



U.S. Fish and Wildlife Service

Josh Eash  
USFWS  
6/30/2015

# EVALUATING HYDROLOGIC RECONNECTION OF THE ROOT RIVER TRACT

Upper Mississippi River National  
Wildlife and Fish Refuge

National Wildlife Refuge System





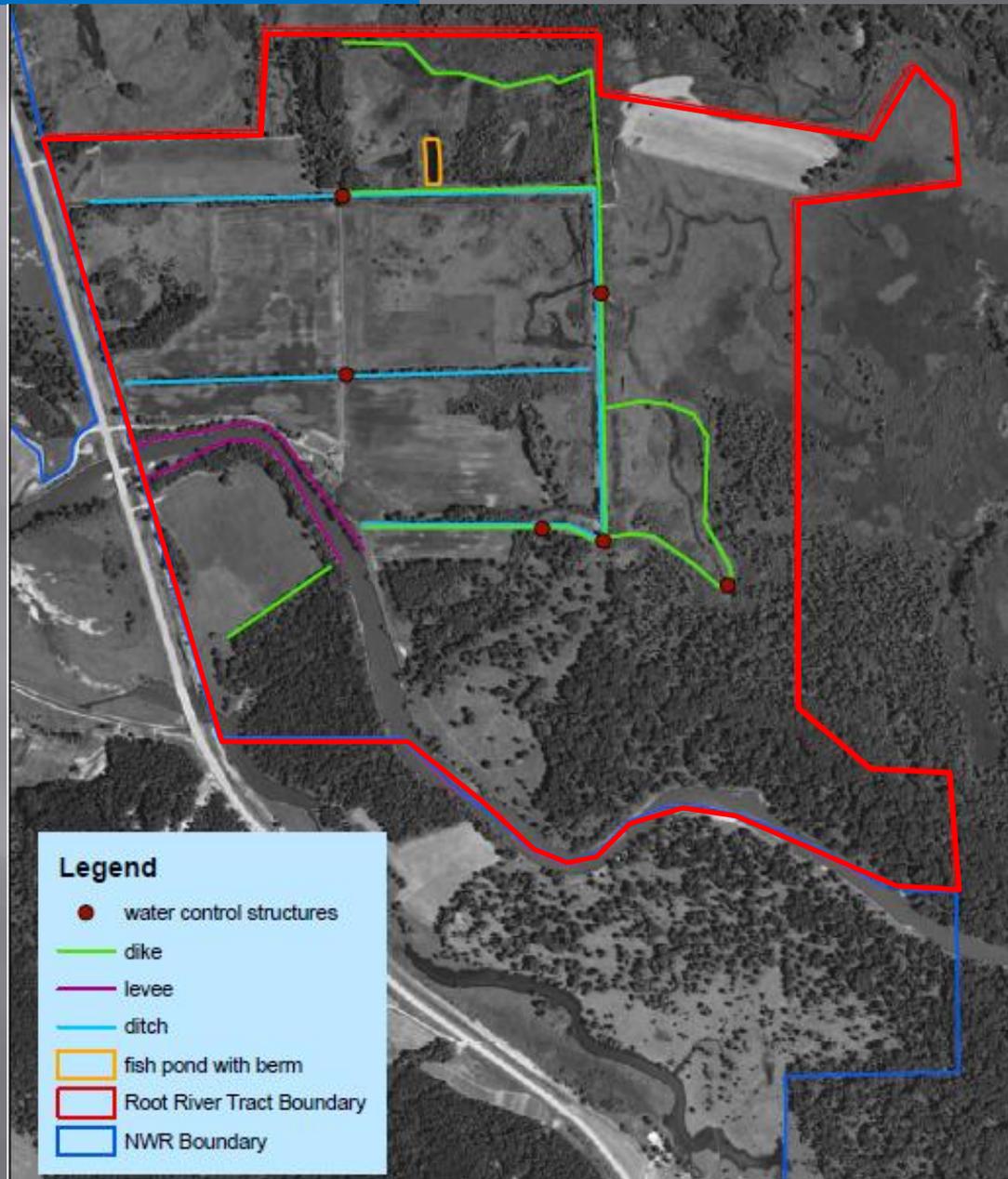
# Basic Hydrology





1.25 miles

© 2015 Google





5-9-1958





4-26-1962

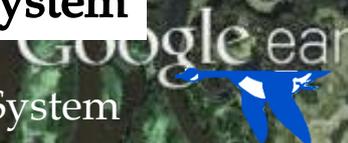




# Source Water Locations and Timing Based on Elevation



**Note: Seasonal occurrence and timing of inundation depends on river system**





# Information, Data and Studies





## 2003 FLOW FREQUENCY STUDY FLOOD PROFILES NGVD 1929

100 year Profile  
2003 Study  
minus  
1979 Study

Location	RIVER MILE	FREQUENCY								1979 Study	100 year Profile 2003 Study minus 1979 Study
		2 year	5 year	10 year	25 year	50 year	100 year	200 year	500 year		
LD 7 TW	702.47	637.3	640	641.6	643.3	644.4	645.5	646.5	648	646.4	-0.9
	702.32	637.2	640	641.5	643.2	644.3	645.4	646.4	647.9	646.1	-0.7
	702.17	637.2	639.9	641.5	643.1	644.3	645.3	646.4	647.8	645.9	-0.6
	701.93	637.2	639.9	641.5	643.1	644.2	645.3	646.4	647.8	645.8	-0.5
	701.82	637.2	639.9	641.4	643	644.1	645.2	646.3	647.7	645.7	-0.5
	701.76	637.2	639.9	641.4	643	644.1	645.2	646.2	647.7	645.7	-0.5
	701.66	637.1	639.8	641.4	643	644.1	645.2	646.2	647.6	645.7	-0.5
	701.28	637.1	639.8	641.3	642.9	644	645.1	646.1	647.5	645.5	-0.4
	700.85	637	639.7	641.3	642.8	643.9	645	646	647.4	645.3	-0.3
	700.37	637	639.6	641.1	642.7	643.8	644.8	645.9	647.2	645	-0.2
	700.22	636.9	639.6	641.1	642.6	643.7	644.7	645.8	647.1	644.9	-0.2
	700.17	636.9	639.5	641	642.6	643.6	644.7	645.7	647.1	644.9	-0.2
	700.06	636.9	639.5	641	642.5	643.6	644.6	645.6	647	644.9	-0.3
	699.8	636.8	639.4	640.9	642.4	643.4	644.5	645.5	646.9	644.7	-0.2
	699.74	636.8	639.4	640.9	642.4	643.4	644.5	645.5	646.8	644.7	-0.2
La Crosse River	699.36	636.7	639.3	640.8	642.3	643.3	644.3	645.3	646.7	644.5	-0.2
	699.06	636.6	639.2	640.6	642.1	643.1	644.1	645.1	646.4	644.4	-0.3
	698.37	636.5	639	640.4	641.8	642.7	643.7	644.7	646	644	-0.3
State Hwy 61 Bridge	697.52	636.3	638.7	640.1	641.4	642.2	643.2	644.1	645.4	642.9	0.3
	697.47	636.2	638.5	639.9	641.2	642	643	643.9	645.1	642.9	0.1
	697.42	636.2	638.5	639.9	641.1	642	642.9	643.8	645	642.9	0
	697.38	636.1	638.4	639.8	641	641.8	642.7	643.6	644.8	642.9	-0.2
	697.22	636	638.3	639.7	640.9	641.7	642.5	643.4	644.6	642.8	-0.3
	696.94	635.9	638.2	639.5	640.7	641.5	642.3	643.1	644.3	642.6	-0.3
	696.75	635.9	638.1	639.4	640.6	641.4	642.2	643	644.2	642.5	-0.3
	696.56	635.8	638	639.3	640.5	641.2	642	642.8	644	642.4	-0.4
	696.34	635.7	637.8	639.1	640.3	641	641.8	642.6	643.8	642.2	-0.4
	696.2	635.6	637.7	638.9	640.1	640.8	641.6	642.4	643.6	642.1	-0.5
	696.03	635.4	637.5	638.7	639.9	640.6	641.4	642.2	643.4	642	-0.6
	695.61	635.3	637.3	638.5	639.6	640.4	641.2	642	643.2	641.8	-0.6
Root River	695.12	635.1	637.1	638.3	639.4	640.1	640.9	641.8	642.9	641.5	-0.6
	694.74	635	636.9	638.1	639.2	639.9	640.7	641.6	642.8	641.2	-0.5
	694.32	634.8	636.7	637.9	639	639.8	640.6	641.4	642.6	640.9	-0.3
	693.99	634.6	636.5	637.6	638.8	639.5	640.3	641.2	642.4	640.7	-0.4
	693.53	634.3	636.1	637.2	638.4	639.2	640	640.9	642.1	640.4	-0.4







Flood Frequency for Water Surface Elevations at River Mile 696.3 of the Mississippi River, the location deemed most representative of water levels that will inundate the Tract.

Flood Frequency	Stage in feet (NAVD, 1988)
2-year	635.6
5-year	637.7
10-year	639.0
25-year	640.2
50-year	640.9
100-year	641.7





# LiDAR

(Light Detection and Ranging)  
(Nov. 2008)

Limited accuracy  
in areas of dense  
vegetation

Elevation

High : 655.8'



Low : 629.4'

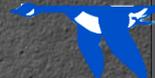
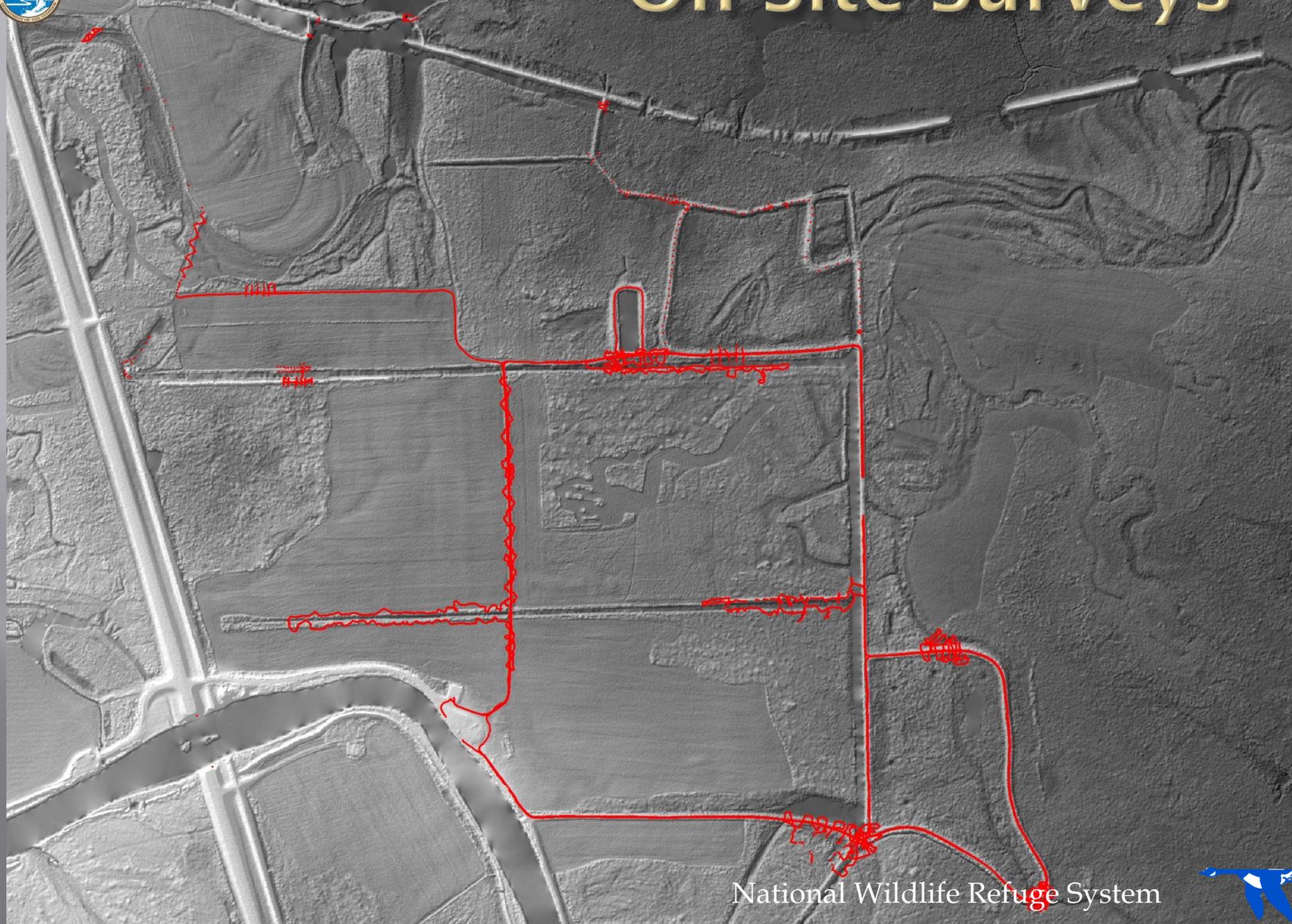
N

0 0.1 0.2 Miles





# On Site Surveys

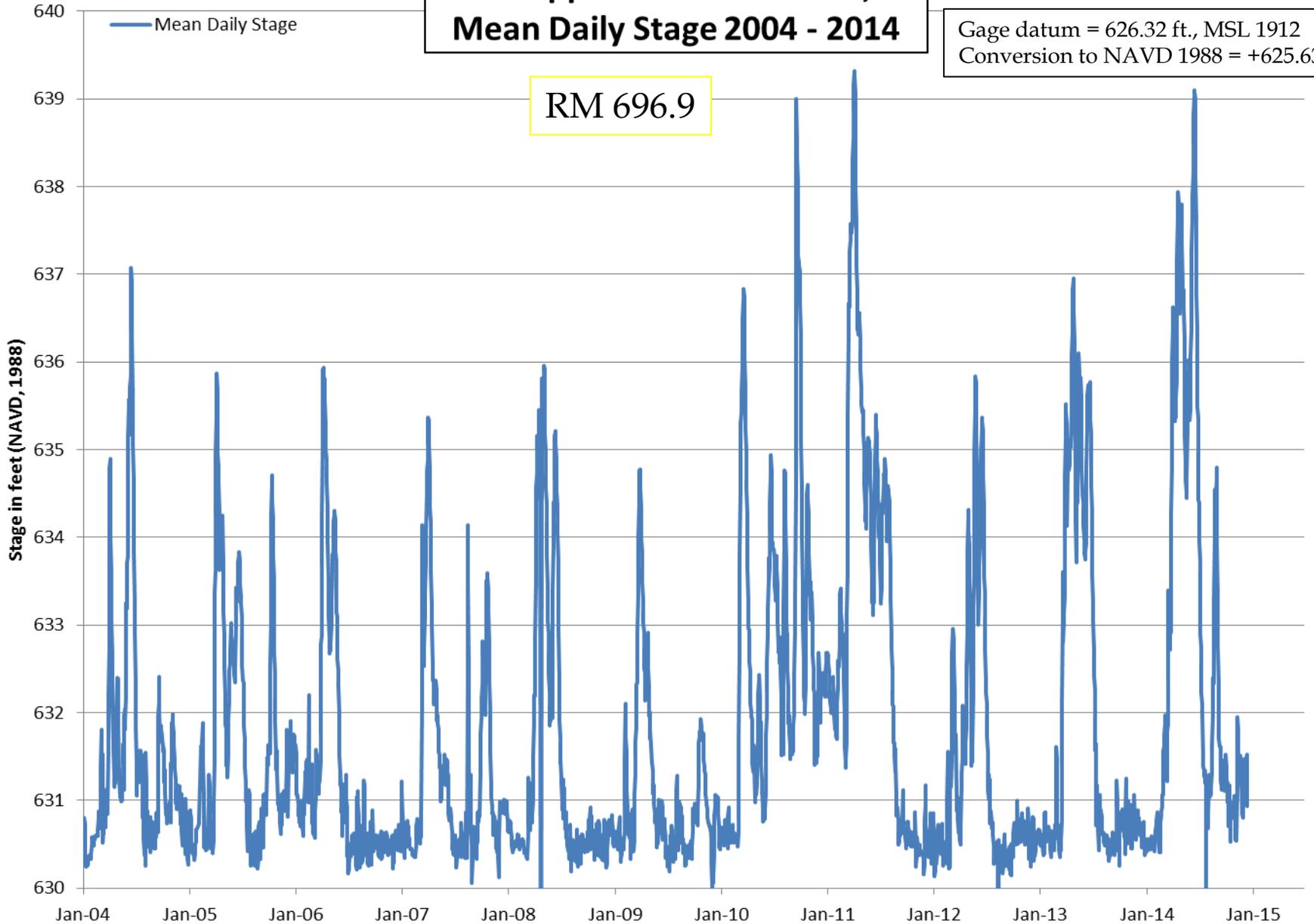




### Mississippi River at LaCrosse, WI Mean Daily Stage 2004 - 2014

Gage datum = 626.32 ft., MSL 1912  
Conversion to NAVD 1988 = +625.63 ft.

RM 696.9





# Days per Range of Stage on the Mississippi River at La Crosse, WI: 2004 - 2014

Stage	Average # of days per Year
Between 633 - 634 ft.	27
Between 634 - 636 ft.	42
Between 636 - 638 ft.	12
Between 638 - 640 ft.	3
Above 633 ft.	83
Above 634 ft.	56
Above 636 ft.	14





AN EVALUATION OF  
ECOSYSTEM RESTORATION AND MANAGEMENT OPTIONS  
FOR THE  
**ROOT RIVER TRACT**  
UPPER MISSISSIPPI RIVER  
NATIONAL WILDLIFE AND FISH REFUGE



Mickey E. Heitmeyer  
Greenbrier Wetland Services  
Advance, MO  
Report No. 10-07

Jessica A. Larson  
U. S. Fish and Wildlife Service  
La Crosse, WI

November 2010





# Among HGM Recommendations

- ▣ Forest: Maintain 2-5 year flood frequency
  - Remove obstructions to inundation and drainage: remove or breach levees / dikes
  - Evaluate east – west connectivity across Hwy 26
- ▣ Wetland
  - Emulate natural hydrologic regimes: spring flood, summer drying and potential late-fall flooding
  - Restore natural topography and drainage patterns: reduce / remove existing infrastructure where possible





I  
MANAGEMENT PLAN FOR THE  
ROOT RIVER TRACT  
UPPER MISSISSIPPI RIVER NATIONAL WILDLIFE AND FISH REFUGE

Prepared for U.S. Fish and Wildlife Service

Prepared by HDR Engineering, Inc.

Minneapolis, MN

October 2011





# HDR Report: Management Alternatives

- 1) No Action Alternative
  - Eventual deterioration of all infrastructure
- 2) Remove Existing Infrastructure Alternative
  - Accelerate 'no action alternative'
- 3) Passive Drainage Improvements Alternative
  - Remove flow impediments and maximize saturated areas to create new or maintain existing saturated areas
- 4) Active Drainage Improvements Alternative
  - Move water in a controlled manner to create moist-soil units to manage water levels in impoundment cells





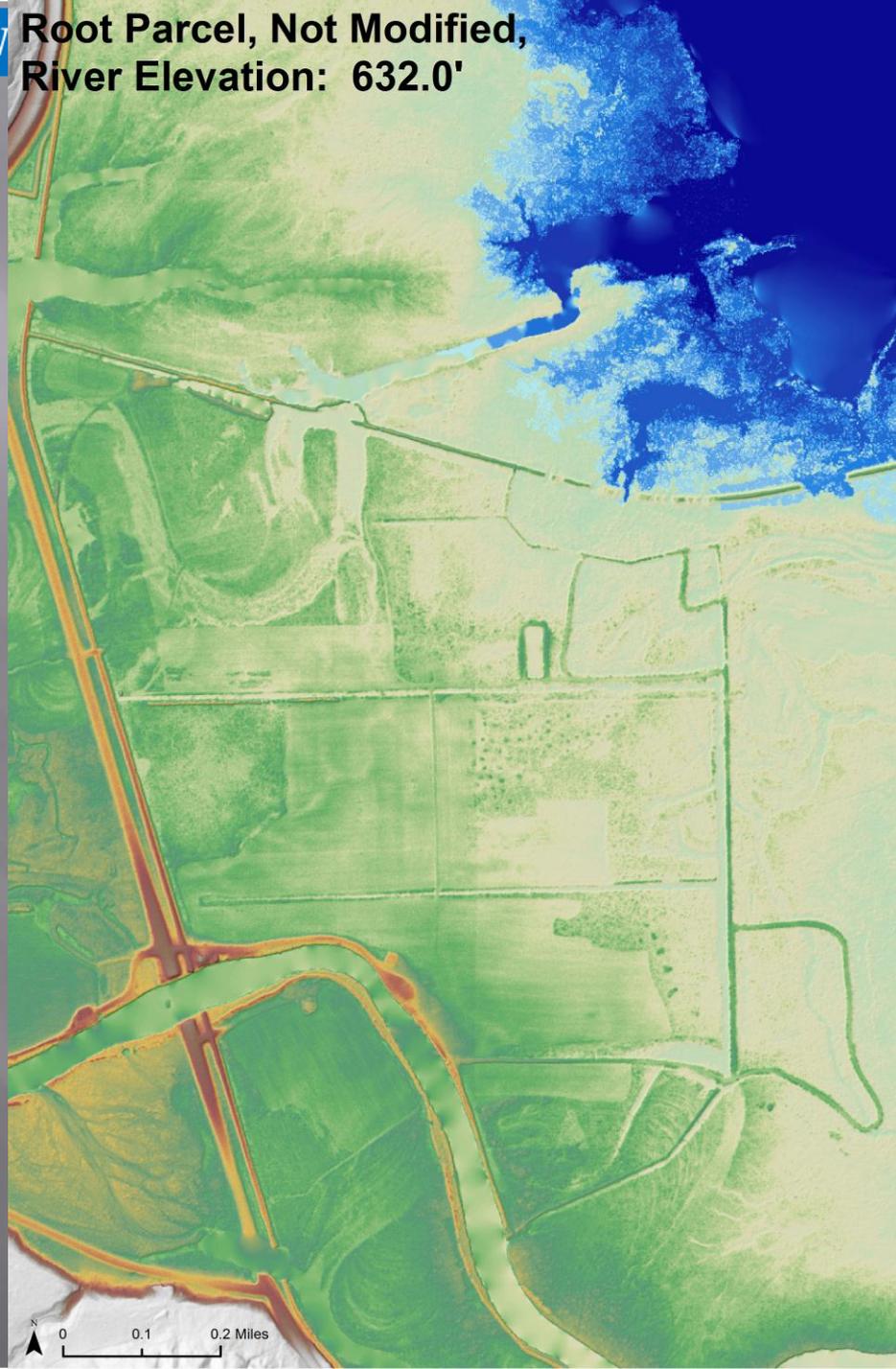
# Water Movement and Ground Surface Elevations

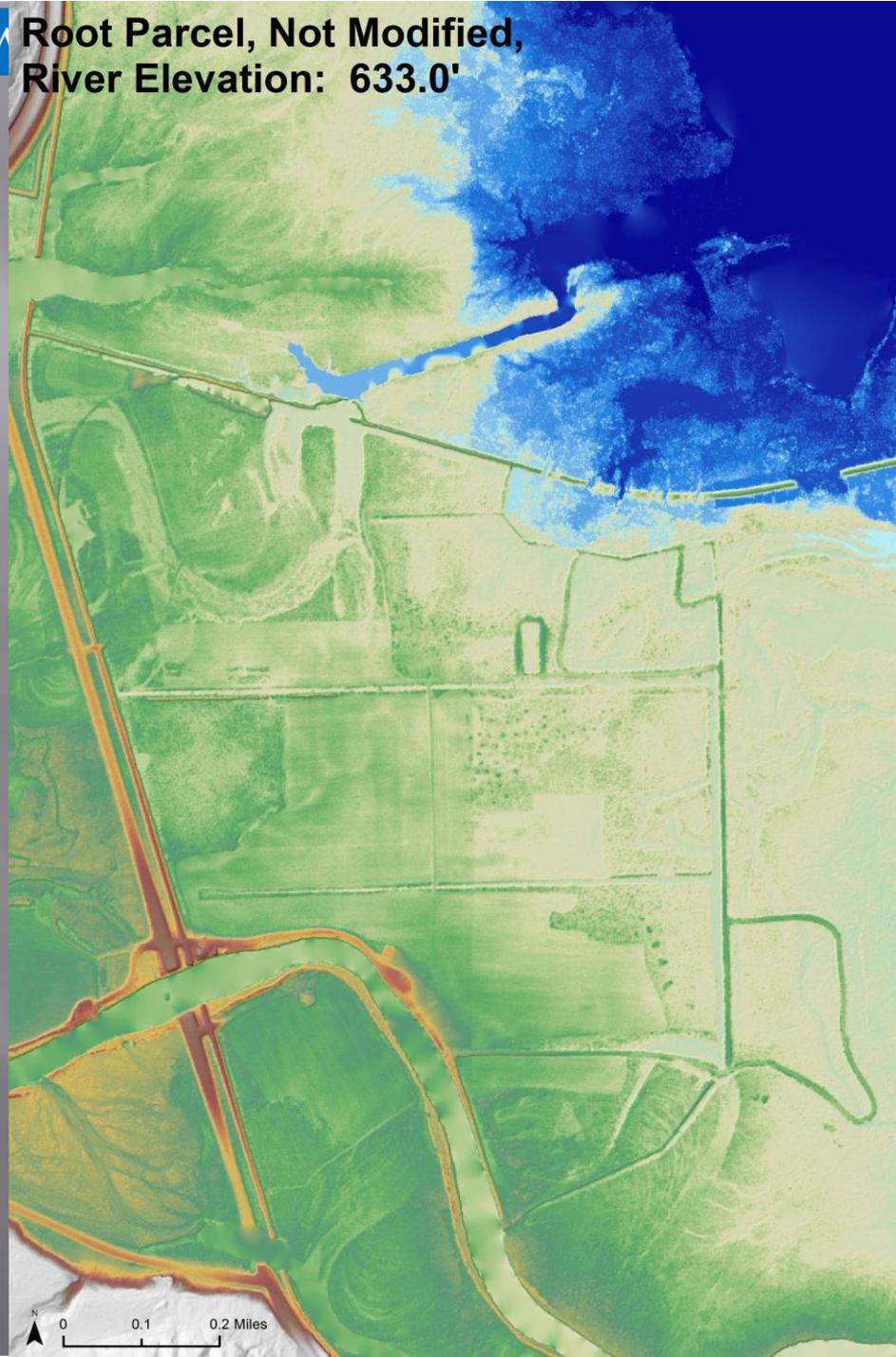
- Tract lies within the Mississippi River floodplain
  - Slope of Mississippi River general runs from north to south
- Tract also lies within the Root River floodplain
  - Slope of Root River runs from west to east
- Land surface slope runs from west to east
  - Inundation will primarily occur from east (Mississippi River) to west
  - Current infrastructure impedes east to west and west to east water movement across the tract





