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Estimating Timing and Location of Stream Depletion in the Central Valley: Comparison of C2VSimFG, SVSim, and SacFEM

April 19, 2023

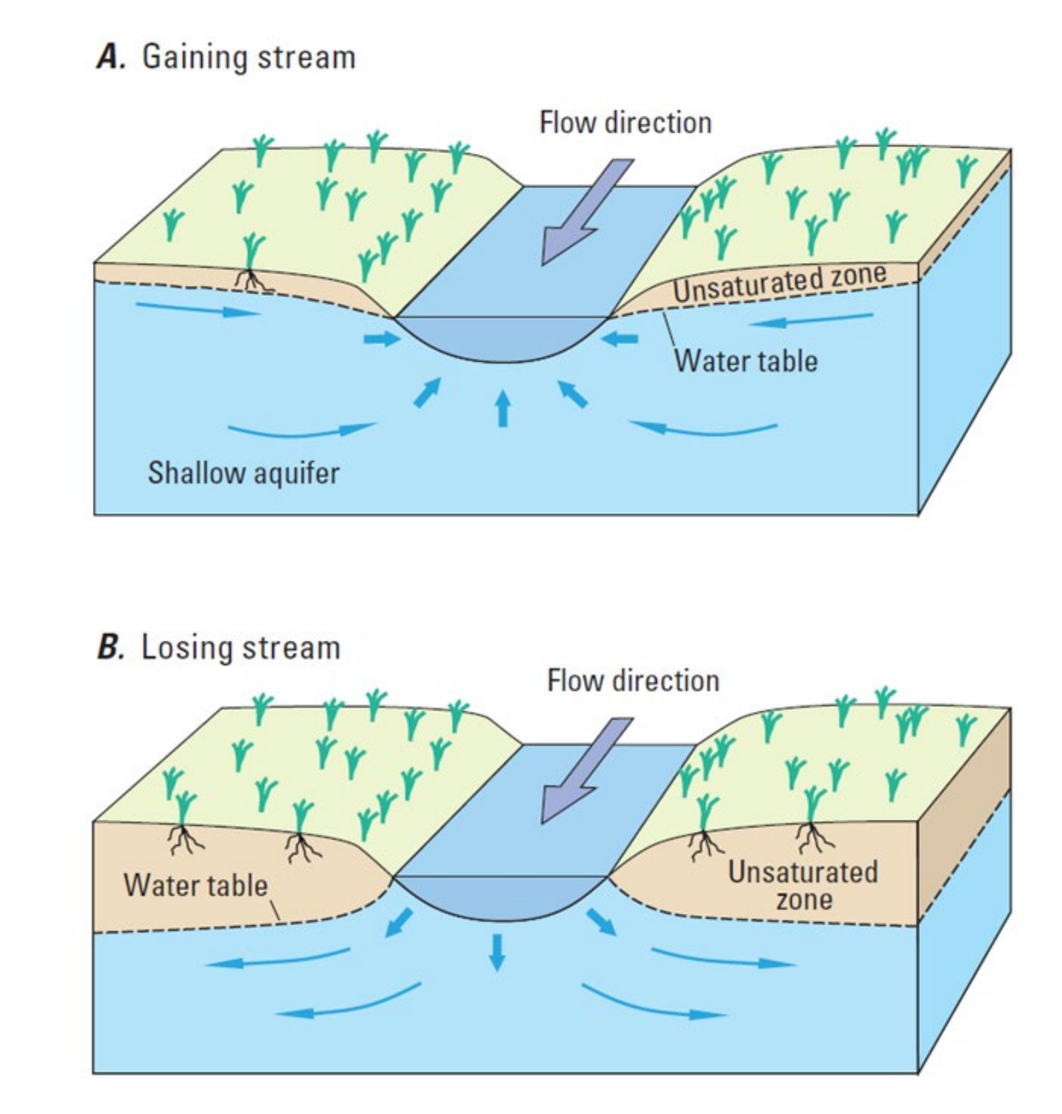
Sustainable Groundwater Management Office

Overview

- Key terms and definitions
- Background and area of interest
- Modeling stream depletion in the Sacramento Valley
  - SacFEM
  - C2VSimFG
  - SVSim

