



# B A S M A A

Alameda Countywide  
Clean Water Program

Contra Costa  
Clean Water Program

Fairfield-Suisun  
Urban Runoff  
Management Program

Marin County  
Stormwater Pollution  
Prevention Program

Napa County  
Stormwater Pollution  
Prevention Program

San Mateo Countywide  
Water Pollution  
Prevention Program

Santa Clara Valley  
Urban Runoff Pollution  
Prevention Program

Sonoma County  
Water Agency

Vallejo Sanitation  
and Flood  
Control District

Bay Area

Stormwater Management

Agencies Association

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February 5, 2016

Bruce Wolfe, Executive Officer  
California Regional Water Quality Control Board  
San Francisco Bay Region

Subject: Model Biotreatment Soil Media Specifications–MRP 2.0 Provision  
C.3.c.i.(2)(c)(ii)

Dear Mr. Wolfe:

This letter and attachments are submitted on behalf of all 76 Permittees subject to the requirements of the Municipal Regional Stormwater NPDES Permit (MRP). In December 2010, the Permittees, per Provision C.3.c.iii.(3) of the MRP<sup>1</sup>, submitted a biotreatment soil specification to the Regional Water Board and received approval to use the specification in low impact development (LID) treatment measures. The permit was amended on November 28, 2011 to include the biotreatment soil specification as Attachment L.

The recently adopted “MRP 2.0,” which took effect on January 1, 2016, allows Permittees to collectively develop and adopt revisions to the biotreatment soil media minimum specifications, subject to the Executive Officer’s approval<sup>2</sup>. The biotreatment soil mix is required to meet the performance criteria stated in the MRP, including a long-term minimum permeability of 5 inches-per-hour over the life of the facility, support healthy plant growth, and remove pollutants.

The current biotreatment soil specification has been in use Bay Area-wide for 5 years<sup>3</sup>. The following immediate issues with the specification have been identified:

- Compost suppliers are having difficulties meeting the gradation specifications, soluble Boron criteria, and occasionally the pH limit listed in the specification;
- There are typographical errors and missing or incorrectly identified units of measurement.

In August 2015, the BASMAA Development Committee formed a Work Group on behalf of the Permittees to re-evaluate the soil specification. The Work Group decided to take a two-prong approach: first, immediately propose minor modifications to the current soil specification to ensure suppliers can deliver

<sup>1</sup> Reference is to the “original” MRP, Order R2-2009-0074, NPDES Permit No. CAS612008, adopted October 14, 2009.

<sup>2</sup> Provision C.3.c.i.(2)(c)(ii), Order No. R2-2015-XXXX, NPDES Permit No. CAS612008, adopted November 19, 2015.

<sup>3</sup> The original very similar specification was developed by the Contra Costa Clean Water Program beginning in 2007, and has been in formal effect in Contra Costa County and its 19 cities and towns since March 2009.

material that complies with the specification, and second, concurrently convene a soil specification “roundtable” (similar to the 2010 roundtable used to reach consensus on the MRP 1.0 Attachment L specification). The newly convened soil specification roundtable will investigate the need for alternative specifications that might enhance the performance of bioretention facilities under varying microclimates and drought conditions and with diverse planting palettes, including trees.

The attachment to this letter includes the following revisions to the Attachment L specification:

For the compost fraction of the mix:

1. Reduce the minimum percent of the #200 sieve size gradation from 2% to 1%;
2. Change the allowable pH range from 6.5-8.0 to 6.2-8.2;
3. Remove the soluble Boron specification;
4. Fix typographical errors, and
5. Correct missing or erroneous units of measure.

There are no proposed changes to the sand fraction of the mix.

Your approval of these minor changes will make it possible for suppliers to meet the letter of the mix specification without compromising performance of the mix. Biotreatment soil mixes having those revised specification limits have in fact been used successfully in meeting the permit requirements. Using the alternative biotreatment soil mix option in Attachment L, the products were able to meet the specification.

The Work Group plans to convene the stakeholder roundtable meeting during Spring 2016. We hope your staff will participate in this effort.

We thank you for your prompt consideration. If we do not hear from you by March 9, 2016, we will assume that the modified soil specification has been approved.

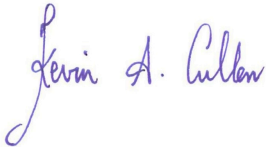
We certify under penalty of law that this document was prepared under our direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on our inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of our knowledge and belief, true, accurate, and complete. We are aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.



