USGA – University of Minnesota Research Partnership

Brian Horgan, Univ. of Minnesota

USGA

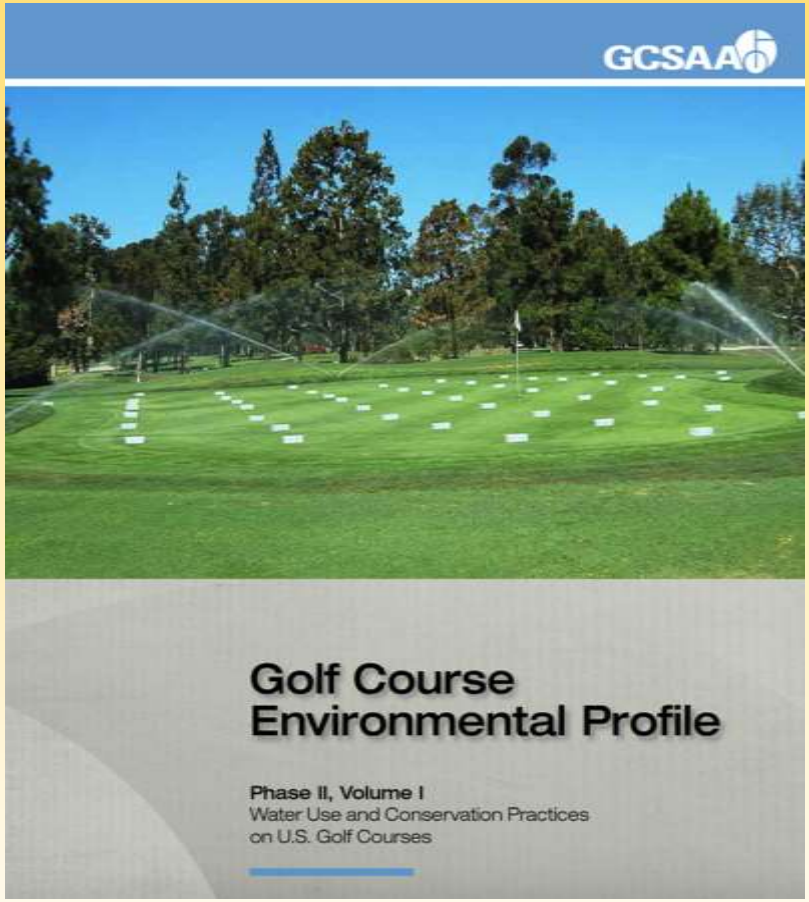
Advancing Research-Based Sustainability for the Golf Industry

