

TNC: Lannon Farm Saturated Buffer

2019 Case Study



Properly evaluating the site saves a lot of headaches!

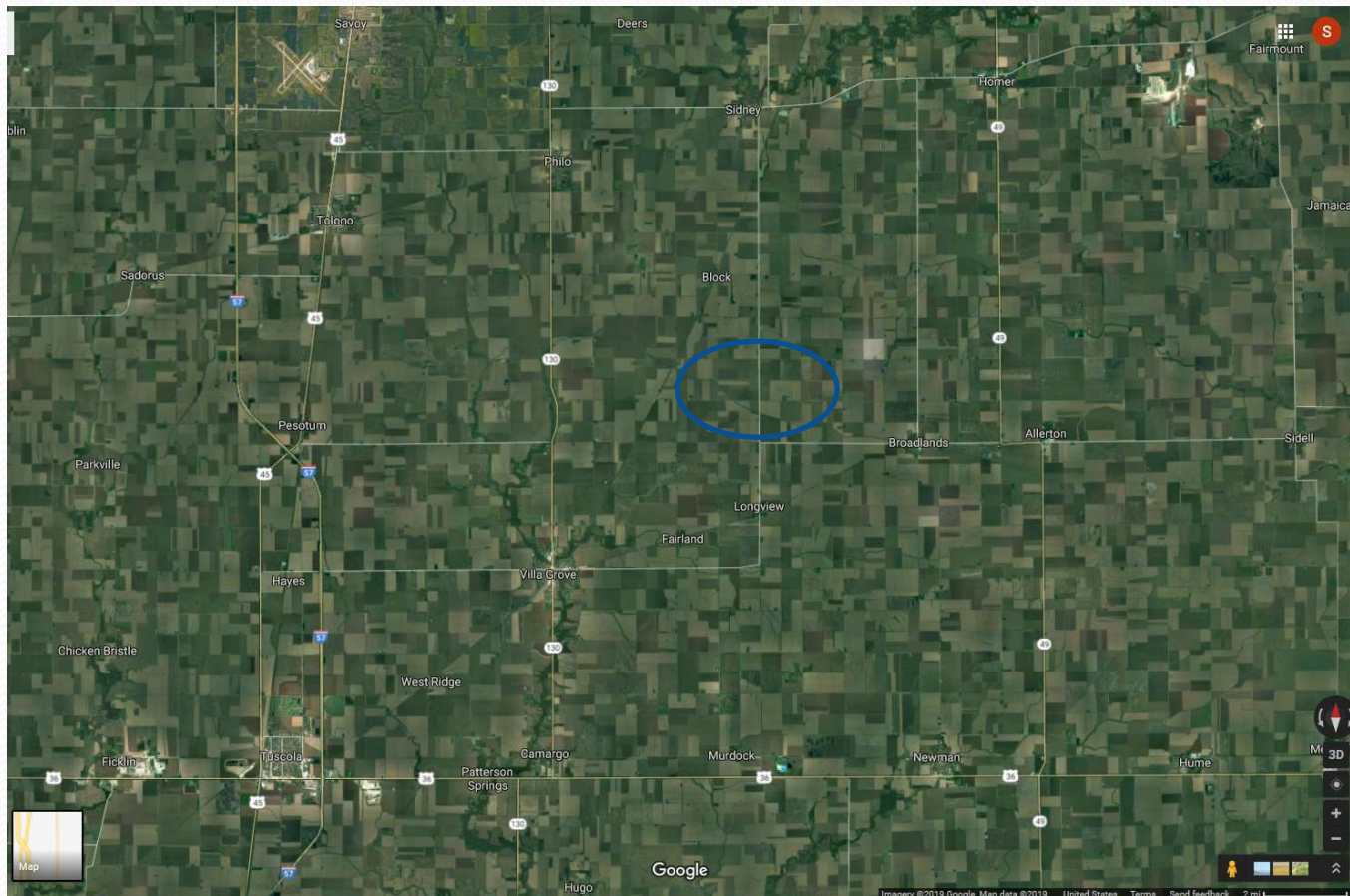
You need:

