

Response of Trout Populations and Pool Depths to Large Wood in Streams



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& Eric Richer



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OUTSIDE**



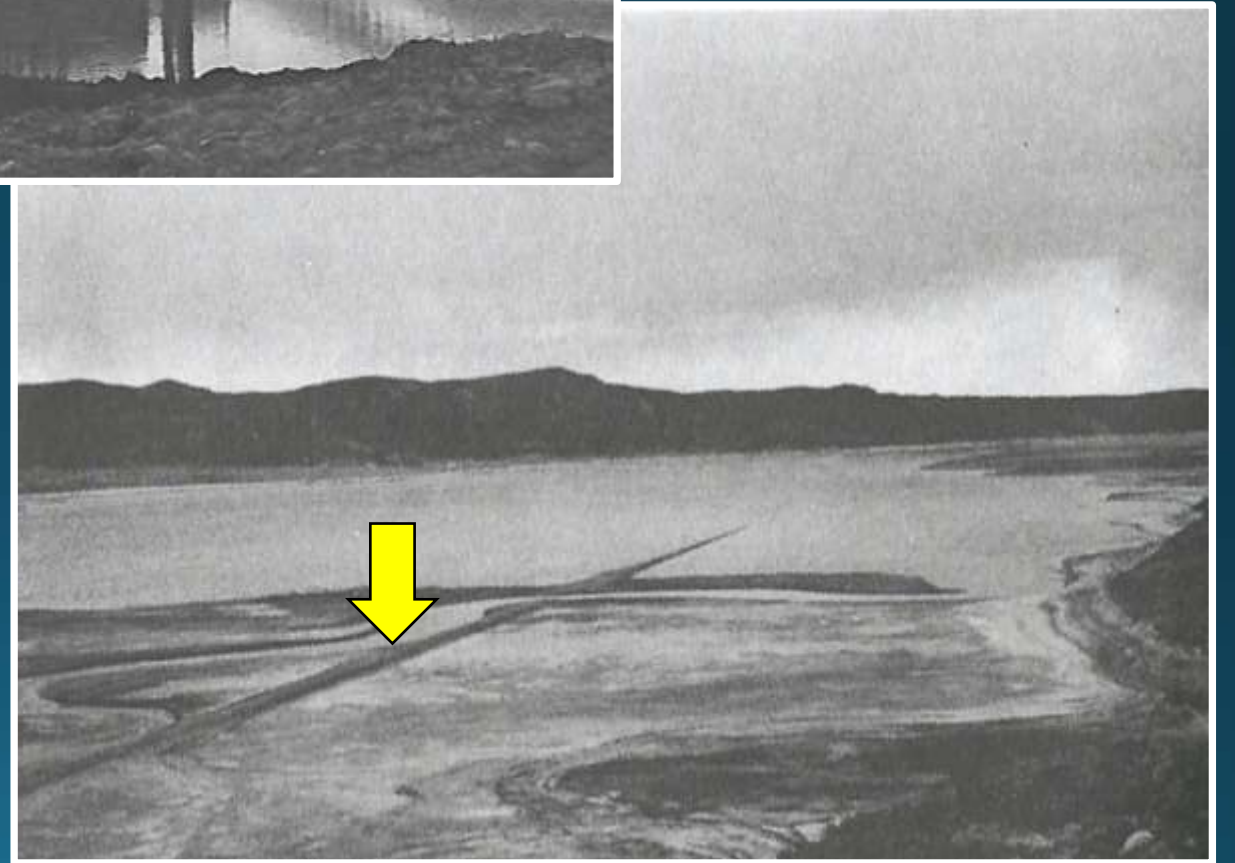
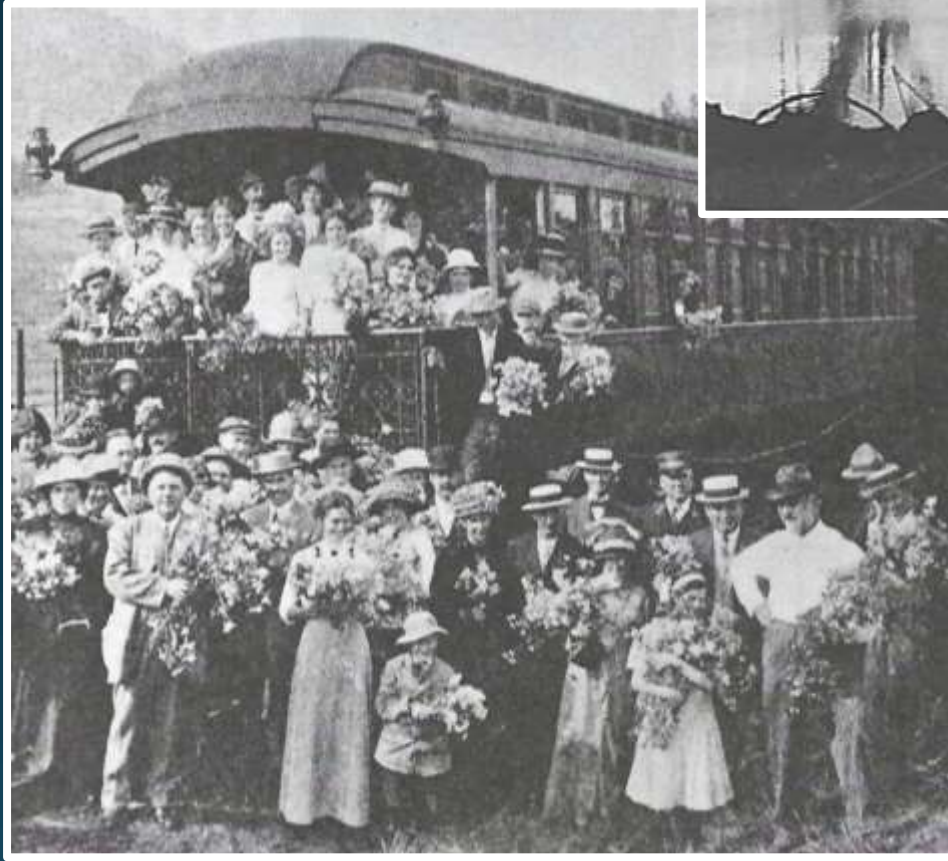
Hartsel, CO
Badger
Basin SWA



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LIVE LIFE
OUTSIDE

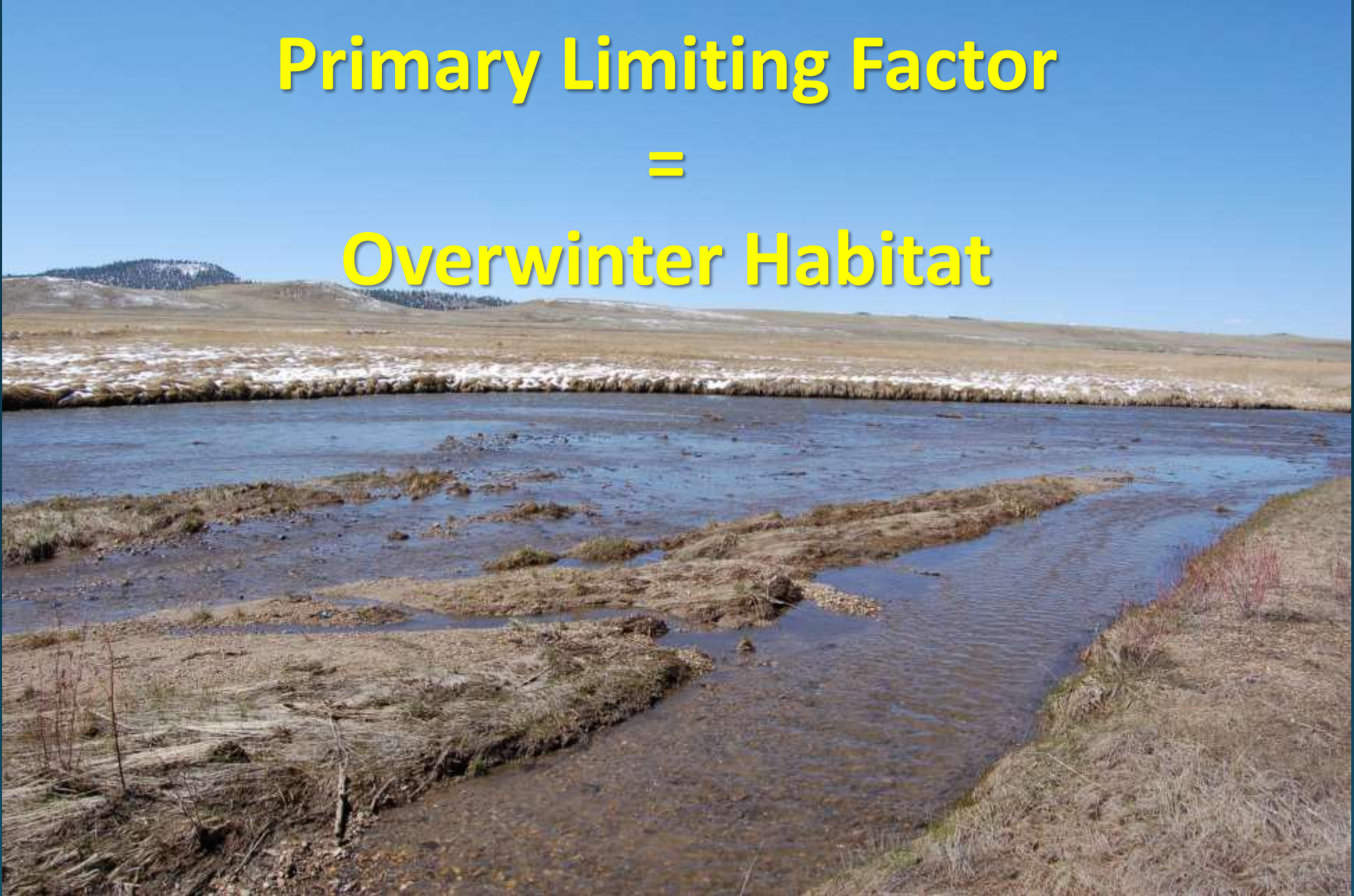


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Primary Limiting Factor

=

Overwinter Habitat



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Badger Basin SWA Habitat Enhancement Project



Legend

	Wood Tie		Log Structure
	Horizontal Log		Point Bar Development
	Boulder Cluster		Pool Development
	Boulder Structure		

0 65 130 260 390 520 Feet

AS-BUILT DRAWING	
DRAWN: TBARNES	1/5/2015
CHECKED:	
APPROVED:	
SHEET: 1 OF 4	

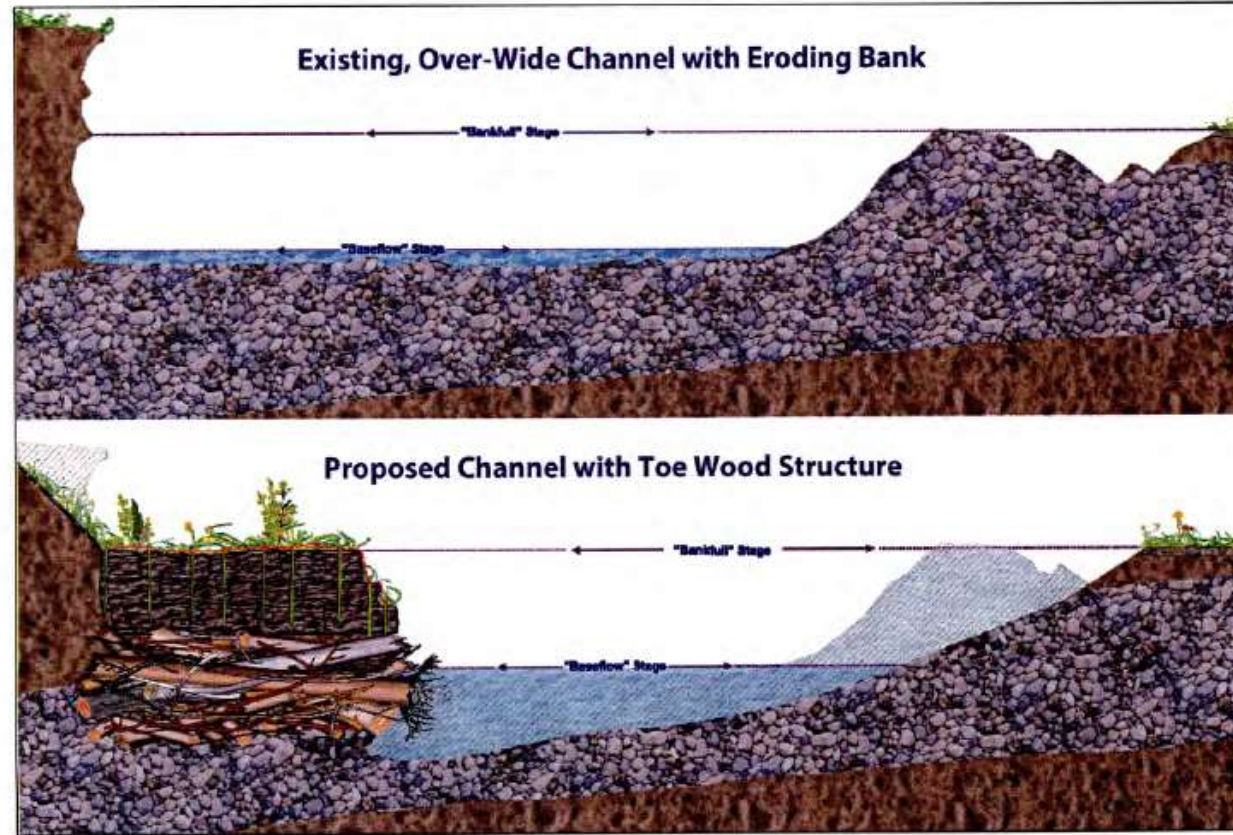
STATE OF COLORADO
DEPARTMENT OF NATURAL RESOURCES
COLORADO PARKS AND WILDLIFE
FORT COLLINS, COLORADO

**SOUTH PLATTE RIVER
BADGER BASIN SWA**

What is Toe Wood?