UNIVERSITY OF MINNESOTA

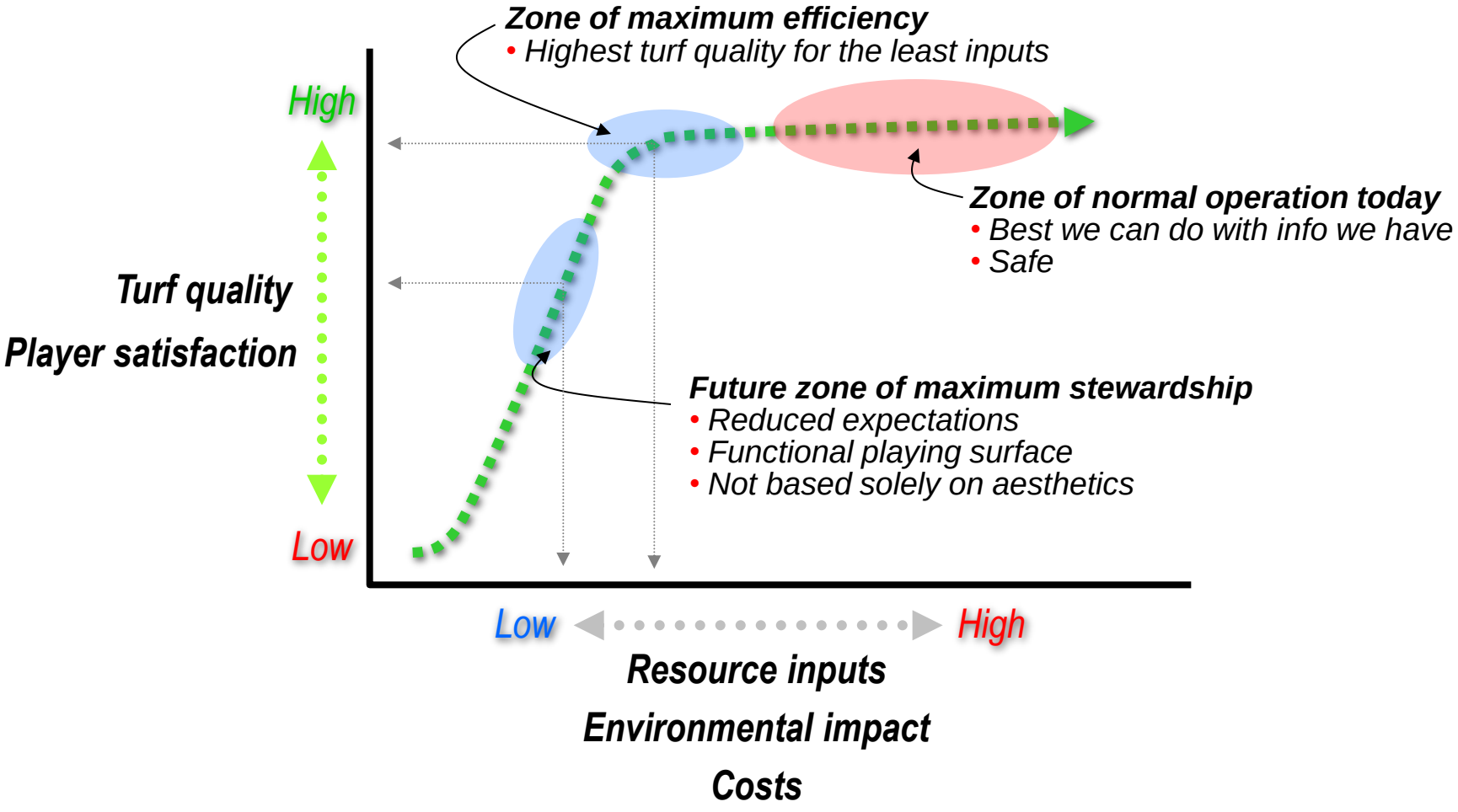
Driven to Discover℠

Good News

- 22% decrease in water use
- 1.4% of irrigation water use
- Median water use range
  - 36 to 396 acre ft/yr



Turf Quality vs. Inputs

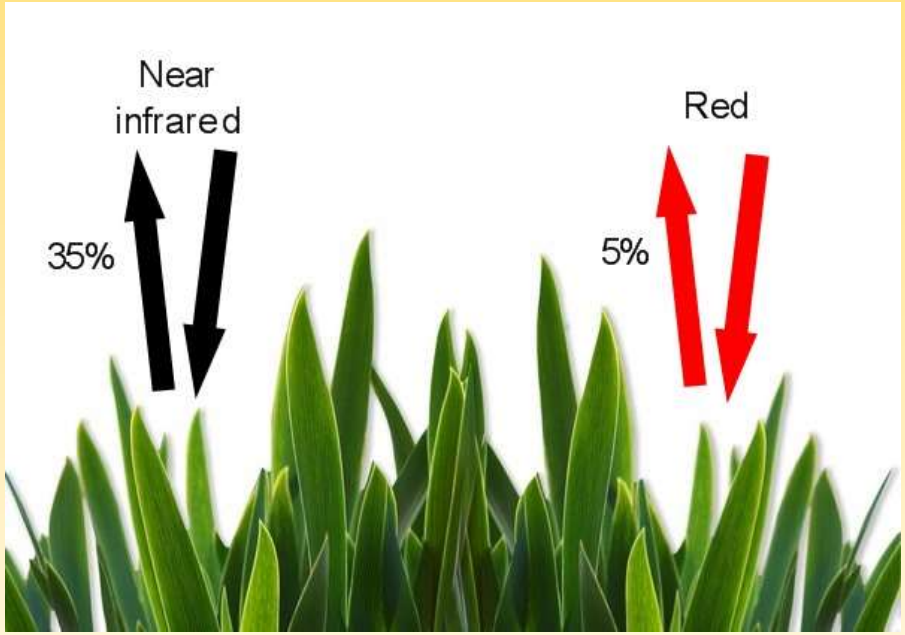


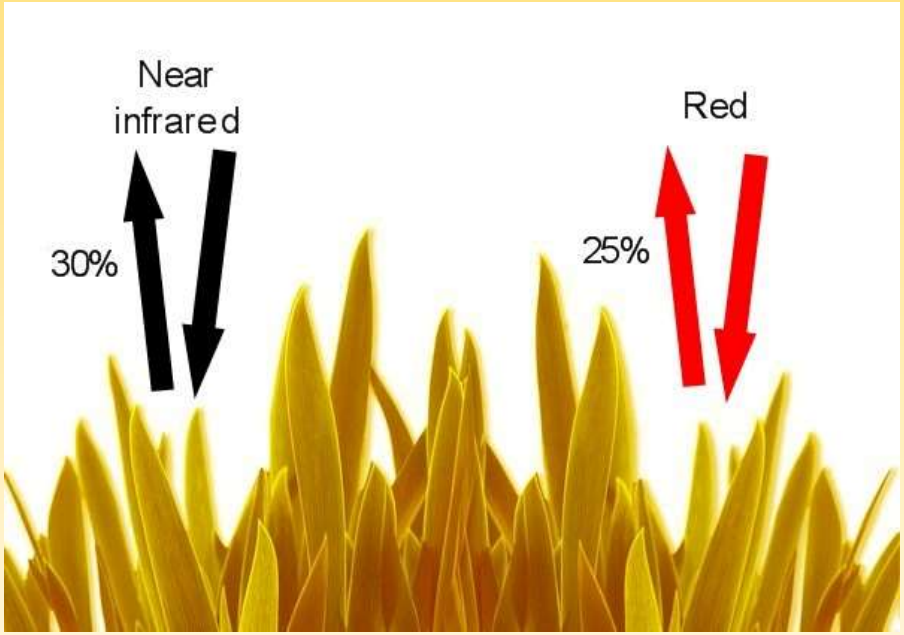
Science, Research and Innovation

- Data vs. Anecdote
- Urban greenspace
- Resource conservation and use efficiency
- Sociology, economics
- Technology
- Managed risk