James Scanlin, Alameda Countywide Clean Water Program



Tom Dalziel, Contra Costa Clean Water Program




Kevin Cullen, Fairfield-Suisun Urban Runoff Management Program



Matt Fabry, San Mateo Countywide Water Pollution Prevention Program



Adam Olivieri, Santa Clara Valley Urban Runoff Pollution Prevention Program



Doug Scott, Vallejo Sanitation and Flood Control District

Model Biotreatment Soil Media Specifications–MRP 2.0 Provision C.3.c.i.(2)(c)(ii)

Attachments:

Mark-up of Specification of Soils for Biotreatment or Bioretention Facilities

Proposed Revised Specification of Soils for Biotreatment or Bioretention Facilities

cc: Tom Mumley, Regional Water Board

Keith Lichten, Regional Water Board

Dale Bowyer, Regional Water Board

Sue Ma, Regional Water Board

BASMAA Board of Directors, Development Committee, and Soil Specifications Work Group

## Specification of Soils for Biotreatment or Bioretention Facilities

Soils for biotreatment or bioretention areas shall meet two objectives:

- Be sufficiently permeable to infiltrate runoff at a minimum rate of 5" per hour during the life of the facility, and
- Have sufficient moisture retention to support healthy vegetation.

Achieving both objectives with an engineered soil mix requires careful specification of soil gradations and a substantial component of organic material (typically compost).

Local soil products suppliers have expressed interest in developing 'brand-name' mixes that meet these specifications. At their sole discretion, municipal construction inspectors may choose to accept test results and certification for a 'brand-name' mix from a soil supplier.

Tests must be conducted within 120 days prior to the delivery date of the bioretention soil to the project site.

Batch-specific test results and certification shall be required for projects installing more than 100 cubic yards of bioretention soil.

### SOIL SPECIFICATIONS

Bioretention soils shall meet the following criteria. "Applicant" refers to the entity proposing the soil mixture for approval by a Permittee.

1. General Requirements – Bioretention soil shall:
  - a. Achieve a long-term, in-place infiltration rate of at least 5 inches per hour.
  - b. Support vigorous plant growth.
  - c. Consist of the following mixture of fine sand and compost, measured on a volume basis:
    - 60%-70% Sand
    - 30%-40% Compost
2. Submittal Requirements – The applicant shall submit to the Permittee for approval:
  - a. A minimum one-gallon size sample of mixed bioretention soil.
  - b. Certification from the soil supplier or an accredited laboratory that the Bioretention Soil meets the requirements of this guideline specification.
  - c. Grain size analysis results of the fine sand component performed in accordance with ASTM D 422, Standard Test Method for Particle Size Analysis of Soils or Caltrans Test Method (CTM) C202.
  - d. Quality analysis results for compost performed in accordance with Seal of Testing Assurance (STA) standards, as specified in 4.
  - e. Organic content test results of mixed Bioretention Soil. Organic content test shall be performed in accordance with by Testing Methods for the Examination of Compost and Composting (TMECC) 05.07A, "Loss-On-Ignition Organic Matter Method".
  - f. Grain size analysis results of compost component performed in accordance with ASTM D 422, Standard Test Method for Particle Size Analysis of Soils.
  - g. A description of the equipment and methods used to mix the sand and compost to produce Bioretention Soil.
  - h. Provide the name of the testing laboratory(s) and the following information:

- (1) Contact person(s)
- (2) Address(s)
- (3) Phone contact(s)
- (4) E-mail address(s)
- (5) Qualifications of laboratory(s), and personnel including date of current certification by USCC, ASTM, Caltrans, or approved equal

3. Sand for Bioretention Soil

- a. Sand shall be free of wood, waste, coating such as clay, stone dust, carbonate, etc., or any other deleterious material. All aggregate passing the No. 200 sieve size shall be nonplastic.
- b. Sand for Bioretention Soils shall be analyzed by an accredited lab using #200, #100, #40 or #50, #30, #16, #8, #4, and 3/8 inch sieves (ASTM D 422, CTM 202 or as approved by municipality), and meet the following gradation:

Sieve Size	Percent Passing (by weight)	
	<i>Min</i>	<i>Max</i>
3/8 inch	100	100
No. 4	90	100
No. 8	70	100
No. 16	40	95
No. 30	15	70
No. 40 or No.50	5	55
No. 100	0	15
No. 200	0	5

Note: all sands complying with ASTM C33 for fine aggregate comply with the above gradation requirements.