Rosgen - The Toe Wood Structure

General Concept



**Installation Sequence for Option 1 –
Use Cuttings & Sod Mats with Staking**

Used with permission from Dave Rosgen

Non-Wood Pool

Excavated Pool

Point bar



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Non-Wood Pool

Excavated pool

Point bar



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BANKFULL BENCH: TOE WOOD SOD MAT

Haphazard Toewood Treatment

Point of Curvature

Point of Tangency

UNDERLAYMENT CHARACTER

GRAVEL/COBBLE FILL

TERRACE

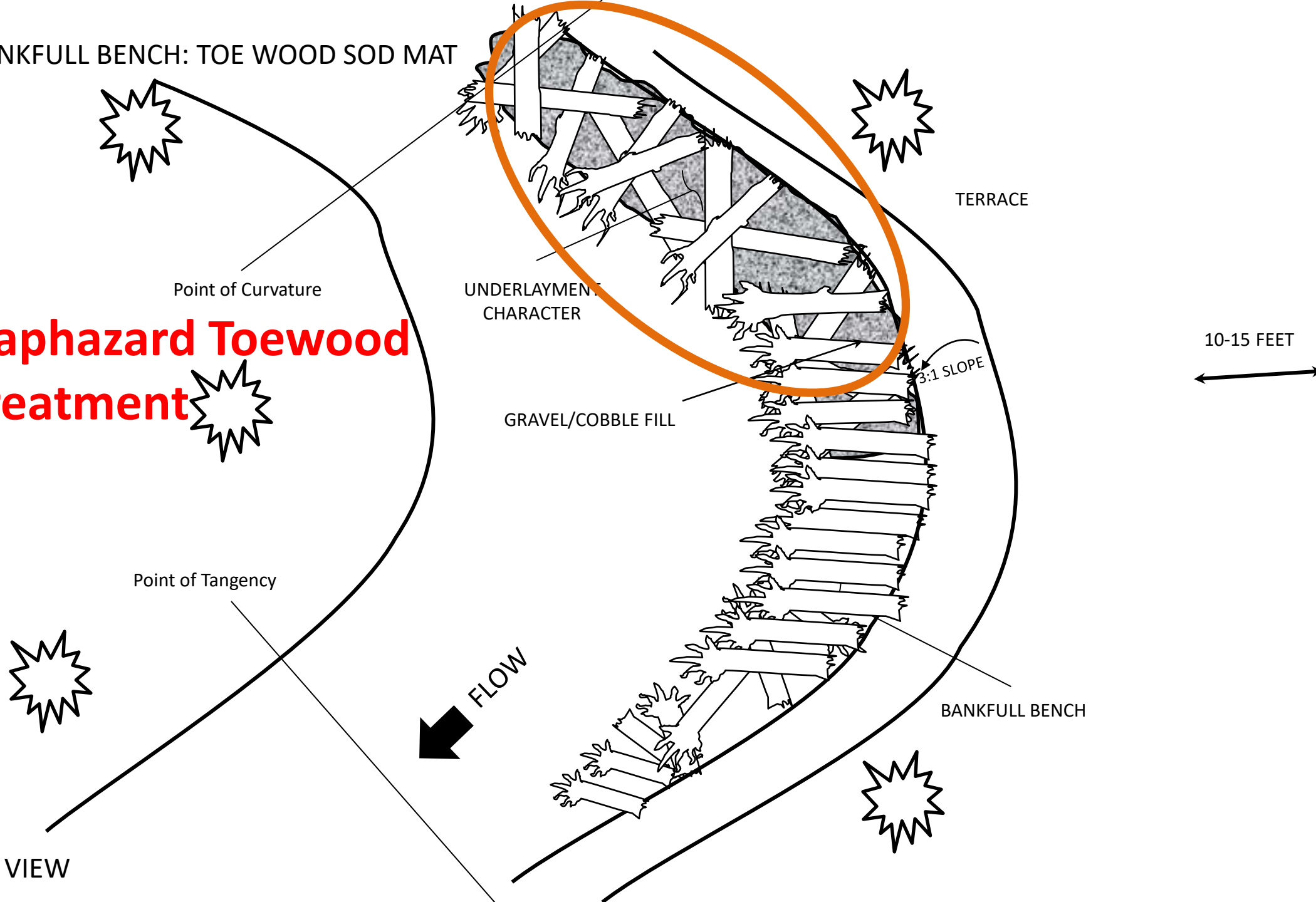
3:1 SLOPE

BANKFULL BENCH

10-15 FEET

FLOW

PLAN VIEW



Haphazard Toewood Pool

Point bar

Large wood
(submerged)

Excavated pool



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Haphazard Treatment- Before



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OUTSIDE

Haphazard Treatment- Construction



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Haphazard Treatment- Construction



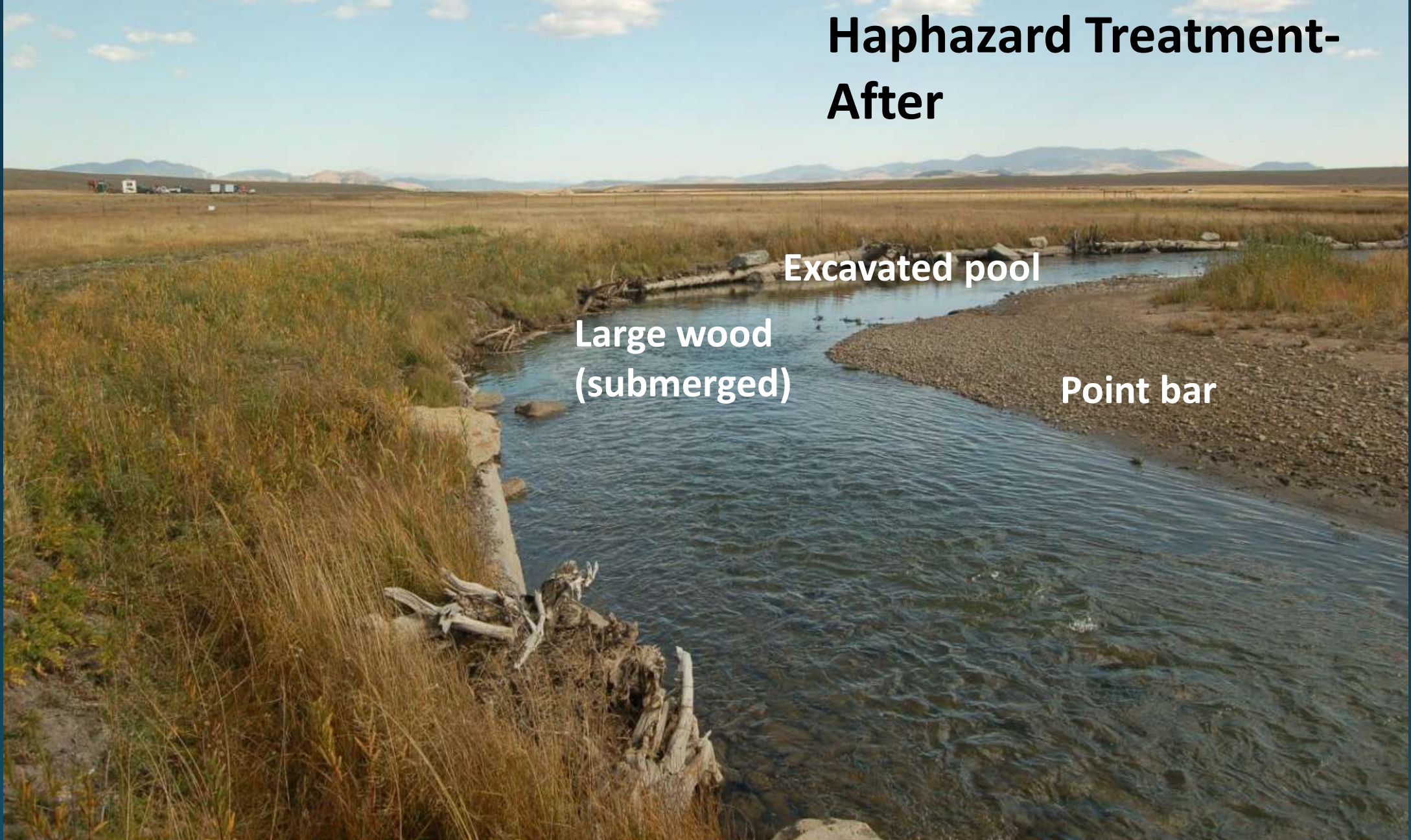
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Haphazard Treatment- De-watered



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Haphazard Treatment- After



Excavated pool

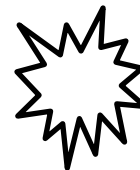
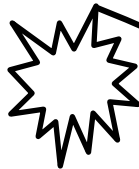
Large wood
(submerged)

Point bar



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BANKFULL BENCH: TOE WOOD SOD MAT



TERRACE

Point of Curvature

UNDERLAYMENT CHARACTER

Undercut Toewood Treatment



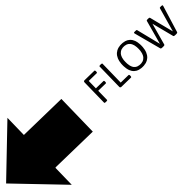
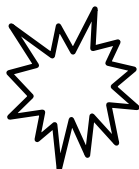
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3:1 SLOPE

10-15 FEET



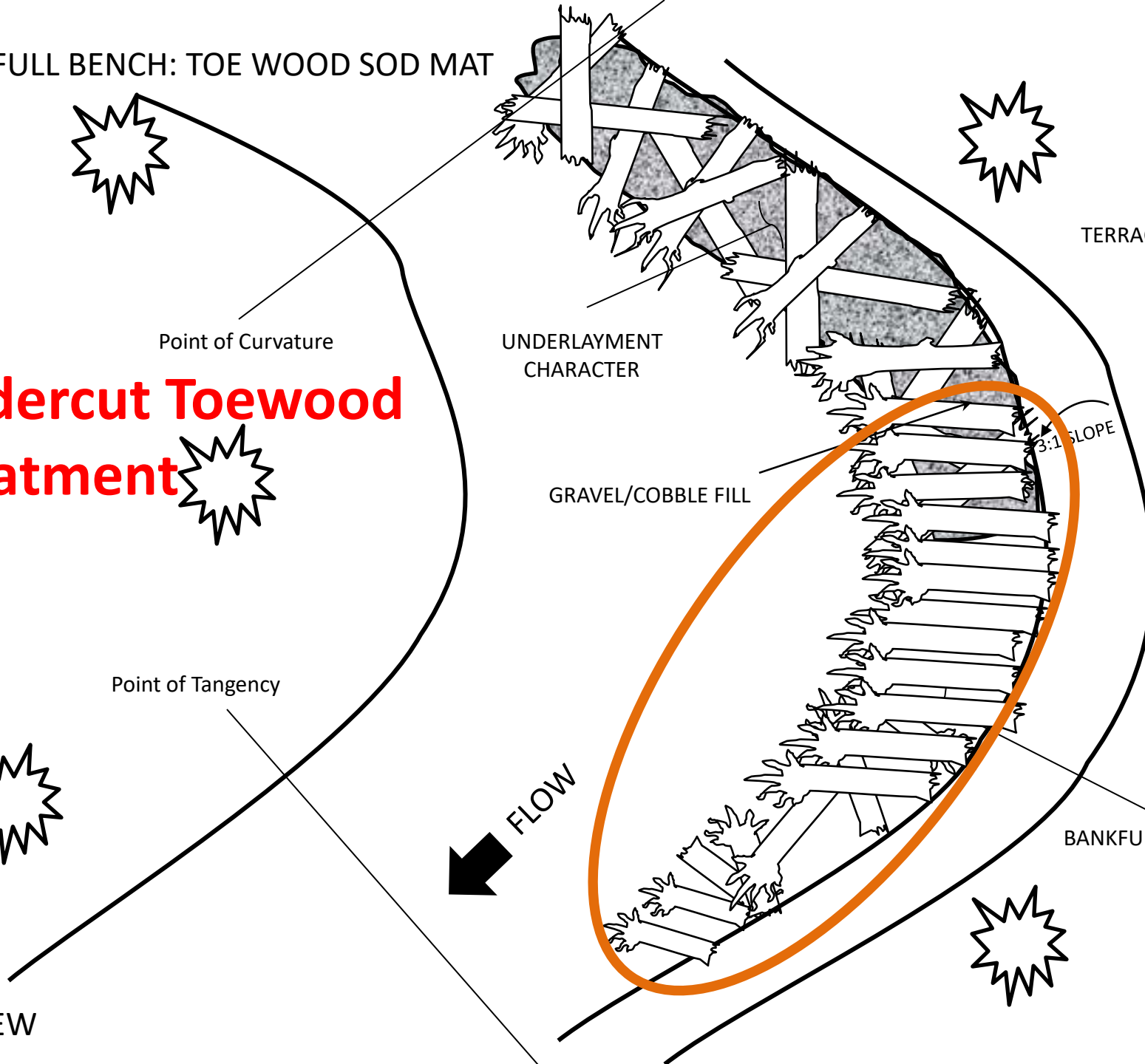
Point of Tangency



BANKFULL BENCH



PLAN VIEW



Undercut Toewood Pool

Large wood



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Undercut Treatment-Before



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Undercut Treatment- Construction



