Agronomics of Renovations

Trey Rogers
Michigan State University

Agronomy – the study of Crop and Soil Sciences.

Agronomy – Construction and Establishment.

I don’t make the rules, I just learned the rule book.

It is 14 years into the 21st Century. Let's use the technology. Regardless, someone will.

Renovation Projects

- Country Club of Detroit, MI - 2010
- Orchard Lake Country Club, MI – 2012
- Shady Canyon Golf Club, CA – 2013
- Inverness Golf Club, OH – 2013
- Baltimore Country Club, MD – 2014

Most Commonly asked Questions

- Which creeping bentgrass do I choose?
- How do I keep the annual bluegrass out of the…?
- Should I regrass or rebuild?
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Renovation Principles

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- Your opening day is always looming.
- The first ‘season’ is the most difficult.

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Standard USGA Putting Green

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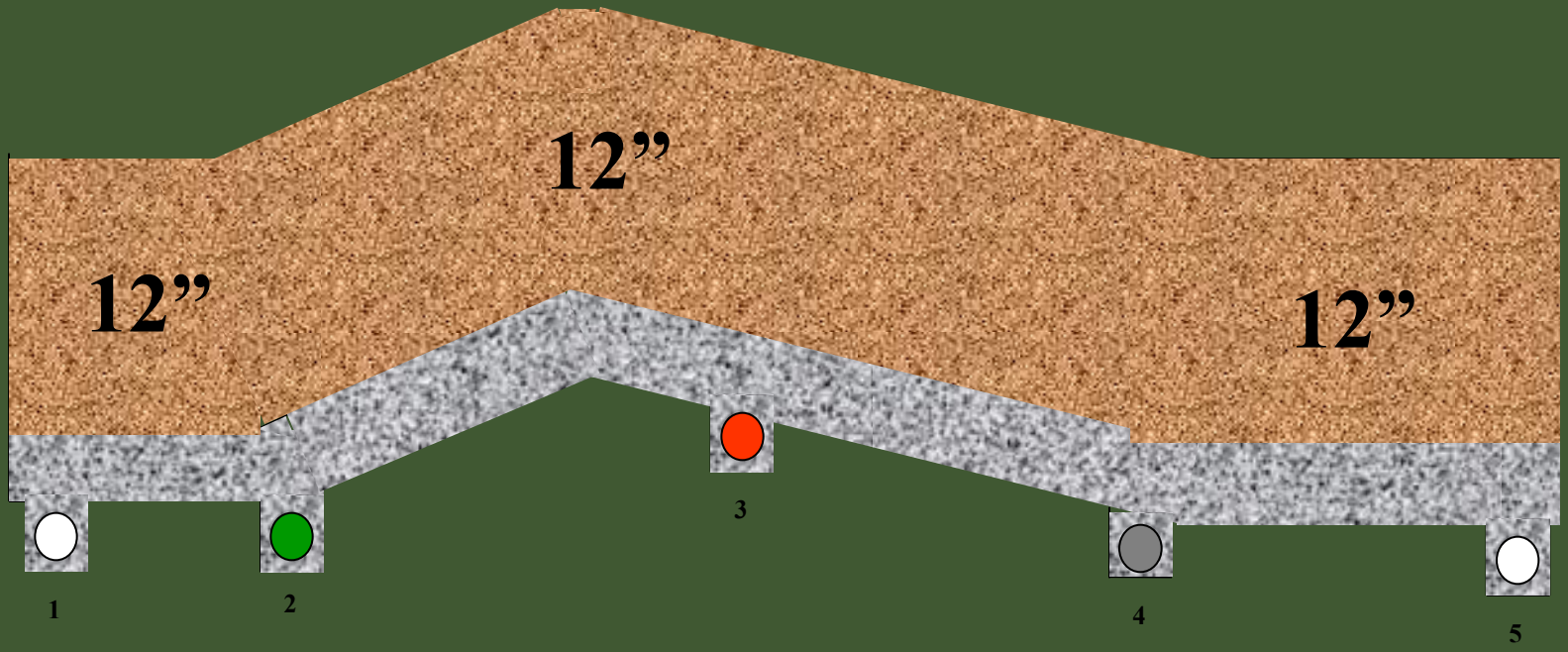
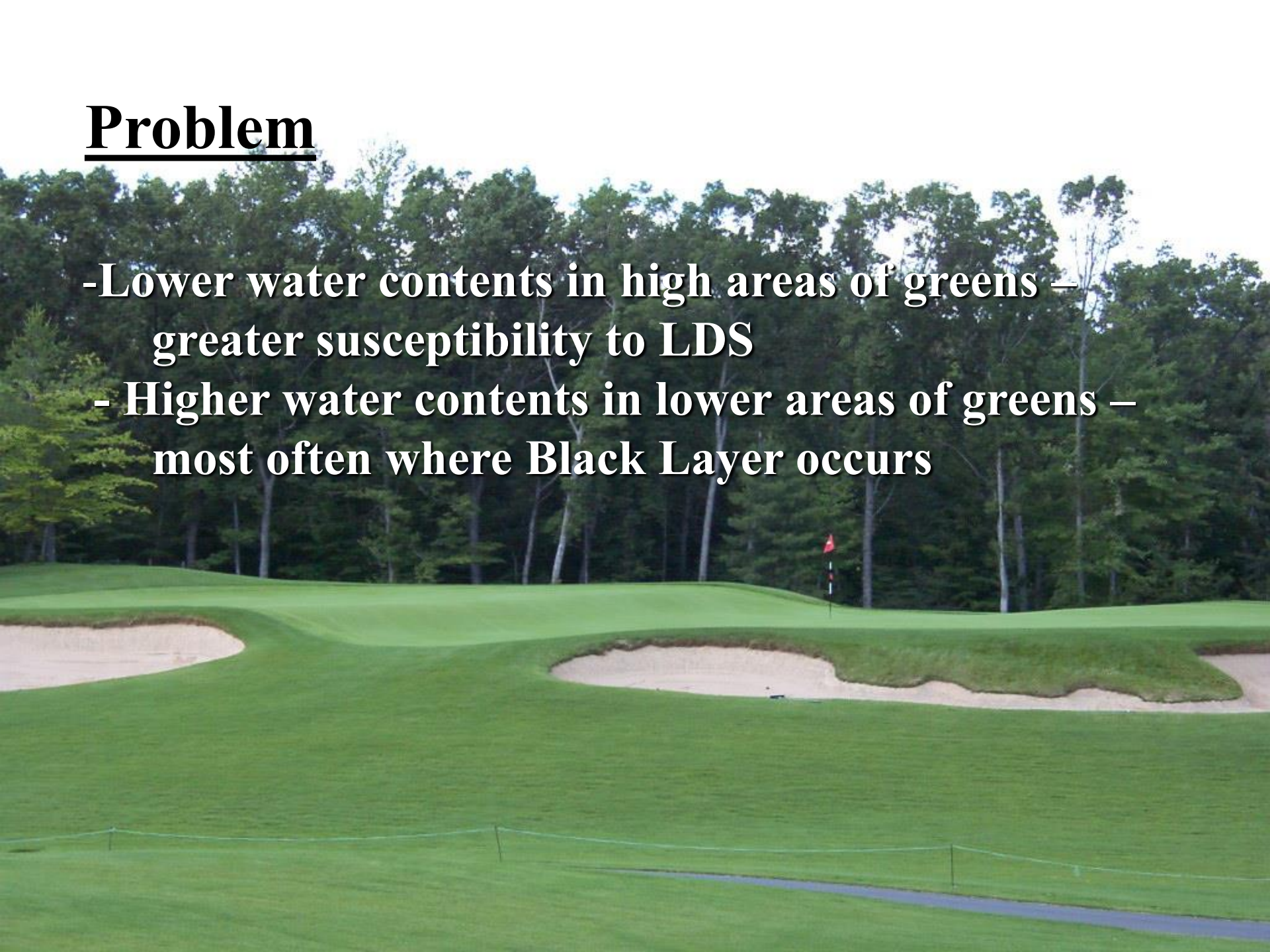


USGA Greens DO NOT account for lateral water flow

- results in uneven wetting of the profile over the slope

Problem



-Lower water contents in high areas of greens – greater susceptibility to LDS

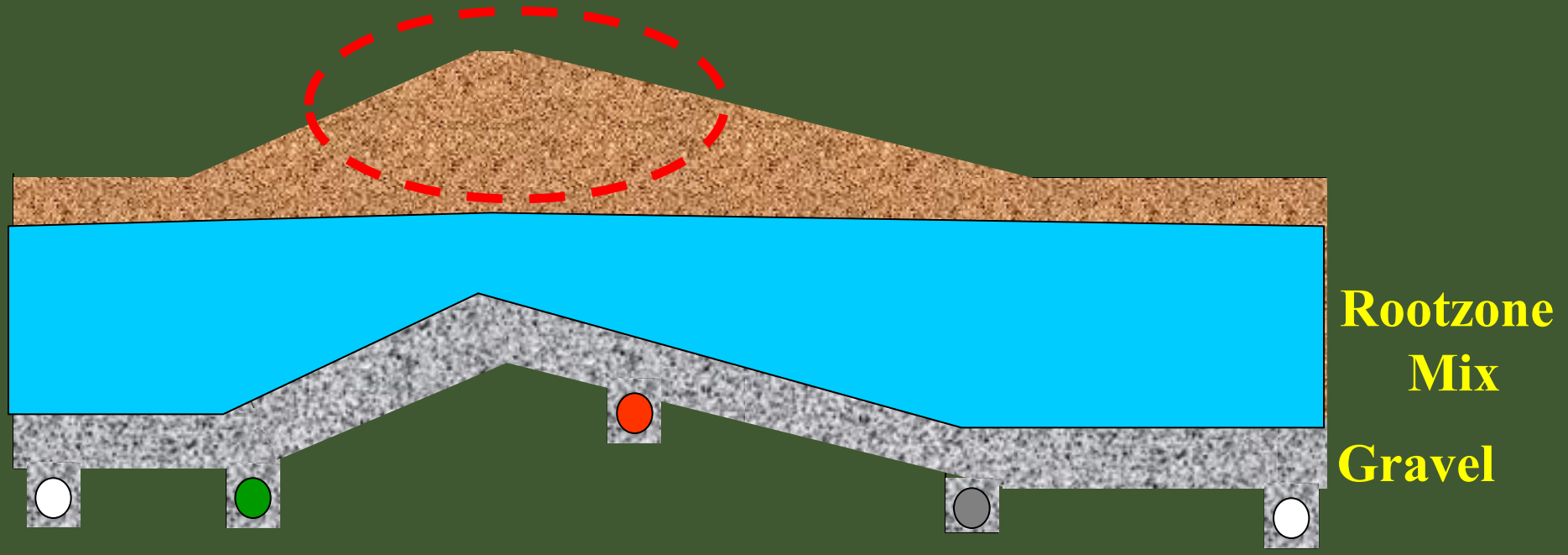
- Higher water contents in lower areas of greens – most often where Black Layer occurs

Solutions to Hot Spots

- Syringing
- Wetting Agents – help water penetrate soil and help soils retain moisture
- Alternative construction method

How do you irrigate the “hot spot”?