Key Terms and Definitions

- Interconnected Surface Water



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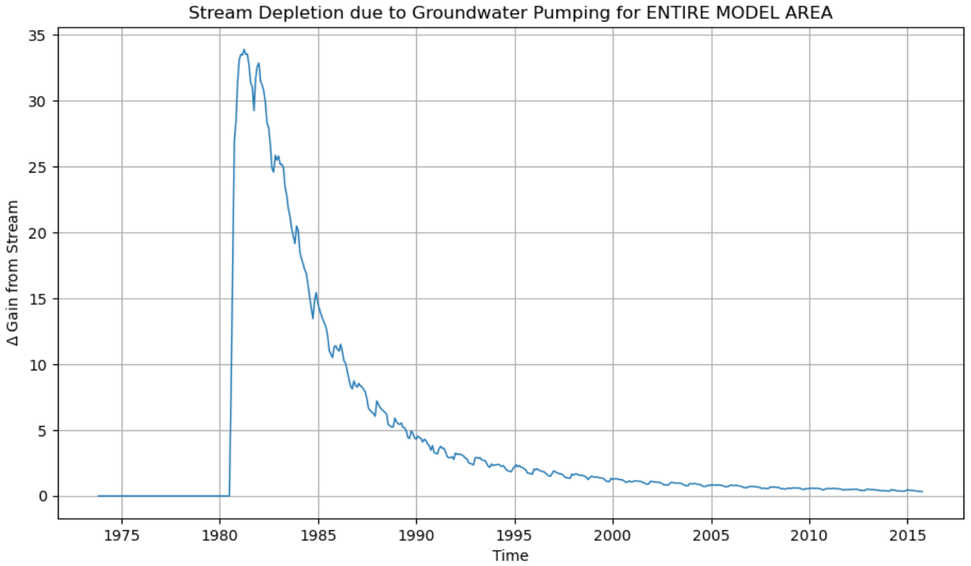
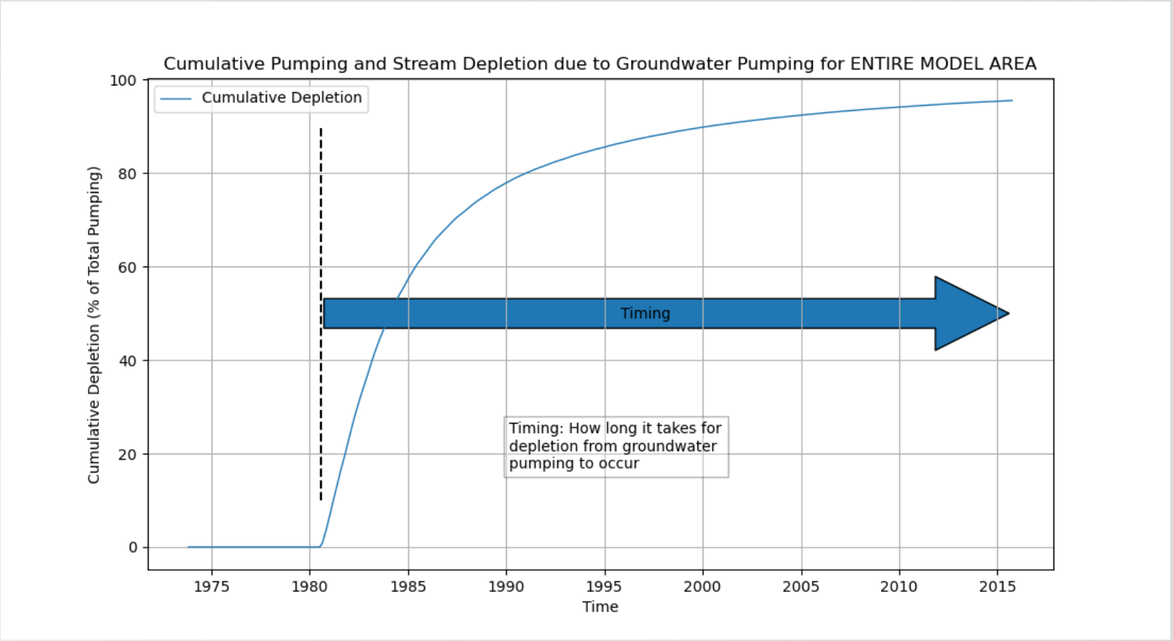
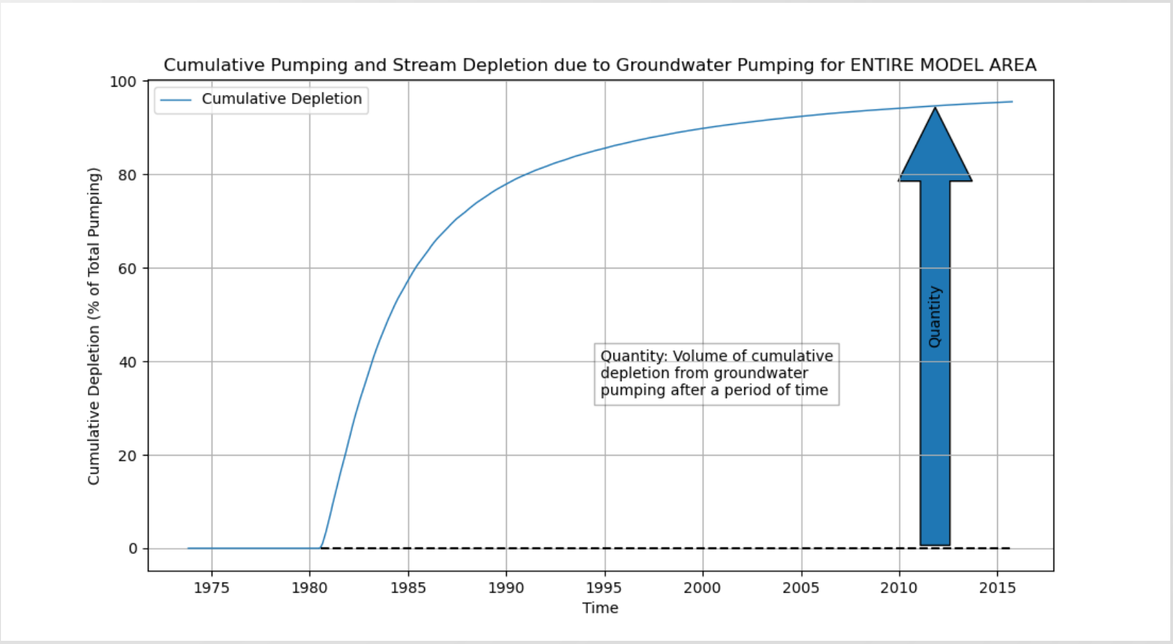
Key Terms and Definitions

- Depletion of Interconnected Surface Water







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Background and Area of Interest

