Critical Aspects During System Installation and Inspection

A to Z

NOWRA

Presentation Topics

- Overview
- Material issues
- Site related issues
  - Erosion
  - Wet sites
  - Proper elevation and grade

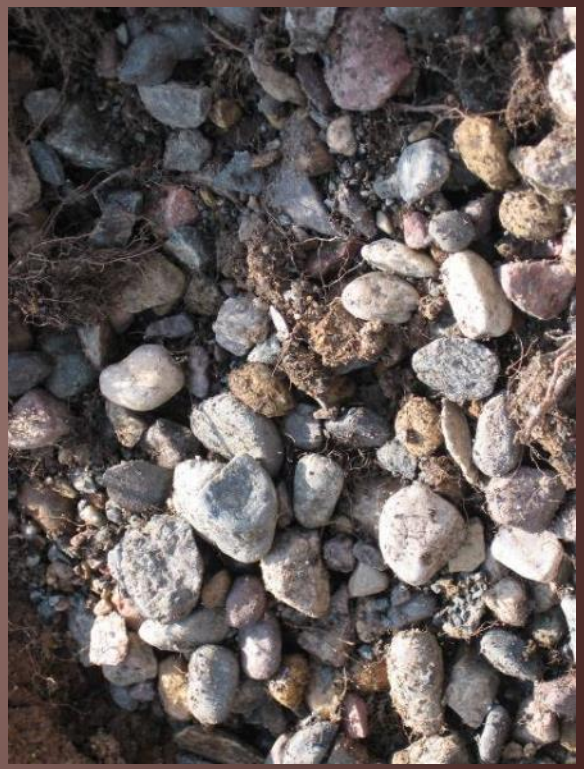
Proper installation is REALLY important!

- Using good material and techniques are critical for long term system performance

- If site or soils are negatively impacted the ability for site to treat and accept wastewater long term will be decreased

Media specifications

- Installer must make sure media available meets specifications of system designer and codes!
  - Know what material to ask for
  - Get documentation that material is what you ordered
  - Know what it should look like
  - Know how to double check if needed
  - Document with pictures



Treatment media - Sand

- Treatment media in:
  - Filters
  - Mounds
- Washed to be free of silt and clay particles (fines <5%) to prevent system failure
- Check design & local code for allowable amount

Bucket cleaning

- When installing media in soil treatment systems & media filters a clean bucket is ***essential*** to avoid contaminating media
- Scrape out all soil before handling media

Fines reduce treatment performance

- Fines migrate to bottom and form a restrictive layer
  - Holds effluent and water in pore space
  - Effluent and water wicked upwards into media due to capillary action
  - Reduced pore space
    - Less air transfer
    - Less space for sloughing of biomass to move through media

Sand quality tests

- Conduct jar test as a field check
- Verify clean sand using a sieve test

Jar test – field procedure - I

- Place two inches of sand in the bottom of a quart jar

Jar test – field procedure - II

- Fill the jar 3/4 full of water
- Cover
- Shake for 1 – 2 minutes

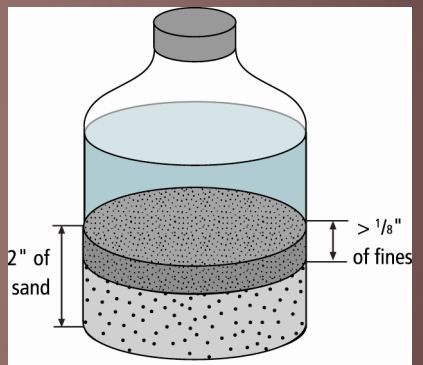
Jar test - field procedure - III

- Allow jar to stand for 30 minutes

30 minutes

Jar test - field procedure - IV

- Measure layer of fines on top of sand
- Layer should measure less than 1/8”



Jar test example

- > 1/8” ~
- More then 5% fines
- Send back and request sieve analysis on next load

