

Soil Restoration

in Accordance with

The NYSDEC 2010 Stormwater Management Design Manual

William Buetow
CPESC, CPSS
The LA Group, P.C.
Saratoga Springs, NY



Implementation of Soil Restoration as a Green Infrastructure Practice

- Soil Restoration
 - Definition
 - Regulations
- Soil Characteristics
 - Compaction
 - Micropores
 - Macropores
 - Soil Structure
- Soil Restoration Methods
 - Topsoil
 - Aeration
 - Full Soil Restoration
- Where Not to Initiate Soil Restoration
- When Should Soil Restoration Be Done
- Things to Look for to Confirm Soil Restoration was Done Correctly
- Keys to Success
- Maintenance of Restored Areas

Soil Restoration

- REQUIRED practice applied across areas of a development site where soils have been disturbed and will be vegetated to recover the original properties and porosity of the soil (Page 5-21 NYSDEC Design Manual).
- Soil restoration or modification of curve numbers is a REQUIRED practice (Page 5-23, NYSDEC Design Manual).

Table 5.3 Soil Restoration Requirements			
Type of Soil Disturbance	Soil Restoration Requirement		Comments/Examples
No soil disturbance	Restoration not permitted		Preservation of Natural Features
Minimal soil disturbance	Restoration not required		Clearing and grubbing
Areas where topsoil is stripped only - no change in grade	HSG A & B	HSG C & D	Protect area from any ongoing construction activities.
	apply 6 inches of topsoil	Aerate* and apply 6 inches of topsoil	
Areas of cut or fill	HSG A & B	HSG C & D	
	Aerate and apply 6 inches of topsoil	Apply full Soil Restoration **	
Heavy traffic areas on site (especially in a zone 5-25 feet around buildings but not within a 5 foot perimeter around foundation walls)	Apply full Soil Restoration (de-compaction and compost enhancement)		
Areas where Runoff Reduction and/or Infiltration practices are applied	Restoration not required, but may be applied to enhance the reduction specified for appropriate practices.		Keep construction equipment from crossing these areas. To protect newly installed practice from any ongoing construction activities construct a single phase operation fence area
Redevelopment projects	Soil Restoration is required on redevelopment projects in areas where existing impervious area will be converted to pervious area.		

*Aeration includes the use of machines such as tractor-drawn implements with coulters making a narrow slit in the soil, a roller with many spikes making indentations in the soil, or prongs which function like a mini-subsoiler.

** Per "Deep Ripping and De-compaction, DEC 2008".



New York State
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Division of Water

Deep-Ripping and Decompaction

April 2008

["http://www.dec.ny.gov/docs/water_pdf/infildecom08.pdf"](http://www.dec.ny.gov/docs/water_pdf/infildecom08.pdf)

New York State
Department of Environmental Conservation

Soil Characteristics

- **Compaction-Compression** of the existing soil reducing the porosity and hydraulic conductivity of the soil.
- **Micropores**-Smaller soil pores associated with the soil texture (sand, silt, clay).
- **Macropores**-Larger soil pores associated with soil structure.

Soil Structure

- Aggregation of sand silt and clay particles in soil into individual structural units (peds).
- Naturally occurs over time.
- Aggregating agents that create soil structure:
 - Water
 - Organic matter
 - Iron oxides
- Structure can be easily destroyed by:
 - Compaction
 - Tillage



- Strong Granular Structure

Soil Restoration Methods

- Topsoil Application
- Aeration
- Full Soil Restoration
 - Deep Ripping
 - Compost Enhancement
 - Deep Subsoiling

Aeration

- Core/Spike Aerator
 - Coulters
 - Shallow Subsoiler/Chisel Plow
 - Tillage and Compost Incorporation
- 
- A person is operating a red core/spike aerator on a large field of dark, aerated soil. The field is surrounded by tall grasses and trees in the background. The aerator is a small, red, walk-behind machine with a single front wheel and a rear-mounted engine. The person is wearing a light-colored shirt and dark pants. The soil is dark brown and appears to be a mix of compost and soil. The field is surrounded by tall grasses and trees in the background. The sky is overcast.