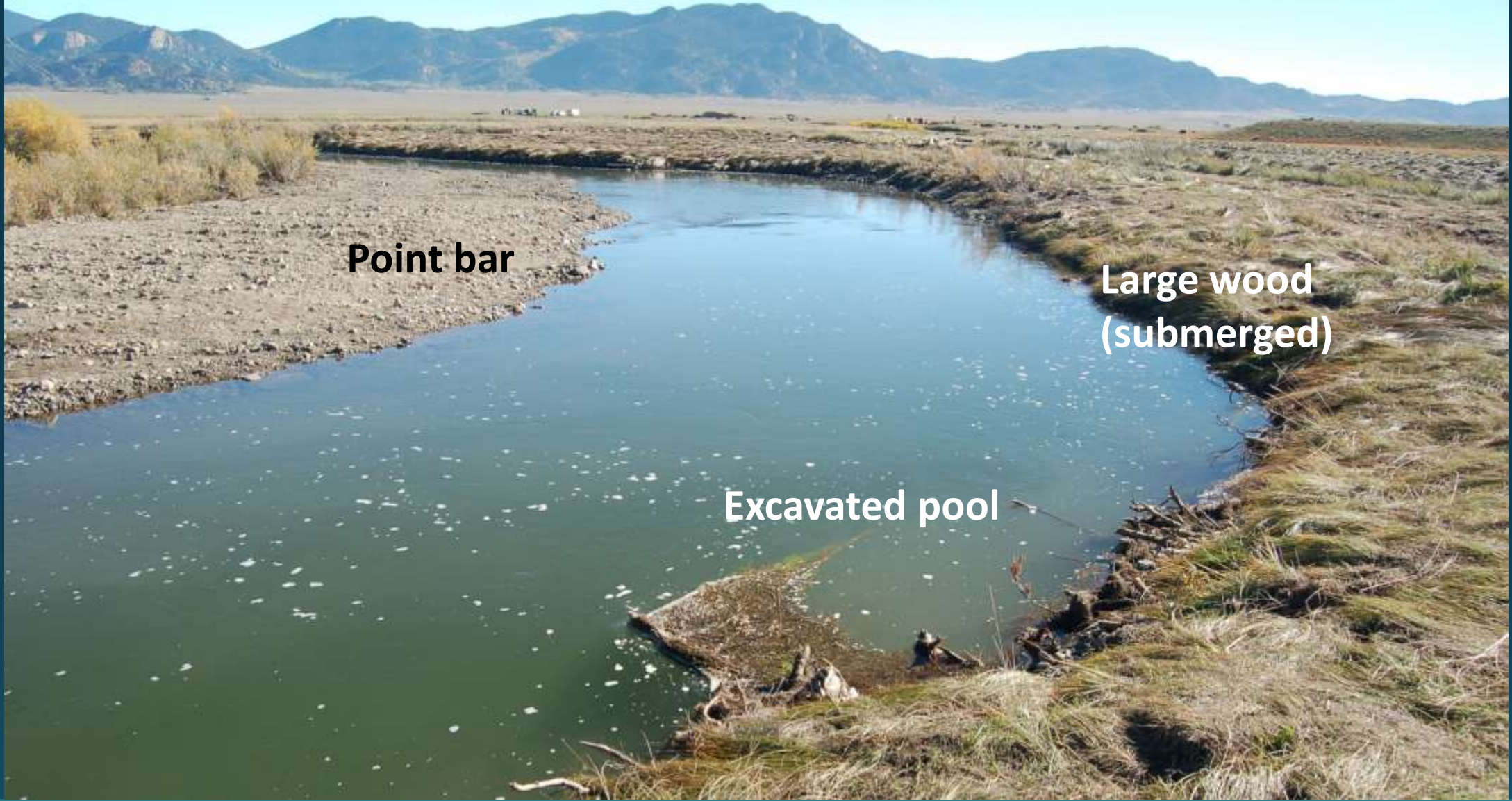
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Undercut Treatment- De-watered



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OUTSIDE

Undercut Treatment-After



Point bar

Large wood
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Excavated pool



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Relative Costs

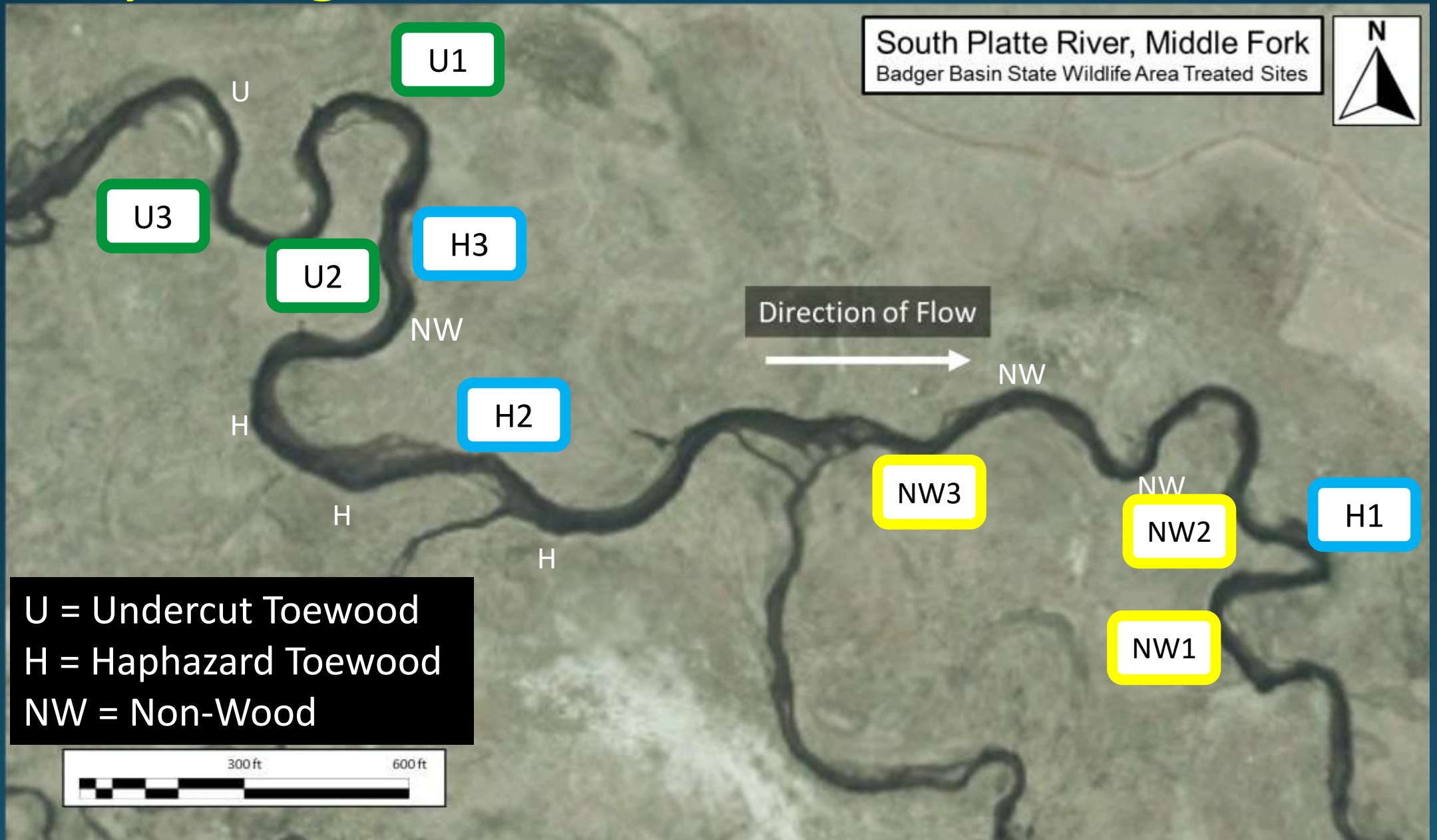
Pool Type	Cost/ft	Cost/mile
Non-Wood	\$25.00/ft	\$132,000
Haphazard	\$40.00/ft	\$211,200
Undercut	\$65.00/ft	\$343,200



