Bioretention

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Storm Water Infiltration Workshop
Waukesha, March 14, 2007

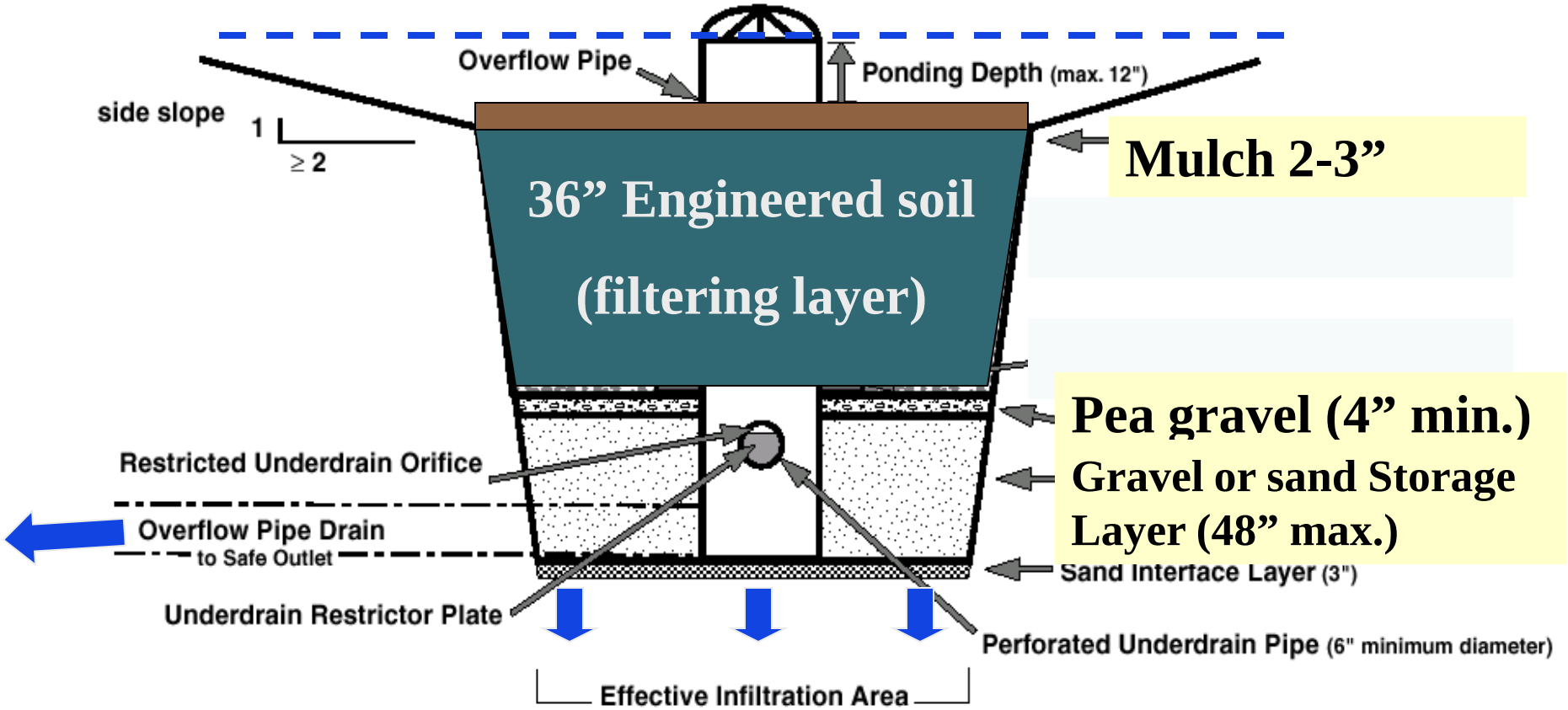
Bioretention Presentations

- Perry Lindquist, Waukesha County
  - Background - what, where and why
  - Brief overview of design criteria & DNR standard 1004
  - Examples
- Pete Wood, DNR
  - Implementation experiences
- Willie Gonwa, Symbiont
  - Implementation experiences

