

# Evaluating the effects of agricultural drainage ditches on water levels in Wisconsin's central sands

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Wisconsin Geological and Natural History Survey



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Wisconsin Geological &  
Natural History Survey

# Acknowledgements

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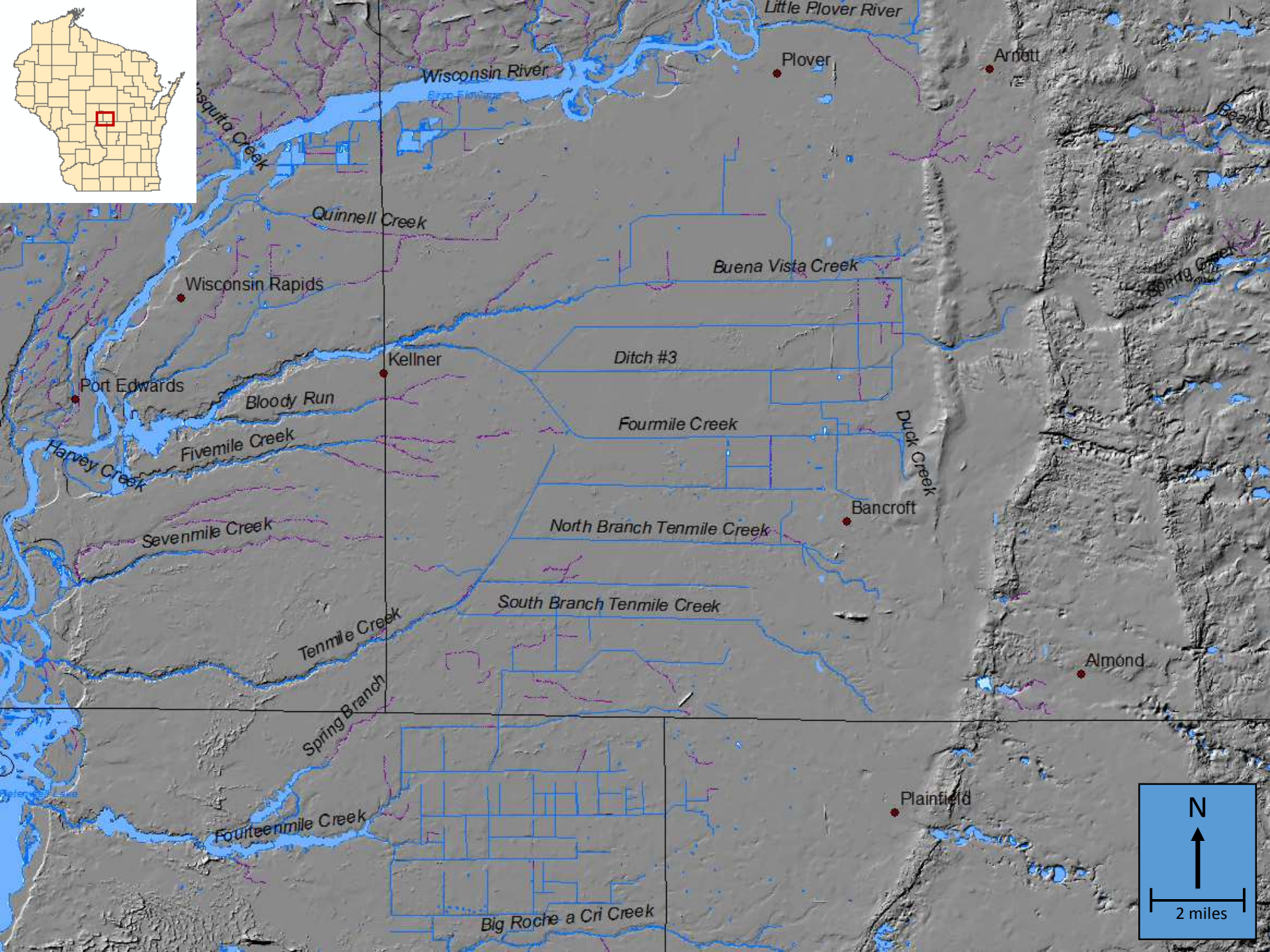
- **USDA – NRCS Conservation Innovation Grant**
- **UW – Madison Department of Horticulture**

**Ken Bradbury, WGNHS, served as project advisor**

**Steve Mael, WGNHS, provided GIS assistance**



**Wisconsin Geological & Natural History Survey**



# Fish Lake near Hancock

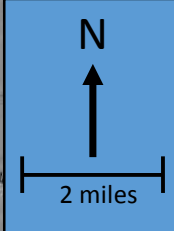
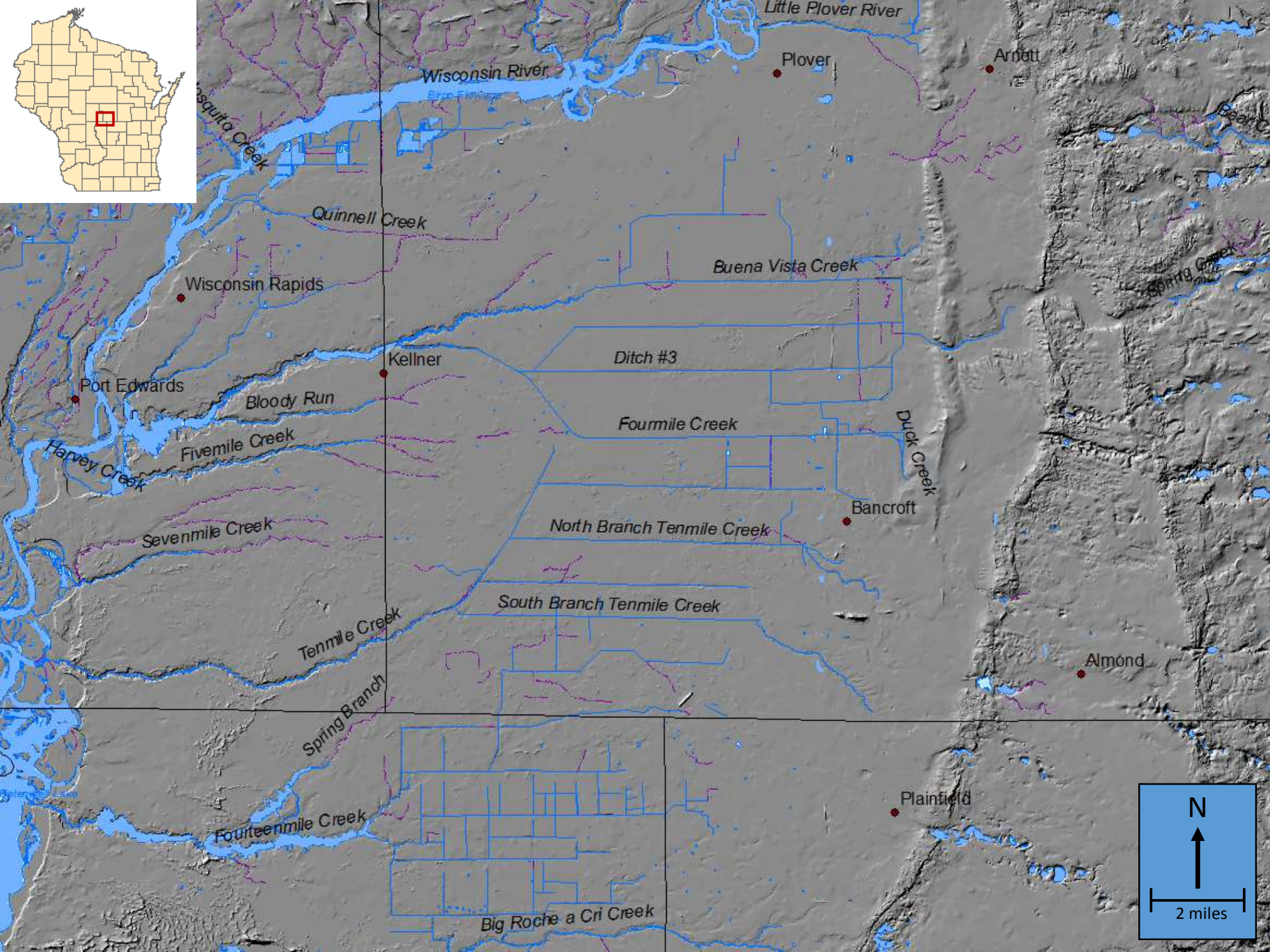


