

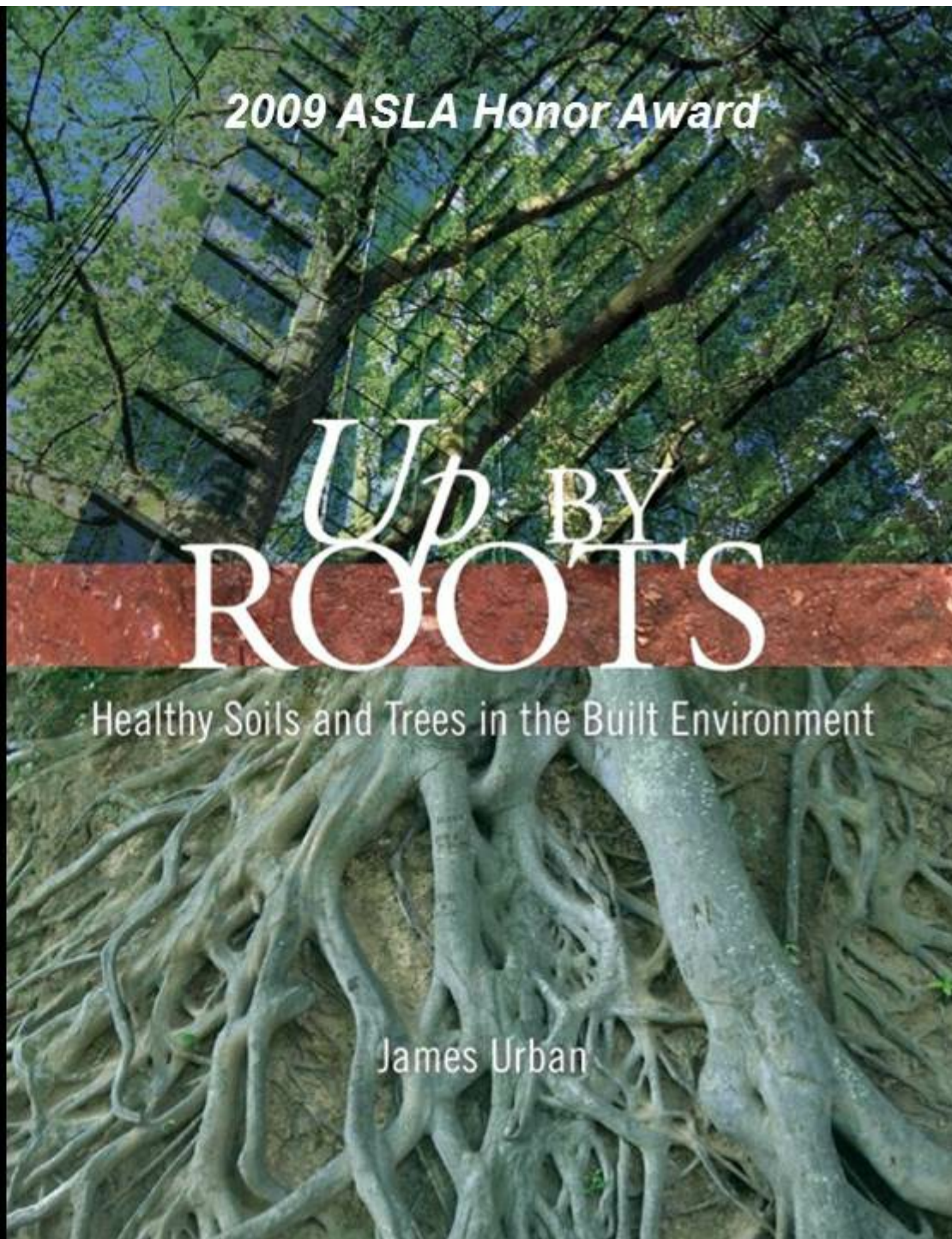
Working with
Urban Soil

2009 ASLA Honor Award

Up BY
ROOTS

Healthy Soils and Trees in the Built Environment

James Urban



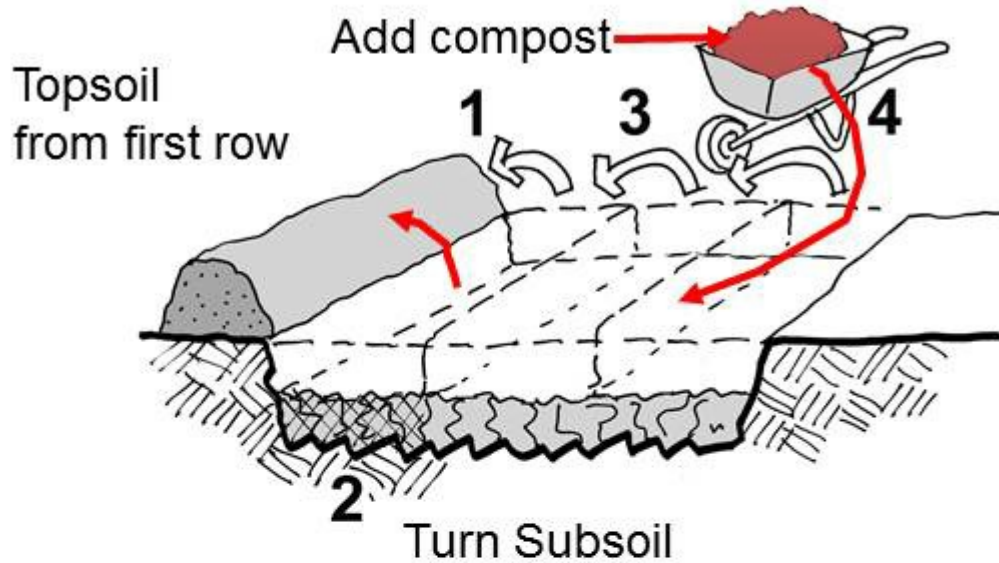
Soil Compaction Modification

Over compaction in soil is one of the greatest causes of plant decline!

1. Mechanical modification
2. Subsoil modification
3. Compaction reduction within the root zone of mature trees



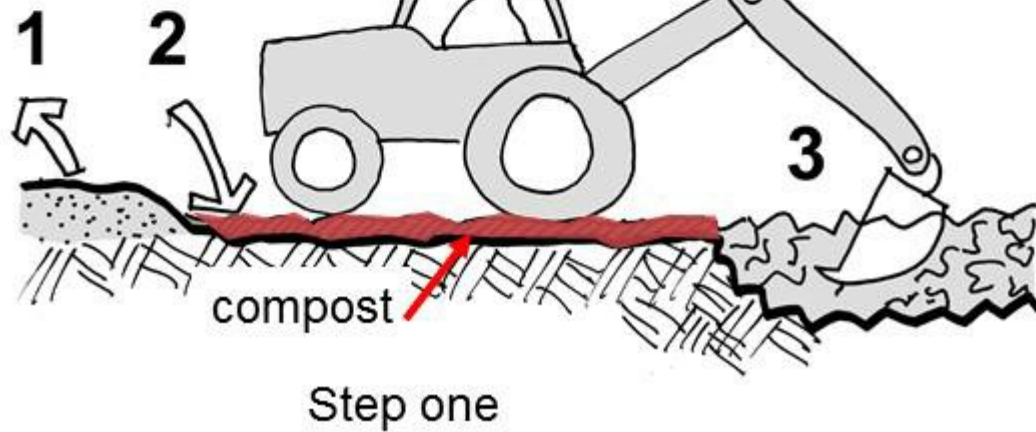
English “double spading”



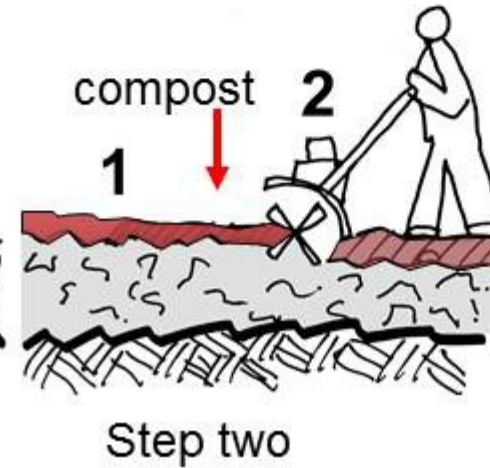
1. MECHANICAL COMPACTION REDUCTION METHODS



Remove topsoil



Machine “double spading”