Definition

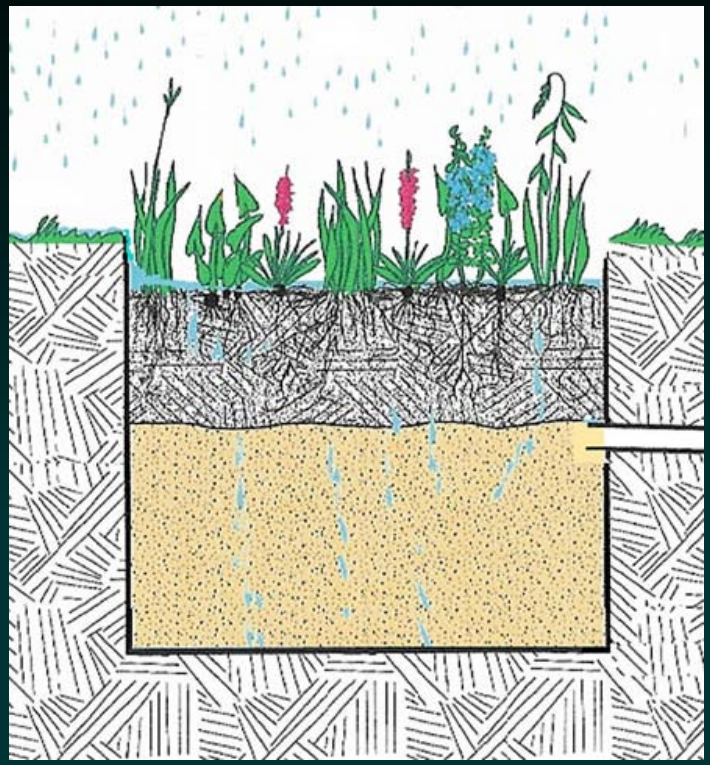
- Engineered device providing physical, chemical & biological treatment and storage of storm water – and possibly infiltration (DNR 1004 Standard)
  - Excavation back-filled with engineered soil mix
  - Surface is mulched (2-3 inches)
  - Planted with diversity of woody & herbaceous plants
  - May include pre-treatment area, flow regulation devices and underlying storage layer

Basic Bioretention Components



Purposes

- Pollutant removal (treatment)
- Thermal reduction
- Annual runoff volume reduction
  - Storage & evapotranspiration
- Peak flow control
  - Temp. storage above surface
  - Permanent storage within device
- Possibly infiltration/groundwater recharge
  - Infiltration below device if adequate soils and groundwater conditions



Engineered Soil Planting Bed

- Engineered soil mixture:
  - Sand 40% sand (washed/drained – ASTM C33)
  - Topsoil 20% (loam) or 30% (sandy loam)
  - Compost 30-40% (DNR S100)
- Depth - minimum 36”
- Other criteria:
  - pH 5.5 - 6.5
  - Adequate nutrients, non-toxic
  - No roots, stumps, etc.