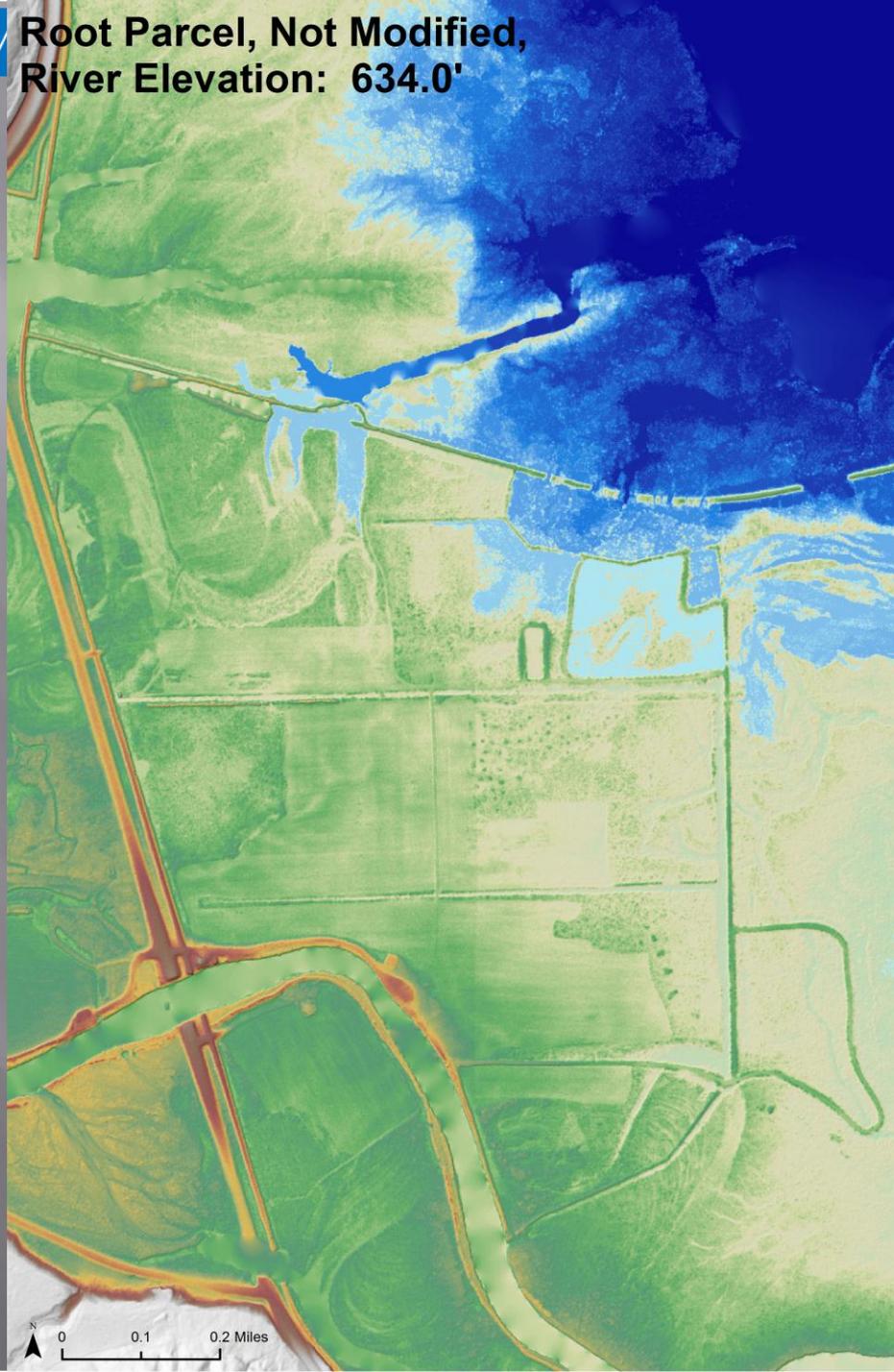
Root Parcel, Not Modified,  
River Elevation: 632.0'





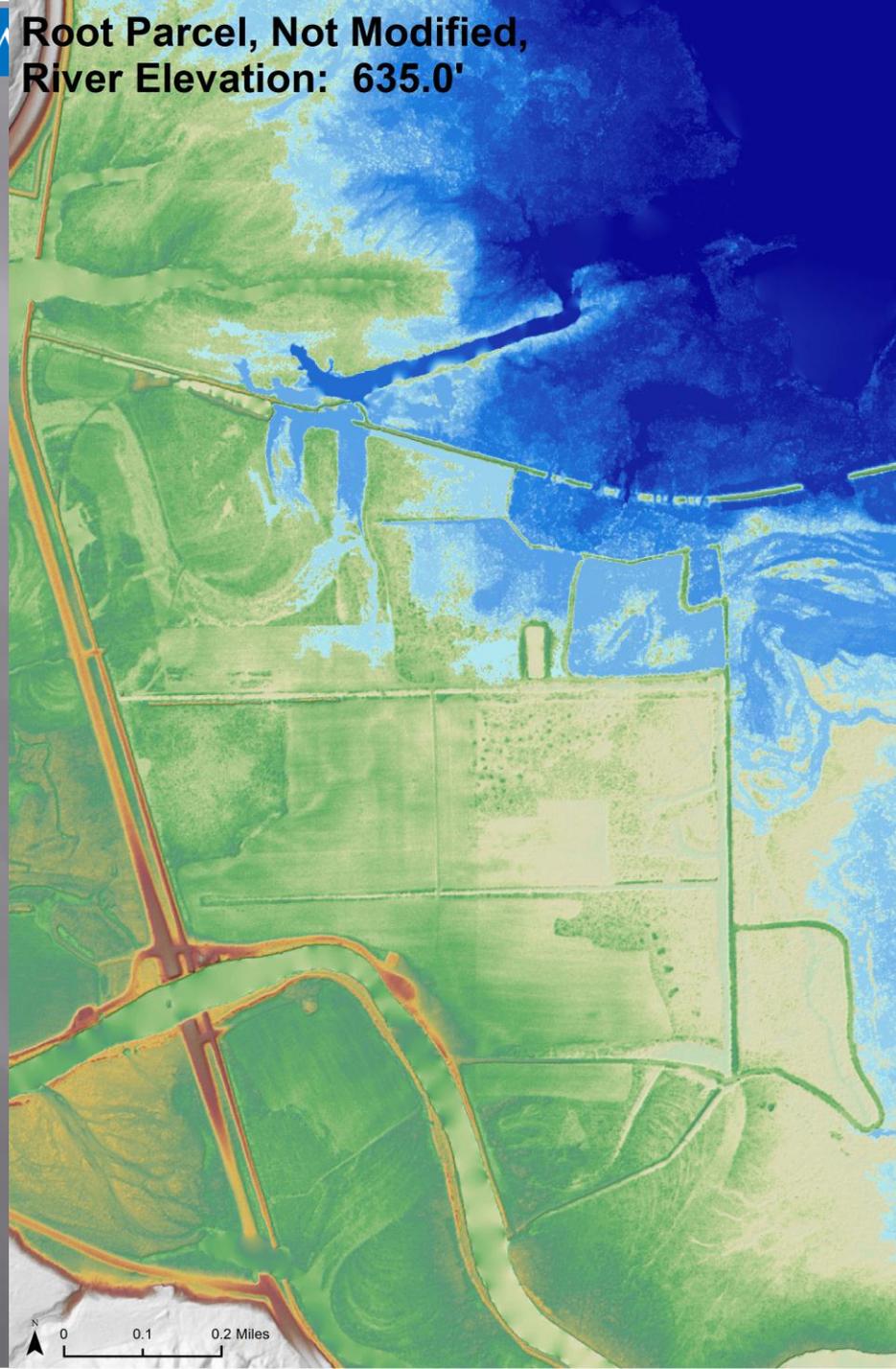


# Root Parcel, Not Modified, River Elevation: 634.0'



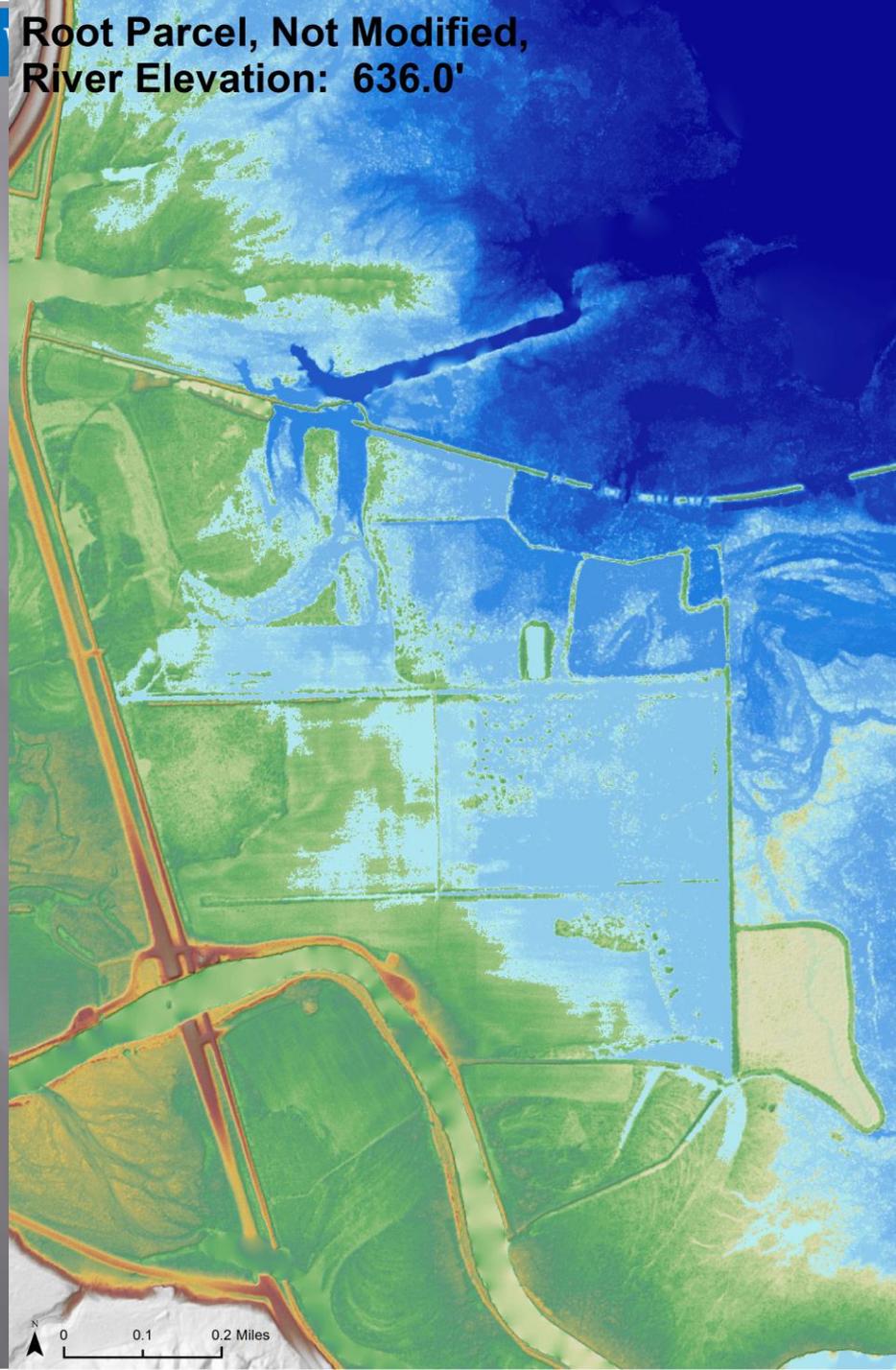


# U.S. Fish and Wildlife Service Root Parcel, Not Modified, River Elevation: 635.0'





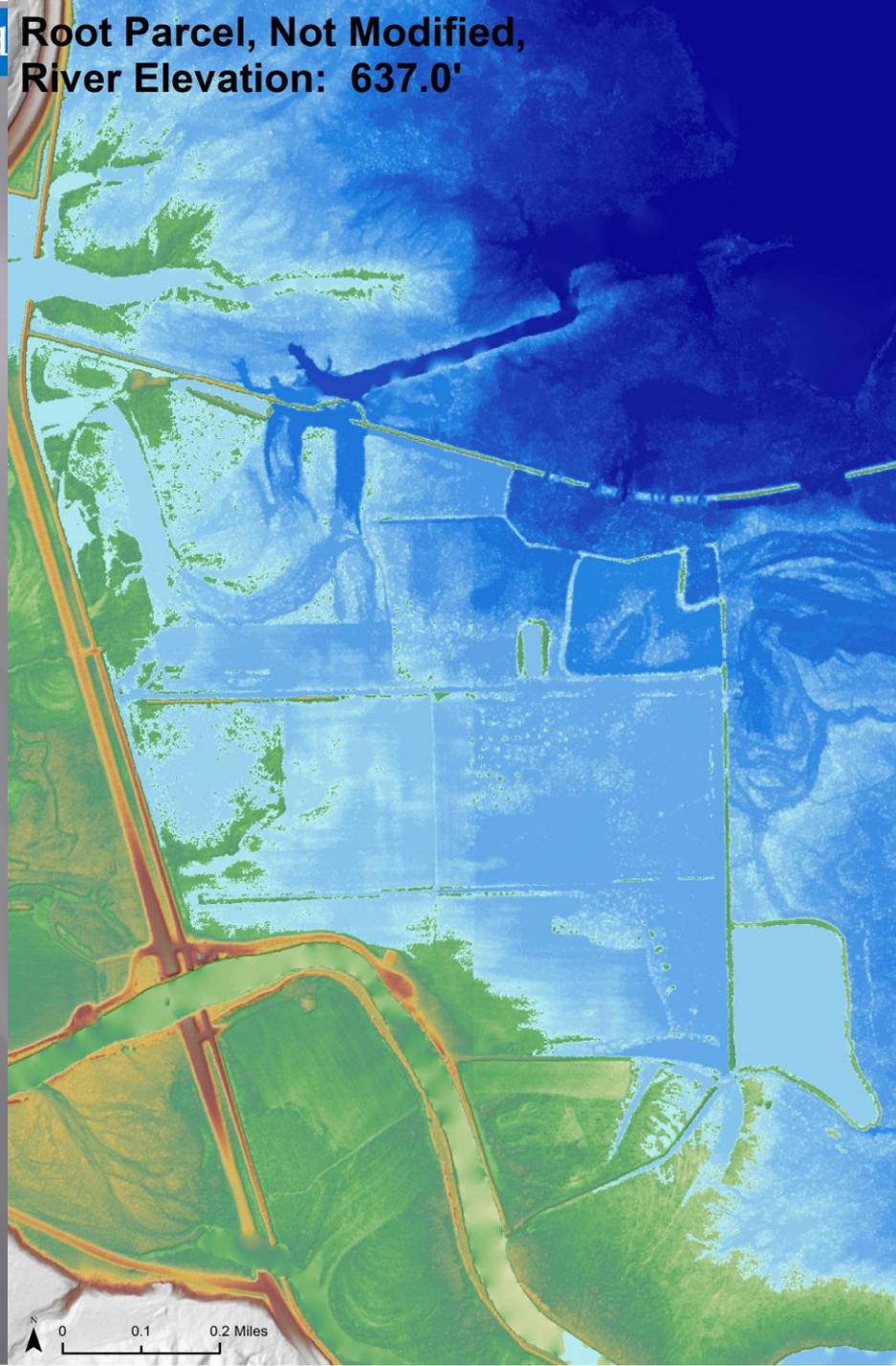
**Root Parcel, Not Modified,  
River Elevation: 636.0'**





# U.S. Fish and Wildlife Service

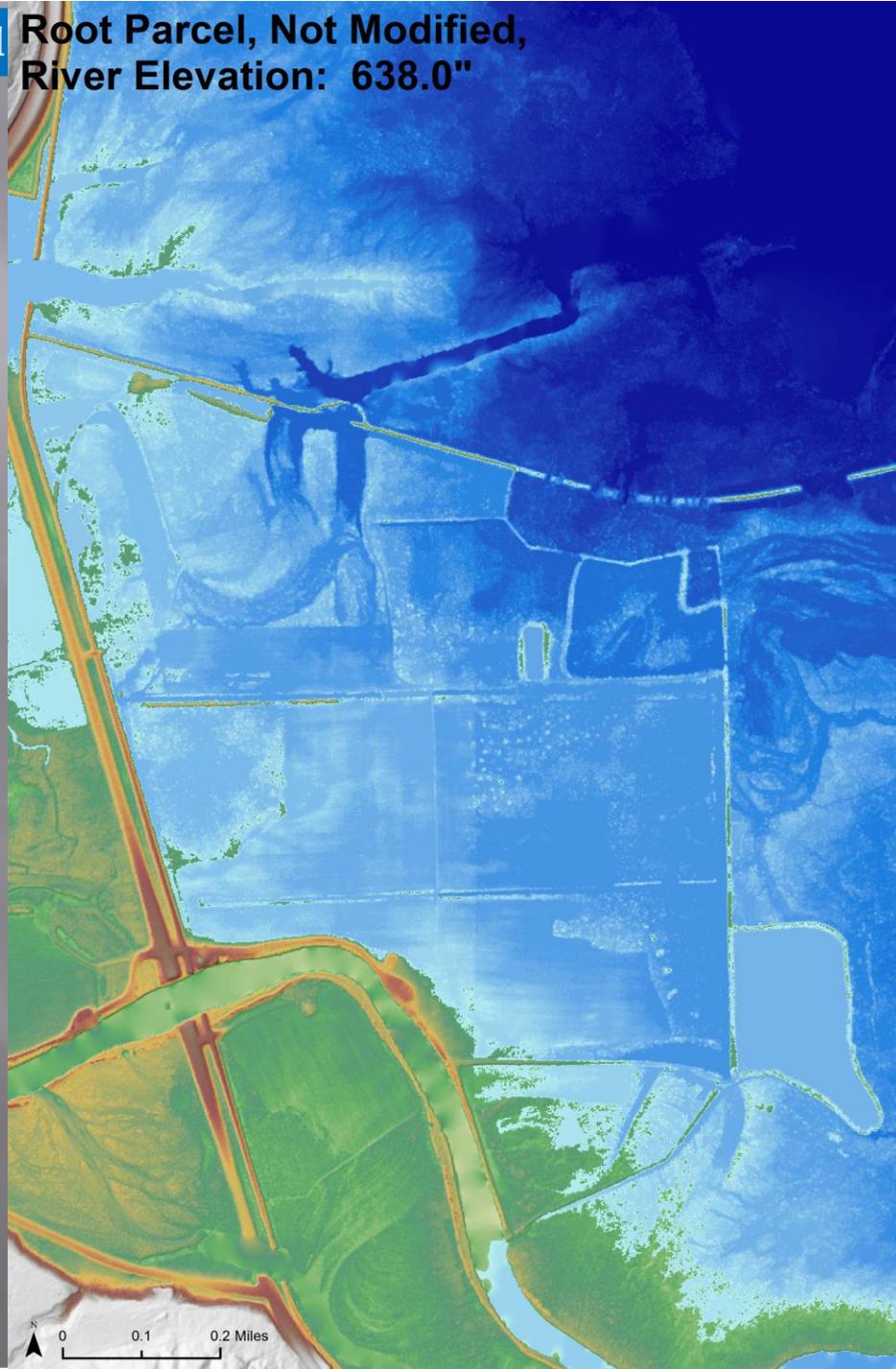
## Root Parcel, Not Modified, River Elevation: 637.0'





U.S. Fish and

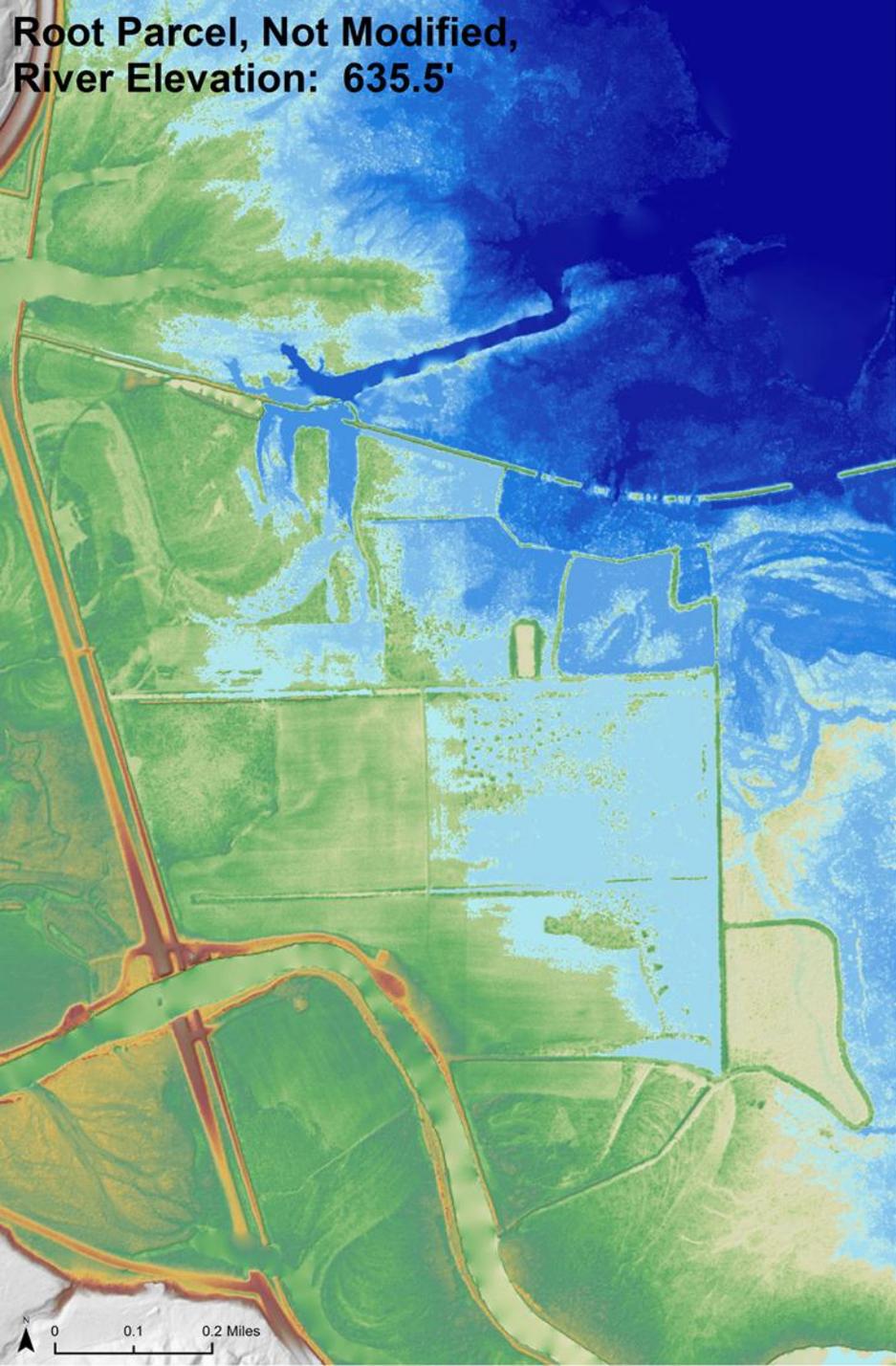
Root Parcel, Not Modified,  
River Elevation: 638.0"



Refuge System



Root Parcel, Not Modified,  
River Elevation: 635.5'



May 4, 1992  
(peak ~Apr. 27)  
(~2yr flood peak)

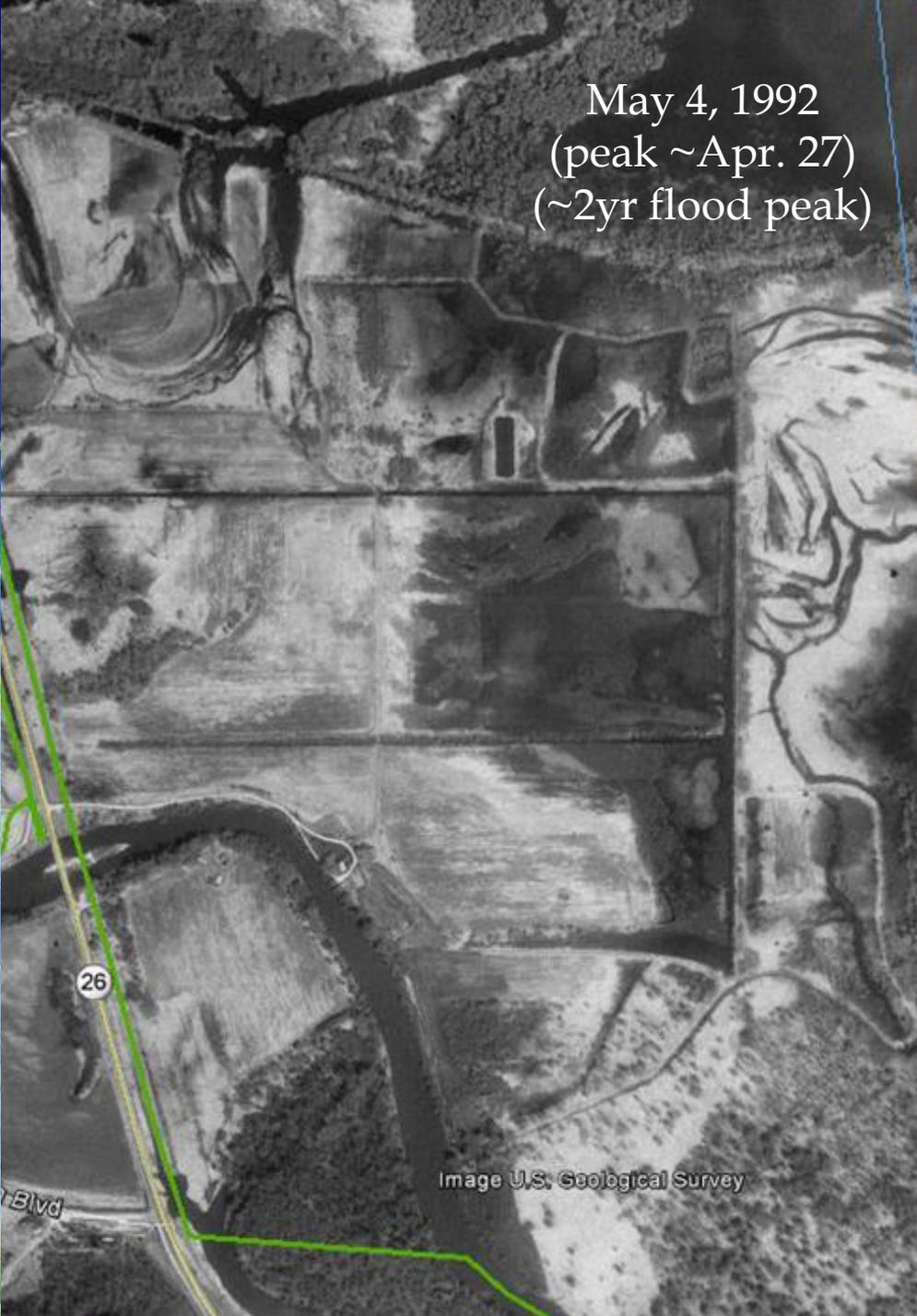


Image U.S. Geological Survey



# Additional Considerations

- ▣ Age is taking its toll
  - The tract is gradually 'reconnecting' itself....
- ▣ Existing infrastructure is limiting habitat potential on the tract
  - Wetland / Floodplain habitat is driven by depth and duration of inundation
    - ▣ Impedes both inundation and drainage - areas dry and/or wet for longer duration
- ▣ Insufficient resources to maintain and manage intensive infrastructure
  - Especially within the floodplain





Questions about hydrology or studies?