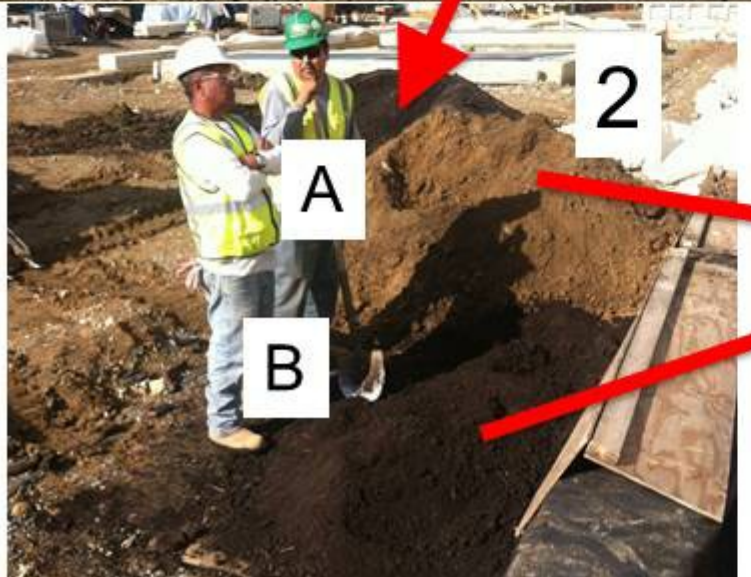


Step 3
Respread
topsoil



Redefining usable soil

Field mixing several soil layers with compost (4:1) to make good quality planting soil



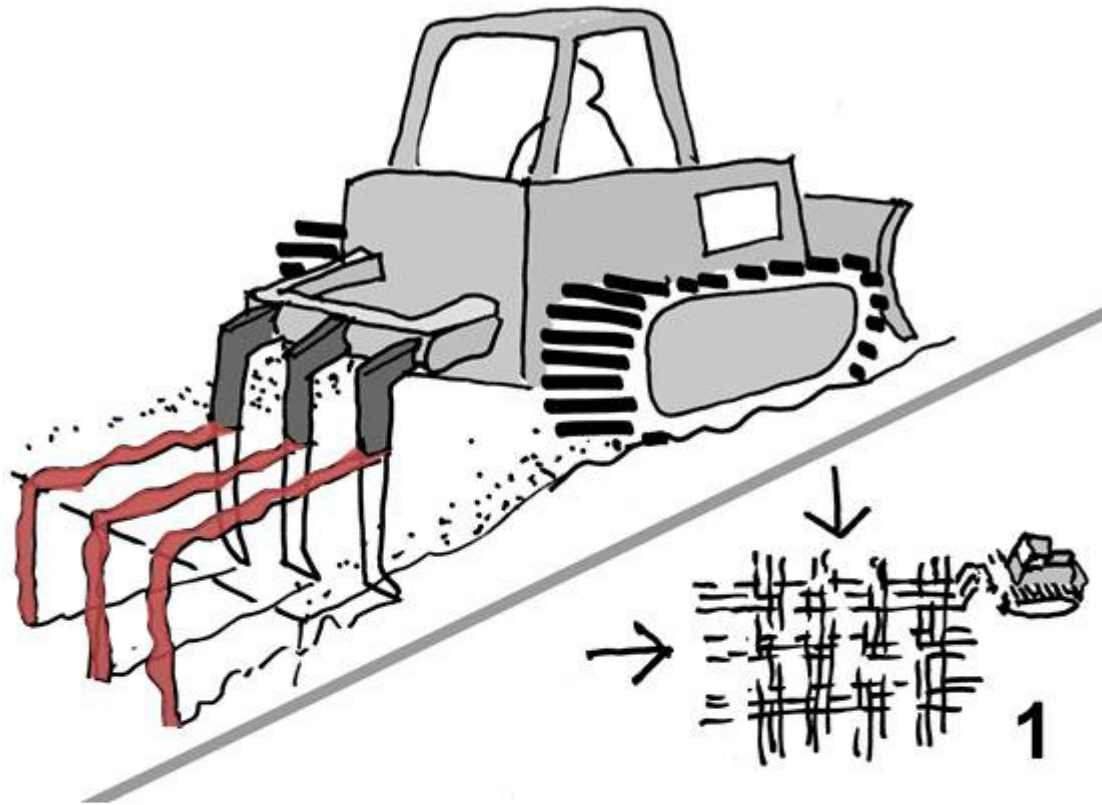
Compost!!!!

Get it into contact with the soil

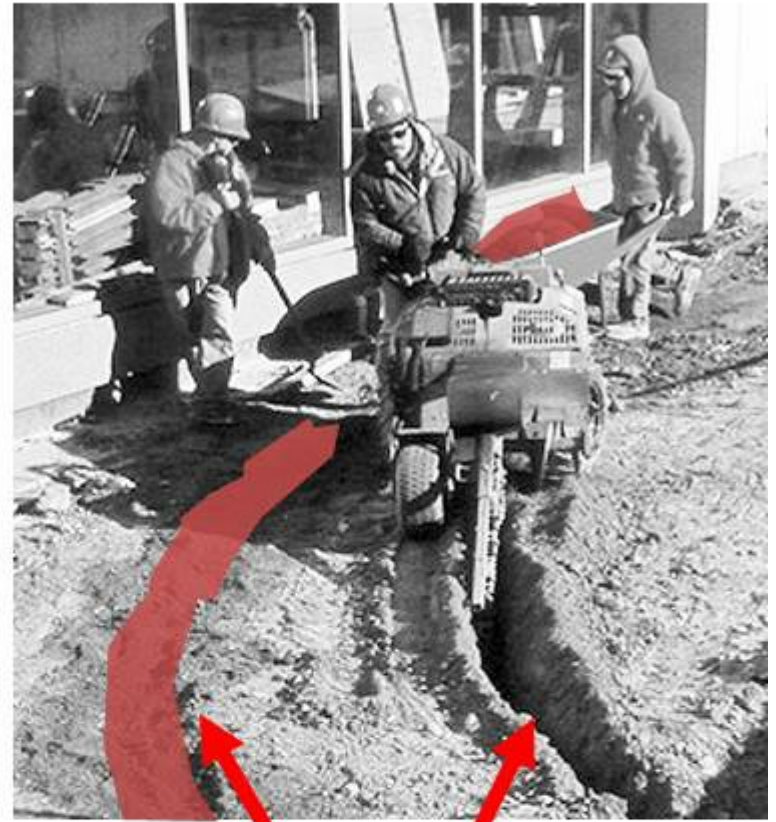


But there are issues with tillers





Subsoiling
large site



Trenches filled
with compost
Subsoiling
small site

Dealing with compaction: Cultivation (break it up!)