Remote Sensing

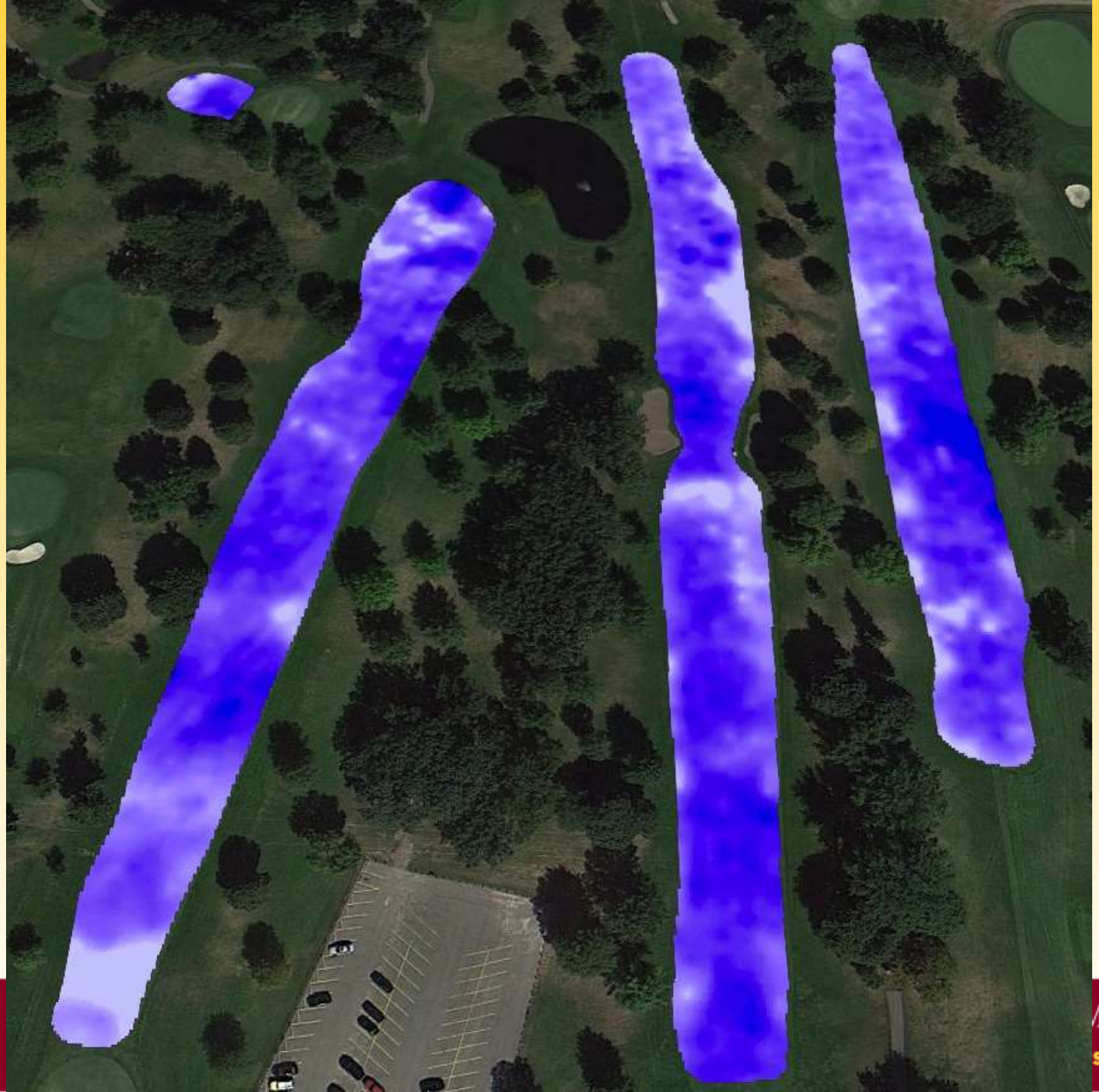
Normalized difference vegetation index
(NDVI) = (NIR-Red)/(NIR+Red)





