
**Technical Quarterly**

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# Soil Color: A Key Element in Determining Soil Drainage

**Soil color has been used for decades as a basic tool for assessing soil drainage class. While soil colors have no effect on behavior (except heat absorption at the surface), they are a good indicator of other soil properties and conditions that are critical to determining the compatibility of a soil for infiltration or wetland-type water quality Best Management Practices (BMPs).**

**Water content influences soil color with moist soils being darker in color than dry ones. However, the quantity and fluctuation of water and oxygen within soil govern the oxidation state of elements such as iron. Reddish brown to yellowish red upland soils suggest the presence of oxidized iron mineral oxides and well drained conditions. In contrast, grayish colors are found where chemically reduced conditions exist. In other words, well drained soils typically have bright matrix colors (high chroma and value) in the upper subsoil (B horizon) which gradually fade with depth to the unweathered (relict) color of the underlying parent material (C horizon). Whereas poorly drained soils typically have matrix colors of low chroma and value (e.g. gray, bluish gray, grayish green, etc.) with redoximorphic features directly below the A horizon.**

**Redoximorphic features are soil attributes gained from soil formation (pedogenesis) as opposed to attributes retained from parent material (e.g. variegated weathered rock). Redoximorphic features include: redox concentrations (high chroma) and depletions (low chroma). While redoximorphic features are indicative of poorly drained soils when present near the soil surface, many upland soils have redoximorphic features in deeper horizons. A key distinction between soil drainage classes is *the depth to* these features from the soil surface down.**

**The depth to redoximorphic features is also a useful metric of the well-aerated zone for urban gardening and landscaping, identification of hydric soils for wetland determination and mitigation, evaluation of infiltrability for on-site wastewater systems, planning for infiltration and wetland-type water quality BMPs, and soil survey for restoring urban ecosystems to name a few. So, while distinct soil colors may be an aesthetic component of the urban landscape, they also serve well as key indicators for use, re-use and management.**

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Take advantage of the Technical Quarterly hyperlinks, visit:

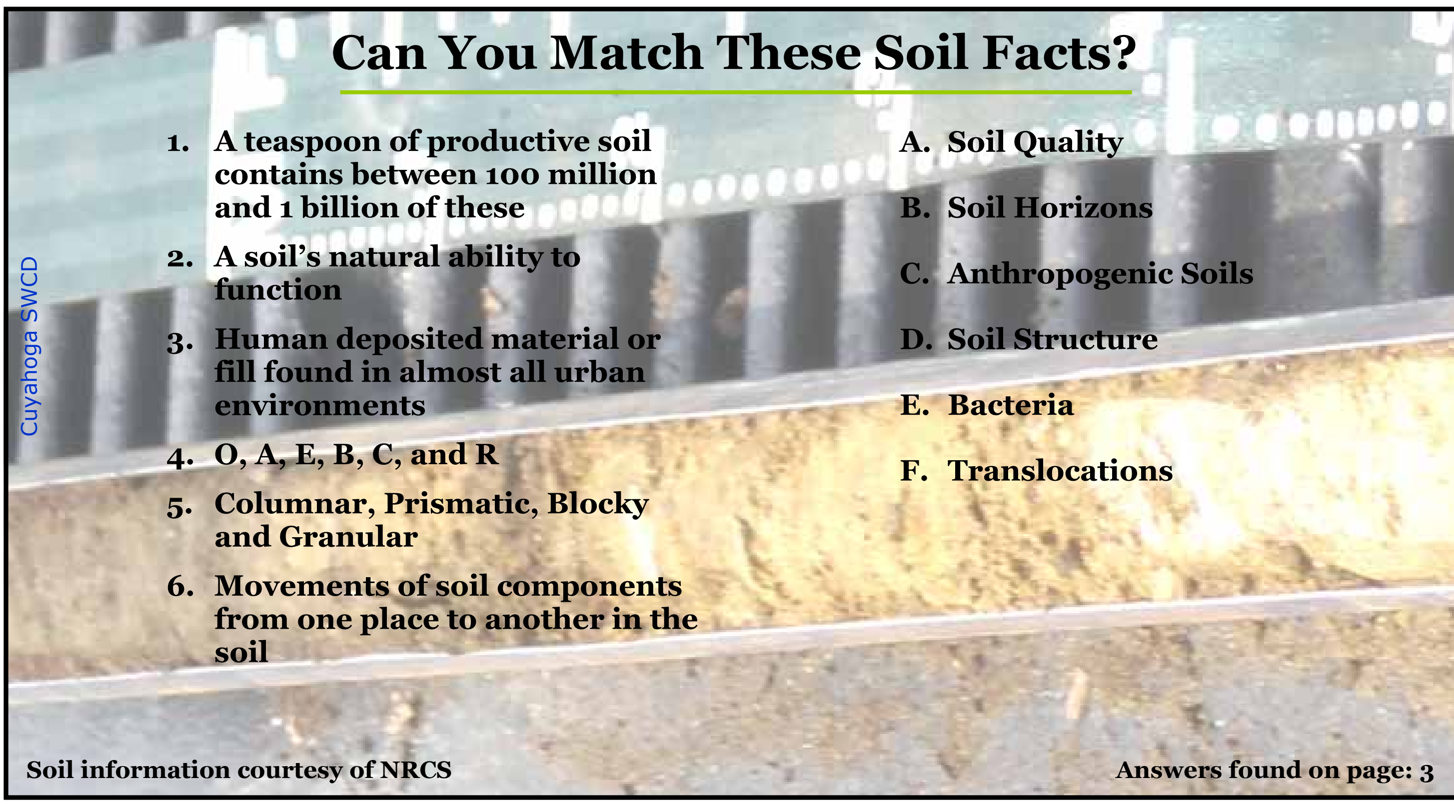
http://www.cuyahogaswcd.org/services-stormwater-publications.html