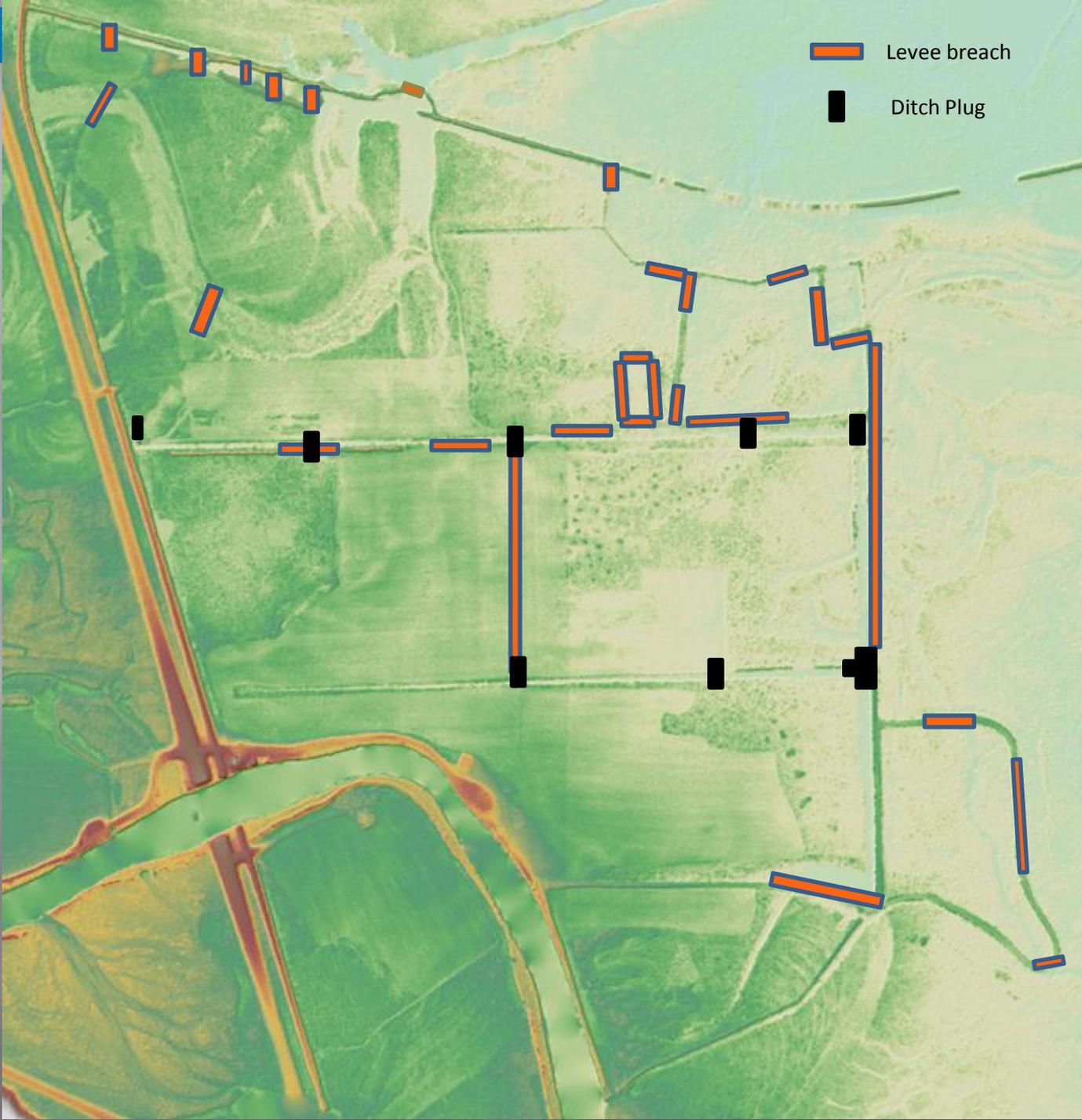




# Reconnection

- ▣ Viewed from a floodplain connectivity and natural processes perspective
  - Reconnection may conflict with other objectives, such as visitor access
    - ▣ Restoration actions may need to balance conflicting objectives
      - Such a balance is not represented here







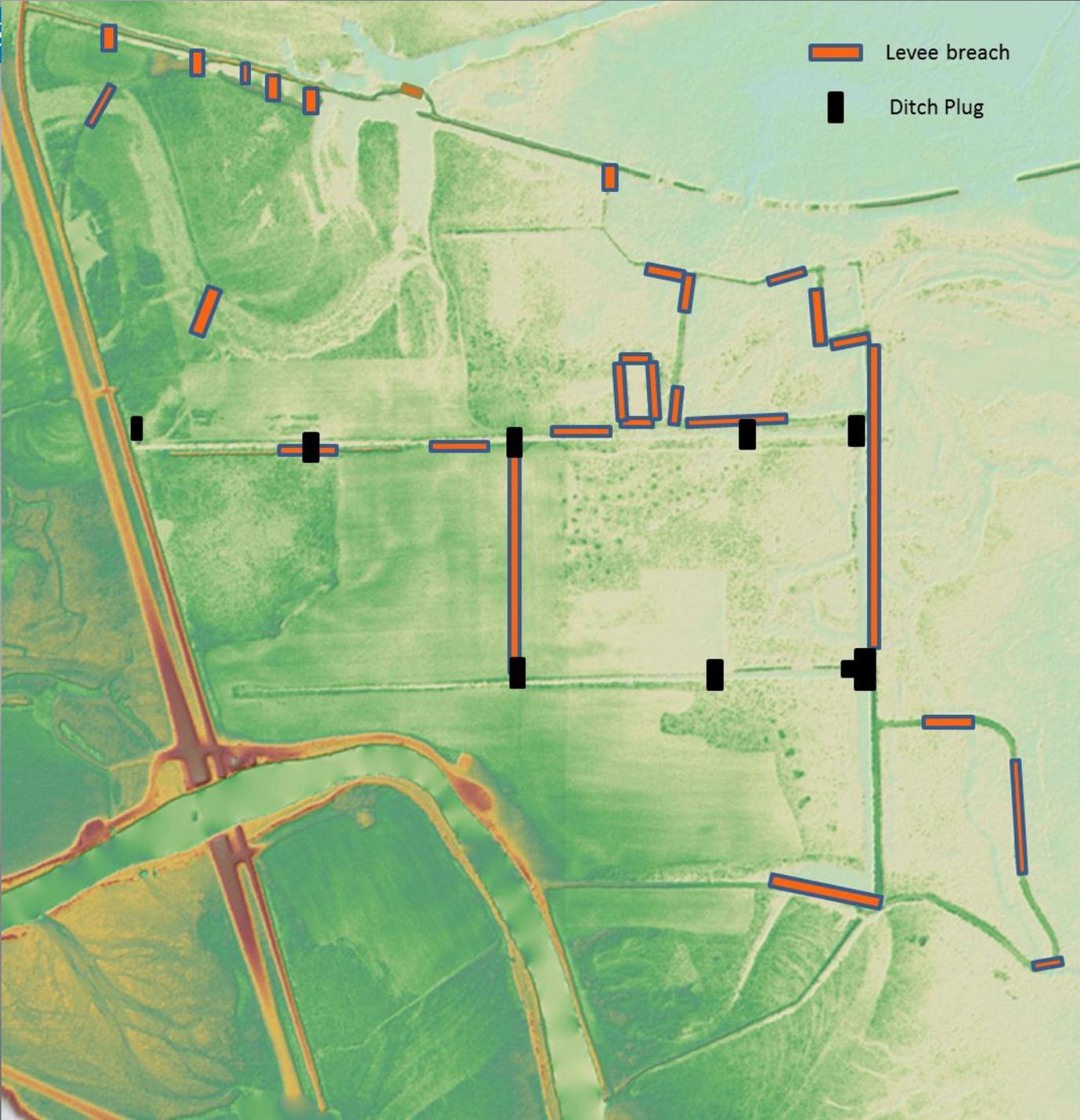
# No proposed actions on the Root River levee at this time

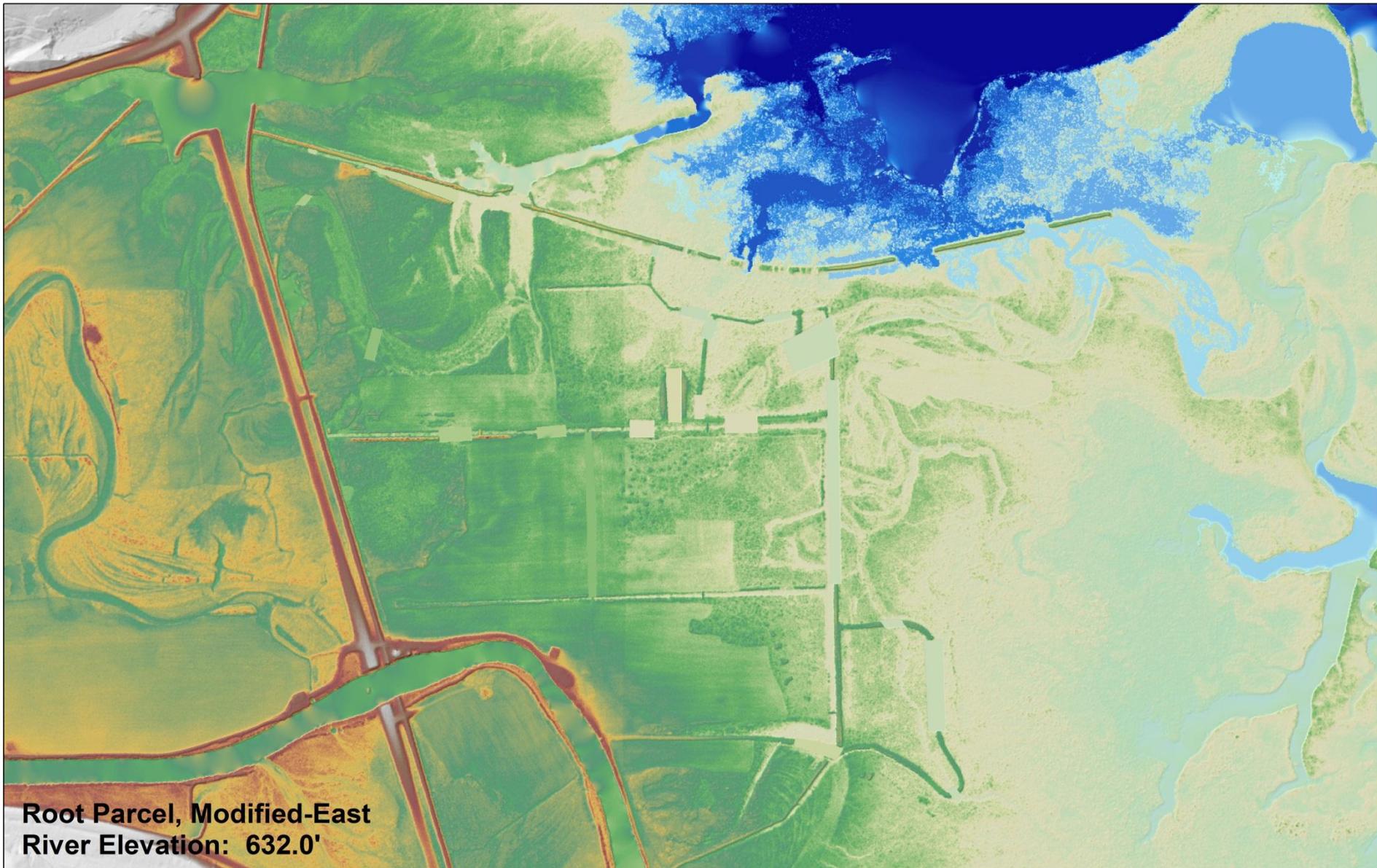




U.S.

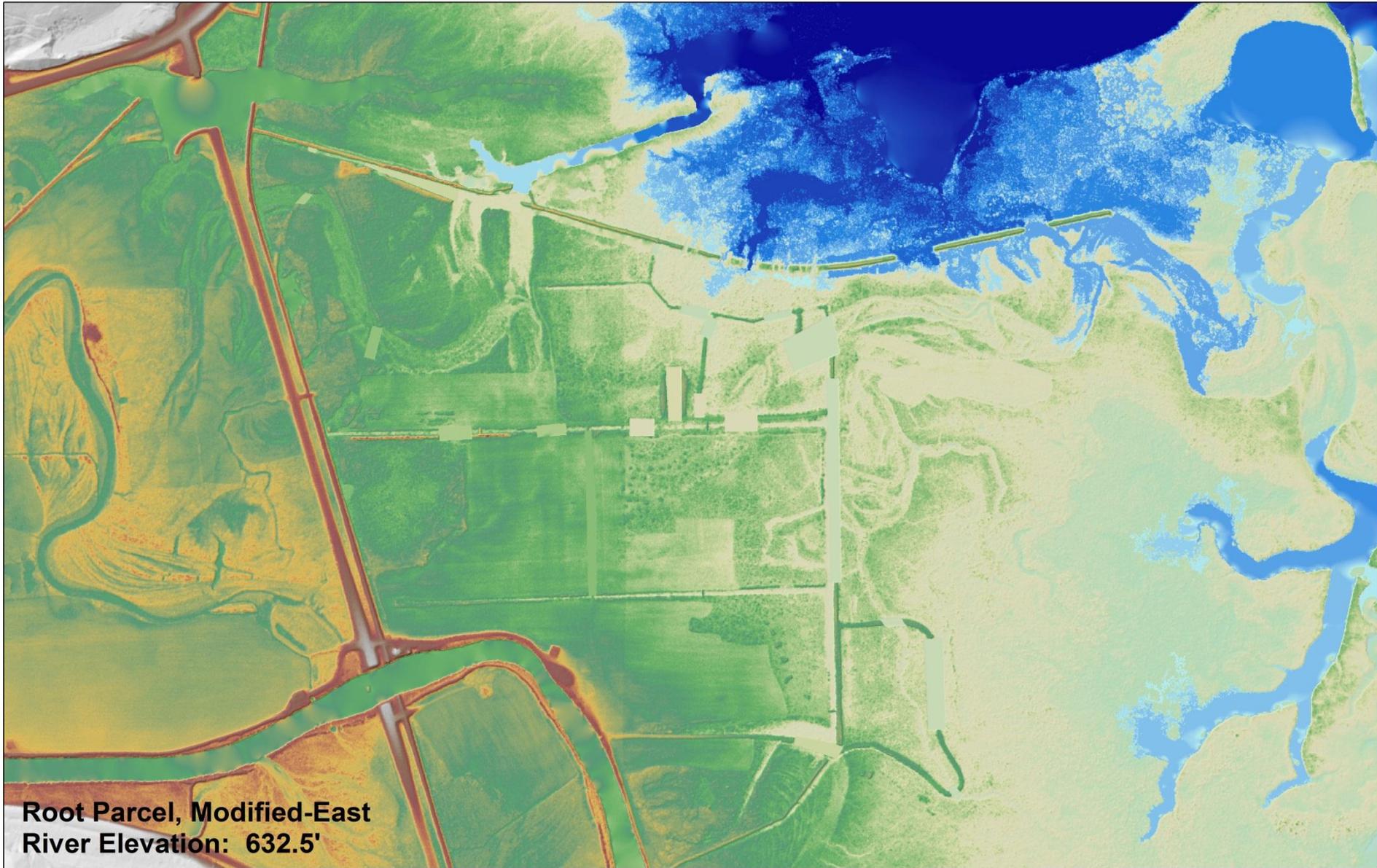
-  Levee breach
-  Ditch Plug





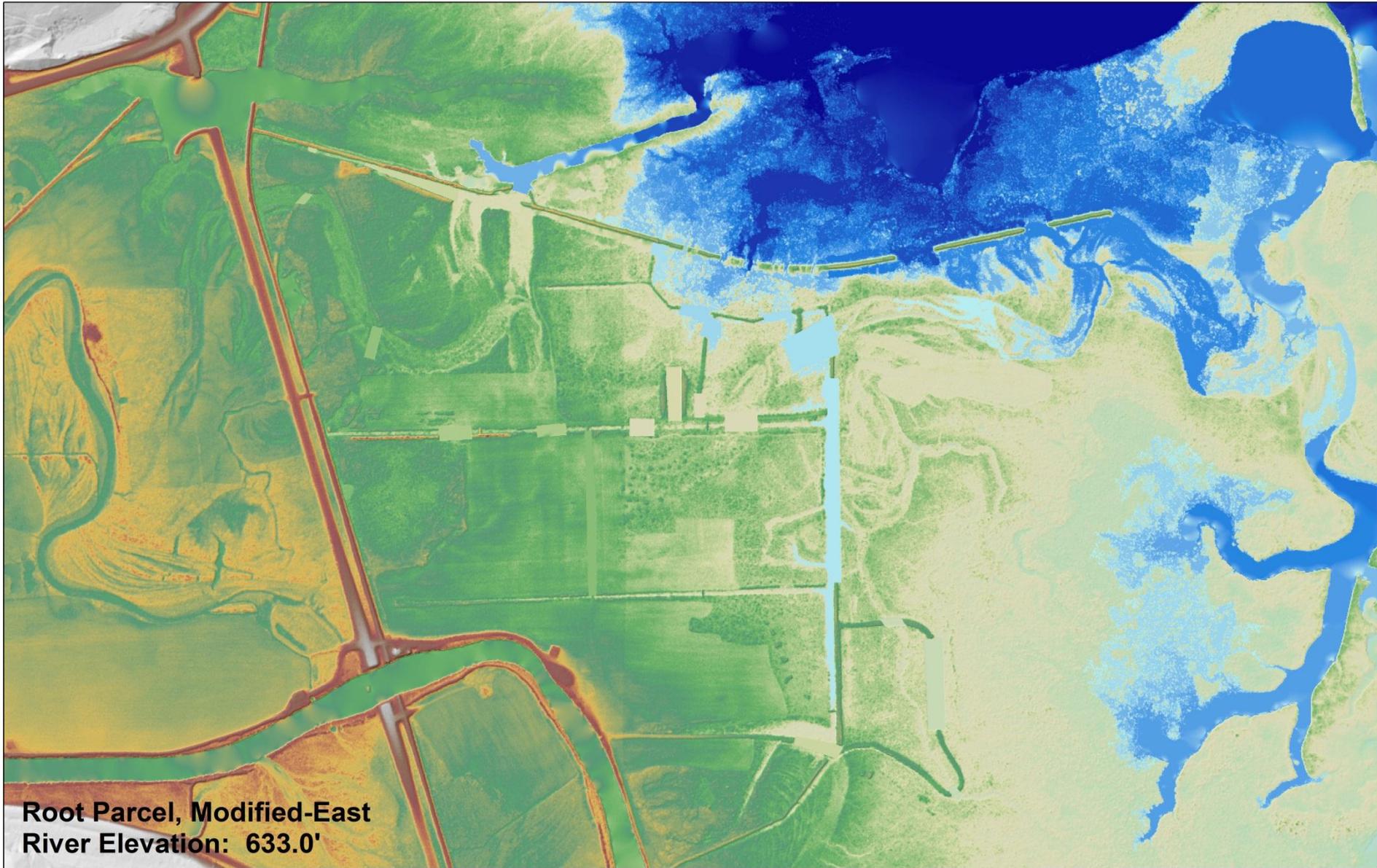
**Root Parcel, Modified-East**  
**River Elevation: 632.0'**





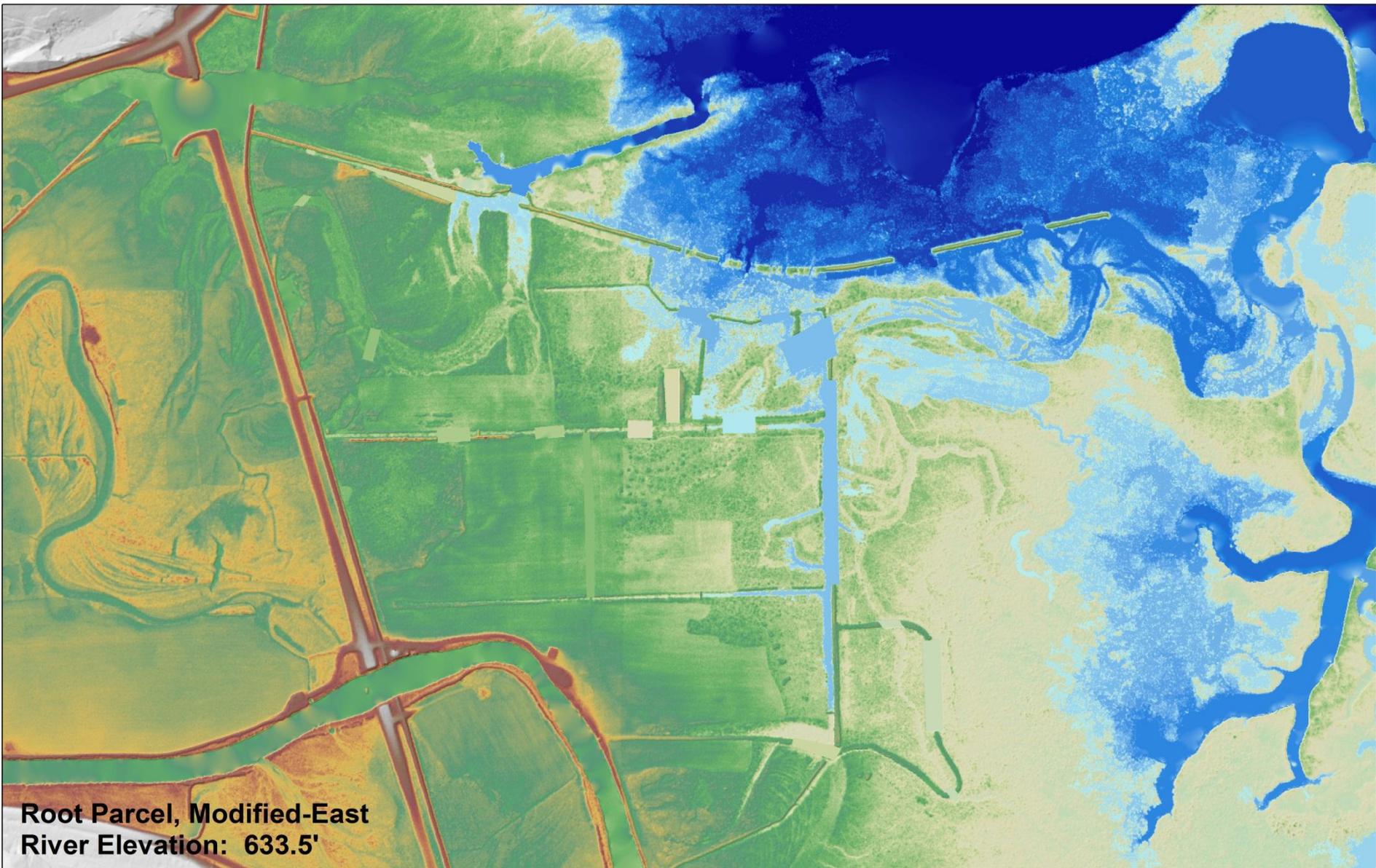
Root Parcel, Modified-East  
River Elevation: 632.5'





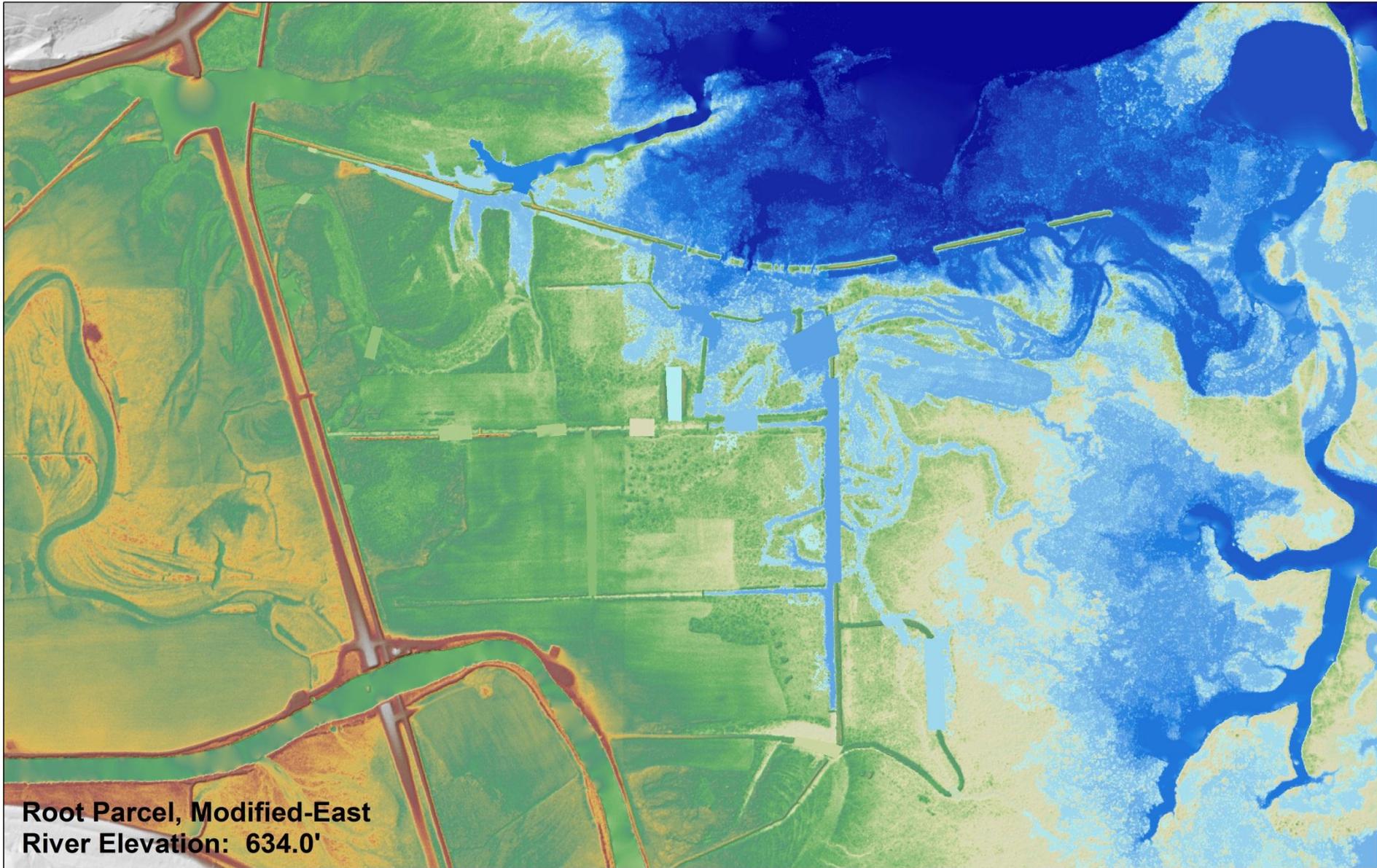
Root Parcel, Modified-East  
River Elevation: 633.0'