- Groundwater Substitution Transfers
  - Stream Depletion Factor

- Sustainable Groundwater Management
  - Undesirable Result #6: depletions of interconnected surface water that have <u>significant and unreasonable</u> adverse impacts to the beneficial users of surface water

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Modeling Stream Depletion in the Sacramento Valley: SacFEM

- Developed 2011 – 2013 (SacFEM2013)
- MicroFEM
  - 153,812 Nodes
  - 7 Layers
- Simulates WY 1970 to 2010
- Refined for use in the Long-Term Water Transfer EIS/R (2020 through 2024)
- Groundwater Model

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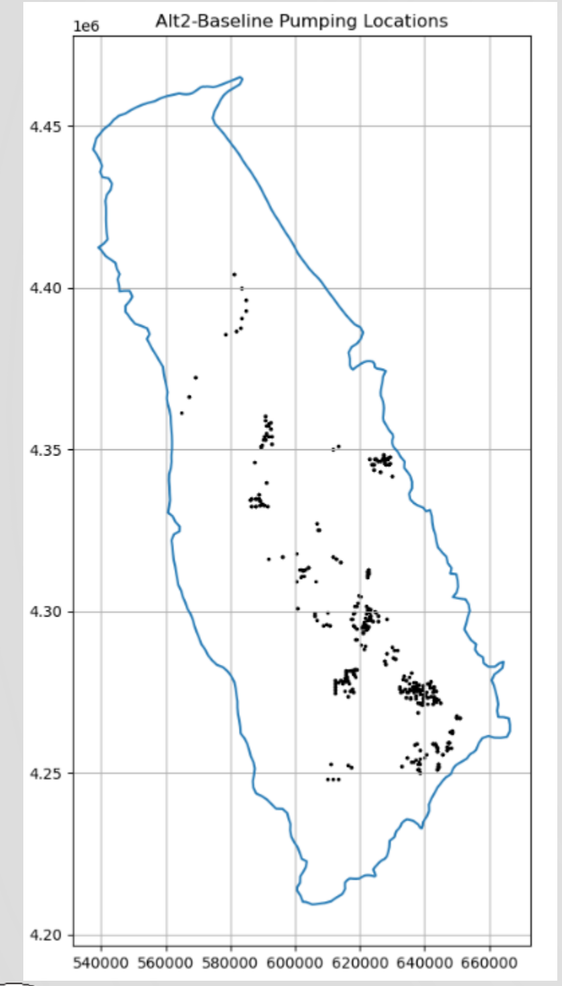
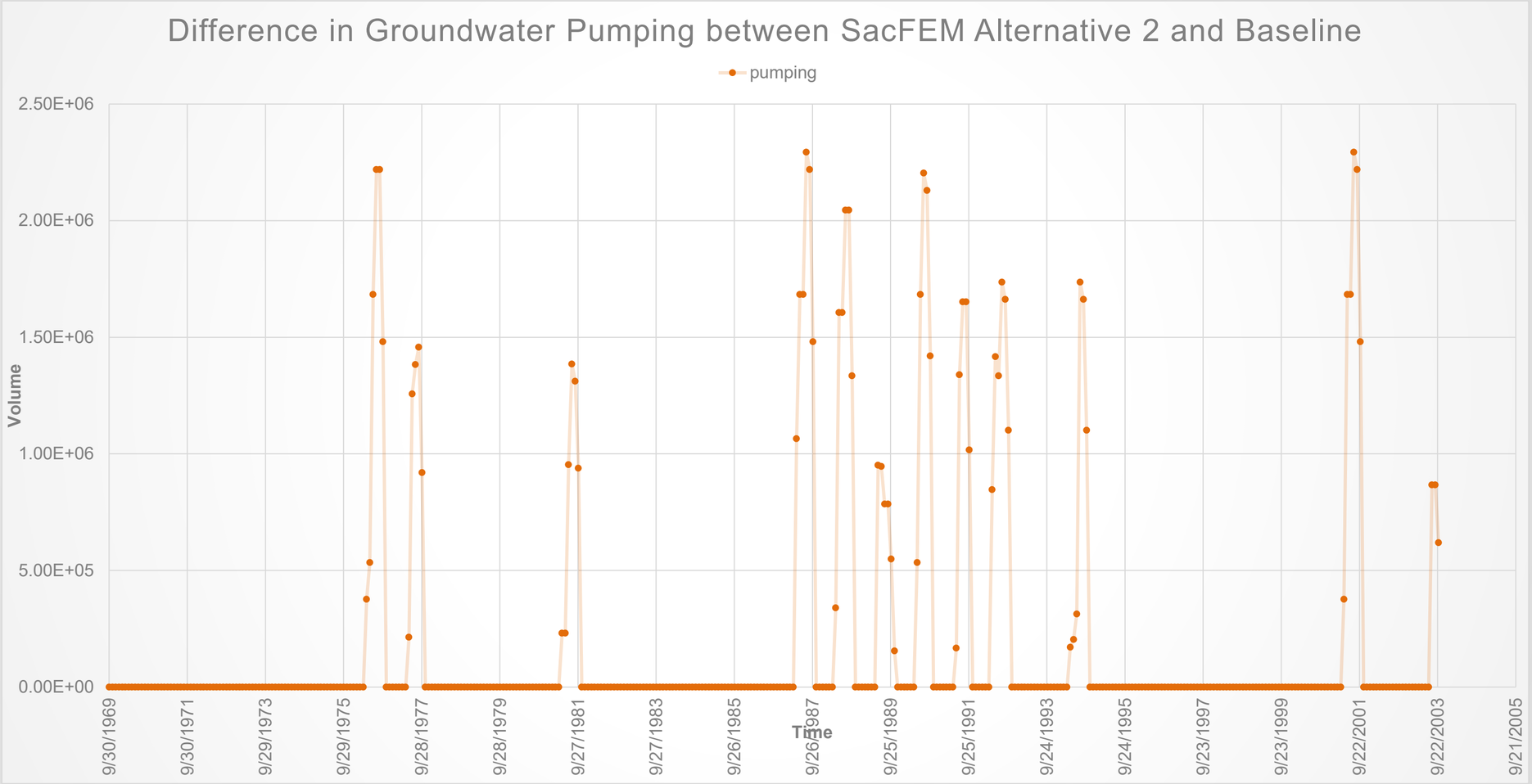
Modeling Stream Depletion in the Sacramento Valley: SacFEM