Backhoe



Auger

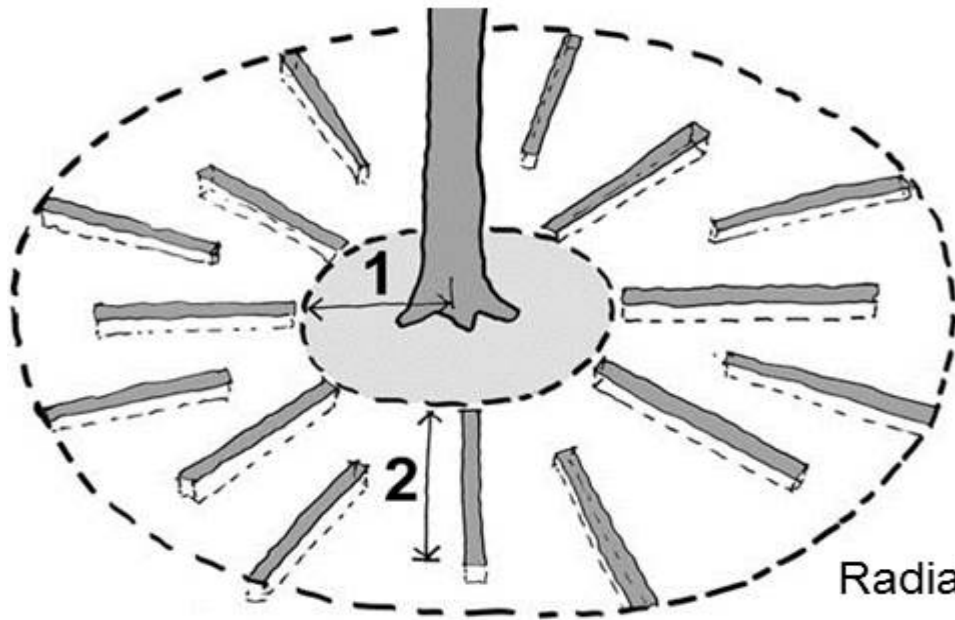


Chisels and rippers



Vertical mulching

3. Compaction reduction in the root zone of mature trees



Radial trenching



Air Spade / compost soil mixing

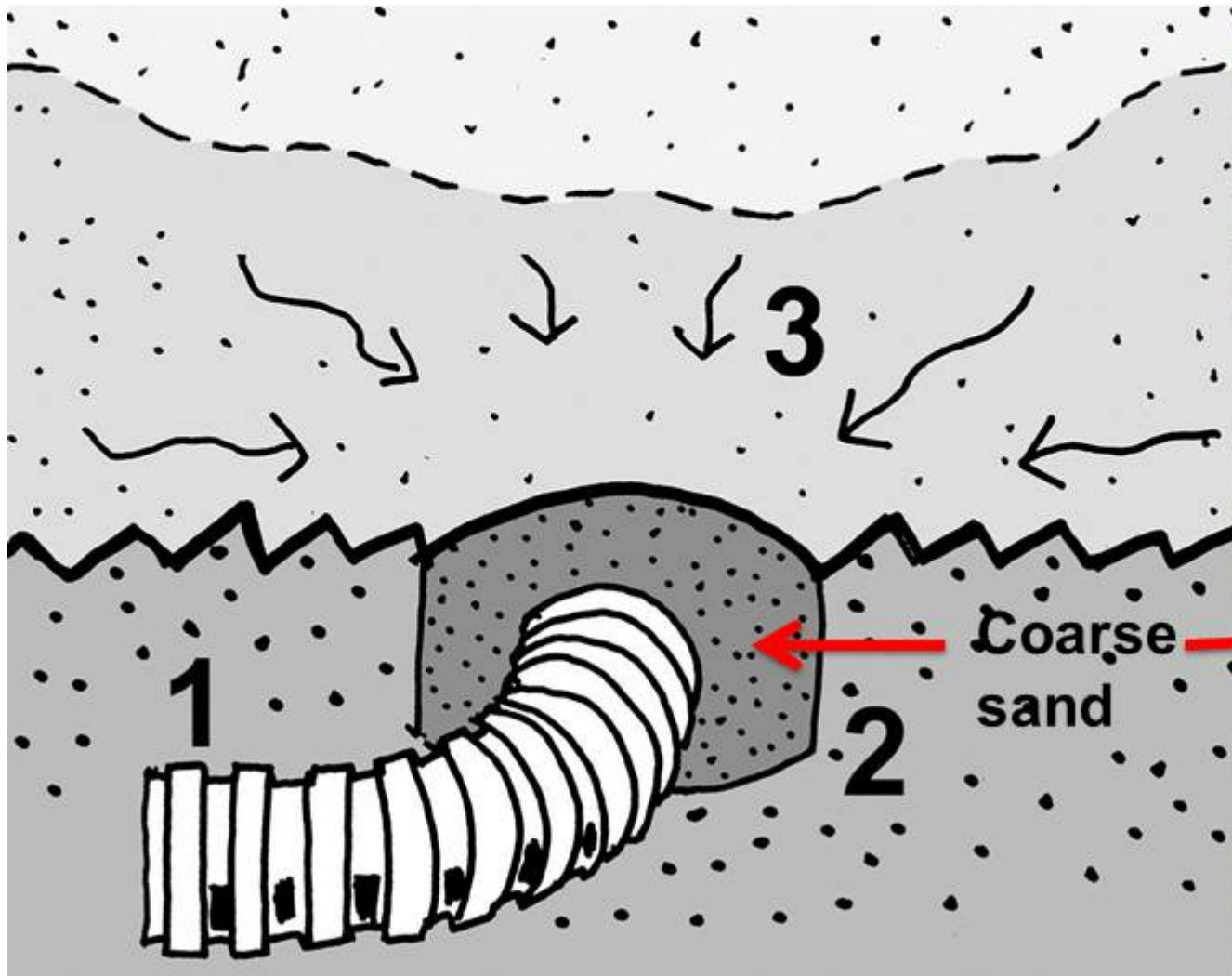


Drainage Modification

1. Drain lines
2. Topography modification
3. Soil bulk density modification
4. Soil texture modification

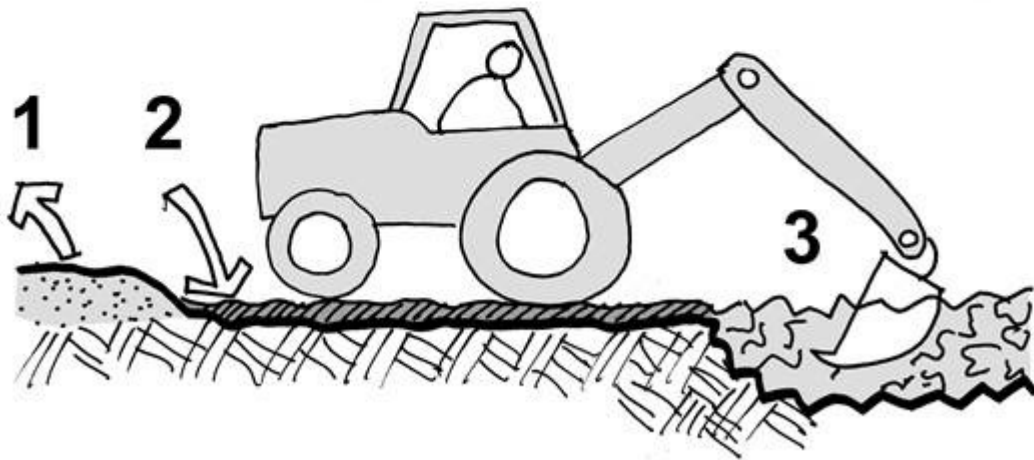
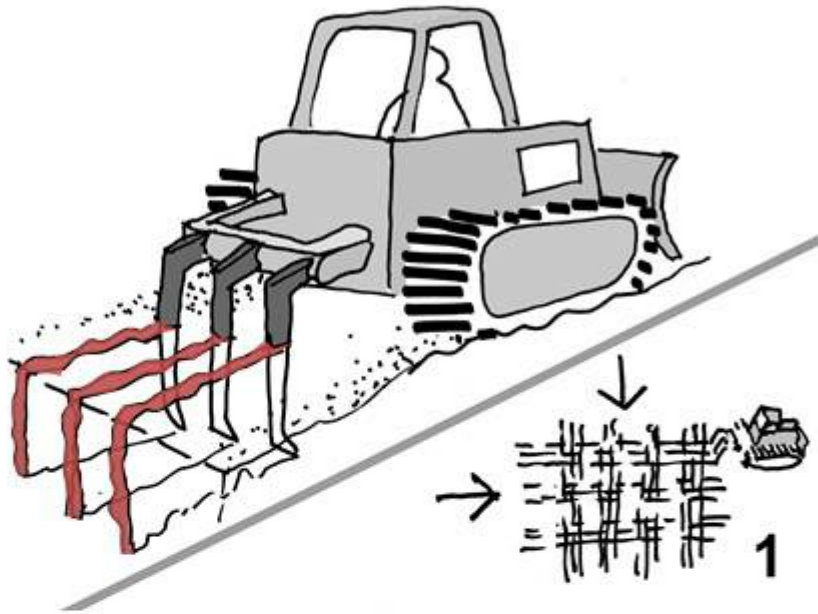


Drain lines



Forget the sock!