Enough OM

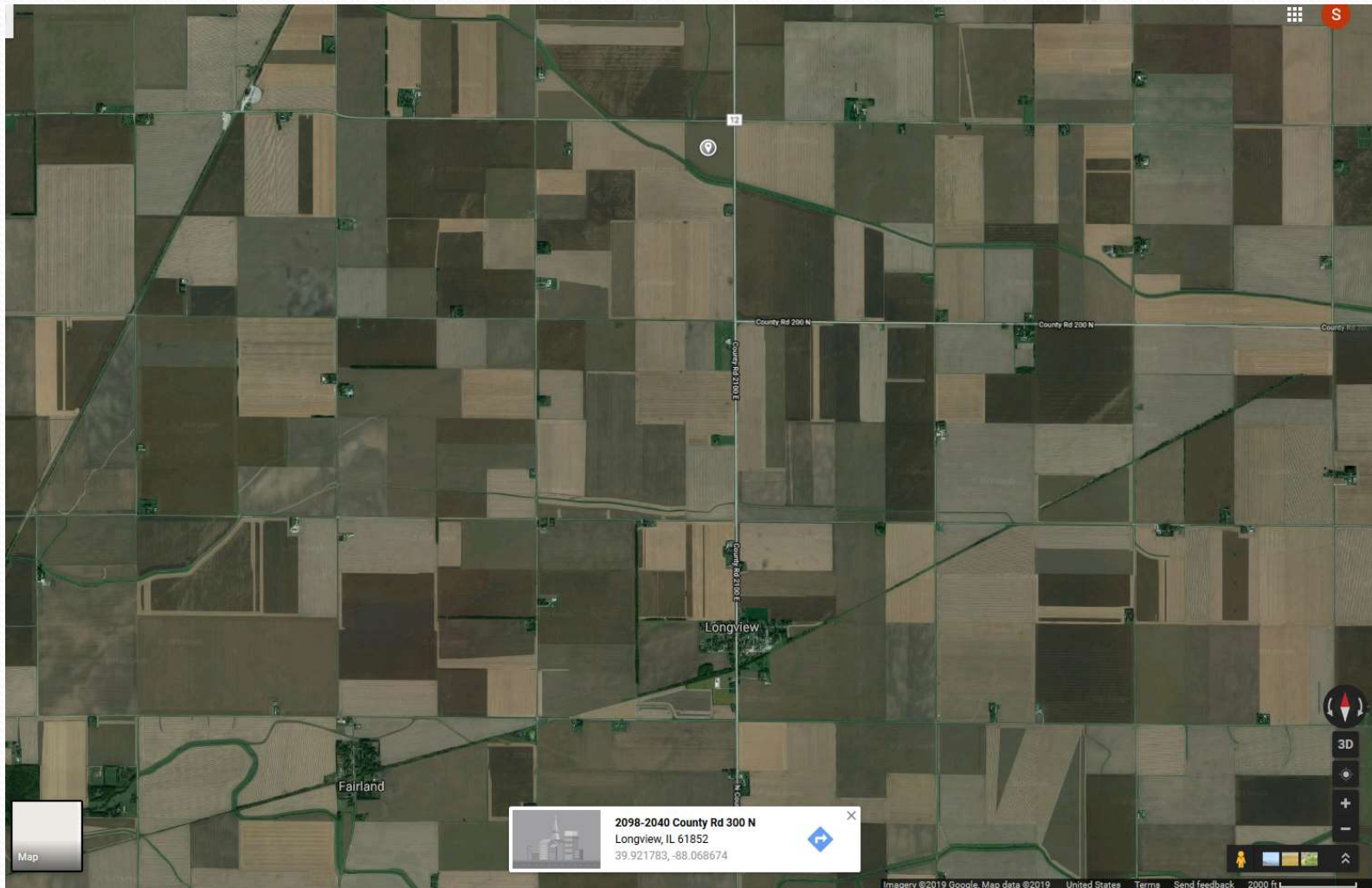
Saturated Soils

Stable streambanks

CLUE?