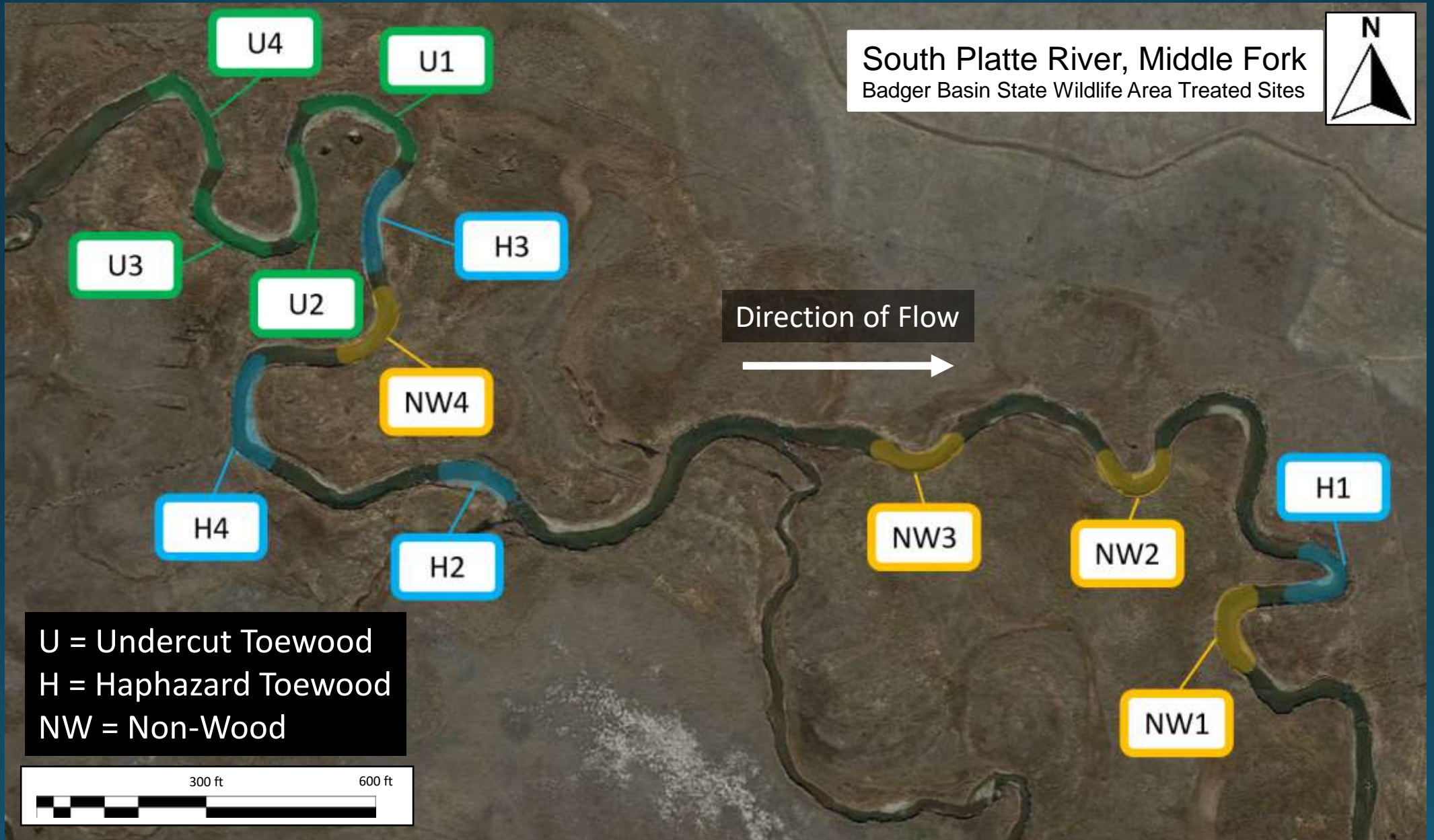
Study Design-2019



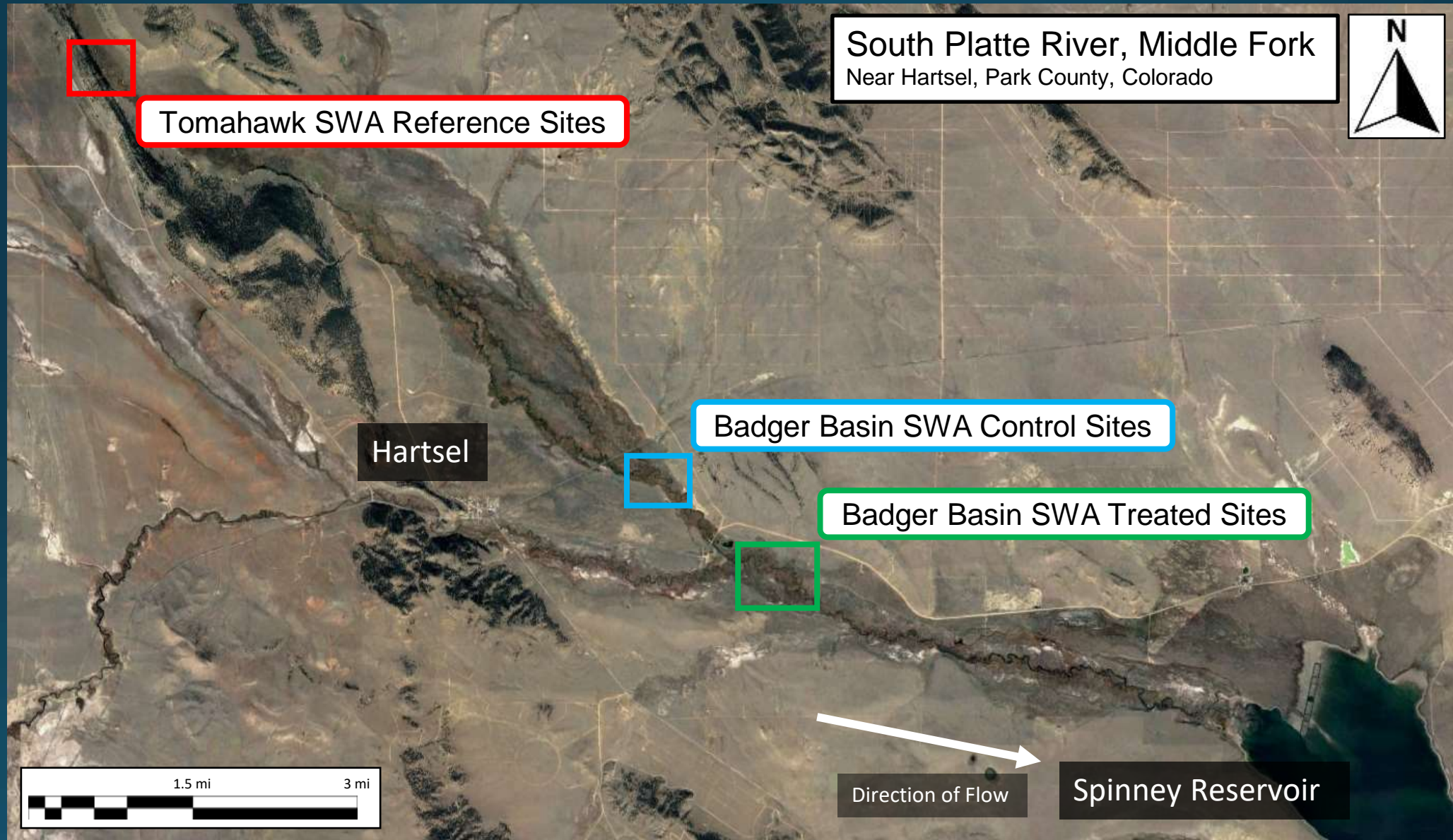
Study Design-2019



Study Design-2021

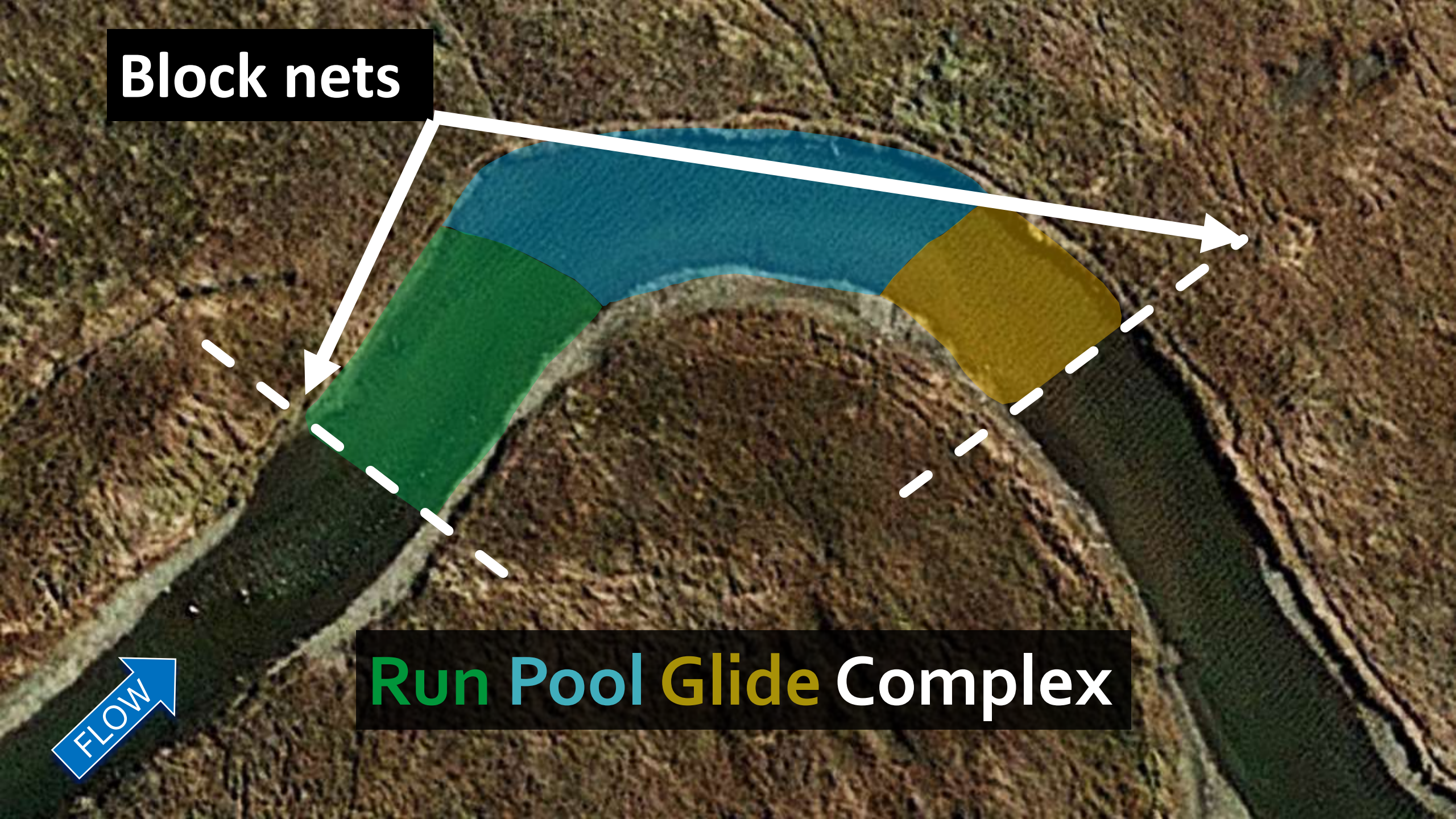
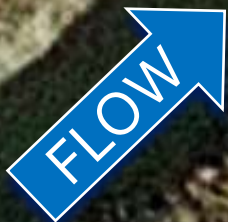


Study Design-2021



Block nets

Run Pool Glide Complex





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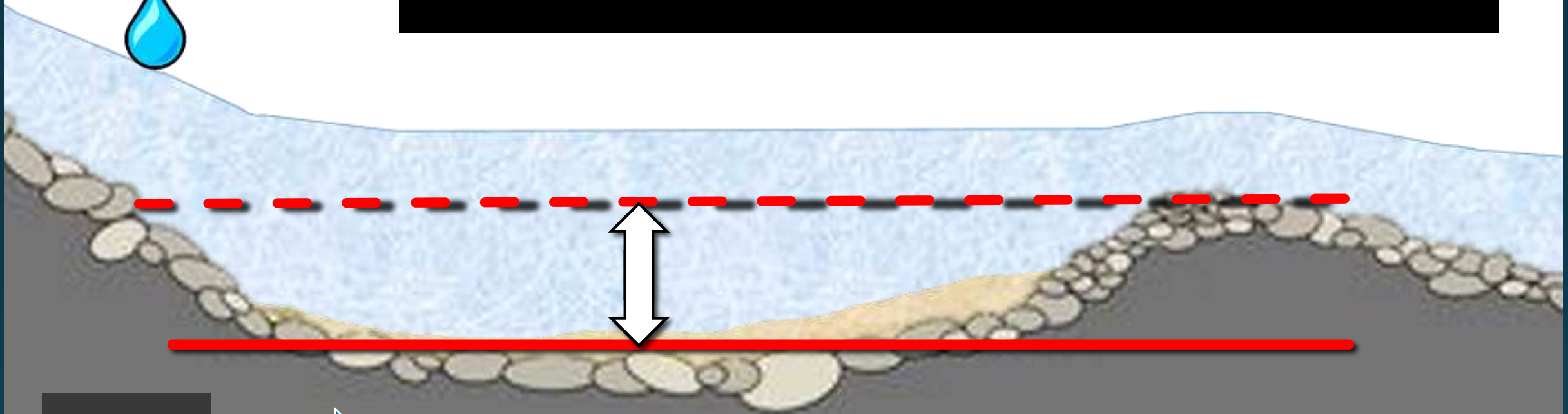
Geomorphic Variables Influencing Depth (Residual Pool Depth)



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Residual Pool Depth = **Max Depth** – **Tail Crest Depth**



Flow



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- Pool type (C, NW, H, U, or R)

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- Pool type (C, NW, H, U, or R)
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- Radius of curvature
- Pool length
- Upstream Riffle length



Geomorphic Variables Influencing Abundance & Biomass



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Geomorphic Variables Influencing Abundance & Biomass

- Pool type (C, NW, H, U, or R)
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Geomorphic Variables Influencing Abundance & Biomass

- Pool type (C, NW, H, U, or R)
- Wood presence
- Year

Geomorphic Variables Influencing Abundance & Biomass

- Pool type (C, NW, H, U, or R)
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- Year
- Residual Pool Depth

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Data Analysis

Goal: Estimate abundance & biomass/100 ft of pool

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1. Estimate detection probabilities (p):
 - Program MARK (Huggins closed capture model)

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 - Modeled as a function of fish length, fish weight, & pool type

Data Analysis

Goal: Estimate abundance & biomass/100 ft of pool

1. Estimate detection probabilities (p):
 - Program MARK (Huggins closed capture model)
 - Modeled as a function of fish length, fish weight, & pool type
2. Modeled detection probabilities were used to generate estimates of abundance (#) & biomass (lbs) standardized per 100 ft of pool length

Data Analysis

Goal: Determine which covariates best explained the variability in pool depths, abundance, and biomass using AIC_c model selection

Results



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Results

Which factors were most effective at maintaining the deepest pools?

Results

Which factors were most effective at maintaining the deepest pools?

