Results of Expanded Land Subsidence Analysis – Friant-Kern Canal Area

May 3, 2019

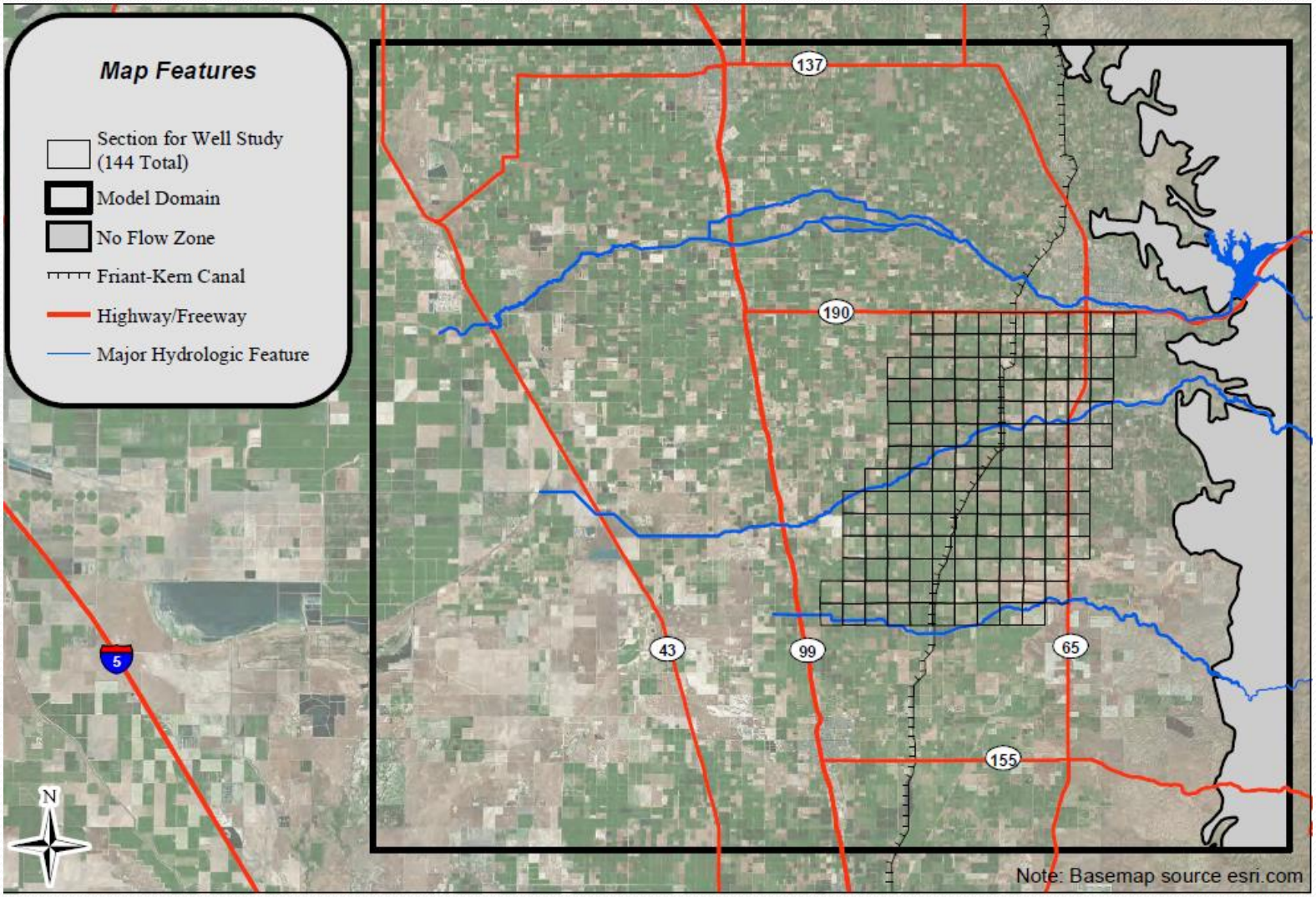
Preliminary Draft
For Discussion Purposes Only

Thomas Harder & Co.
Groundwater Consulting

The purpose of this presentation is to provide the Results of an Expanded Analysis of the Causes of Subsidence in the Vicinity of the Friant-Kern Canal

- Context for Expanded Land Subsidence Study
- Expanded Study Area
- Cause of Projected Land Subsidence Beneath the Friant-Kern Canal at the White River
- Description of Additional Water Budget Alternatives Analyzed
- Results of Our Analysis

Original Area for Focused Subsidence Analysis



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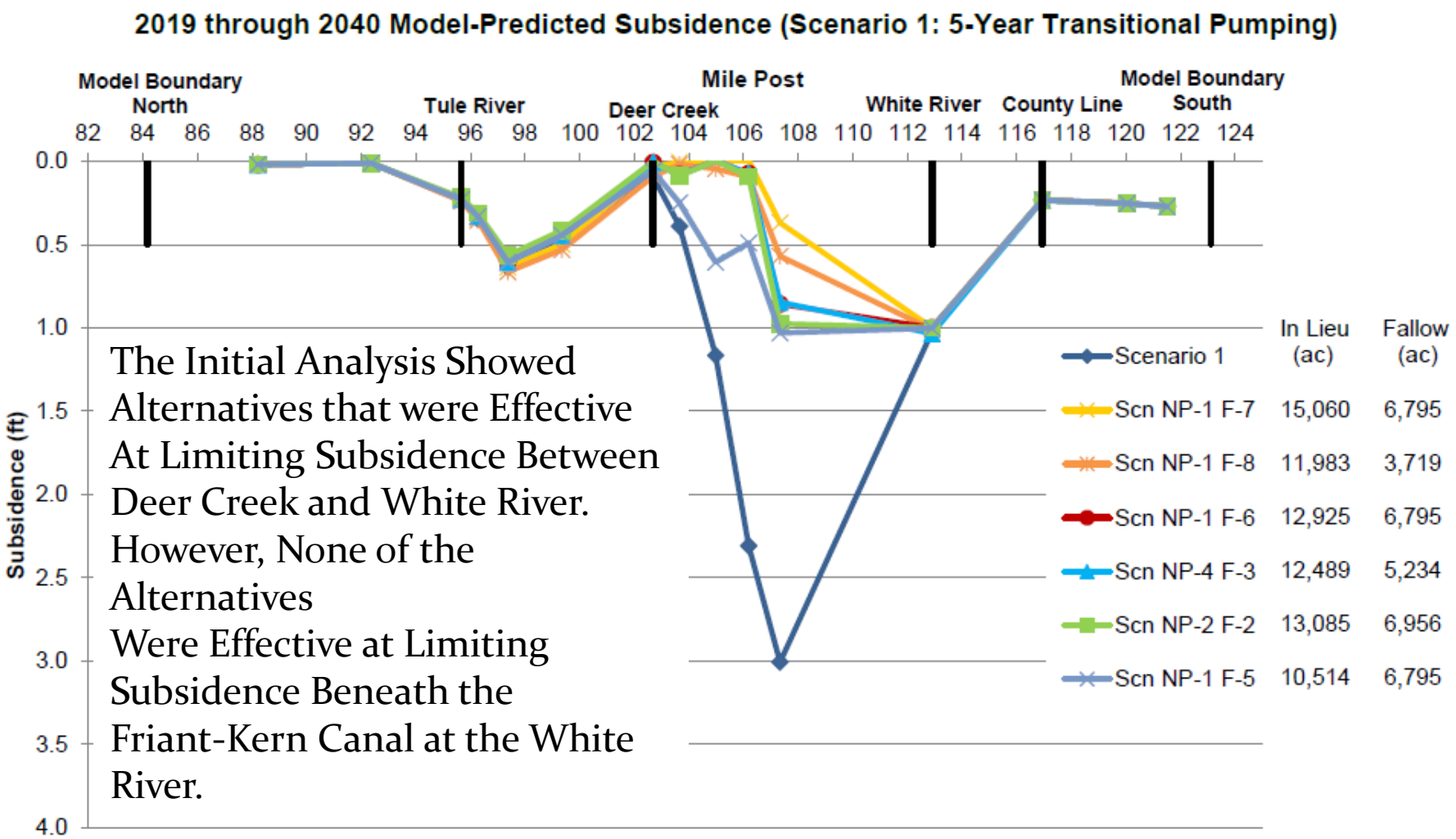
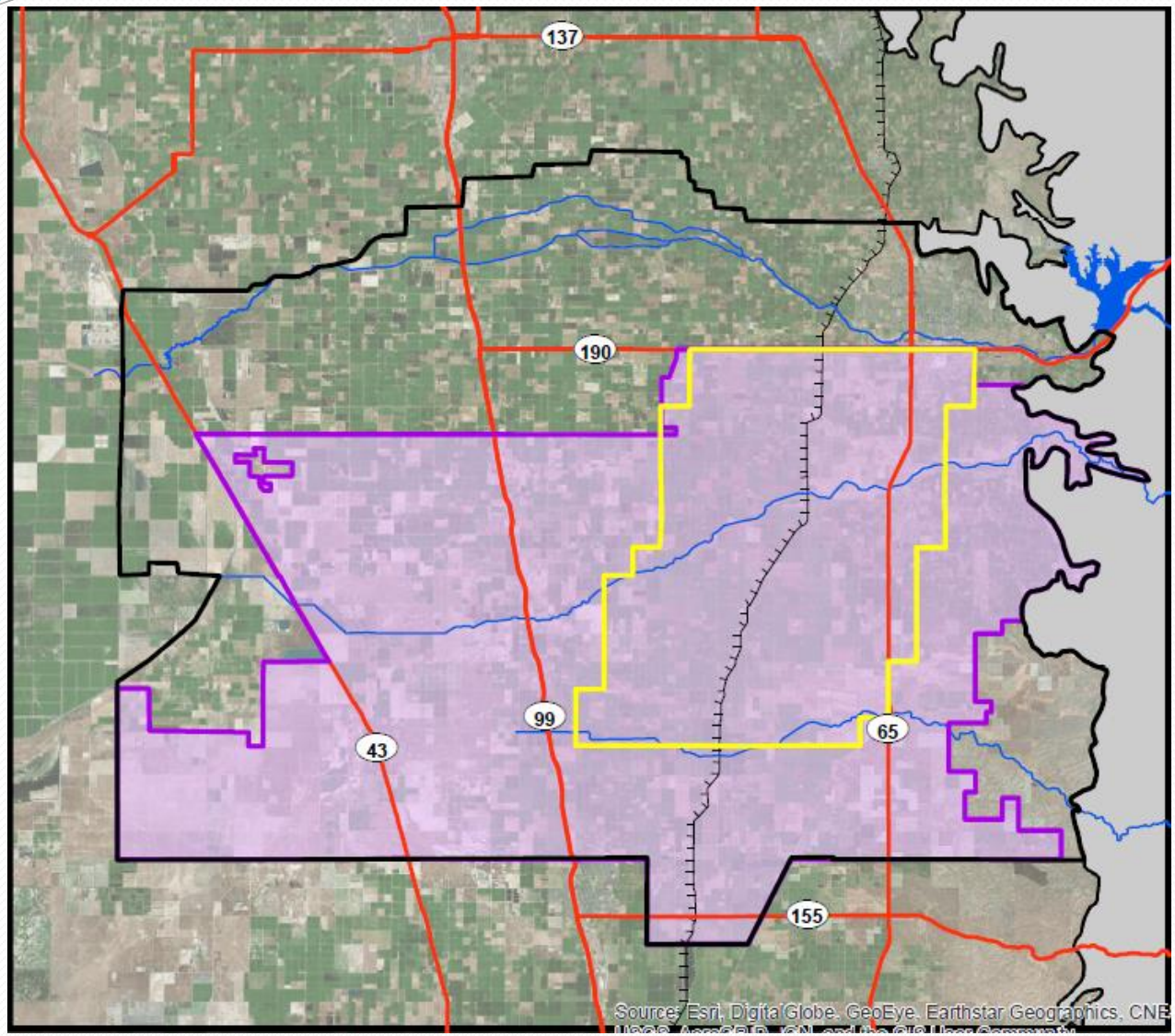
Subsidence Profile with 6 Previous Best Alternatives Presented April 17, 2019



The Initial Analysis Showed Alternatives that were Effective At Limiting Subsidence Between Deer Creek and White River. However, None of the Alternatives Were Effective at Limiting Subsidence Beneath the Friant-Kern Canal at the White River.