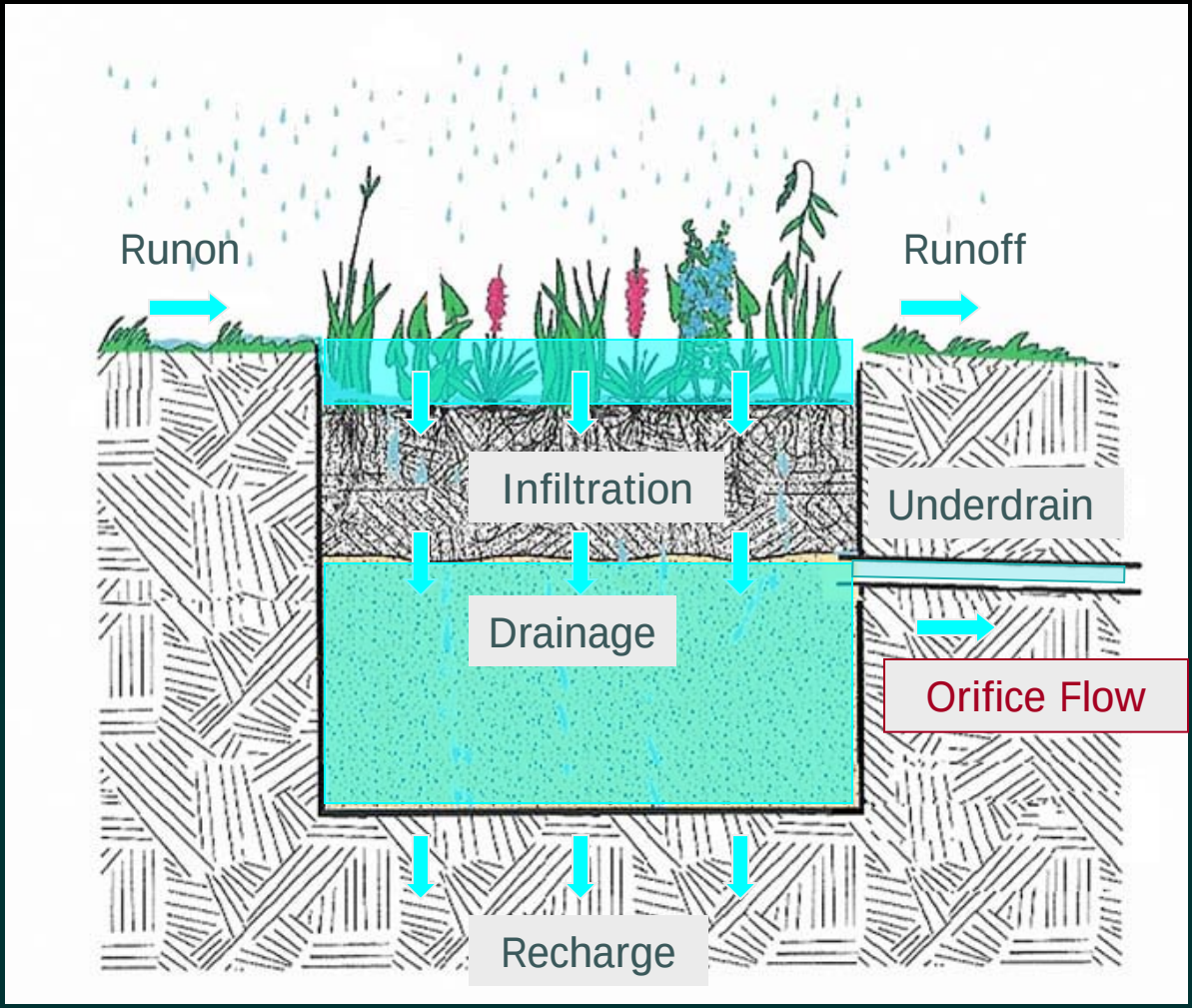
S 100 Compost

Engineered Soil
(Std. 1004)

Plants

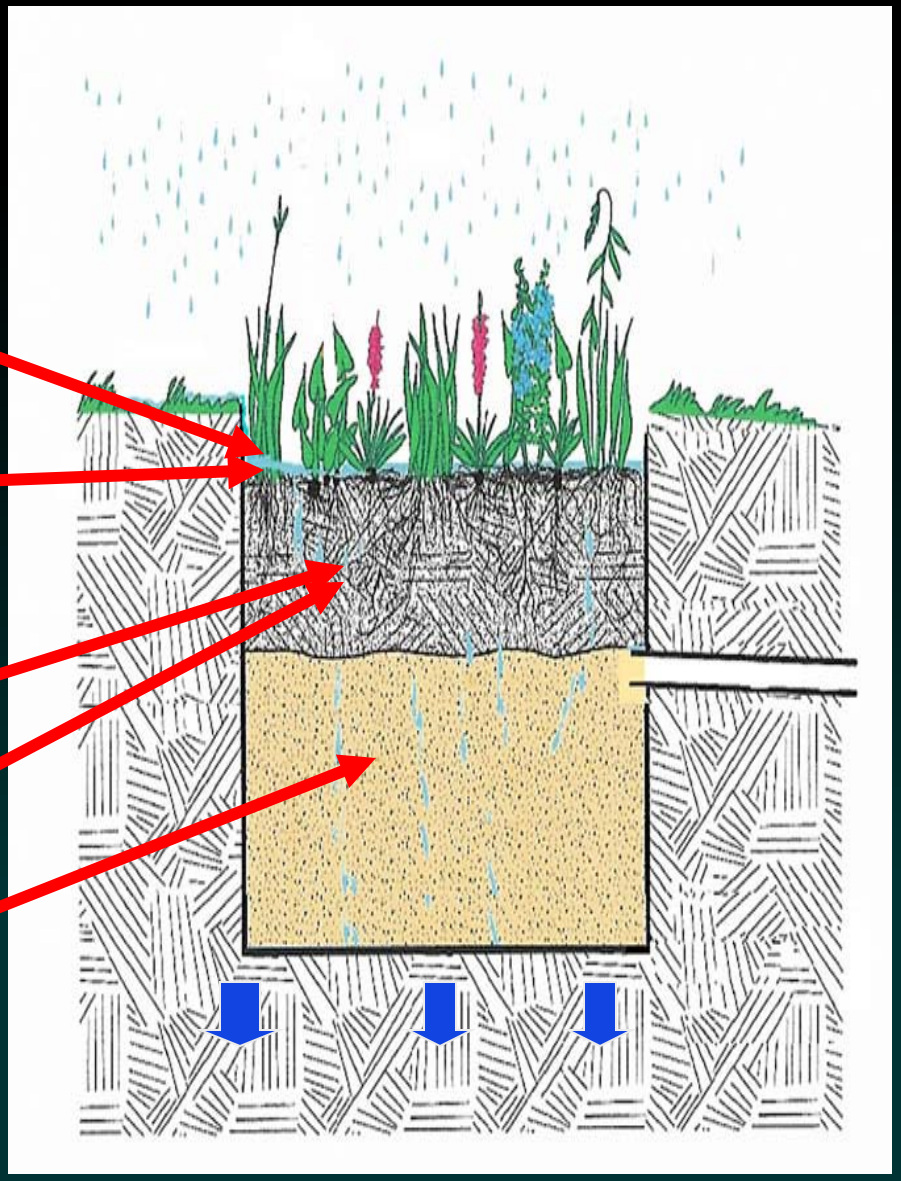
- Must use plugs (no seed)
- Diverse mix of prairie specie & shrubs
- See Standard for plant references
- Plan for some necessary replacement