- Wood presence
- Pool type
- Radius of curvature
- Pool length
- Upstream riffle length



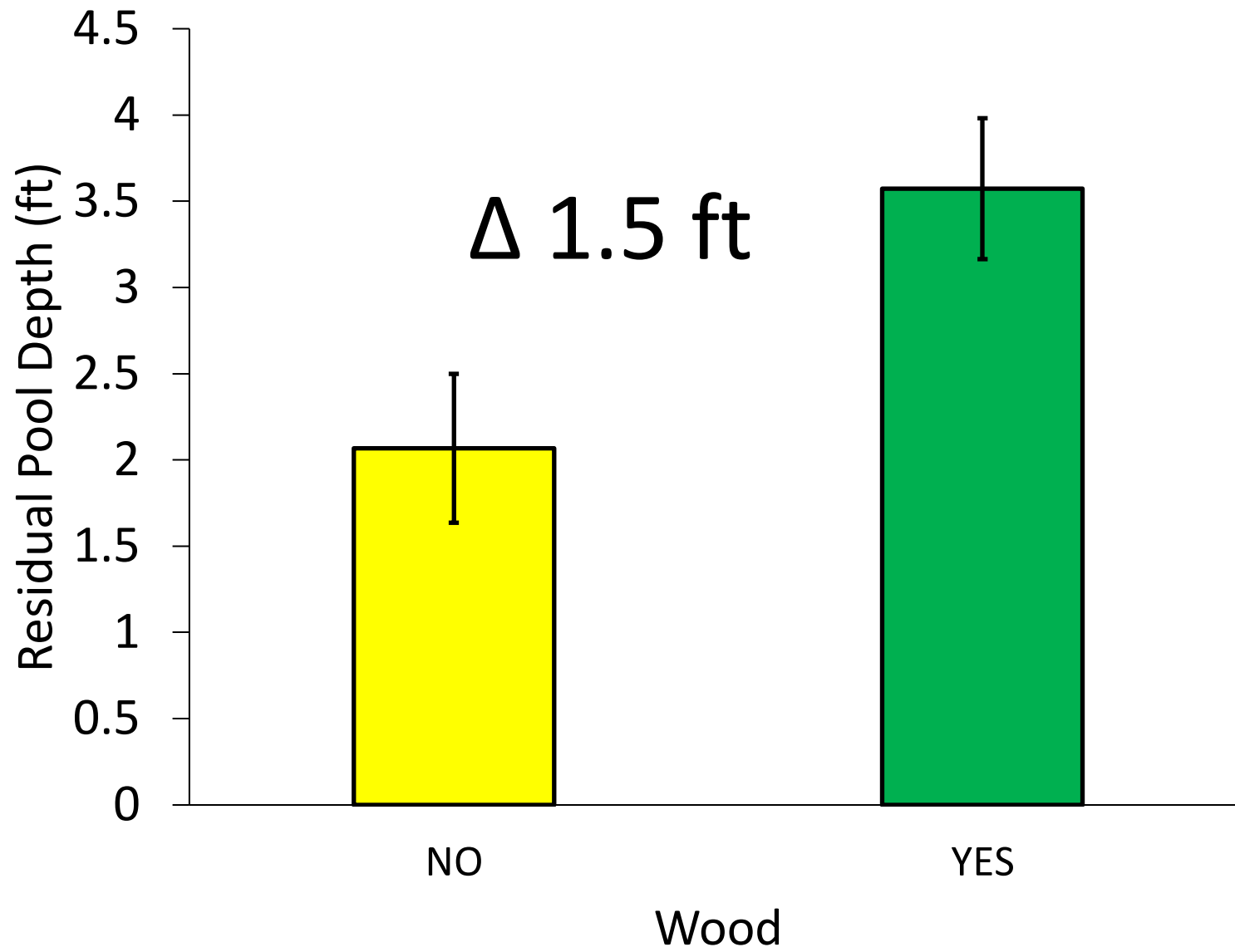
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Results

Which factors were most effective at explaining variability in Brown Trout abundance?

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- Year
- Wood presence
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- Pool length
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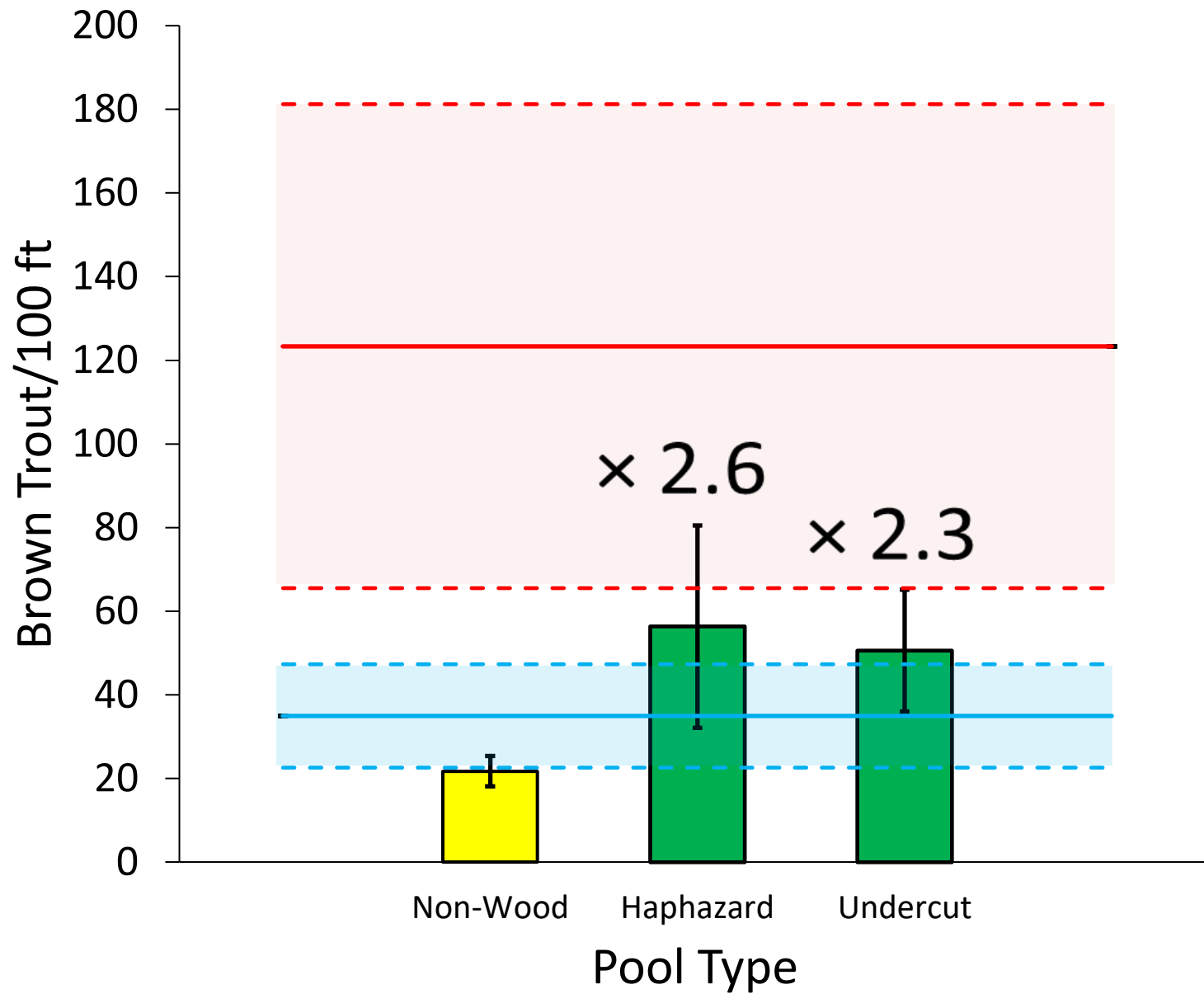
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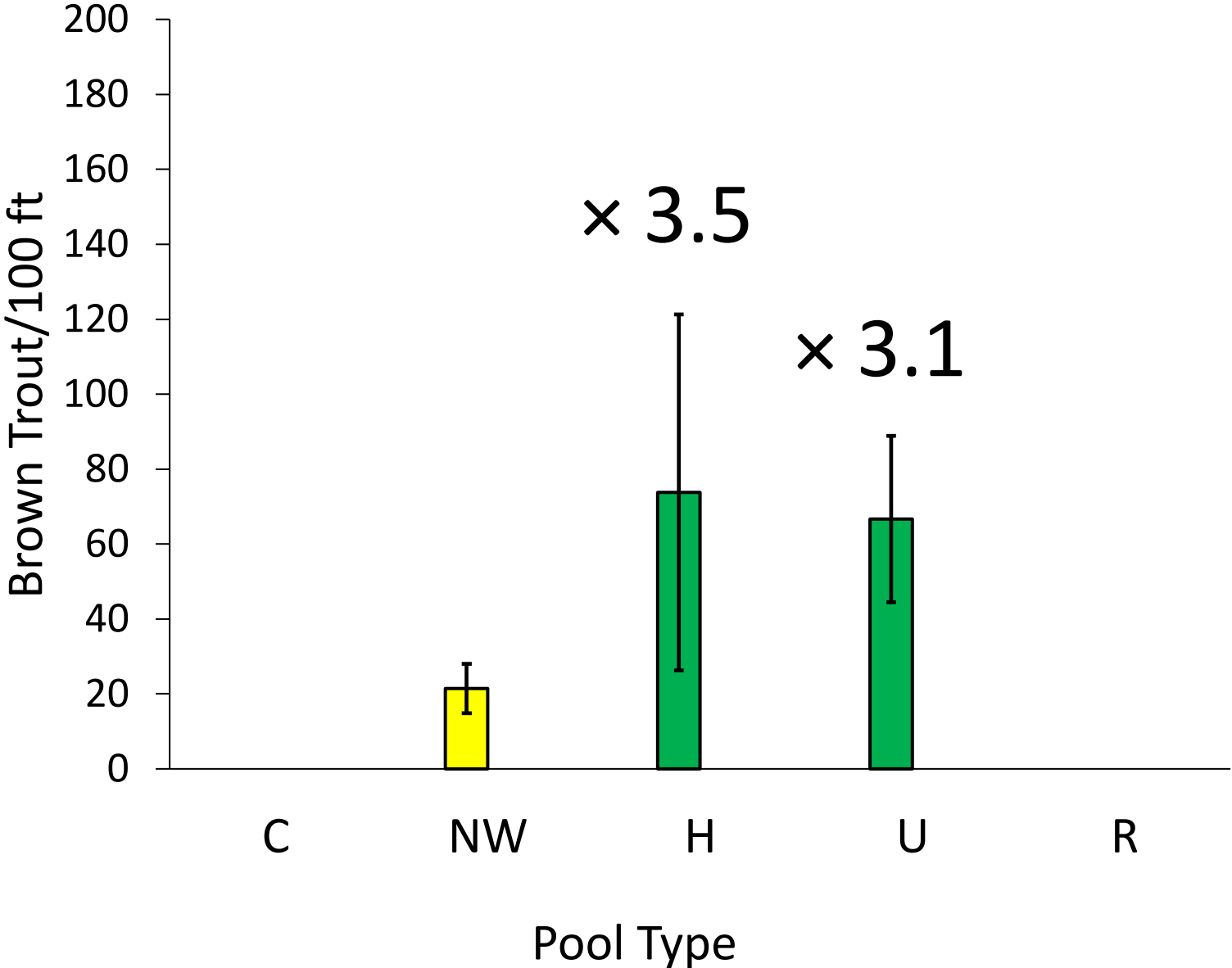
- Year
- Wood presence
- **Pool type**
- Residual pool depth
- Pool length
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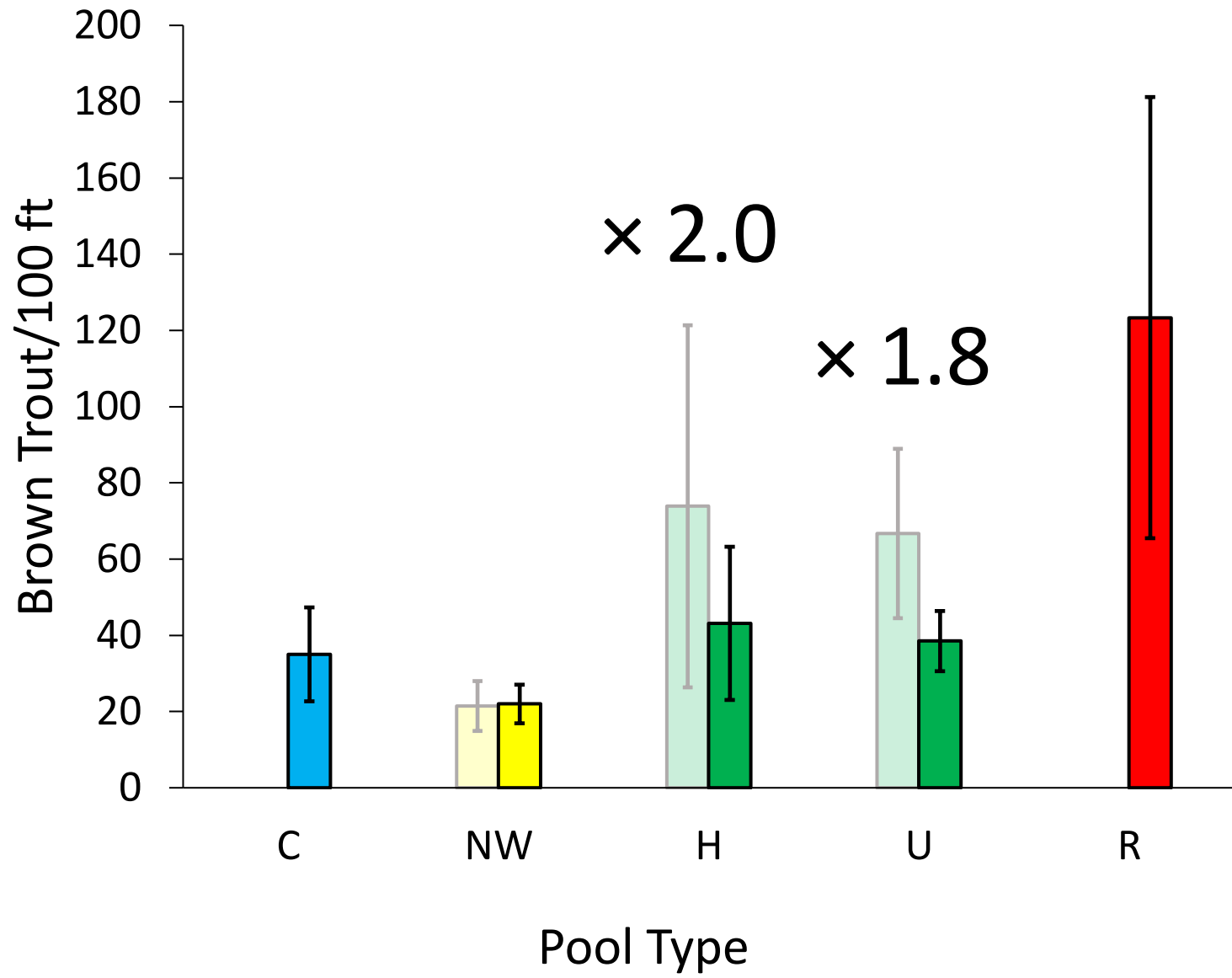
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2019