(Friends of the Central Sands on Facebook)

# Huron Lake near Plainfield



(Friends of the Central Sands on Facebook)

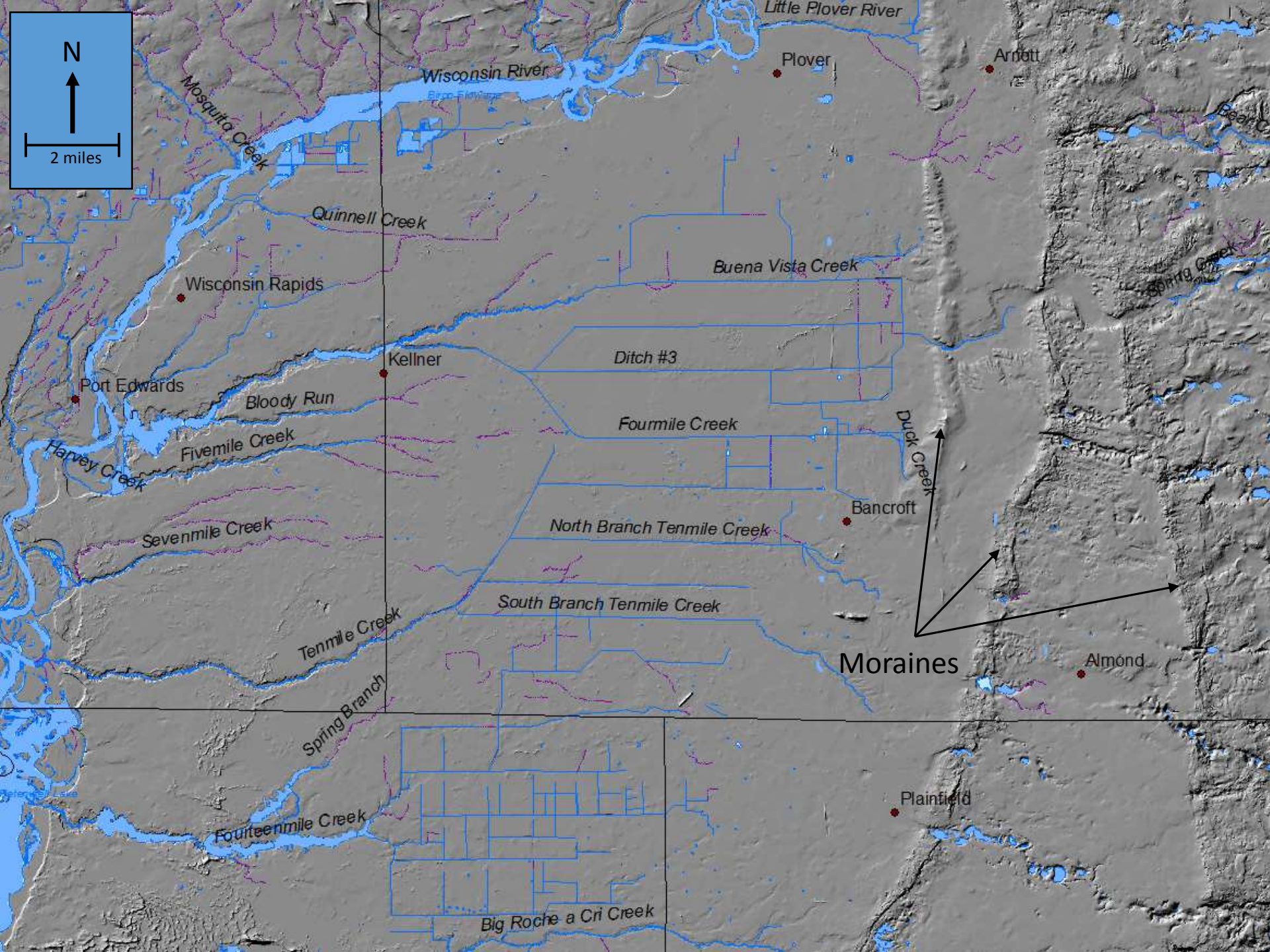




(Seth McClure, WDATCP)