TNC Lannon Farm Case Study

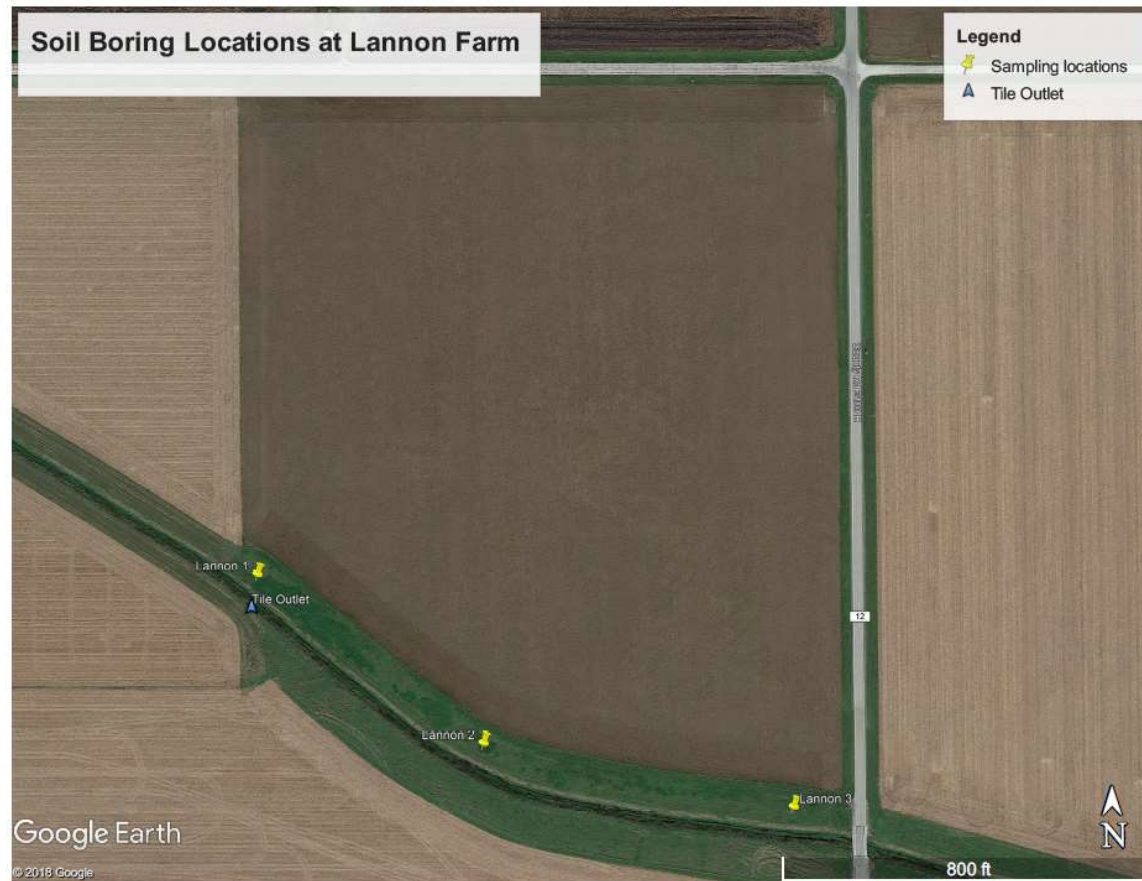


TNC Lannon Farm Case Study



TNC Lannon Farm Case Study

Soil Boring Locations at Lannon Farm



Legend

- Sampling locations
- Tile Outlet


Soil Profile Description

Soil Profile #: Lannon 1 Date Described: 2/27/19 County: Champaign
 Marker is in the third horizon at _____ inches. Twp.: 17N Range: 10E Sec.: 21
 Property Location: 72' due east of western property boundary; 20' north of creek bank
 Described By: Scott Wiesbrook

<http://www.illinoissoils.org/>



TNC Lannon Farm Case Study



When you don't have a soil scientist handy ...

... you can probe your own soil core.



TNC Lannon Farm Case Study



What is 'stable'?