Compaction reduction
will improve drainage

Compost may improve drainage in the Soil layer in which it is placed,

But....

If the soil below does not drain,
the added compost can make
an **anaerobic** stew!



Soil removal / replacement

Soil removal and ped retention

Use big loaders and excavators

Remove soil in big scoops to preserve clumps. Do not screen. Preserve peds!





Too much Sand? Too little Sand? No sand? Soil Screening?



Re-Thinking Soil Screening



Do not screen the soil

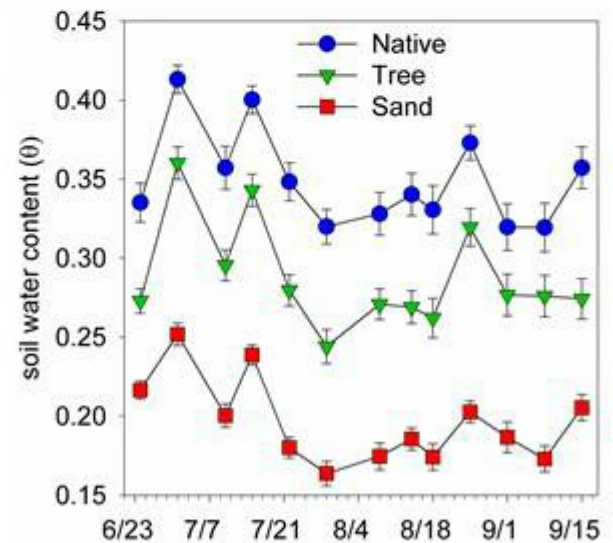
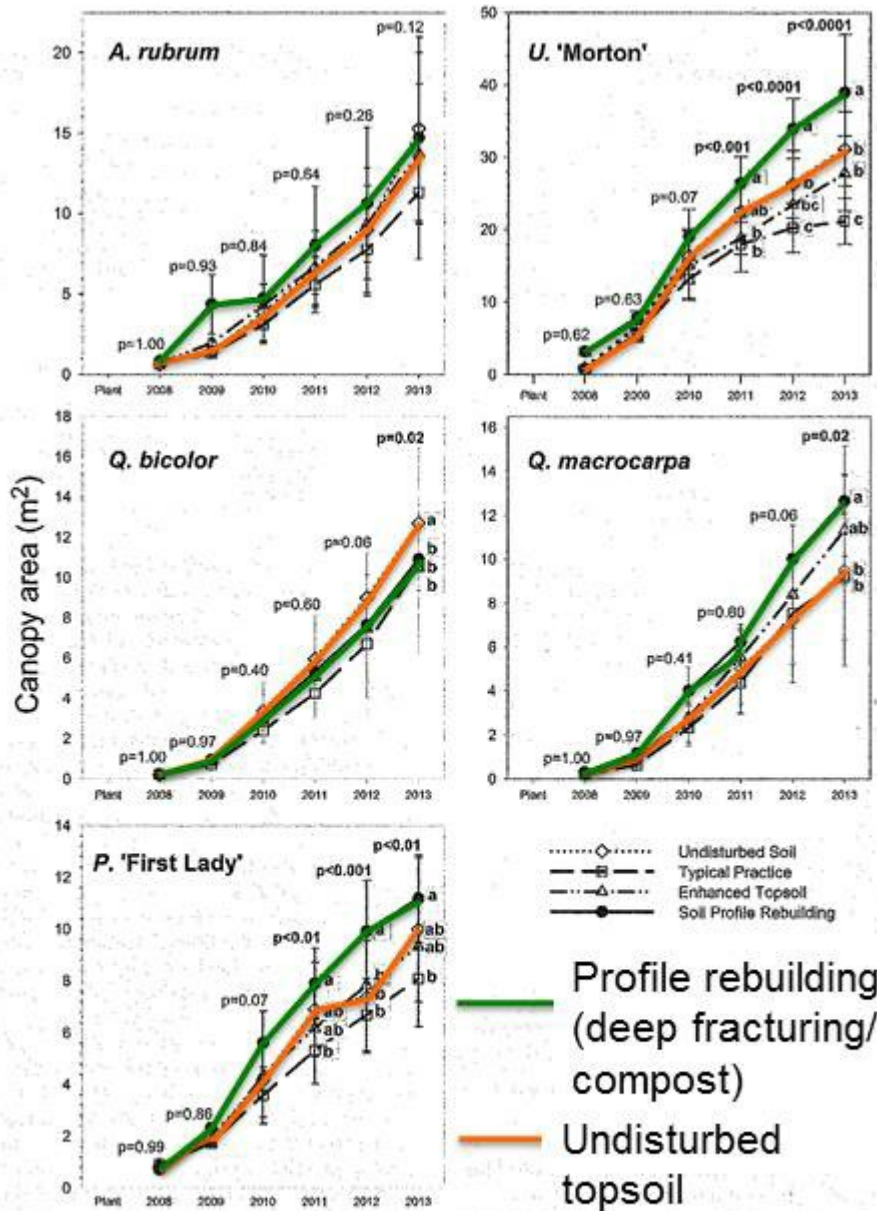


Change specs to allow a combined rocks, roots, sticks, debris up to 5% or maybe even 10%.