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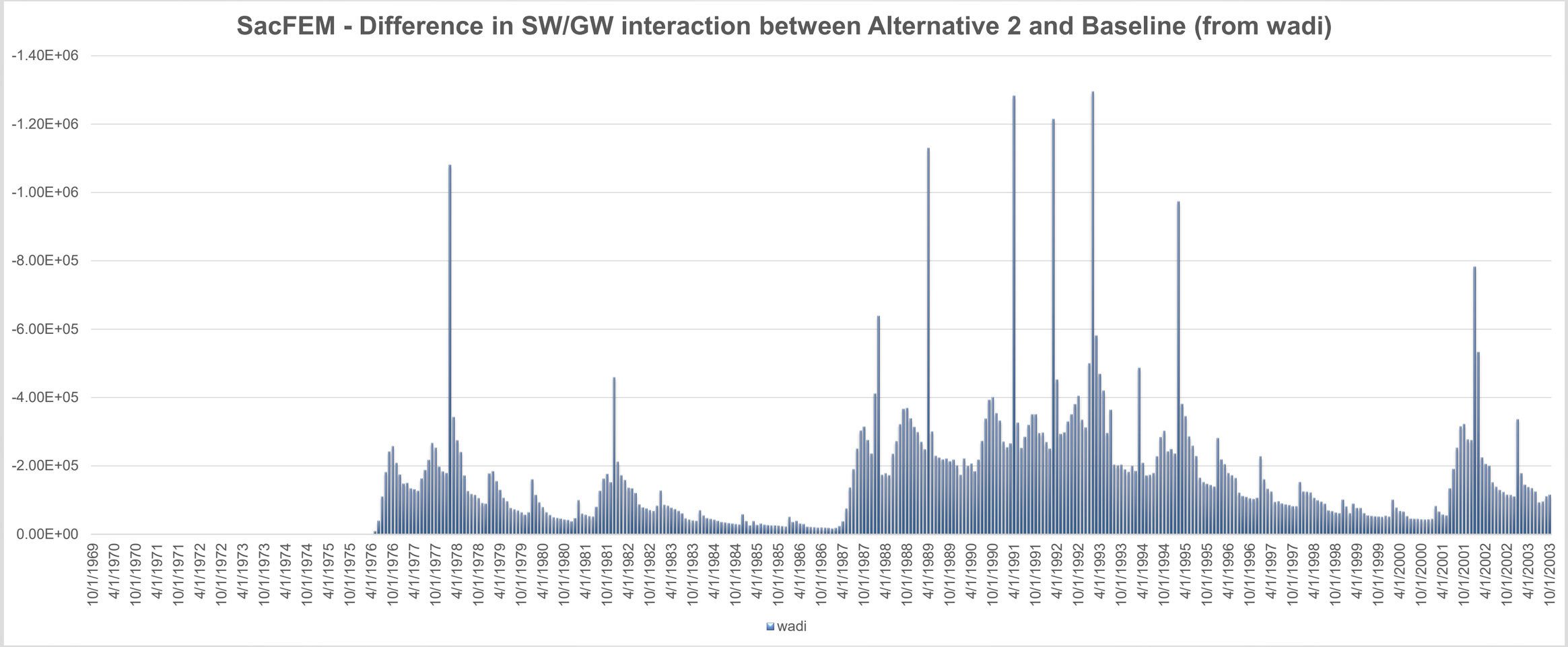
Modeling Stream Depletion in the Sacramento Valley: SacFEM



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Reproduced from Figure C-6, Appendix C, Long-Term Water Transfer EIS/R

Modeling Stream Depletion in the Sacramento Valley: SVSim

- Developed 2015 to 2022
- IWFM
  - 22642 Nodes (23767 Elements)
  - 9 Layers
- Simulates WY 1974 to 2015
- Developed for estimating stream depletion for water transfer projects. Also, available for SGM Analysis of stream depletion.
- Integrated Hydrologic Model

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SVSim Streams

- 67 Stream Reaches
- “Instantaneous” streamflow routing
  - Ok because travel time is less than simulation timestep
- Wide Streams
  - Sutter Bypass/Butte Creek (Reach 40)
  - Yolo Bypass (Reaches 54, 56, 58)
- 20 ft Streambed Thickness*
  - *unless bottom of layer 1 is less than 20 feet below the bottom of the stream channel.
- Hydraulic disconnection assumed to occur when groundwater levels fall below bottom of the streambed.