Expanded Area for Subsidence Analysis



Expanded Study Area

Original Study Area

The Purpose for the Expanded Study was to Evaluate the Cause of Land Subsidence Beneath The Friant-Kern Canal At the White River.

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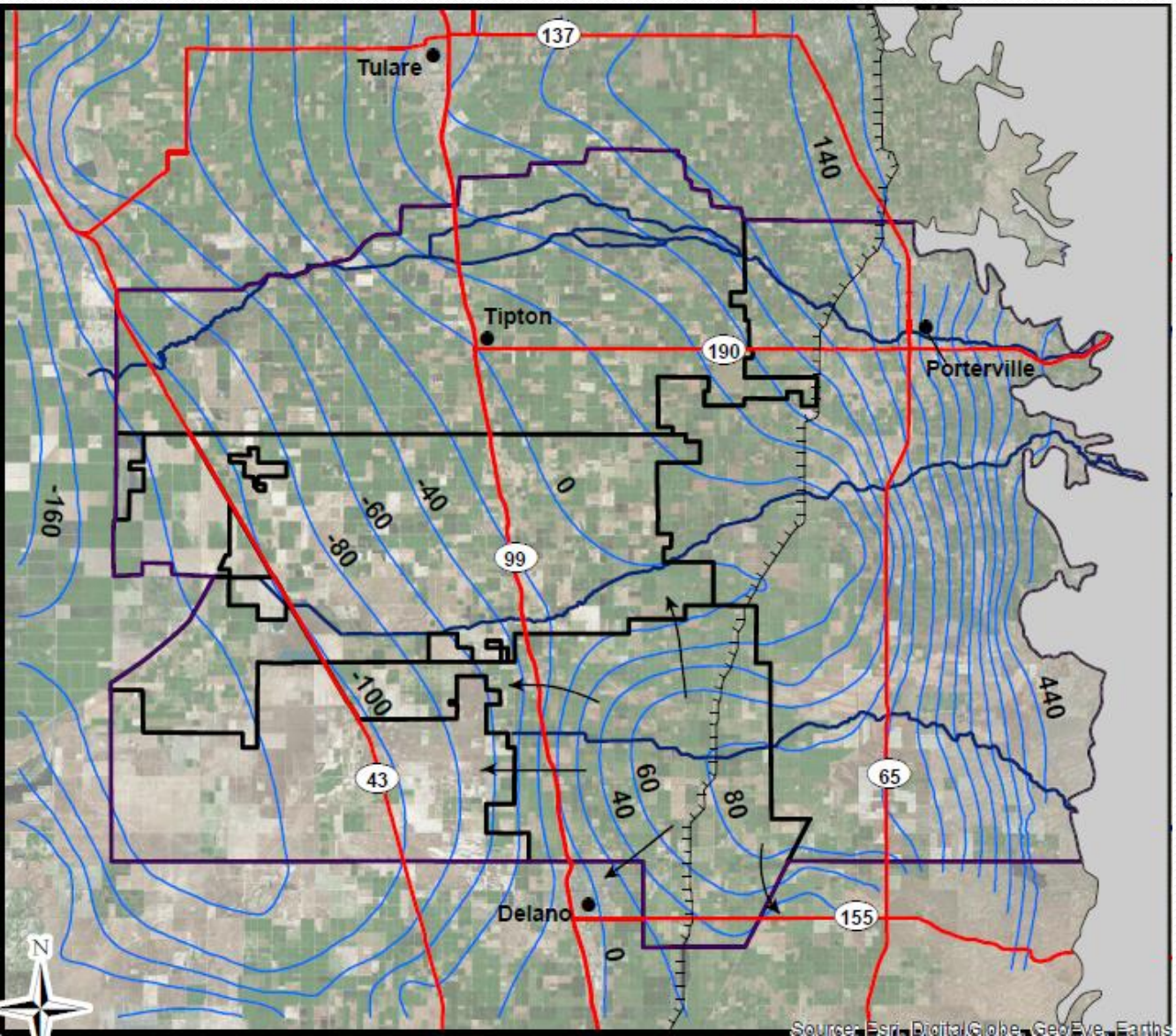
Lower Aquifer Groundwater Level Contours - 2020



Groundwater Levels Beneath DEID are Higher Than Surrounding Areas to the North, West and South. Groundwater Underflow Out of DEID to the North and West has Historically Been Increased by Groundwater Level Depressions to the North , West and South Caused by Pumping in those Areas.

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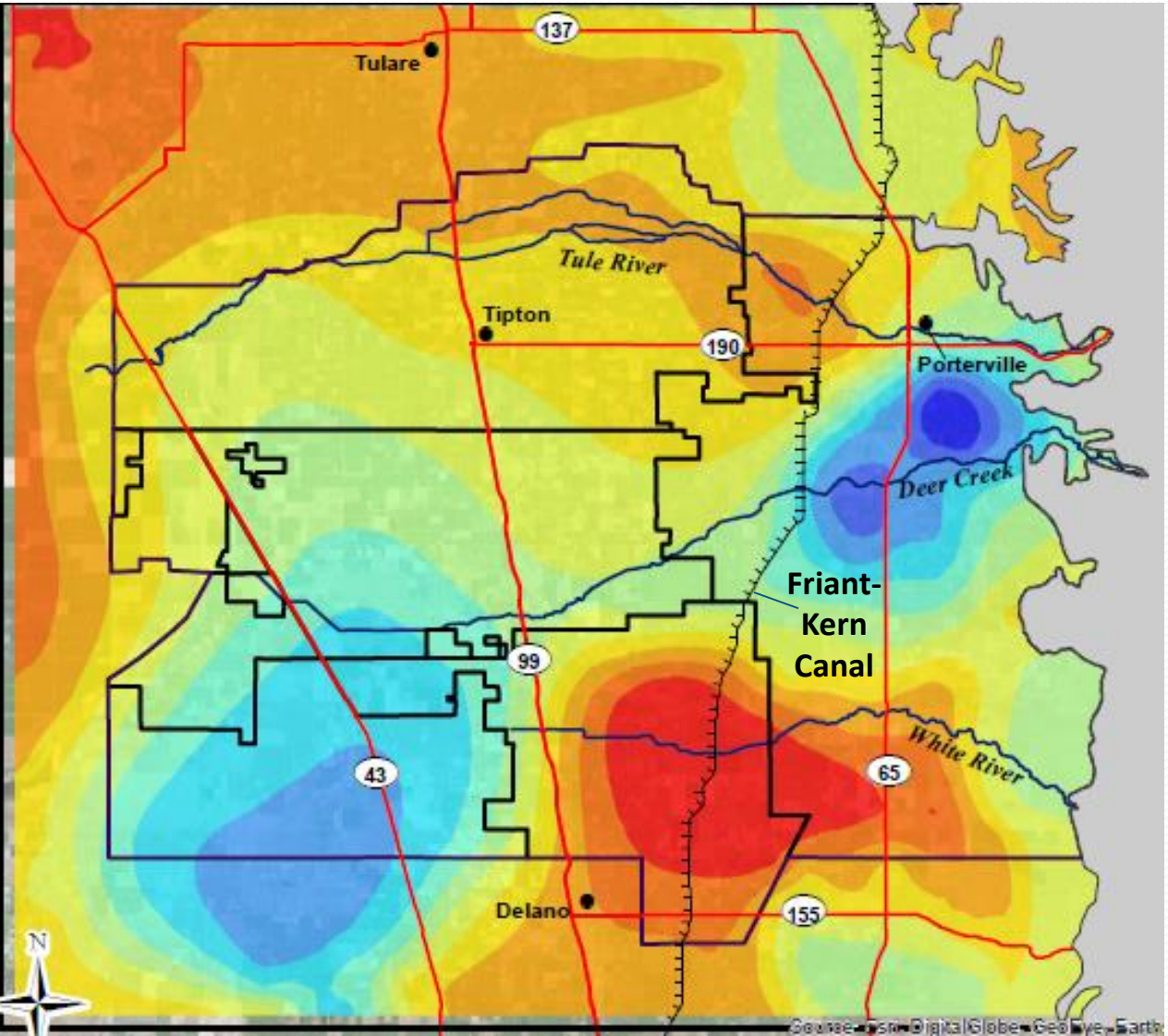
Subsidence Is Projected to Continue Along the Friant-Kern Canal Near White River Because Groundwater Levels are Projected to Continue to Decline in this Area As Groundwater from the Mound Continues to Fill in the Depressions Caused by Historical Pumping to the North and West



Scenario 1 5-Yr Ramp Down
2020 – 2040
Lower Aquifer

Groundwater Elevation Difference (ft)
-40 to -30
-30 to -20
-20 to -10
-10 to 0
0 - 10
10- 20
20 - 30
30 - 40
40 - 50
50 - 60
60 - 75