Sand size characteristics

- Specific size
- Uniformity coefficient
- Effective size
- Sieve test is a method to characterize the size of the sand

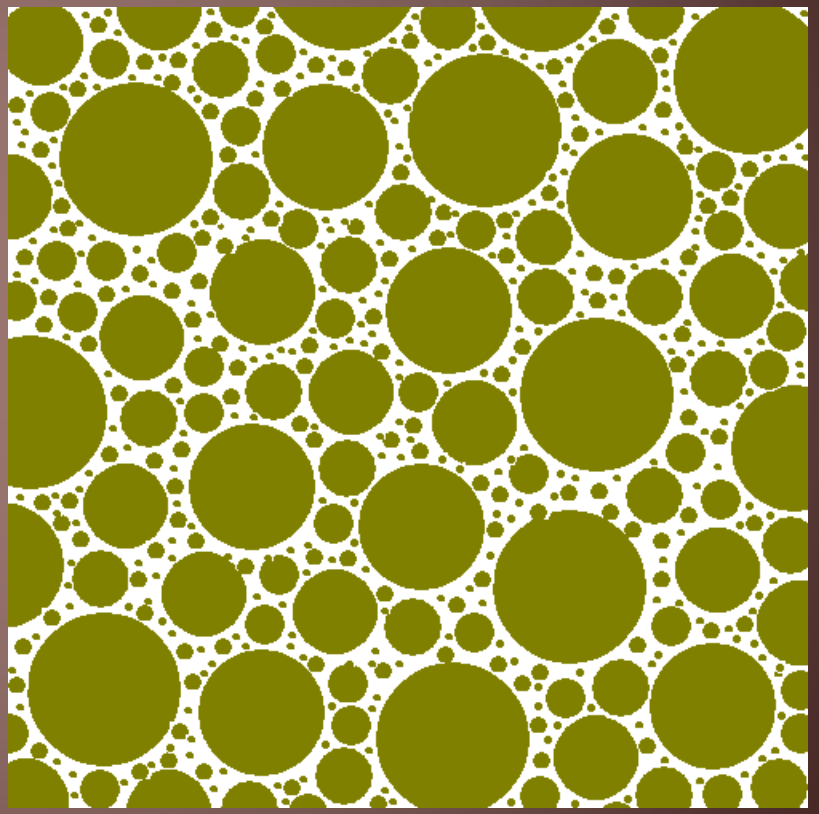
Sieve analysis

- Soil sample is placed on top sieve and run through a shaker to separate different size grains

- Material collected from each sieve is weighed and the point data plotted

Uniformity coefficient (UC)

- How well graded your sand sample is
- UC = 1 - material uniform in size
- UC > 1 - less uniform – wide range of sizes
- Range of sizes of particles is important due to pore space



Sand moisture content

- When evaluating various sources for clean sand, observe the moisture line in the sand piles
  - Treatment issue – if moisture line is high, there are fines – more water wicking upward
  - Economic issue - wet sand weighs more than dry
  - Installation issue - wet sand can be installed without a problem as it will compact easier than dry sand

Sand media installation

- Mounds and media filters
- Sand installed in lifts of 6-8 inches
- Foot compaction and light watering to reduce volume of pore spaces
- In mounds, after 6-12 inches of media has been installed tracked equipment maybe allowed across area
- Compaction equipment should not be used

Distribution Media

- Drainfield rock
- Rock substitutes
  - Chambers
    - ADS
    - Infiltrator
  - Geocomposites
    - Infiltrator Ezflow
- Gravel less pipe
- Drip distribution

Rock characteristics - hardness

- Hardness is an important characteristic as soft rock can break into pieces reducing void capacity
- If a penny can scratch a rock without crumbing and flaking it is OK
- Rating of > 3 on the Moh's Scale of Hardness