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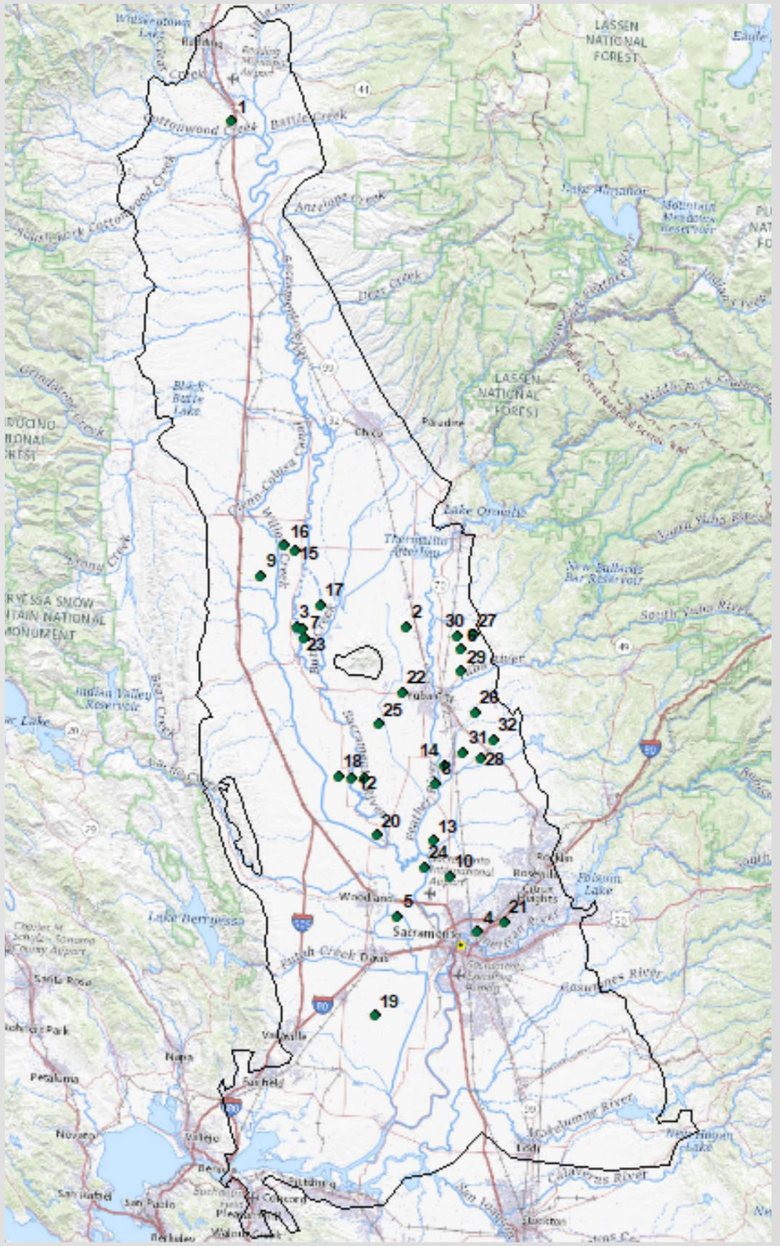
Streamflow Depletion with SVSim

- 32 transfer projects were analyzed.
- Evaluation by adding pumping wells other conditions remain the same.
- Evaluate the extra streamflow depletion caused by this transfer pumping.



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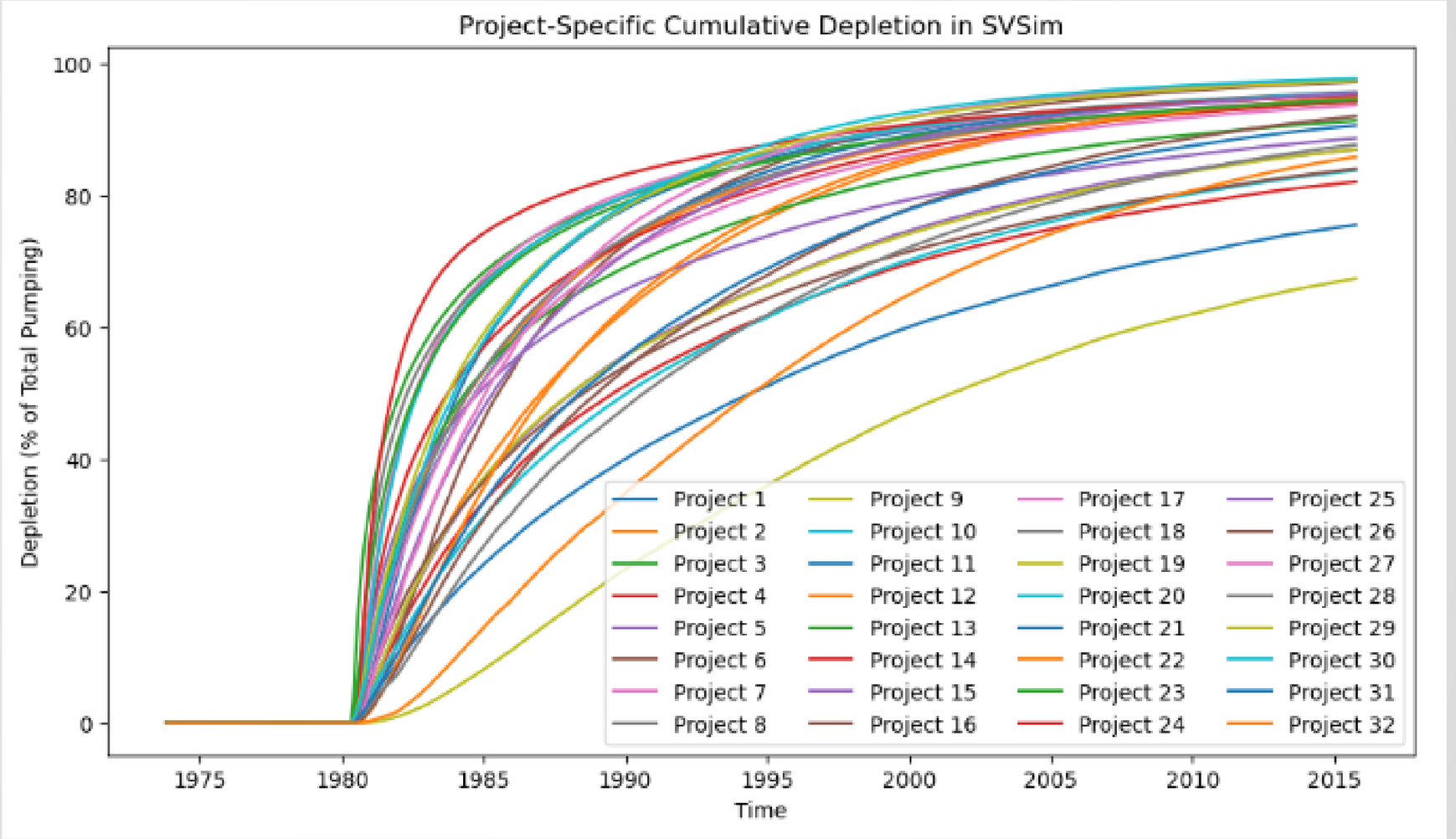
SVSim Depletion Curves