4. Composted Material

Compost shall be a well decomposed, stable, weed free organic matter source derived from waste materials including yard debris, wood wastes or other organic materials not including manure or biosolids meeting the standards developed by the US Composting Council (USCC). The product shall be certified through the USCC Seal of Testing Assurance (STA) Program (a compost testing and information disclosure program).

- a. Compost Quality Analysis by Laboratory – Before delivery of the soil, the supplier shall submit a copy of lab analysis performed by a laboratory that is enrolled in the US Composting Council’s Compost Analysis Proficiency (CAP) program and using approved Test Methods for the Examination of Composting and Compost (TMECC). The lab report shall verify:
  - (1) Organic Matter Content: 35% - 75% by dry wt.

- (2) Carbon and Nitrogen Ratio: C:N < 25:1 and C:N >15:1
- (3) Maturity/Stability: Any one of the following is required to indicate stability:
  - (i) Oxygen Test < 1.3 O<sub>2</sub> /unit TS /hr
  - (ii) Specific oxy. Test < 1.5 O<sub>2</sub> / unit BVS /hr
  - (iii) Respiration test < 8 mg CO<sub>2</sub>-C /g OM / day
  - (iv) Dewar test < 20 Temp. rise (°C) e.
  - (v) Solvita® > 5 Index value
- (4) Toxicity: Any one of the following measures is sufficient to indicate non-toxicity.
  - (i) NH<sub>4</sub><sup>+</sup> : NO<sub>3</sub><sup>-</sup>-N < 3
  - (ii) Ammonium < 500 ppm, dry basis
  - (iii) Seed Germination > 80 % of control
  - (iv) Plant Trials > 80% of control
  - (v) Solvita® = 5 Index value
- (5) Nutrient Content: provide analysis detailing nutrient content including N-P-K, Ca, Na, Mg, S, and B.
  - (i) Total Nitrogen content 0.9% or above preferred.
  - (ii) Boron: Total shall be <80 ppm;
- (6) Salinity: Must be reported; < 6.0 mmhos/cm
- (7) pH shall be between 6.2 and 8.2 May vary with plant species.
- b. Compost Quality Analysis by Compost Supplier – Before delivery of the compost to the soil supplier the Compost Supplier shall verify the following:
  - (1) Feedstock materials shall be specified and include one or more of the following: landscaping/yard trimmings, grass clippings, food scraps, and agricultural crop residues.
  - (2) Maturity/Stability: shall have a dark brown color and a soil-like odor. Compost exhibiting a sour or putrid smell or containing recognizable grass or leaves, or is hot (120F) upon delivery or rewetting is not acceptable.
  - (3) Weed seed/pathogen destruction: provide proof of process to further reduce pathogens (PFRP). For example, turned windrows must reach min. 55C for 15 days with at least 5 turnings during that period.
- c. Compost for Bioretention Soil Texture – Compost for bioretention soils shall be analyzed by an accredited lab using #200, 1/4 inch, 1/2 inch, and 1 inch sieves (ASTM D 422 or as approved by municipality), and meet the following gradation:

Sieve Size	Percent Passing (by weight)	
	<i>Min</i>	<i>Max</i>
1 inch	99	100
1/2 inch	90	100
1/4 inch	40	90
No. 200	1	10

- d. Bulk density shall be between 500 and 1100 dry lbs/cubic yard
- e. Moisture content shall be between 30% - 55% of dry solids.
- f. Inerts – compost shall be relatively free of inert ingredients, including glass, plastic and paper, < 1 % by weight or volume.
- g. Select Pathogens – Salmonella <3 MPN/4grams of TS, or Coliform Bacteria <10000 MPN/gram.
- h. Trace Contaminants Metals (Lead, Mercury, Etc.) – Product must meet US EPA, 40 CFR 503 regulations.
- i. Compost Testing – The compost supplier will test all compost products within 120 calendar days prior to application. Samples will be taken using the STA sample collection protocol. (The sample collection protocol can be obtained from the U.S. Composting Council, 4250 Veterans Memorial Highway, Suite 275, Holbrook, NY 11741 Phone: 631-737-4931, www.compostingcouncil.org). The sample shall be sent to an independent STA Program approved lab. The compost supplier will pay for the test.

### VERIFICATION OF ALTERNATIVE BIORETENTION SOIL MIXES

Bioretention soils not meeting the above criteria shall be evaluated on a case by case basis. Alternative bioretention soil shall meet the following specification: “Soils for bioretention facilities shall be sufficiently permeable to infiltrate runoff at a minimum rate of 5 inches per hour during the life of the facility, and provide sufficient retention of moisture and nutrients to support healthy vegetation.”