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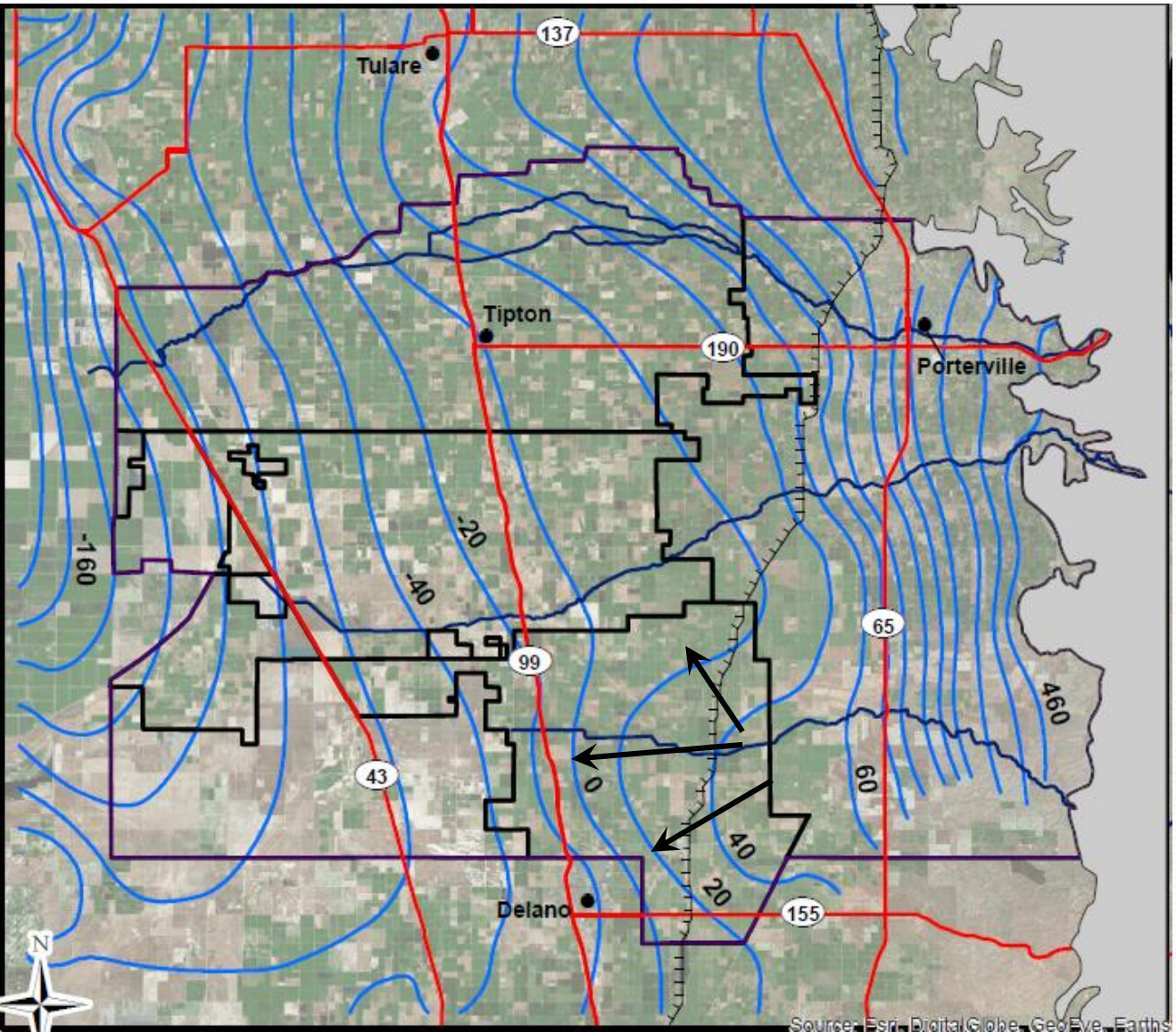
Lower Aquifer Groundwater Level Contours - 2040



As the Subbasin Achieves Sustainability in 2040, the Groundwater Depressions to the North And West of DEID Continue to Equilibrate With the Higher Ground Water Levels Beneath DEID.

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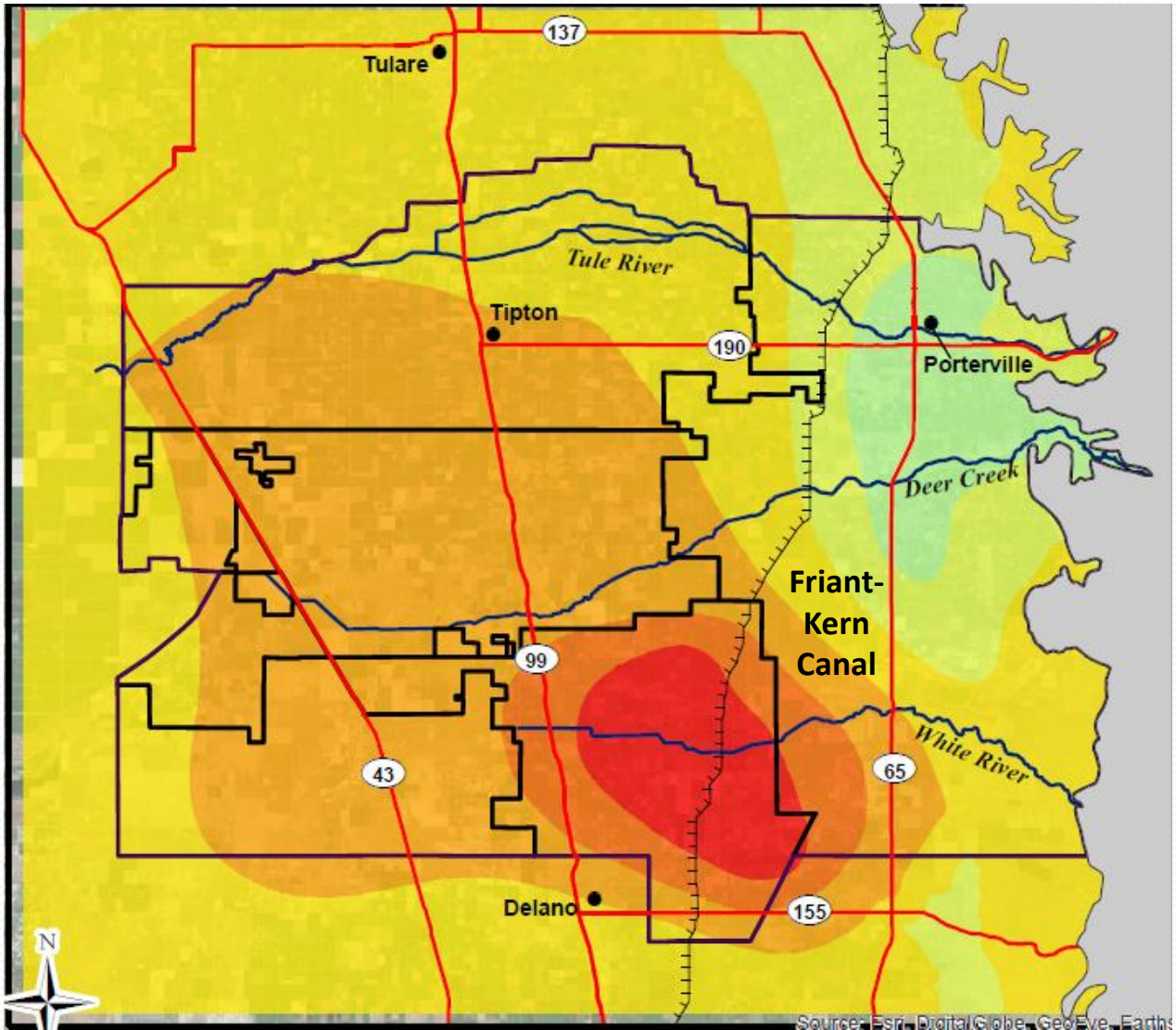
Groundwater Level Decline Is Forecast to Continue in the DEID Area After 2040 As Groundwater Levels Continue to Equilibrate



Scenario 1 5-Yr Ramp Down
2040 – 2070
Lower Aquifer

Groundwater Elevation Difference (ft)
-40 to -30
-30 to -20
-20 to -10
-10 to 0
0 - 10
10- 20
20 - 30
30 - 40
40 - 50
50 - 60
60 - 75

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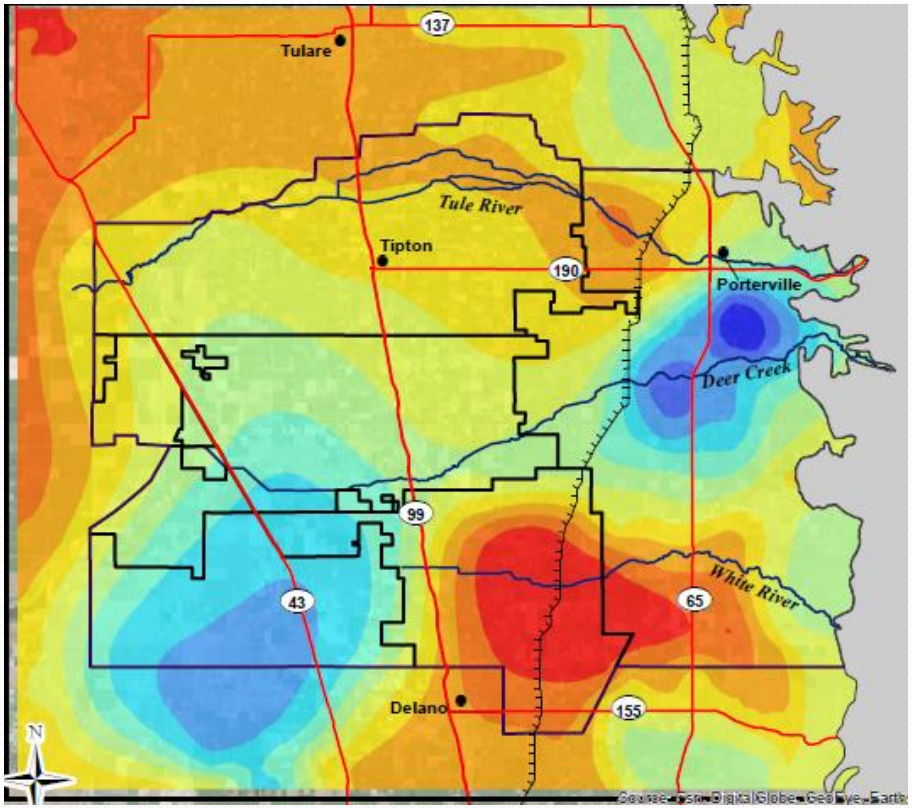
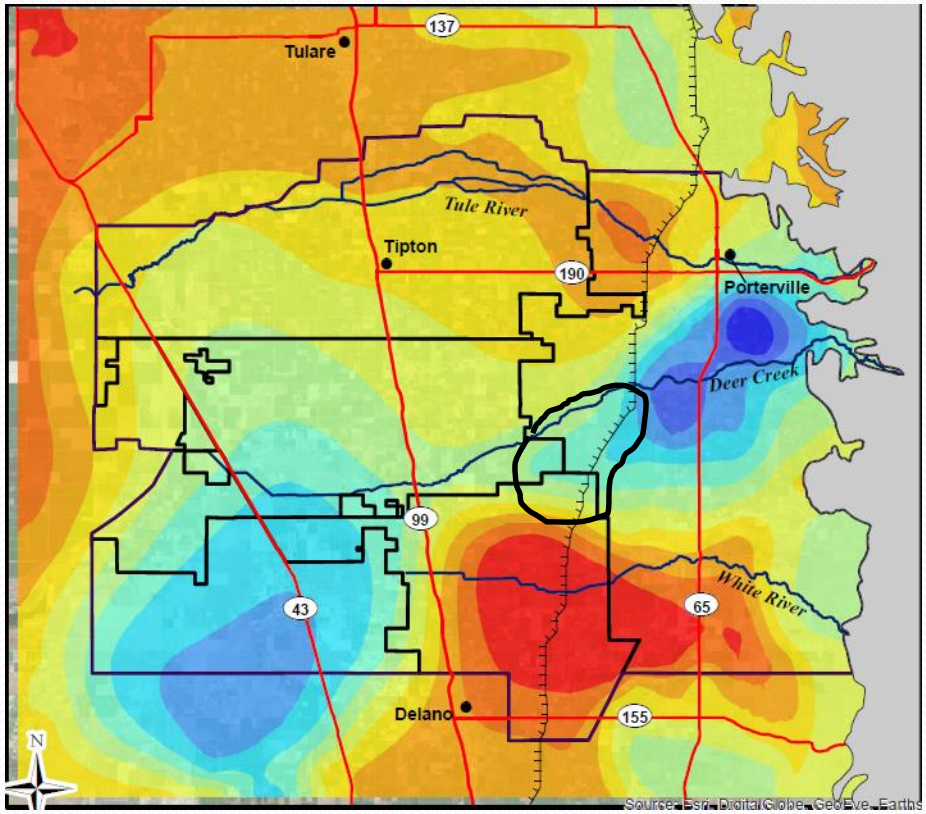
Previous Alternative NP-1 F-8 Was Effective at Maintaining Groundwater Levels (and Therefore Limiting Subsidence) Between the Deer Creek Crossing and DEID's Northern Boundary. However, Previous Alternatives Did Not Address the Projected Groundwater Level Declines in DEID's Service Area that are Resulting in the Simulated Subsidence at the White River Crossing.