# Pre-Ditch Model Development





N

2 miles

Wisconsin River

Mosquito Creek

Plover

Arnett

Quinnell Creek

Wisconsin Rapids

Buena Vista Creek

Ditch #3

Port Edwards

Bloody Run

Kellner

Fourmile Creek

Harvey Creek

Fivemile Creek

Duck Creek

Bancroft

Sevenmile Creek

North Branch Tenmile Creek

South Branch Tenmile Creek

Tenmile Creek

Moraines

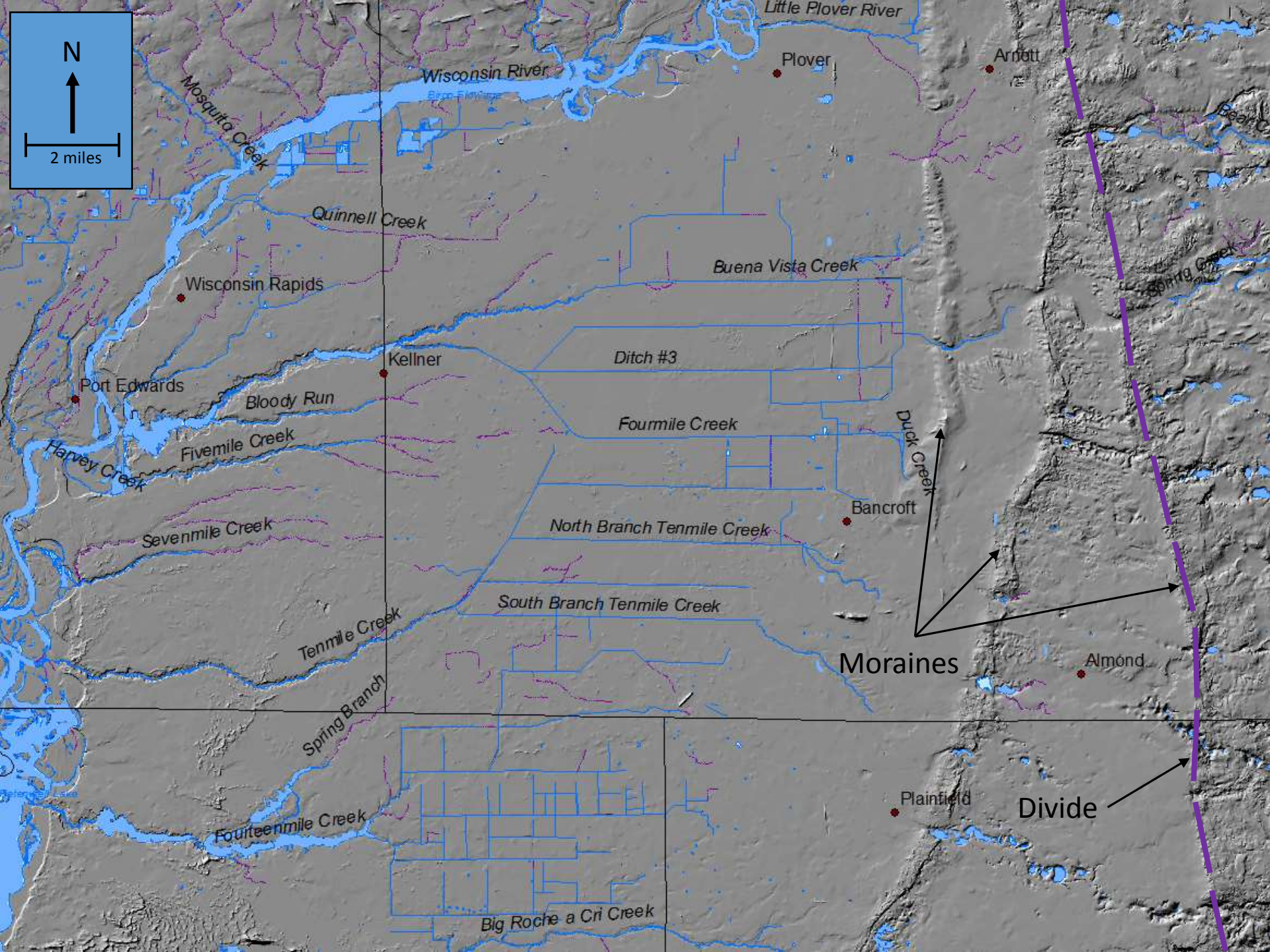
Almond

Spring Branch

Fourteenmile Creek

Plainfield

Big Roche a Cri Creek



N

2 miles

Wisconsin River

Plover

Arnett