$$\frac{(0.35-0.05)}{(0.35+0.05)} = 0.75$$

$$\frac{(0.30-0.25)}{(0.30+0.25)} = 0.09$$



Best Management Practices

Hollow Tine Aeration

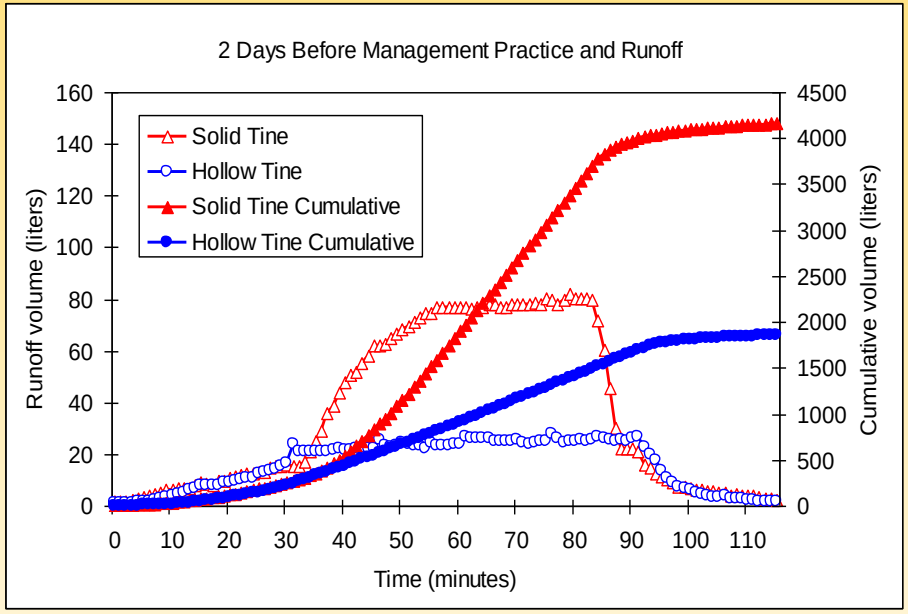
vs.

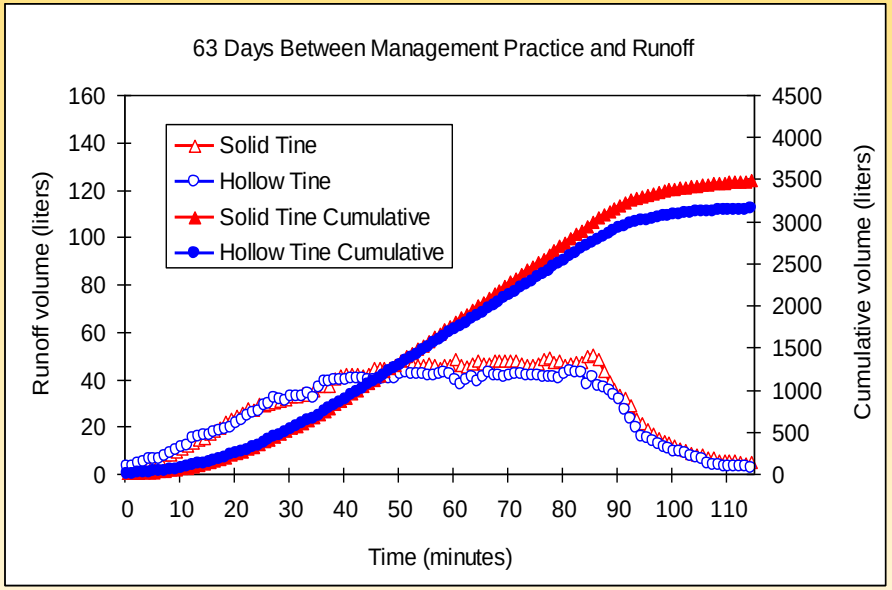
Hollow Tine Aeration

Hollow vs. Solid Tine Aerification

Reduced Runoff Volumes with Hollow Tine

(2 and 63 days between aerification and runoff)





Runoff volume

55% reduction with hollow tine aerification (2 d)

10% reduction with hollow tine aerification (63 d)

Defining Ecosystem Services

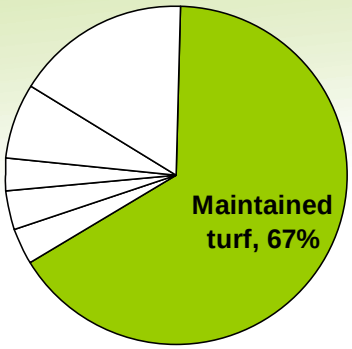
1. Turfgrass reduces water runoff
2. Turfgrass reduces nutrient runoff
3. Proper fertilization improves surface water quality