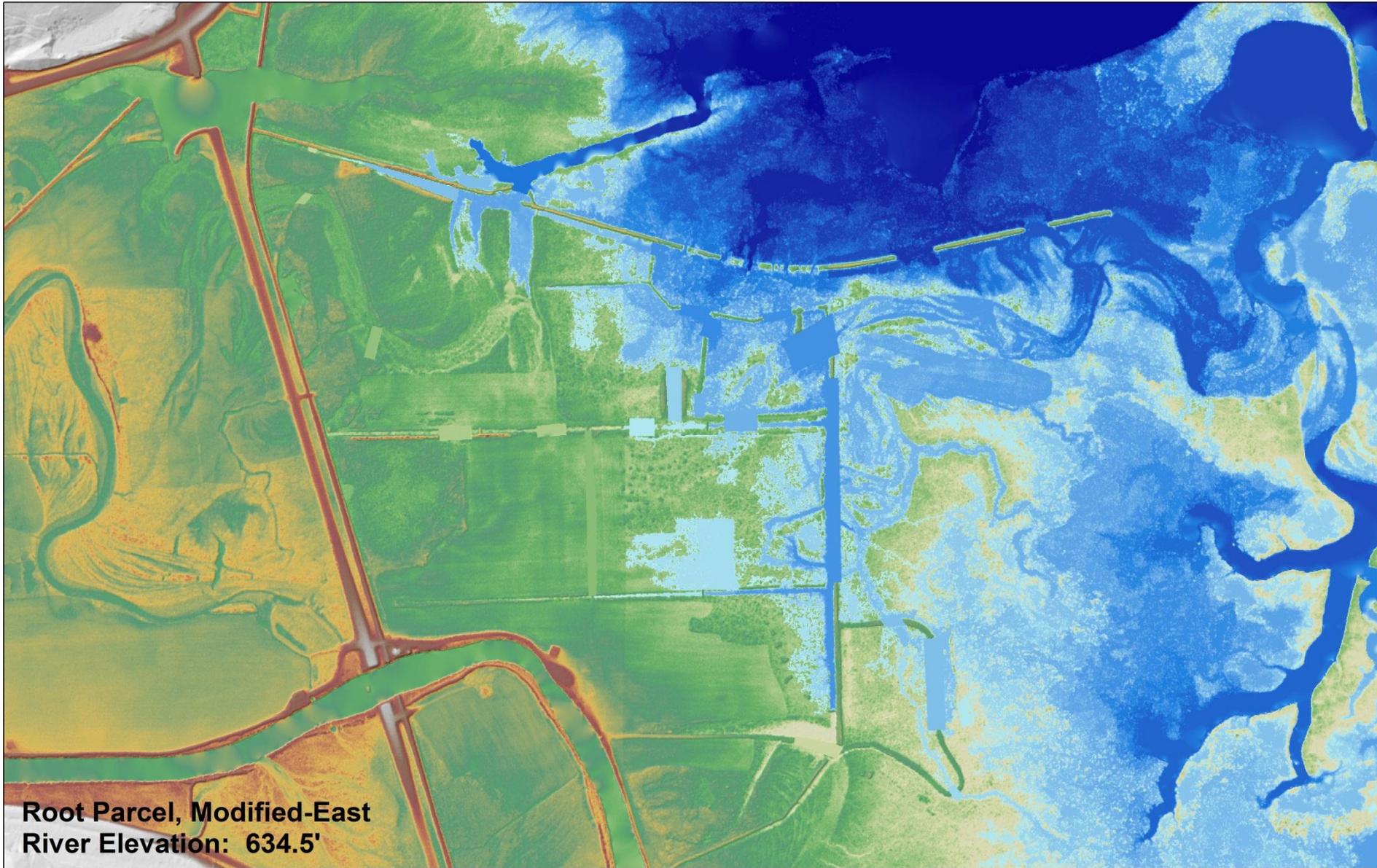
**Root Parcel, Modified-East  
River Elevation: 633.5'**





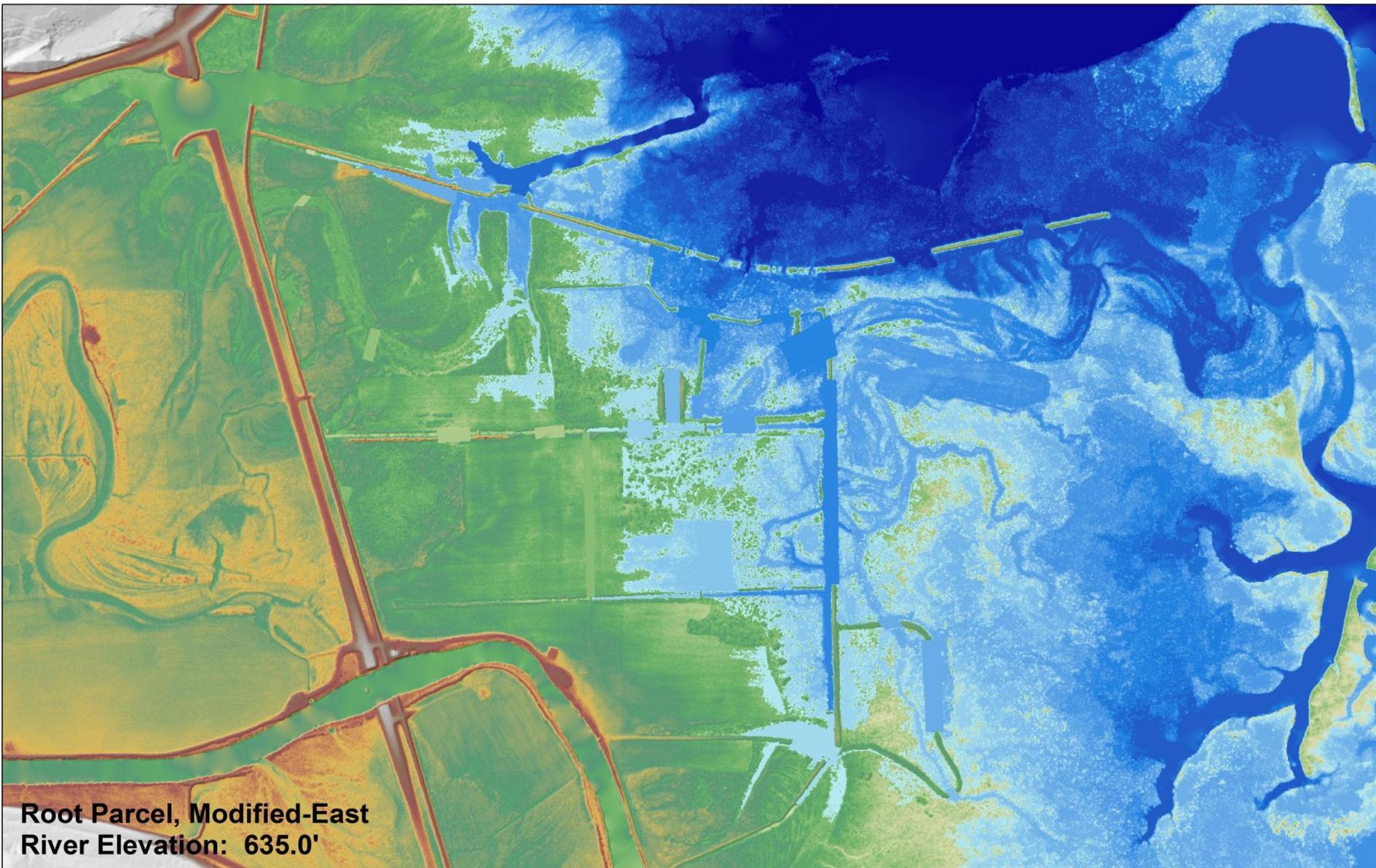
**Root Parcel, Modified-East  
River Elevation: 634.0'**





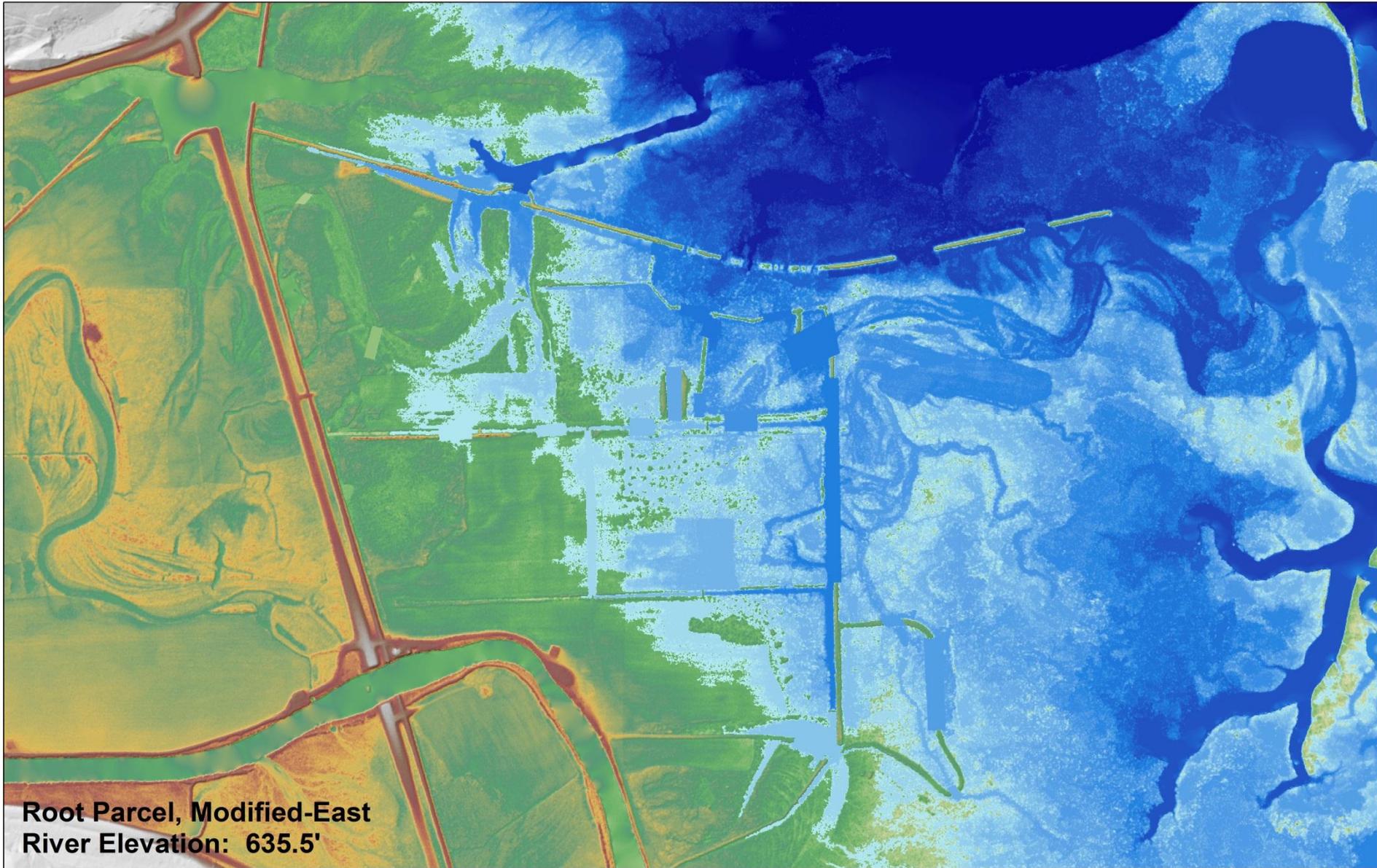
**Root Parcel, Modified-East  
River Elevation: 634.5'**





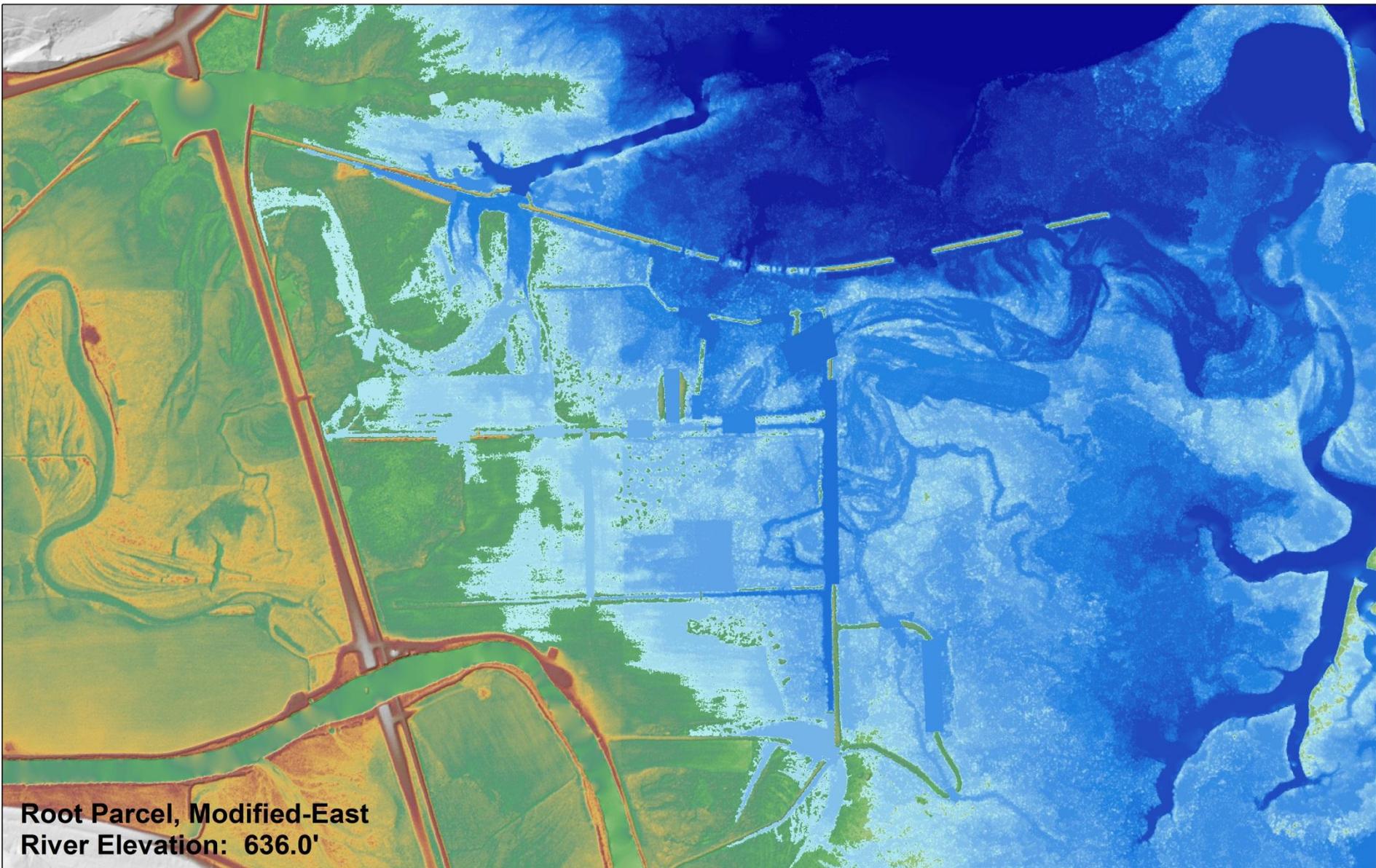
**Root Parcel, Modified-East  
River Elevation: 635.0'**





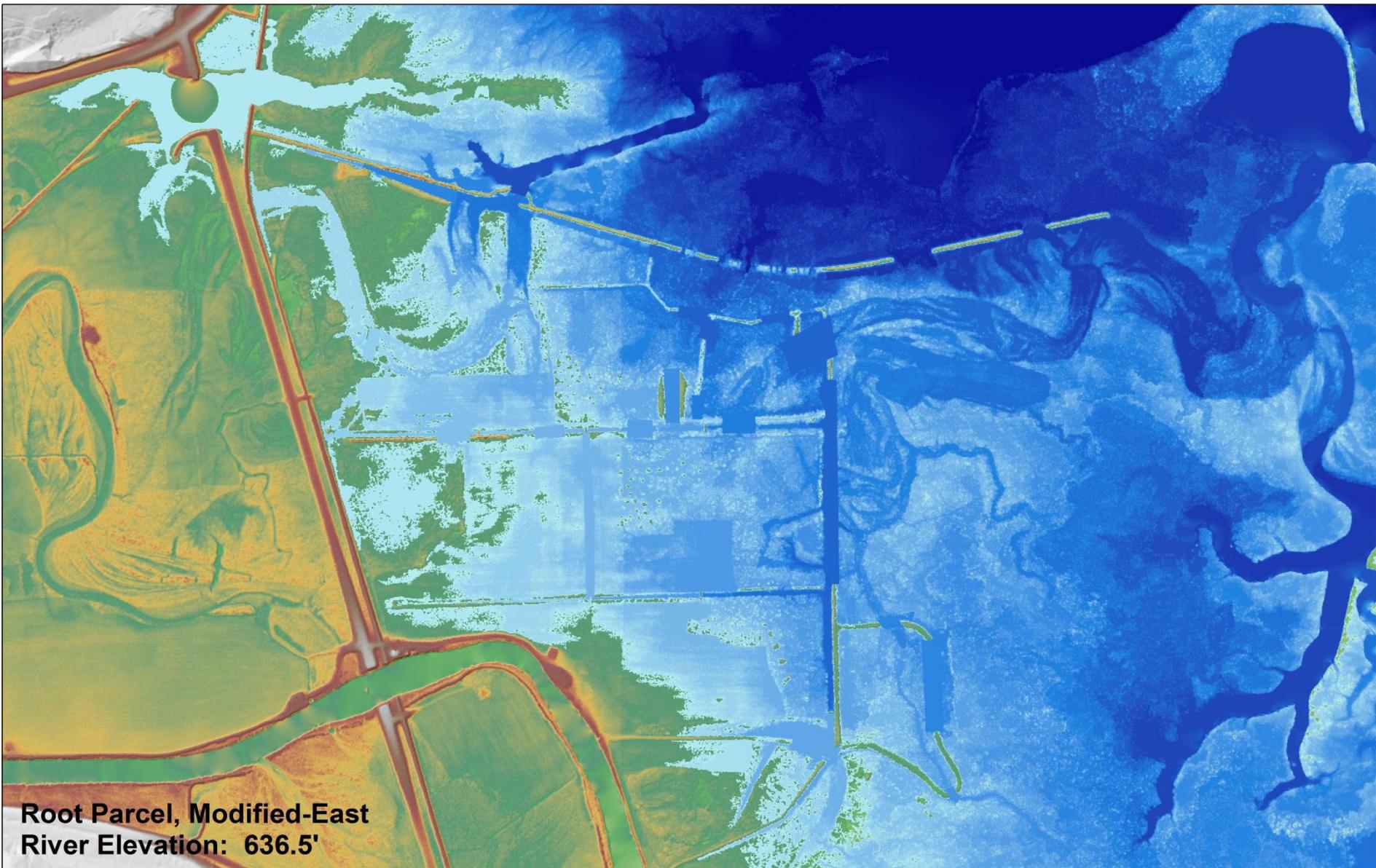
Root Parcel, Modified-East  
River Elevation: 635.5'





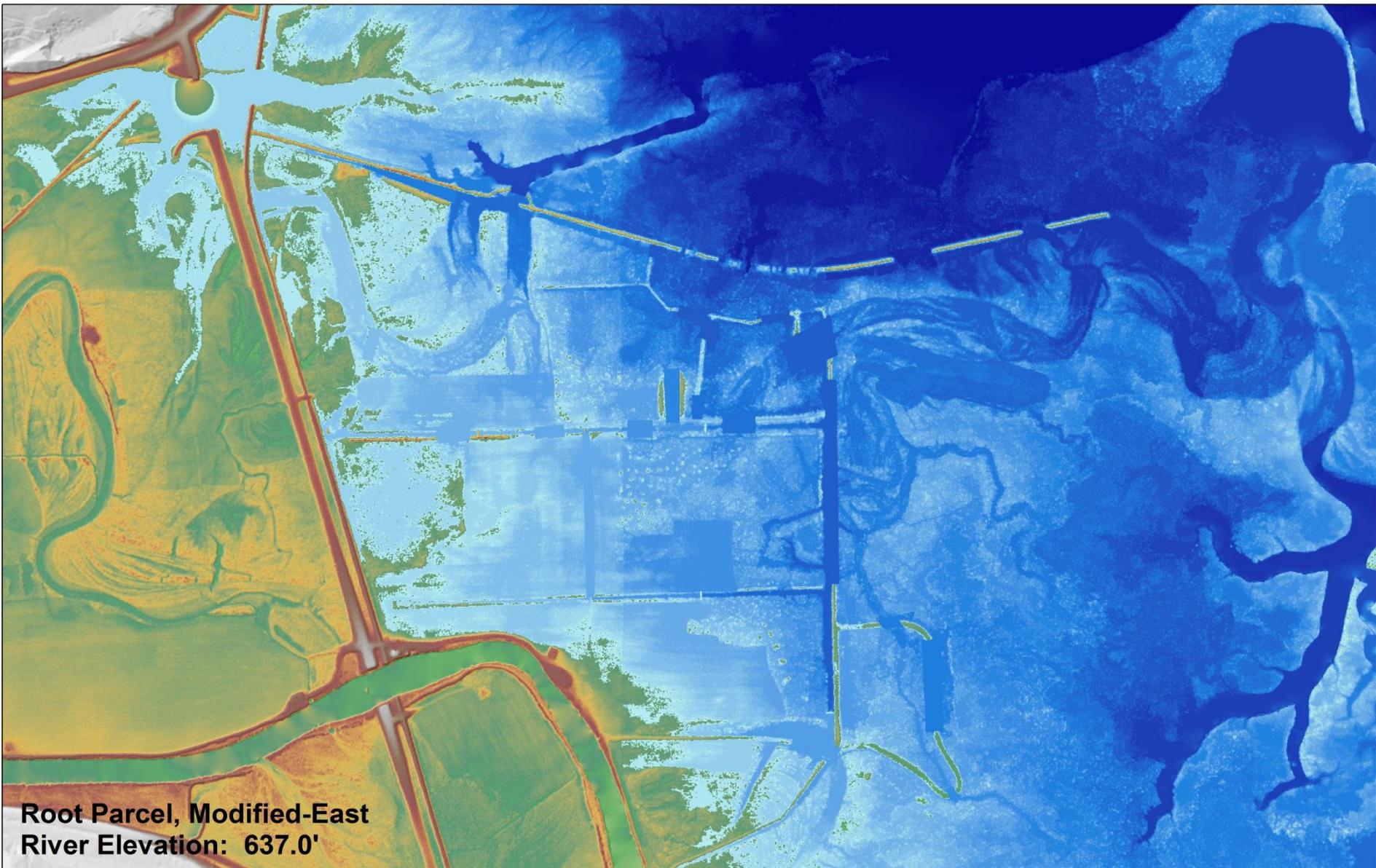
Root Parcel, Modified-East  
River Elevation: 636.0'





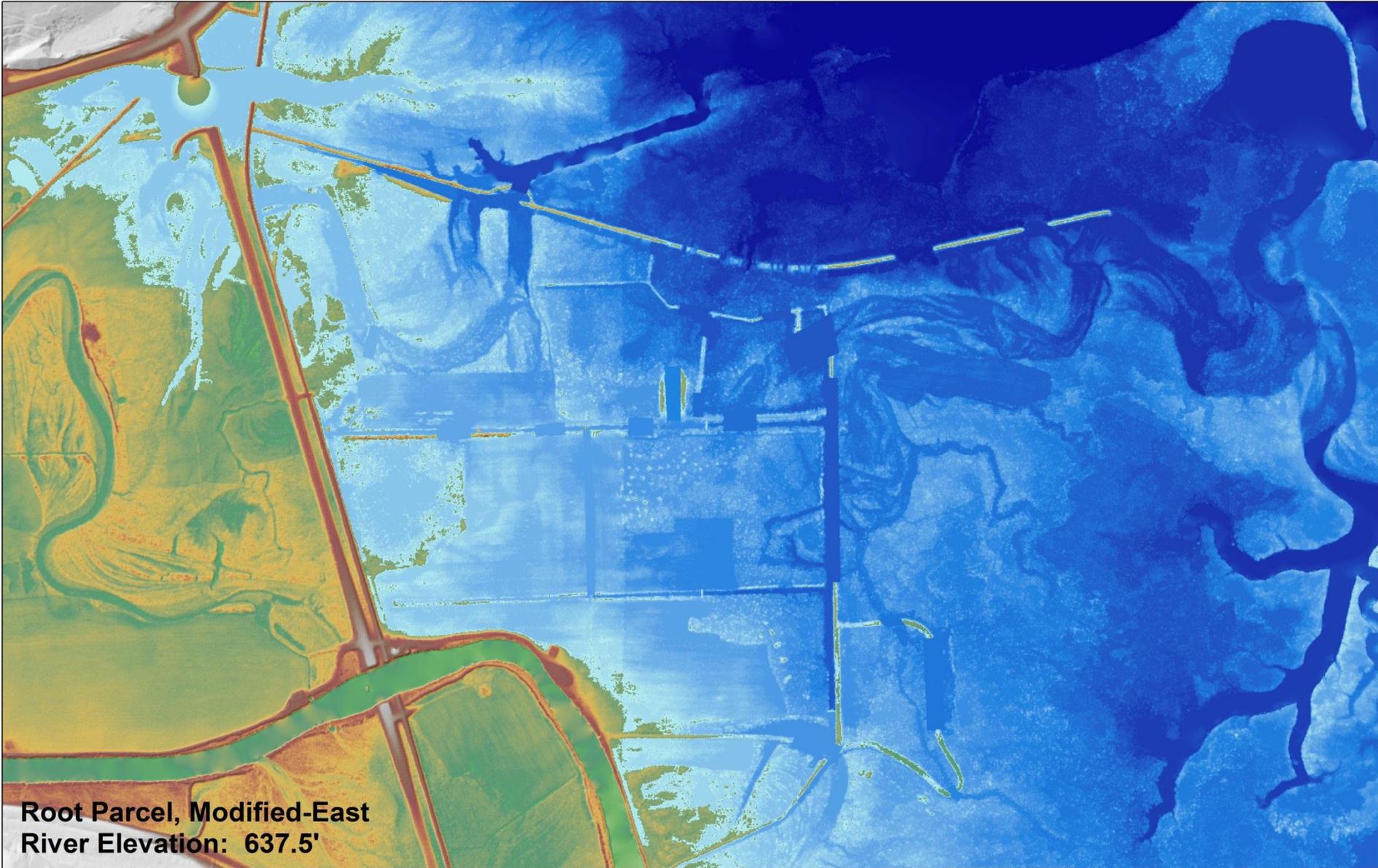
**Root Parcel, Modified-East**  
**River Elevation: 636.5'**