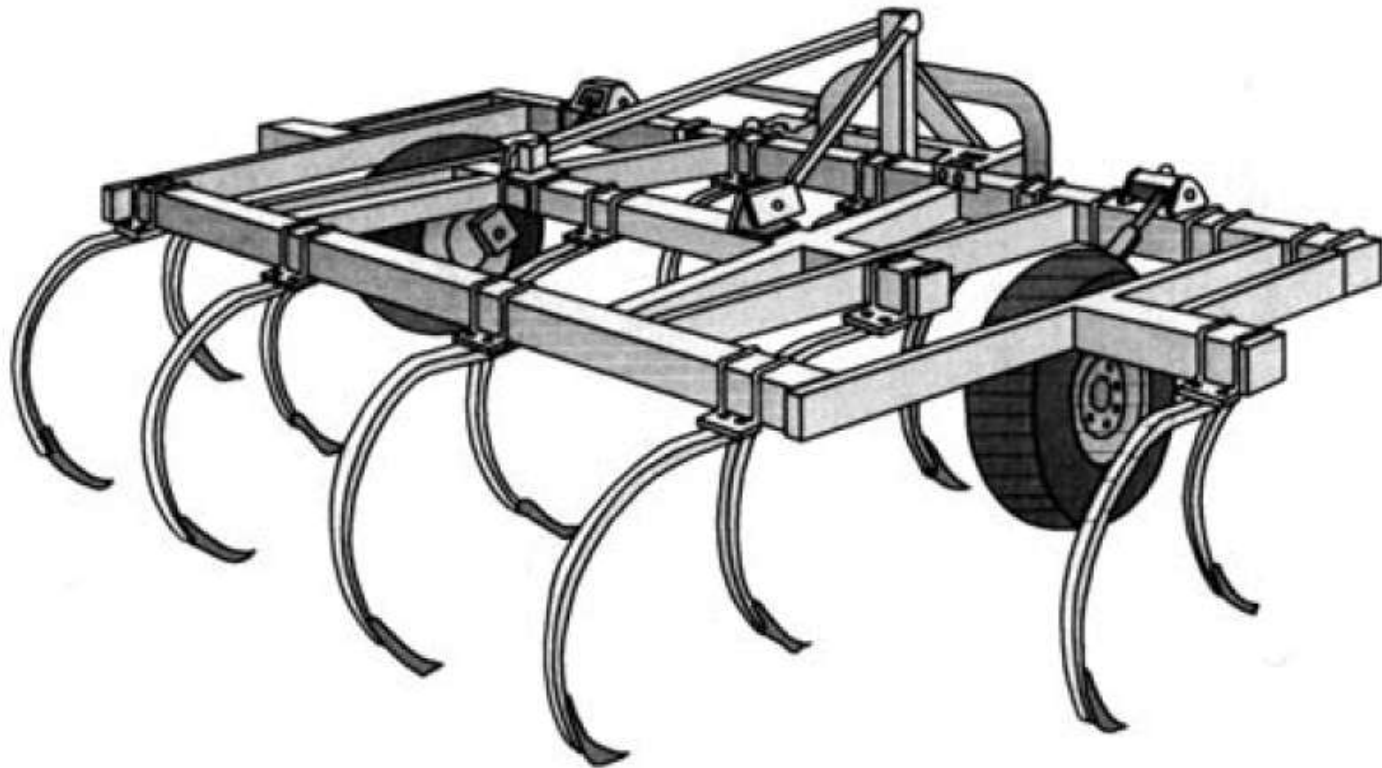
Core Aerator



Coulters



Chisel Plow



Deep Ripping

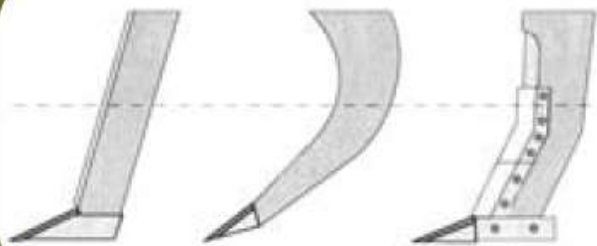
- Typically done to a 12” to 24” depth. Be sure to specify what depth is needed and confirm equipment can reach that depth.
- Recommended tool to be used is a “heavy duty” agricultural ripper and a BIG TRACTOR.
- Use the correct equipment to suit the site.
- Tillage is slow (2 to 3 mph recommended).
- Typically takes multiple passes to get full depth.





Decompaction

- After deep ripping is done and topsoil applied, conduct decompaction. Compost can be added during this step.
 - Recommended tool to be used is a deep subsoiler.
- This tillage does not have to be as deep as the heavy duty agricultural ripper.
- Goal is to alleviate the compaction that may have occurred from applying the topsoil over the ripped soil.
- Mixes the topsoil with the upper portion of the subsoil.
- Uplifts surface, incorporates compost and topsoil.



**SUBSOILER
SHANKS: (A) STRAIGHT,
(B) PARABOLIC, AND
(C) BENT LEG.**

A

B

C

B

Where Not to Apply Soil Restoration

- Undisturbed Areas
- Steep Slopes
- Bedrock or Severe Natural Hardpan
- Soils too Wet (HSG D Soils)
- Drip-line of Existing Trees
- Over Buried Utilities
- Confined Spaces Where Equipment Cannot Fit

Wet Tillage





When Should Soil Restoration Occur

- After Construction is Complete and Traffic Will Not Go Through Restored Area.
- During Construction Site Restoration/Landscaping
- Do Not Drive Over Restored Areas!!
 - Landscapers Will Want to Disk or Cultipack Area to Grow Lawn.



THE CULTIPACKER FIRMS THE SEED BED. THIS CONTRIBUTES TO BETTER SEED SOIL CONTACT AND IS IMPORTANT FOR ESTABLISHMENT SMALL SEEDED CROPS LIKE FORAGES.

Was it Done Right?

- NYSDEC Design Manual page 5-23
- “An inspector should be able to push a 3/8” metal bar into the soil with body weight.”
- Penetrometer Reading of around 200 not to exceed 400 pounds per square inch (psi). Root growth is reduced above 300 psi, (Cornell Soil Health Training Manual 2nd Edition, 2009)



Keys to Success

- COMUNICATION
- Be present during construction to observe traffic patterns, note areas that will need treatment.
- Be present when tillage is occurring to confirm soil moisture and appropriate equipment is being used.
- Measure depths of tillage equipment.
- Get soil probe or 3/8" bar and poke around in the soil.

Maintenance of Restored Areas

- Grow vegetation (grass) and maintain
- Reseed bare areas

References

- NYSDEC Stormwater Management Design Manual, 2010
<http://www.dec.ny.gov/chemical/29072.html>
- NYSDEC Deep-Ripping and Decompaction, 2008
http://www.dec.ny.gov/docs/water_pdf/infildecom08.pdf
- NRCS Tillage Implements, A Pocket Guide
<http://www.mn.nrcs.usda.gov/technical/ecs/agron/Tillage%20pocket%20guide.pdf>
- **QUANTIFYING DECREASES IN STORMWATER RUNOFF FROM DEEP TILLING, CHISEL PLOWING, AND COMPOST-AMENDMENT**, 2003, Jeremy D. Balousek, P.E., Dane County Land Conservation Department

Questions?