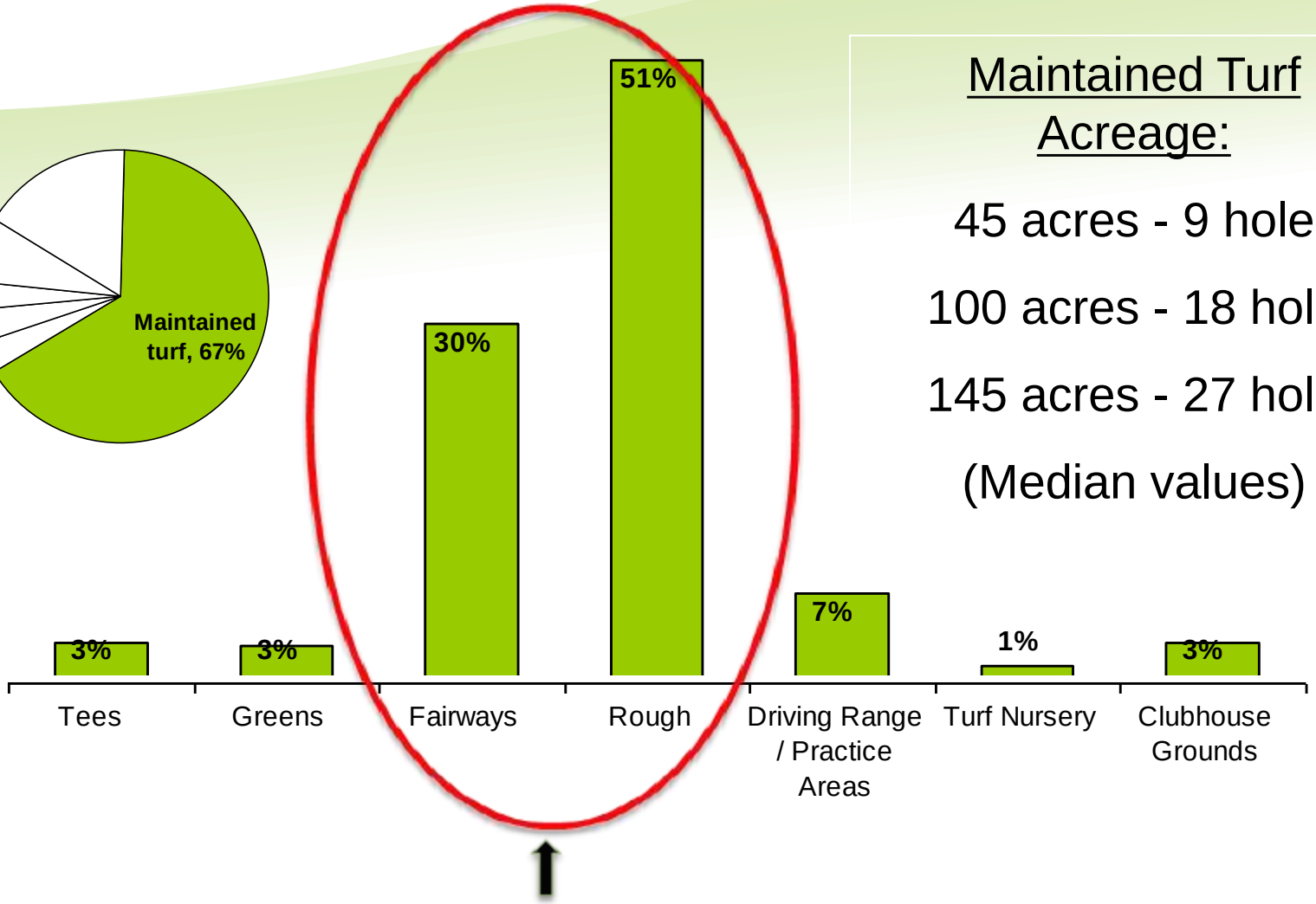
Initiative to study, evaluate and further define sustainable business practices, agronomic practices and environmental stewardship

Leadership Needed

- 4,000 golf courses built in 80's and 90's
  - Lifespan 20-30 yrs
  - Need to renovate
- Last 4 renovations in TCMA – $3M to $6M
  - ROI
- Flip model upside down

Maintained Turf Features On An Average 18 Hole Golf Course





Maintained Turf Acreage:

45 acres - 9 hole

100 acres - 18 hole

145 acres - 27 hole

(Median values)

Greatest opportunity for resource conservation

Converts Les Bolstad GC into a living laboratory to demonstrate core principles that integrates science and advances sustainability goals of golf course renovations through innovation