Mosquito Creek

Quinnell Creek

Buena Vista Creek

Wisconsin Rapids

Ditch #3

Port Edwards

Bloody Run

Kellner

Fourmile Creek

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Bancroft

Sevenmile Creek

North Branch Tenmile Creek

Moraines

Almond

Tenmile Creek

South Branch Tenmile Creek

Divide

Fourteenmile Creek

Plainfield

Spring Branch

Big Roche a Cri Creek

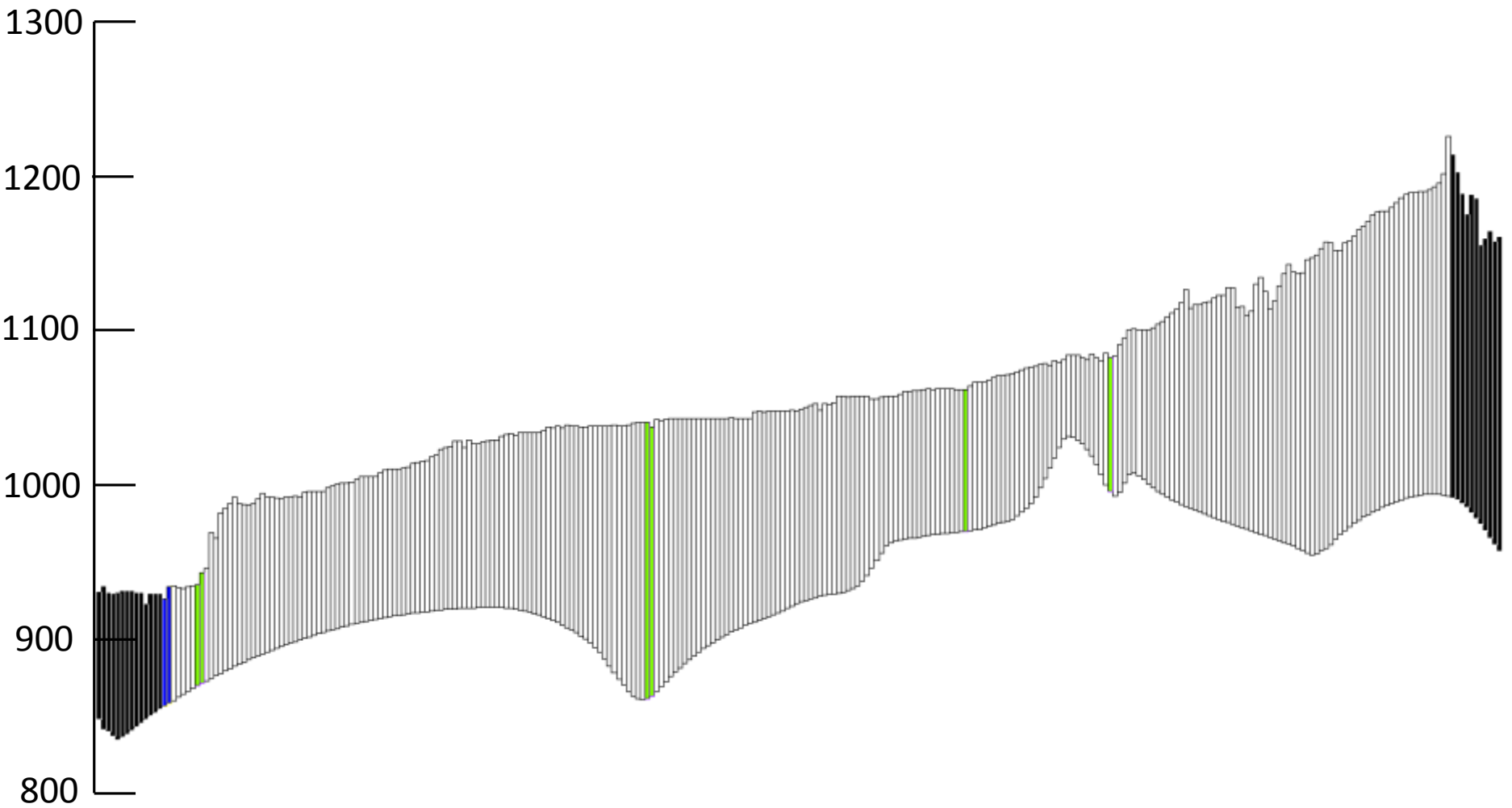
West

East

1300  
1200  
1100  
1000  
900  
800

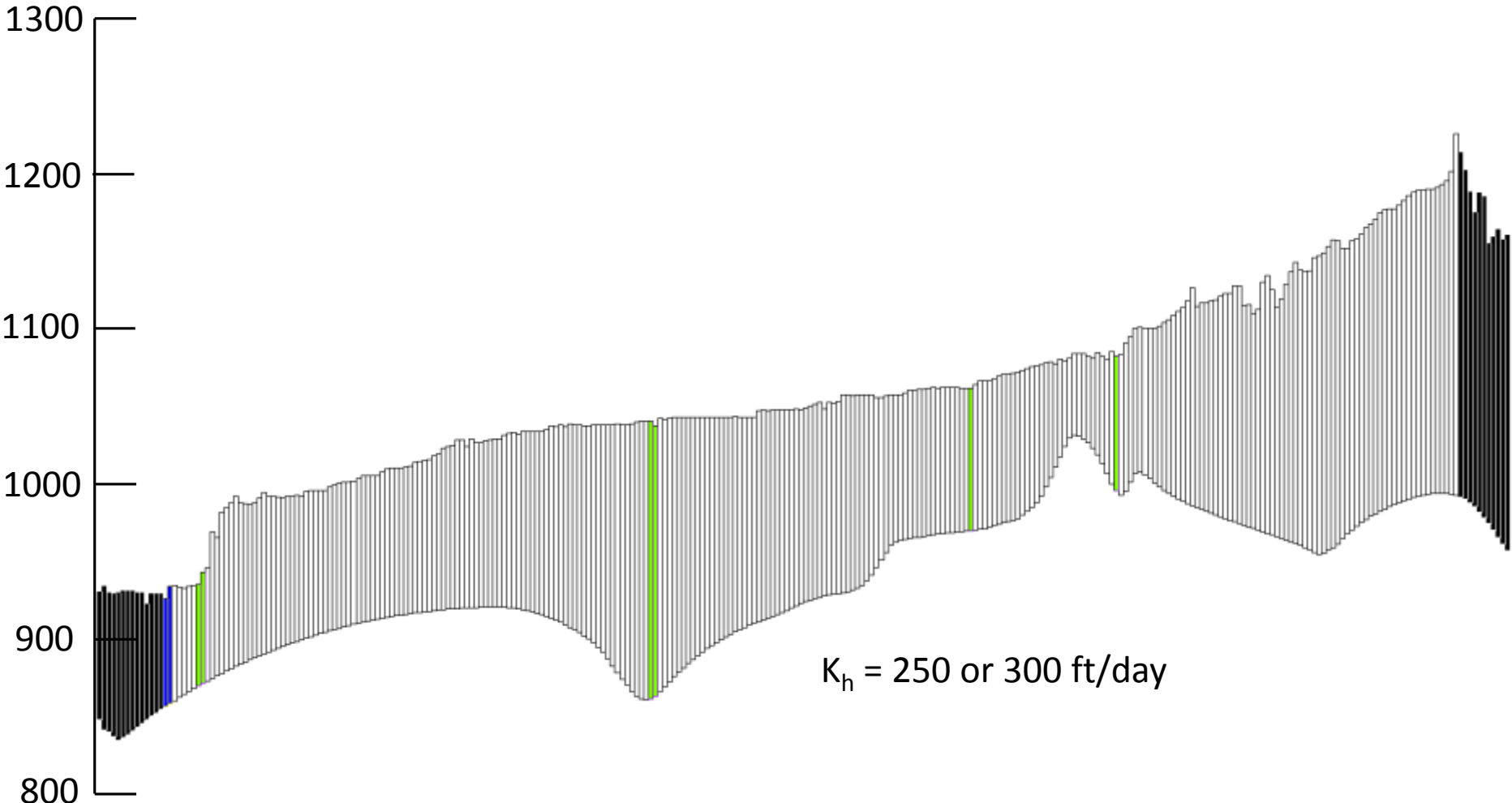
Elevation  
(ft amsl)