TNC Lannon Farm Case Study

Good



TNC Lannon Farm Case Study

Good



TNC Lannon Farm Case Study

Bad



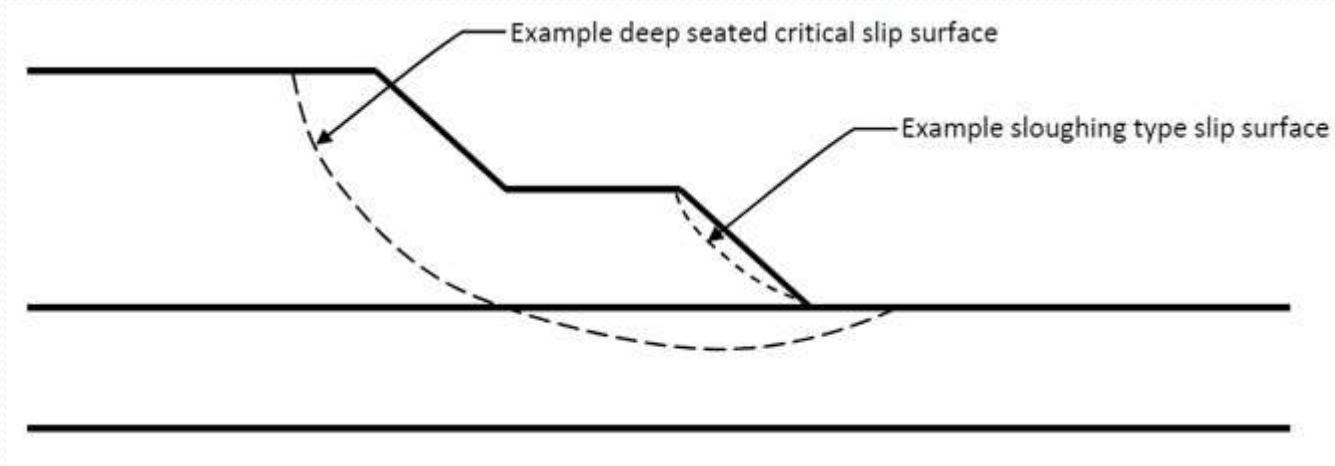
TNC Lannon Farm Case Study

Bad

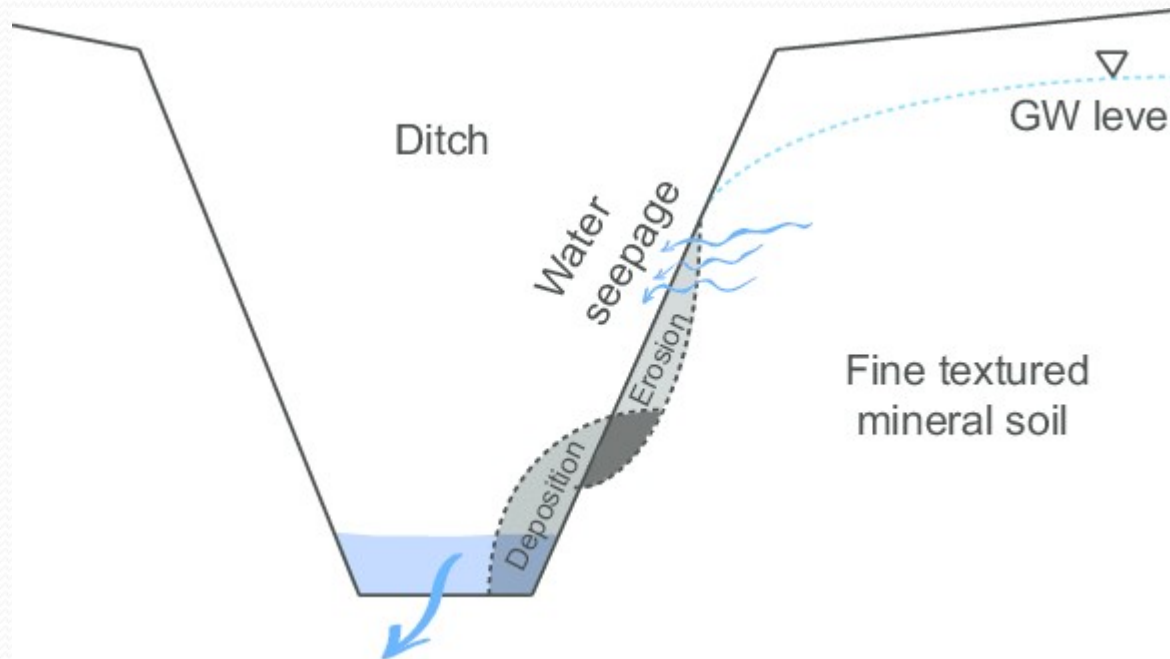


TNC Lannon Farm Case Study

Why and How?



