

SOIL GUIDELINES FOR STORMWATER TREATMENT MEASURES

The New Development Subcommittee of the San Mateo Countywide Clean Water Program (SMCWPPP) is providing these guidelines to its member municipalities for use in non-proprietary, landscaped-based stormwater treatment measures. The purpose of these guidelines is to help project applicants specify soils that will provide suitable growing conditions for appropriate plantings and meet the percolation guidelines identified in Chapter 6 of SMCWPPP's C.3 Stormwater Technical Guidance (March 2007) for the specific types of landscape-based treatment measures proposed in their projects. SMCWPPP's member municipalities are not required to use these guidelines, and the municipalities may modify the guidelines as needed to address local concerns. Before using these guidelines, project applicants should check with the jurisdiction having authority over the project regarding local considerations.

The guidelines refer specifically to treatment measures for which technical guidance is included in the SMCWPPP's C.3 Stormwater Technical Guidance. The guidelines identify planting soils to be used (Section I), guidelines for compost amendments in the planting soils (Section II), and a top dressing layer of mulch (Section III).

I. PLANTING SOILS

Planting soil is to be placed for the purpose of providing a soil for plants to be established in the treatment measure. One of two types of planting soils shall be used: dewatering soils or treatment soils.

Dewatering soils (moderate percolation planting soils, such as sandy loam) shall be used for dewatering of treatment measures such as vegetated swales, vegetated buffer strips and extended detention basins. These treatment measures remove pollutants from runoff by filtering the runoff through both plants and surface features, or holding a volume of water for a duration of time and then releasing runoff to a storm drain system. These treatment measures do not rely on a percolation rate for treatment. Dewatering planting soils percolate runoff that has been trapped in the treatment measure.

Treatment Soils (high percolation planting soils, such as loamy sands) shall be used for filtering of a volume of water in the treatment measures, such as flow-through planters and bioretention areas. These treatment measures shall treat runoff by passing it through the surface layer of high percolation planting soil, then saturating a zone of crushed drain rock and finally in most cases, entering a perforated sub-drain.

A. IMPORTED MATERIAL FOR DEWATERING (SANDY LOAM)

Planting soil material for surface dewatering shall consist of soil (no gravel) with a moderate percolation rate (2 to 10 inches per hour), supplied from previously tested and approved sources, and shall conform to the following guidelines:

1. All material shall be free of trash and debris, expansive clays or any other deleterious materials, and shall be subject to the approval and acceptance of the Authority Having Jurisdiction.
2. The contractor shall designate their proposed import sources in advance and shall provide source samples of material to the jurisdiction having authority.
3. Material shall be free of seeds.
4. The dewatering planting soil material shall have documentation from the supplier showing conformance to the following gradation guidelines:

Screen Information

Percentage

- | | |
|--|----------------------------|
| a. Maximum particle size | 2 millimeters (0.078 inch) |
| b. Percent passing No. 10 screen (2mm) | 100 (coarse sand or finer) |
| c. Percent passing No. 200 screen (0.074mm) | 15 to 50% |
| d. The 15 to 50% percent passing #200 sieve is silt, clay and organics, with a range of silt from 5-35% and a clay content of 5-20%. | |
5. The above screened dewatering planting soil shall have 4 to 6% by dry weight organic compost mixed in (see section II). Final dry weight per unit volume mixed in may be lowered by the jurisdiction having authority for varying plant species in the treatment measure. Native in-situ sandy loam soils can be used, with 4 to 6% by weight of organic compost mixed in, if approved by the jurisdiction having authority. This native soil used must be certified to meet the imported planting soil guidelines. Organic compost shall meet the guidelines stated in Section II – Organic Compost Amendment. The soil shall have a salt concentration less than 500 mg/L. The pH shall be between 5.5 and 7, unless directed otherwise by the jurisdiction having authority.
 6. One test shall be conducted by the supplier per each 500 cubic yards supplied. Testing shall be conducted for the above gradation requirements, salt contents and pH range.
 7. Contractor shall demonstrate the in-situ percolation of each treatment measure for design storm flows through the installed soil to the satisfaction of the Authority Having Jurisdiction. The material shall have an onsite tested percolation rate of 2 to 10 inches per hour. In-field percolation test shall consist of a 1-foot diameter pipe, 2.5 feet long pipe, driven 1.5 feet deep into dewatering soils, as shown in Figure 1 attached. Pipe shall be filled with 1 foot of water after the treatment measure has been wetted. The pipe should empty 1 foot of water above the wetted soil layer in no less than 1 hour and 12 minutes, and no longer than 6 hours. Contractor shall provide records of percolation tests to city inspector.
 8. Standard compaction of a minimum of 85 percent shall be used when placing the mixed material. Complete inundation of the soil shall be used to reach this compaction.
 9. Soil shall be placed in lifts of 8-10 inches.