Vertical exaggeration = 170:1



West

East



$K_h = 250$  or  $300$  ft/day

Elevation  
(ft amsl)

Vertical exaggeration = 170:1

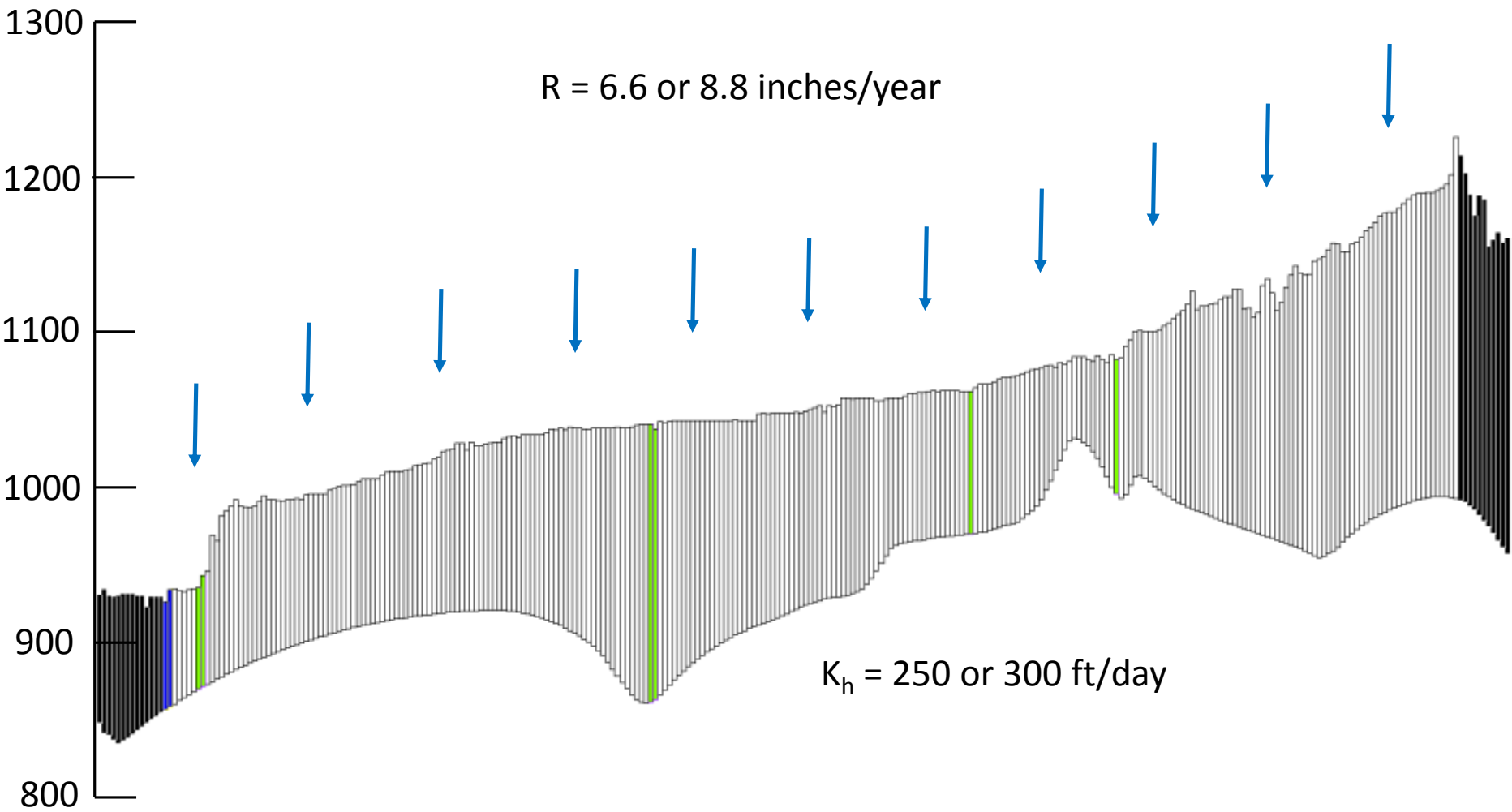
West

East

$R = 6.6$  or  $8.8$  inches/year

$K_h = 250$  or  $300$  ft/day

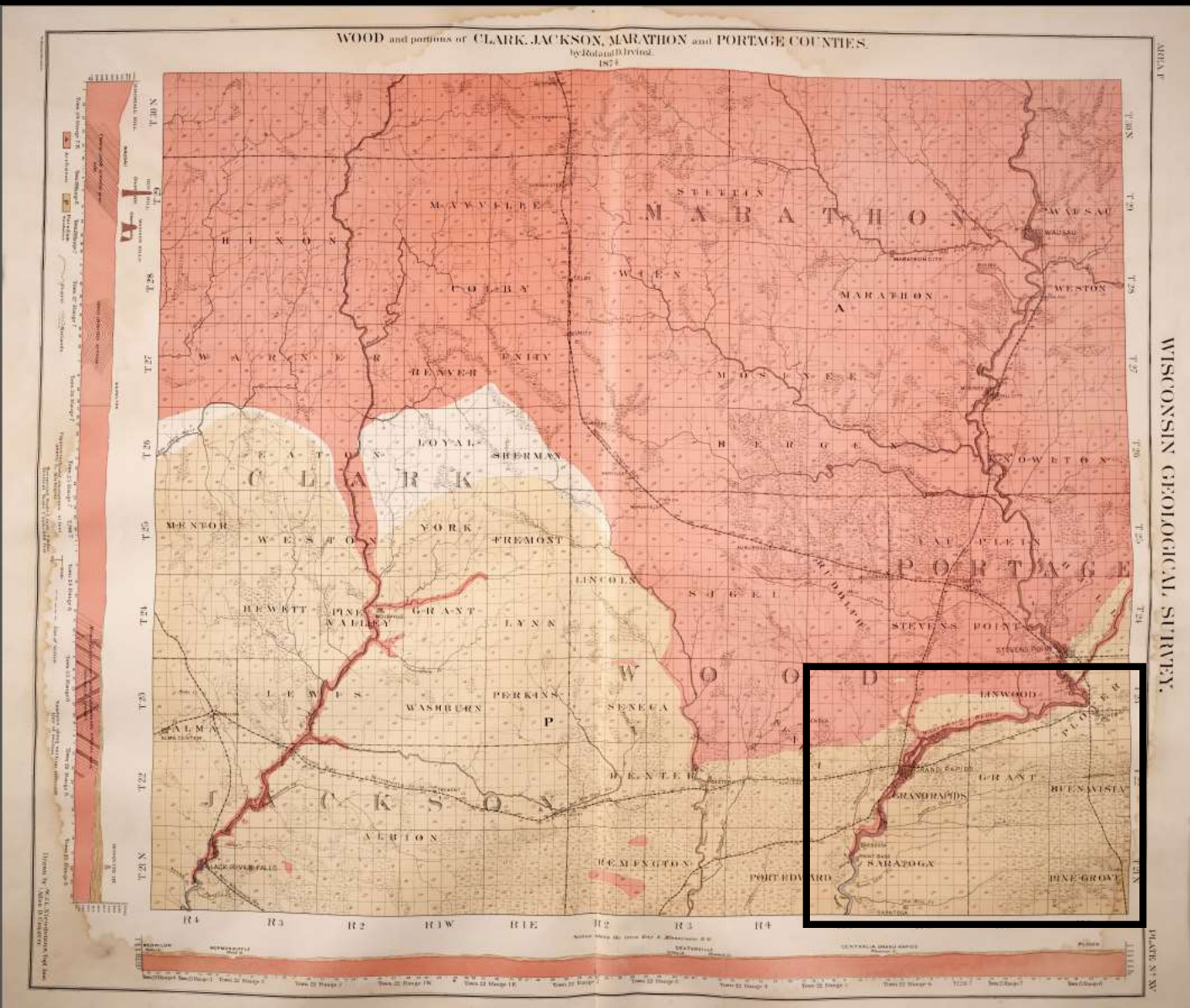
Vertical exaggeration = 170:1



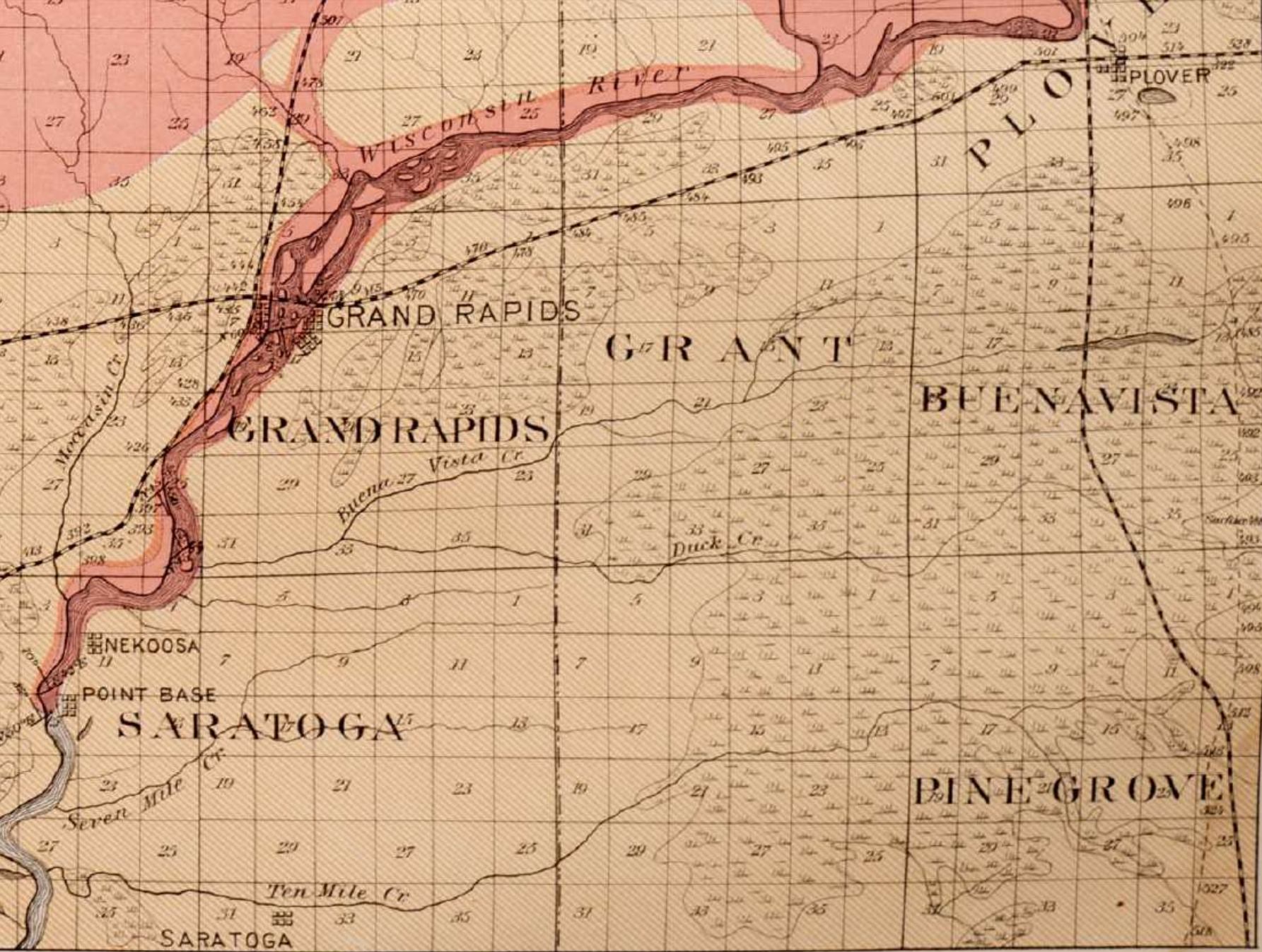
Elevation  
(ft amsl)

# Pre-Ditch Stream Network

WOOD and portions of CLARK, JACKSON, MARATHON and PORTAGE COUNTIES.  
by Roland D. Irving.  
1874.