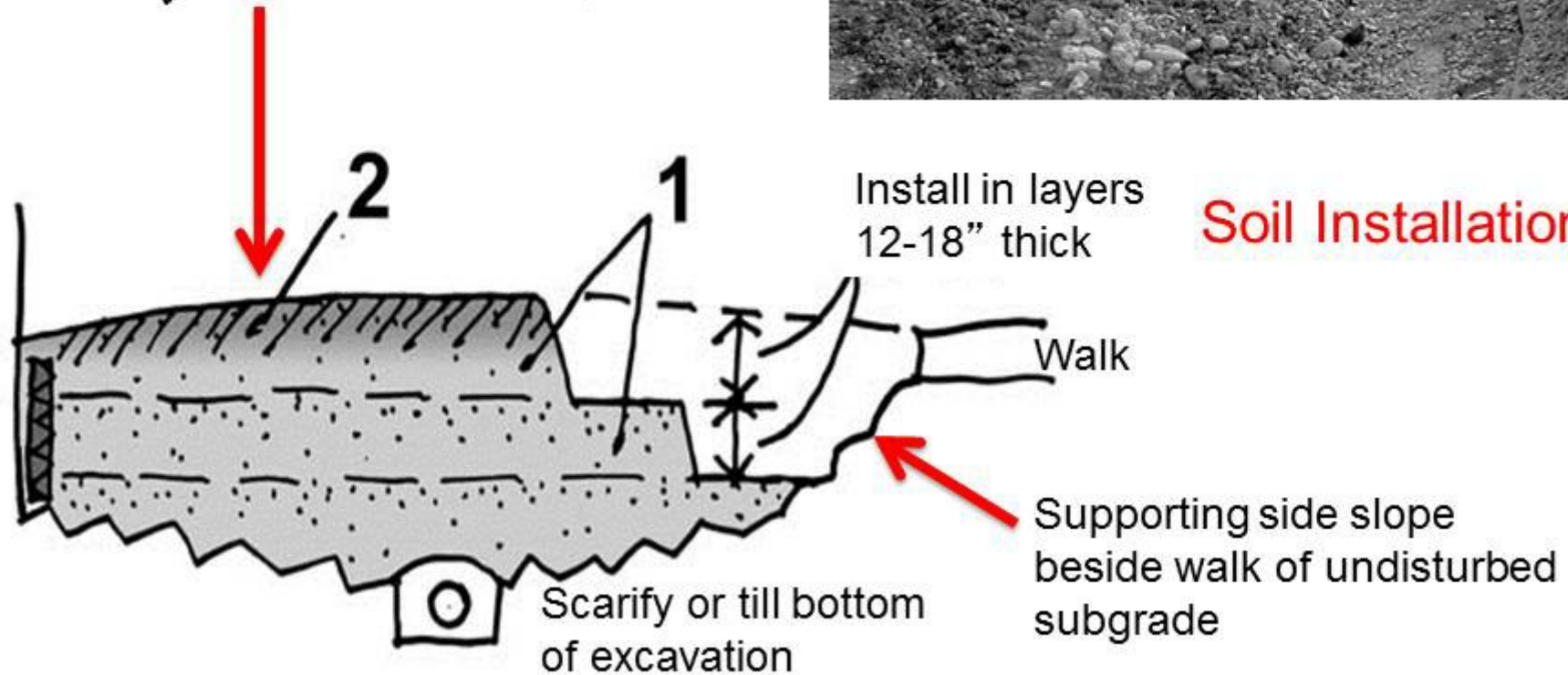
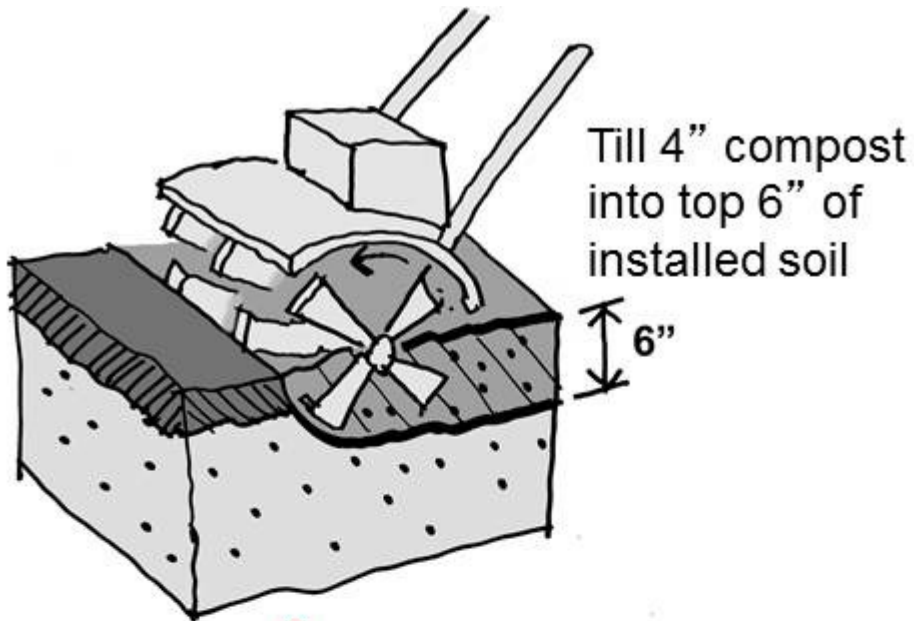
Eliminate **“free of”** from your spec.

Light screening through 2 or 3 inch mesh may be needed on soil with large amounts of debris.

Control construction debris and trash by approval of soil source not by screening.



Unscreened soils vs Sand soil mix
Scharenbroch 2015

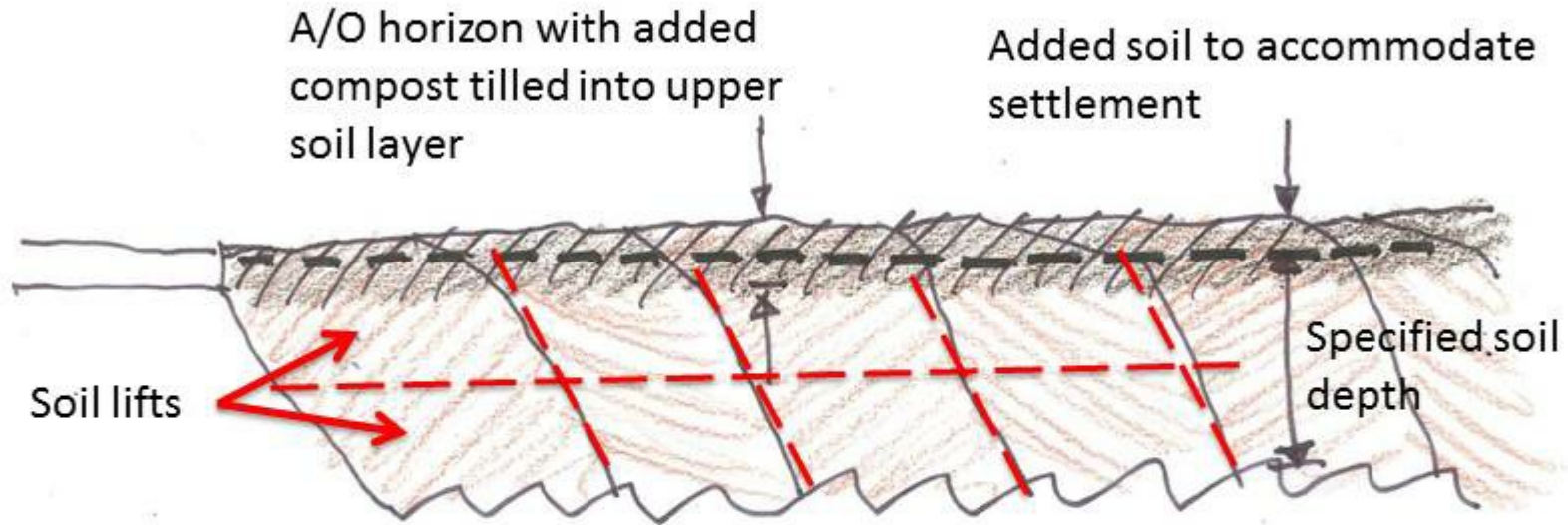


Soil Installation

Anticipated settlement

Soil/sand/compost soil mix

10-15% of soil depth



Many specs are silent on compaction requirements



Avoid tracking over soil



Units
% maximum bulk density
standard proctor or Bulk
density Lb/CF Dry weight



Densitrometer
Moderately slow 10 minutes
Accurate
Expensive
Must calibrate to soil.
Readings impacted by OM
Soil service only

Units
PSI LB pressure per Sq In



Penetrometer
Fast less than one minute
Not very accurate
Soil moisture limited
Inexpensive
LA can operate