Note: Lower percolation rate of dewatering soil may be allowed by the local jurisdiction.

B. IMPORTED MATERIAL FOR TREATMENT (LOAMY SAND)

Planting soil material for treatment shall consist of high organics soil (no gravel) with a high percolation rate, supplied from previously tested and approved sources, and shall conform to the following guidelines:

1. All material shall be free of trash and debris, expansive clays or any other deleterious materials, and shall be subject to the approval and acceptance of the Authority Having Jurisdiction.
2. The contractor shall designate their proposed import sources in advance and shall provide source samples of material to the jurisdiction having authority.
3. Material shall be free of seeds.
4. The treatment planting soil shall have documentation from the supplier showing conformance to the following gradation guidelines:

Screen Information

Percentage

- | | |
|---|----------------------------|
| a. Maximum particle size | 2 millimeters (0.078 inch) |
| b. Percent passing No. 10 screen (2mm) | 100 (coarse sand or finer) |
| c. Percent passing No. 200 screen (0.074mm) | 10 to 15% |
- d. The overall dry weight percentages shall be 85-90% sand, less than 5% clay, and less than 5% silt. The range of clay and silt and organics should be 10-15% of total volume.
 5. The treatment planting soil shall have 4 to 6% by dry weight organic compost mixed in. Organic compost percentage may be lowered by the jurisdiction of authority for varying plant species in the treatment measure. Native in-situ loamy sand soils can be used, with 4 to 6% of organic compost mixed in. This mixed soil must be certified to meet the imported planting soil guidelines. Organic compost shall meet the guidelines stated in Section II – Organic Compost Amendment. The soil shall have a salt concentration less than 500 mg/L. The pH shall be between 5.5 and 7, unless directed otherwise by the jurisdiction of authority.
 6. One test shall be conducted by the supplier per each 500 cubic yards supplied. Testing shall be conducted for the above gradation requirements, salt contents and pH range.
 7. Contractor shall demonstrate the in-situ percolation of each treatment measure for design storm flows through the installed soil to the satisfaction of the Authority Having Jurisdiction. The material shall have an onsite tested percolation rate of 5 to 10 inch per hour. In-field percolation test shall consist of a 1-foot diameter pipe, 2.5 feet long pipe, driven 1.5 feet deep into treatment soils. Pipe shall be filled with 1 foot of water after the treatment measure has been wetted. The pipe should empty 1 foot of water above the wetted soil layer in no less than 1 hour and 12 minutes, and no longer than 2

hours and 24 minutes. Contractor shall provide records of percolation tests to city inspector.

8. Soil shall be placed in lifts of 8-10 inches.
9. Standard compaction to a minimum of 85 percent shall be used when placing the mixed material. The method to achieve 85% compaction shall be approved by the local jurisdiction before the soil is placed in the treatment measure.

II. ORGANIC COMPOST AMENDMENT

An organic amendment per Attachment 1 is to be mixed into the planting soil for the purpose of providing organic material to be utilized by plantings placed within the treatment measure. The following guidelines are for amendments used in bioretention areas, flow through planters, vegetated buffer strips, vegetated swales, and extended detention basins only.

A. COMPOST GUIDELINES

Organic compost shall meet the requirements of the Alameda County Bay-Friendly Landscape program. Provide a lab analysis of proposed material performed by either: (1) a certified US Composting Council Compost Analysis Program (CAP) laboratory or (2) a laboratory approved by the local jurisdiction, using approved Test Methods for the Evaluation of Composting and Compost (TMECC). Verifying current participation in CAP can be achieved by visiting www.compostingcouncil.org. The TMECC methods are explained at www.tmecc.org/tmecc. Check with local jurisdiction for a list of approved laboratories.

See the attached Friendly Landscaping (BFL) Soil Preparation Specifications, Part 2.1.B.1, Section 02920: Soil Preparation for approved testing ranges of attributes for compost amendments.

Organic content may be lowered by the jurisdiction having authority for varying plant species in the treatment measure. This mixed soil must be certified by the laboratory to meet the imported planting soil guidelines.

III. TOP DRESSING MULCH

A three-inch thick layer of top dressing mulch shall be placed in all designated planting areas for the purpose of retaining moisture, preventing erosion and minimizing weed growth. Keep top dressing six inches away from tree trunks for tree health except where approved by the jurisdiction having authority. The following guidelines are for top dressing soils used in bioretention areas, flow through planters, vegetated buffer strips, vegetated swales, and extended detention basins only.