Rock characteristics - size

- Uniform size is preferred to provide maximum void space

Rock characteristics - size

- ½ - 2 ½ inches
- Quarry/pit should provide gradation information

Rock characteristics - “clean”

- The rock must be “clean” as dirty rock has fines (silt and clay particles)
- These fines can cause system failure because they will reduce the long term acceptance rate of the underlying soil or media

Dirty Rock

Checking rock for cleanliness

- Is there a large dust cloud when the media is dumped?
- Verify quarry results for cleanliness and other characteristics
- Use field jar test to check the cleanliness of rock

Soil treatment area backfill

- Suitable native soil material for backfill and cover must be free of:
  - Debris
  - Clods
  - Frozen soil
  - Peat

ASTM 2321

Soil treatment area backfill

- Material should:
  - Allow oxygen to get to the soil treatment system
  - Shed surface water
  - Support the growth of vegetation

Storing materials

- Contamination risk
- Try not to store materials - install them immediately
- If media is stockpiled, keep different types separate
  - Clean sand
  - Clean rock
  - Pea gravel
  - Backfill, cover and topsoil

Stockpiling

- Bottom portion lost due to mixing with native soil unless materials are placed on a
  - Tarp
  - Concrete pad
  - Plywood
- For long term stockpiling, cover with plastic

Erosion control

- Cover bare Soils
  - Smart work
    - Work in dry weather
    - Preserve existing vegetation
  - Cover with mulch, plastic, rock
  - Temporary seed
- Slow down water
  - Smart grading
    - Benches and berms
    - Slope roughening
  - Ditch blocks

Erosion control practices

- Grading
  - Cat tracking
- Vegetation
- Mulch
- Blankets
- Riprap
- Down drains
- Hydraulic soil stabilizers
- Compost
- Erosion control mats

Stop sediment

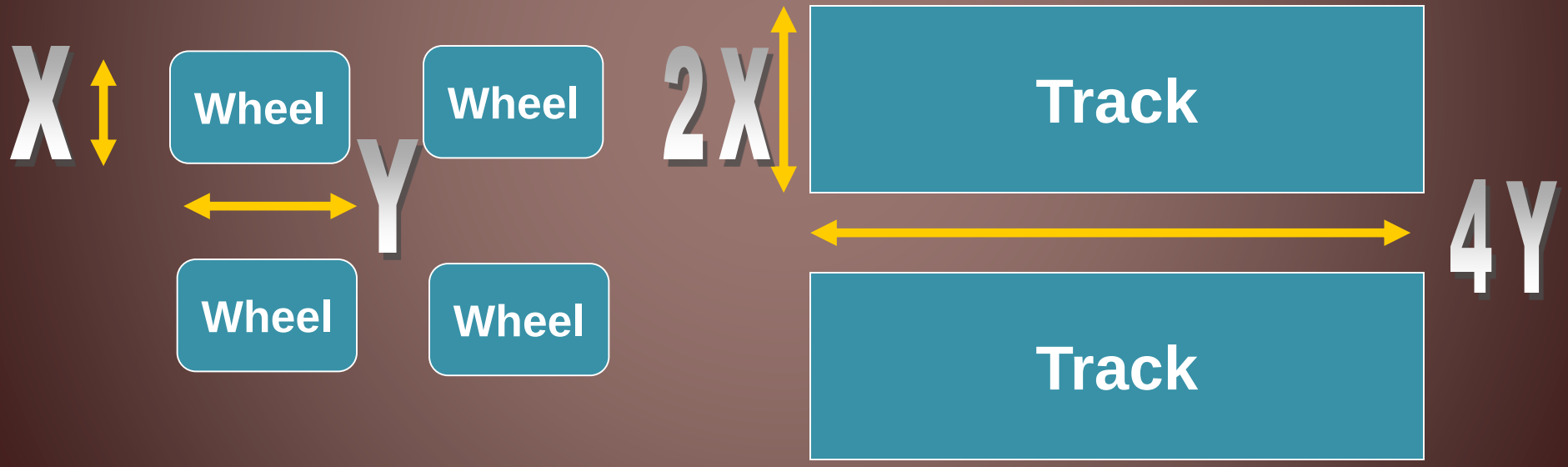
- Buffers
  - Leave the grass
- Trap water and hold it
  - Silt fence
  - Ponds
- Filter water
  - Compost logs
  - Rock and mulch barriers