Why and How?





Properly evaluating the site saves a lot of headaches!

You need:

Enough OM

Saturated Soils

Stable streambanks



Design is a two-step process:

1. Determine System Capacity

2. Size Distribution Pipe

SATURATED BUFFER DESIGN

USDA- Natural Resources Conservation Service

Illinois NRCS Version 2.1 - 4/10/2017

Project Name TNC Saturated Buffer
Site Location Lannon
County Champaign

Designed by: SMA/WMS
Checked by: _____

Date: 5/24/2019
Date: _____

Determine System Capacity:

Option 1 - Mainline Configuration

| | |
|---|-------------|
| Mainline tile size (in) | 8 |
| Mainline tile grade (%) | 0.50 |
| Mainline tile material | CPT |
| Manning's 'n' = 0.016 | |
| Peak velocity in mainline given size and grade | 1.99 ft/sec |
| Peak flow from mainline size and grade | 0.696 cfs |
| Minimum Design Capacity: (5% of Option 1, 2, or 3; whichever is lower) | 0.019 cfs |
| Selected Design Capacity | 0.020 cfs |

Option 2 - Drainage Coefficient

| | |
|-----------------------------------|-----------|
| Drainage area of tile system (ac) | 46 |
| Drainage coefficient (inches/day) | 0.2 |
| Capacity of drainage system | 0.387 cfs |

Option 3 - Saturated Buffer system flow rate (Based on DRAINMOD Model or other source)

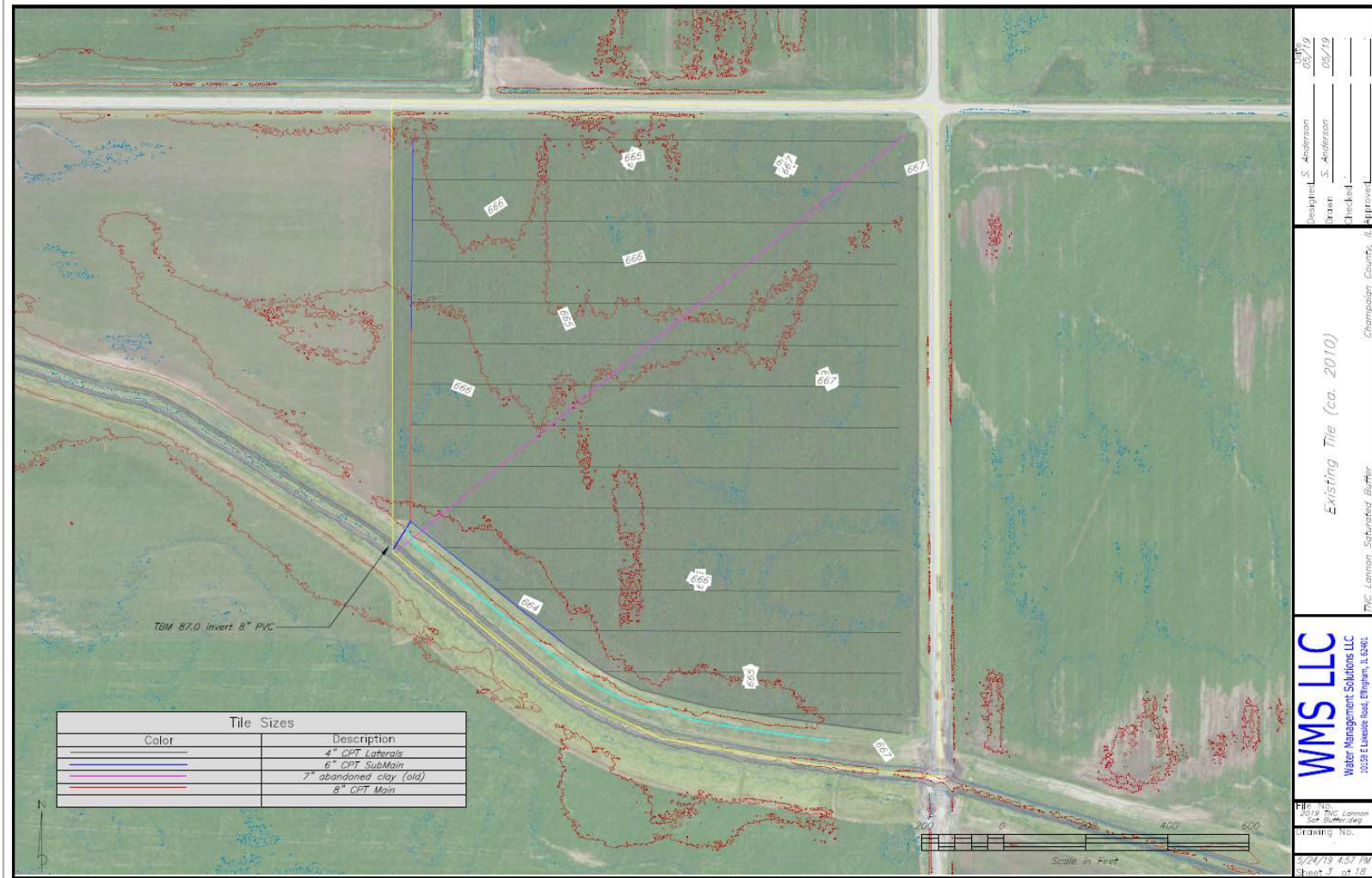
| | |
|--------------------------------|--|
| Describe Value Used and source | |
|--------------------------------|--|