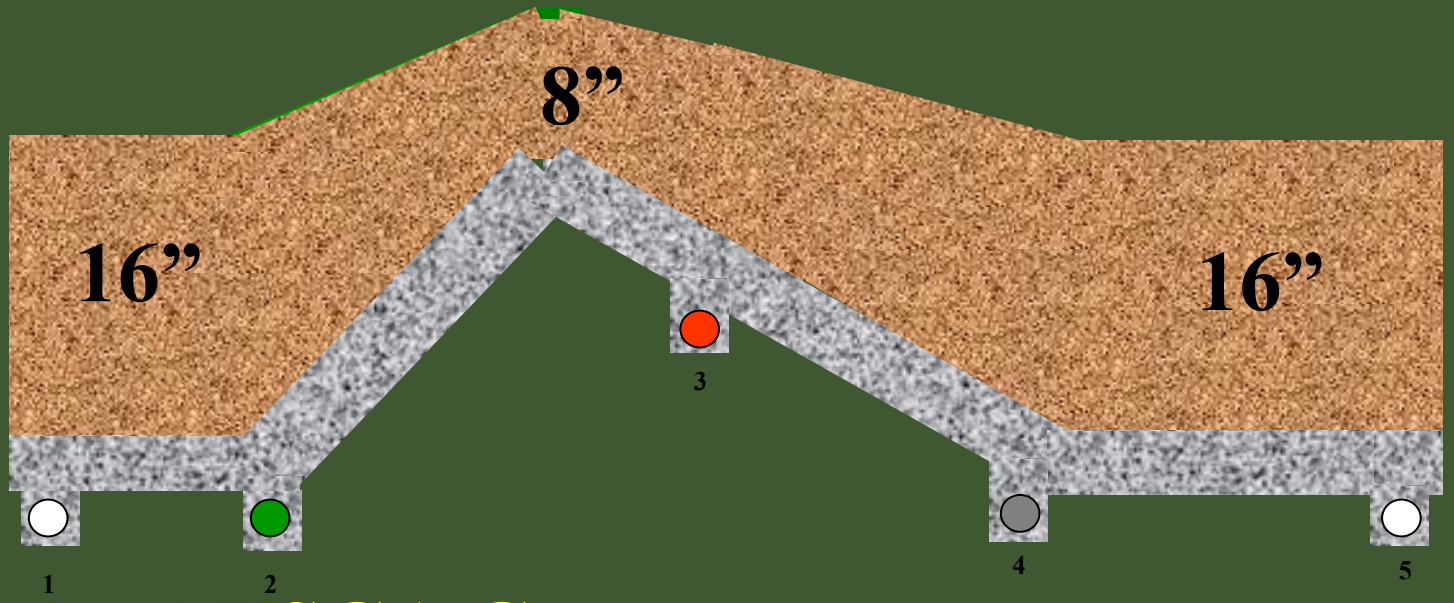
- Over-water?
- Under-water?
- Hand-water?



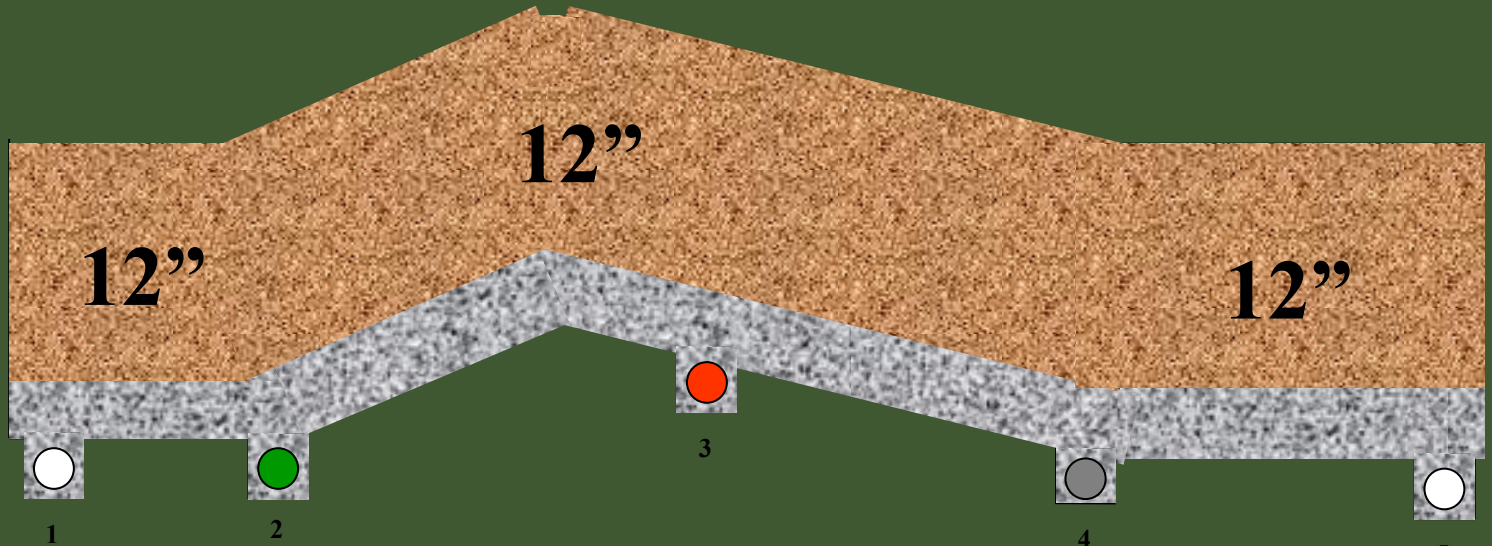
Hypothesis:

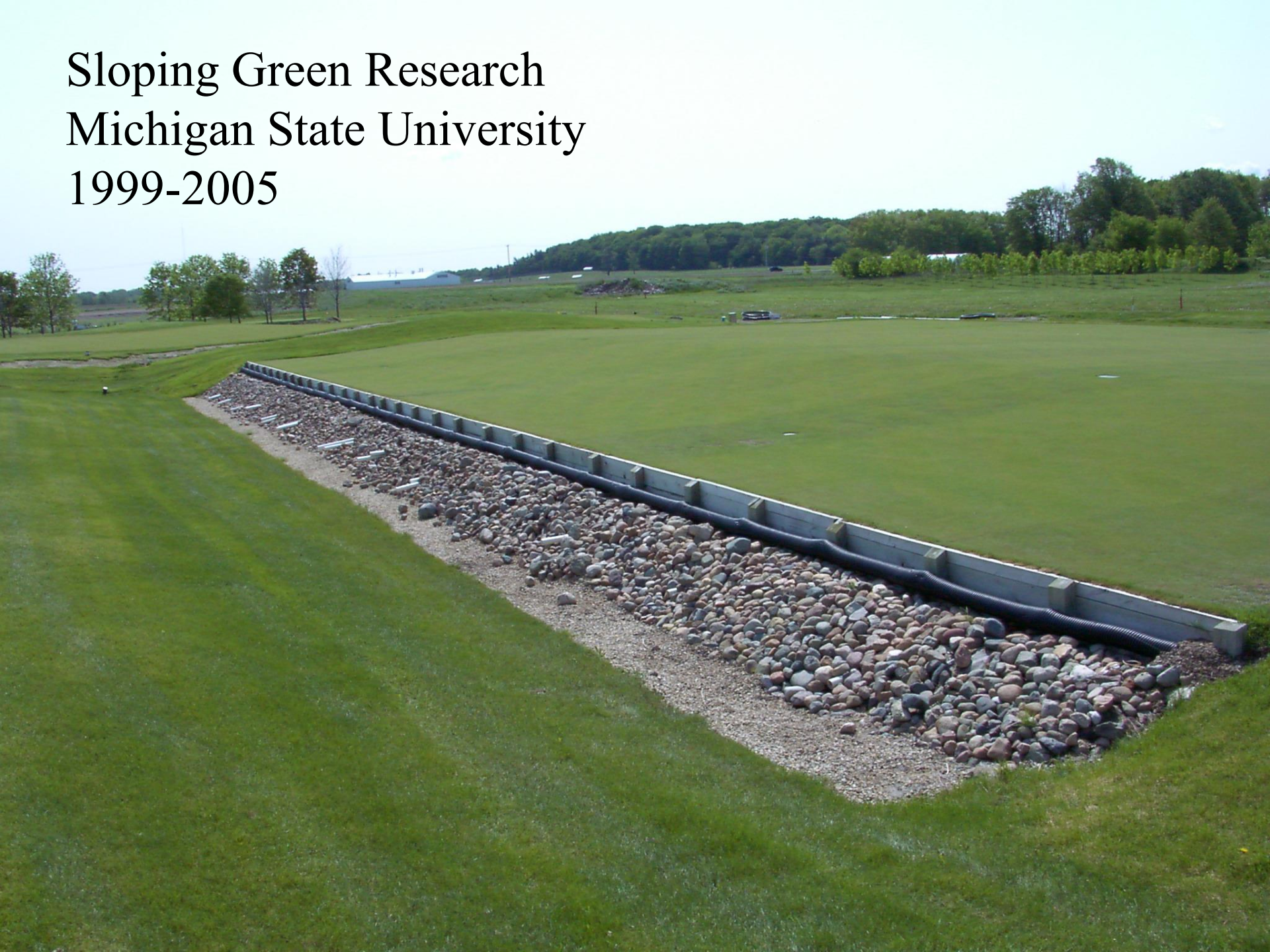
- Decreasing the depth of the rootzone mix at higher elevations and increasing the depth at lower elevations will provide more uniform soil moisture content across the entire slope of the green