**Root Parcel, Modified-East**  
**River Elevation: 637.0'**





**Root Parcel, Modified-East  
River Elevation: 637.5'**



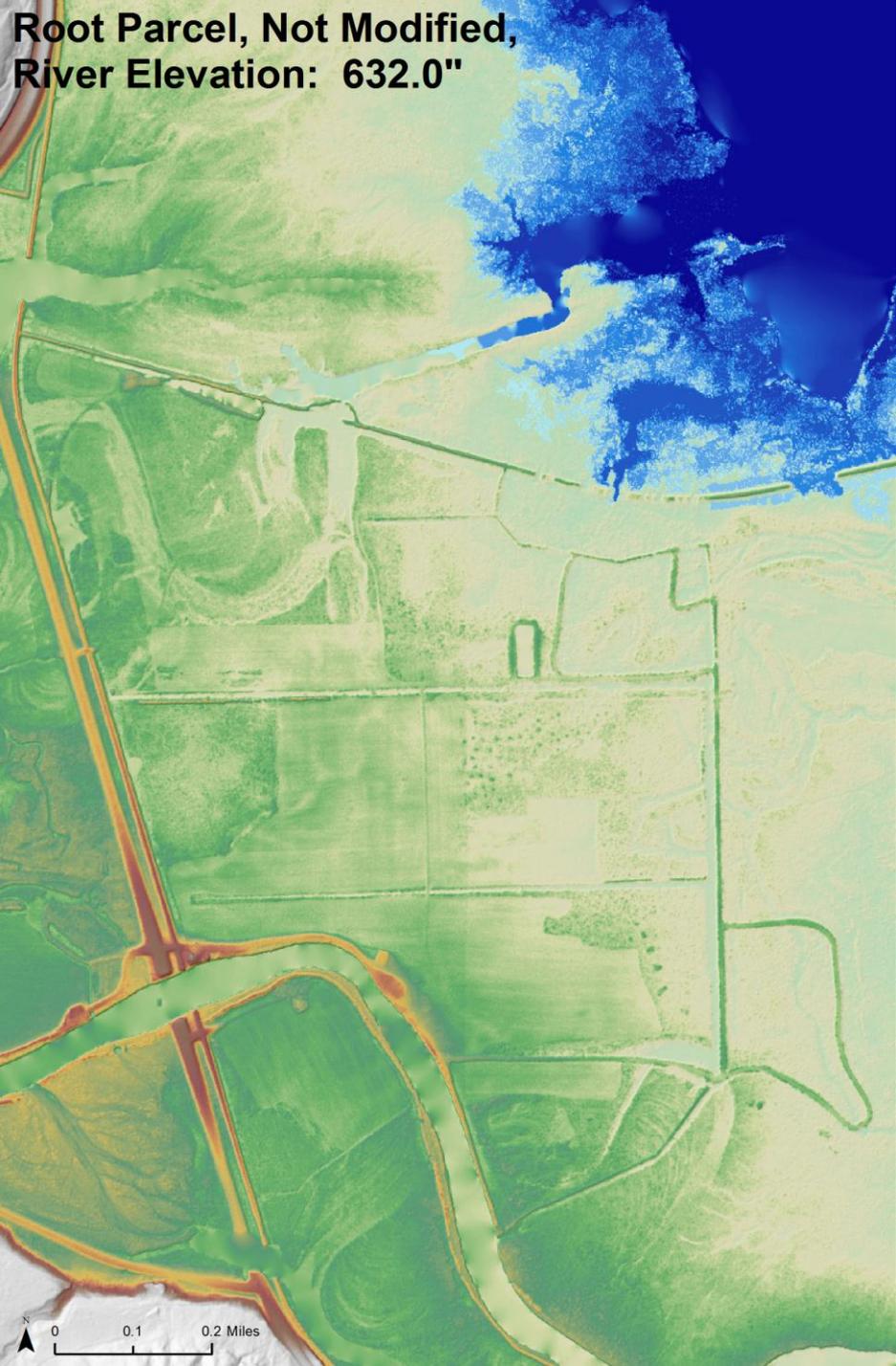
**Root Parcel, Not Modified**



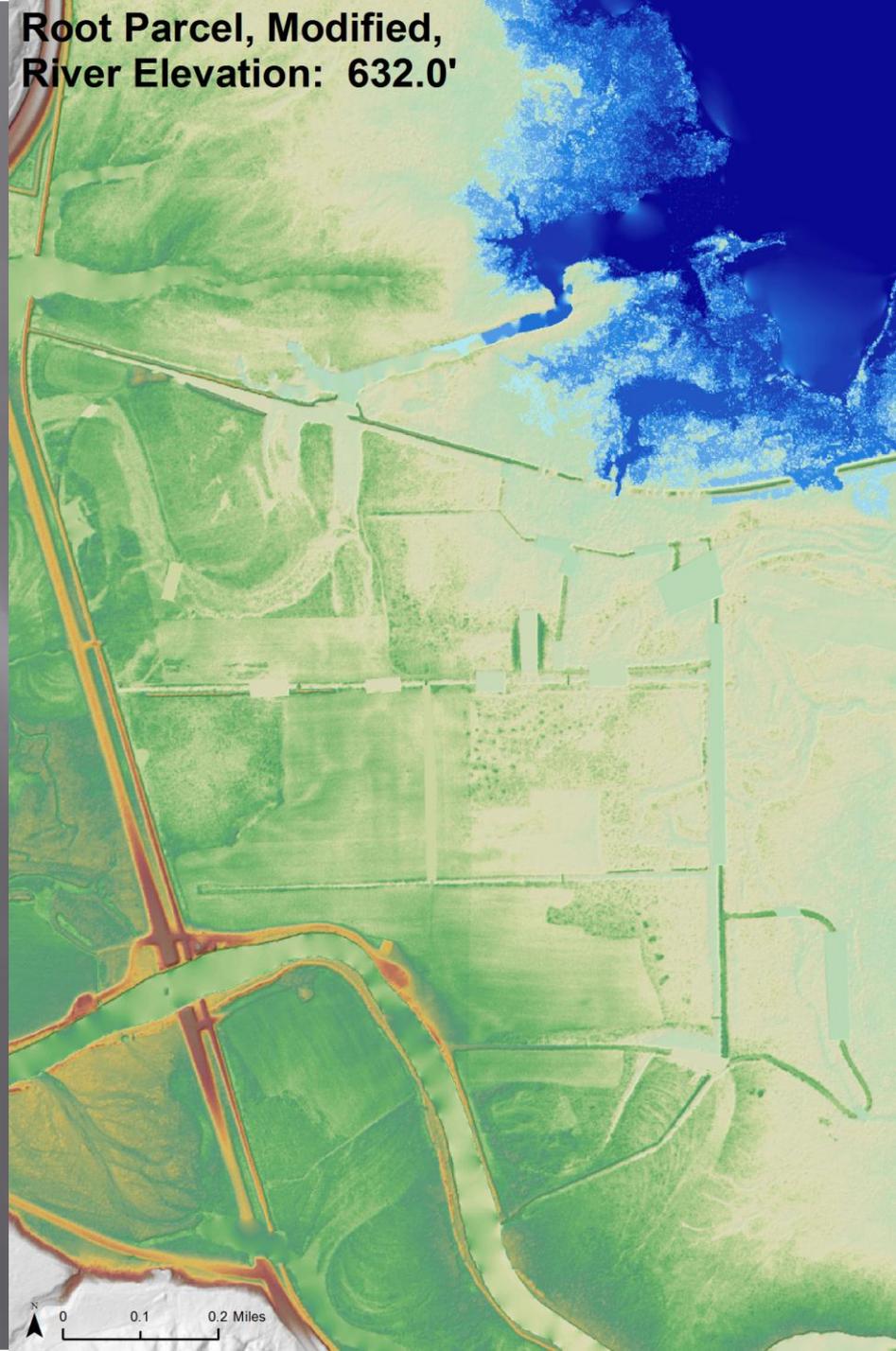
**Root Parcel, Modifications  
Removals, Scrapes, and Plugs**



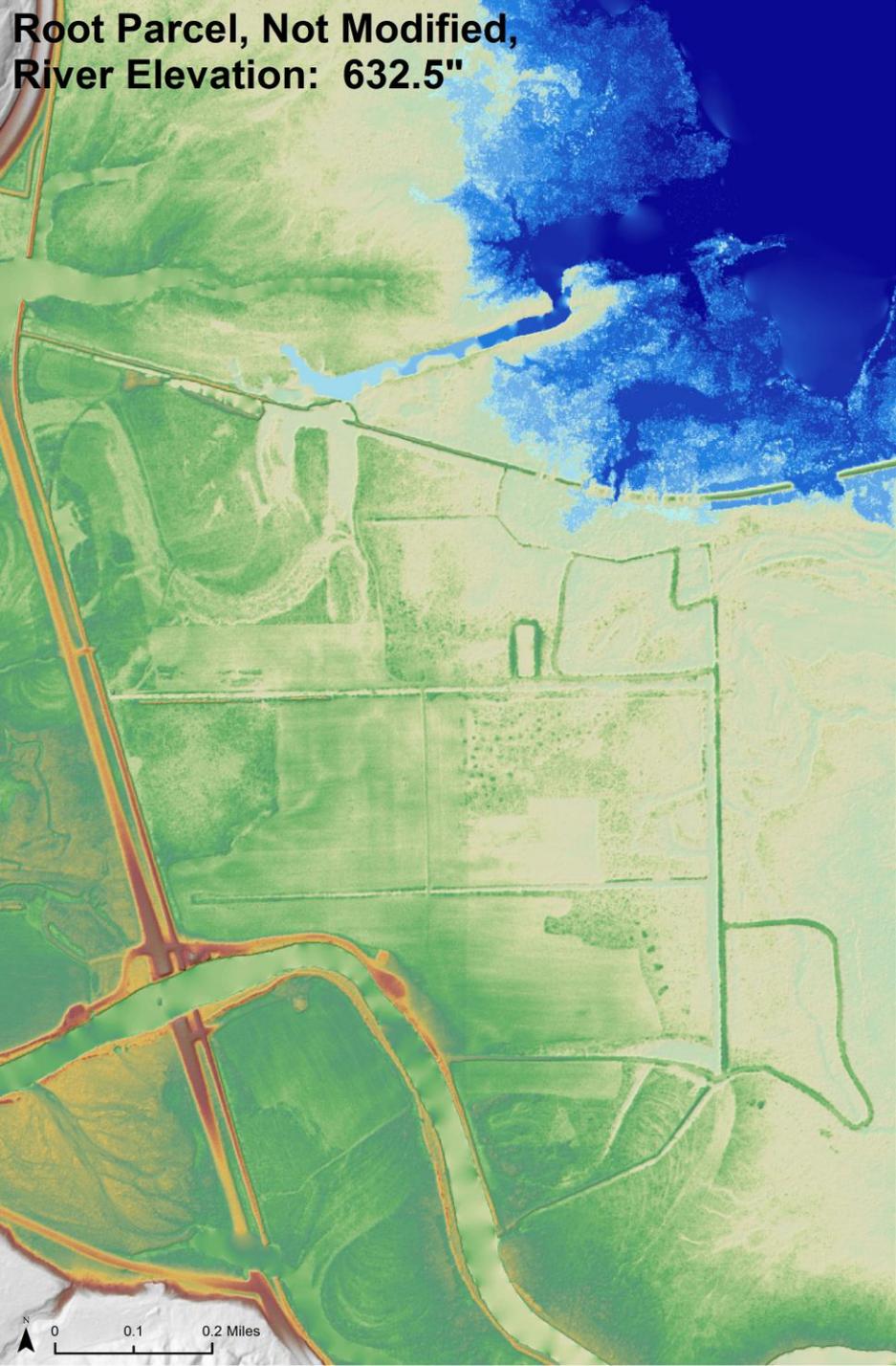
**Root Parcel, Not Modified,  
River Elevation: 632.0"**



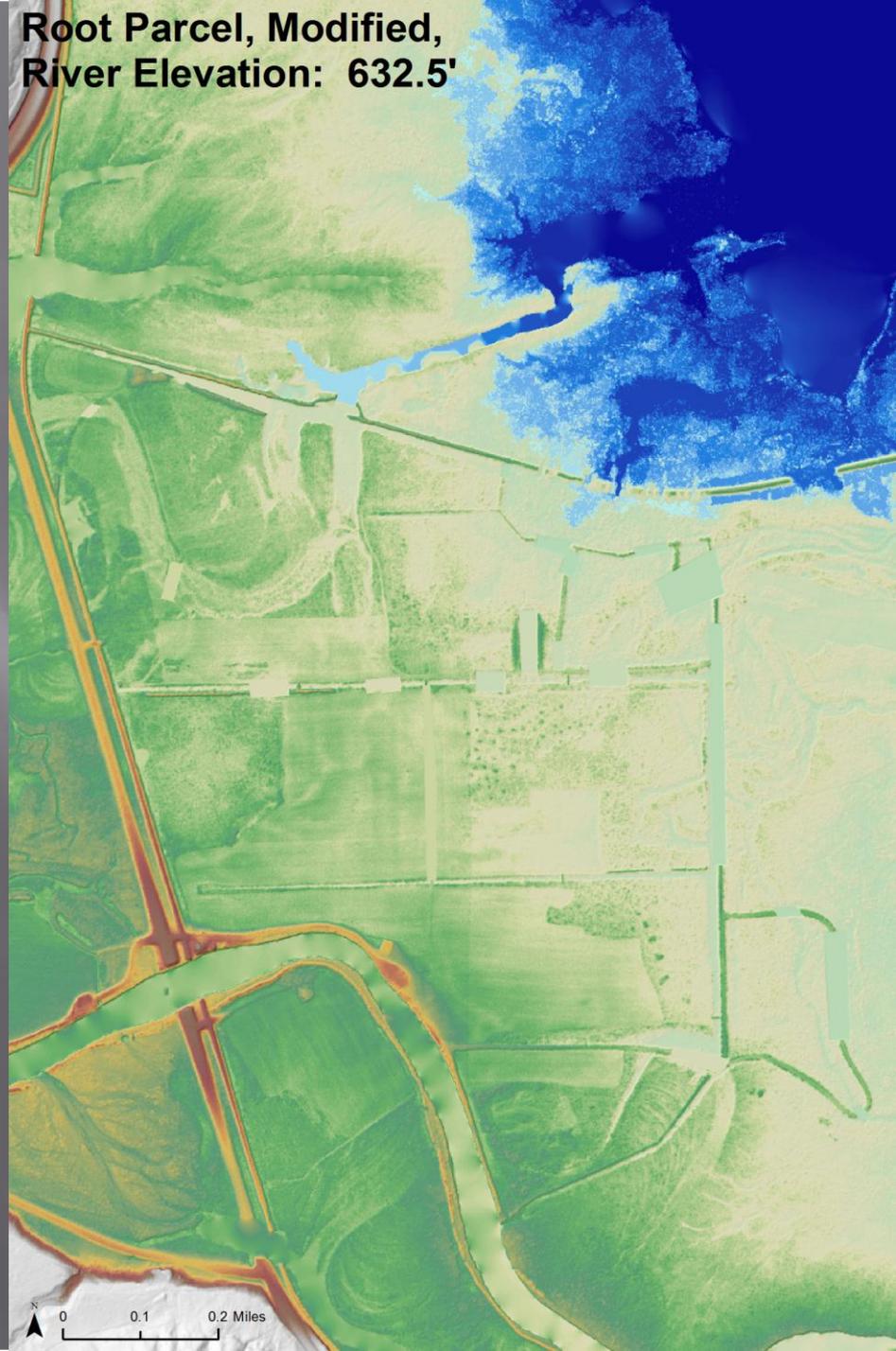
**Root Parcel, Modified,  
River Elevation: 632.0"**



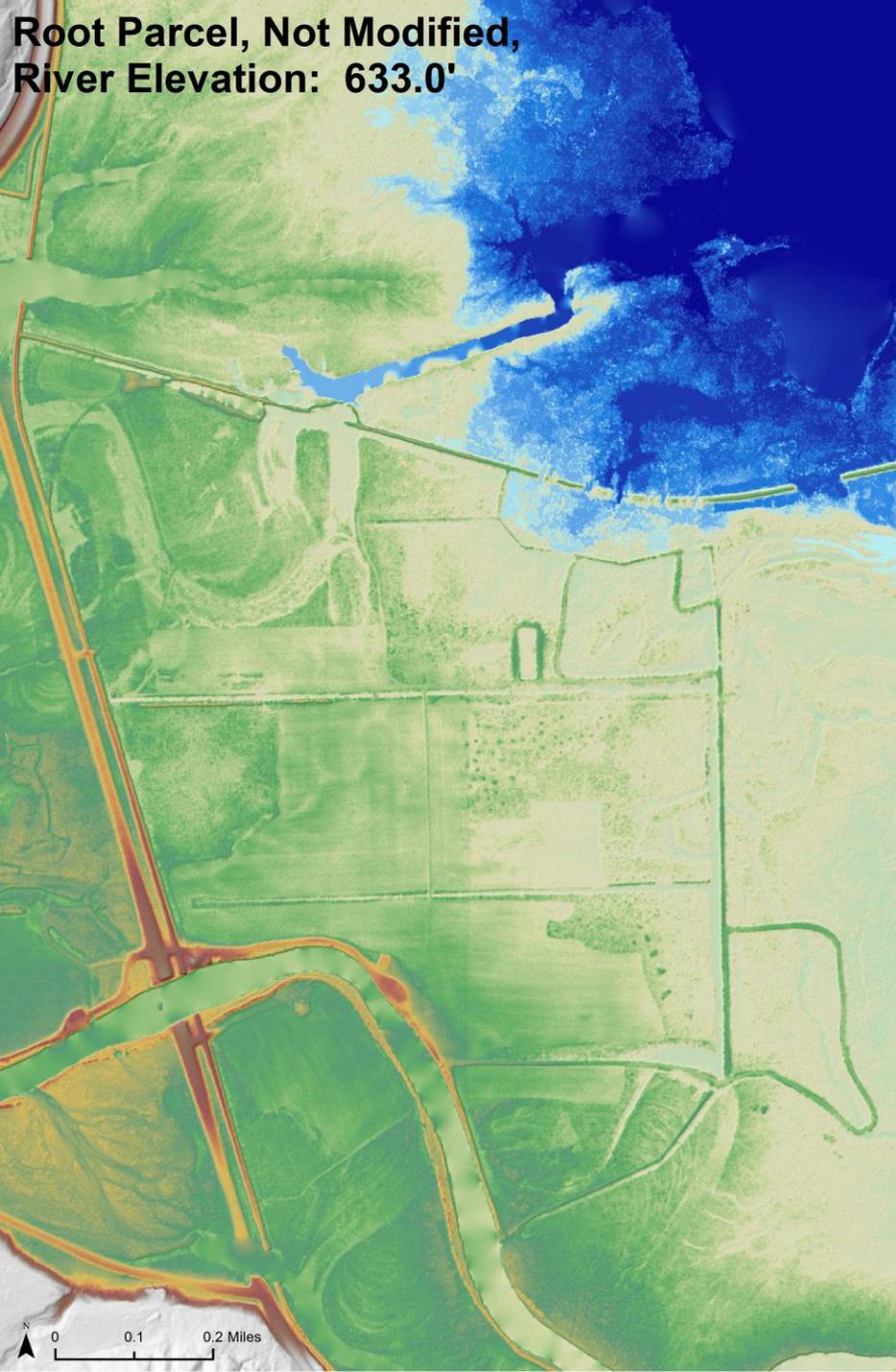
**Root Parcel, Not Modified,  
River Elevation: 632.5'**



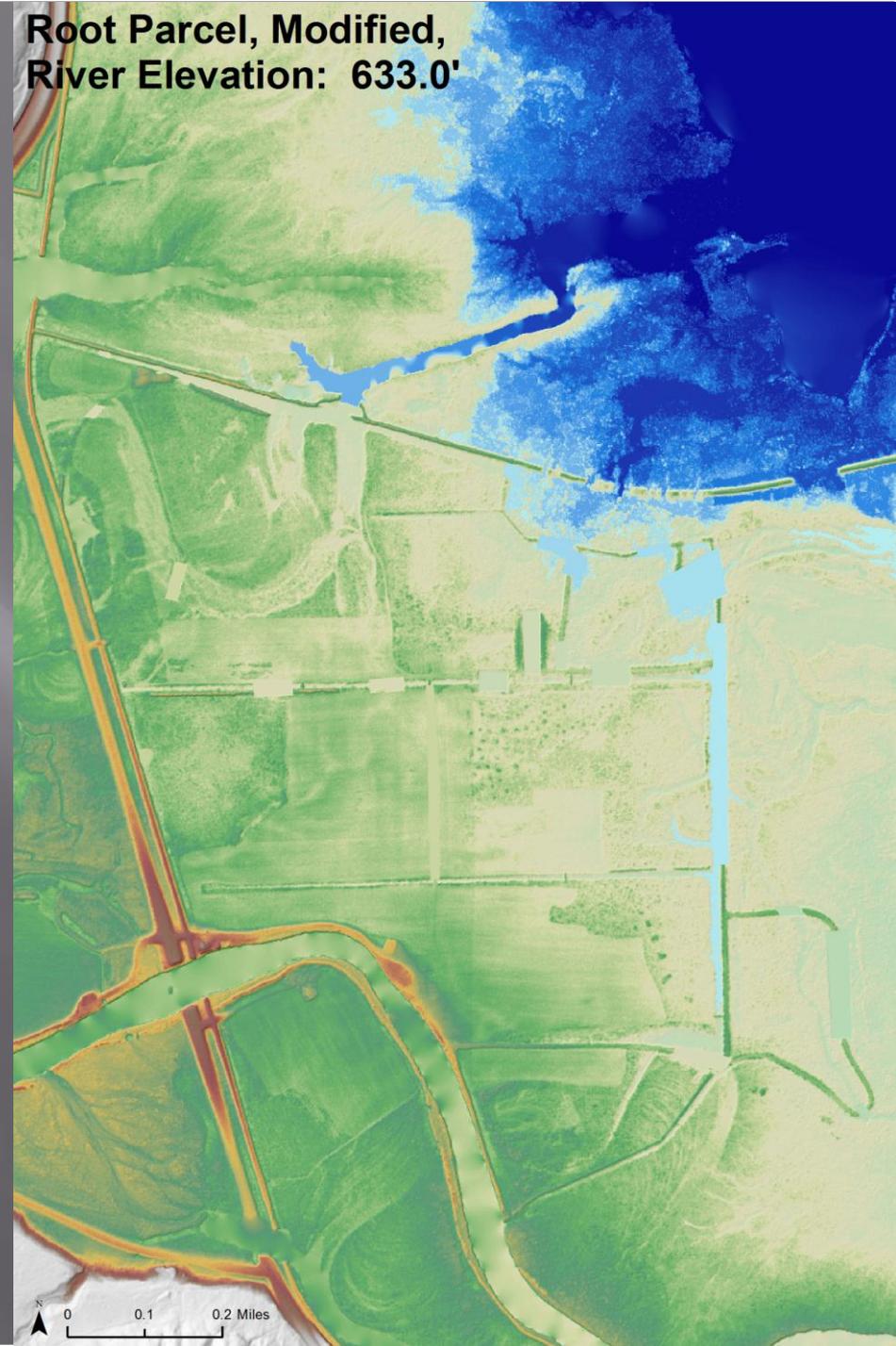
**Root Parcel, Modified,  
River Elevation: 632.5'**



