
Physical Properties of Bioretention Soils

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Stormwater Treatment



Rainfall

x

Tributary Area

x

Soil Infiltration (Biotreatment)

=

Clean Water

Why 5? (in/hr)

- Compromise between treatment and loading rate
- Treatment area: 4% of tributary impervious area
- Equivalent Rainfall of *400-600 inches* per year
- Seems to work!!!
- Adopted into Municipal Regional Permit

Soil Infiltration Rate



- Gravel = high infiltration

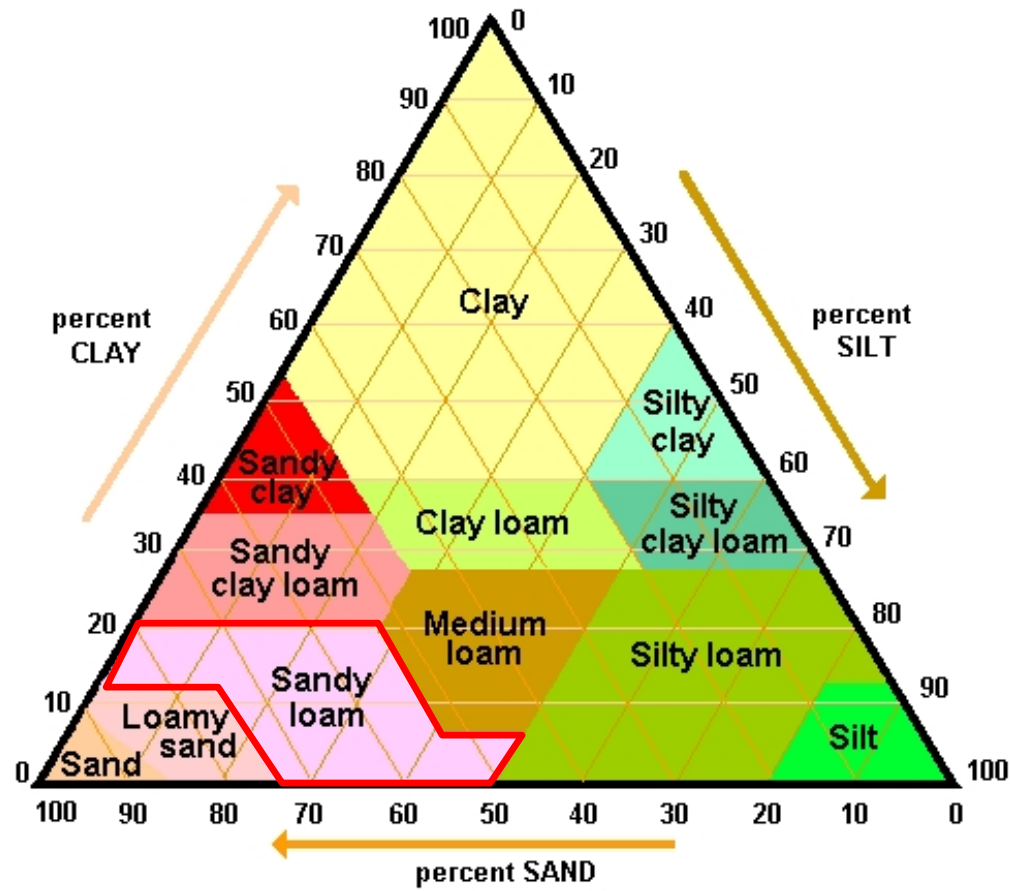


- Sandy Loam = Just Right!



- Clays = low infiltration

Sandy Loam or is it Loamy Sand?