All 32 Projects



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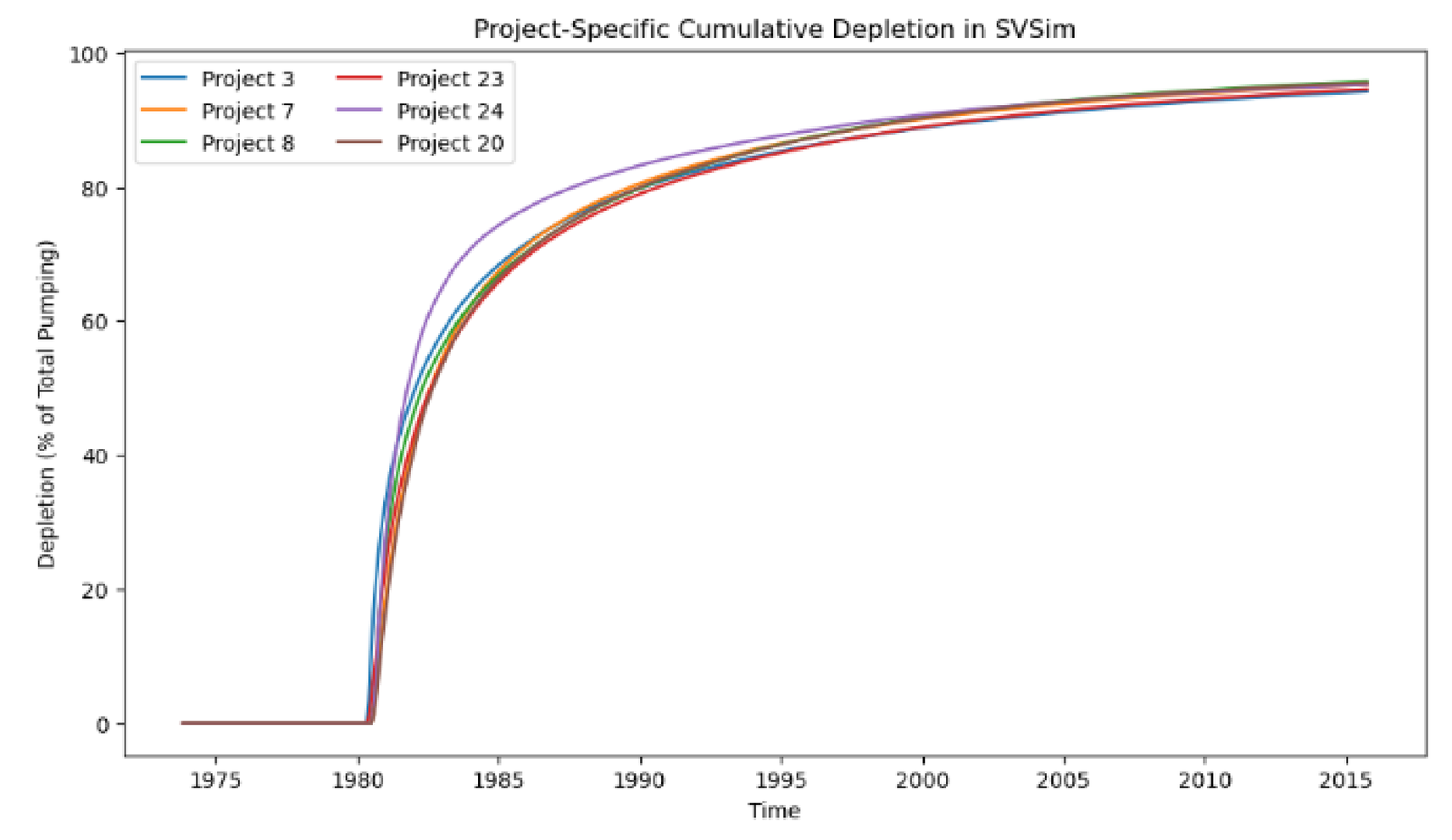
SVSim Depletion Curves

Wells distance from major water body:

<1 mile



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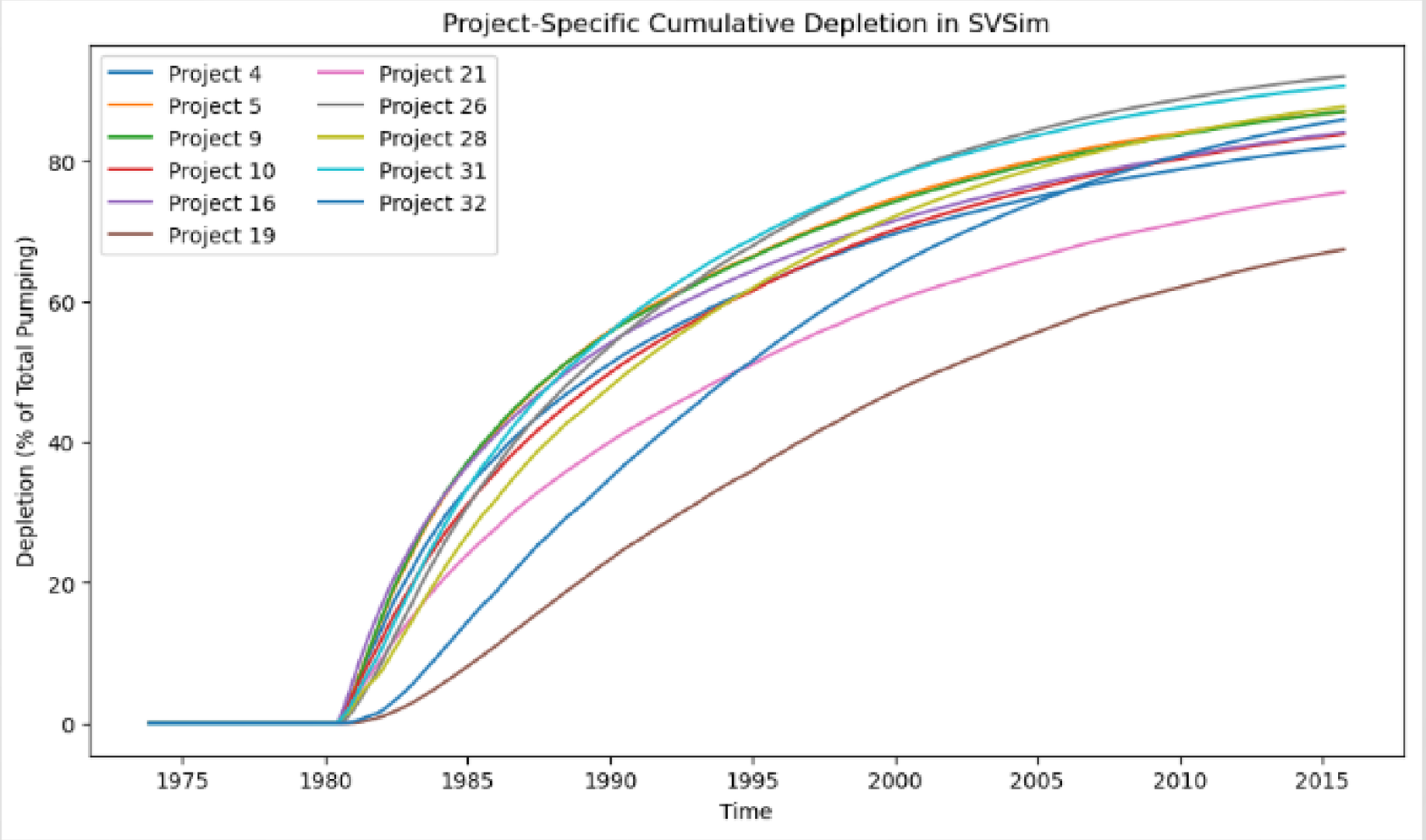
SVSim Depletion Curves

Wells distance from major water body:

>3 miles



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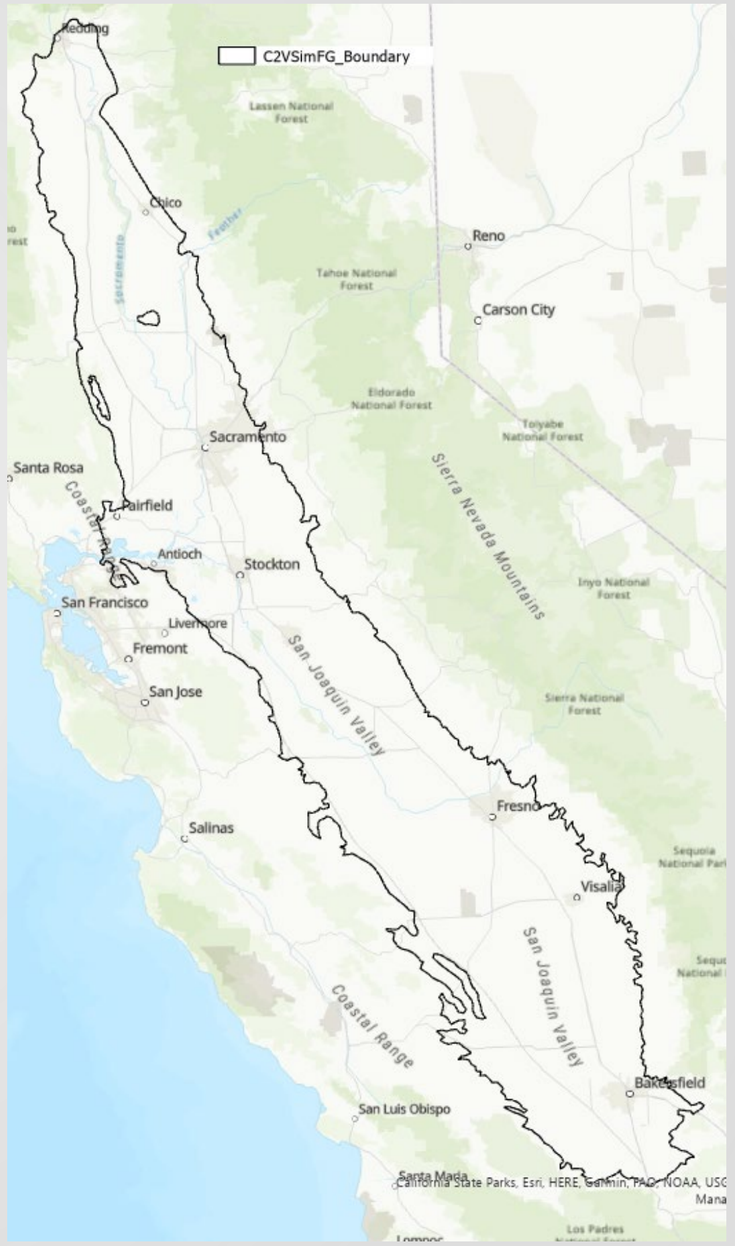
Modeling Stream Depletion in the Sacramento Valley: C2VSimFG