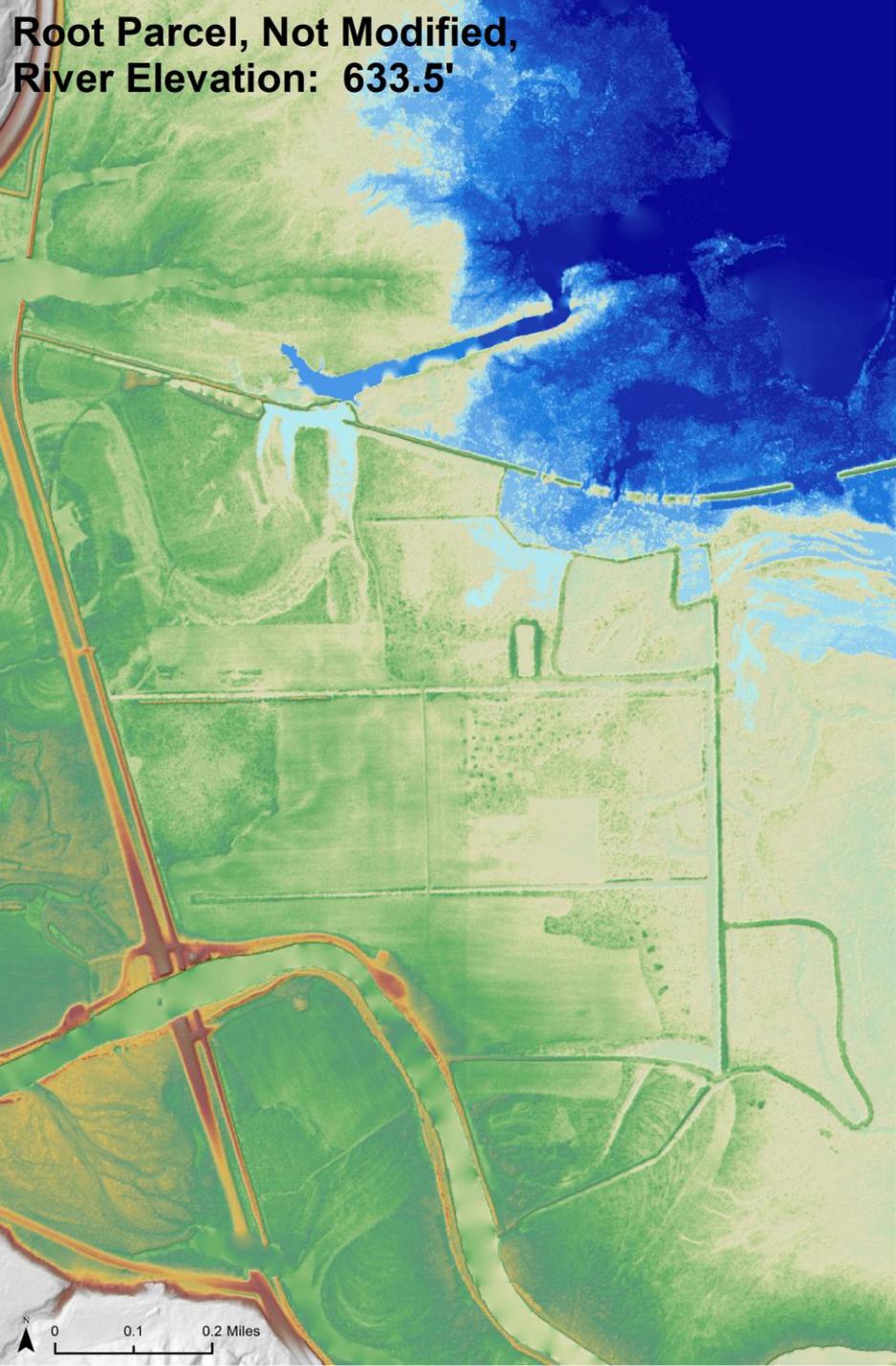
**Root Parcel, Not Modified,  
River Elevation: 633.0'**



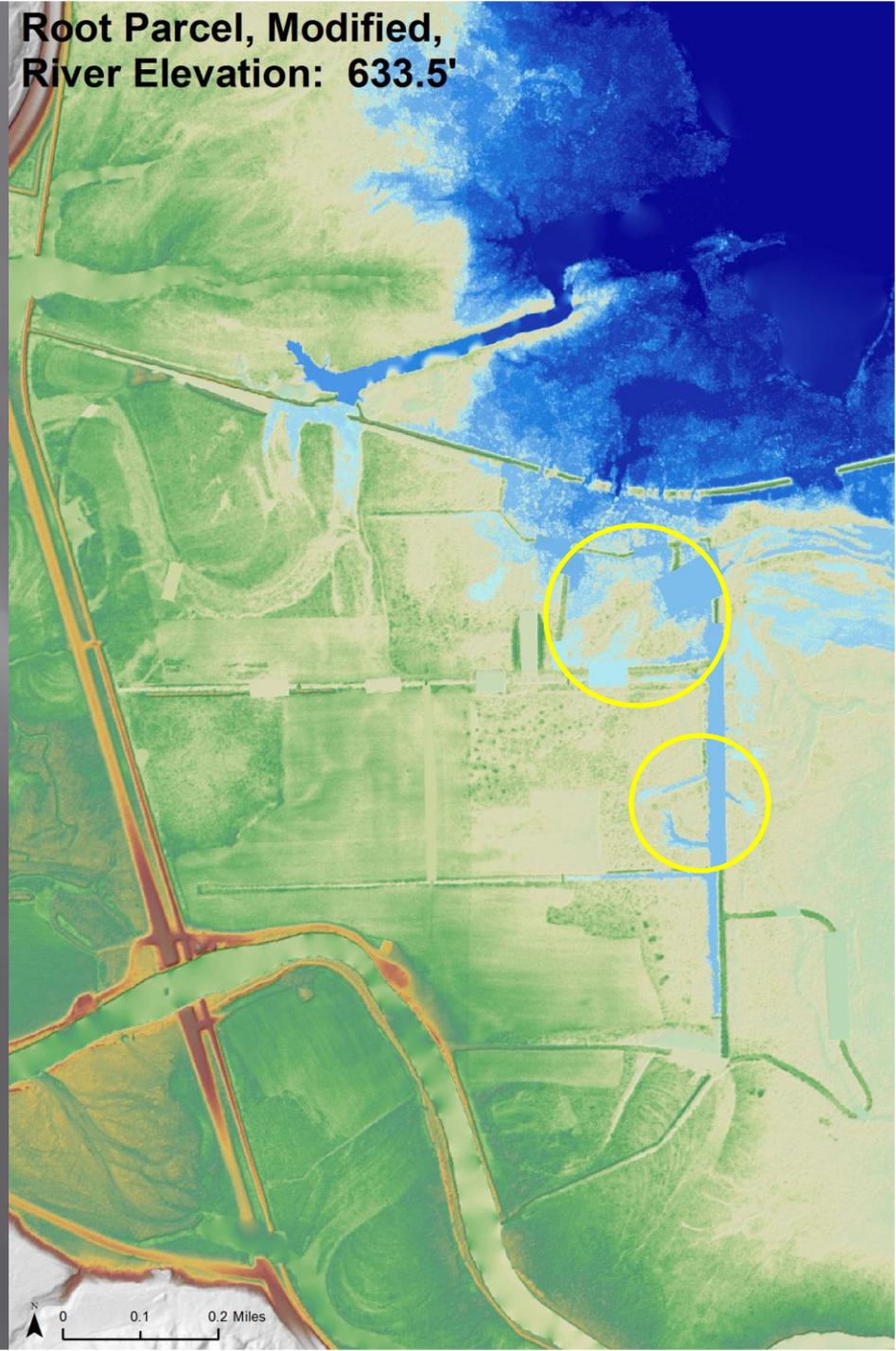
**Root Parcel, Modified,  
River Elevation: 633.0'**



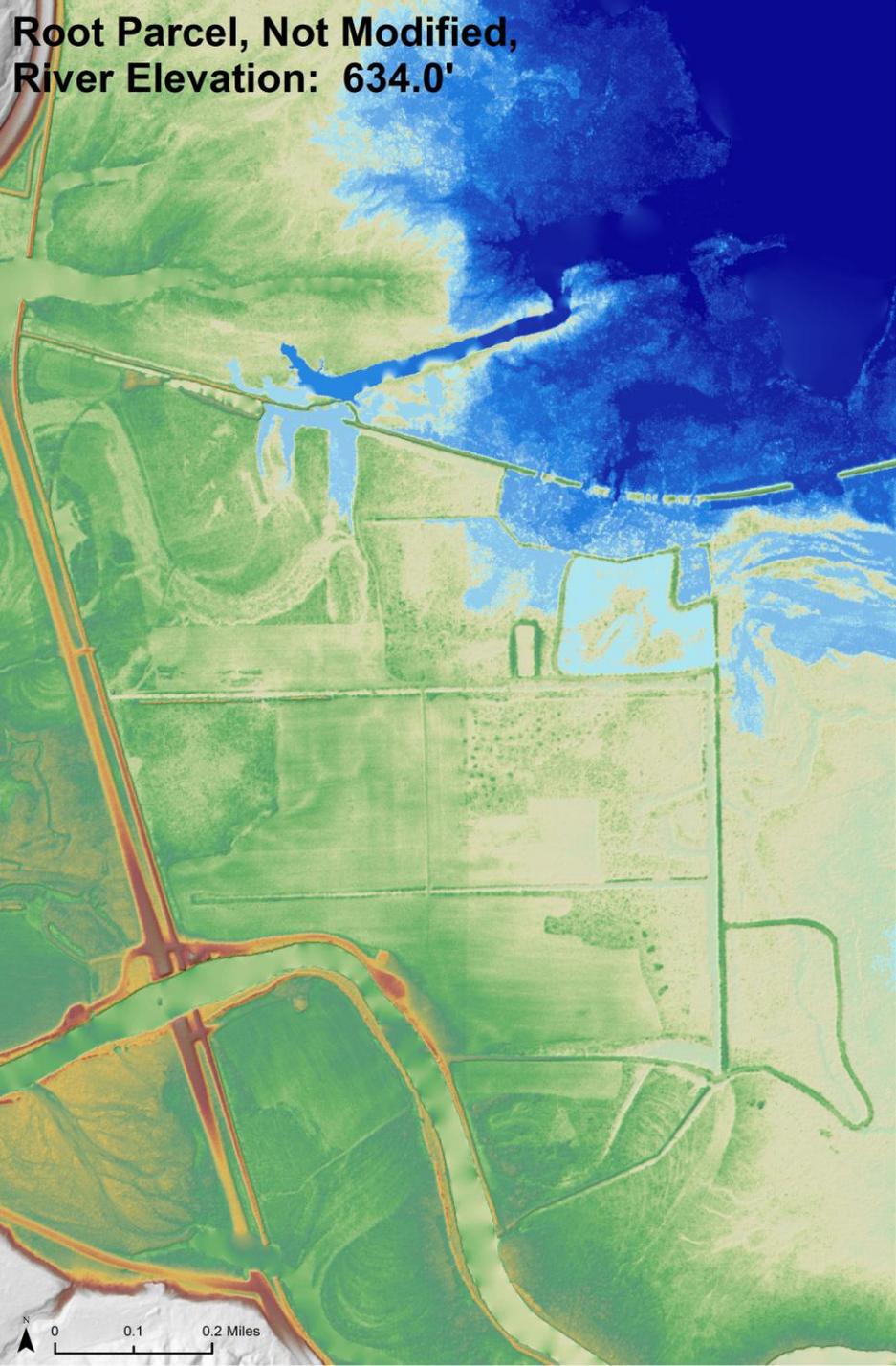
**Root Parcel, Not Modified,  
River Elevation: 633.5'**



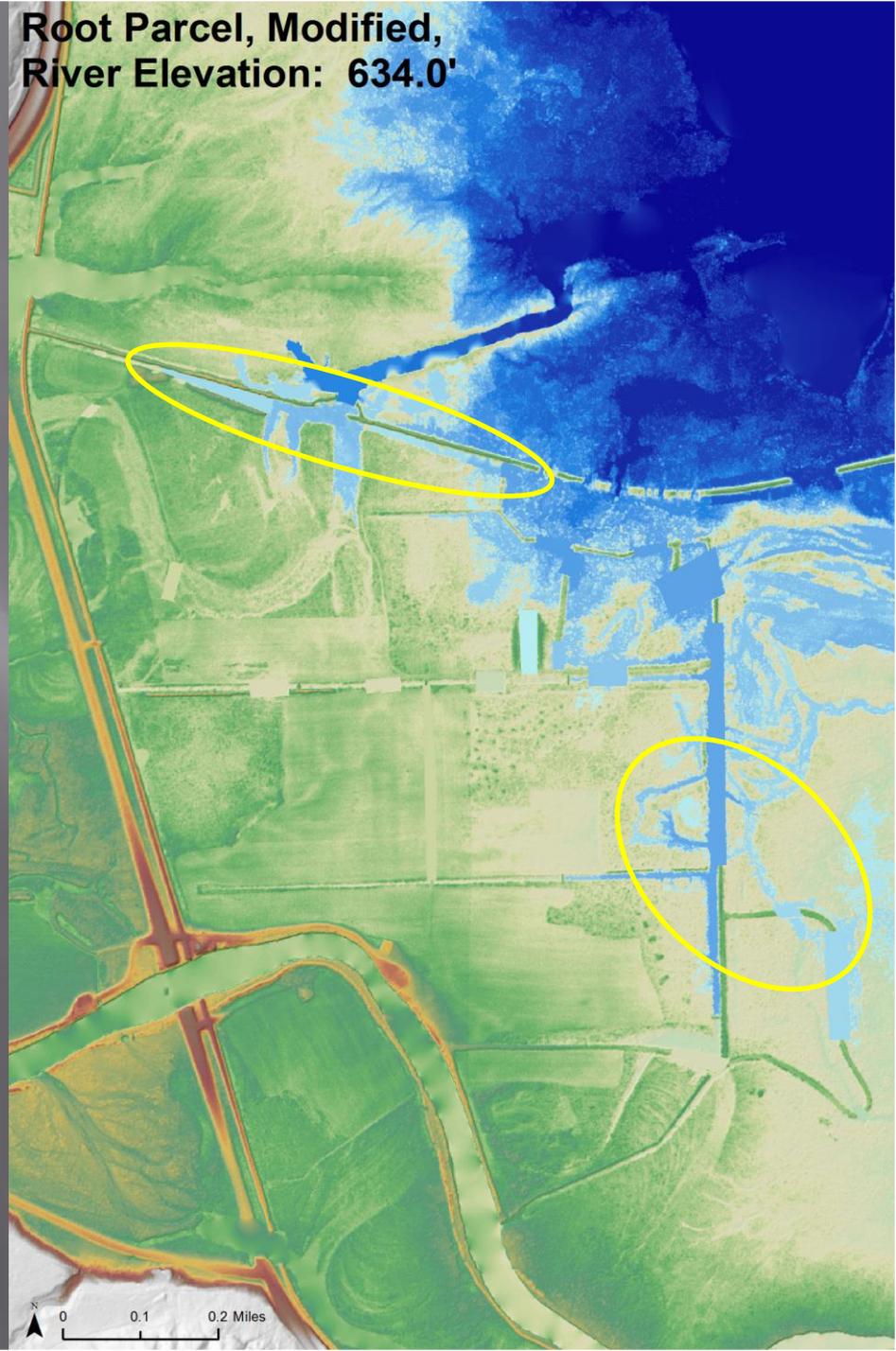
**Root Parcel, Modified,  
River Elevation: 633.5'**



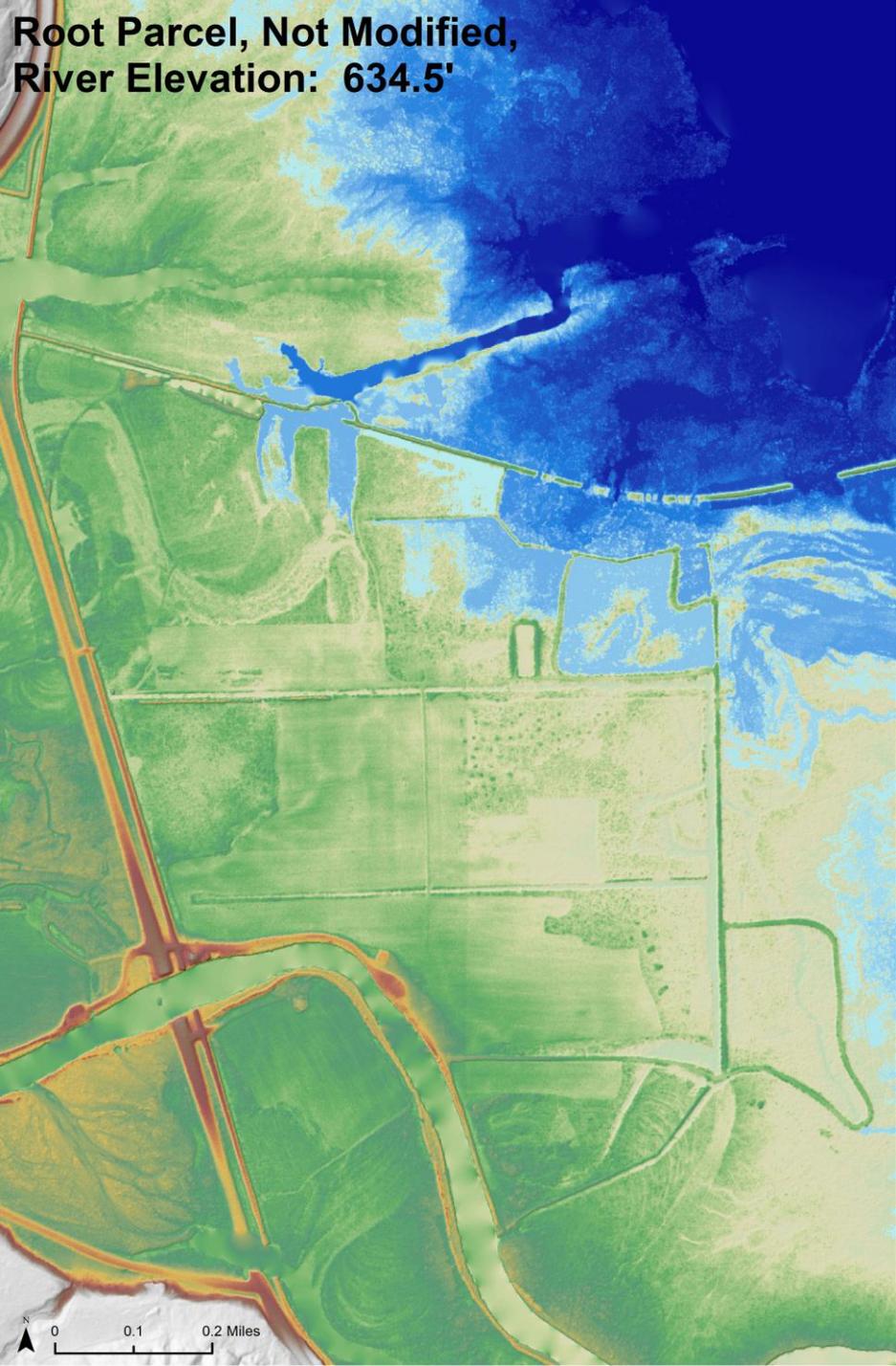
**Root Parcel, Not Modified,  
River Elevation: 634.0'**



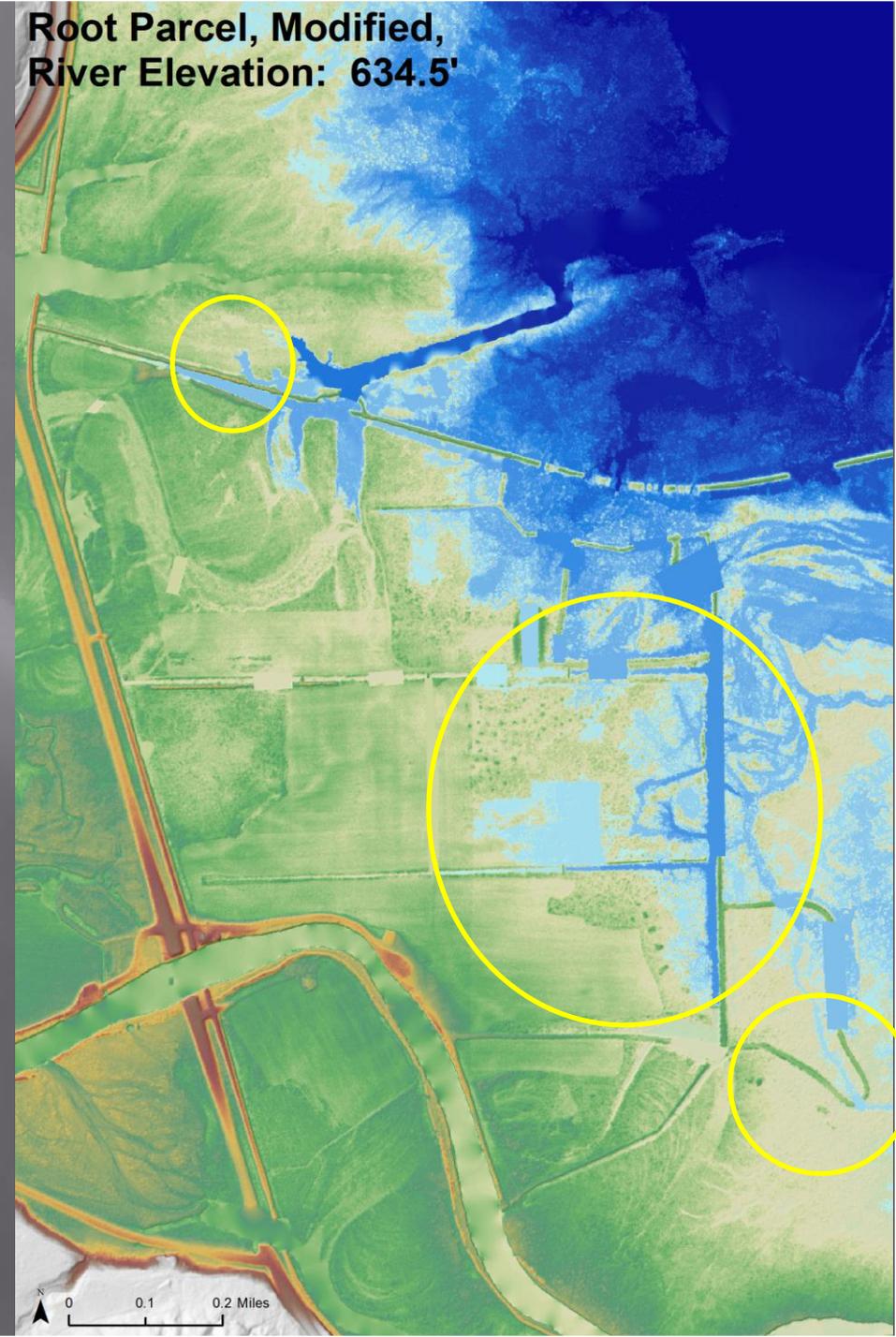
**Root Parcel, Modified,  
River Elevation: 634.0'**



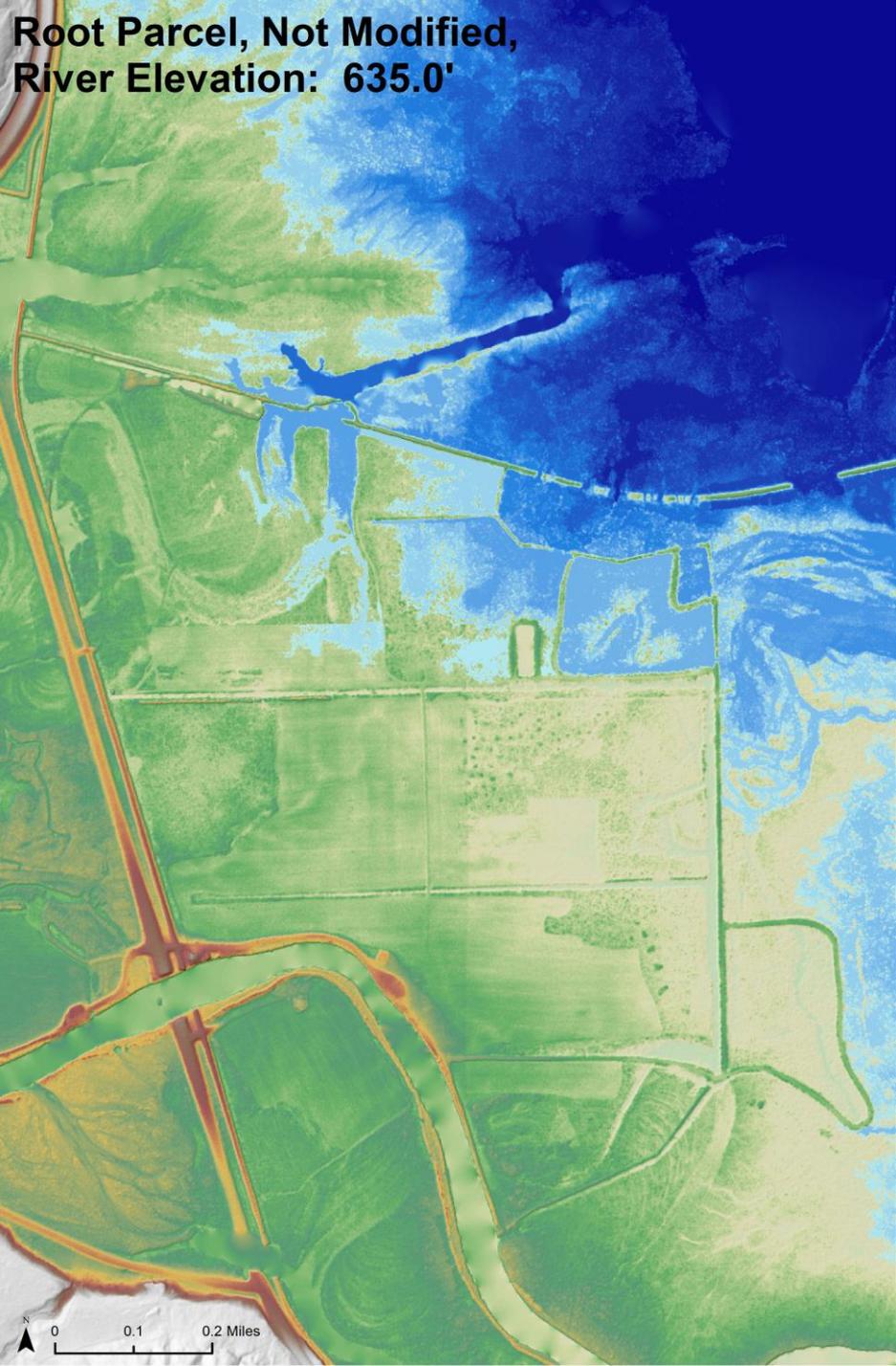
**Root Parcel, Not Modified,  
River Elevation: 634.5'**