Modified USGA Green

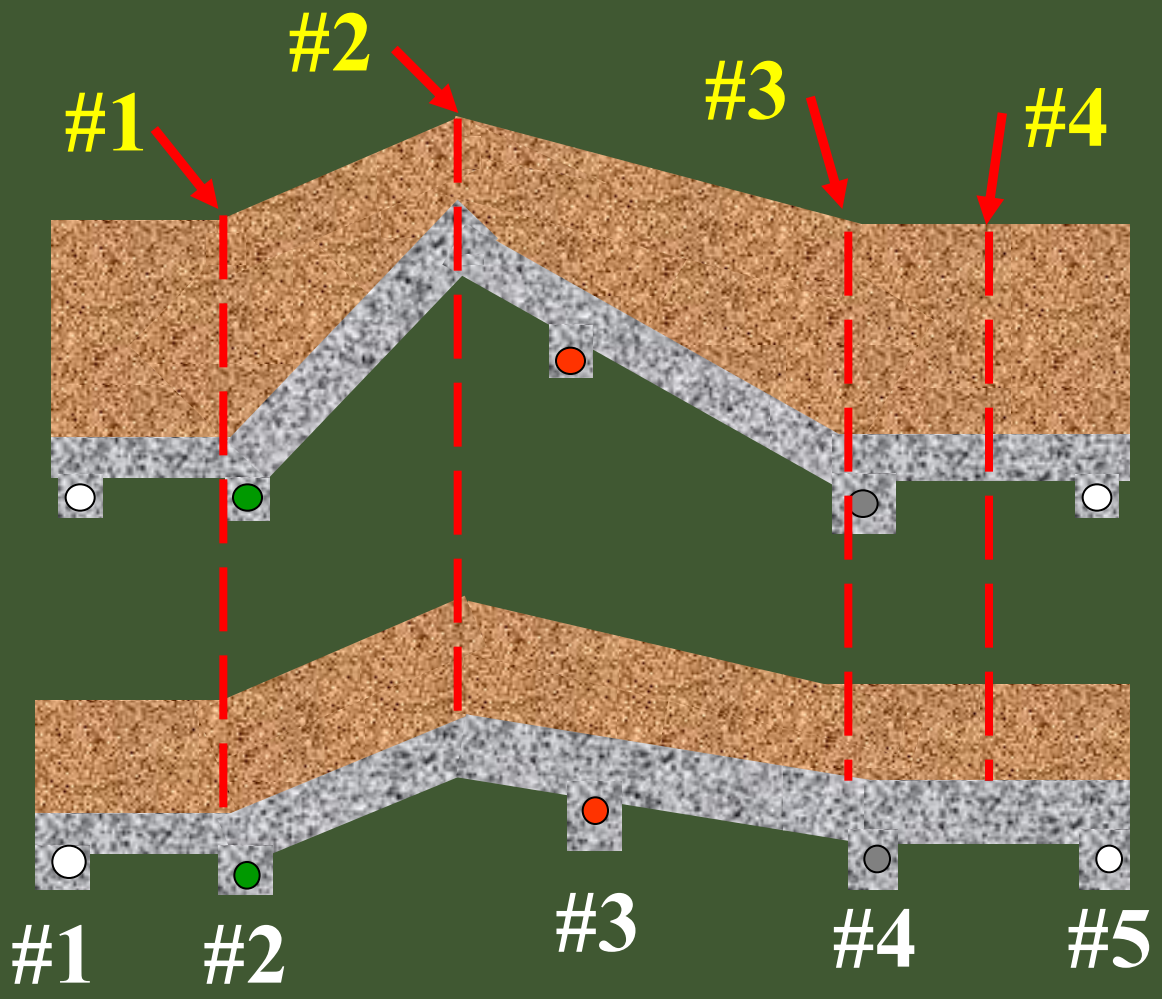


Standard USGA Green




Sloping Green Research
Michigan State University
1999-2005

TDR Probe Locations



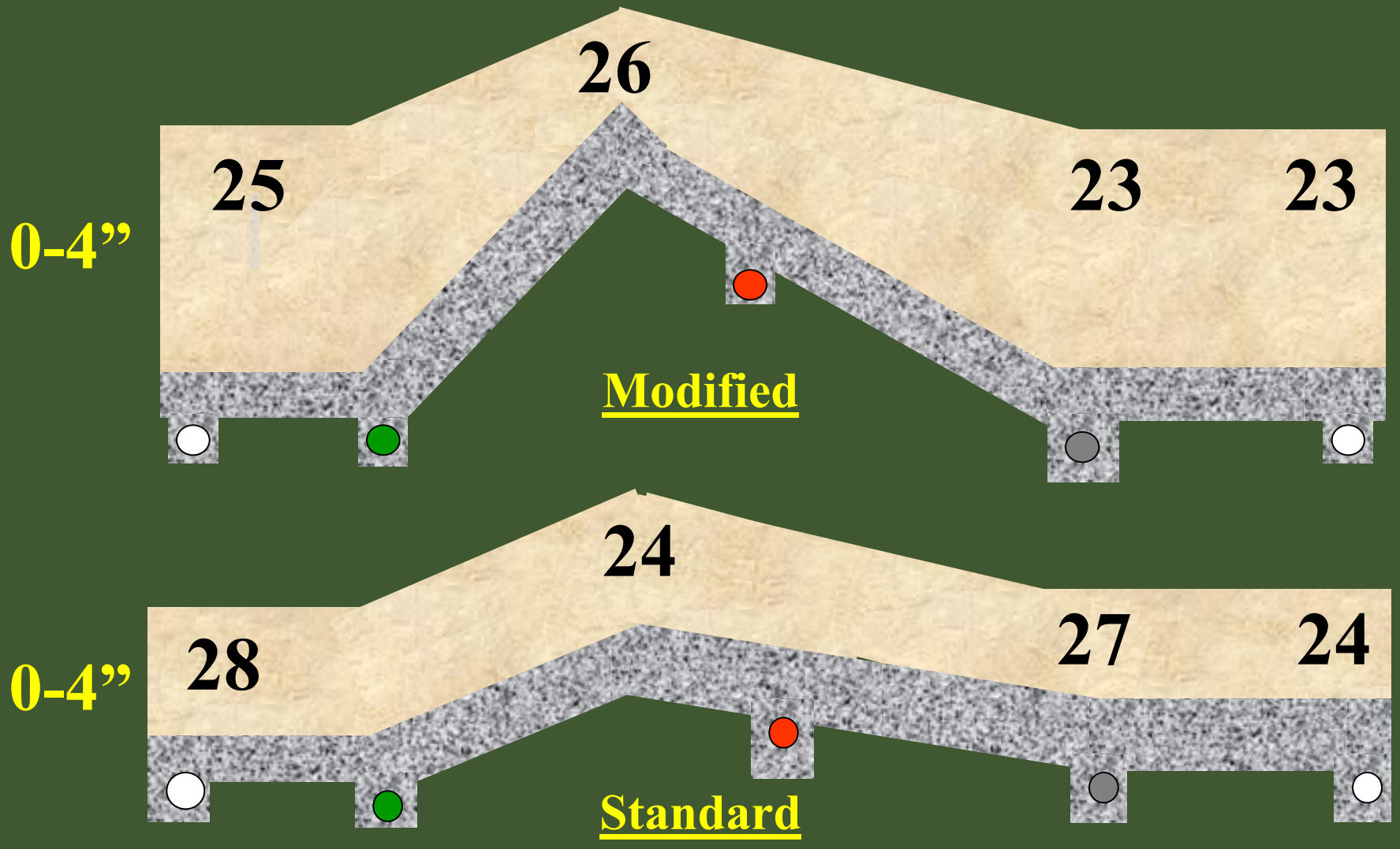
Draintile Locations

Dry Down Cycle

- Irrigation withheld for a 4-5 day period
- TDR Measurements taken throughout the dry down period
- Tipping bucket – quantify water drainage

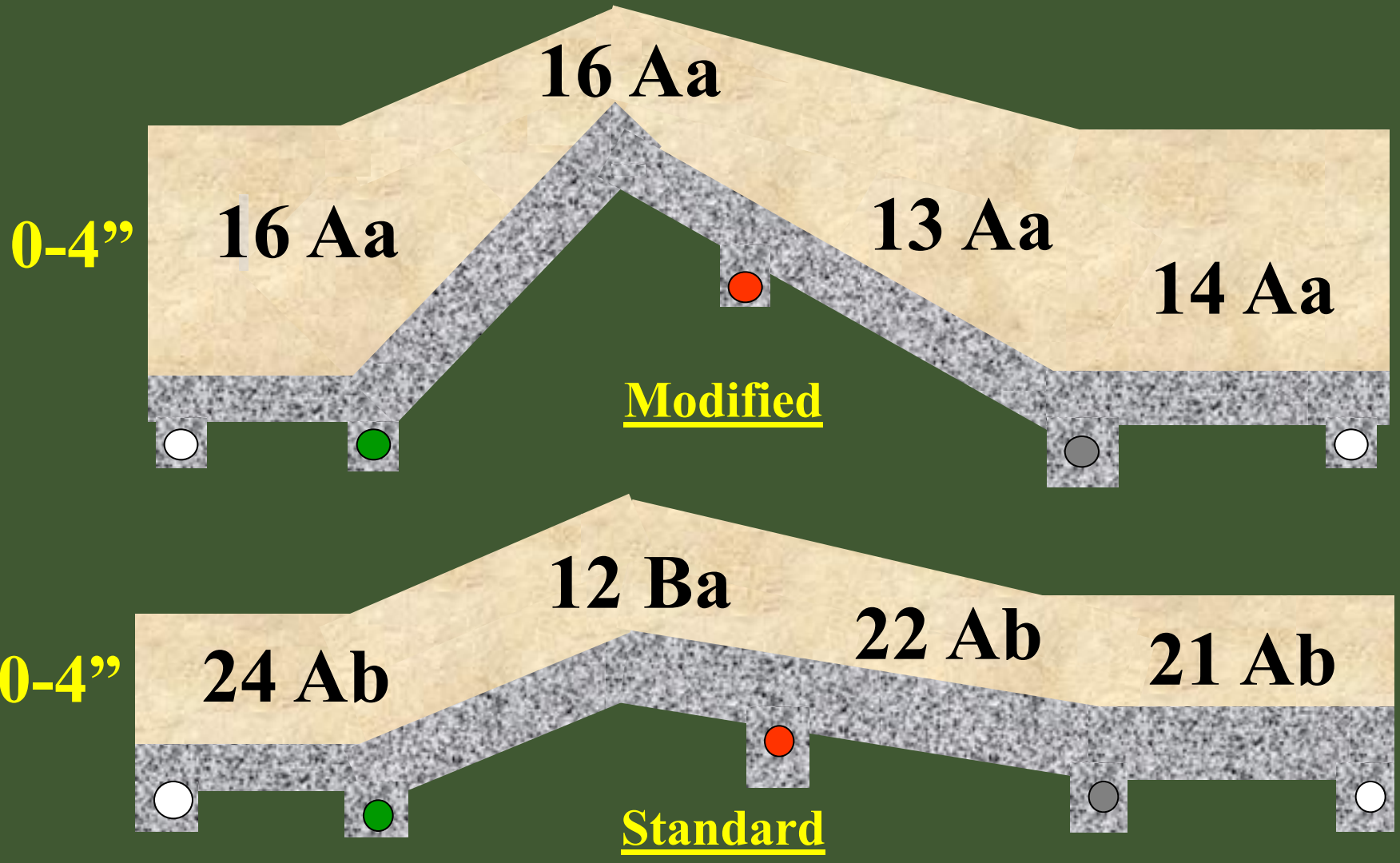
Day 1: July 7, 2001

Volumetric Soil moisture content (%)

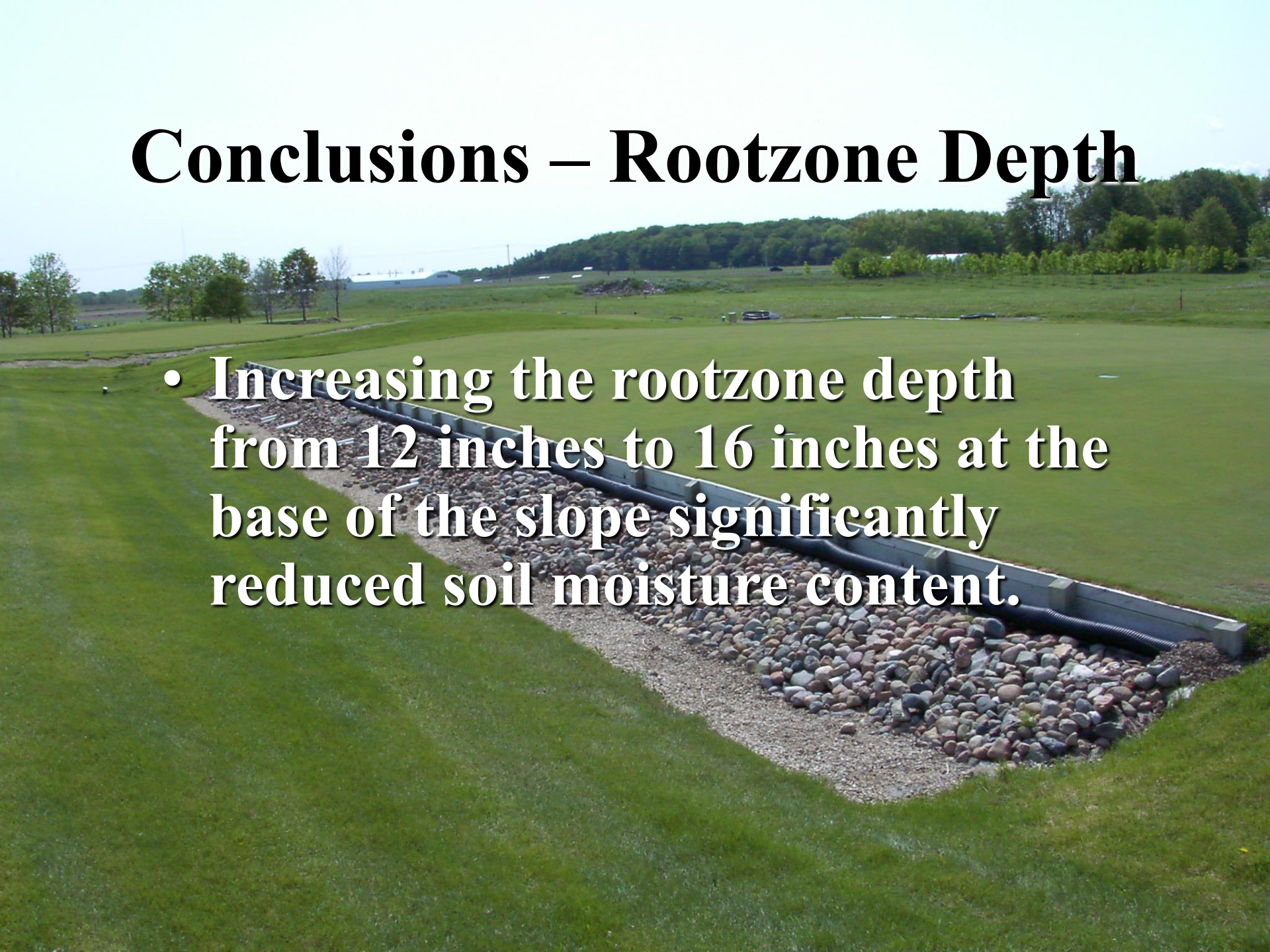


Day 4: July 10, 2001

Volumetric Soil moisture content (%)