# Turbidity: Improving Water Quality One Measurement at a Time

Construction sites of 20 acres or more in size are about to enter the world of Turbidity measurement and management. Turbidity is a physical characteristic caused in most surface waters by the scattering and absorption of light by suspended (soil) particles. Turbidity is an index of water clarity rather than a measurement of suspended sediment. However, turbidity is helpful in monitoring and understanding the effects of construction-related activities and urban land uses on surface water quality.

Early attempts to quantify turbidity date back to 1900 when a light attenuation method known as the ***Jackson Candle Turbidimeter*** was developed. By 1926, Kingsbury and Clark discovered a compound (*formazin*) that improved the consistency in standards formulation for the Jackson Candle Turbidimeter. Turbidity measurements changed dramatically in the 1970s when the nephelometer was developed. A nephelometer determines turbidity by the light reflected at an angle of $90^\circ$ as opposed to attenuation of light due to cloudiness of the water. The nepholometer has become the preferred method for measuring turbidity because of applicability over a wide range of particle sizes and suspended sediment concentration. By the 1990s, submersible sensors were commercially-available and turbidity sampling became a more routine tool used in surface water monitoring programs. Today, easily calibrated, hand-held devices and instruments for continuous measurement are widely available.

Based on the availability of hand-held devices and simplified calibration, it is predictable that turbidity monitoring will become more widespread for professionals working in the field of soil conservation; particularly, given the fact that construction sites disturbing 20 or more acres of land at one time will be required to conduct turbidity sampling beginning on August 1, 2011. Nevertheless, as with most water quality assessment efforts, consistent procedure and instrumentation will be paramount to good measurements.




## Can You Match These Soil Facts?

1. A teaspoon of productive soil contains between 100 million and 1 billion of these
2. A soil's natural ability to function
3. Human deposited material or fill found in almost all urban environments
4. O, A, E, B, C, and R
5. Columnar, Prismatic, Blocky and Granular
6. Movements of soil components from one place to another in the soil

A. Soil Quality

B. Soil Horizons

C. Anthropogenic Soils

D. Soil Structure

E. Bacteria

F. Translocations

Soil information courtesy of NRCS

Answers found on page: 3

## Using Flocculants for Treating Storm Water Discharges

Minimizing sediment-laden discharges from construction sites is an ongoing battle. In keeping with Stokes' Law, slowing sediment-laden runoff typically allows larger soil particles to settle out, but quite often leaves soil fines (e.g. silt and clay) suspended. Turbidity (see opposite page) associated with the suspension of soil particles is regularly used as a metric for assessment of surface water quality.

Under the new National Pollutant Discharge Elimination System (see effluent guidelines), governing storm water discharges from construction sites of one or more acres, water quality and turbidity monitoring criteria have recently been established. Waiting for fine particles to settle out of suspension in order to meet established limits can take hours to weeks. However, with the aid of flocculants and proper application, suspended particles can be flocculated and turbidity reduced in significantly shorter timeframes.