Concerns for installations on wet sites

- Installations on sites with:
  - High water tables
  - Soil textures with high clay content
- Compaction and smearing are more likely
- Soil must be treated carefully
- Check weather before starting construction & be prepared

Ground pressure

- For same piece of equipment, ground pressure will be much higher with wheels



Ground pressure =
5000 pounds / 4 (2ft x 4ft) /12 in/ft
= 26 psi

Ground pressure =
5000 pounds / 2 (4ft x 16ft) / 12 in/ft
= 3.3 psi

Considerations for installations on wet sites

- Excavation only when:
  - Moisture content less than the plastic limit
  - Soil is not frozen

Protecting exposed natural soil

- If site has been scarified, immediately cover with media to prevent
  - damage
  - contamination
- When you can't cover exposed soil immediately, protect area with tarp

Maintaining natural soil conditions

- Soil located at or near the soil surface is generally the best for:
  - Treatment
  - Internal drainage
    - Dispersal
    - Oxygen-transfer
  - Evapotranspiration
  - Natural biological activity
  - Biochemically more reactive

Compacted soil problems

- Compacted soil has:
  - Less pore space
  - Reduced air and water movement
  - Reduced permeability and oxygen transfer

Techniques to maintain natural soil conditions of infiltrative surface

- Do not drive any equipment on infiltrative surface
- Limit foot traffic
- Rake sidewalls of trenches and beds
- Use low ground pressure equipment
- Position equipment upslope of system when placing media

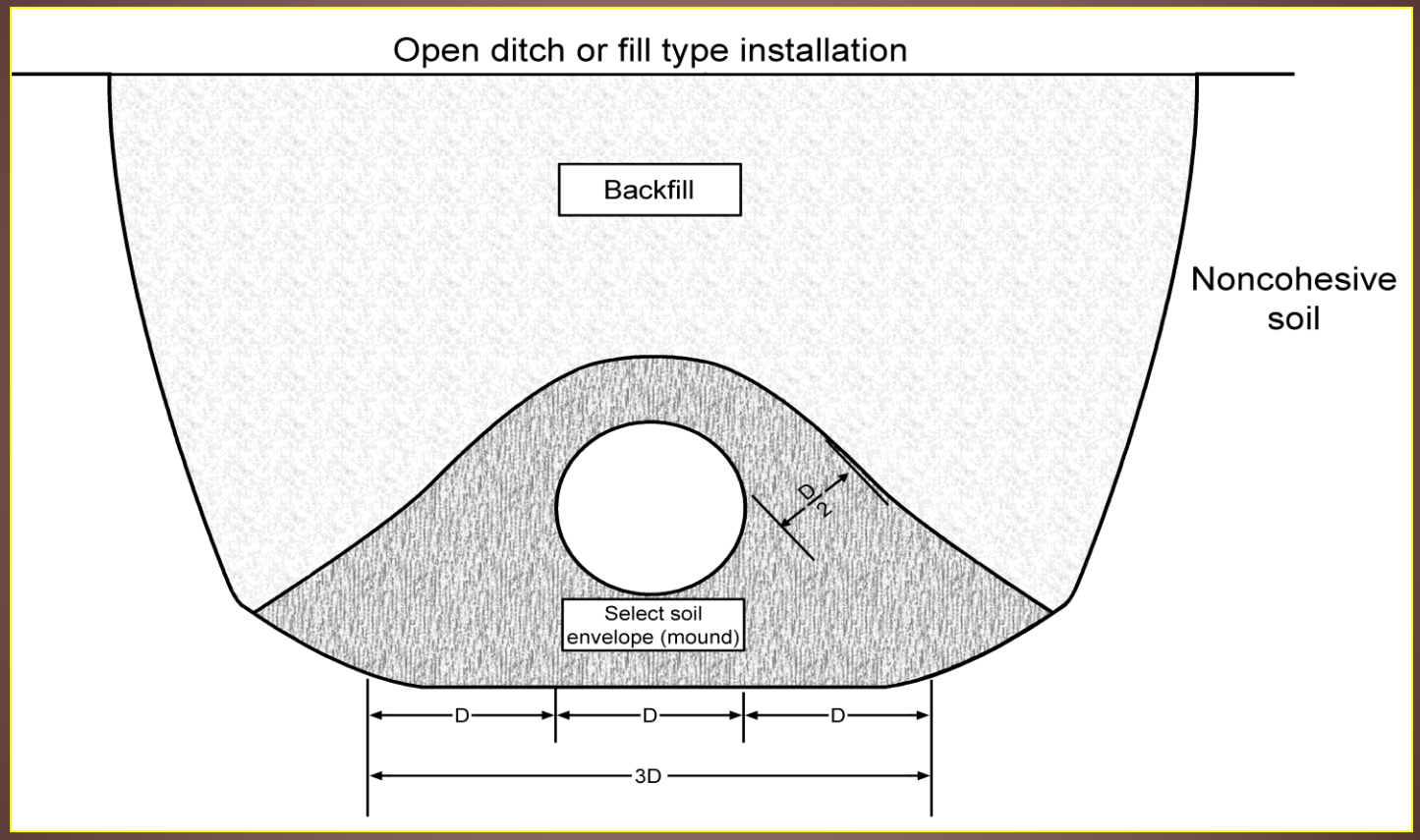
Compacted site – what to do?