A. MULCH GUIDELINES

Any of the following materials may be used as top dressing for any of the treatment measures listed above, subject to the jurisdiction of authority's approval. Options for top dressing material include:

Arbor Mulch: Arbor Mulch shall be wood waste from tree trimming and not contain eucalyptus. Local tree companies may have material available free of charge. Submit a minimum one-quart sample of proposed material to be used, to jurisdiction with authority.

Wood Chip Mulch: Wood Chip Mulch shall be a coarse wood mulch made from salvaged kiln dried lumber and be color enhanced with mineral pigments that have a demonstrated color longevity of one year. Mulch material shall pass a two inch screen.

Organic Compost: Organic Compost may be used as mulch as determined by the jurisdiction having authority. Organic compost shall meet the guidelines stated above in Section II – Organic Compost Amendment.

The following are guidelines for the above dressing materials:

1. The top dressing soil material shall not float when three inches or more of water has ponded in the treatment measure.
2. Natural compaction is adequate for top dressing layer soil.
3. The 3 inches of top dressing mulch shall be placed in a single lift.

IV. SOURCES/ACKNOWLEDGEMENTS

SMCWPPP gratefully acknowledges the Alameda Countywide Clean Water Program (ACCWP), for its preparation of Soil Specifications for Stormwater Treatment Measures, which formed the basis for these soil guidelines; and Stopwaste.org, for its preparation of the Bay-Friendly Landscaping Soil Preparation Specifications, included as Attachment 1.

V. DEFINITIONS

1. Lift – Depth of soil placed before compaction is necessary
2. Expansive clay soils – are in-situ clay soils. These soils must be amended to be used in the treatment measures.
3. Stormwater treatment measure – Any engineered system designed to remove pollutants from stormwater by simple gravity settling of particle pollutants, filtration, biological uptake, media adsorption or any other physical, biological, or chemical process. Sometimes called a treatment control, treatment control measure, treatment best management practice (BMP), or treatment facility.
4. Wetted soil – soil that has been irrigated until the water has penetrated soil to a minimum of 4 inches.

Attachment 1**BFL Soil Preparation Specifications Part 2.1.B.1****Section 02920: Soil Preparation****1. Organic Amendment**

Compost shall be a well decomposed, stable, weed free organic matter source. The product shall be certified through the US Composting Council's (USCC) Seal of Testing Assurance Program (STA) Program (a compost testing and information disclosure program). It shall be derived from agricultural or food waste or yard trimmings. The product shall contain no substances toxic to plants, shall possess no objectionable odors and shall not resemble the feedstock (the original materials from which it was derived).

Before delivery of the compost, the supplier shall submit a copy of lab analysis performed by a laboratory that is enrolled in the US Composting Council's CAP and using the approved Test Methods for the Evaluation of Composting and Compost (TMECC). The lab report shall verify:

- A. Feedstock Materials shall be specified and include one or more of the following:
landscape/yard trimmings, grass clippings, food scraps, and agricultural crop residues.
- B. Organic Matter Content: 50% - 60% by dry wt. preferred, 35-70% acceptable
- C. Carbon and Nitrogen Ratio: C:N < 25:1 plus at least one measure of stability and at least one measure of toxicity.
- D. 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 any one of the following is required to indicate stability
 - a. Oxygen Test < 1.3 O_2 / unit TS / hr
 - b. Specific oxy. Test < 1.5 O_2 / unit BVS / hr
 - c. Respiration test < 8 C / unit VS / day
 - d. Dewar test < 20 Temp. rise ($^{\circ}C$)
 - e. Solvita® > 5 Index value
- E. Toxicity: any one of the following measures is sufficient to indicate non-toxicity.
 - a. $NH_4^+ : NO_3-N < 3$
 - b. Ammonium < 500 ppm, dry basis
 - c. Seed Germination > 80 % of control
 - d. Plant Trials > 80% of control
 - e. Solvita® > 5 Index value
- F. Nutrient Content: provide analysis detailing nutrient content including N-P-K, Ca, Na, Mg, S, and B.
 - a. Total Nitrogen content 0.9% or above preferred.
 - b. Boron: Total shall be <80 ppm; Soluble shall be <2.5 ppm
- G. Salinity: Must be reported; may vary but < 4.0 mmhos/cm preferred. Soil should also be tested: <2.5 mmhos/cm is preferred for soil/compost blend but may vary with plant species.
- H. pH: pH shall be between 6.5 and 8. May vary with plant species.