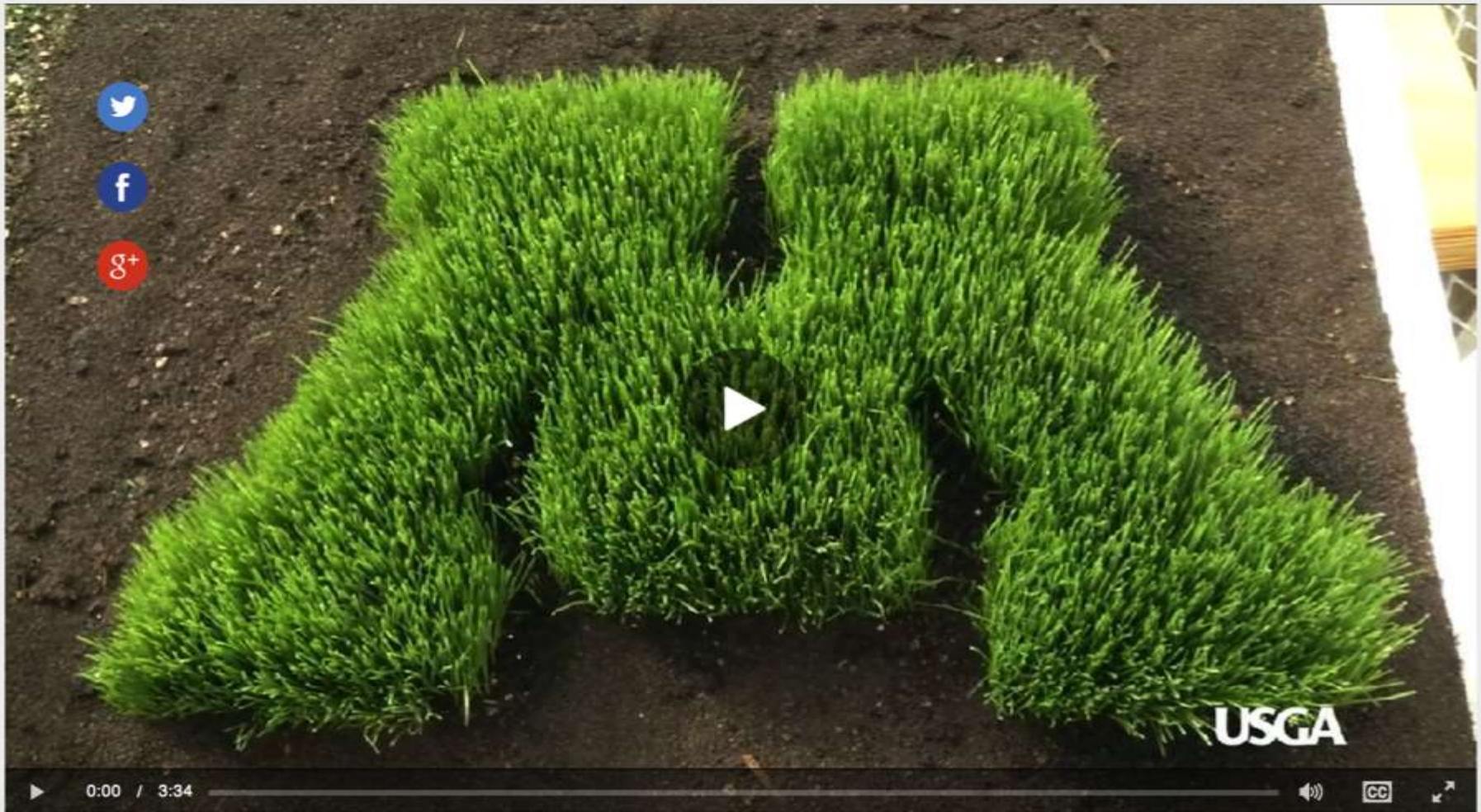
SOTG Core Principles

1. Drainage
   Recycle, reuse, recharge, runoff, filter, snowmelt
2. Grass Species
   Alternative, functional, low input, player preference, out of play
3. Irrigation
   Species specific, cost effective, integrated w/ technology, functional
4. Construction
   Local sourcing, soil prep, alt. green construction, sand capping, compaction
5. Design
   Greens complex watershed, hazard placement, runoff collection
6. Economics
   ROI, local sourcing, construction technique
7. Environment
   Community storm water credit, enhance natural resources, reduced input, likeness/player preference, carbon sequestration, snow garden
8. Technology
   Remote sensing, operational efficiency, input use efficiency
9. Biological Diversity
   Pollinators, wildlife habitat
10. Communication/marketing

SERVING THE GAME

USGA, University of Minnesota Partner to Strengthen Golf's Future

SUN NOV 01 23:43:00 EST 2015 | FAR HILLS, N.J. AND MINNEAPOLIS, MINN.
By USGA



USGA & UMN Partnership

- Golf's Grand Challenges
- Advance sustainability of golf
- Science, Research and Innovation
- Transdisciplinary

COLLEGE OF
Science & Engineering
UNIVERSITY OF MINNESOTA

UNIVERSITY OF MINNESOTA
EXTENSION

CARLSON
SCHOOL OF MANAGEMENT
UNIVERSITY OF MINNESOTA

UNIVERSITY OF MINNESOTA
Supercomputing Institute

RECREATION & WELLNESS
UNIVERSITY OF MINNESOTA

INSTITUTE ON THE
ENVIRONMENT
UNIVERSITY OF MINNESOTA

Water Resources Center
UNIVERSITY OF MINNESOTA

College of Food, Agricultural
and Natural Resource Sciences
UNIVERSITY OF MINNESOTA