No Managed Area NP-1 F8



With Managed Area NP-1 F8



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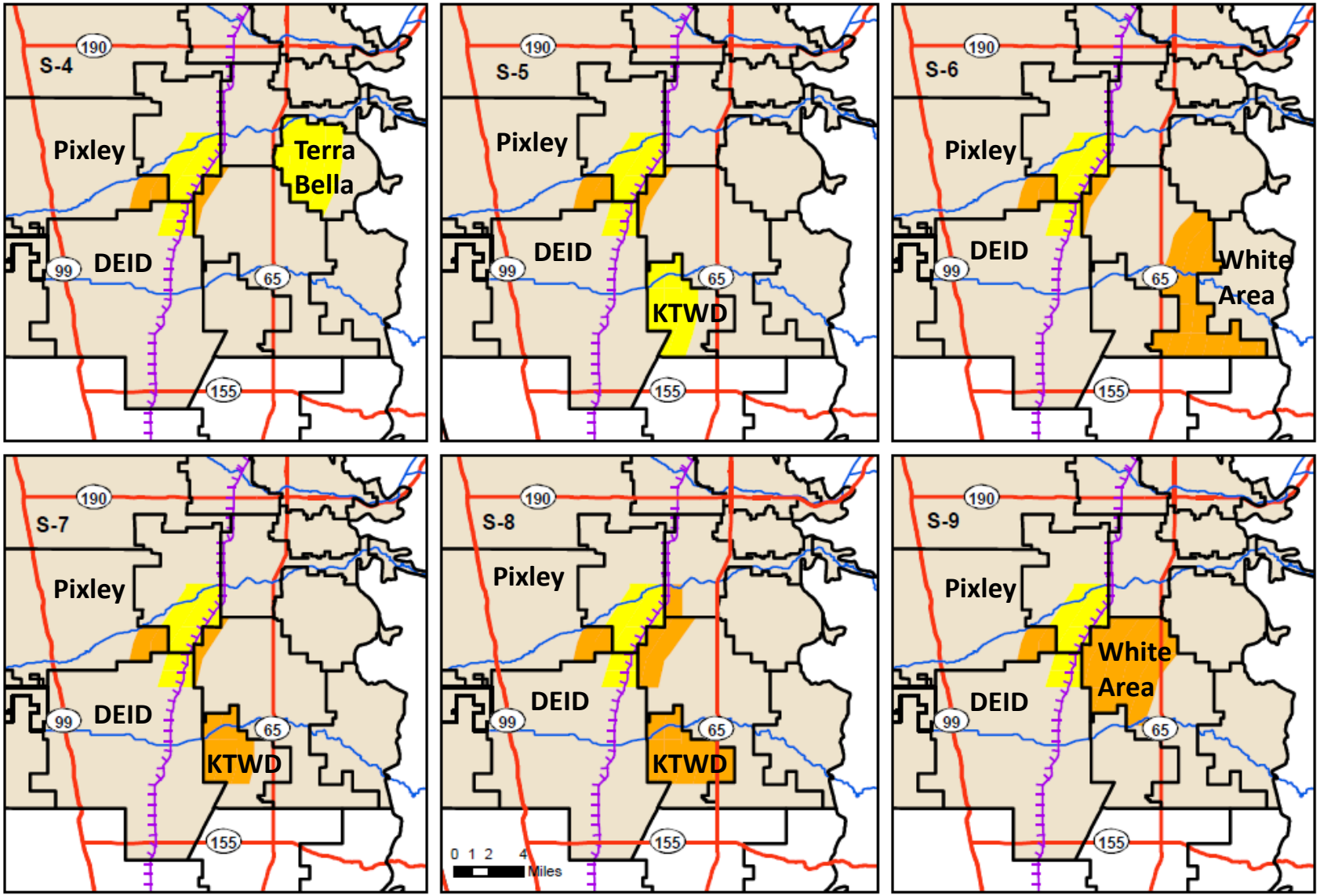
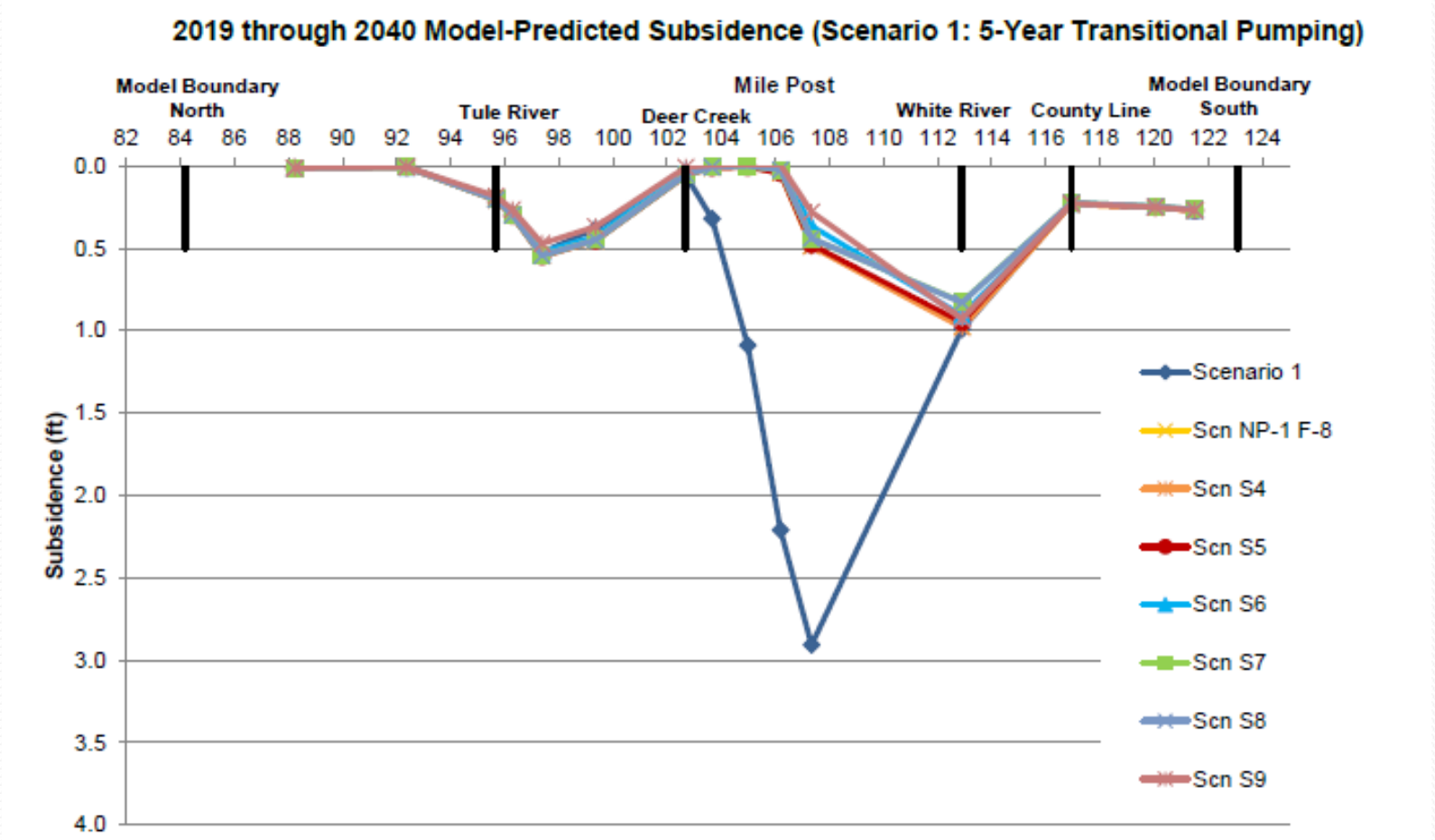
Assumptions for the Detailed Analysis Included:

- Groundwater Pumping in Each Water Budget Zone Modified for Analysis Was Discontinued in 2020
- For Water Budget Zones in Areas Where the Zone Coincided with an Agency with Surface Water Rights, It was Assumed that Consumptive Use would Continue at Sustainable Levels, Beginning in 2020
- The Sustainability Target for Consumptive Use of Crops with No Surface Water Supply (i.e. transitional pumping target) was 0.37 acre-ft/acre

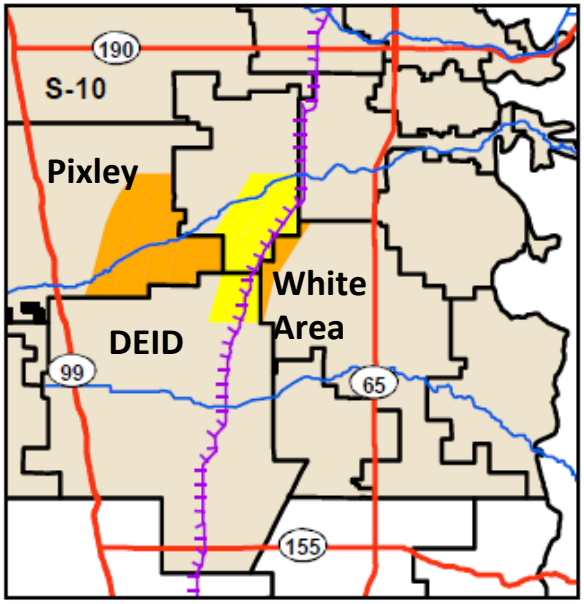
TH&Co Analyzed A Total of 30 Additional Water Budget Zone Configurations Under Scenario 1 (5-Yr Transitional Pumping). The Most Effective Eastern Zone Configurations At Limiting Subsidence Near the White River are As Follows:

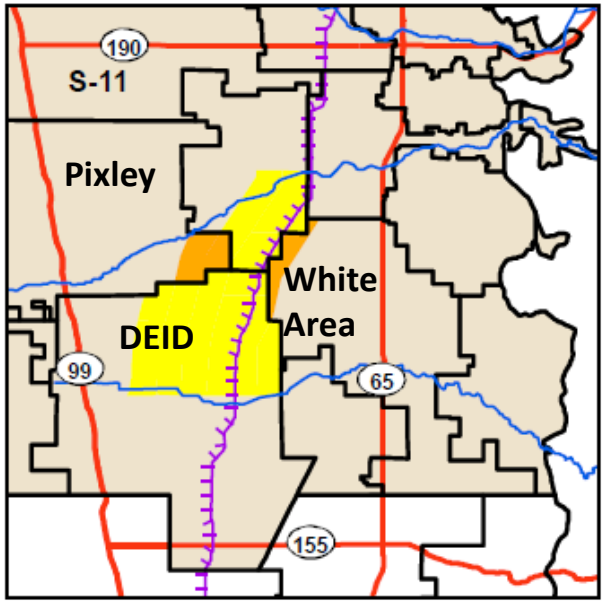


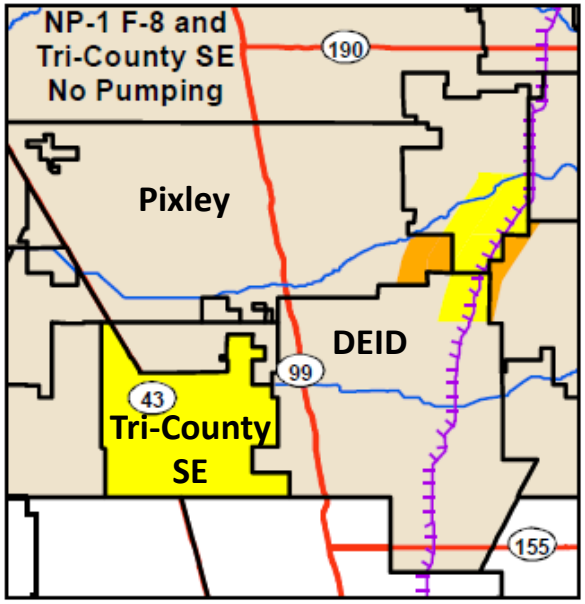
The Six Eastern Water Budget Alternatives that Were Most Effective at Limiting Subsidence Beneath the Friant-Kern Canal Near the White River (5-Yr Subbasin Transitional Pumping Conditions; Pumping in Water Budget Zones Off in 2020)

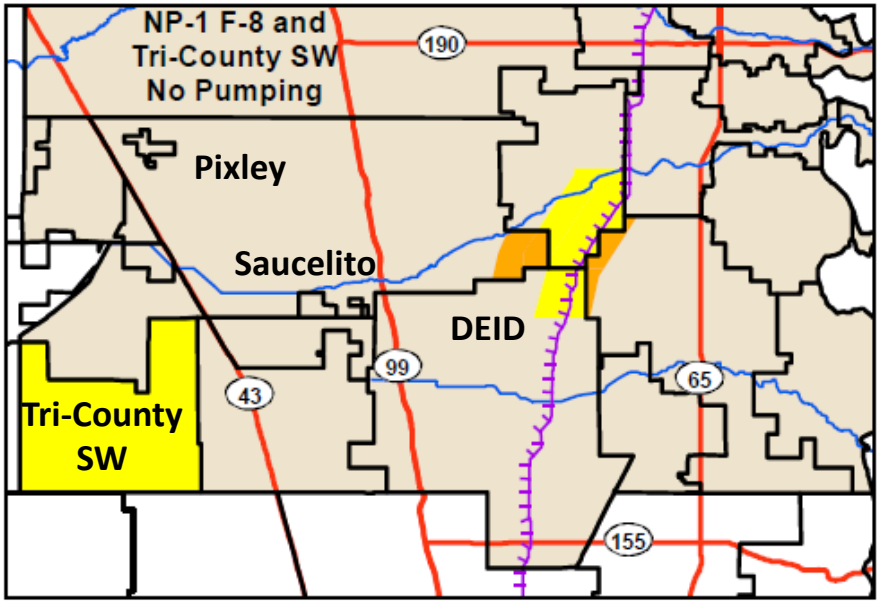


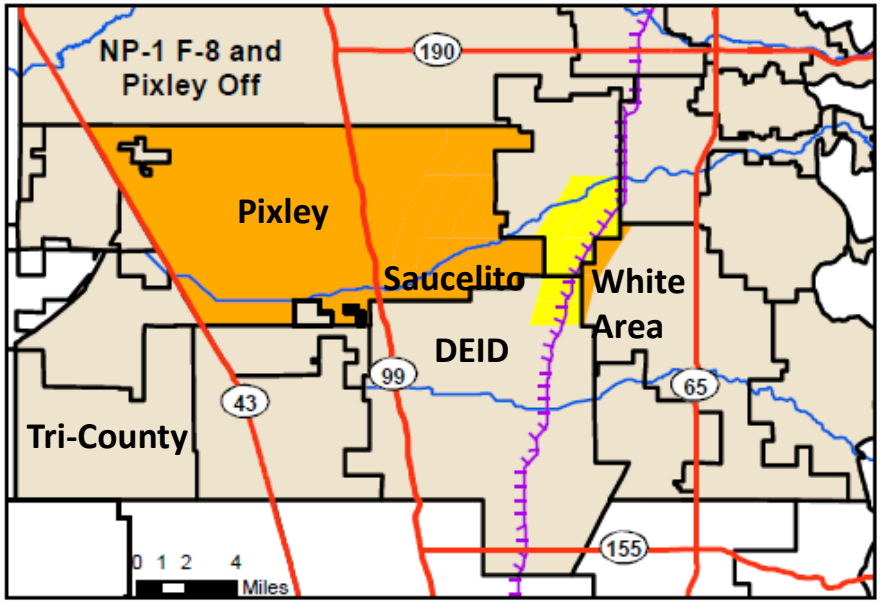
Water Budget Zone Configurations Focused West of the Friant-Kern Canal that were Analyzed with the Model are As Follows:



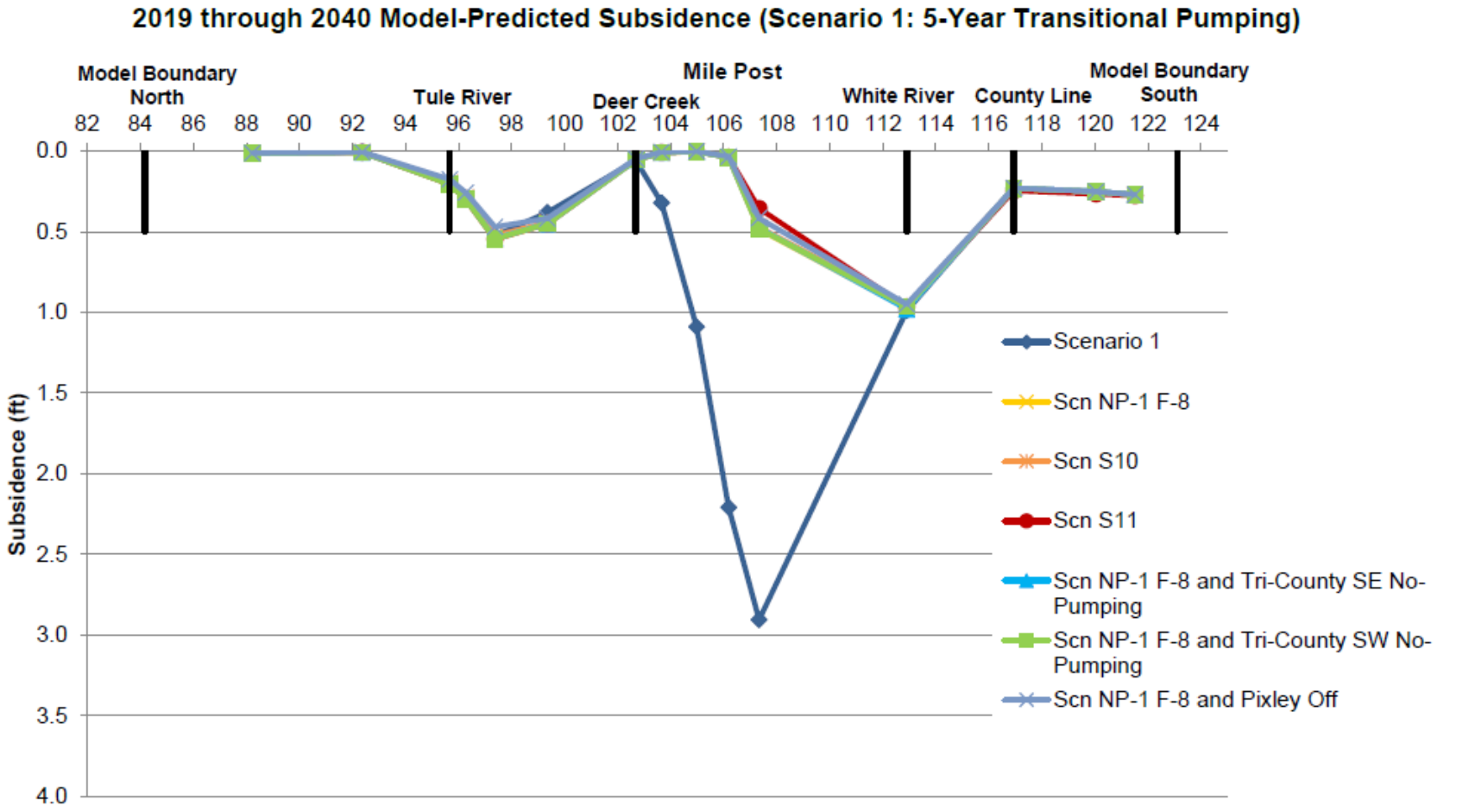








Results of Western Water Budget Alternatives (5-Yr Subbasin Transitional Pumping Conditions; Pumping in Water Budget Zones Off in 2020)