How Does it Work?



How Does it Really Work?

- Sedimentation (temporary)
  - Trash, TSS, Phosphorus
- Exposure to Sunlight & Dryness
  - Pathogens, Oil & Grease
- Chemical Processes
  - Metals, Phosphorus
- Microbial Processes
  - Nitrogen
- Temperature



Applications

- Small drainage areas (2 acres)
  - Adjacent to source areas
- Commercial/high impervious
  - Condos, etc.
- Sensitive/cold water sites
  - With or without infiltration
- Clayey soils (upper layer?)

- Do NOT apply to:
  - Construction sites (sediment clogging)
  - Heavy use of chlorides (reduce CEC/microbes)

Figure 1. Example of **Bioretention Device – plan view**

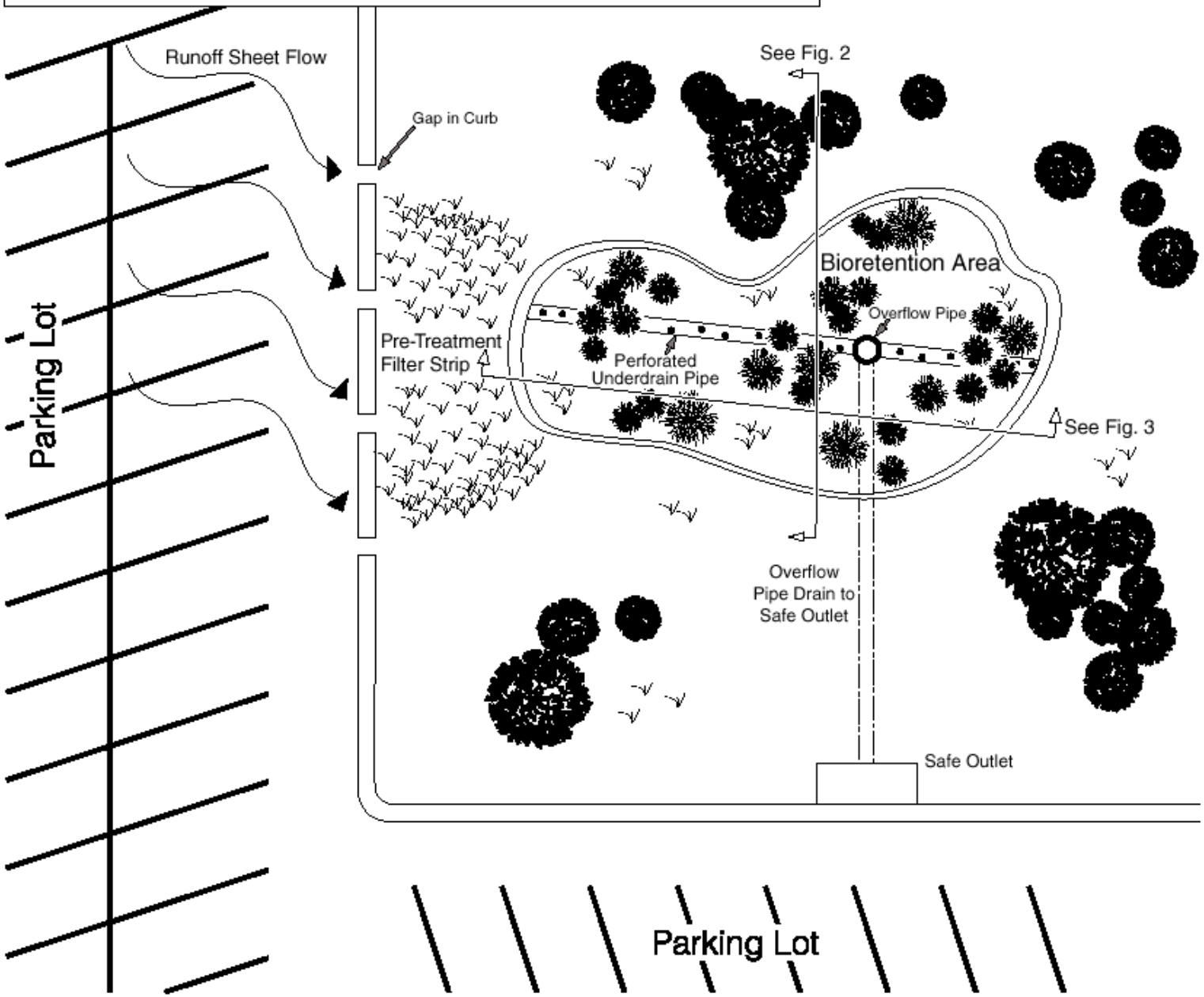
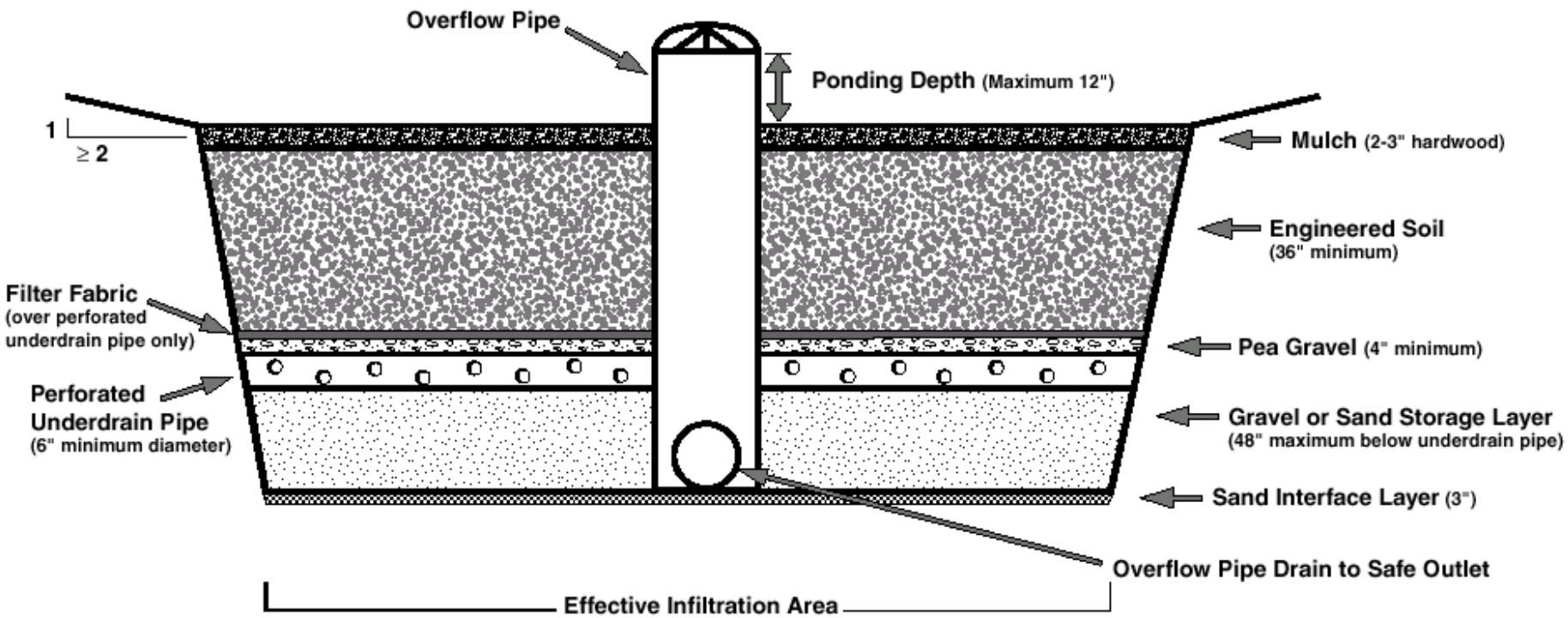