2021



Results

Which factors were most effective at explaining variability in Quality Brown Trout (Trout > 14" TL) abundance?

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- Year
- Wood presence
- Pool type
- Residual pool depth
- Pool length
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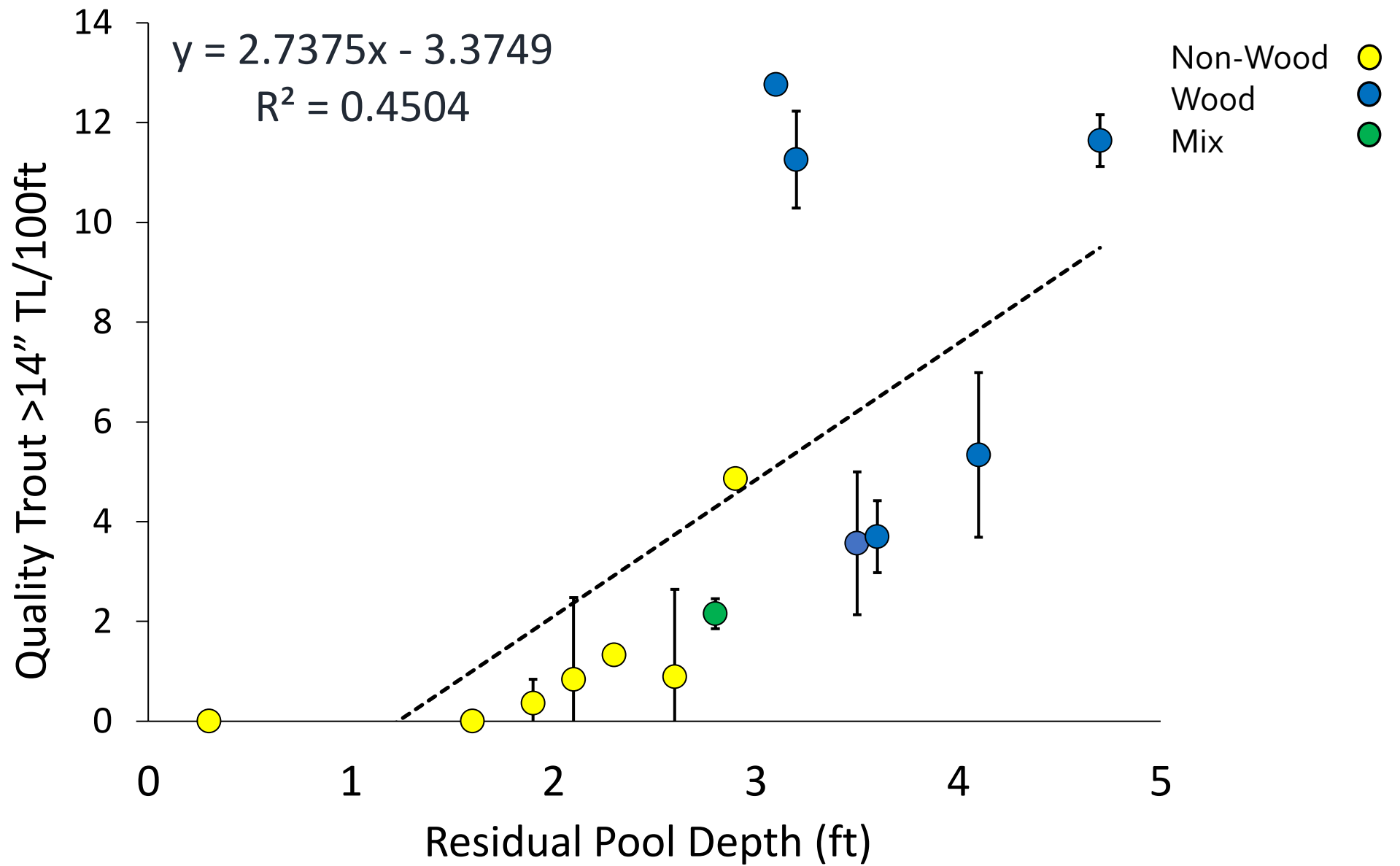
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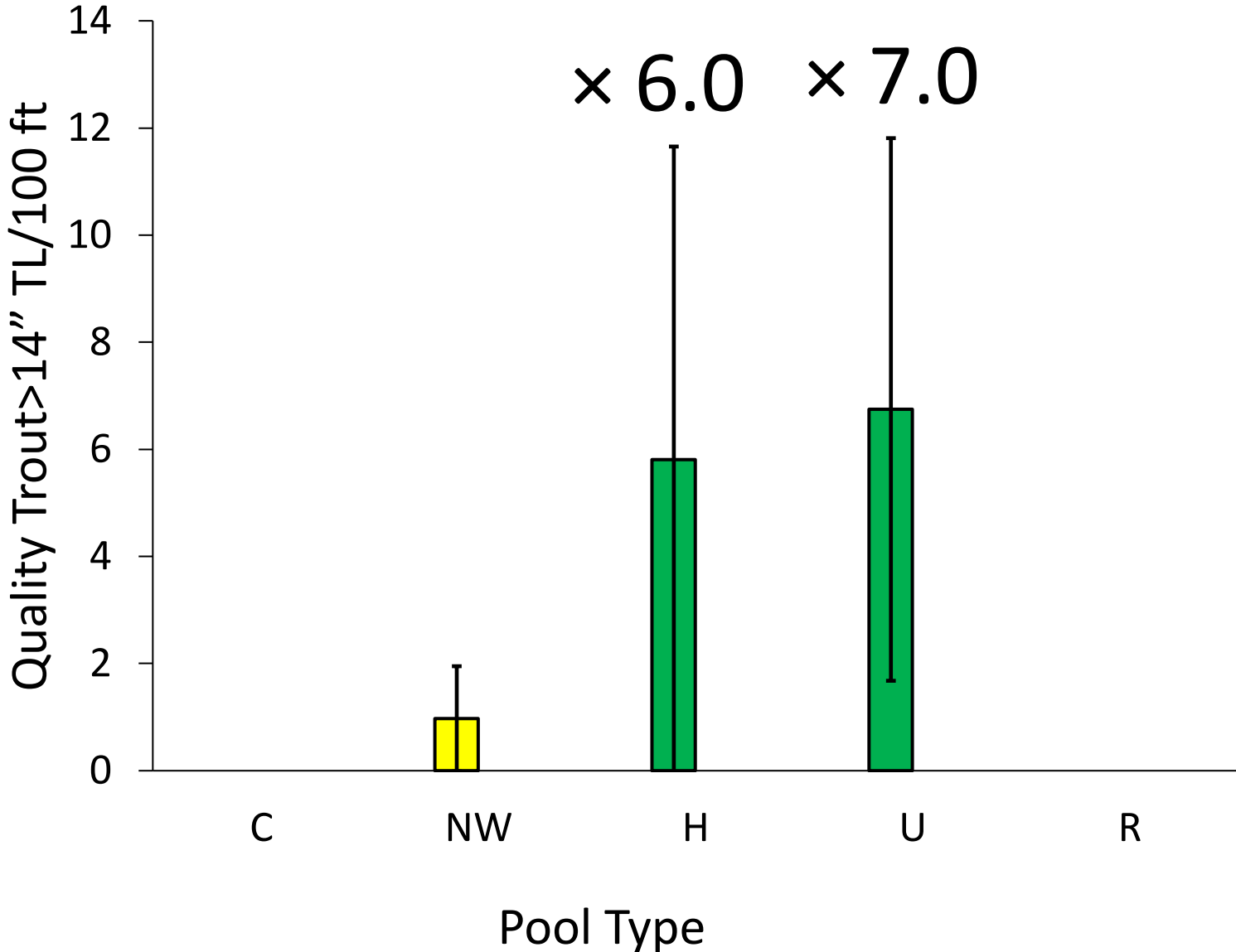
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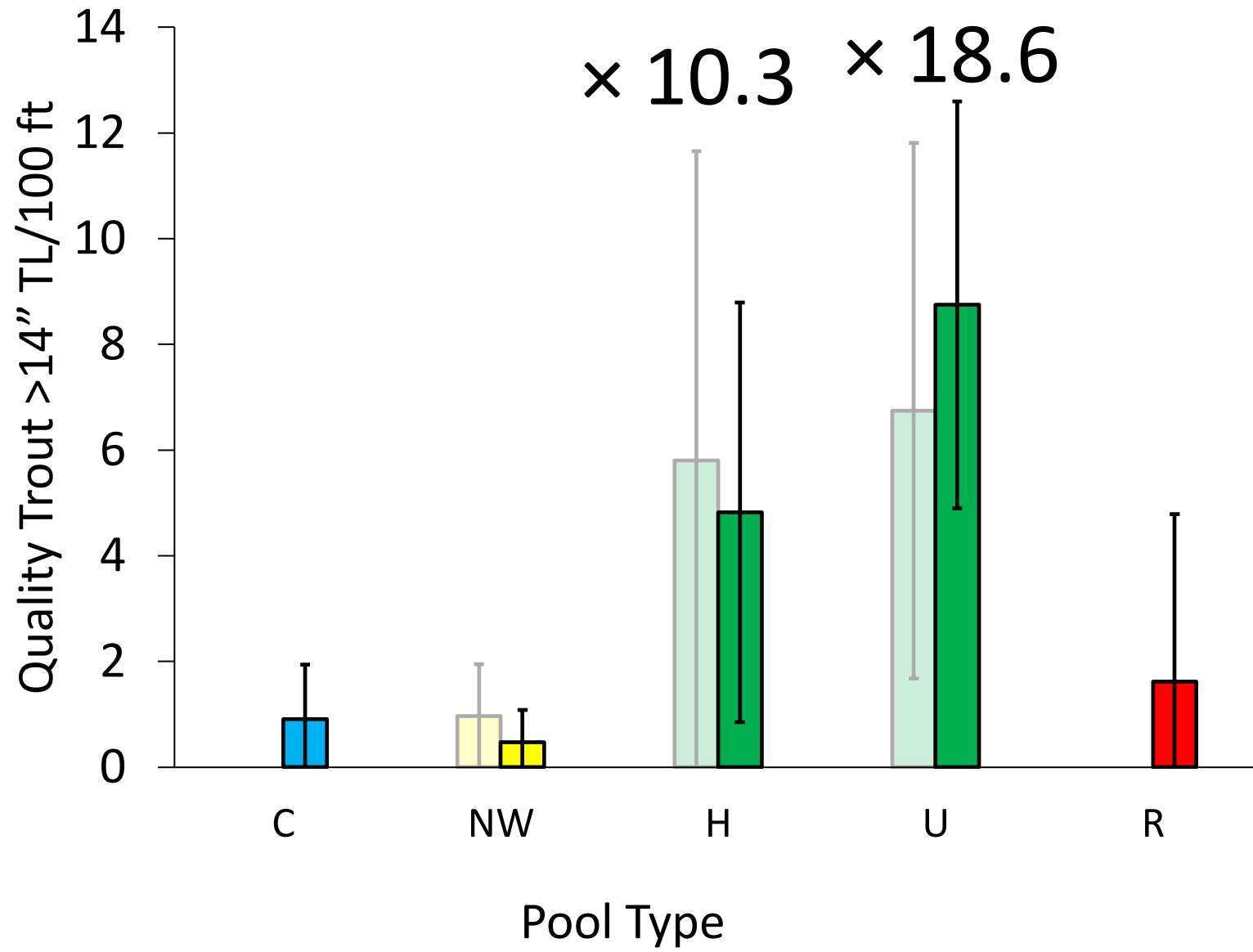
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2019