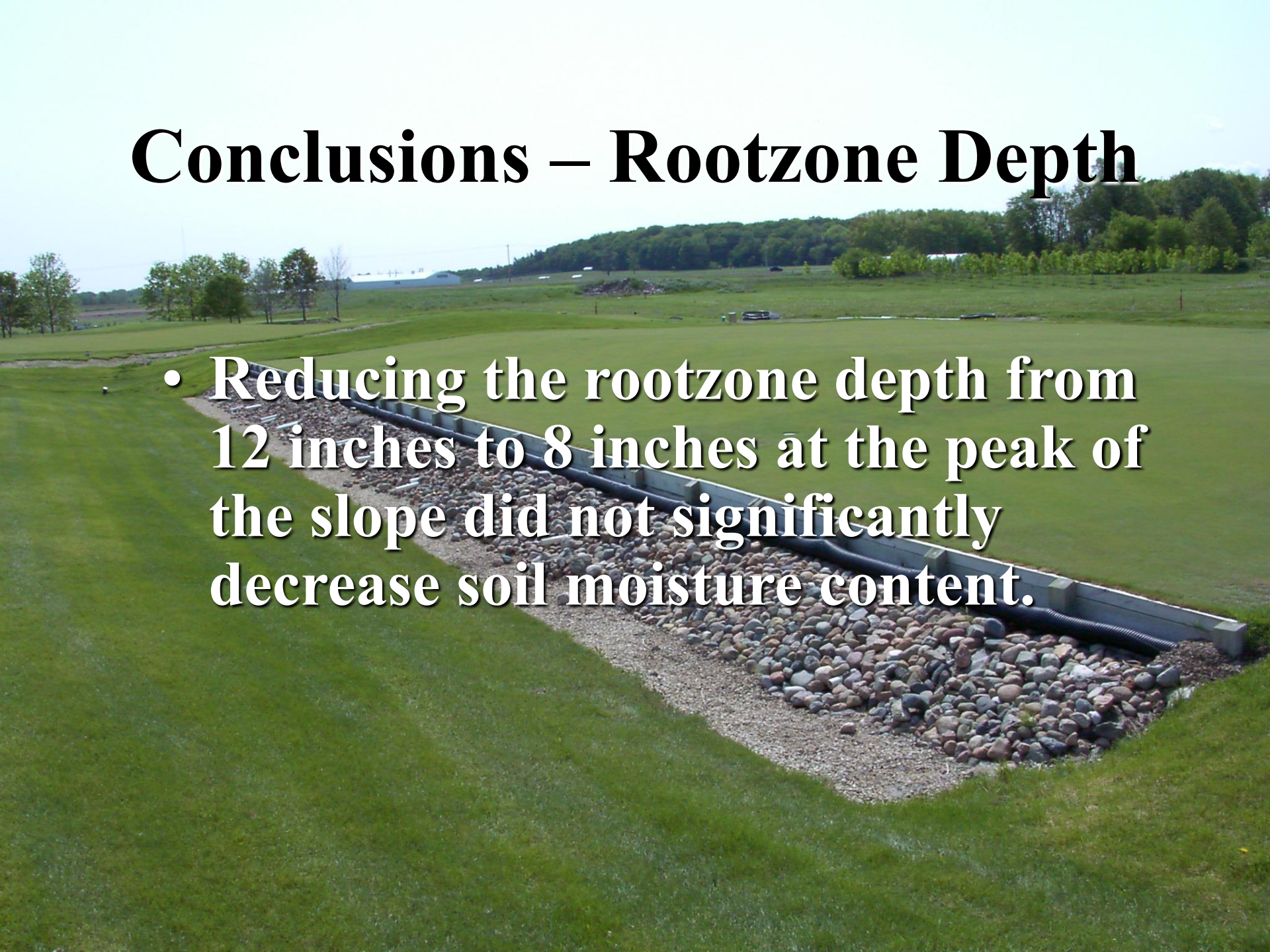


Conclusions – Rootzone Depth



- Increasing the rootzone depth from 12 inches to 16 inches at the base of the slope significantly reduced soil moisture content.

Conclusions – Rootzone Depth



- Reducing the rootzone depth from 12 inches to 8 inches at the peak of the slope did not significantly decrease soil moisture content.

Rieke Green Construction

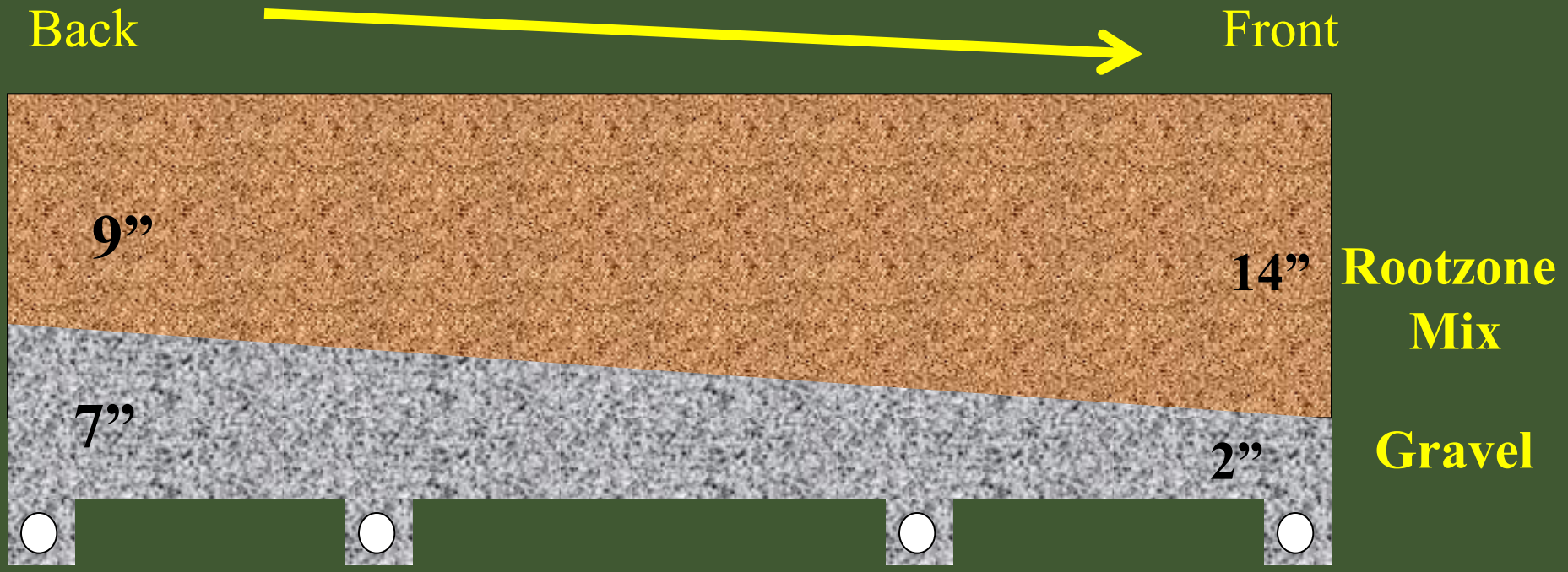
OLCC August 2012

Orchard Lake CC, August 2012

Number fifteen green rebuild that used gravel layer depth to set grade for root zone mix.