T.C. Chamberlin, Geology of Wisconsin, Survey of 1873-1879, Atlas



3

T 22

T 21 N

R 5

R 6

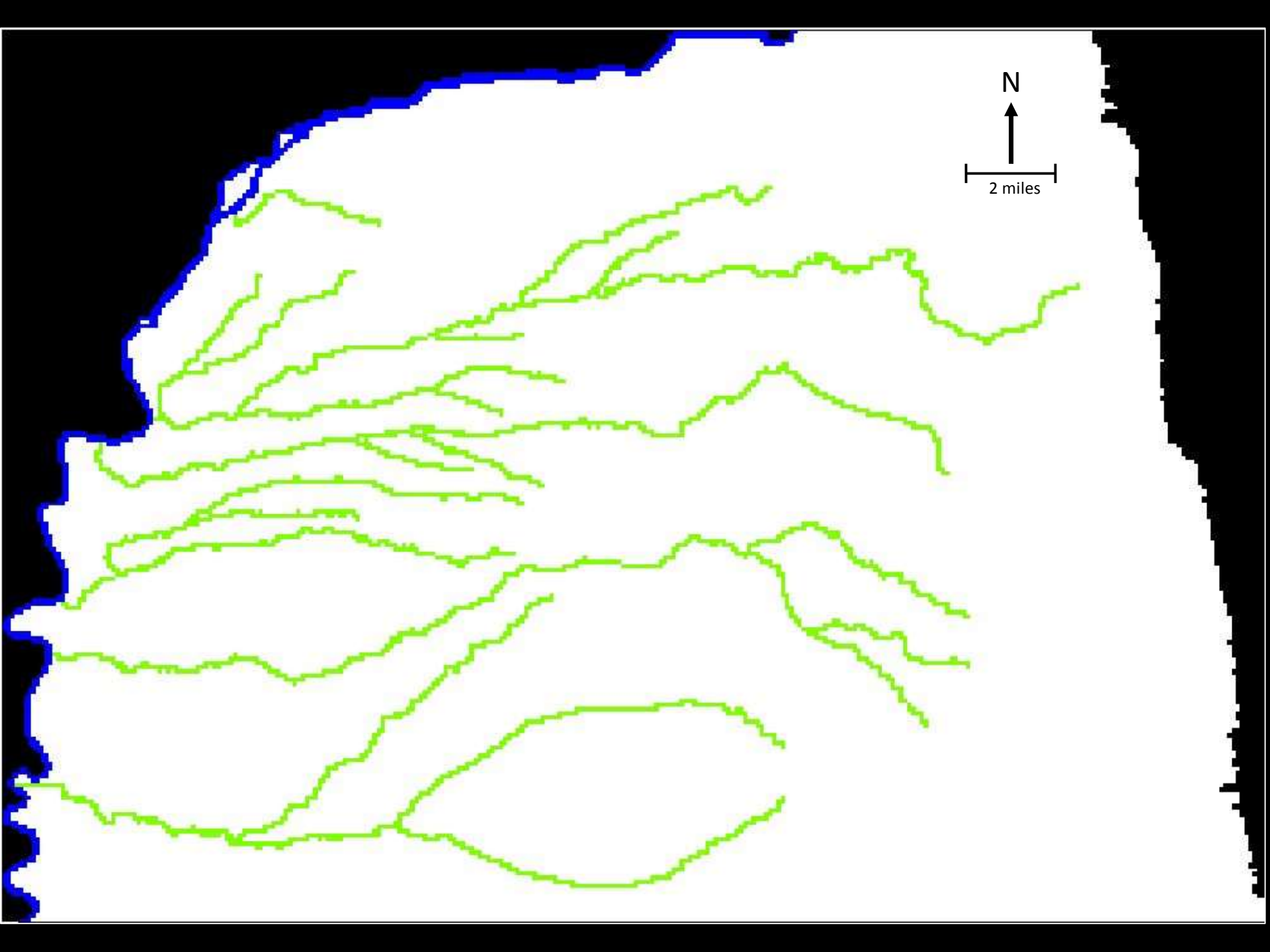
R 7

R 8

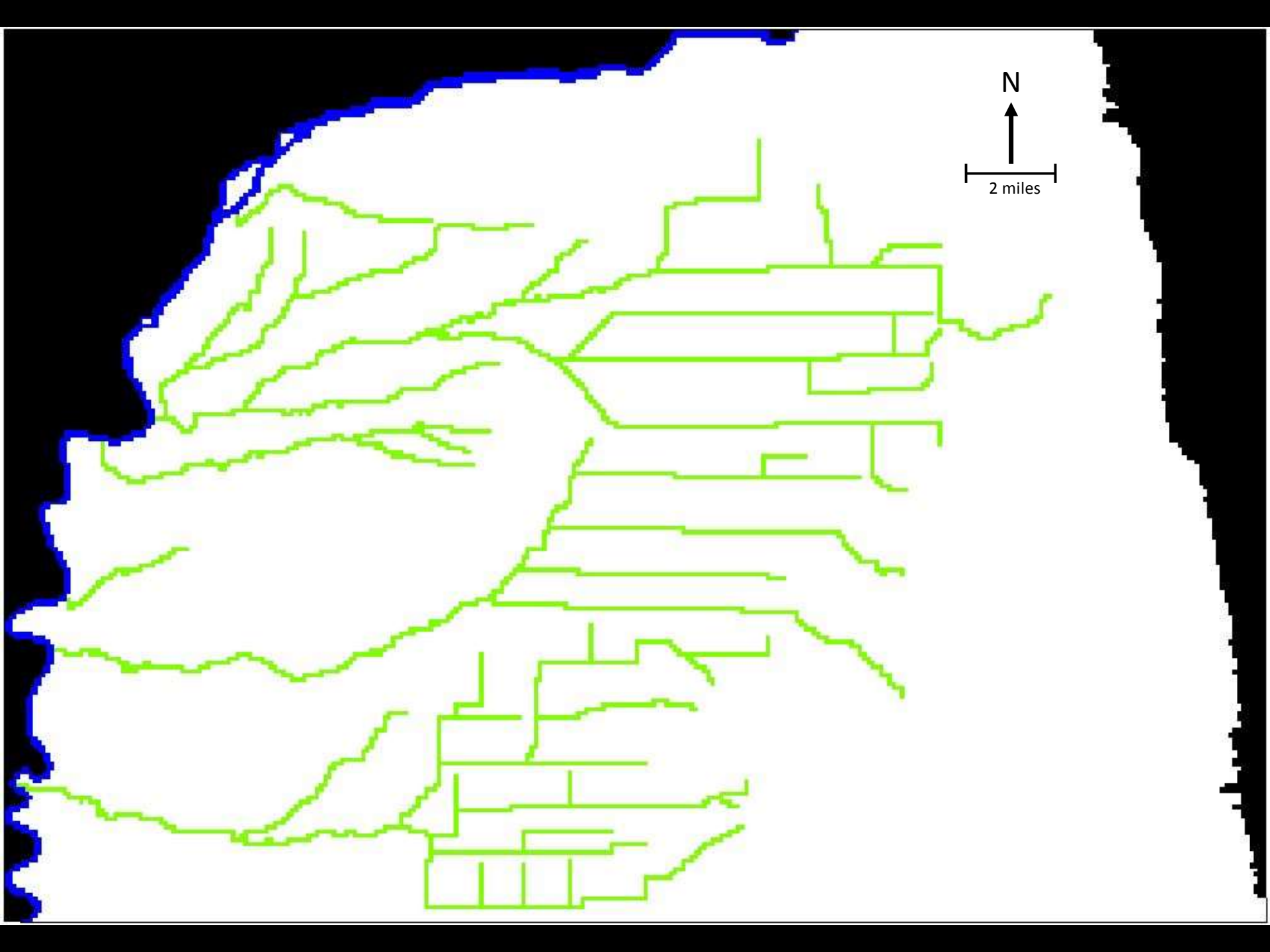


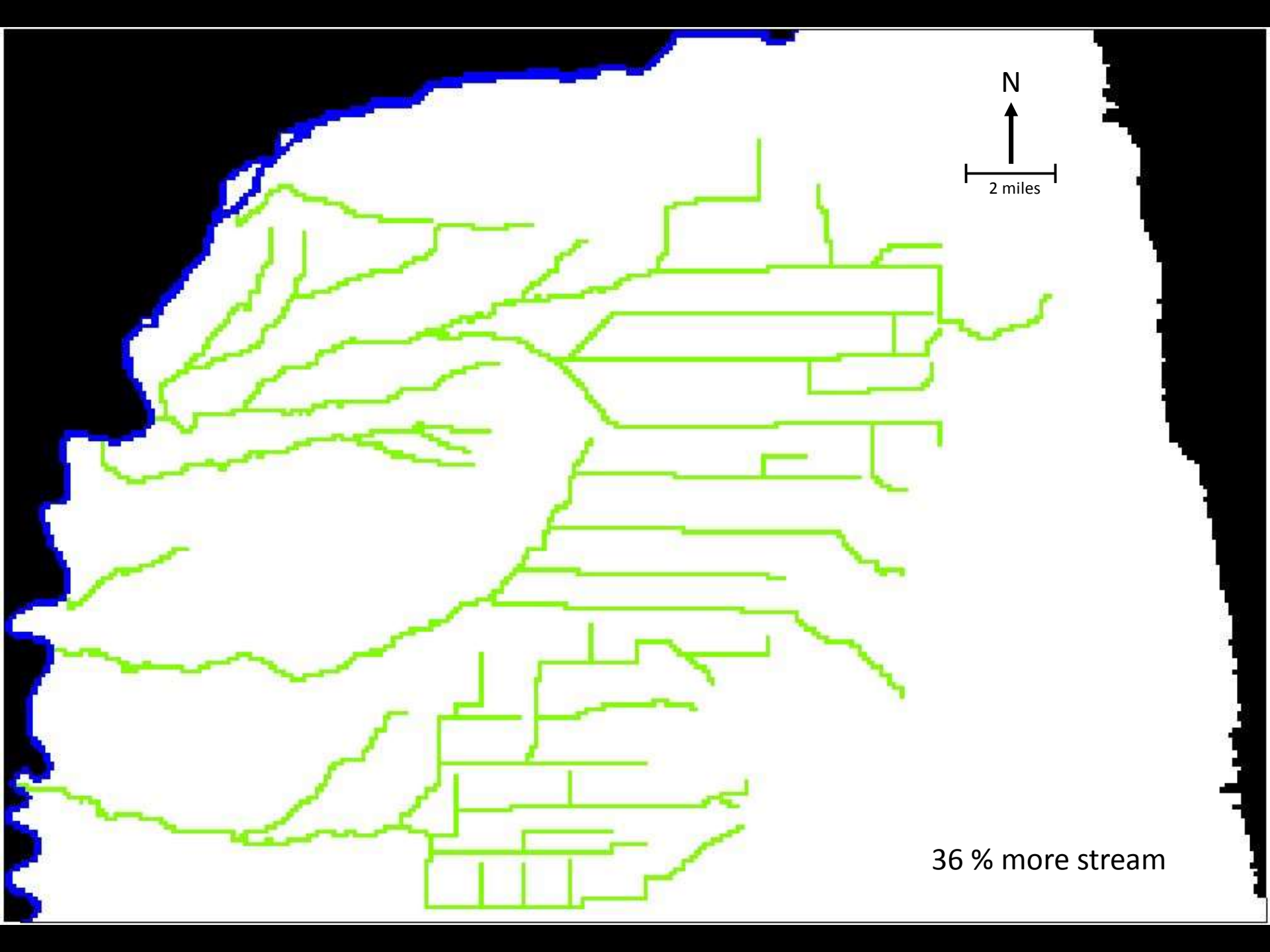






# Post-Ditch Model Development





N



2 miles

36 % more stream

# Summary of Assumptions, etc.

- **Steady-state**
- **Models not calibrated**
- **Uniform K (250 or 300 ft/day)**
- **Uniform R (6.6 or 8.8 in/yr)**
- **Uniform streambed thickness (3 ft)**
- **Uniform streambed K (10 ft/day)**
- **No pumping**