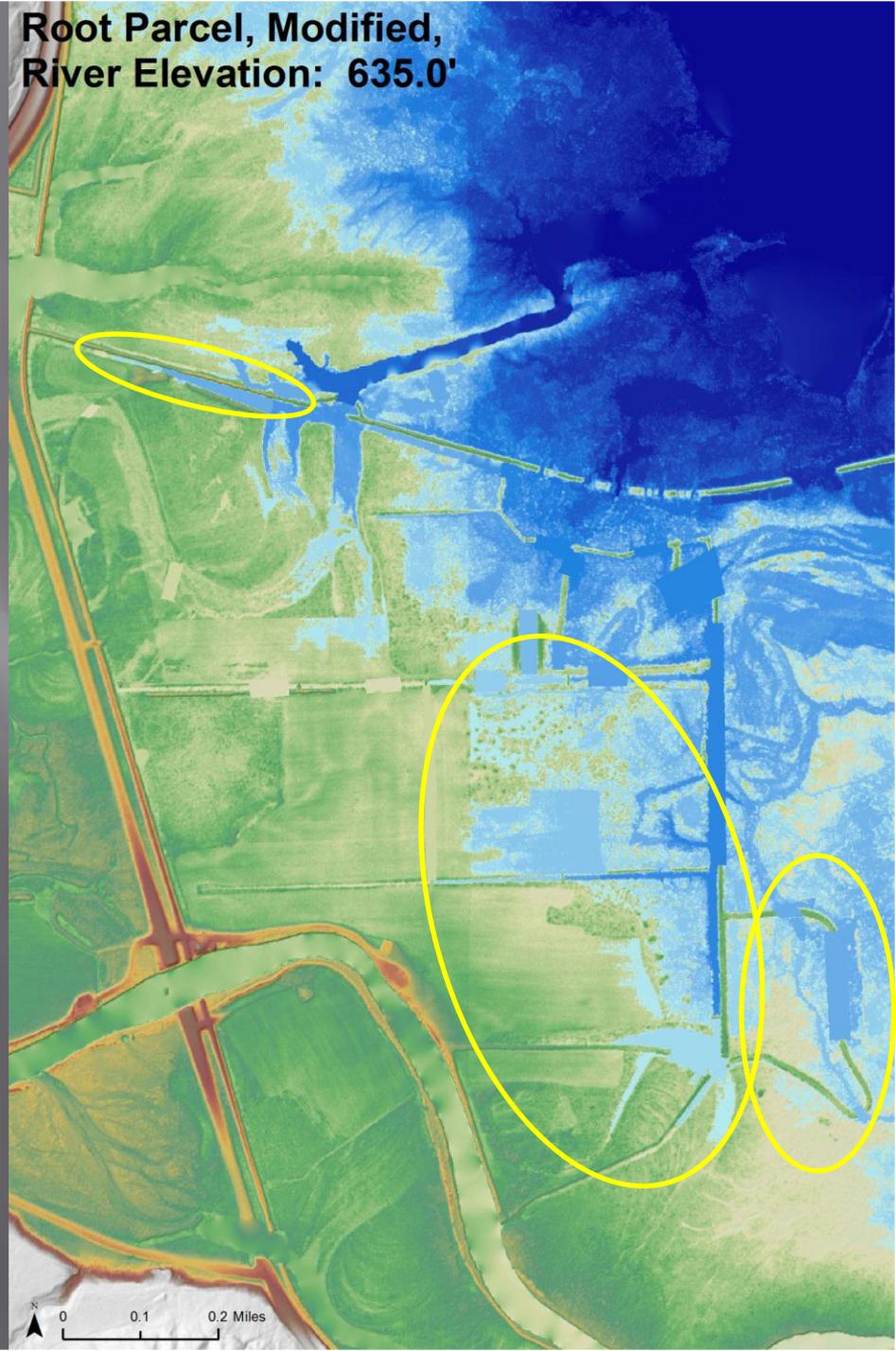
**Root Parcel, Modified,  
River Elevation: 634.5'**



**Root Parcel, Not Modified,  
River Elevation: 635.0'**



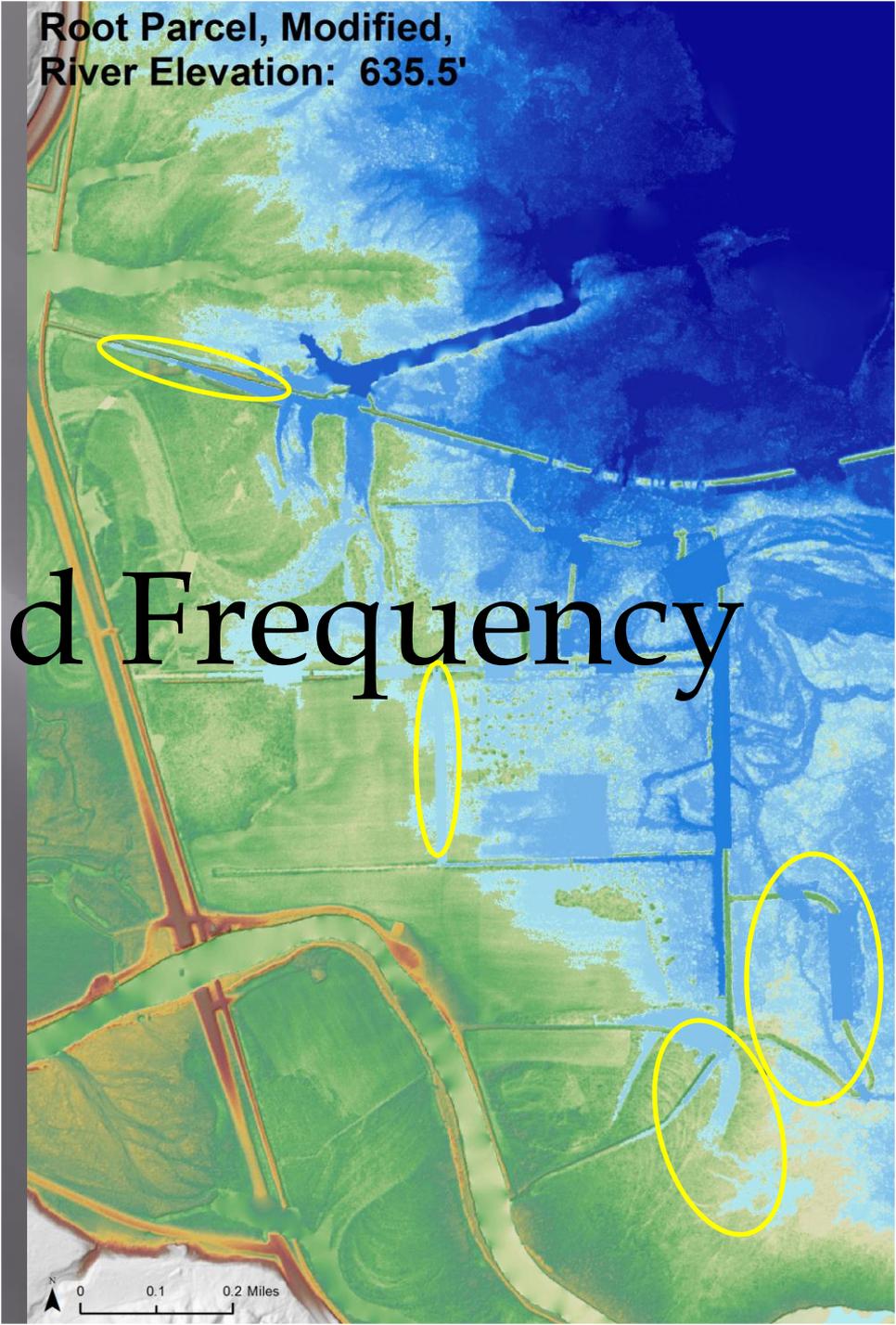
**Root Parcel, Modified,  
River Elevation: 635.0'**



Root Parcel, Not Modified,  
River Elevation: 635.5'

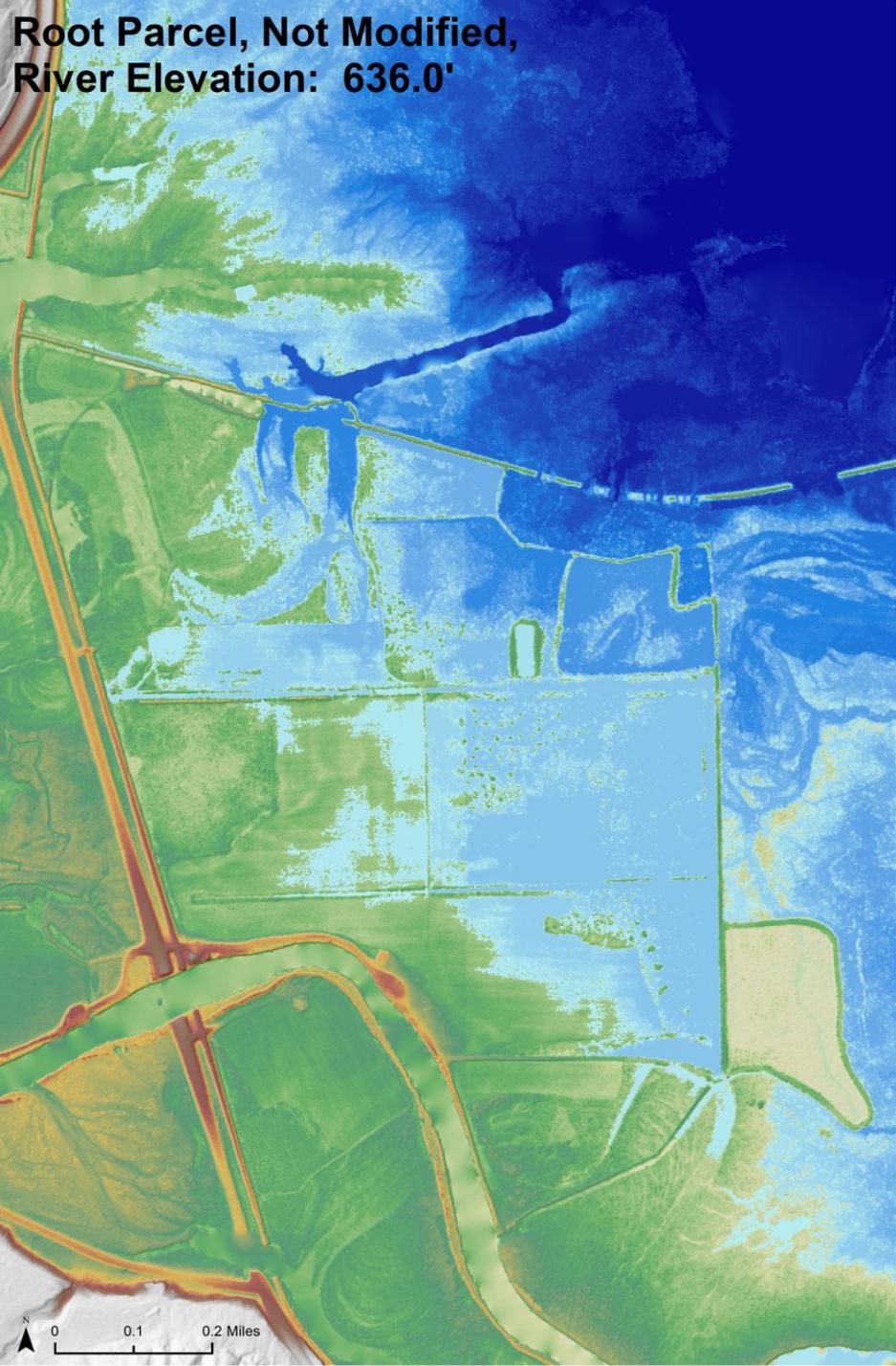


Root Parcel, Modified,  
River Elevation: 635.5'

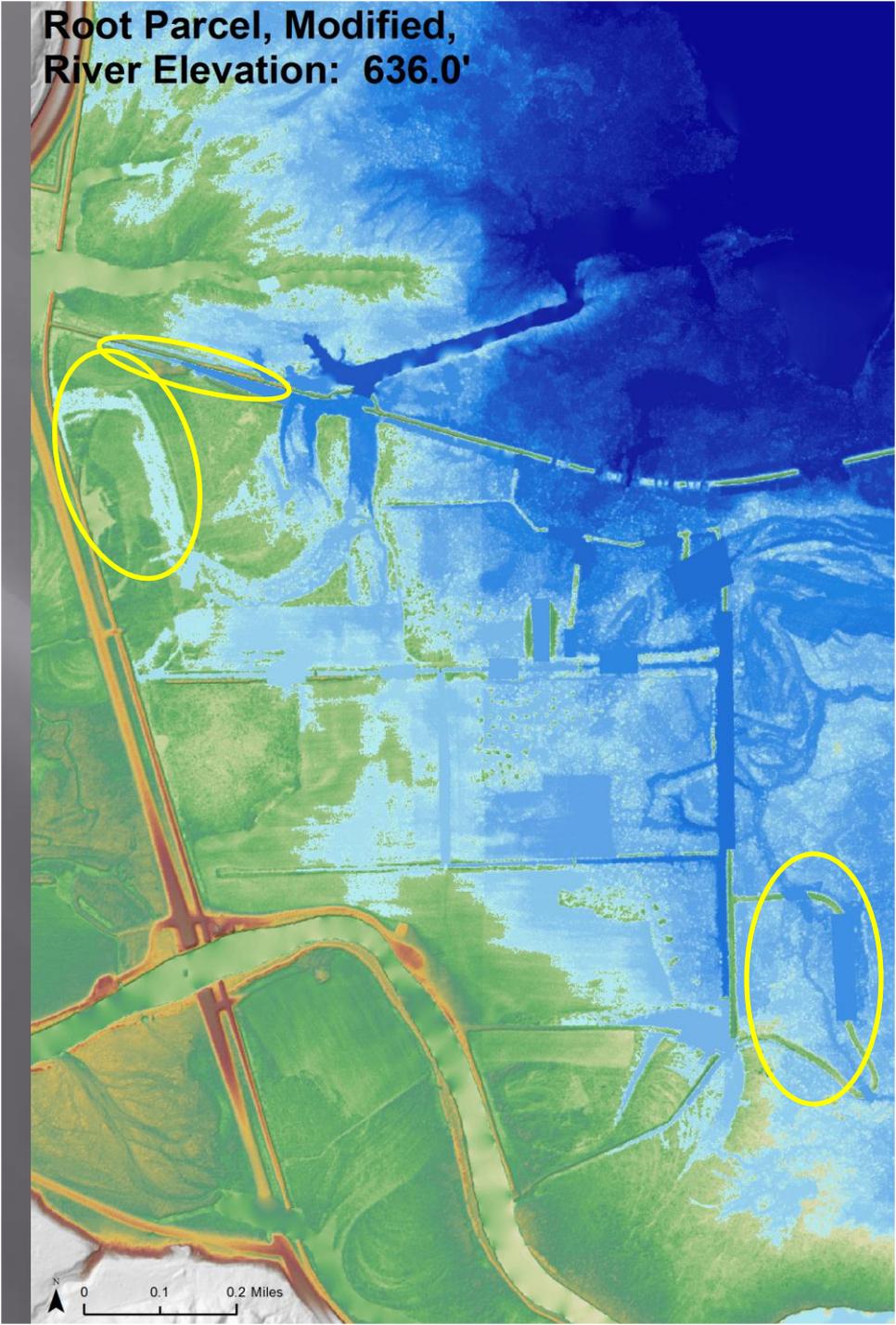


~2 Year Flood Frequency

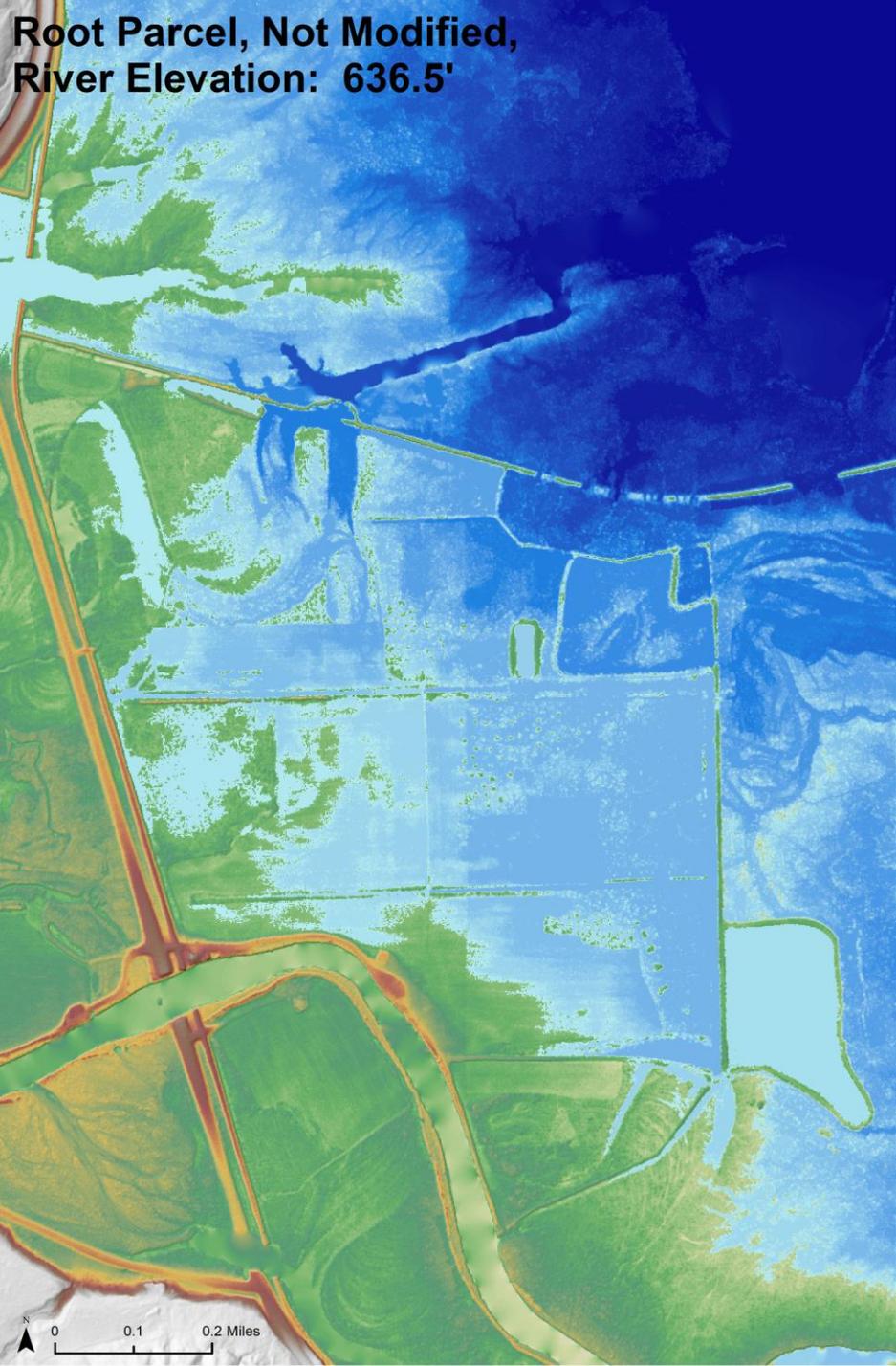
**Root Parcel, Not Modified,  
River Elevation: 636.0'**



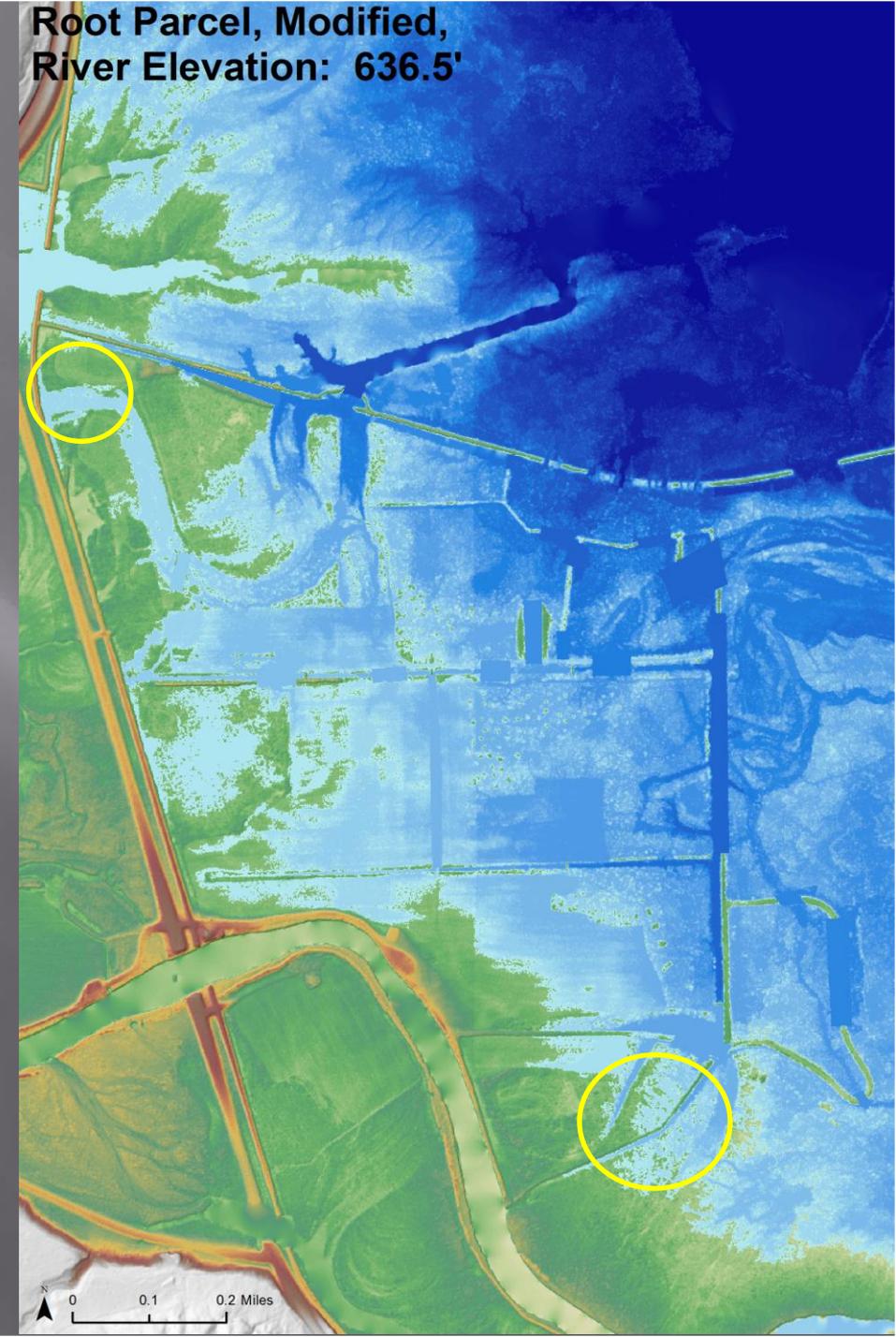
**Root Parcel, Modified,  
River Elevation: 636.0'**



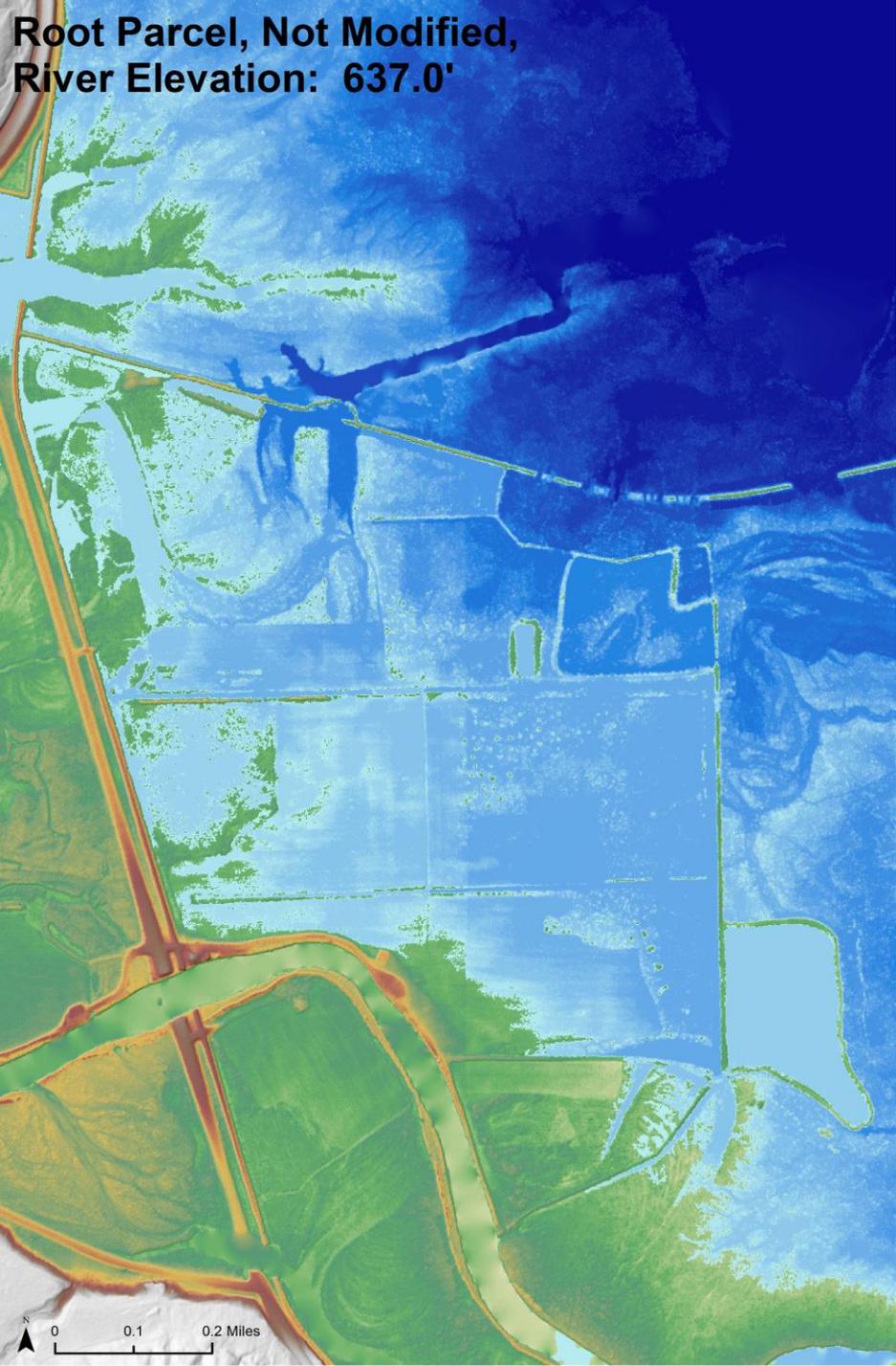
**Root Parcel, Not Modified,  
River Elevation: 636.5'**