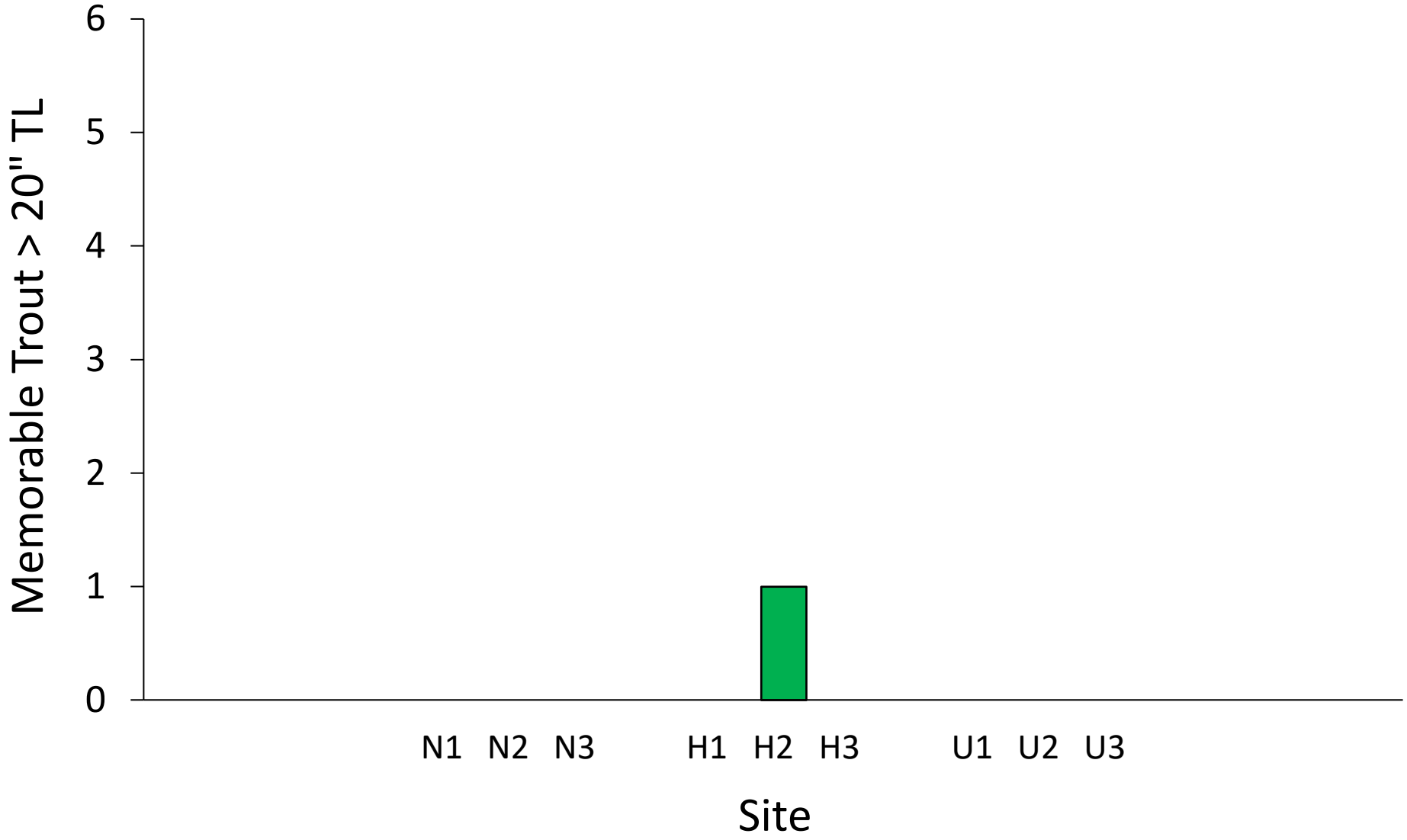
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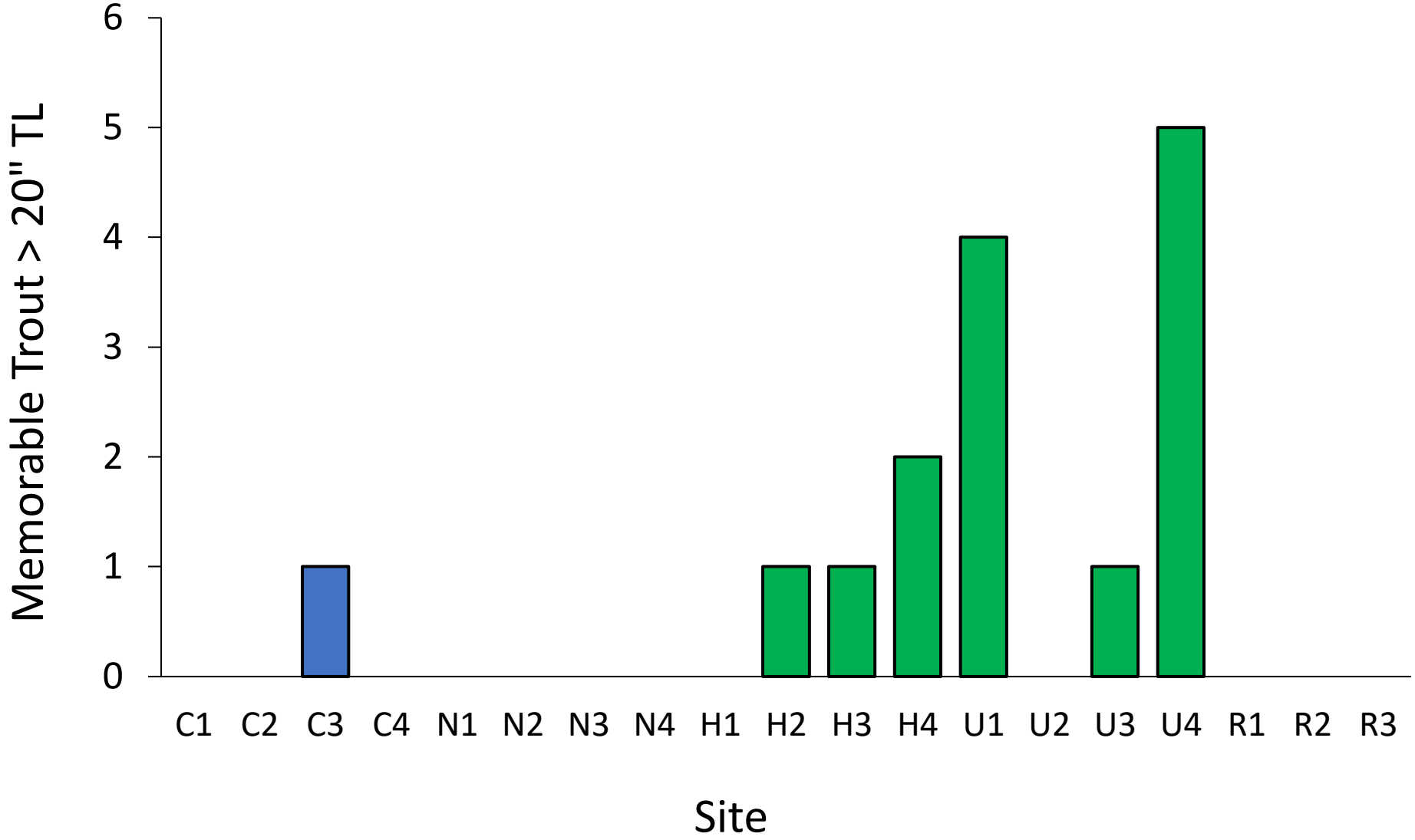
Results

Which factors were most effective at explaining variability in Memorable (Trout > 20" TL) abundance?

2019



2021



Results

Which factors were most effective at explaining variability in Brown Trout biomass (lbs of Trout/ 100 ft of pool)?

Results

Which factors were most effective at explaining variability in Brown Trout biomass (lbs of Trout/ 100 ft of pool)?

- Year
- Wood presence
- Pool type
- Residual pool depth
- Pool length
- Upstream riffle length



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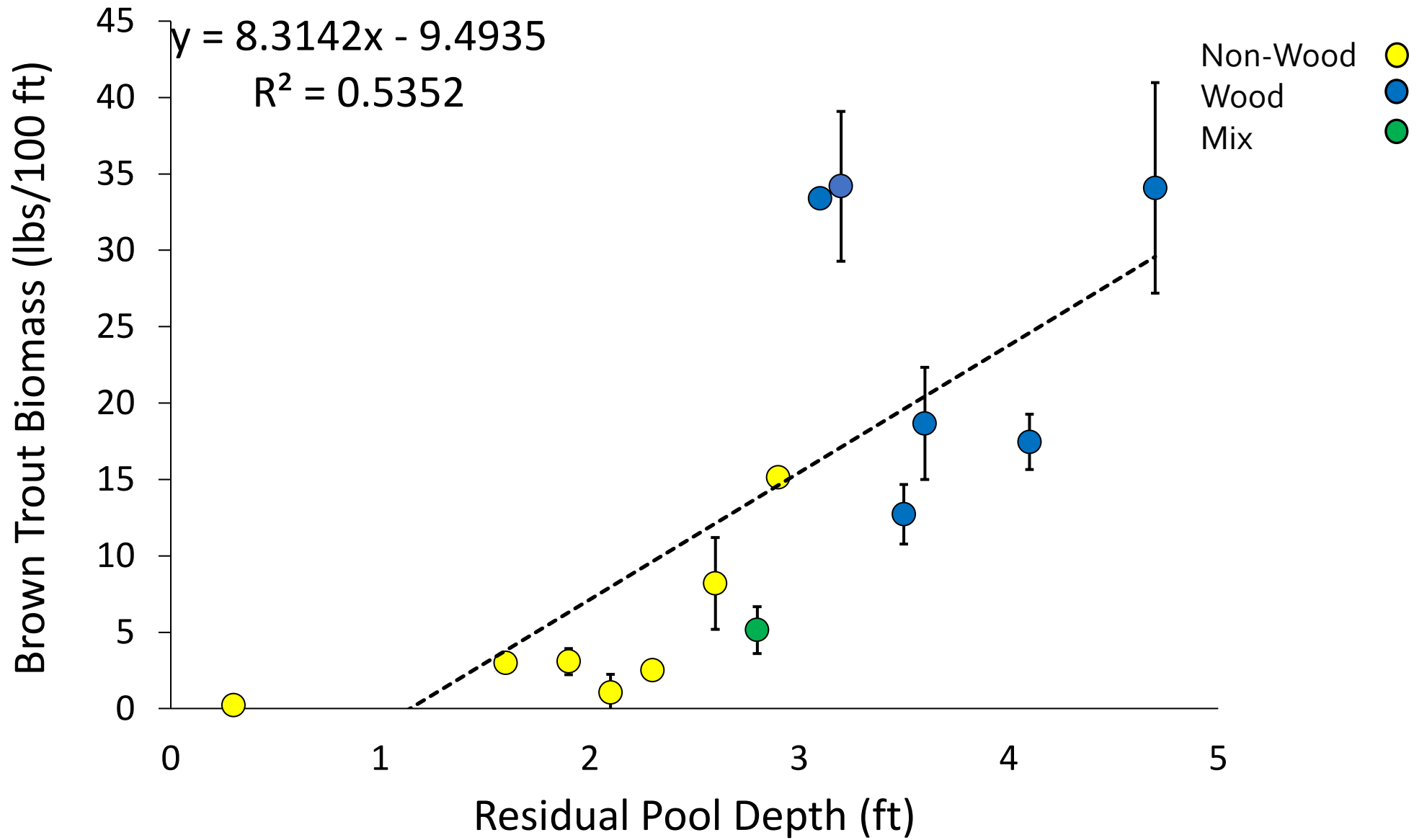
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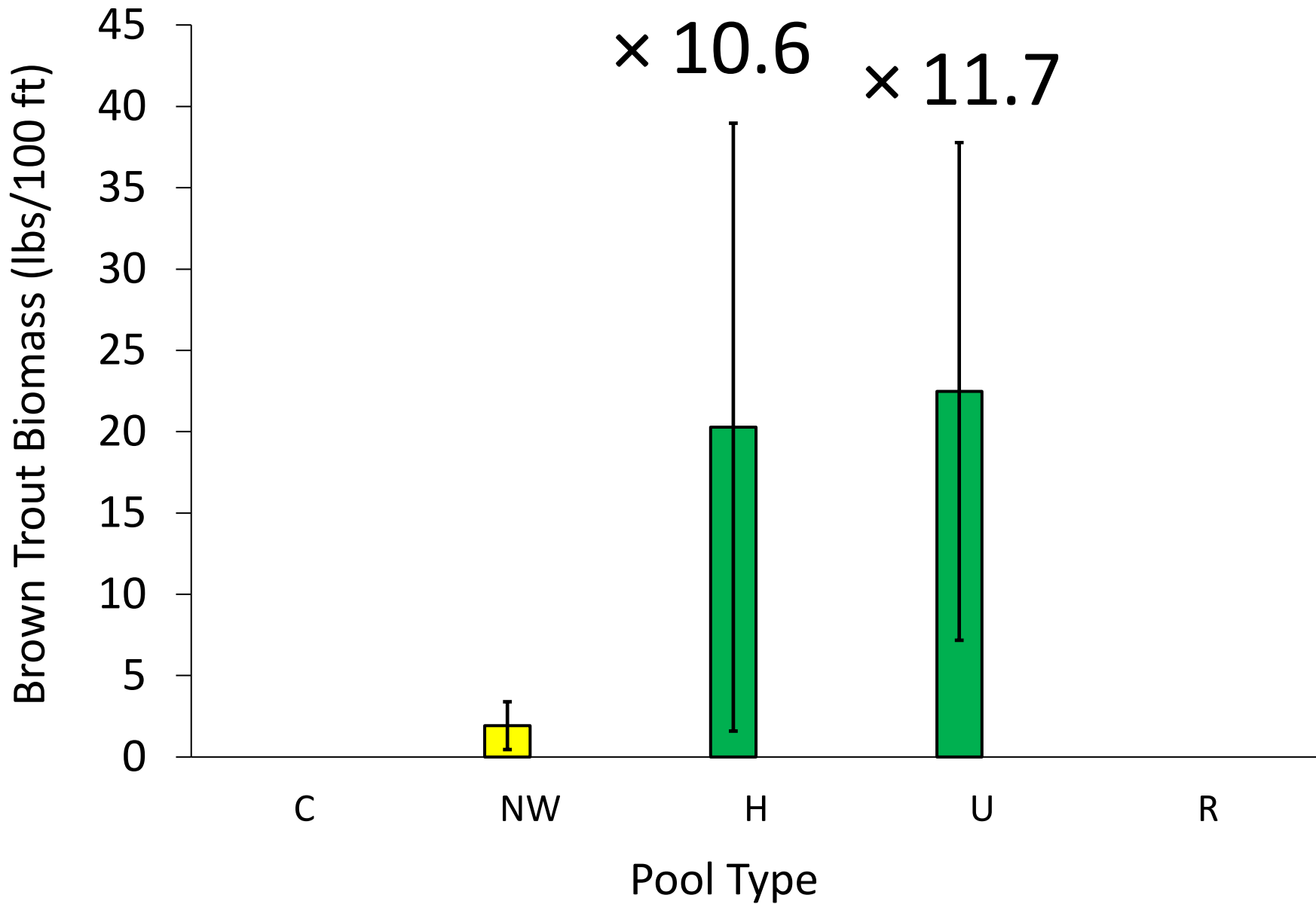
- Year
- Wood presence
- Pool type
- Residual pool depth
- Pool length
- Upstream riffle length