HUMPHREY SCHOOL
OF PUBLIC AFFAIRS
UNIVERSITY OF MINNESOTA

COLLEGE OF LIBERAL ARTS

UNIVERSITY OF MINNESOTA
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Golf Lab

Science of (the) Green

Renovation

Drainage
Grass Species
Irrigation
Construction
Design
Economics
Environment
Technology
Bio-Diversity
Communication

Sustainability

Water
Grass Species
Out-of-Play
Pesticides
Fertilizers
Labor
Fuel
Design
Difficulty
Technology
Bio-diversity
Economics
Routing options
Walkability
Feature maintenance
Irrigation system
Equipment age
Greens construction
Greens age
Water budget
Soil type
watershed

Biomechanics

Kinesiology – golf classes
Intercollegiate Athletics – women's and men's golf
Recreation and Wellness – PGA professionals

Course Setup/Testing

Dynamic slope and rating
Dynamic handicapping
Discrete optimization
Pace of play & Cycle times
Optimized course setup
Innovative routing
Number of rounds

Golfer Interaction

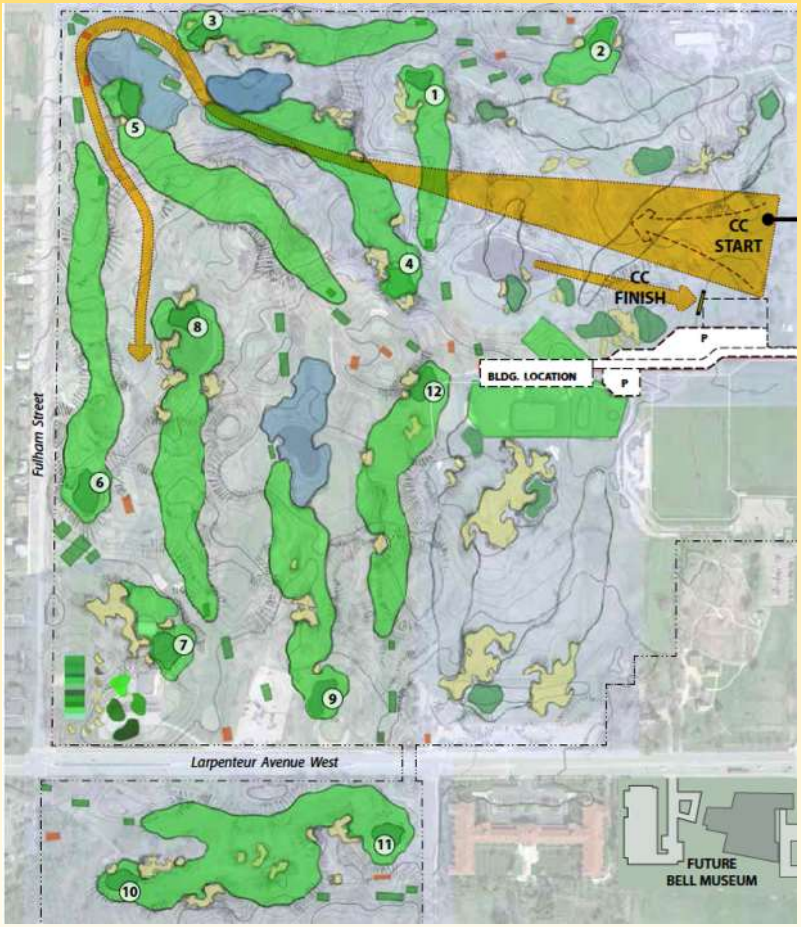
Sociology
Player preference
Routings
Loops
Time
Environmental stewardship
Community asset
Translational
Interactive
Next Gen.

Golf Lab: Innovative Routing

- Maximize facility use
- Resource conservation
- Theoretical modeling
- Next gen golfers
- Looping options

Golf Lab: Multifunctional

- Public golf
- Intercollegiate Athletics
  - Men's golf
  - Women's golf
  - Men's x-country
  - Women's x-country
- Nordic skiing
- Winter sports