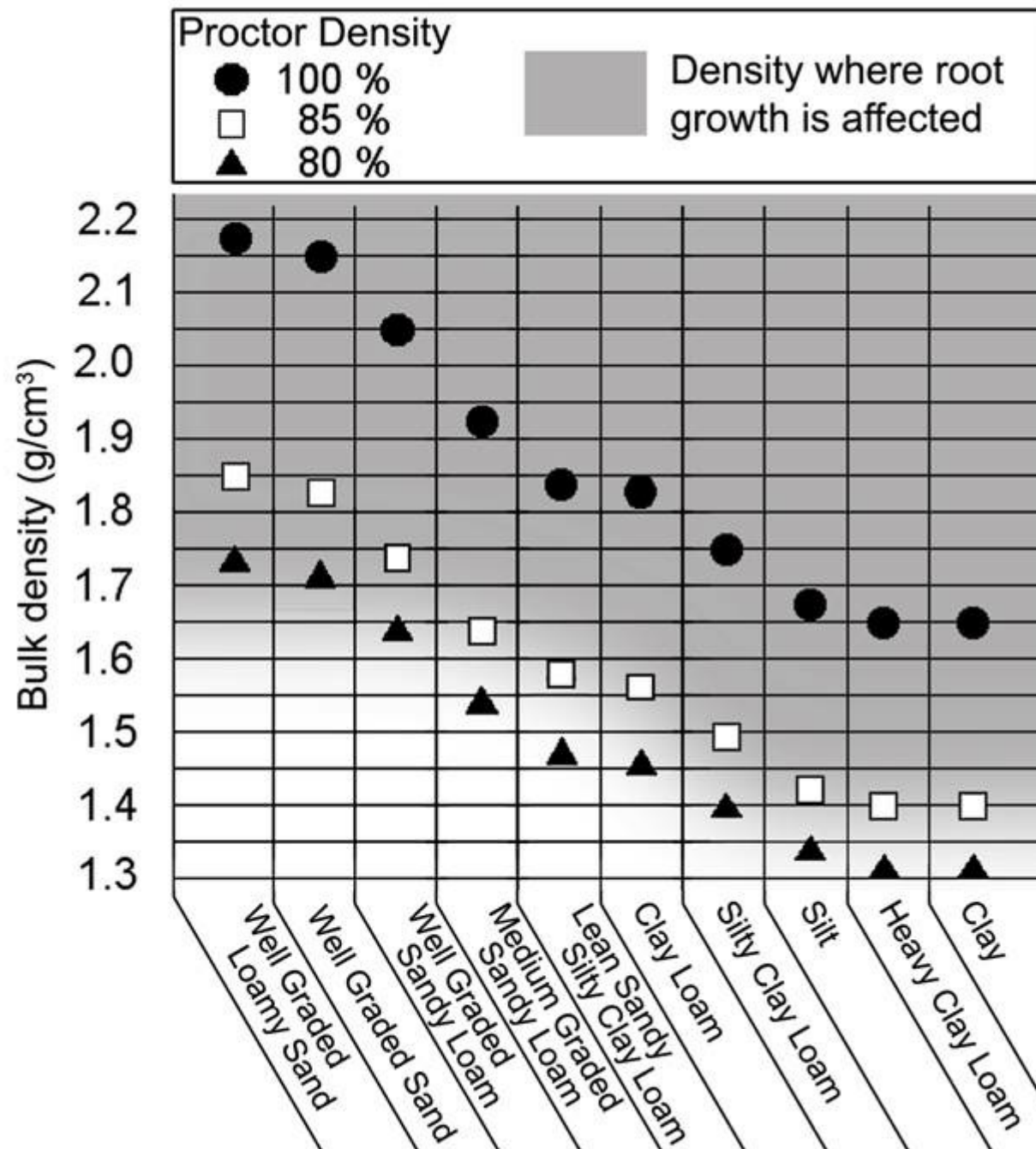
Units
Bulk density Lb/CF dry weight



Bulk density cores
Slow one day
Accurate
Somewhat expensive
LA or soil service

Soil Compaction testing

Linking Proctor Density to Bulk Density by soil type

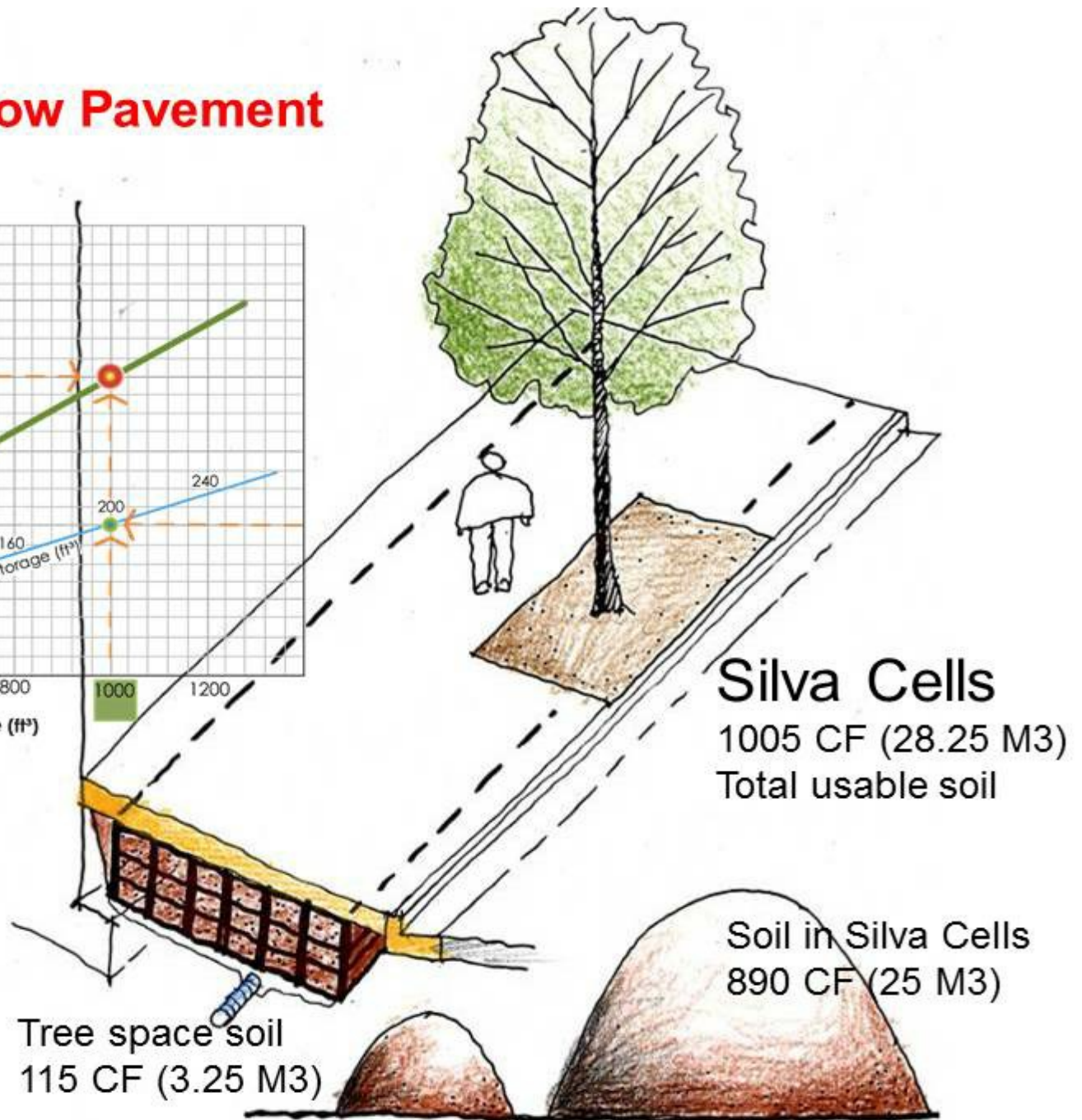
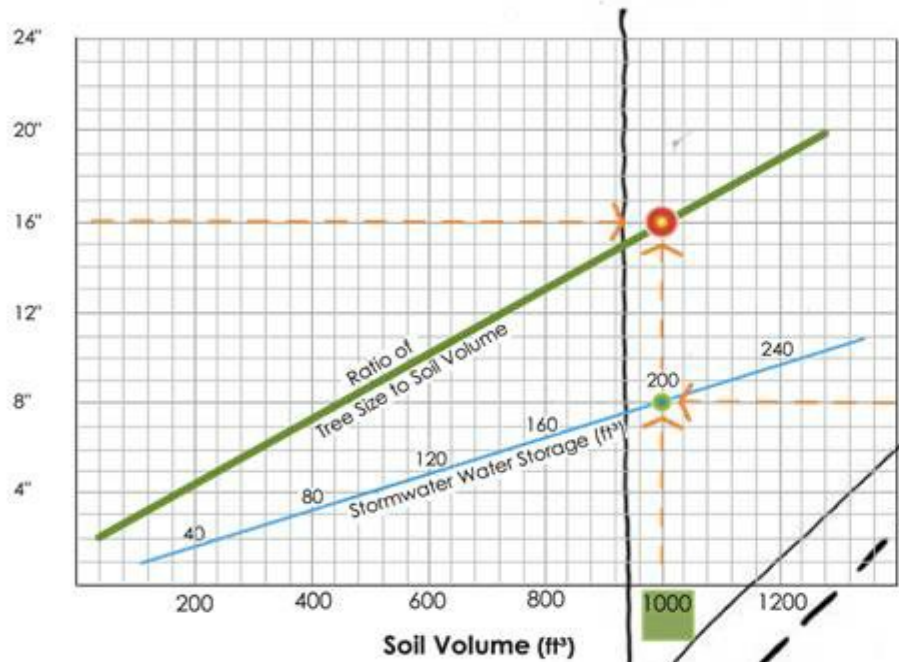