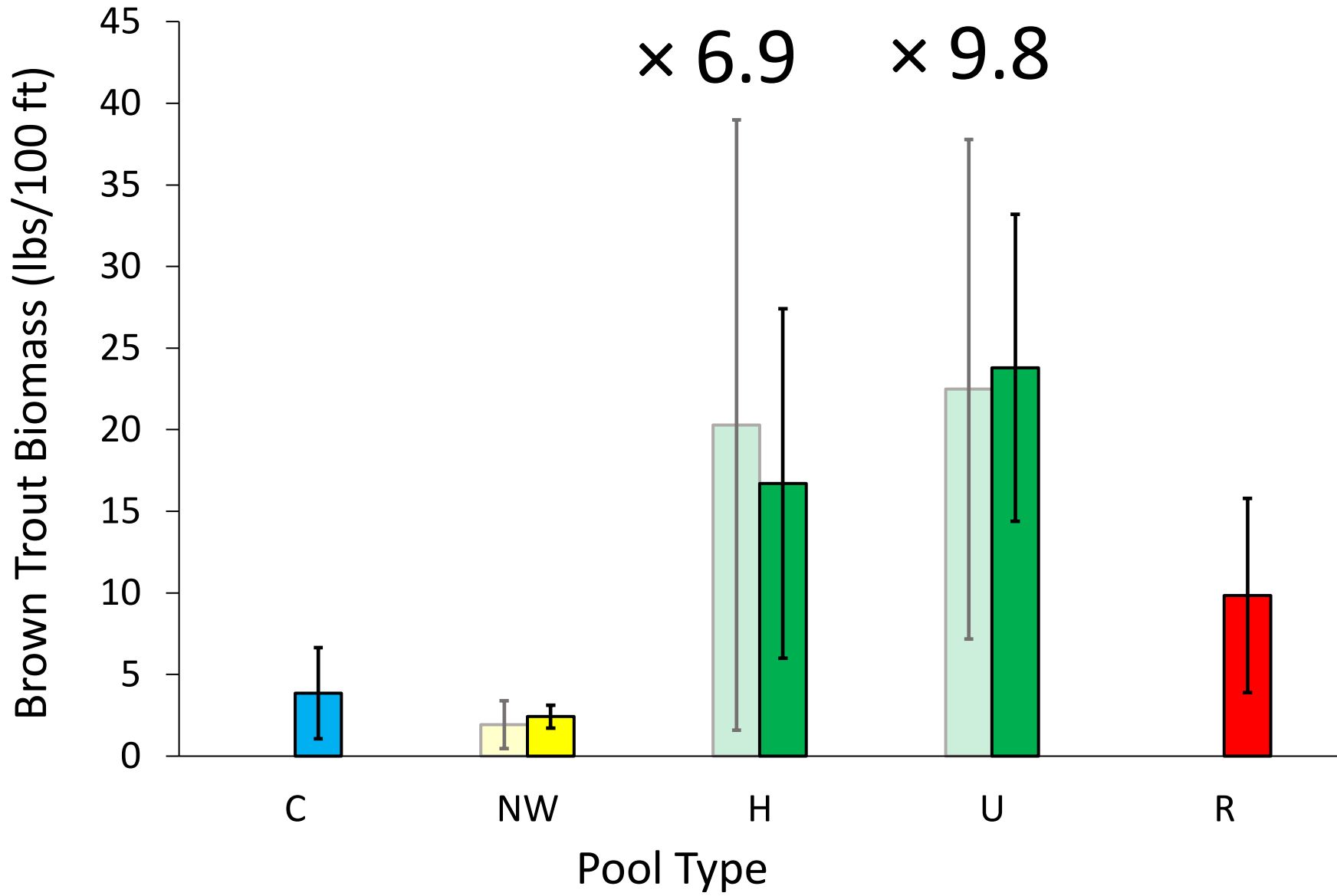
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2019



2021



Results

Which factors were most effective at explaining variability in Rainbow Trout biomass (lbs of Trout/ 100 ft of pool)?

Results

Which factors were most effective at explaining variability in Rainbow Trout biomass (lbs of Trout/ 100 ft of pool)?

- Year
- Wood presence
- Pool type
- Residual pool depth
- Pool length
- Upstream riffle length



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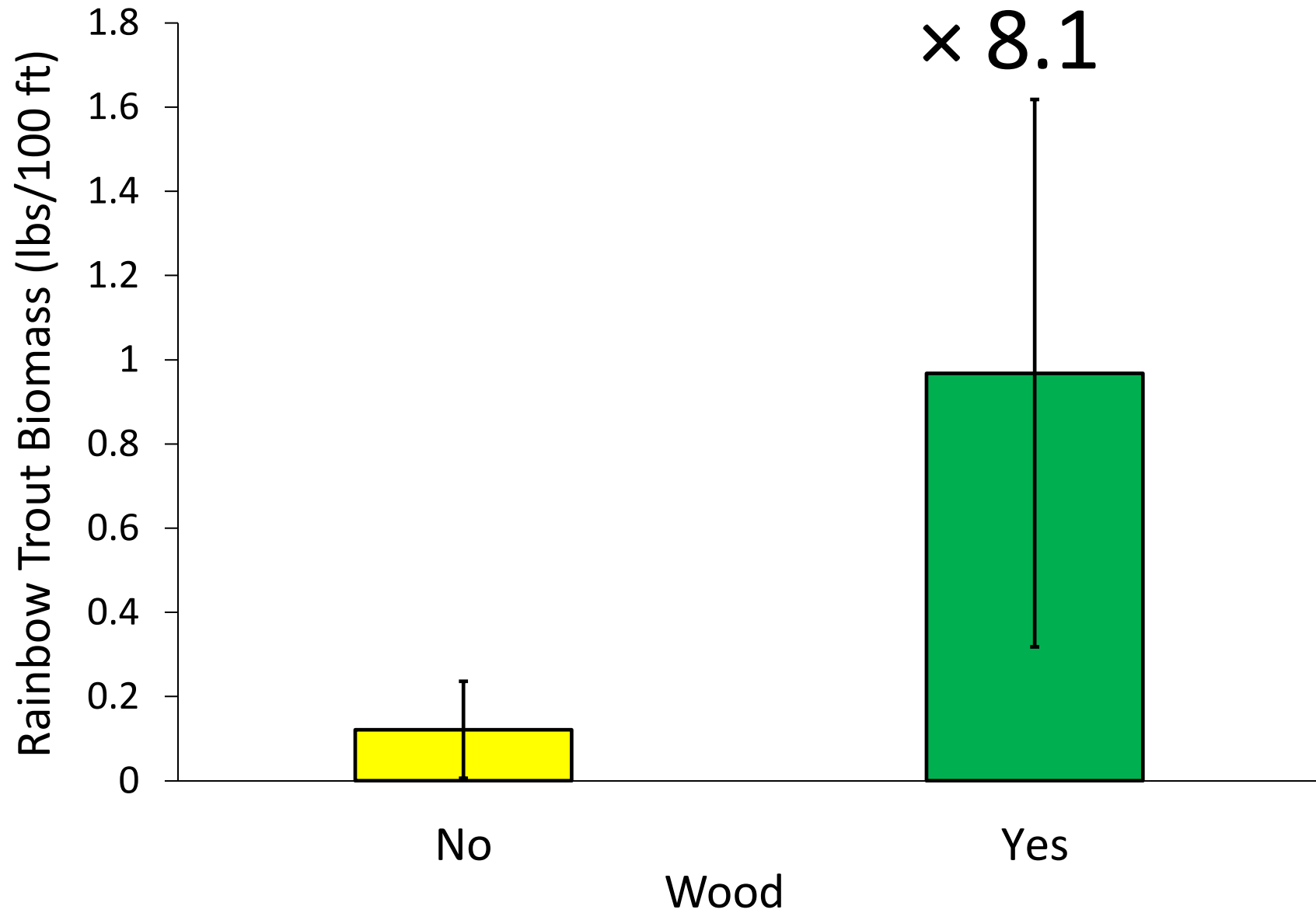
Results

Which factors were most effective at explaining variability in Rainbow Trout biomass (lbs of Trout/ 100 ft of pool)?

- Year
- **Wood presence**
- Pool type
- Residual pool depth
- Pool length
- Upstream riffle length



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Summary



Large wood-treated lateral scour pools created & maintained the deepest pool conditions



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Wood presence was associated with increased abundance & biomass for Rainbow Trout and the Total fish present within pools



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Summary



Large wood-treated lateral scour pools created & maintained the deepest pool conditions



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WOOD IS GOOD for increasing Brown Trout population metrics regardless of construction type (Haphazard or Undercut Toewood)



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Acknowledgements



Acknowledgements

Vocation Heavy Construction Technology program (Buena Vista Corrections):
Tom Bowen, Tom Foreman, Rich Smythe, and the inmates

CPW:
Tyler Swarr (Fish Bio), Bill Rivale (Property Technician), Jeff Spohn (Senior Bio), Tyler Stoltzfus (DWM), Aquatic Biologist Technicians, volunteers

My Research Technicians:
Sam Graf, Matt Robinson, Mallory Allgeier

My Mentors on this project:
Rod VanVelson, Dave Bidelspach, and Dave Rosgen