Figure 3. Example of **Bioretention Device – cross-section across length of device**



General Design Requirements

- Drainage areas <2 acres
- Ponding depth <12 inches (above mulch layer)
- Draw-down times:
  - <24 hours for “ponding area”
  - <72 hours for “fully saturated device”
- Surface area based on ordinance/regulations:
  - 25% of 2 year post-development runoff volume
  - RECARGA modeling (average annual “stay-on depth”)
    - 90% predevelopment for residential (23-25”)
    - 60% predevelopment for commercial (15-17”)

RECARGA_2_3

Units English

RECARGA Version 2.3

Bioretention/Raingarden Sizing Program

Planview Data

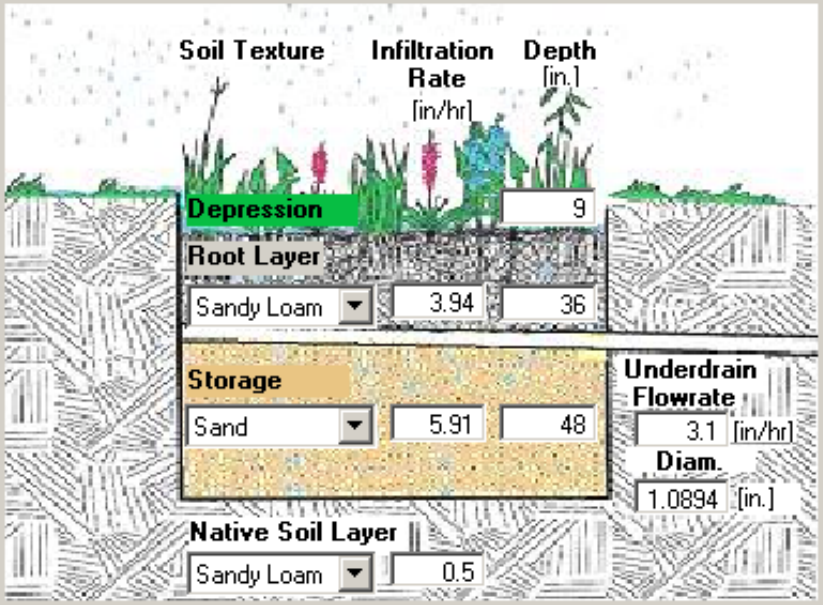
Facility Area	870	[sf]
Tributary Area	1	[acre]
Percent Imperviou	90	
Pervious CN	76	

Files

Regional Ave.	0.13	[in./day]
Simulation Type	Continuous	
Input File	266	days
Precip. File	Mad1981us	
Output File	MadkXXAXX	

Summa Record

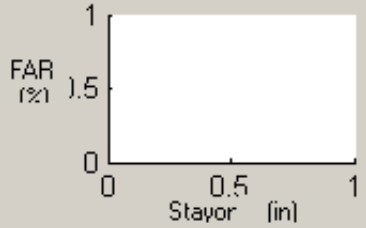
Facility Inputs



Target 0 I[in]

Facility Area Ratio Edit Text [%]

Run FAR



Results

Plant Survivability

(Less than 48 hours max.

	max.	Total
Hrs. Ponded	11.25	116.5
Number of overflows		12

Tributary Runoff [in]

Precipitation	28.81
Impervious Runoff	20.82
Pervious Runoff	3.514

Raingarden Water Balance

	[in.]	%
Runon	19.124	66.38
Runoff	5.754	19.97
Recharge	7.418	25.74
Evaporation	0.767	2.663
Underdrain	5.242	18.19
Soil Moisture	0.057	0.199
Stay-on	17.81	61.83