Soil Mechanics 101

- Three types of soil: Sand, Silt, and Clay
- Silt is just very small Sand
 - Finer than 0.0029 inches (#200 sieve)
- Clays are different
 - Finer than 0.0029 inches (#200 sieve)
 - Thin, flat plate-like shape
 - Negative electrical charge attracts and bonds to water

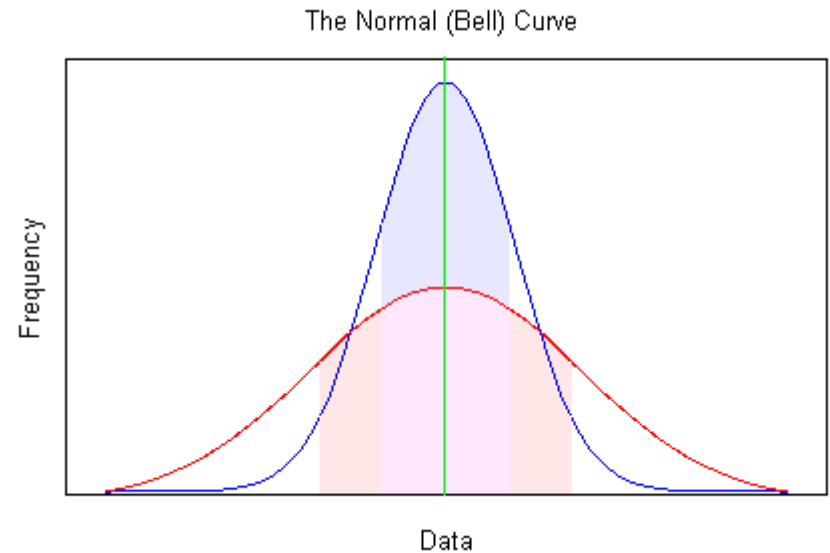
Soil Infiltration (Permeability) Ranges

- Gravel ~ 10,000 inches / hr
- Clean Sand ~ 50 inches / hr
- Fine Sand / Silt ~ 1 inch / hr
- Silty Sandy Clay ~ 0.05 inches / hr
- Clay ~ 0.001 inches / hr

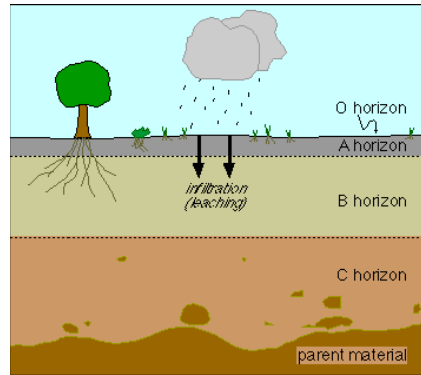
Stormwater Treatment

$$\text{Rainfall} \times \text{Tributary Area} \times \text{Soil Infiltration} \\ = \text{Clean Water}$$

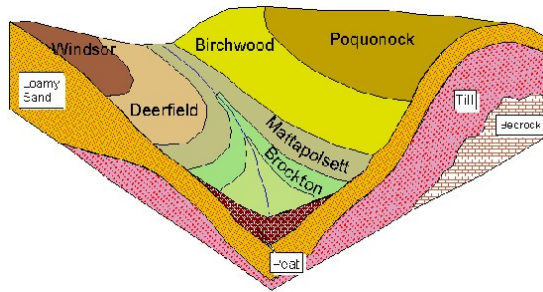
Rainfall	+/- 100%
Area	+/- 20%
Infiltration	+/- 10,000%



Soil Variability



- Vertical Variation
- Horizontal Variation
- Parent Rock Material
- Deposition Method