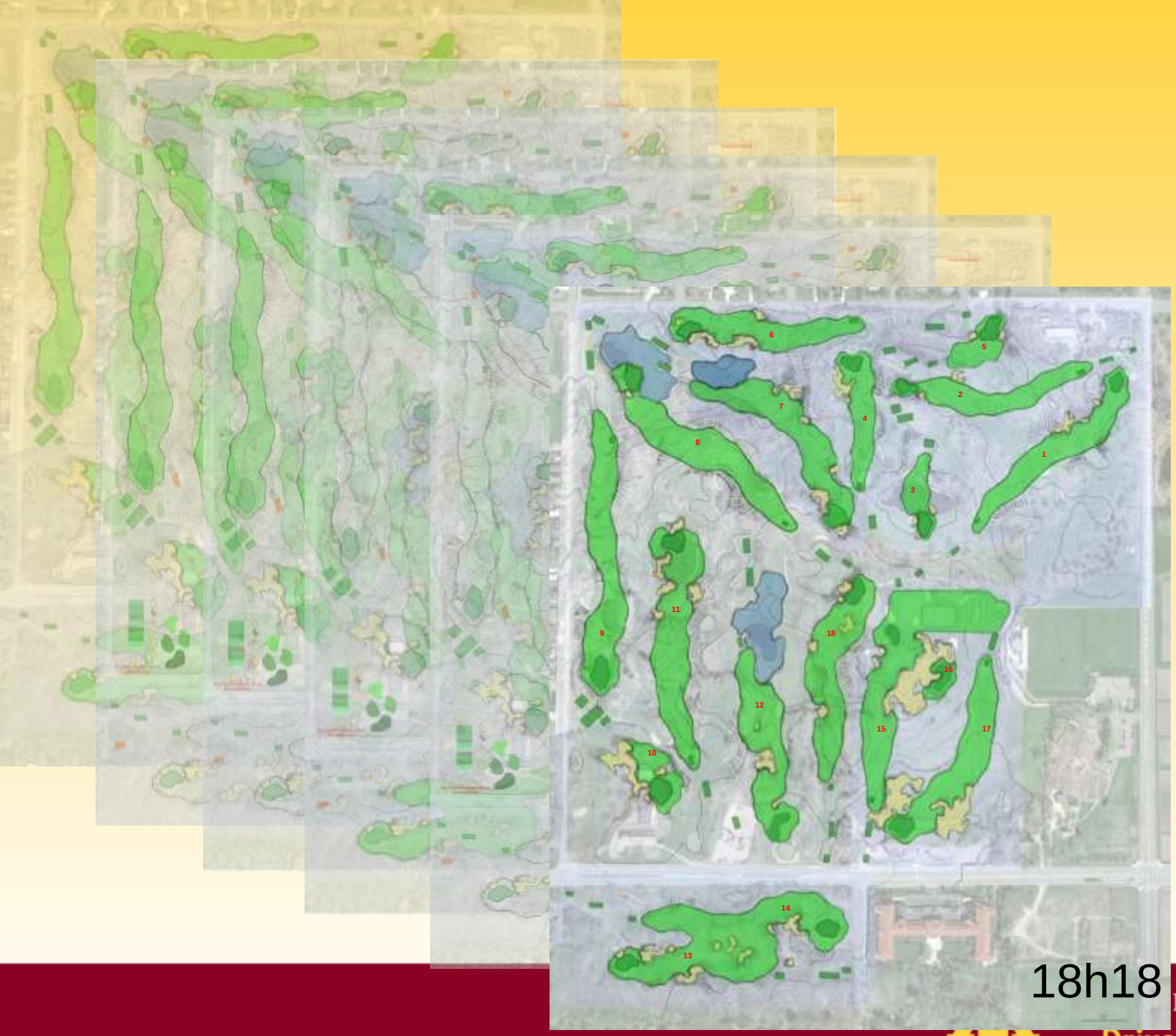

12h18


9h18

1


4h18


3h18



18h18

Time not Holes

3h18	→	45 min
4h18	→	1 h
6h18	→	1.5 h
9h18	→	2.25 h
12h18	→	3h
18h18	→	4.5h

Discrete Optimization

- Not starting on hole 1 and 10 only
- Golfers asking to play when they have the TIME not based on a 9 or 18 hole platform

Considerations

- Golf Industry
- Sustainability
- Water
- Not just sports page
- Economics
- Multifunctional
- Transdisciplinary
- Grand Challenges
- Repurposing green space

- Ryder Cup 2016 (500M)
- US Senior Amateur 2017
- Super Bowl 2018 (100M)
- Final Four 2019
- World Expo 2023

Next Steps

- USGA partnership
  - 1, 3, 5 and 10 yr goal/vision/outcomes
- Implement golf centric mini-campaign
  - case statement, cost estimates, timeline
- Strategically identify other partners

research
golf
water
industry
course
environmental
turfgrass
courses
University
laboratory
management
sustainability
Minnesota
Science
use
land
provide
Golf
community
communities
Green
game
tolerance
questions
practices
renovation
maintenance
facility
drought
facilities
benefits
Course
recreational
Bolstad
beyond
major
inputs
include
opportunities
species
sustainable
development
economic
green
protect
urban
public
Research
address
advance
valuable
Turfgrass
recreation
bentgrass
Resource
responsibility
support
billion
homeowners
protection
robotics
Food
Sciences
greater
help
quality
managers
College
States
Natural
natural
new
Agricultural
climates
innovative
fertilizer
million
areas
members
study
United
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partnership
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existing
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local
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skiing
including
includes
coming
make
offer
leisure
one
erosion
professional
initiative
design
others
within
living
pesticides
fescue
faculty
successful
business
New
resource
marketing
issues
resistance
best
improved
health
increase
projects
varieties
nationwide
concept
reduce
conservation
wildlife
stewardship
history
promoting
opportunity
important
changes
replicated
resources
soil
landscape
physical
growing
unique
contributions
value
also
sport

Thank you