**Steady-state pre-ditch head**

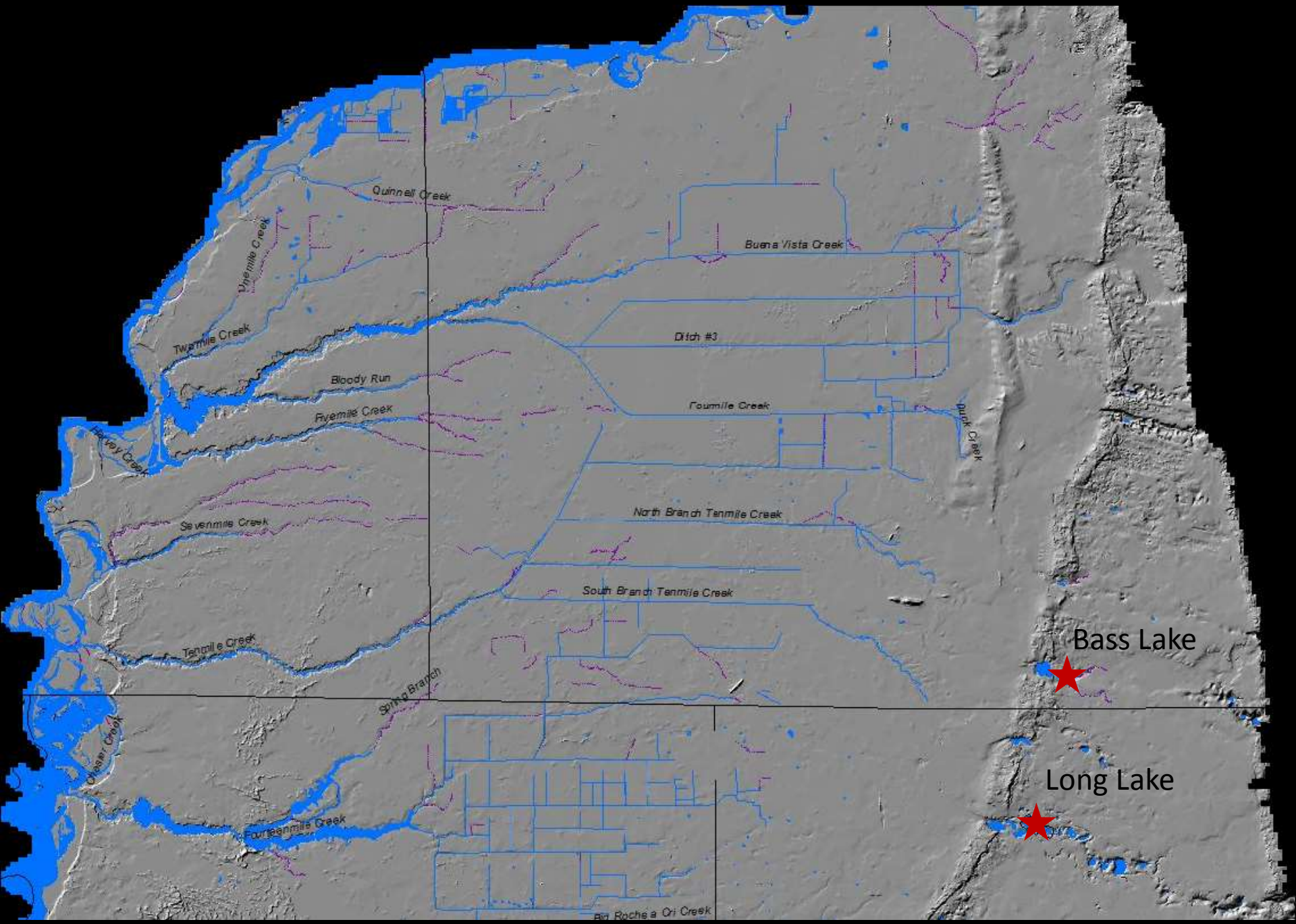
**–**

**Steady-state post-ditch head**

**=**

**Steady-state drawdown caused  
by ditching**



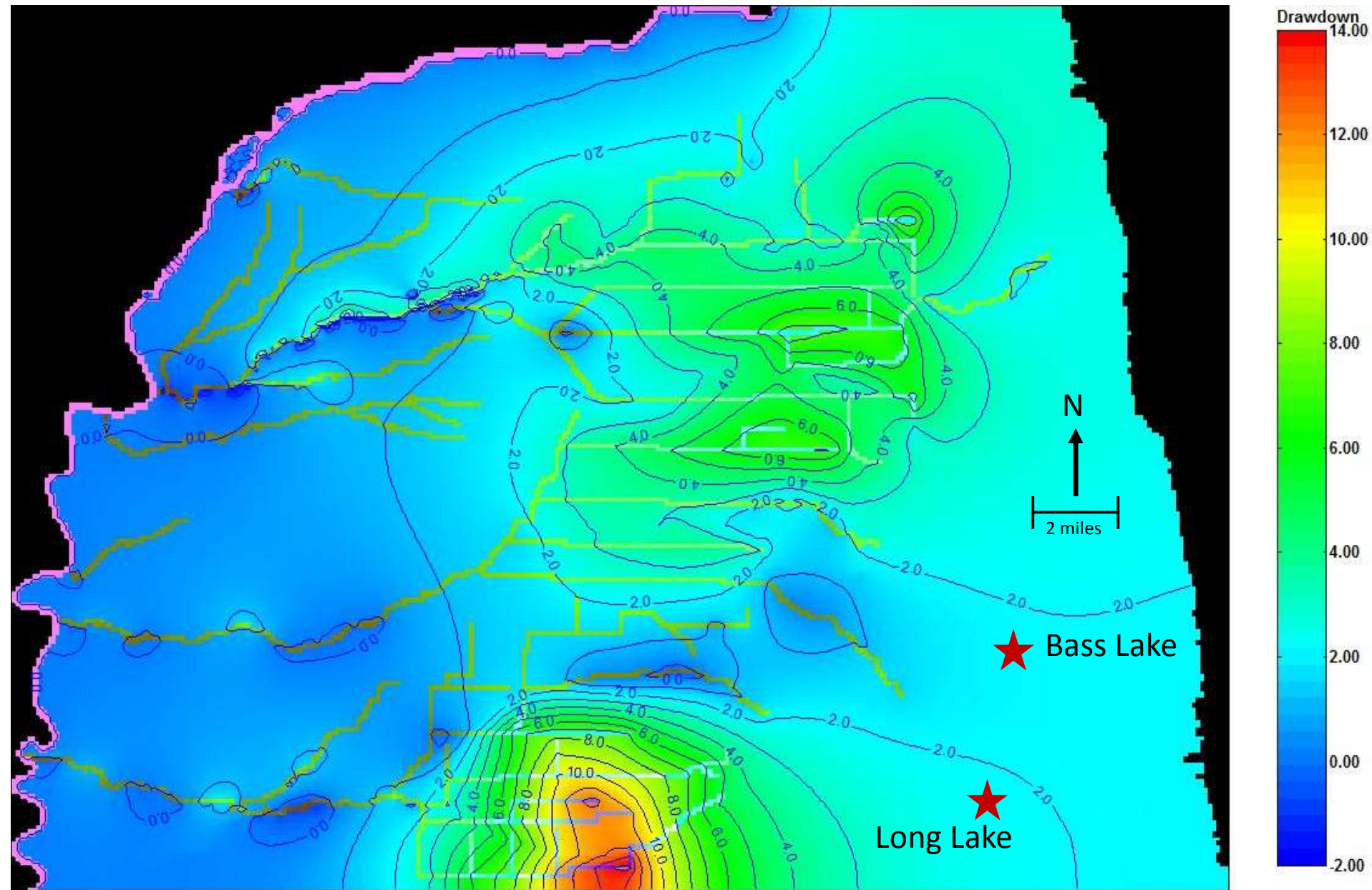


Bass Lake

Long Lake



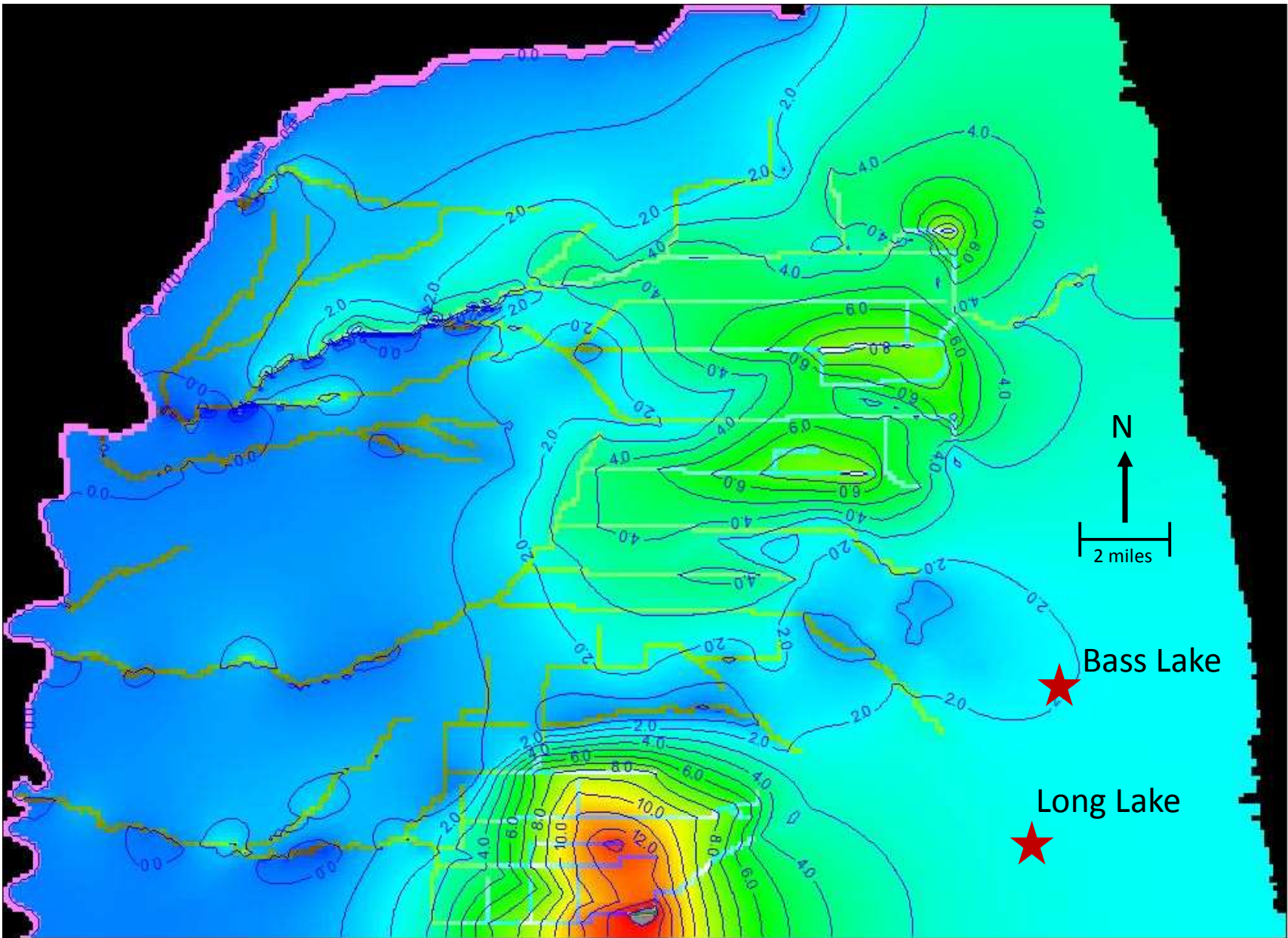
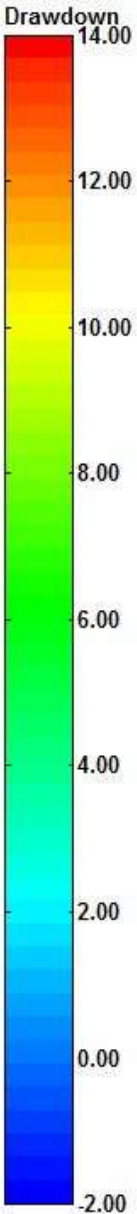
# Contoured Drawdown (ft)



$R = 6.6 \text{ in/yr}$

$K_h = 300 \text{ ft/day}$

# Contoured Drawdown (ft)



$R = 8.8 \text{ in/yr}$

$K_h = 300 \text{ ft/day}$

# Results

Scenario	R (in/yr)	$K_h$ (ft/day)	Bass Lake Drawdown (ft)	Long Lake Drawdown (ft)
1	6.6	250	1.9	2.1
2	8.8	250	1	1.6
3	8.8	300	2	2.3
4	6.6	300	1.9	2.1

# Conclusion

- **Modeling suggests that installation of drainage ditches may have caused 1 or 2 feet of lake drawdown**
- **Raising lake levels by 1 or 2 feet would require re-flooding the ditched fields**