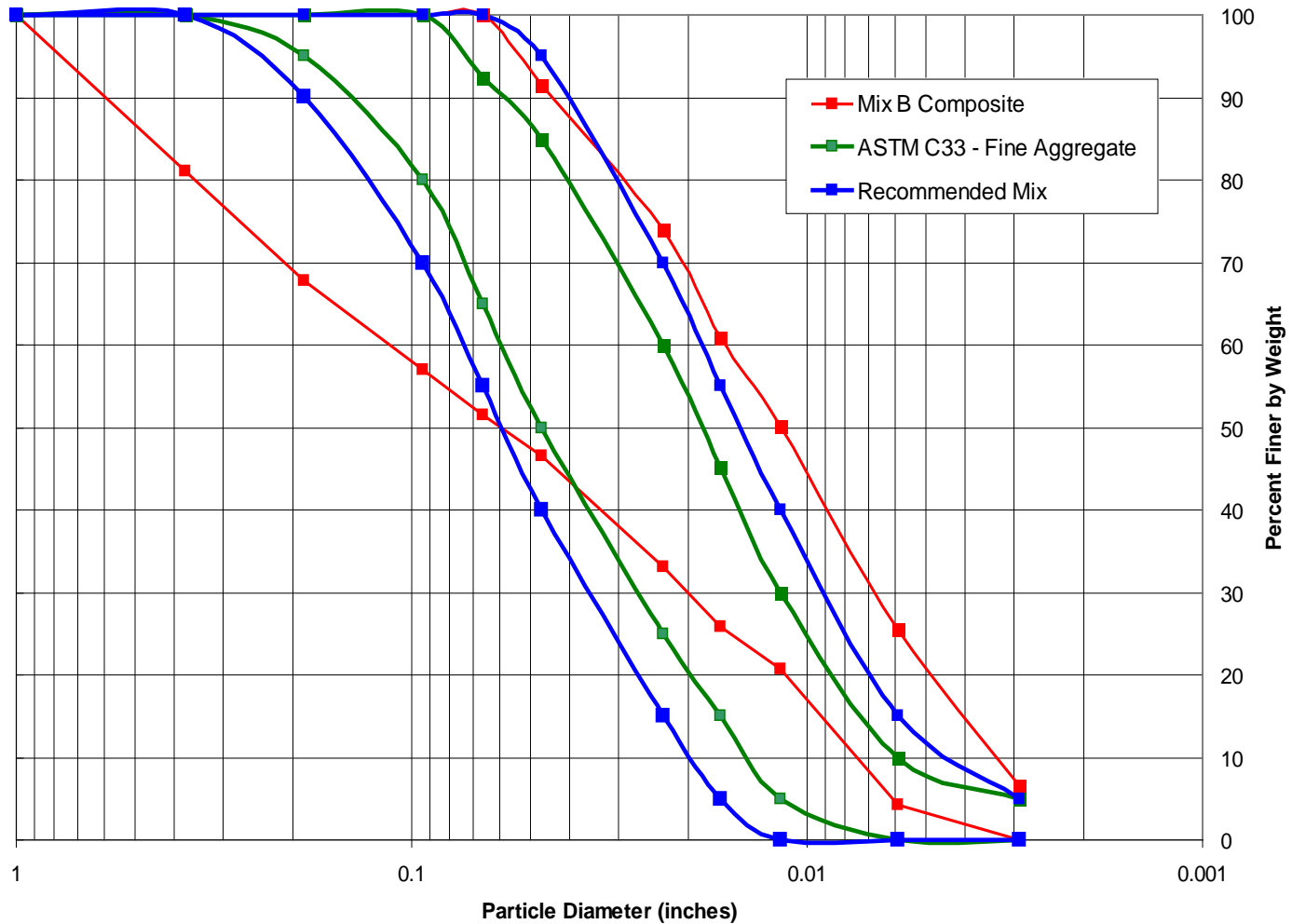
Contra Costa Soil Spec – Part I

- Several installations using on-site soils failed
- Soil Supplier mix worked well
 - Well graded mix of two local soils
 - Some “Topsoil”
 - Amended with Compost
- How to Verify?
- Hard to replicate throughout Bay Area

Contra Costa Soil Spec - Part II

- Target: 8-12 inches per hour
- Goal: 5-50 inches per hour
- Limit fines content, especially clay
- Readily available – not a proprietary soil blend
- Consistent mix
- Testing and verification considerations

Soil Gradation Curves



Contra Costa Soil Spec – Part III

- Performance Spec
 - Minimum 5 inches per hour infiltration rate
 - Support Healthy Plant Growth
- Two Mixes provided: Fine Sand with Compost
- ASTM C33 Fine Aggregate “Concrete Sand”
- Contra Costa Clean Water Program Verification
- Inspectors pull tags at jobsite.

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- Questions?
 - Comments!
 - Discussion...

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