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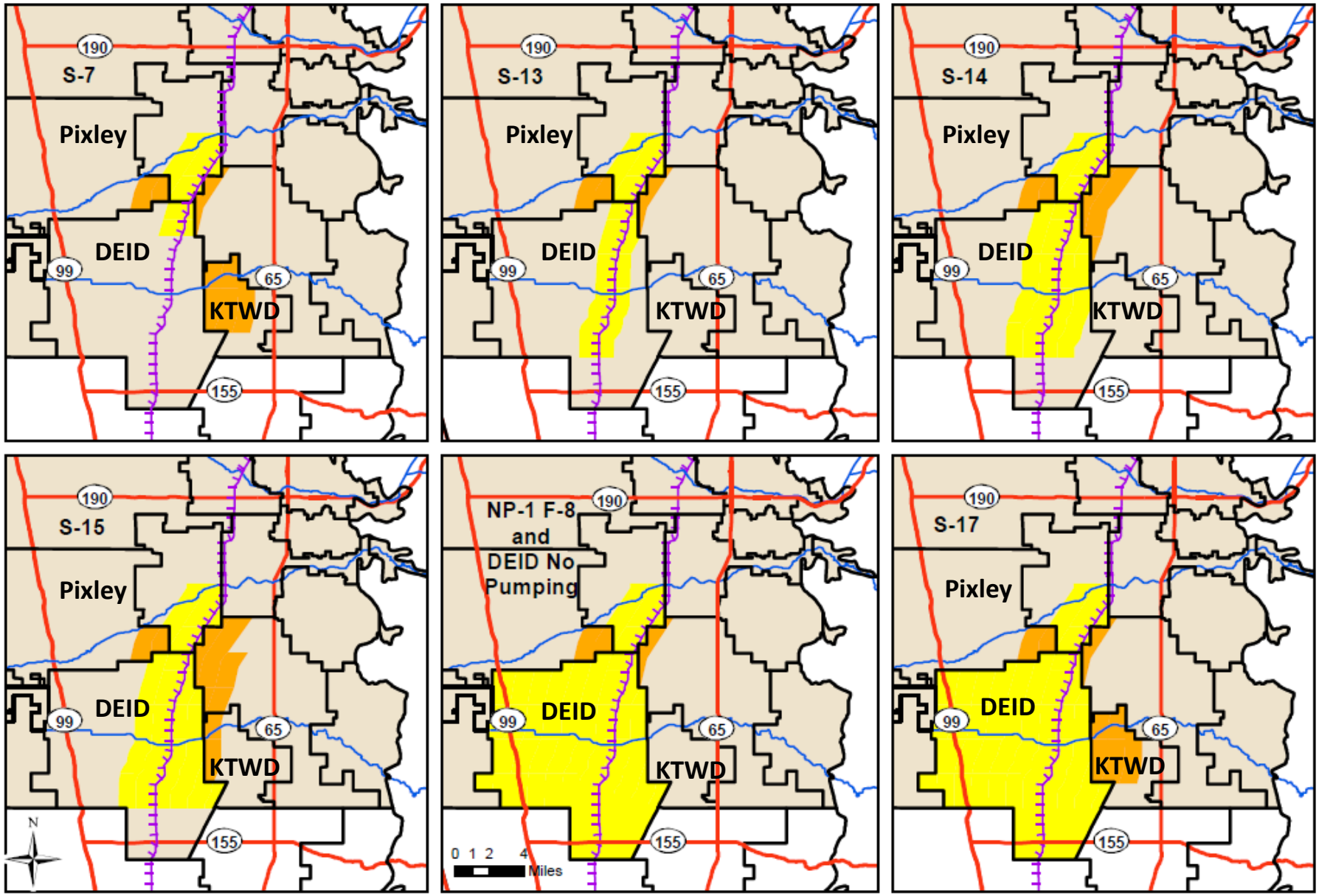
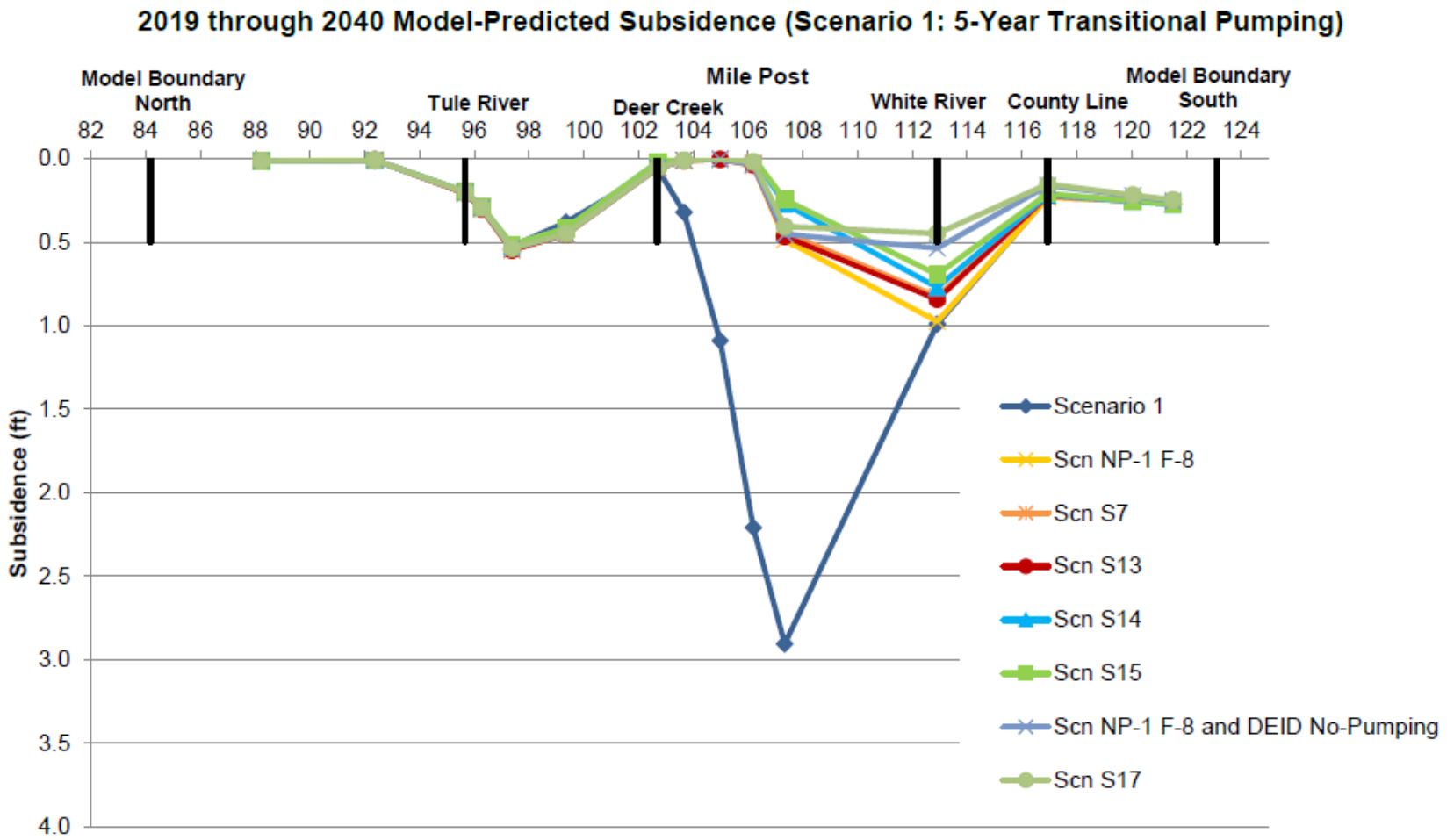
Analysis of Alternatives Immediately East and West of the Friant-Kern Canal Are As Follows:

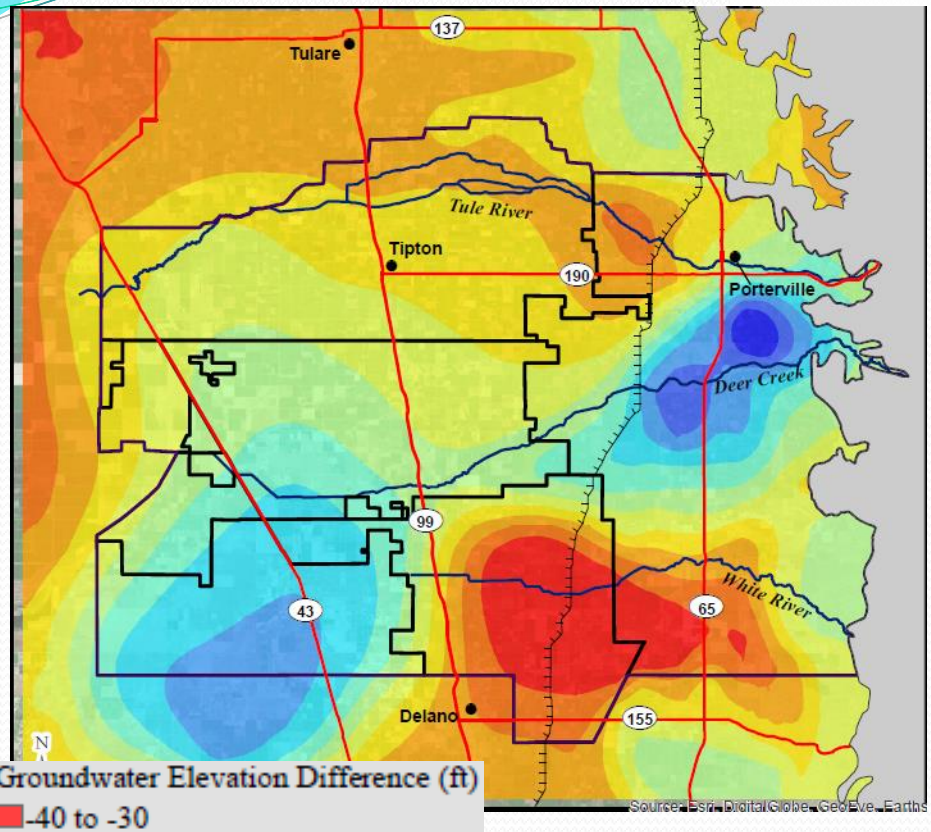


Results of Alternatives Immediately East and West of the Canal in DEID (5-Yr Subbasin Transitional Pumping Conditions; Pumping in Water Budget Zones Off in 2020)