Size Distribution Pipe:

| | |
|--|------|
| Distribution pipe min. grade (%) | 0.05 |
| Design distribution pipe diameter (in) | 6 in |
| Distance from dist. pipe to outlet channel, L (ft) | 40.0 |
| Ground surface elevation at WCS (ft) | 93.0 |
| Depth of impervious layer (ft) | 7.4 |



TNC Lannon Farm Case Study



TNC Lannon Farm Case Study

Drainage Characteristics of Soil Groups

Alphabetic Order Numeric Order

Darwin
Del Rey
Denny
Denrock
Dockery
Drummer
Dunham
Dupo

E
F

Distribution of Drummer in Illinois

Drummer (152)

Steady State Drainage Transient Drainage General Information

☒ Drainage Coefficient ☐ Spacing ☐ Range What is Steady State Drainage?

Depth to Impermeable layer (ft) 4.986876

Hydraulic Conductivity (ft/day) 3.152

Drain Depth (ft) 3.5

Depth to mid-drain water table (ft) 1

Calculate Drainage Coefficient (in/day) 0.199

Required Spacing (ft) 100

Specify Data Path Description of Soils and Their Role in Subsurface Drainage Exit

TNC Lannon Farm Case Study

SATURATED BUFFER DESIGN

USDA- Natural Resources Conservation Service

Illinois NRCS Version 2.1 - 4/10/2017

Project Name TNC Saturated Buffer
Site Location Lannon
County Champaign

Designed by: SMA/WMS
Checked by: _____

Date: 5/24/2019
Date: _____

Determine System Capacity:

Option 1 - Mainline Configuration

| | |
|---|-------------|
| Mainline tile size (in) | 8 |
| Mainline tile grade (%) | 0.50 |
| Mainline tile material | CPT |
| Manning's 'n' = 0.016 | |
| Peak velocity in mainline given size and grade | 1.99 ft/sec |
| Peak flow from mainline size and grade | 0.696 cfs |
| Minimum Design Capacity: (5% of Option 1, 2, or 3; whichever is lower) | 0.019 cfs |
| Selected Design Capacity | 0.020 cfs |

Option 2 - Drainage Coefficient

| | |
|-----------------------------------|-----------|
| Drainage area of tile system (ac) | 46 |
| Drainage coefficient (inches/day) | 0.2 |
| Capacity of drainage system | 0.387 cfs |