- I. Particle size: 95% passing a 1/2" screen.
 - J. Bulk density: shall be between 500 and 1100 dry lbs/cubic yard
 - K. Moisture Content shall be between 35% - 55% of dry solids.
 - L. Inerts: compost shall be relatively free of inert ingredients, including glass, plastic and paper, < 0.1 % by weight or volume.
 - M. 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.
 - N. Select Pathogens: Salmonella <3 MPN/4grams of TS, or Coliform Bacteria <10000 MPN/gram.
 - O. Trace Contaminants Metals (Lead, Mercury, Etc.) Product must meet US EPA, 40 CFR 503 regulations.
2. Additional amendments and/or fertilizers as required in the soils report.
- a. Additional amendments and fertilizers that are approved for use by the Organics Materials Research Institute (OMRI) for use in crop production are approved for use. See www.omri.org. Fertilizers that are not approved or are restricted for use by OMRI shall be applied only after review and written approval by the Owner.

Notes:

- 1) Solvita is a registered trademark test. Please see <http://solvita.com/>
- 2) TS is Total Solids, BVS is Biological Volatile Solids, VS is Volatile Solids, MPN/gram is Most Probable Number per gram, ppm is parts per million.

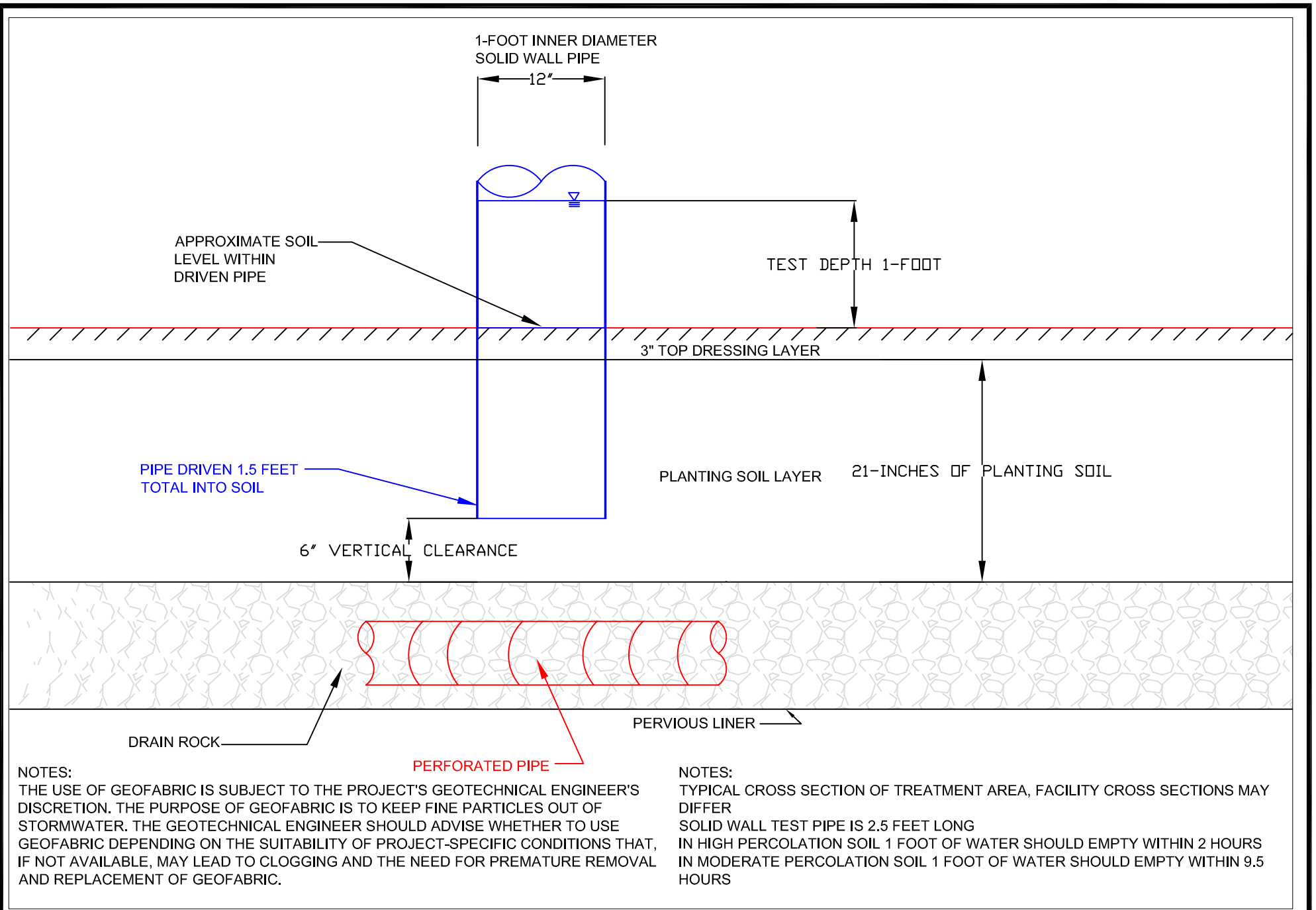


FIGURE 1
PERCOLATION TEST SETUP

Source: ACCWP