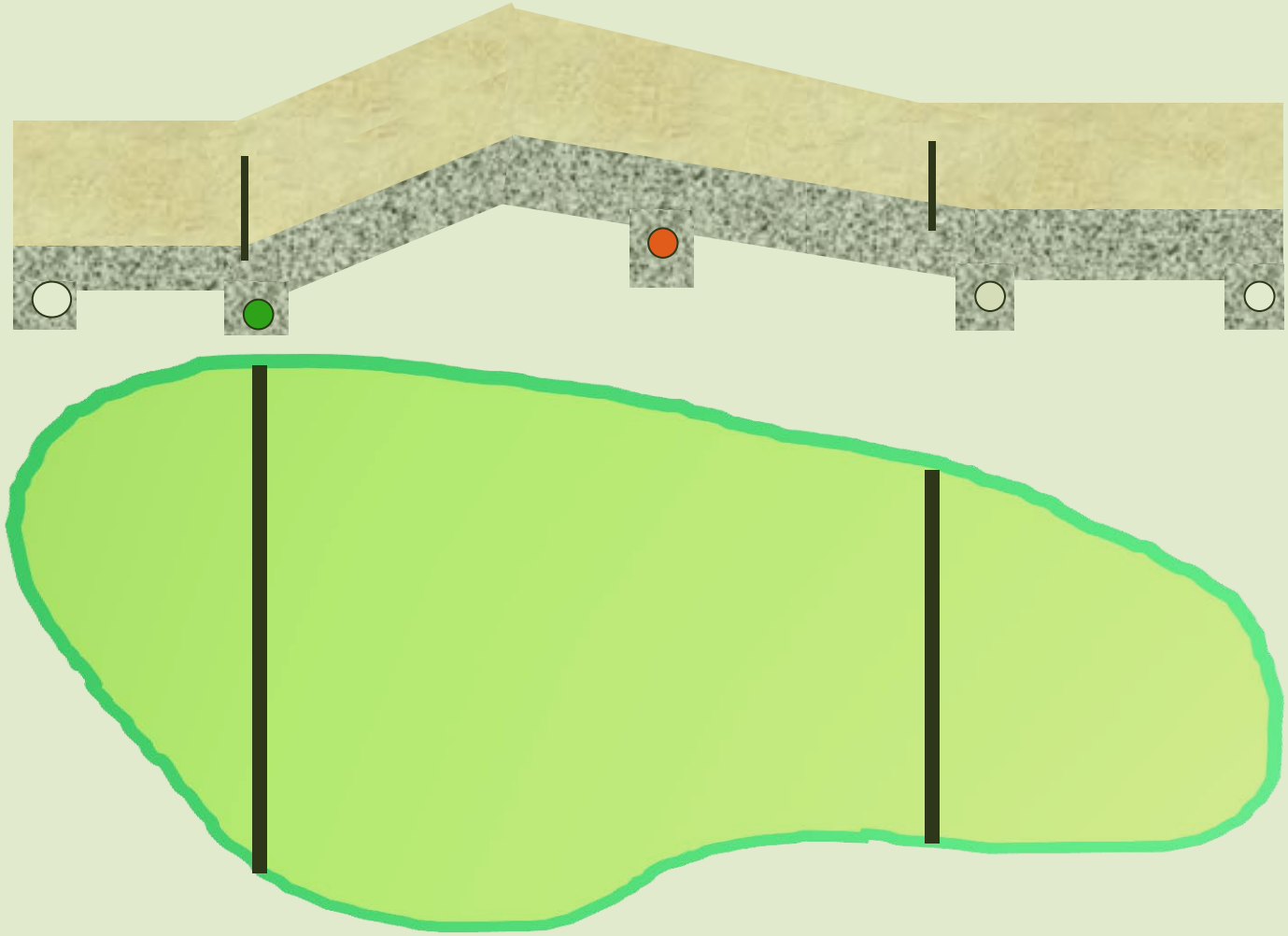
Photos courtesy of Travis Fox

OLCC "Rieke" Putting Green



Curtain

McGinnis – Texas A & M



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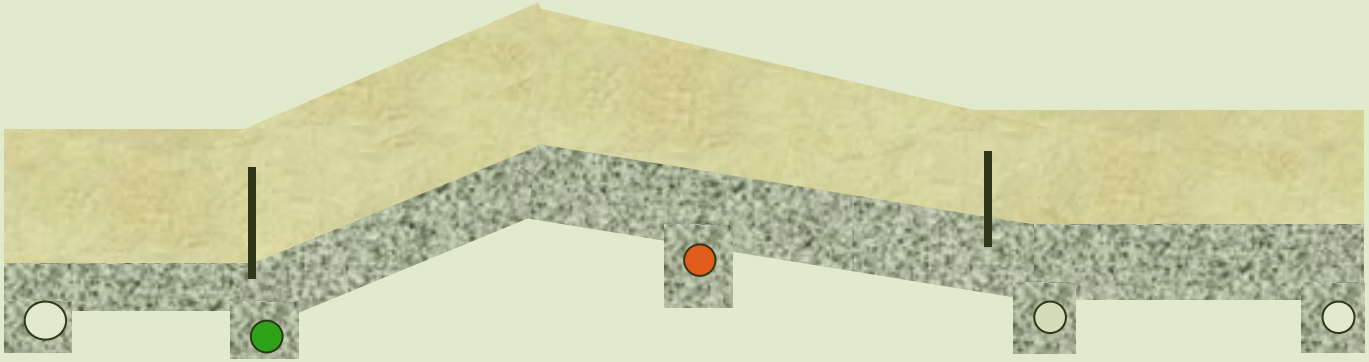
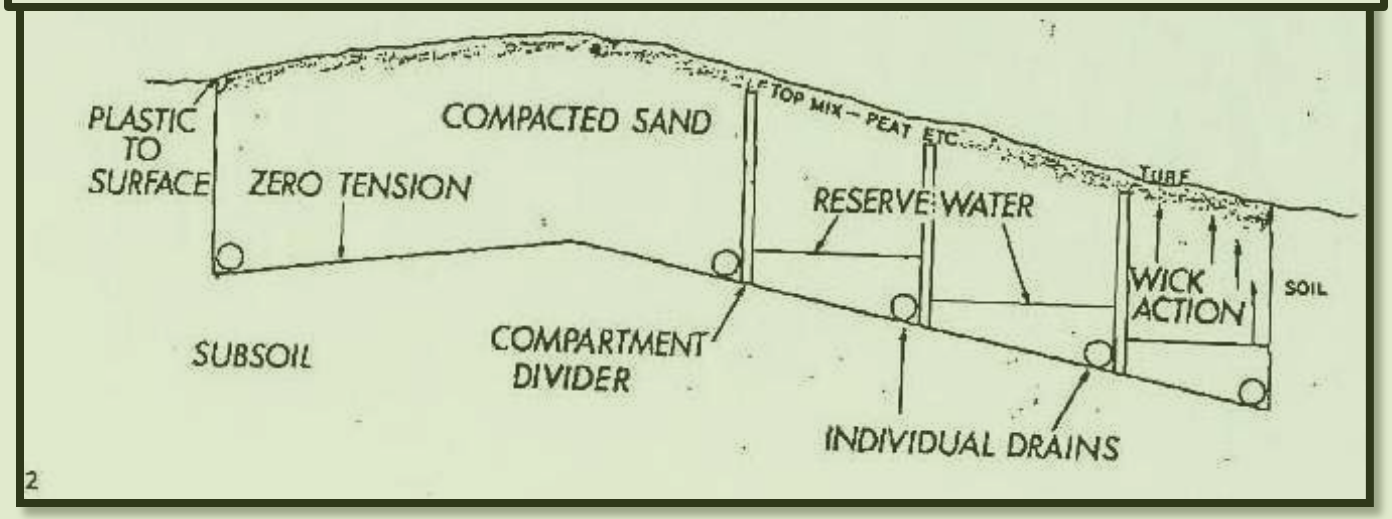
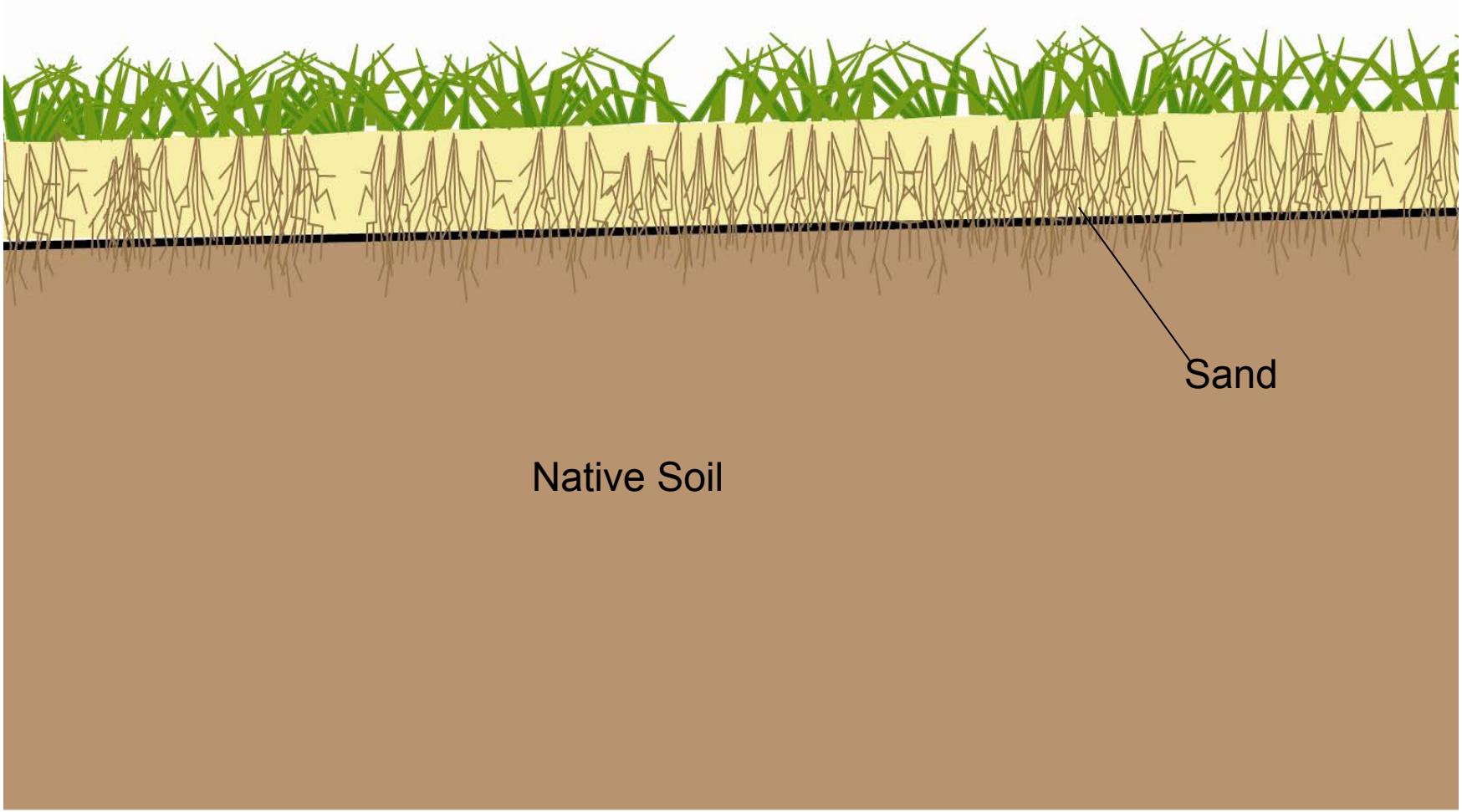


Purr-Wick System, 1968



Surface Drainage

Sand Topdressing



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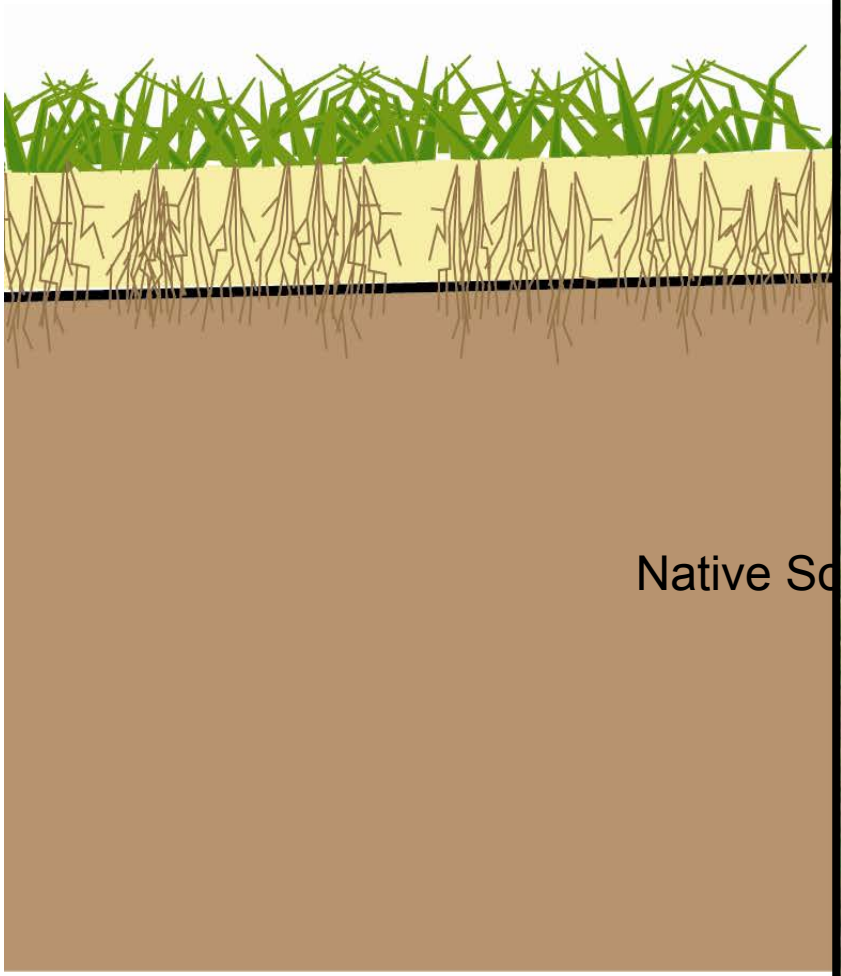
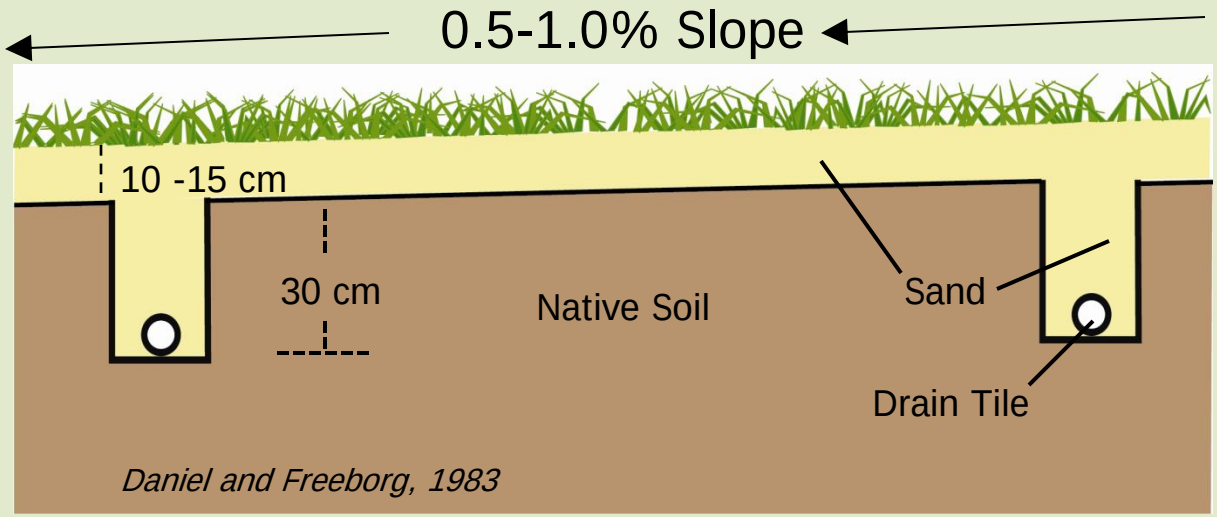