Option 3 - Saturated Buffer system flow rate (Based on DRAINMOD Model or other source)

| | |
|--------------------------------|--|
| Describe Value Used and source | |
|--------------------------------|--|

Size Distribution Pipe:

| | |
|--|------|
| Distribution pipe min. grade (%) | 0.05 |
| Design distribution pipe diameter (in) | 6 in |
| Distance from dist. pipe to outlet channel, L (ft) | 40.0 |
| Ground surface elevation at WCS (ft) | 93.0 |
| Depth of impervious layer (ft) | 7.4 |

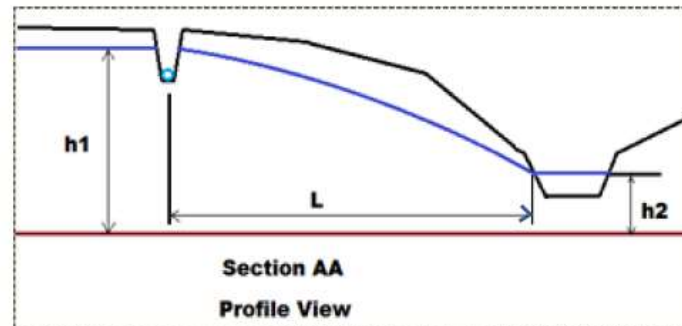
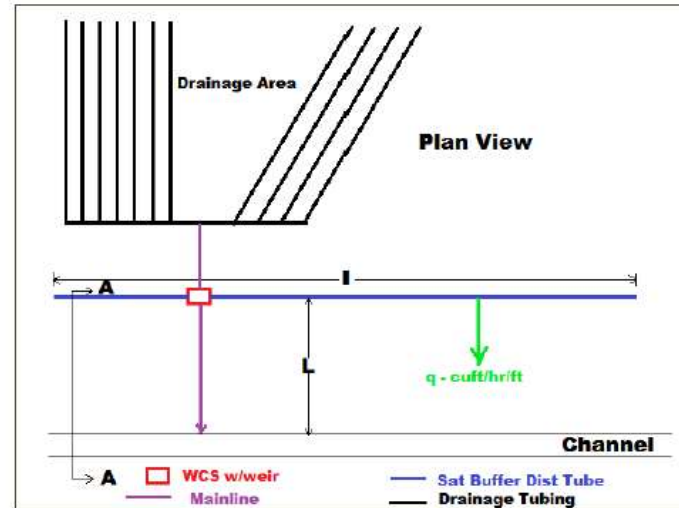


TNC Lannon Farm Case Study

Selected Design Capacity 0.020 cfs

Size Distribution Pipe:

| | |
|--|------------|
| Distribution pipe min. grade (%) | 0.05 |
| Design distribution pipe diameter (in) | 6 in |
| Distance from dist. pipe to outlet channel, L (ft) | 40.0 |
| Ground surface elevation at WCS (ft) | 93.0 |
| Depth of impervious layer (ft) | 7.4 |
| Design water control weir elevation (ft) | 92.0 |
| Baseflow water elevation in ditch or outlet (ft) | 85.6 |
| Head at WCS, h_1 | 6.4 ft |
| Head at outlet, h_2 | 0.0 ft |
| Soil saturated hydraulic conductivity, K_{sat} ($\mu m/sec$) | 9.70 |
| | 0.11 ft/hr |
| Unit flow from distribution pipe, q (ft^3/hr per ft) | 0.059 |
| $q = \frac{K_{sat}}{2L}(h_1^2 - h_2^2)$ | |
| Distribution pipe length for min. design capacity | 1187 ft |
| Selected distribution pipe length (ft) | 1200 |
| Distribution pipe flow rate (ft^3/hr) | 70.4 |
| % of drainage system capacity handled by saturated buffer design | 5.1% |



Notes:

TNC Lannon Farm Case Study

Discussion?

Stephen M Anderson, PE
Water Management Solutions, LLC
10158 E Lakeside Road
Effingham, IL 62401
stephen@wmsag.com
217.821.3559 (mobile)

TNC Lannon Farm Case Study