RUN SIMULATION

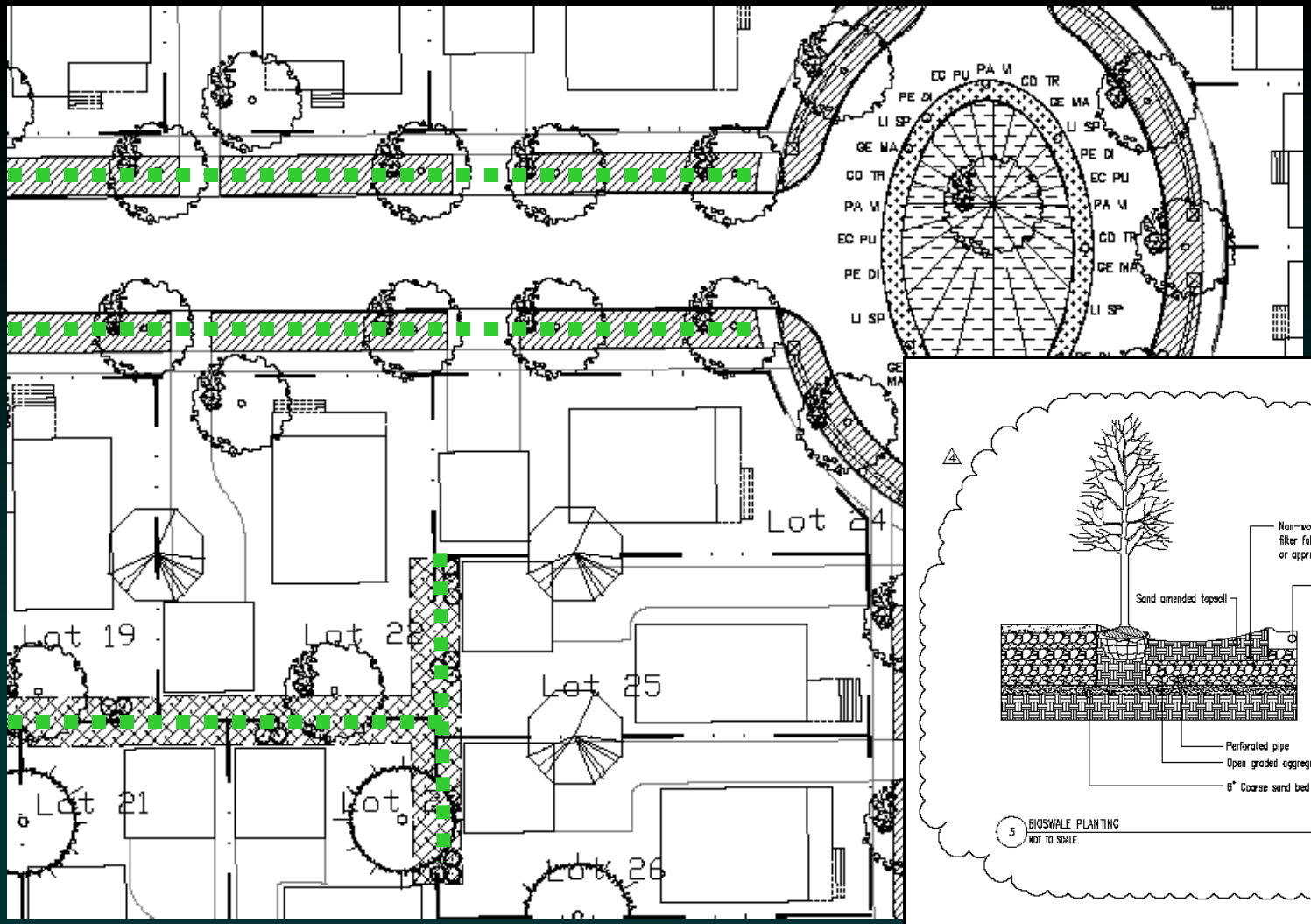
CLEAR RESULTS

Developed by the University of Wisconsin-Madison
Civil & Environmental Engineering Water Resources

Start | RECARGA | E:\RECARGA\RECARGA_... | RECARGA_2_3 | 5:25 PM

Josey Heights – Milwaukee

(bio-swales – no storm sewers)



Gas Station *(CTH TT & STH 18)*

2000

2003

DNR Presentations

- More details on std. 1004 design procedures, etc.

www.dnr.state.wi.us/org/water/wm/nps/stormwater/post-constr