- Avoid compaction
- Discuss options with Designer/Local unit of government
- Determine severity
- Move system location
- Time will help
  - Freeze/thaw
  - Root activity
  - Weathering
- Experimental methods
  - Lower loading rates
  - Mechanical soil fracturing
  - Deep plowing/ripping
  - Removing & backfilling

Pipe trench

- Trench bottom
  - Dry
  - Free of rocks & debris
  - Continuous
  - Provides uniform support

Pipe trench



Tracer wire????

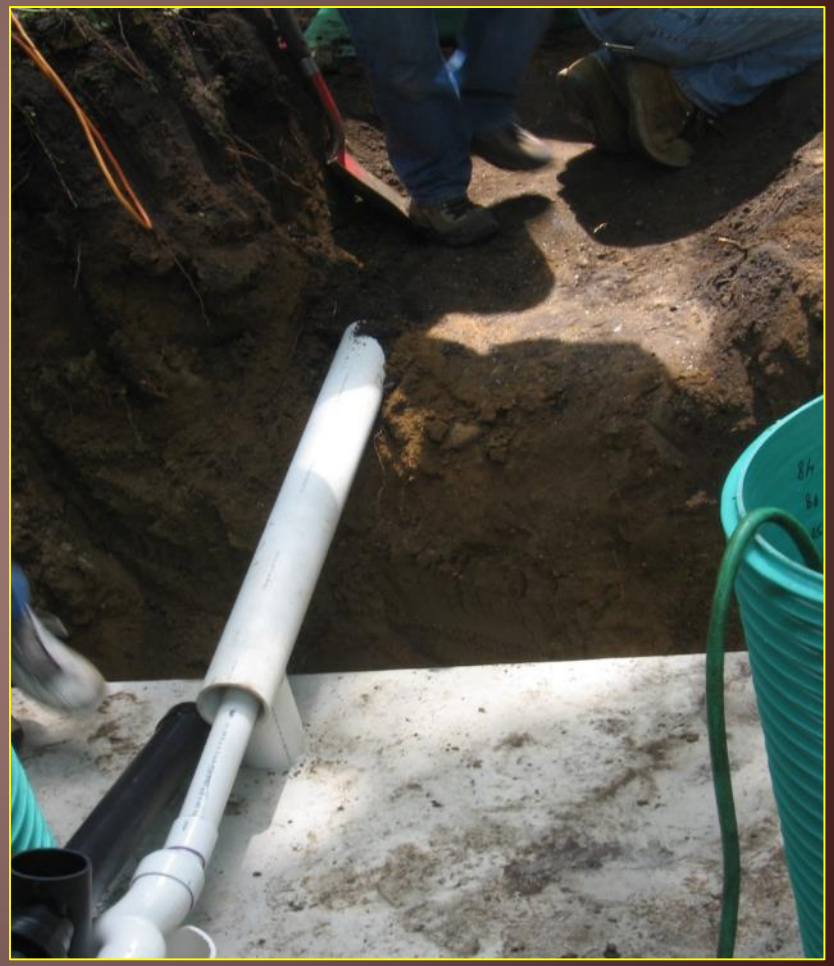
Pipe layout

- PVC will expand or contract:
  - 3.36″ per 100′ of pipe per 100° F change in temp
  - Example
    - 30 ° F of temp change

    = 1 inch of expansion/contraction
- Solutions
  - Snake pipe
  - Install during cooler part of day

Pipe sleeving

- Use in areas where pipe needs additional support
  - Under driveways, roads, structures
  - Wastewater pipe close to water lines or crosses water lines.
  - Underlying soil is disturbed



Pipe sleeving methods

- Place a larger *and* stronger pipe around smaller pipe:
  - Helps support pipe
  - Prevents bowing
    - Where debris gets caught
  - Spray insulation:
    - Prevents soil backfill from filling pipe

Key points with glued connections

- Fittings
  - Correct size & pressure rating
- Surface
  - Cleaned and primed
- “Cleaners” aren’t “primers”
  - Primer dissolves 2 surfaces
- Apply enough glue to fill gap between pipe and fitting

Standard set times for PVC piping*

- The necessary time to wait before the joint can be carefully handled

Temp Range	Pipe Size ½ to 1¼ inch	Pipe Size 1½ to 3 inch
60° -100° F	15 min	30 min