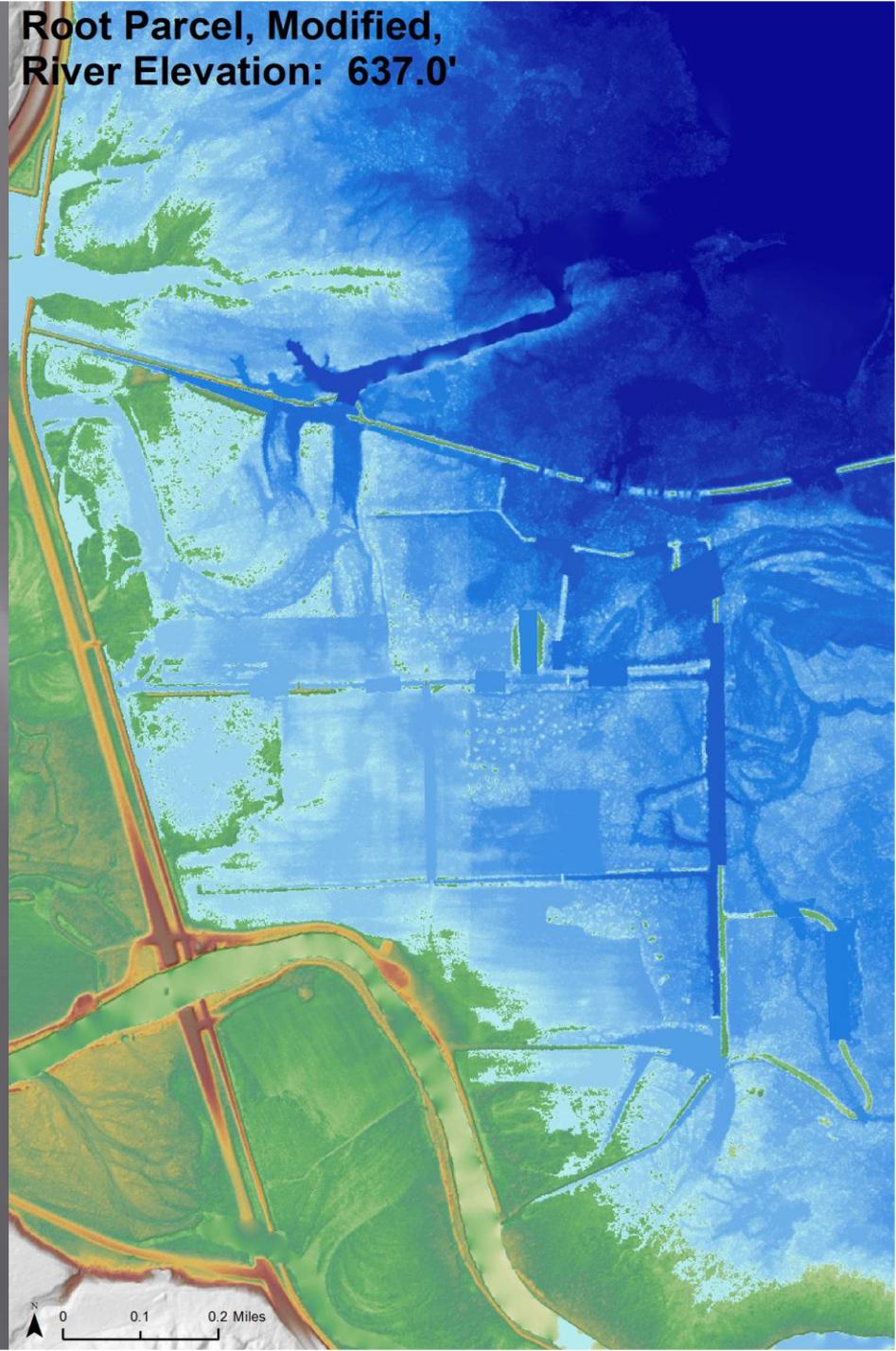
**Root Parcel, Modified,  
River Elevation: 636.5'**



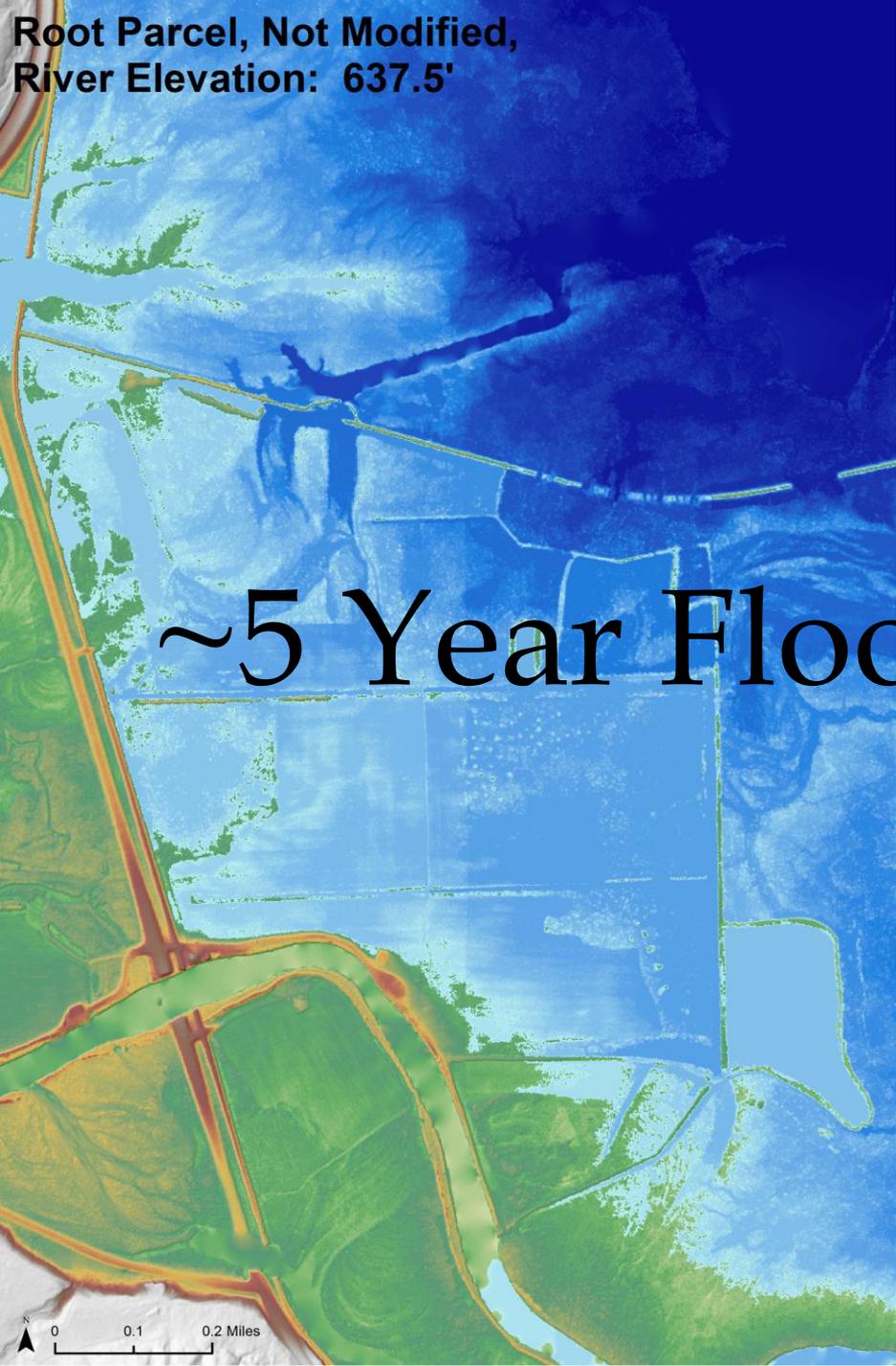
**Root Parcel, Not Modified,  
River Elevation: 637.0'**



**Root Parcel, Modified,  
River Elevation: 637.0'**



Root Parcel, Not Modified,  
River Elevation: 637.5'

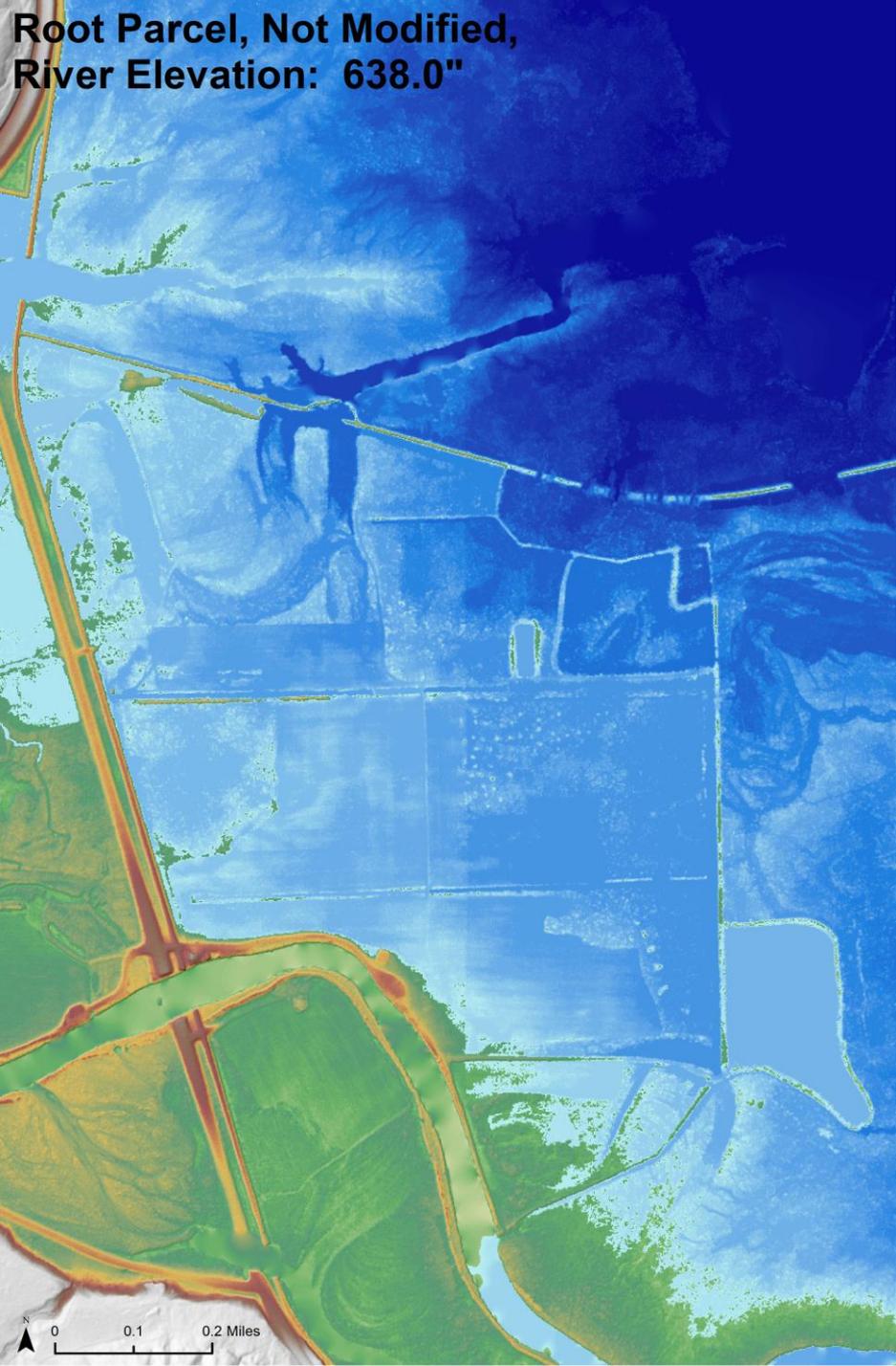


Root Parcel, Modified,  
River Elevation: 637.5'

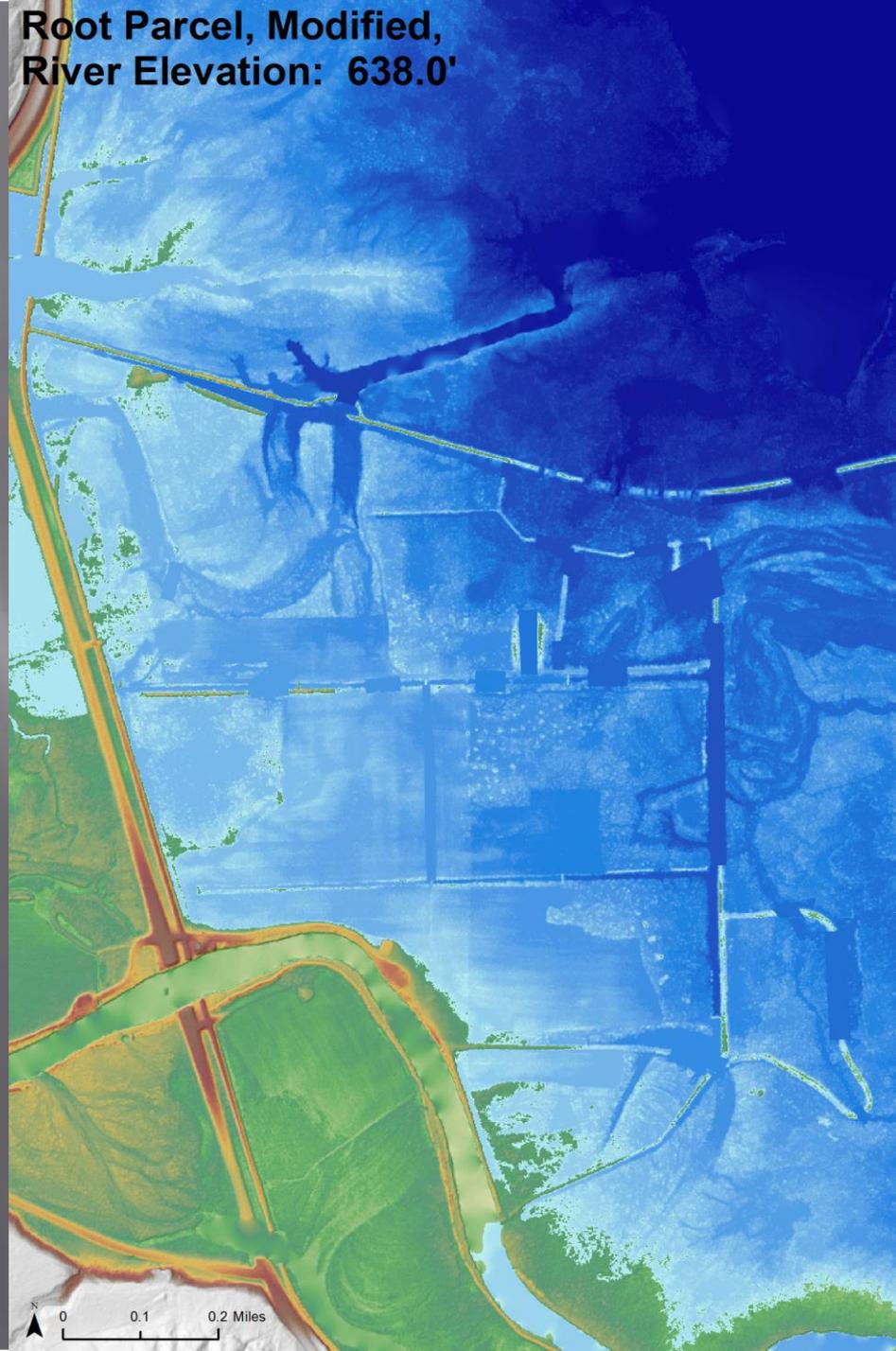


~5 Year Flood Frequency

**Root Parcel, Not Modified,  
River Elevation: 638.0"**



**Root Parcel, Modified,  
River Elevation: 638.0"**





### Days per Range of Stage on the Mississippi River at La Crosse, WI: March - April, 2004 - 2014

Stage	Average # of days per Year
March - April: Between 633 - 634 ft.	7.2
March - April: Between 634 - 636 ft.	13
March - April: Between 636 - 638 ft.	4.1
March - April: Between 638 - 640 ft.	1.1
March - April: Above 633 ft.	25.4
March - April: Above 634 ft.	18.2
March - April: Above 636 ft.	5.2

### Days per Range of Stage on the Mississippi River at La Crosse, WI: May - August, 2004 - 2014

Stage	Average # of days per Year
May - August: Between 633 - 634 ft.	15.7
May - August: Between 634 - 636 ft.	26.0
May - August: Between 636 - 638 ft.	6.4
May - August: Between 638 - 640 ft.	1.0
May - August: Above 633 ft.	49.1
May - August: Above 634 ft.	33.4
May - August: Above 636 ft.	7.4

### Days per Range of Stage on the Mississippi River at La Crosse, WI: September - November, 2004 - 2014

Stage	Average # of days per Year
September - November: Between 633 - 634 ft.	3.7
September - November: Between 634 - 636 ft.	3.1
September - November: Between 636 - 638 ft.	1.0
September - November: Between 638 - 640 ft.	0.6
September - November: Above 633 ft.	8.4
September - November: Above 634 ft.	4.7
September - November: Above 636 ft.	1.6

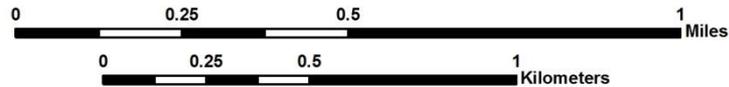
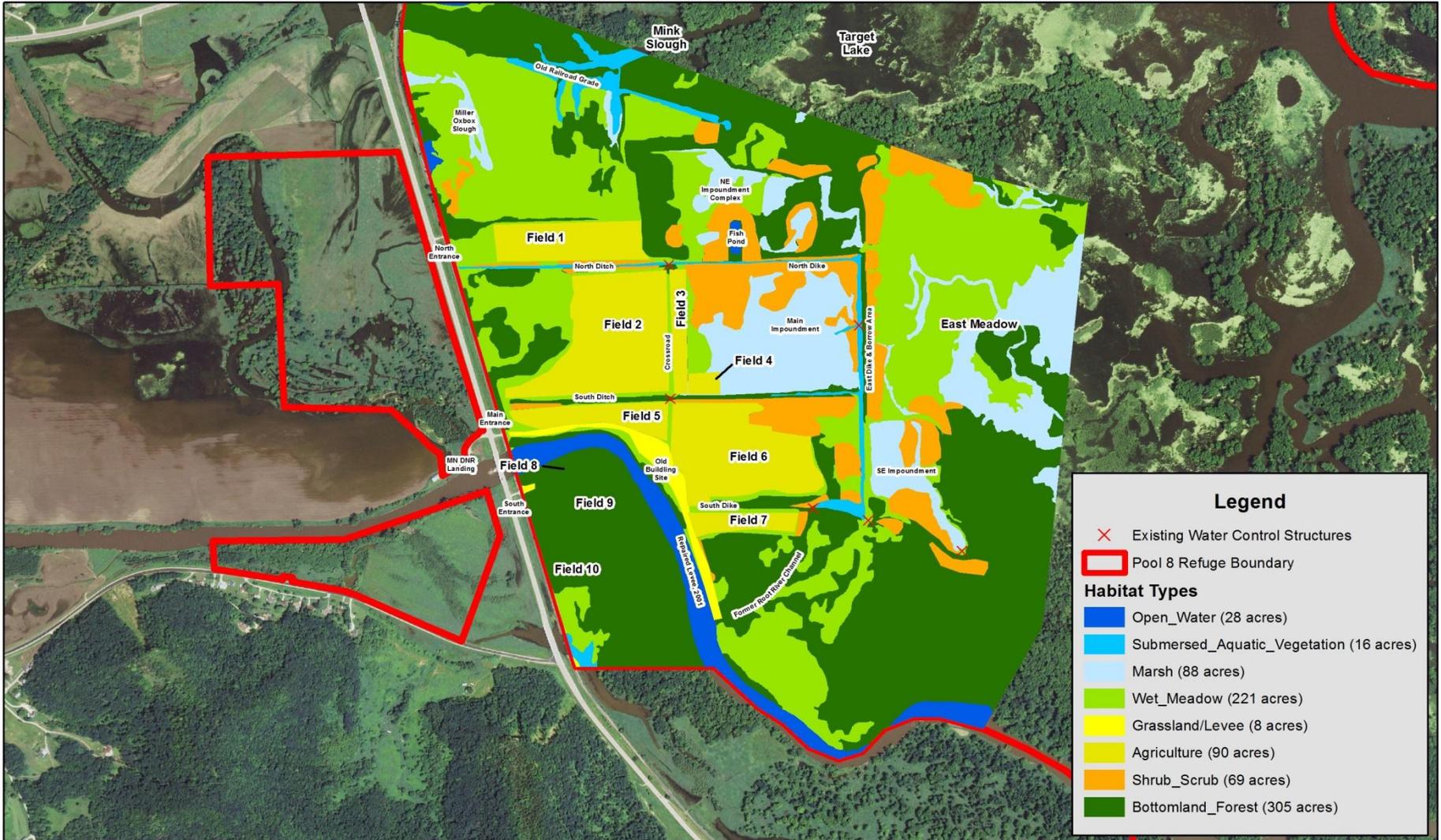




# Upper Mississippi River National Wildlife & Fish Refuge

Pool 8

# Existing

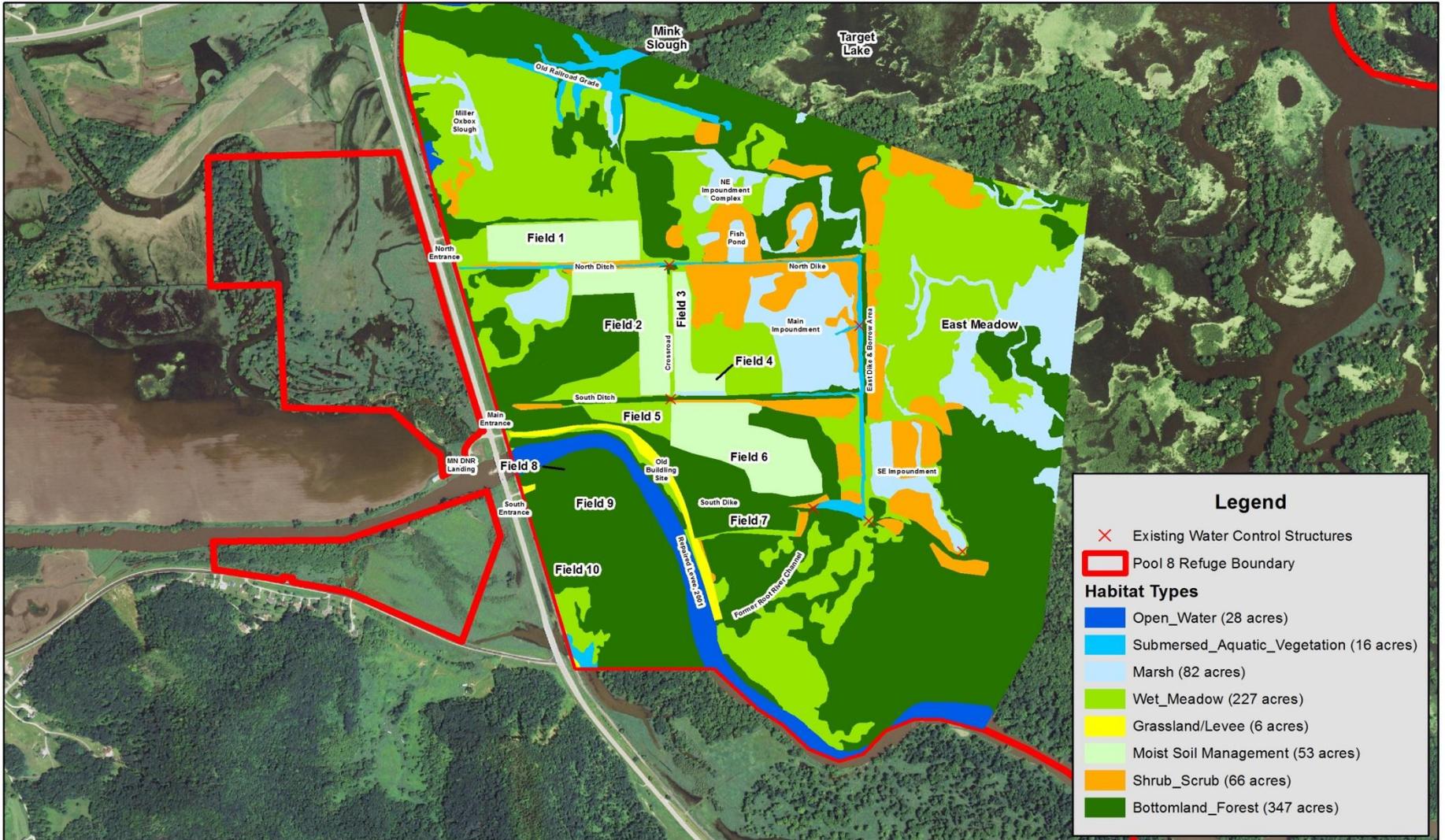




# Upper Mississippi River National Wildlife & Fish Refuge

Pool 8

# Future

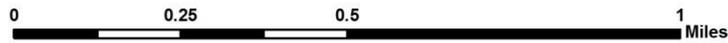


**Legend**

- ✕ Existing Water Control Structures
- ▭ Pool 8 Refuge Boundary

**Habitat Types**

- Open\_Water (28 acres)
- Submersed\_Aquatic\_Vegetation (16 acres)
- Marsh (82 acres)
- Wet\_Meadow (227 acres)
- Grassland/Levee (6 acres)
- Moist Soil Management (53 acres)
- Shrub\_Scrub (66 acres)
- Bottomland\_Forest (347 acres)





# Existing

# Future



## Legend

✗ Existing Water Control Structures

Pool 8 Refuge Boundary

### Habitat Types

- Open\_Water (28 acres)
- Submersed\_Aquatic\_Vegetation (16 acres)
- Marsh (88 acres)
- Wet\_Meadow (221 acres)
- Grassland/Levee (8 acres)
- Agriculture (90 acres)
- Shrub\_Scrub (69 acres)
- Bottomland\_Forest (305 acres)

## Legend

✗ Existing Water Control Structures

Pool 8 Refuge Boundary

### Habitat Types

- Open\_Water (28 acres)
- Submersed\_Aquatic\_Vegetation (16 acres)
- Marsh (82 acres) -6 ac
- Wet\_Meadow (227 acres) +6 ac
- Grassland/Levee (6 acres) -2 ac
- Moist Soil Management (53 acres) +53 ac
- Shrub\_Scrub (66 acres) -3 ac
- Bottomland\_Forest (347 acres) +42 ac



# Conclusion

- ❑ Tract has a great deal of potential for habitat, species and public enjoyment
- ❑ Reconnection will need to balance multiple objectives
- ❑ Approach needs to be capable of meeting objectives, sustainable and avoid unintended consequences
- ❑ We need your input!





# THANK YOU!

---

# QUESTIONS?

Future Questions?

Please Contact:

Tim Yager

Deputy Refuge Manager

Upper Mississippi River National Wildlife and  
Fish Refuge

Phone: 507-494-6219

E-mail: [timothy\\_yager@fws.gov](mailto:timothy_yager@fws.gov)