The following steps shall be followed by municipalities to verify that alternative soil mixes meet the specification:

1. General Requirements – Bioretention soil shall achieve a long-term, in-place infiltration rate of at least 5 inches per hour. Bioretention soil shall also support vigorous plant growth. The applicant refers to the entity proposing the soil mixture for approval.
  - a. Submittals – The applicant must submit to the municipality for approval:
    - (1) A minimum one-gallon size sample of mixed bioretention soil.
    - (2) Certification from the soil supplier or an accredited laboratory that the Bioretention Soil meets the requirements of this guideline specification.
    - (3) Certification from an accredited geotechnical testing laboratory that the Bioretention Soil has an infiltration rate between 5 and 12 inches per hour as tested according to Section 1.b.(2)(ii).
    - (4) Organic content test results of mixed Bioretention Soil. Organic content test shall be performed in accordance with by Testing Methods for the Examination of Compost and Composting (TMECC) 05.07A, “Loss-On-Ignition Organic Matter Method”.
    - (5) Grain size analysis results of mixed bioretention soil performed in accordance with ASTM D 422, Standard Test Method for Particle Size Analysis of Soils.
    - (6) A description of the equipment and methods used to mix the sand and compost to produce Bioretention Soil.
    - (7) The name of the testing laboratory(s) and the following information:
      - (i) Contact person(s)
      - (ii) Address(s)
      - (iii) Phone contact(s)



- (iv) E-mail address(s)
  - (v) Qualifications of laboratory(s), and personnel including date of current certification by STA, ASTM, or approved equal.
- b. Bioretention Soil
- (1) Bioretention Soil Texture: Bioretention Soils shall be analyzed by an accredited lab using #200, and 1/2" inch sieves (ASTM D 422 or as approved by municipality), and meet the following gradation:

Sieve Size	Percent Passing (by weight)	
	<i>Min</i>	<i>Max</i>
1/2 inch	97	100
No. 200	2	5

- (2) Bioretention Soil Permeability testing: Bioretention Soils shall be analyzed by an accredited geotechnical lab for the following tests:
- (i) Moisture – density relationships (compaction tests) shall be conducted on bioretention soil. Bioretention soil for the permeability test shall be compacted to 85 to 90 percent of the maximum dry density (ASTM D1557).
  - (ii) Constant head permeability testing in accordance with ASTM D2434 shall be conducted on a minimum of two samples with a 6-inch mold and vacuum saturation.

**MULCH FOR BIORETENTION FACILITIES**

Three inches of mulch is recommended for the purpose of retaining moisture, preventing erosion and minimizing weed growth. Projects subject to the State’s Model Water Efficiency Landscaping Ordinance (or comparable local ordinance) will be required to provide at least three inches of mulch. Aged mulch, also called compost mulch, reduces the ability of weeds to establish, keeps soil moist, and replenishes soil nutrients. Aged mulch can be obtained through soil suppliers or directly from commercial recycling yards. It is recommended to apply 1" to 2" of composted mulch, once a year, preferably in June following weeding.

# ~~ATTACHMENT L~~

## ~~Provision C.3.c.i.(1)(b)(vi)~~

### Specification of soils for Biotreatment or Bioretention Facilities

Soils for biotreatment or bioretention areas shall meet two objectives:

- Be sufficiently permeable to infiltrate runoff at a minimum rate of 5" per hour during the life of the facility, and
- Have sufficient moisture retention to support healthy vegetation.

Achieving both objectives with an engineered soil mix requires careful specification of soil gradations and a substantial component of organic material (typically compost).

Local soil products suppliers have expressed interest in developing 'brand-name' mixes that meet these specifications. At their sole discretion, municipal construction inspectors may choose to accept test results and certification for a 'brand-name' mix from a soil supplier.

Tests must be conducted within 120 days prior to the delivery date of the bioretention soil to the project site.

Batch-specific test results and certification shall be required for projects installing more than 100 cubic yards of bioretention soil.

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Bioretention soils shall meet the following criteria. "Applicant" refers to the entity proposing the soil mixture for approval by a Permittee.