40° – 60° F	1 hr	2 hr
0° – 40° F	3 hr	6 hr

**** Check label as some are fast set***

Standard cure times for PVC pipe

- The necessary time to wait for full strength rating & before pressurizing the system

RELATIVE HUMIDITY 60% or Less*	Pipe Size ½″ to 1¼″	Pipe Size 1½″ to 3″
Temperature Range	≤ 180 psi	
60° – 100° F	1 hr	2 hr
40° – 60° F	2 hr	4 hr
0° – 40° F	8 hr	16 hr

Over-excavation

- Should be avoided whenever possible by the use of a laser
- Stability is essential when backfill is needed

Why over-excavate?

- Some site conditions require it:
  - Shallow bedrock
  - Organic peat soils
  - Large diameter trees and rocks
  - Loose fill material
  - Soil substitution
- Construction mistakes
- In these situations, proper backfilling/bedding is very critical to assure components are stable

Selecting bedding materials

- Key issues are:
  - Can the material be effectively compacted?
  - Is there potential that water will collect in the area where material is being installed?
  - Note – areas with more bedding materials will settle more (A versus B) if not properly compacted

Compaction equipment

- Machine or mechanism used to reduce the volume of soil through compaction
- Two main types of compactors:
  - Plate
  - “Jumping jack"

Where do we use a compactor?

- Pipe bedding
- At bottom and along sides of tank excavation area
- Around modular media filters and ATUs

Where do we not use a compactor?

- In media filters
- Soil treatment areas particularly infiltrative surface and absorption area
- Around fragile components which could be damaged

Questions ?