Sand-Capped (XGD)
Orchard Lake Country Club, MI, April 2012

Photos courtesy of Travis Fox



Orchard Lake Country Club, MI, April 2012

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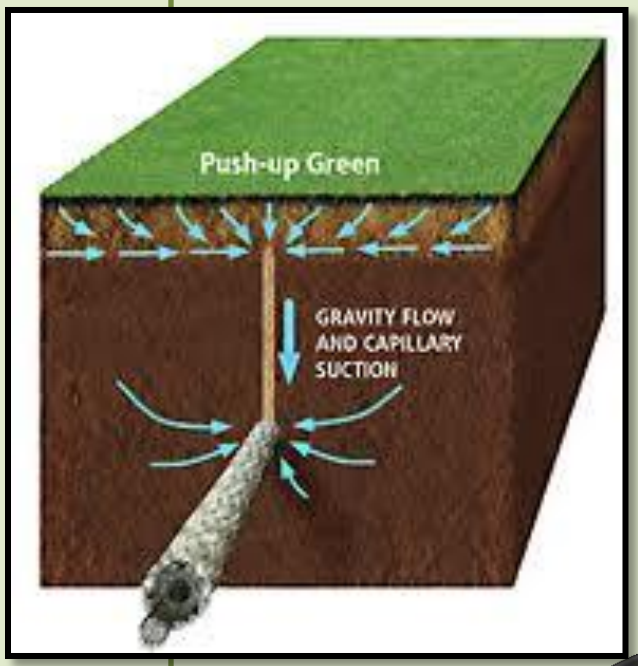
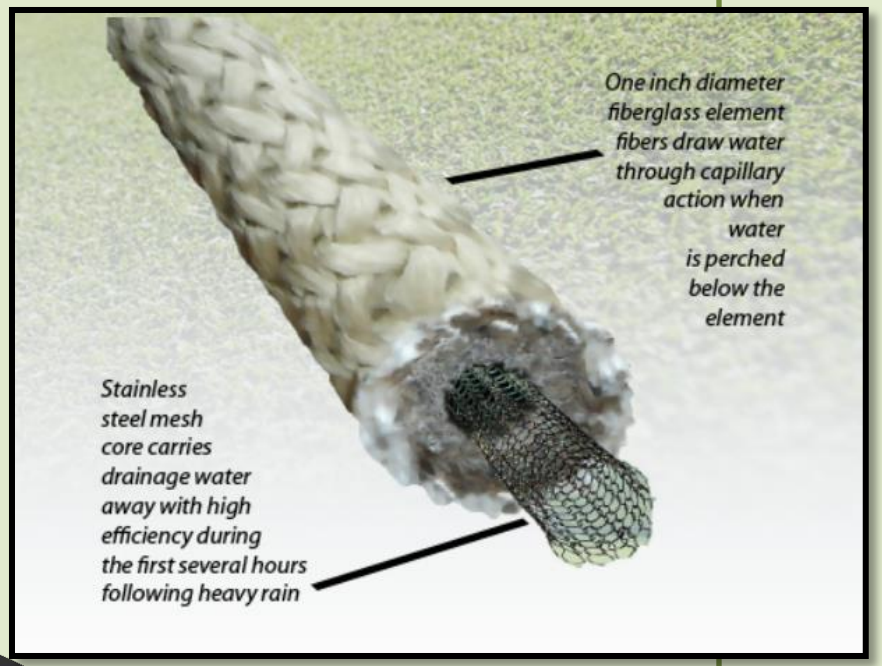
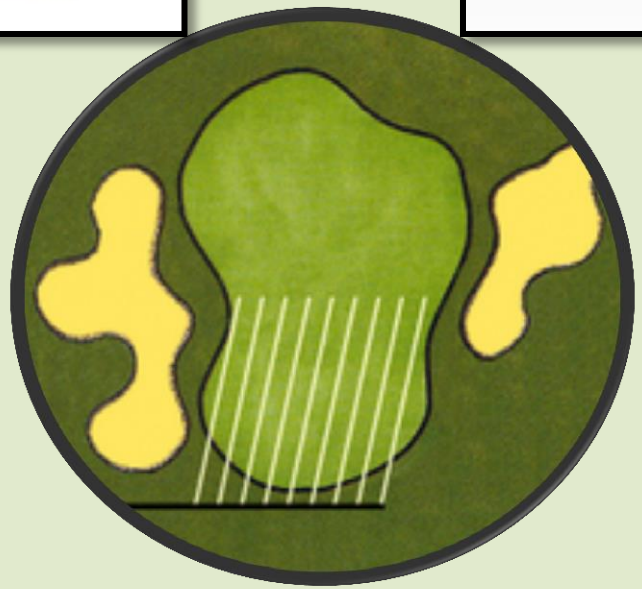
PC Drainage®

Passive Capillary Water Movement





Narrow (3/8”) sand curtain with 3 ft spacing



PC Drainage®

Passive Capillary Water Movement

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Introduction

Seeding rate

- Recommendations based on seed size
- Guidelines for creeping bentgrass
  - *Agrostis stolonifera*
    - 0.5 to 1.5 lb 1000 ft^{-2}
    - 22 to 66 seeds in^{-2}

Introduction

- Seeding rate on *sand base rootzone*
  - Benefits of lower rate
    - Rapid turfgrass ***plant*** development
      - Roots and shoots
    - Reduced disease and traffic stress
      - Increased air and sunlight for the plant
    - Reduced renovation cost

Table 1. Main and strip plot treatments for an experiment to evaluate the effects of different seeding rates and traffic initiation on *A. stolonifera* var. 'V8' quality. East Lansing, MI.

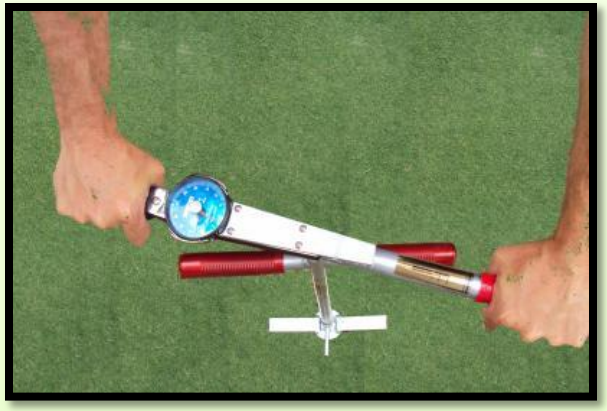
Factor (split plot two-way factorial with 8 replications)	Treatment
Seeding Rate (lb/1000 ft^2) August 2012 and to be replicated in 2013	0.125
	0.25
	0.50
	0.75
	1.0
	2.0
Traffic simulation (initiation) *	May
	June
	July
	Control (no traffic)

Figure 1. Modified Jacobsen PGM 22 with 116-golf shoe spikes making four passes, three times weekly.*

Materials and Methods

NDVI TCM 500 Turf Color Meter

CM 1000 Chlorophyll Meter



TS2-M Shear Vane Tester

Figure 3. Tools used to evaluate turfgrass ground cover, traffic tolerance, and rooting strength. East Lansing, MI 2012 and 2013

Table 3. Effects of seeding rate on percentage green coverage of turfgrass plot surface area. *A. stolonifera* var. 'V8' seeded August 8, 2012. Means and LSD comparisons; East Lansing, MI 2012 and 2013.

Treatment		Percentage green coverage of plot surface area (0-100%)			
		2012		2013	
		Sept. 20 43 DAS [x]	Oct. 26 79 DAS	May 5 269 DAS	May 29 293 DAS
Seeding rate (lb/1000 ft^2)	2.0	84 a [y]	87 a	92 a	96 a
	1.0	73 b	76 b	83 b	91 b
	0.75	73 b	75 b	81 b	88 b
	0.50	61 c	70 b	74 c	81 c
	0.25	43 d	56 c	59 d	75 d
	0.125	37 d	51 c	54 d	71 d
Significance		*	*	*	*

[x] Days after seeding: experimental site seeded on August 8, 2012.
[y] Within columns, means followed by the same letter not significantly different based on LSD 0.05.
* Significant at the 0.05 level of probability and ł NS = not significant at the 0.05 probability level.

Figure 6. Showing plots at 58 DAS; October 5, 2012 East Lansing, MI

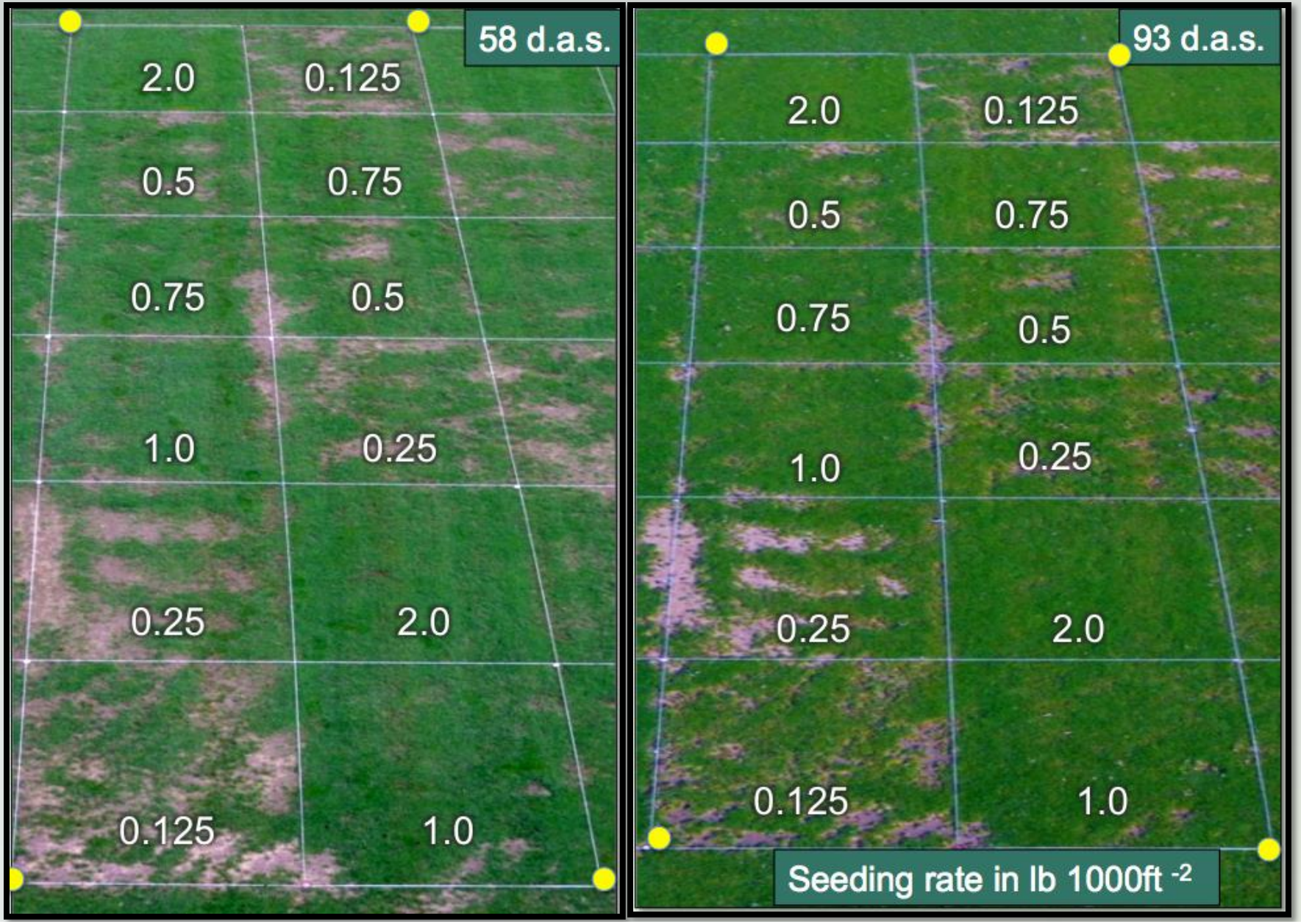


Figure 10. Showing plots in replication III at 58 DAS (left) and 93 DAS (right). East Lansing, MI 2012

Table 5. Effects of seeding rate and traffic on NDVI (normalized difference vegetation index) of turfgrass plot surface area. *A. stolonifera* var. 'V8' seeded August 8, 2012. Means and LSD comparisons; East Lansing, MI 2013.

Treatment		NDVI (x 1000)			
		May 8 272 DAS[x]	June 4 300 DAS	July 4 330 DAS	Aug. 3 360 DAS
Seeding Rate (lb/1000 ft^2) (S)	2.0	619 a [y]	689 a	734 a	736 a
	1.0	598 ab	687 a	730 ab	730 ab
	0.75	601 ab	681 a	716 cd	736 a
	0.50	600 ab	677 a	723 abc	717 bc
	0.25	568 b	659 b	718 bcd	701 cd
	0.125	566 b	620 c	705 d	684 d
Significance		*	*	*	*
Traffic Initiation (T)	May	N/A [z]	656 b	713 b	704 b
	June	N/A	672 a	706 b	708 b
	July	N/A	N/A	731 a	717 b
	Control No Traffic	N/A	678 a	734 a	740 a
Significance			*	*	*
S x T		NS	NS	NS	NS

[x] Days after seeding: experimental site seeded on August 8, 2012.
[y] Within columns, means followed by the same letter not significantly different based on LSD 0.05.
* Significant at the 0.05 level of probability and [t] NS = not significant at the 0.05 probability level and [z] N/A = No ratings recorded for given dates

Table 7. Effects of seeding rate and traffic on chlorophyll index of turfgrass plot surface area. *A. stolonifera* var. 'V8' seeded August 8, 2012. Means and LSD comparisons; East Lansing, MI 2013.

