BIORETENTION MEDIA

Compost Research & Education Foundation

USING COMPOST AS A COMPONENT

Description:

This work consists of blending compost into a sand-based media used for stormwater management. The media and overall feature are typically used to capture sheet flow generated water and treat it using natural processes. The system captures and slowly releases water, often removing sediment and chemical contaminants.

Key Benefits:

- Increases water-holding capacity, reducing irrigation requirements,
- Slowly releases nutrients, typically eliminating fertilization for 1-2 years,
- Increases cation exchange capacity, improving the capture of chemical contaminants,
- Enhances microbial processes, better degrading petroleum hydrocarbons, and
- Improves vegetation establishment and long-term sustainability.

Various communities and storm water management agencies require compost use in their bioretention media specifications.

Construction Requirements:

- Pre-treat the water flow to remove excess debris and sediment before it reaches the bioretention feature to help minimize on-going maintenance requirements.
  - When treating concentrated flows of water, it is important to reduce its velocity by running the flow over a bed of stone, rip rap, compost filter sock, or a similar material.
- Excavate biotreatment area, as outlined on the engineering plans.
- Where an inch or more of water is required to drain, install an under drain consisting of a 4 to 6-inch perforated pipe, surrounded by a 6 to10-inch layer of pea gravel/stone which leads to the discharge point.
  - Some bioretention features may require an additional layer of gravel, below the pea gravel/ stone and on top of the existing soil.
- Fill a basin with compost using a telebelt or slinger truck, not a bulldozer because a bulldozer would compact the soil. Place a 2 ½ foot layer (minimum) of media. The bioretention planting and treatment media should contain 20 to 40% compost (by volume), with the remainder being a coarse sand (0.02 in – 0.04 sizing), or mineral aggregate by volume. Some media recipes also contain 10 to 20% sandy loam soil. The media is typically required to possess a minimum infiltration rate of 2 to 5 inches per hour.
  - The sand or mineral aggregate used in the bioretention media should be specifically graded based on the goals of the bioretention feature. Often, materials containing over 5 or 10% fines (sized at No. 200 sieve) are avoided.
  - The compost inclusion rate is dependent upon the characteristics of the mineral components of the media and the goals of the treatment system. The compost should be highly stable and mature, containing low levels of mobile nitrogen and phosphorus. Lower nutrient containing compost may be required in some bioretention media.
- Rake soil surface smooth prior to planting, removing large clods, roots, stones greater than 2 inches, and other material which will interfere with planting and subsequent site maintenance.
- Plant shrubs, trees, or desired vegetation. Water thoroughly after planting.
- Apply 2–3 inches of mulch over the treatment area, covering the media, and water into place.
  - Using mulches possessing a higher bulk density will be less likely to migrate.
- Depending on the nutrient content of the compost, pre-plant fertilization may be reduced or avoided entirely.

Additional Information:

Plants in a bioretention facility help to bind and uptake pollutants, remove water through evapo-transpiration, encourage infiltration, and create an aesthetically pleasing landscape feature.

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Compost Parameters:

Parameters[1,5]	Reported as (units of measure)	General Range
pH[2]	pH units	6.0 - 8.5
Soluble Salt Concentration[2] (electrical conductivity)	dS/m (mmhos/cm)	Maximum 10
Moisture Content	%, wet weight basis	30 – 60%
Organic Matter Content	%, dry weight basis	30 – 65%
Particle Size	% passing a selected mesh size, dry weight basis	95% pass through 3/8" screen or smaller
Stability Carbon Dioxide Evolution Rate	mg CO2-C per g OM per day	< 4
Maturity (Bioassay) Seed Emergence and Seedling Vigor	 %, relative to positive control %, relative to positive control	 Minimum 80% Minimum 80%
Physical Contaminants (man-made inerts)	%, dry weight basis	< 0.5% (0.25% film plastic)
Chemical Contaminants[3]	mg/kg (ppm)	Meet or exceed US EPA Class A standard, 40 CFR § 503.13, Tables 1 and 3 levels
Biological Contaminants[4] Indicator Organisms Fecal Coliform Bacteria, and /or Salmonella	 MPN per gram dry weight MPN per 4 grams dry weight	 Meet or exceed US EPA Class A standard, 40 CFR § 503.32(a) levels

General:

Compost Analysis: All compost products have different characteristics. Before selecting a compost product, a compost analysis should be completed by a reputable laboratory* to determine the characteristics of the material, so that the right material can be used for the appropriate purpose. Once determined, the media should be appropriately amended to a range suitable for the plant species to be established and results desired.

Media Analysis: During production and before planting, analyze the media to assure that it meets the final media specifications and is acceptable to the plants being established.

References:

Filtrexx Bioretention System, SWPPP Cut Sheet, 1-1-2008.
Use of Bio-Soils Design, Kurt Kutter, P.E., Cochran Engineering, 10-12-2021.
Model Bioretention Soil Media Specifications–MRP Provision C.3.c.iii.(3), 12-1-2010.

***The Seal of Testing Assurance (STA) Certified Compost Program provides a comprehensive history of compost analysis results from proficiency-tested laboratories, list of ingredients, and suggested directions for using that unique product.** **www.compostingcouncil.org/participants**

[1] Recommended test methodologies are provided in Test Methods for the Examination of Composting and Compost (TMECC, The Compost Research & Education Foundation).

[2] It should be noted that the pH and soluble salt content of the final amended media is more relevant to the establishment and growth of a particular plant, than is the pH or soluble salt content of the specific compost used to amend the media. The pH and soluble salt content of the compost is diluted when mixed with the native soil, so testing for these parameters in the amended soil is suggested. Each specific plant species requires a specific pH range. Each plant also has a salinity tolerance rating, and maximum tolerable quantities are known. Most ornamental plants and turf species can tolerate a soil/media soluble salt level of 2.5 dS/m and 4 dS/m, respectively. Seeds, young seedlings and salt sensitive species often prefer soluble salt levels at half the afore mentioned levels. When specifying the establishment of any plant or turf species, it is important to understand their pH and soluble salt requirements, and how they relate to existing soil conditions.

[3] US EPA Class A standard, 40 CFR § 503.13, Tables 1 and 3 levels = Arsenic 41ppm, Cadmium 39ppm, Copper 1,500ppm, Lead 300ppm, Mercury 17ppm, Molybdenum 75ppm, Nickel 420ppm, Selenium 100ppm, Zinc 2,800ppm.

[4] US EPA Class A standard, 40 CFR § 503.32(a) levels = Salmonella <3 MPN/4grams of total solids or Fecal Coliform <1000 MPN/gram of total solids.

[5] Landscape architects and project (field) engineers may modify the allowable compost specification ranges based on specific field conditions and plant requirements.

Developed for the CREF by R. Alexander Associates, Inc.