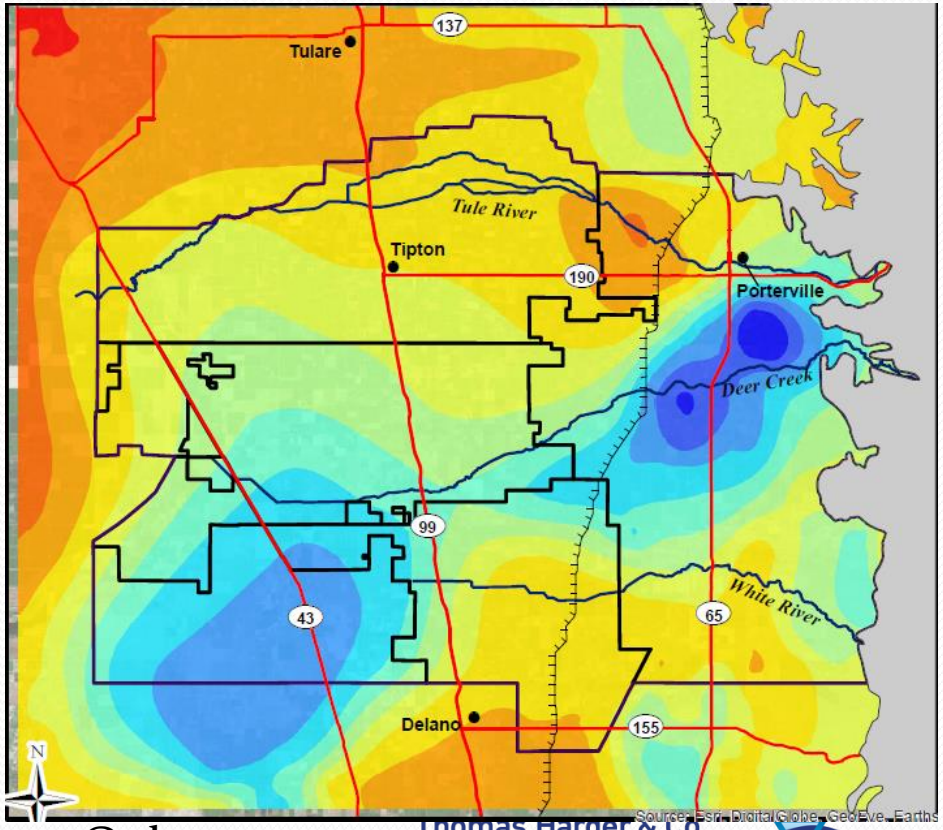
Projected Groundwater Level Change Between 2020 and 2040 with NP-1 F-8 Managed Area and S17

2020 – 2040
Lower Aquifer
NP-1 F-8 Only



Groundwater Elevation Difference (ft)
-40 to -30
-30 to -20
-20 to -10
-10 to 0
0 - 10
10- 20
20 - 30
30 - 40
40 - 50
50 - 60
60 - 75

5- Yr Transitional Pumping
2020 – 2040
Lower Aquifer
NP-1 F-8 + S17



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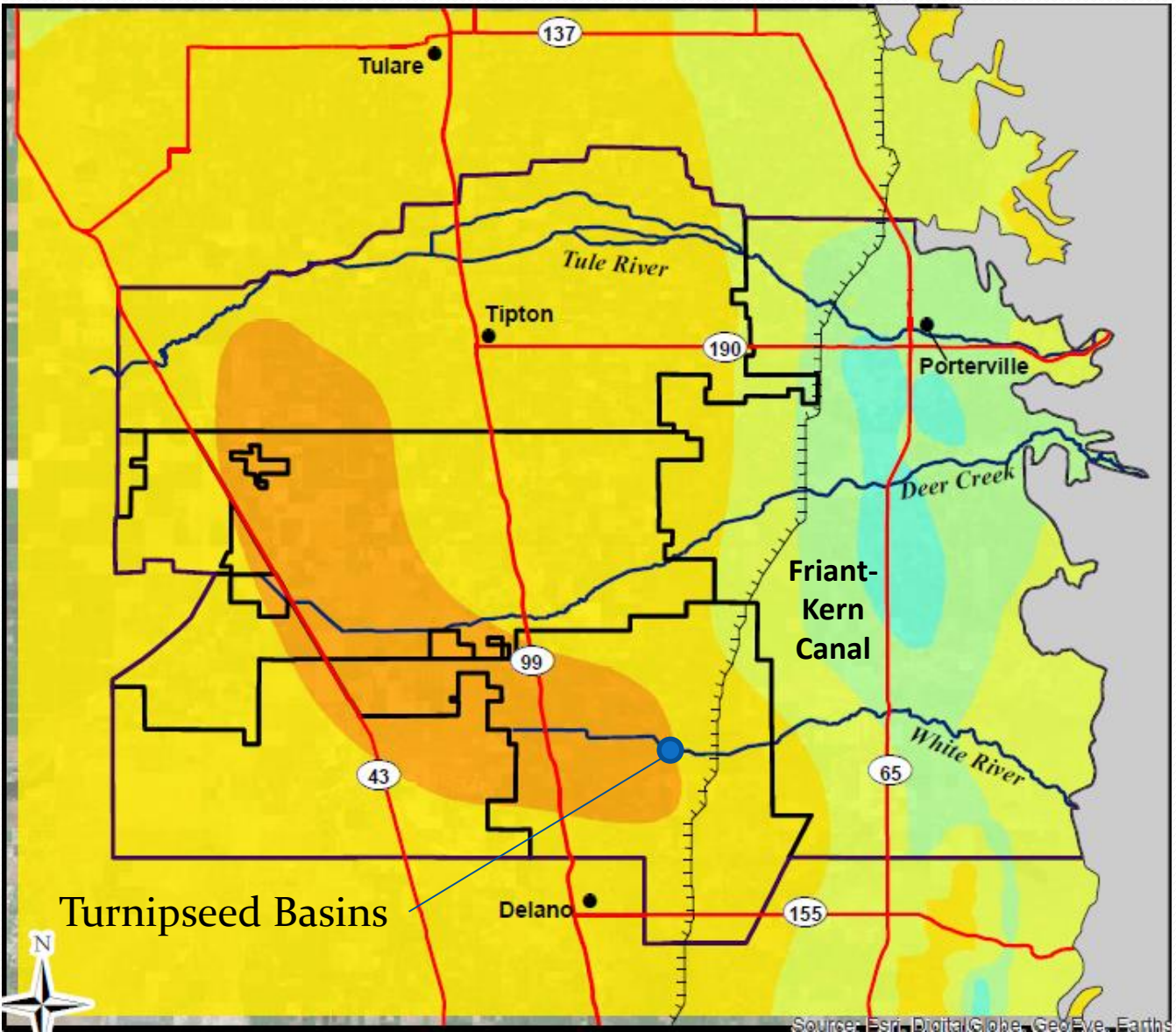
Projected Groundwater Level Change Between 2040 and 2070 with NP-1 F-8 Managed Area and S17



2040 – 2070
Model Layer 3

Groundwater Elevation Difference (ft)
-40 to -30
-30 to -20
-20 to -10
-10 to 0
0 - 10
10- 20
20 - 30
30 - 40
40 - 50
50 - 60
60 - 75

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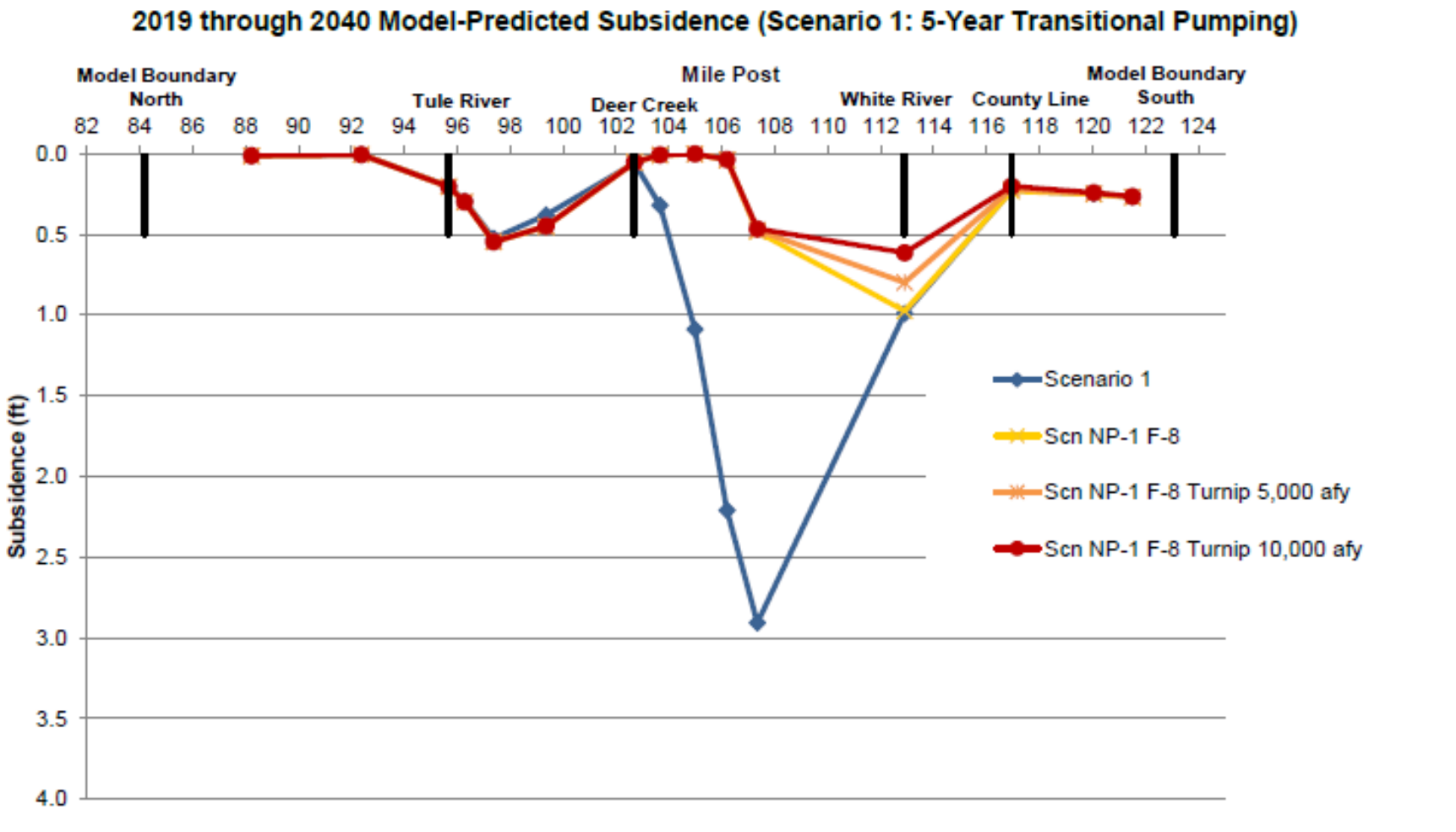
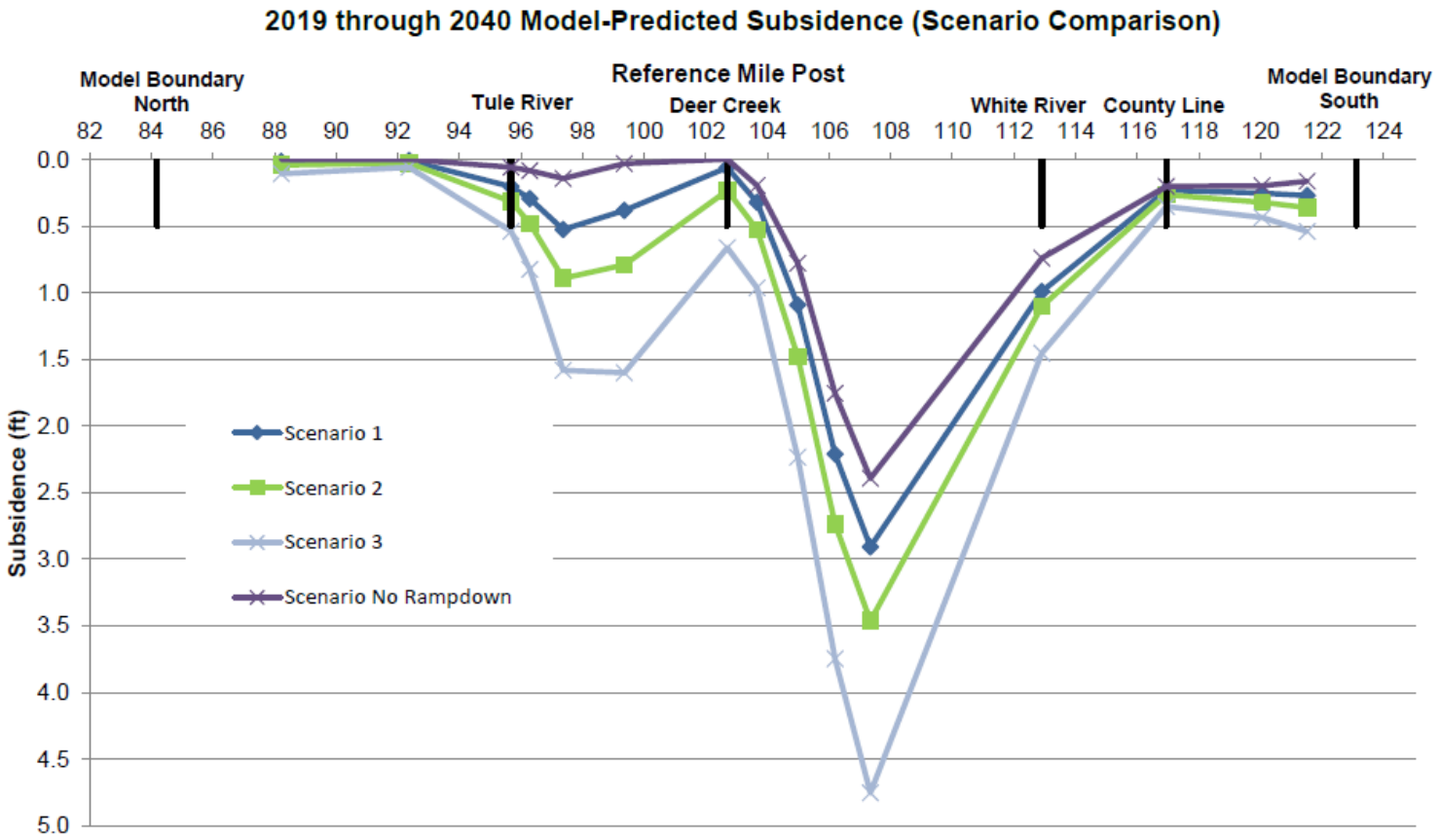
Alternatively, Increased Recharge in the Turnipseed Basins Also Limits Subsidence Beneath the Friant-Kern Canal at the White River



