

OFTEN GREATER THAN 30% FOR CLAYEY SOILS

NOW THINK IN TERMS OF THE VOLUME OF STORED WATER LOST WHEN 8 INCHES OF NATURAL TOPSOIL IS HAULED OFFSITE---NO LONGER AVAILABLE FOR PLANT RESPIRATION

AND WHEN THE REMAINING 4 INCHES OF REPLACED NATURAL TOPSOIL IS COMPACTED PRIOR TO SODDING

COMPARATIVE SOILS AVAILABLE VOID STORAGE

SANDY LOAMS, LOAMS	<1.40	>0.472	1.63	0.385	>1.80	<0.321
SANDY CLAY LOAMS, CLAY LOAMS	<1.40	>0.472	1.60	0.396	>1.75	<0.340
OPTIMUM SILT LOAM (50% Solids, 50% Voids	1.33	0.5	1.60	0.396	>1.75	<0.340
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LOOSE SURFACE SOILS **COMPACTED INORGANIC SOILS**

THE REMAINING PORTION OF NATURAL PORE SPACE IS AIR SPACE Vv -Vw = Va

HISTORICALLY AVAILABLE TO STORE INFILTRATING RAINFALL

NOW THINK IN TERMS OF THE NATURAL VOLUME OF TOPSOIL THAT WAS THEORETICALLY AVAILABLE TO STORE INFILTRATING RAINFALL---UNTIL IT WAS HAUED AWAY

FROM NEW IMPERVIOUS SURFACES --- (22% TO 32%) X 12 " = 2.64" TO 3.84"

FROM STRIPPED PERVIOUS AREAS

(22% TO 32%) X 8" = 1.76" TO 2.56"

Add 8% X 4" = 0.32" DUE TO TOPSOIL COMPACTION

Add ADDITIONAL VOID LOSS DUE TO COMPACTION OF UNDERLYING SOIL

TERRA ENGINEERING LTD.

Park Forest
Live Grow Discover

IAFSM
Illinois Association for Floodplain and Stormwater Management

NUTRIENT CYCLING FUNCTION

Topsoil provides the organic nutrients as well as other elements needed to support vegetative growth through the biogeochemical process of nutrient cycling.

- Stores Nutrients
- Moderates Nutrient Release
- Cycles Nutrients
- Facilitates Nutrient Transformation into Plant Available Forms

SOIL RESPIRATION ENABLEMENT FUNCTION

Soil Respiration constitutes the carbon dioxide release from the soil structure.

- Dependent upon organic composition of soil
- Essential for micro-organisms to provide a diverse physical, chemical, and biological habitat

FILTERING AND BUFFERING FUNCTION

Topsoil

- Acts as filter to protect water quality
- Enables degradation of toxic compounds
- Buffers excess nutrient availability to plants and animals.

PHYSICAL STABILITY AND SUPPORT FUNCTION

Topsoil has the ability to:

- Maintain its porous structure essential for passage of air and water
- Form soil texture necessary for flexibly supporting root growth

PRIMARY TOPSOIL FUNCTIONAL SUSTAINABILITY FACTORS

- Extent of organic matter
- Depth of topsoil

WHAT IS REQUIRED

FOR

RESPONSIBLE STEWARDSHIP

OF

TOPSOIL?

ANALYSIS METHODOLOGY

- Agricultural soil science based USDA Natural Resources Conservation Service (NRCS) publications

- Applies WHY ⟷ HOW Functional Analysis Principles of Value Engineering

INFILTRATION IMPEDIMENTS TO EFFICIENT SOIL VOID STORAGE

- Soil surface tension
  - Mulch protection
  - Vegetative cover

- Soil permeability for air and water
  - Trapped air barrier
  - Texture dependent
  - Density dependent
  - Pore size
  - Pore continuity

TOPSOIL PRESERVATION RECOMMENDATIONS

- 6” minimum topsoil replacement in all turf areas
- Incentify use of rain gardens and bioswales by reduced CN’s to 63
- Incentify 8” to 10” topsoil in passive use areas
- Use 12” of sandy or silty loam topsoil in swales
- Place 24” of Loam type topsoil in landscape footprint areas surrounding buildings and shrub or tree placement areas

TOPSOIL PRESERVATION RECOMMENDATIONS

- Specify use of Loam type topsoil for all imported topsoil
- Require topsoil types and thickness to be detailed on project civil and landscape plans and building permit
- Require site topsoil to be defined and handled by NRCS soil types
- Place first 2” of replaced topsoil on subgrade and disk it to a total of 8” depth to help overcome compaction due to heavy equipment during construction

PROPOSED CN REDUCTION
TOPSOIL PRESERVATION BMP INCENTIVE

CN Reduction of 2.0 for each additional inch of topsoil placed above 6 inches

- Applied for a maximum of 6 additional inches
- Placement must be at least 12 inches above seasonal water table for full credit
- Apply 50% of CN reduction credit when placed only 6 inches above the water table

REQUIRED REGULATORY CHANGES

- Countywide Stormwater Management ordinances
  - To apply BMP CN reduction for rain gardens and bioswales
  - To apply BMP CN reduction Topsoil Preservation Incentive

- Municipal code or ordinance revisions
  - For above BMP CN reduction incentives
  - For requirement of 6” topsoil replacement depths
  - For all other topsoil preservation recommendations

- Incorporate LEED and Envision sustainability credits for topsoil preservation