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  - c. Consist of the following mixture of fine sand and compost, measured on a volume basis:
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2. Submittal Requirements – The applicant shall submit to the Permittee for approval:
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  - c. Grain size analysis results of the fine sand component performed in accordance with ASTM D 422, Standard Test Method for Particle Size Analysis of Soils [or Caltrans Test Method \(CTM\) C202](#).
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- g. A description of the equipment and methods used to mix the sand and compost to produce Bioretention Soil.
- h. Provide the name of the testing laboratory(s) and the following information:
  - (1) Contact person(s)
  - (2) Address(s)
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  - (5) Qualifications of laboratory(s), and personnel including date of current certification by [USCCSTA](#), ASTM, [Caltrans](#), or approved equal

3. Sand for Bioretention Soil

- a. Sand shall be free of wood, waste, coating such as clay, stone dust, carbonate, etc., or any other deleterious material. All aggregate passing the No. 200 sieve size shall be nonplastic.
- b. Sand for Bioretention Soils shall be analyzed by an accredited lab using #200, #100, #40 or #50, #30, #16, #8, #4, and 3/8 inch sieves (ASTM D 422, [CTM 202](#) or as approved by municipality), and meet the following gradation:

Sieve Size	Percent Passing (by weight)	
	<i>Min</i>	<i>Max</i>
3/8 inch	100	100
No. 4	90	100
No. 8	70	100
No. 16	40	95
No. 30	15	70
No. 40 <u>or</u> <a href="#">No.50</a>	5	55
No. 100	0	15
No. 200	0	5

Note: all sands complying with ASTM C33 for fine aggregate comply with the above gradation requirements.

4. Composted Material

Compost shall be a well decomposed, stable, weed free organic matter source derived from waste materials including yard debris, wood wastes or other organic materials not including manure or biosolids meeting the standards developed by the US Composting Council (USCC). The product shall be certified through the USCC Seal of Testing Assurance (STA) Program (a compost testing and information disclosure program).

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~~(1)~~ Feedstock Materials shall be specified and include one or more of the following: landscape/yard trimmings, grass clippings, food scraps, and agricultural crop residues.

~~(2)~~ (1) Organic Matter Content: 35% - 75% by dry wt.

~~(3)~~ (2) Carbon and Nitrogen Ratio: C:N < 25:1 and C:N > 15:1

~~(4)~~ (3) Maturity/Stability: shall have a dark brown color and a soil-like odor. Compost exhibiting a sour or putrid smell, containing recognizable grass or leaves, or is hot (120F) upon delivery or rewetting is not acceptable. In addition Aany one of the following is required to indicate stability:

(i) Oxygen Test < 1.3 O<sub>2</sub> /unit TS /hr

(ii) Specific oxy. Test < 1.5 O<sub>2</sub> / unit BVS /hr

(iii) Respiration test < 8 mg CO<sub>2</sub>-C /g OM unit VS / day

(iv) Dewar test < 20 Temp. rise (°C) e.

(v) Solvita® > 5 Index value

~~(5)~~ (4) Toxicity: Aany one of the following measures is sufficient to indicate non-toxicity.

(i) ~~NH<sub>4</sub><sup>+</sup> : NO<sub>3</sub><sup>-</sup> -N < 3~~ NH<sub>4</sub><sup>+</sup> : NO<sub>3</sub><sup>-</sup> -N < 3

(ii) Ammonium < 500 ppm, dry basis

(iii) Seed Germination > 80 % of control

(iv) Plant Trials > 80% of control

(v) Solvita® ⇒ 5 Index value

~~(6)~~ (5) Nutrient Content: provide analysis detailing nutrient content including N-P-K, Ca, Na, Mg, S, and B.

(i) Total Nitrogen content 0.9% or above preferred.

(ii) Boron: Total shall be <80 ppm; ~~Soluble shall be <2.5 ppm~~

~~(7)~~ (6) Salinity: Must be reported; < 6.0 mmhos/cm

~~(8)~~ (7) pH shall be between 6.25 and 8.2 May vary with plant species.

b. Compost Quality Analysis by Compost Supplier – Before delivery of the compost to the soil supplier the Compost Supplier shall verify the following:

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- (2) Maturity/Stability: shall have a dark brown color and a soil-like odor. Compost exhibiting a sour or putrid smell or containing recognizable grass or leaves, or is hot (120F) upon delivery or rewetting is not acceptable.
- (3) Weed seed/pathogen destruction: provide proof of process to further reduce pathogens (PFRP). For example, turned windrows must reach min. 55C for 15 days with at least 5 turnings during that period.

b.c. Compost for Bioretention Soil Texture – Compost for bioretention soils shall be analyzed by an accredited lab using #200, 1/4 inch, 1/2 inch, and 1 inch sieves (ASTM D 422 or as approved by municipality), and meet the following gradation:

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1/4 inch	40	90
No. 200	<u>12</u>	10