Planting Soil
Compaction

Load bearing planting soil

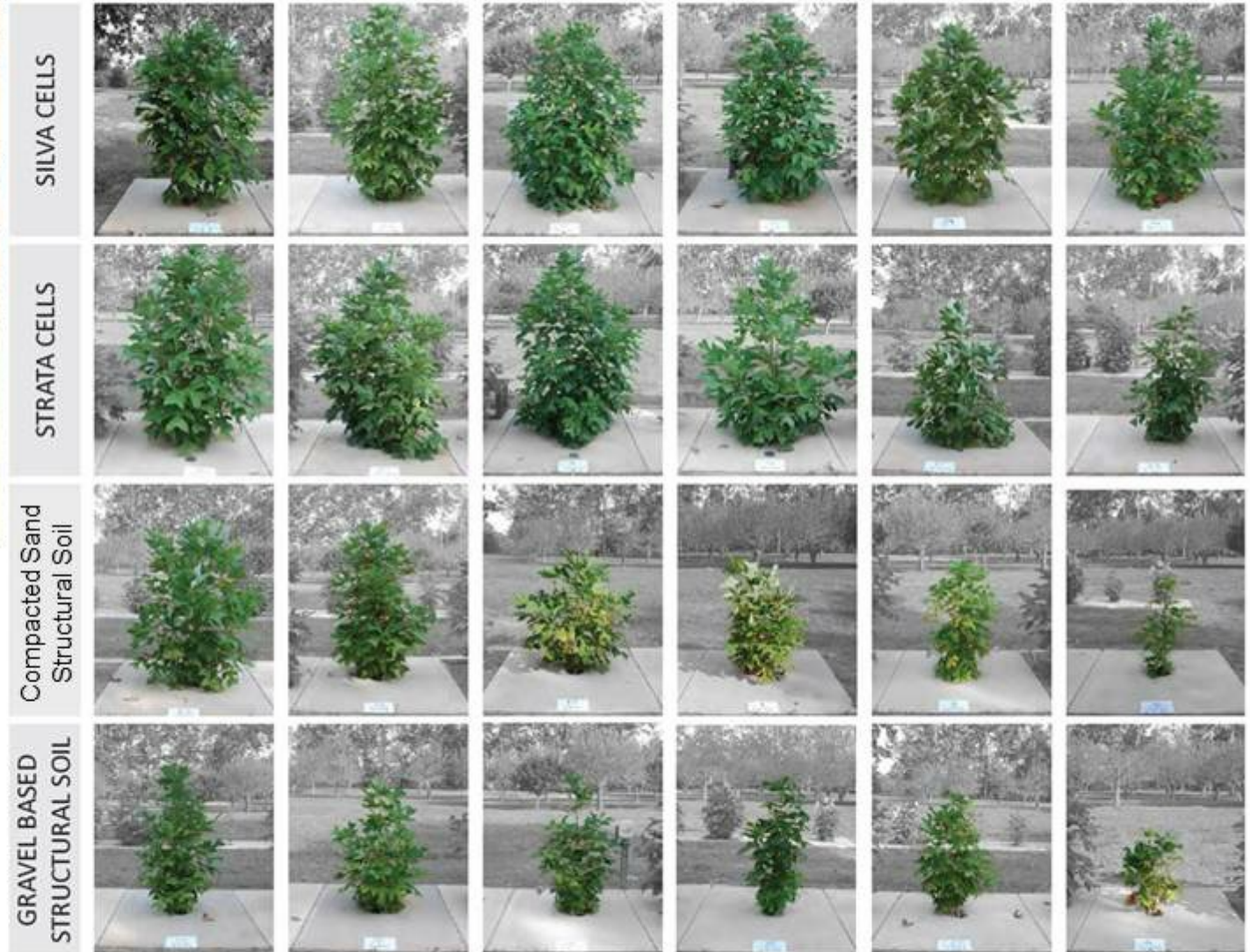


Soil Volume Below Pavement Current Research



Boston Streetscape tree study 330 trees!

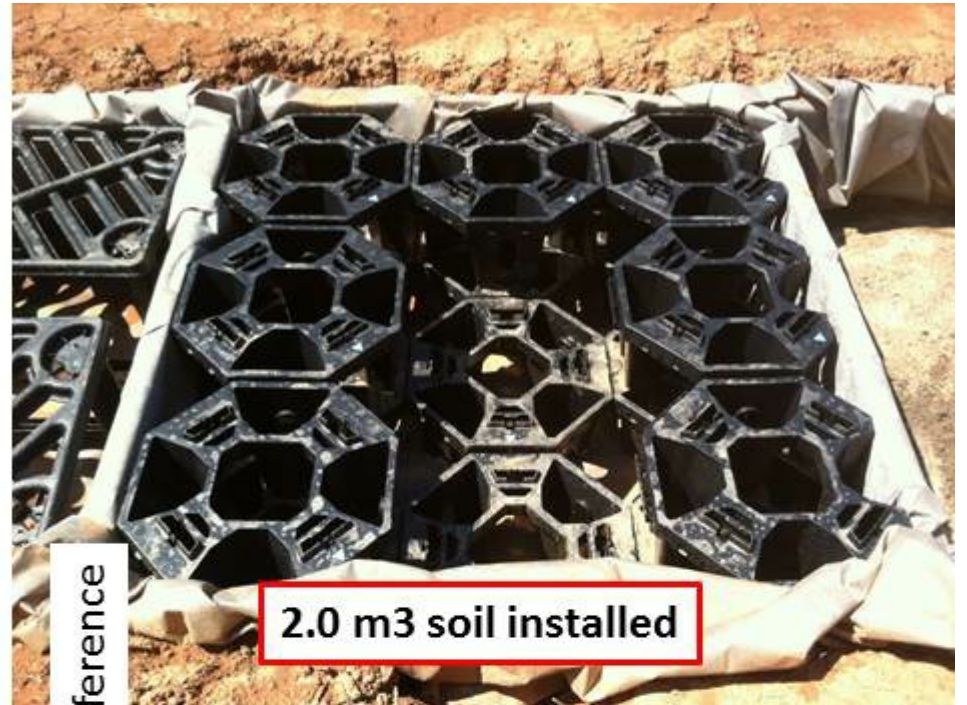




Bartlett Labs Study - Soil below pavement comparisons



Available Volume of each empty pit:
1.23m³ (5ft x 5ft x 21" deep)