Flocculants work by causing suspended soil particles to *stick* to each other and form "flocs"


which settle out of suspension at higher settling velocities. The key to getting the best result from a flocculant is to ensure complete dissolution when mixing with sediment-laden runoff, and combining proper application with a well constructed and maintained sediment settling pond.

Polyacrylamides, (PAMs) are effective flocculants and widely used to control turbidity. However, it is critical to note that not all PAMs are created alike. While PAMs are available in net positive (cationic), neutral, and negative (anionic) charge, the anionic PAMs are much less toxic to fish and aquatic critters, and extensively used for soil conservation purposes.

Though keeping up with the advancements in applied science can be a challenge, blending conventional and new Best Management Practices to combat suspended sediment and turbidity can help achieve a better end result of cleaner runoff from construction sites.

## Rediscovering the Beneficial Uses of Urban Soils in the Cleveland Metropolitan Area

The use of urban soils in the Cleveland Metropolitan Area holds many potential uses for redevelopment and beneficial functions related to urban gardening and landscaping, storm water volume reduction and treatment, and urban ecosystem restorations to name a few. Take a look at what another big city has undertaken to inspire metropolitan areas everywhere to move toward a better quality of life.


### Technical Contributors

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**Answers to Soil Facts**

| | | | |
|---|---|---|---|
| 1. | E | 4. | B |
| 2. | A | 5. | D |
| 3. | C | 6. | F |

# Plants: Good for Landscaping and Water Quality

**Storm water wetlands, bio-retention, and other infiltration-type water quality Best Management Practices (BMPs) are becoming commonplace in the Greater Cleveland Area. The interplay between plants, the soil, and hydrology are vital to the function of many water quality features. A critical aspect to the function and success of many water quality features is dependent on the plants selected and their long-term maintenance.**

**The proper selection of plants will provide increased pollutant removal (e.g. metals, total suspended solids, nitrogen, phosphorus, etc.) and resistance to storm water flow, which thereby reduces the velocity of storm water runoff. Slower velocity promotes settling, filtering, infiltration and adsorption, just to name a few of the benefits.**

**It is essential that selected plants are appropriate for the anticipated conditions. All water quality BMPs will have some period (24-48 hours) of slow dewatering. Therefore, it is critical for the overall success of the BMP to incorporate a selection of plants that can handle the sometimes dramatic and frequent fluctuations of storm water and northeast Ohio winter and summer temperatures and soil moisture conditions. A well-functioning water quality BMP with high pollutant removal efficiency will have a dense and diverse ecosystem, which also aids in mosquito control. Some of the common name plants include: Duckweed, Boxelder, Arrow Arum, Pickerelweed, Cardinal Flower, Elderberry, Silky Dogwood, River Birch, Sycamore, and Bald Cypress. There are many resources available that list plant recommendations for specific conditions (e.g. infiltration-type BMPs, deep and shallow pools, aquatic benches, etc.), as well as many professionals (e.g. arborist, urban forester, horticulturist, etc.) that can provide guidance on this topic.**


**Maintenance of vegetation is an important component to any storm water quantity and/or quality maintenance program and needs to be performed regularly. The plant community reflects management and can indicate needed improvements or problems. For example, a requirement of submergent aquatic plants, such as pondweed, is for light to penetrate the water column. The disappearance of these plants may indicate inadequate water clarity (North Carolina Storm Water Manual). The appearance of invasive species or the development of a monoculture can indicate a problem with the overall aquatic system. For example, cattails are common in water quality features such as water quality ponds and storm water wetlands. They can become very aggressive and crowd out other more desirable plant species.**

**So, no matter what type of water quality BMP that is of interest, make sure that the plants selected are compatible with the site and soil conditions, local climate and a maintenance plan that includes landscaping needs is in place.**

## 2010 Schedule of Training Opportunities

Find details on our website's Calendar of Events for the most up-to-date information.

| Date | Event |
|---|---|
| August 11-12 | Ohio Statewide Floodplain Management Conference |
| August 16-20 | Upcoming USACE and Great Lakes Commission Workshop - Interpreting the Sedimentary Record |
| August 26-27 | OEPA-OCAPP- Grant Writing for Storm Water Education Projects |
| September 14 | OEPA-OCAPP: Exams only for Certified Professional Erosion and Sediment Control Inspector (CPESC) , Certified Erosion, Sediment and Storm Water Inspector (CESSWI), Certified Professional in Storm Water Quality (CPSWQ), and Certified Municipal Separate Storm Sewer System Specialist (CMS4S), - Registration deadline August 31, 2010, Twinsburg, OH |