Treatment		Chlorophyll Index			
		May 8 272 DAS[x]	June 4 300 DAS	July 4 330 DAS	Aug. 3 360 DAS
Seeding Rate (lb/1000 ft^2) (S)	2.0	161 a [y]	211 a	198 a	209 a
	1.0	159 ab	209 a	195 a	210 a
	0.75	159 ab	208 a	193 a	205 ab
	0.50	148 b	199 b	192 a	200 b
	0.25	132 c	191 c	183 b	190 c
	0.125	130 c	174 d	175 c	179 d
Significance		*	*	*	*
Traffic Initiation (T)	May	N/A [z]	185 c	181 b	190 bc
	June	N/A	201 b	181 b	189 c
	July	N/A	N/A	197 a	196 b
	Control No Traffic	N/A	211 a	199 a	221 a
Significance			*	*	*
S x T		NS [ł]	NS	NS	NS

[x] Days after seeding: experimental site seeded on August 8, 2012.
[y] Within columns, means followed by the same letter not significantly different based on LSD 0.05.
* Significant at the 0.05 level of probability and [ł] NS = not significant at the 0.05 probability level and [z] N/A = No ratings recorded for given dates

Table 8. Effects of seeding rate and traffic on turfgrass rooting strength/soil cohesiveness. *A. stolonifera* var. 'V8' seeded August 8, 2012. Means and LSD comparisons; East Lansing, MI.

Treatment 2013		Shear Vane Index (Nm) [x]
		Aug. 3 360 DAS [y]
Seeding Rate (lb/1000 ft^2) (S)	2.0	15.8 a
	1.0	14.9 b
	0.75	14.4 b
	0.50	13.6 c
	0.25	12.0 d
	0.125	10.8 e
Significance		*
Traffic Initiation (T)	May	12.4 c
	June	13.2 c
	July	14.0 a
	Control No Traffic	14.6 a
Significance		*
S x T		NS

[x] Newton meter of force (torque) required to shear the soil rootzone (ASTM, 1984)
[y] Days after seeding; experimental site seeded on August 8, 2013

Figure 11. TS2-M Shear Vane Tester

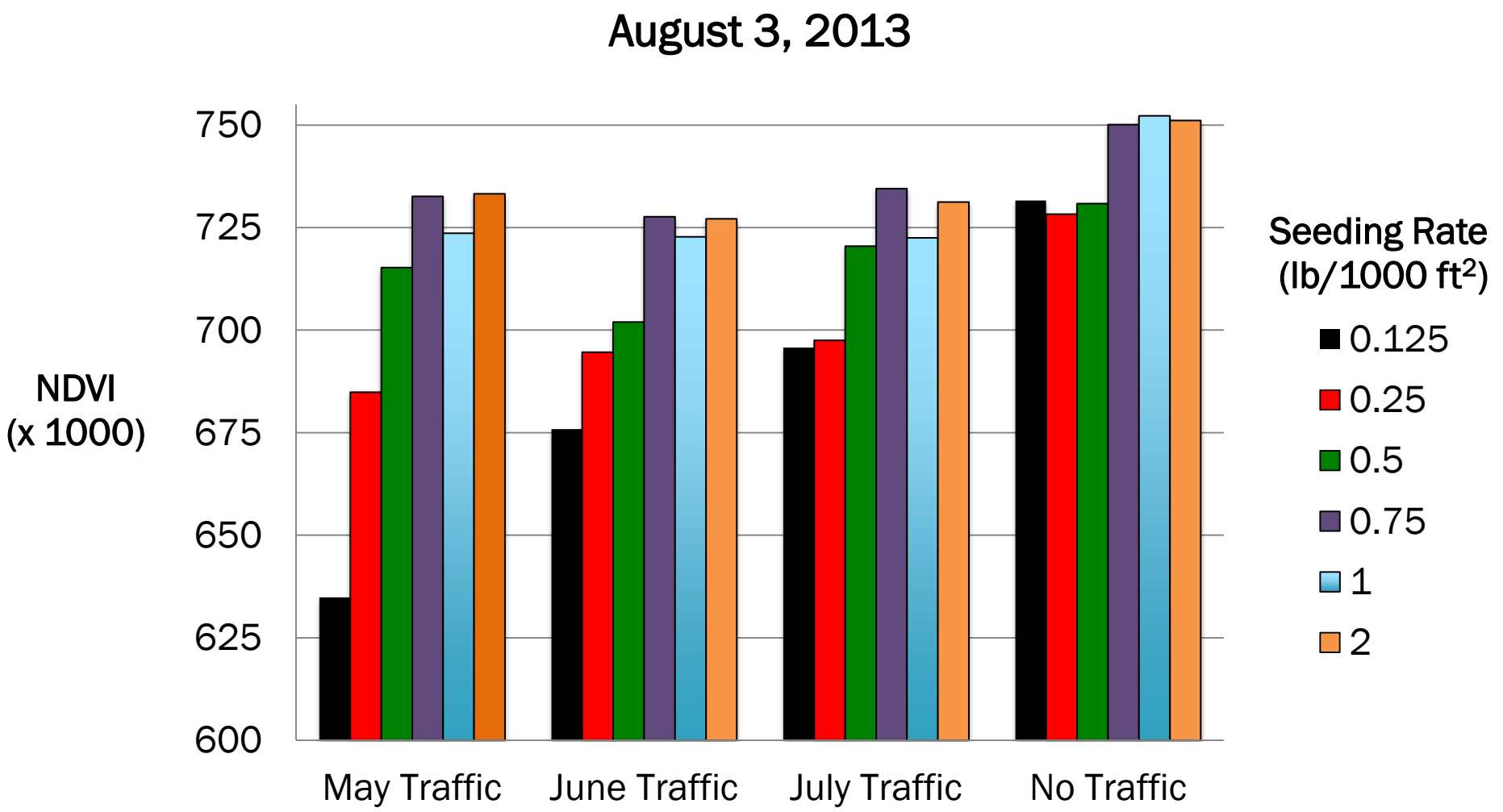


Figure 13. Interaction effects of seeding rate and traffic initiation on NDVI (normalized difference vegetation index)of turfgrass plot surface area. East Lansing, MI.

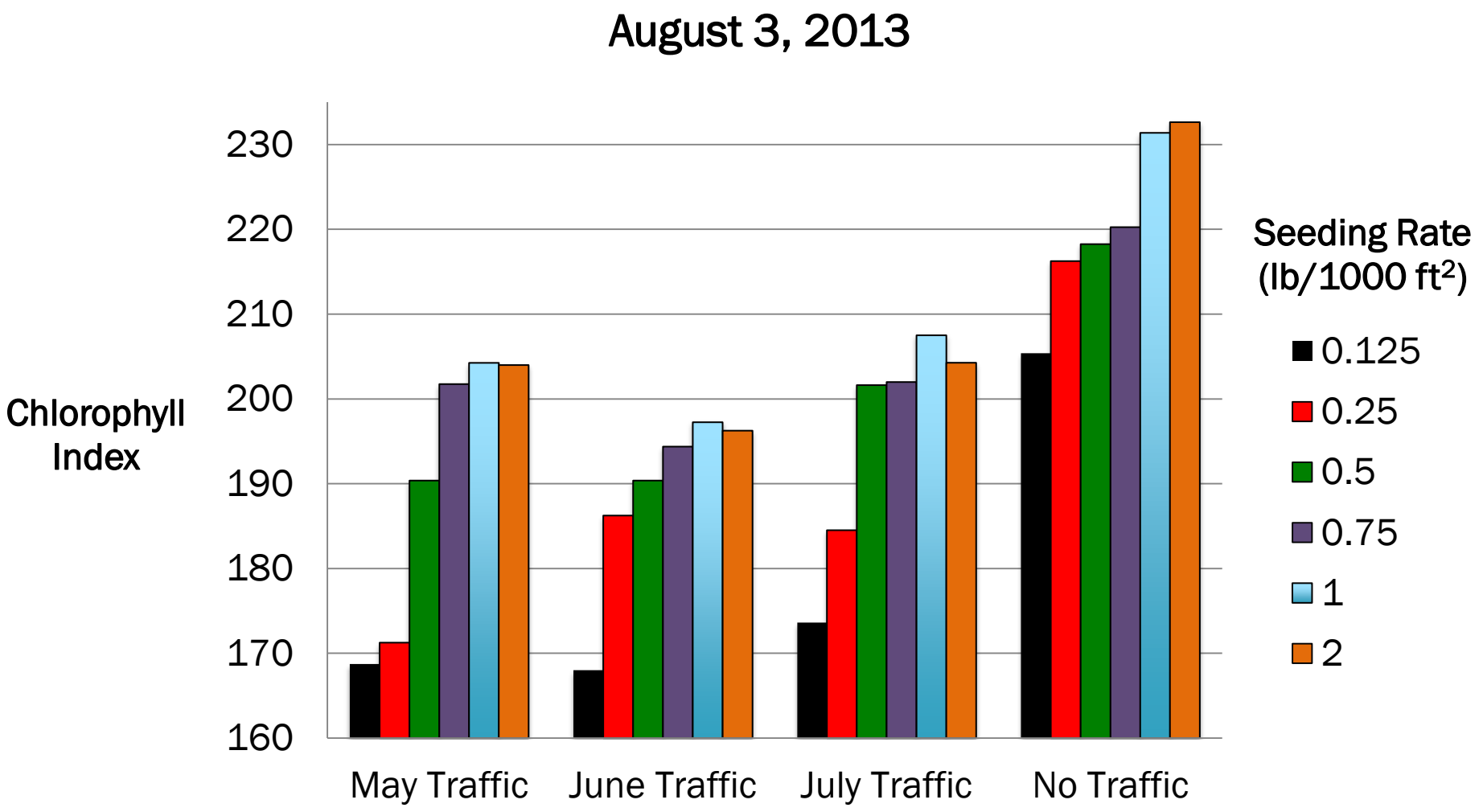


Figure 15. Interaction effects of seeding rate and traffic initiation on chlorophyll index of turfgrass plot surface area. East Lansing, MI

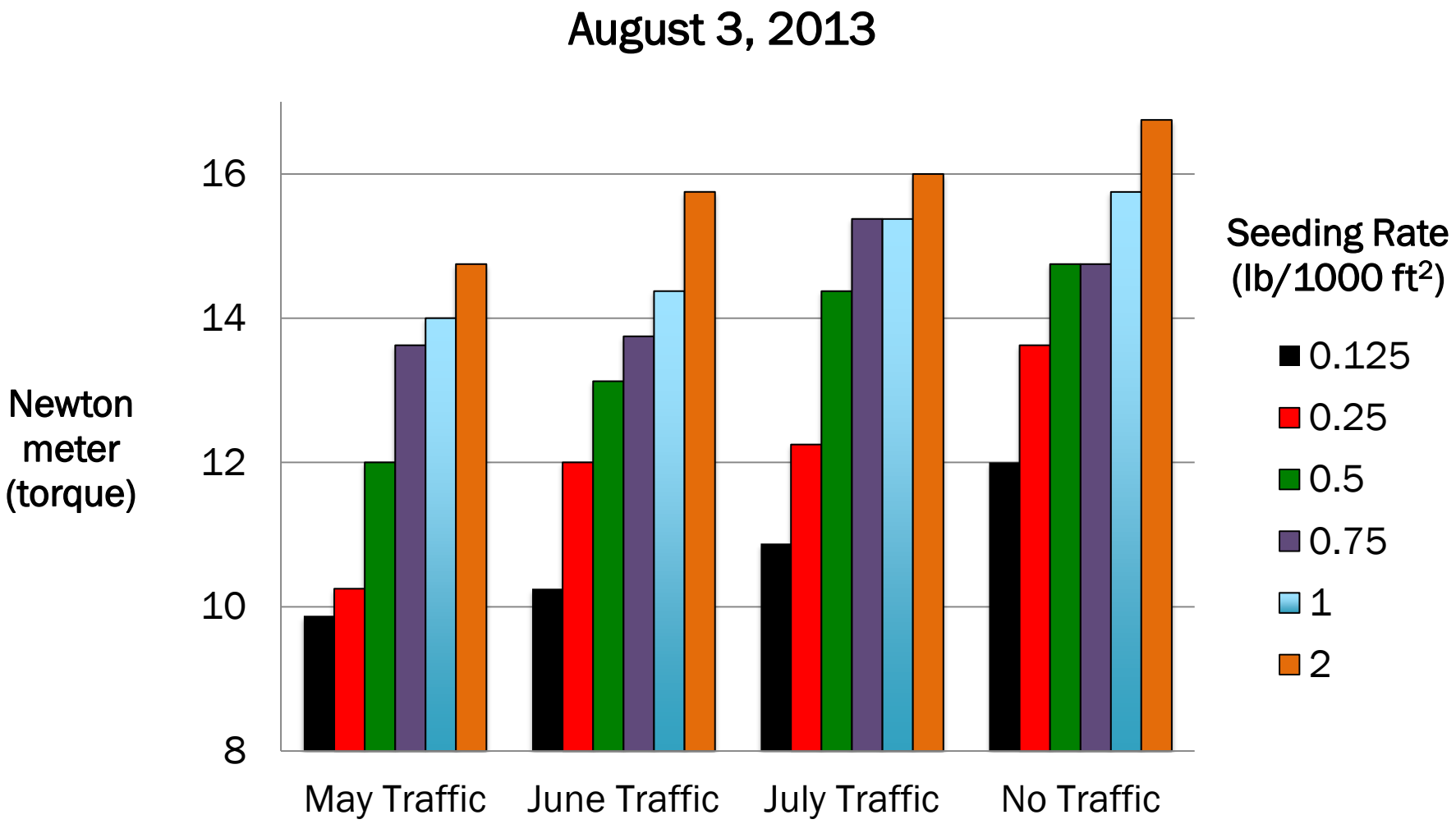


Figure 16. Interaction effects of seeding rate and traffic initiation on turfgrass rooting strength and soil cohesiveness. East Lansing, MI.