- e.d. Bulk density shall be between 500 and 1100 dry lbs/cubic yard
- ~~e.e.~~ Moisture content shall be between 30% - 55% of dry solids.
- e.f. Inerts – compost shall be relatively free of inert ingredients, including glass, plastic and paper, < 1 % by weight or volume.
- ~~f.~~ Weed seed/pathogen destruction—provide proof of process to further reduce pathogens (PFRP). For example, turned windrows must reach min. 55C for 15 days with at least 5 turnings during that period.
- f.g. Select Pathogens – Salmonella <3 MPN/4grams of TS, or Coliform Bacteria <10000 MPN/gram.
- ~~g.h.~~ Trace Contaminants Metals (Lead, Mercury, Etc.) – Product must meet US EPA, 40 CFR 503 regulations.
- ~~h.i.~~ Compost Testing – The compost supplier will test all compost products within 120 calendar days prior to application. Samples will be taken using the STA sample collection protocol. (The sample collection protocol can be obtained from the U.S. Composting Council, 4250 Veterans Memorial Highway, Suite 275, Holbrook, NY 11741 Phone: 631-737-4931, www.compostingcouncil.org). The sample shall be sent to an independent STA Program approved lab. The compost supplier will pay for the test.

## VERIFICATION OF ALTERNATIVE BIORETENTION SOIL MIXES

Bioretention soils not meeting the above criteria shall be evaluated on a case by case basis. Alternative bioretention soil shall meet the following specification: “Soils for bioretention facilities shall be sufficiently permeable to infiltrate runoff at a minimum rate of 5 inches per hour during the life of the facility, and provide sufficient retention of moisture and nutrients to support healthy vegetation.”

The following steps shall be followed by municipalities to verify that alternative soil mixes meet the specification:

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  - a. Submittals – The applicant must submit to the municipality for approval:
    - (1) A [minimum one-gallon size](#) sample of mixed bioretention soil.
    - (2) Certification from the soil supplier or an accredited laboratory that the Bioretention Soil meets the requirements of this guideline specification.
    - (3) Certification from an accredited geotechnical testing laboratory that the Bioretention Soil has an infiltration rate between 5 and 12 inches per hour as tested according to Section 1.b.(2)(ii).
    - (4) Organic content test results of mixed Bioretention Soil. Organic content test shall be performed in accordance with by Testing Methods for the Examination of Compost and Composting (TMECC) 05.07A, “Loss-On-Ignition Organic Matter Method”.
    - (5) Grain size analysis results of mixed bioretention soil performed in accordance with ASTM D 422, Standard Test Method for Particle Size Analysis of Soils.
    - (6) A description of the equipment and methods used to mix the sand and compost to produce Bioretention Soil.
    - (7) The name of the testing laboratory(s) and the following information:
      - (i) Contact person(s)
      - (ii) Address(s)
      - (iii) Phone contact(s)
      - (iv) E-mail address(s)
      - (v) Qualifications of laboratory(s), and personnel including date of current certification by STA, ASTM, or approved equal.
  - b. Bioretention Soil
    - (1) Bioretention Soil Texture: Bioretention Soils shall be analyzed by an accredited lab using #200, and 1/2” inch sieves (ASTM D 422 or as approved by municipality), and meet the following gradation:

Sieve Size	Percent Passing (by weight)	
	Min	Max

1/2 inch	97	100
No. 200	2	5

- (2) Bioretention Soil Permeability testing: Bioretention Soils shall be analyzed by an accredited geotechnical lab for the following tests:
- (i) Moisture – density relationships (compaction tests) shall be conducted on bioretention soil. Bioretention soil for the permeability test shall be compacted to 85 to 90 percent of the maximum dry density (ASTM D1557).
  - (ii) Constant head permeability testing in accordance with ASTM D2434 shall be conducted on a minimum of two samples with a 6-inch mold and vacuum saturation.

### **MULCH FOR BIORETENTION FACILITIES**

Three inches of mulch is recommended for the purpose of retaining moisture, preventing erosion and minimizing weed growth. Projects subject to the State’s Model Water Efficiency Landscaping Ordinance (or comparable local ordinance) will be required to provide at least threetwo inches of mulch. Aged mulch, also called compost mulch, reduces the ability of weeds to establish, keeps soil moist, and replenishes soil nutrients. Aged mulch can be obtained through soil suppliers or directly from commercial recycling yards. It is recommended to apply 1" to 2" of composted mulch, once a year, preferably in June following weeding.