Subbasin-Wide Transitional Pumping Impacts the Anticipated Subsidence Beneath the Friant-Kern Canal



*October 2019 through September 2040

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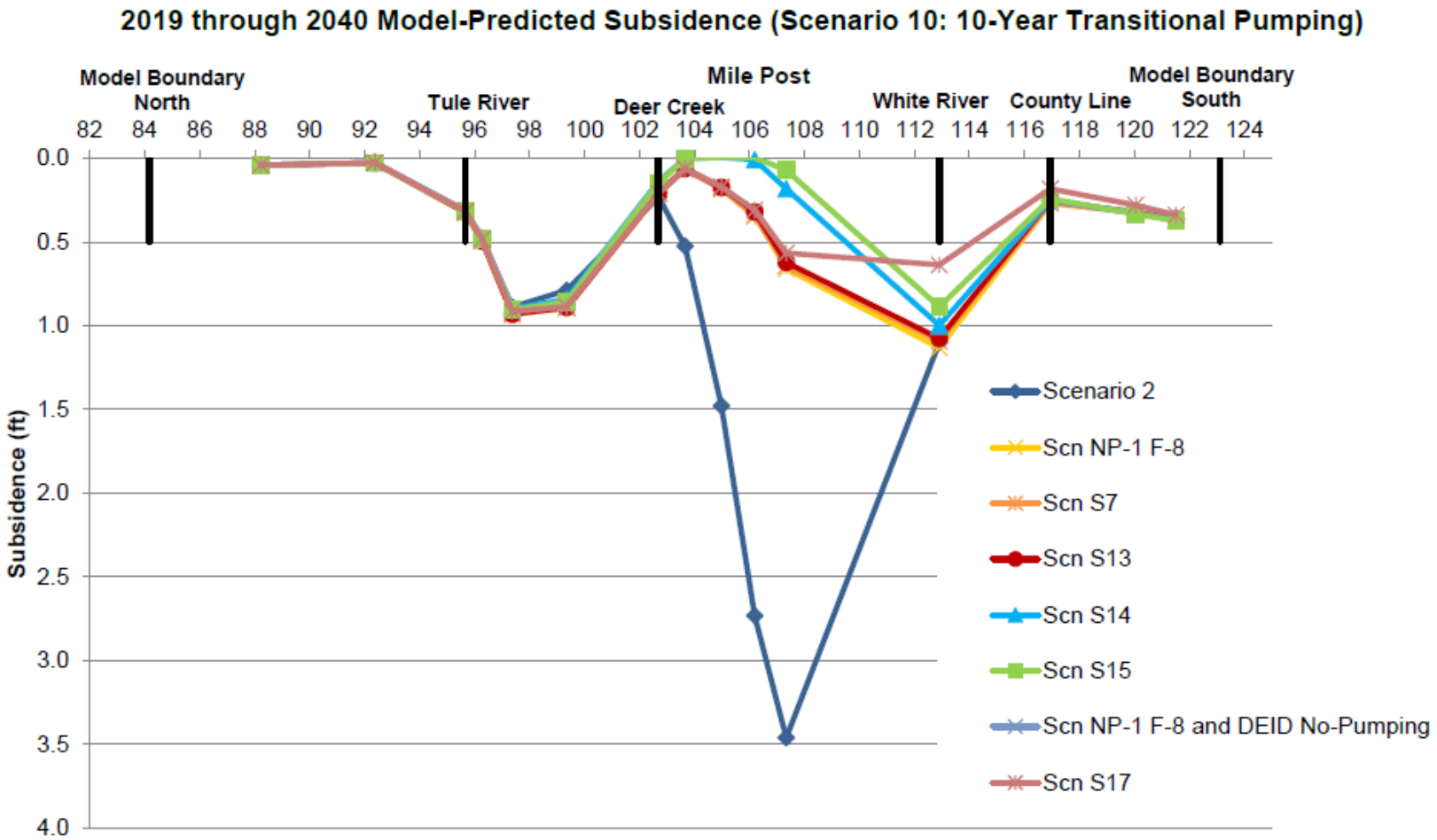
Simulation of Scenario 2 (10-Yr Transitional Pumping) Using the Most Effective Water Budget Zone Combinations for Limiting Subsidence Beneath the Friant-Kern Canal at the White River



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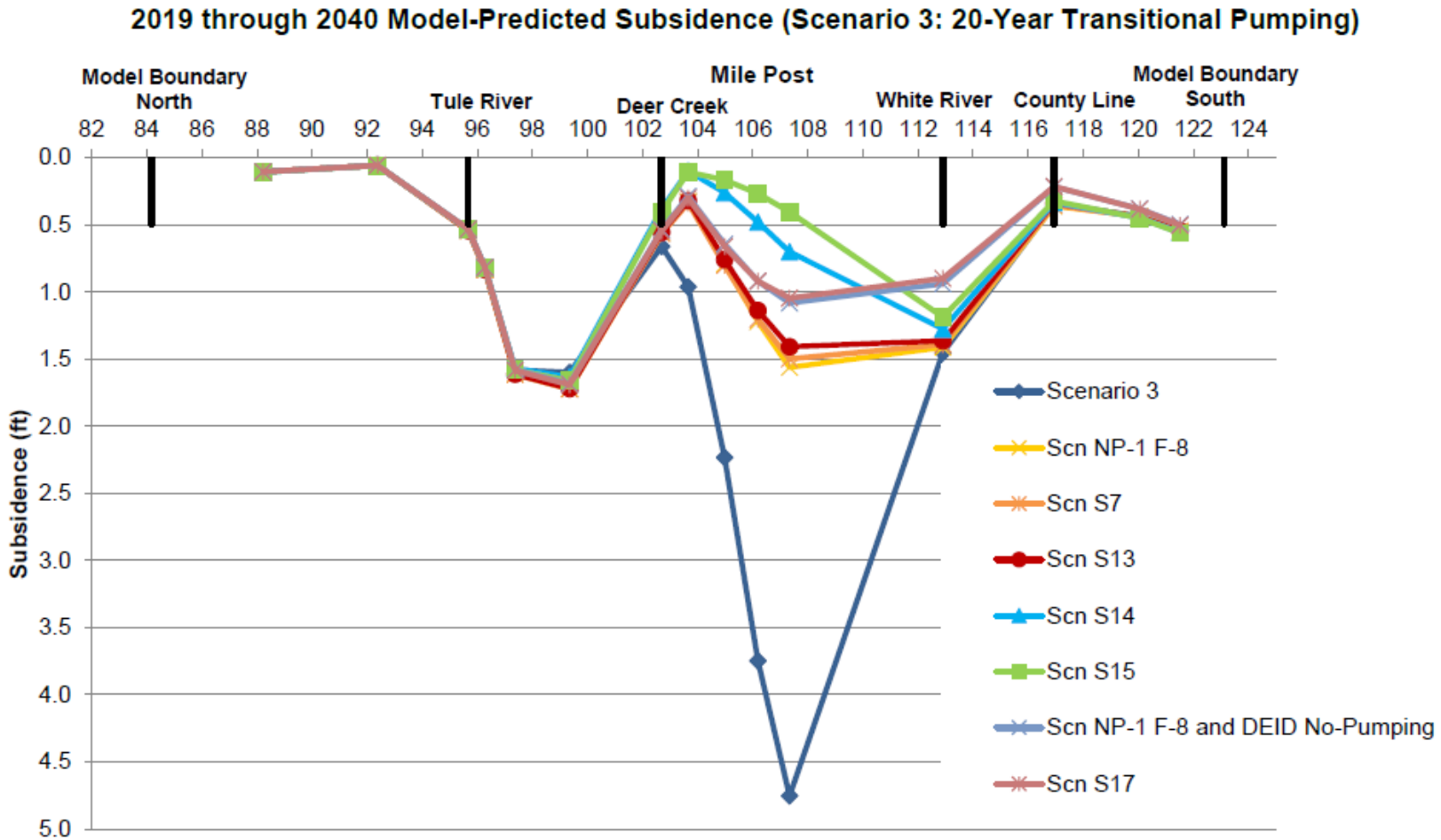
Simulation of Scenario 3 (20-Yr Transitional Pumping) Using the Most Effective Water Budget Zone Combinations for Limiting Subsidence Beneath the Friant-Kern Canal at the White River