2014

Table 2. Main plot and strip plot treatments for an experiment to evaluate various cultural regimes to expedite turfgrass establishment during renovation. East Lansing, MI

Treatments				
Factor		Level		
Fertilizer: Liquid Urea 46-0-0	A	1	0.05 lb N/1000 ft^2	Applied @ 7-d intervals fall 2013. Continued in 2014
		2	0.10 lb N/1000 ft^2	
		3	0.15 lb N/1000 ft^2	
Plant Growth Regulator: PrimoMaxx® (trinexapac-ethyl)	B	1	0.6 fl oz/1000 ft^2	Applied @ 14-d intervals starting in 2014
		2	None	
Mowing Height: Initial Height of Cut (HOC) [w]	M	1	0.15 in (-0.01in)	HOC reduced until 0.125 in
		2	0.2 in (-0.025in)	
Vertical Mowing	V	1	Bi-monthly	Initiating spring of 2014
		2	None	
Traffic Simulation	T	1	3x per week	Initiating spring of 2014
		2	None	

[w] Mowing done 3x per week in 2013 (with no reduction in HOC), eventually increasing to 5x per week in 2014

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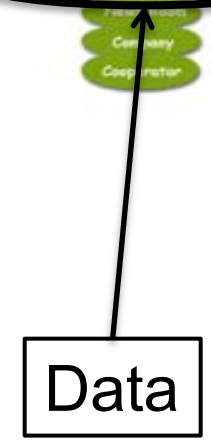
- Which creeping bentgrass do I choose?
- How do I keep the annual bluegrass out of the…?
- Should I regrass or rebuild?
- How long before I can safely open?

Creeping bentgrass Varieties

- Pre 1990
  - Seeded
    - Seaside
    - Penncross
    - Penneagle
    - Pennlinks
    - Putter
  - Vegetative
    - Toronto
    - Cohansey
    - Washington
- Post 1990
  - Crenshaw
  - Providence
  - SR 1020

  Post 1996
  - A series (PSU)
  - G series (PSU)
  - L-93
- Post 2005
  - Declaration
  - 007
  - Memorial
  - Alpha
  - T-1
  - Tyee
  - Pure Distinction

National Turfgrass Evaluation Program
NTEP.org (Home)



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PLEASE HELP PLAN OUR NEW TALL FESCUE TRIAL!

All NTEP Reports Select A Turfgrass Species	2006-10 Ky. Bluegrass Report-Posted 2010 Tall Fescue Report-Posted 2010 St. Augustinegrass Report-Posted	New Select A State

Enhancing the Environment Through Research

The National Turfgrass Evaluation Program (NTEP) is designed to develop and coordinate uniform evaluation trials of turfgrass varieties and promising selections in the United States and Canada. Test results can be used by national companies and plant breeders to determine the broad picture of the adaptation of a cultivar. Results can also be used to determine if a cultivar is well adapted to a local area or level of turf maintenance. For more information see Information or Contact Us.

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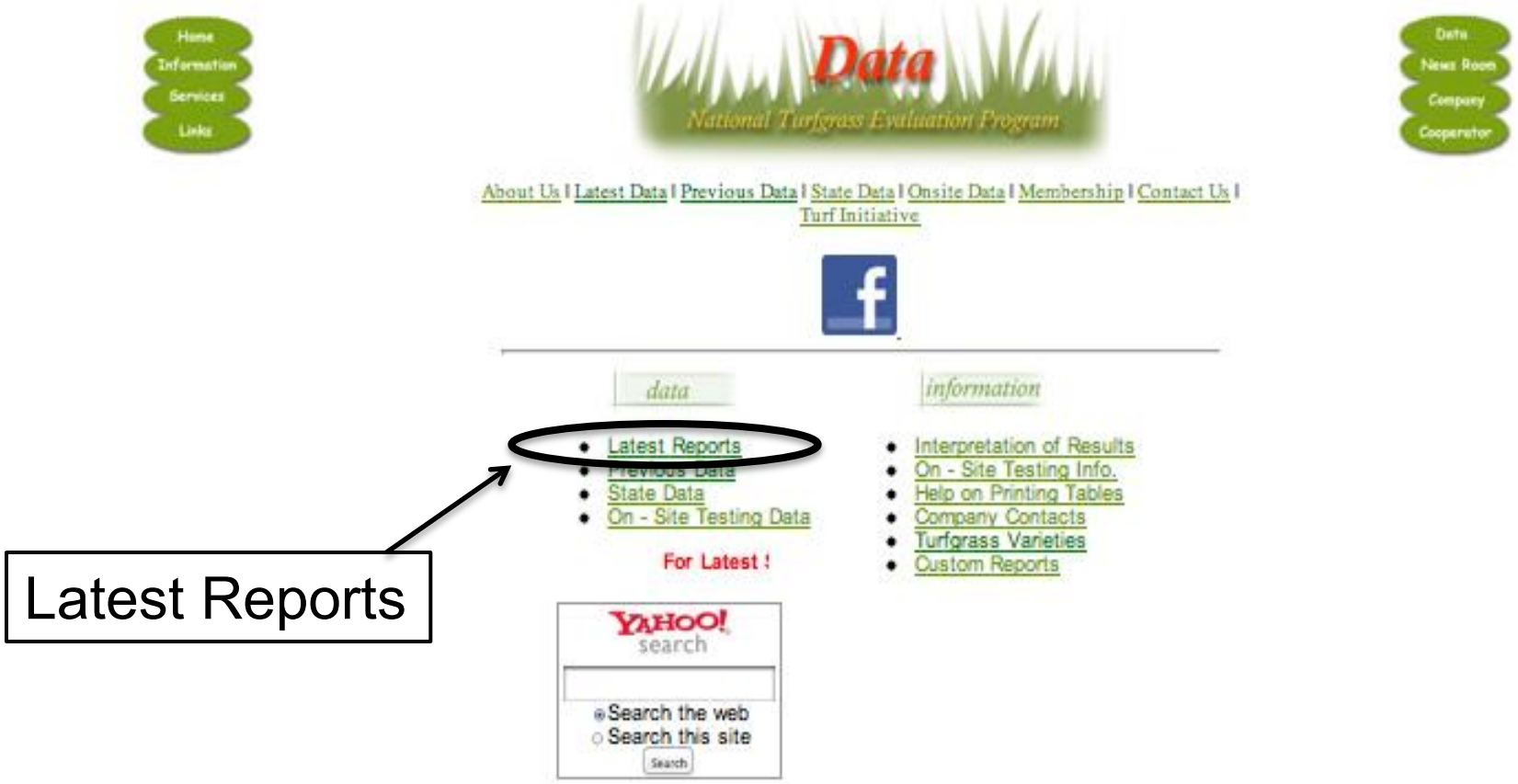
Latest News

September 15 , 2011
NTEP's September newsletter is now available. Find the most recent and past issues of our newsletter in our News Room.
Also, you can now connect with NTEP on Facebook. Please keep in touch with what is happening with NTEP!

August 31, 2011
NTEP's newest Kentucky bluegrass trial has been assembled and mailed to cooperators for planting. Read more about this new trial in our News Room.

June 22, 2011
NTEP's June newsletter is out! Read in our News Room. Also, information and application forms for the upcoming 2011 National Kentucky Bluegrass Test are now available in our News Room.

National Turfgrass Evaluation Program
NTEP.org (Data)



Latest Reports

National Turfgrass Evaluation Program
NTEP.org (Latest Data - Cool Season Grasses)

About Us | Latest Data | Previous Data | State Data | Onsite Data | Membership | Contact Us | Turf Initiative

latest reports

- Cool Season Grasses
- Warm Season Grasses
- Previous Data
- State Data
- Onsite Data
- Interpretation of Results
- Help Printing Tables
- BACK TO "DATA"

id News ... Cl

YAHOO! search
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2010 Preliminary Report - Posted
(not for publication)

Cool Season Grasses updated 10/7/11

National Kentucky Bluegrass Test - 2005
NTEP No. 11-10
2006-10 Final Report
Ky. Bluegrass
Poa pratensis

National Tall Fescue Test - 2006
NTEP No. 11-8
2010 Report
Tall Fescue
Festuca arundinacea

National Fineleaf Fescue Test - 2008
NTEP No. 11-3
2010 Progress Report
Fine Fescue
Festuca spp.

National Bentgrass Test - 2008
Fairway/Tee
NTEP No. 11-2
2010 Progress Report
Bentgrass
Agrostis spp.

National Bentgrass Test - 2008
Putting Green
NTEP No. 11-1
2010 Progress Report
Bentgrass
Agrostis spp.

National Perennial Ryegrass Test - 2004
NTEP No. 10-11
2005-09 Final Report
Perennial Ryegrass
Lolium perenne

Back to top

Creeping Bentgrass NTEP

TABLE 1A. MEAN TURFGRASS QUALITY RATINGS OF BENTGRASS CULTIVARS GROWN ON 1/
A GREEN AT FIVE LOCATIONS IN THE U.S. FOR AMMI GROUP 1 **/
2010 DATA

TURFGRASS QUALITY RATINGS 1-9; 9=IDEAL TURF 2/

	NAME	NJ1	RI1	VA1	IN1	WA3	MEAN
	PST-QJO	7.6	5.7	4.9	7.7	7.1	6.6
	A08-TDN2	7.5	5.4	4.7	7.6	7.0	6.4
*	DECLARATION	5.4	6.5	5.6	7.5	6.4	6.3
*	PIN-UP (HTM)	5.4	6.5	5.5	7.4	6.4	6.2
*	PROCLAMATION (LTP-FEC)	6.0	6.0	5.2	7.5	6.5	6.2
*	BARRACUDA (MVS-AP-101)	6.2	5.5	5.1	7.5	6.4	6.2
	SRP-1GMC	5.7	5.6	5.2	7.4	6.2	6.0
	AFM	4.7	6.3	5.4	7.2	6.0	5.9
*	V8	6.5	4.6	4.7	7.4	6.2	5.9
*	AUTHORITY	5.1	5.5	5.1	7.1	5.9	5.7
*	VILLA	6.2	6.0	3.5	6.0	6.4	5.6
	SRP-1BLTR3	5.1	5.3	4.7	6.9	5.7	5.6
*	PENN A-1	4.2	5.9	5.0	6.8	5.5	5.5
*	ALPHA	4.3	5.3	4.8	6.7	5.3	5.3
*	T-1	5.3	4.3	4.5	6.9	5.4	5.3
*	PENN A-2	3.6	5.6	4.7	6.4	5.1	5.1
*	SR 7200	3.8	6.7	3.6	5.3	5.4	4.9
*	L-93	2.9	5.5	4.7	6.2	4.7	4.8
*	PENNCROSS	1.9	4.6	3.7	5.2	3.7	3.8
	LSD VALUE	1.0	1.0	1.0	1.0	1.0	1.0
	C.V. (%)	12.4	11.3	13.3	9.2	10.8	11.2


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Questions?