2.0 m³ soil installed

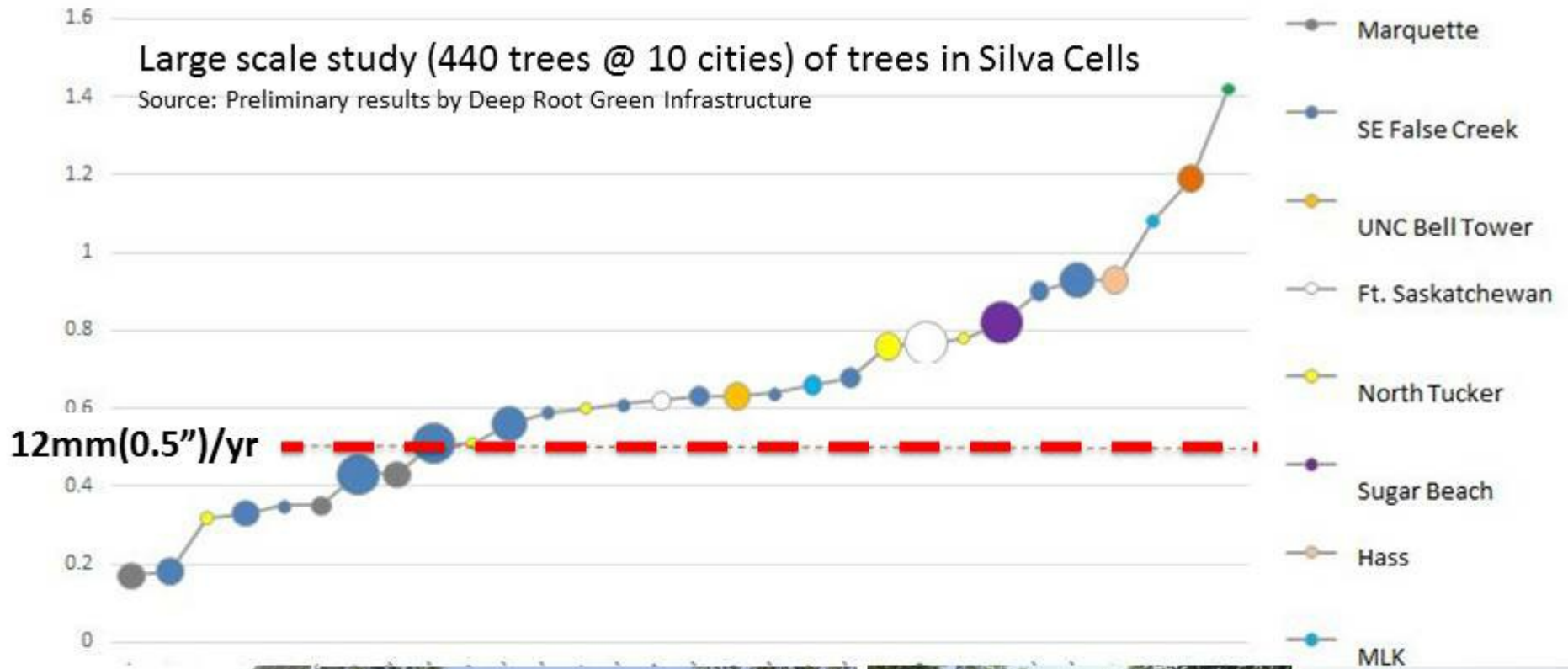


2.5 m³ soil installed

20%+/- difference

Large scale study (440 trees @ 10 cities) of trees in Silva Cells

Source: Preliminary results by Deep Root Green Infrastructure





LOAM SOIL
1000 c.f.
28.3m³



100%
EFFICIENT



Post
Soil
Cells
50.9m³



93%
EFFICIENT



Segmente
d Soil
Cells
225 c.f.
36.5m³



71%
EFFICIENT

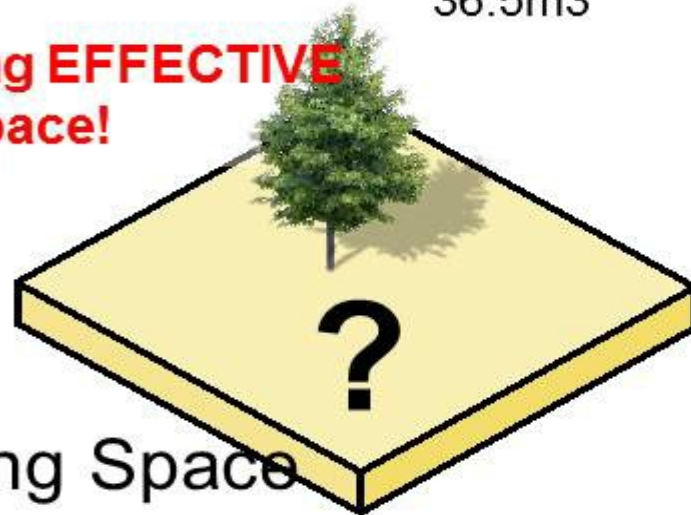
Calculating **EFFECTIVE**
rooting space!



COMPACTED
SAND SOIL
2000 c.f.
56.6m³



50%
EFFICIENT



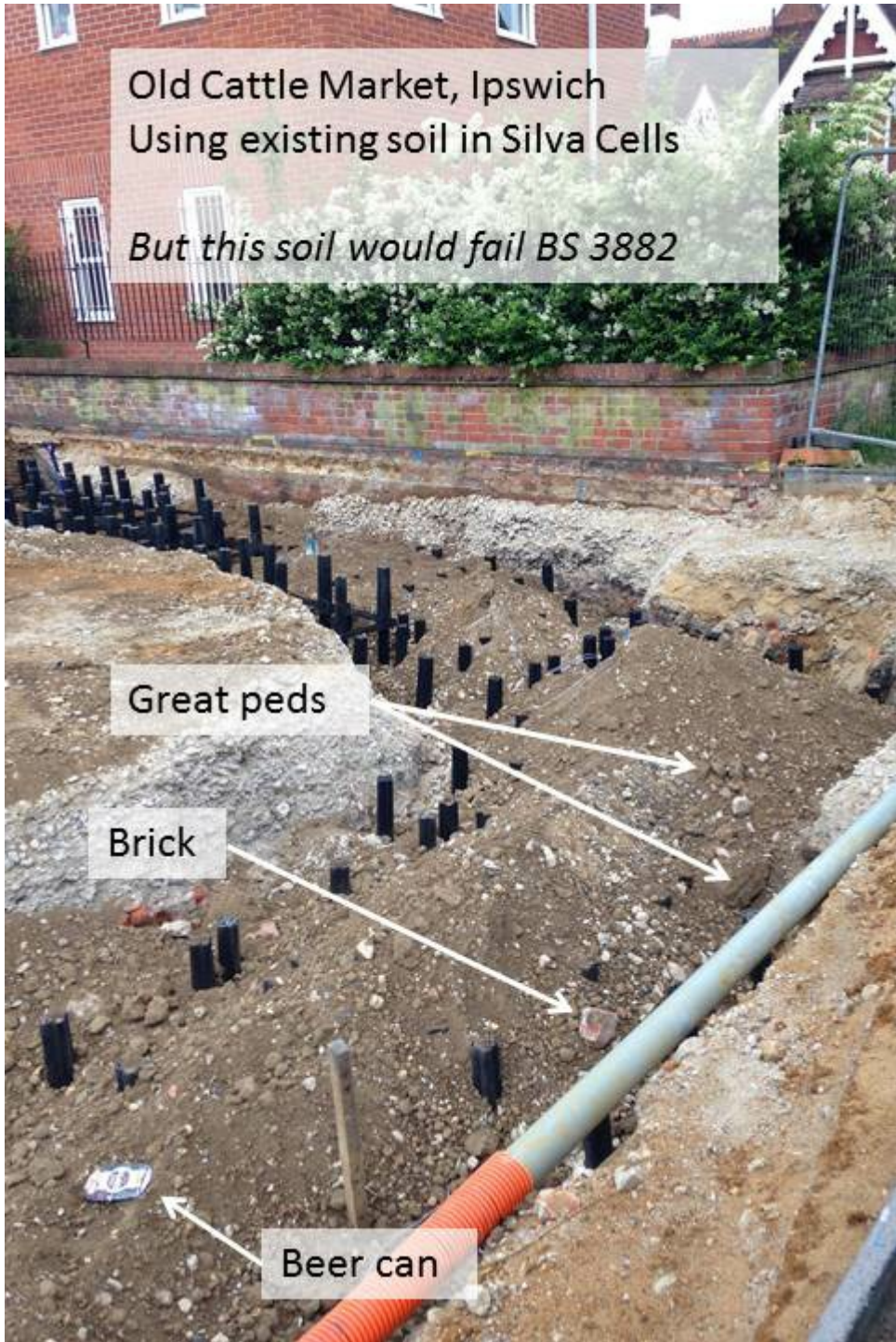
GRAVEL BASED
STRUCTURAL SOIL
5000 c.f.
141.6m³



20%
EFFICIENT

Effective Rooting Space

Old Cattle Market, Ipswich
Using existing soil in Silva Cells
But this soil would fail BS 3882





2010



2011

Sugar Beach, Toronto



2012



2013

Lunch break