- Developed 2017 – 2020 (C2VSimFG v1.01)
- IWFM
  - 30179 Nodes (32537 Elements)
  - 4 Layers
- Simulates WY 1974 to 2015
- Developed for general purpose regional groundwater occurrence and movement
- Integrated Hydrologic Model



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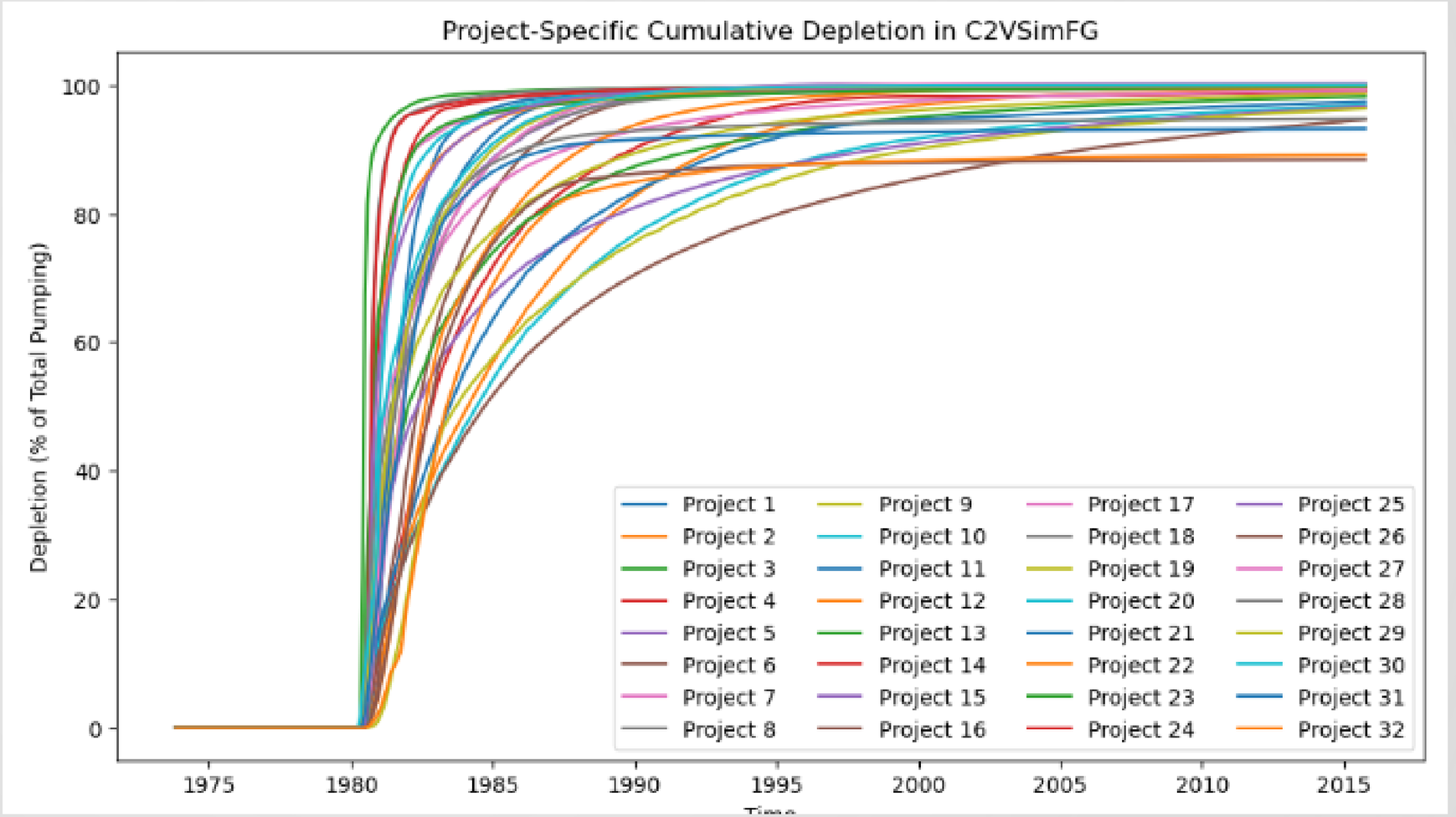
Modeling Stream Depletion in the Sacramento Valley: C2VSimFG

All 32 Projects



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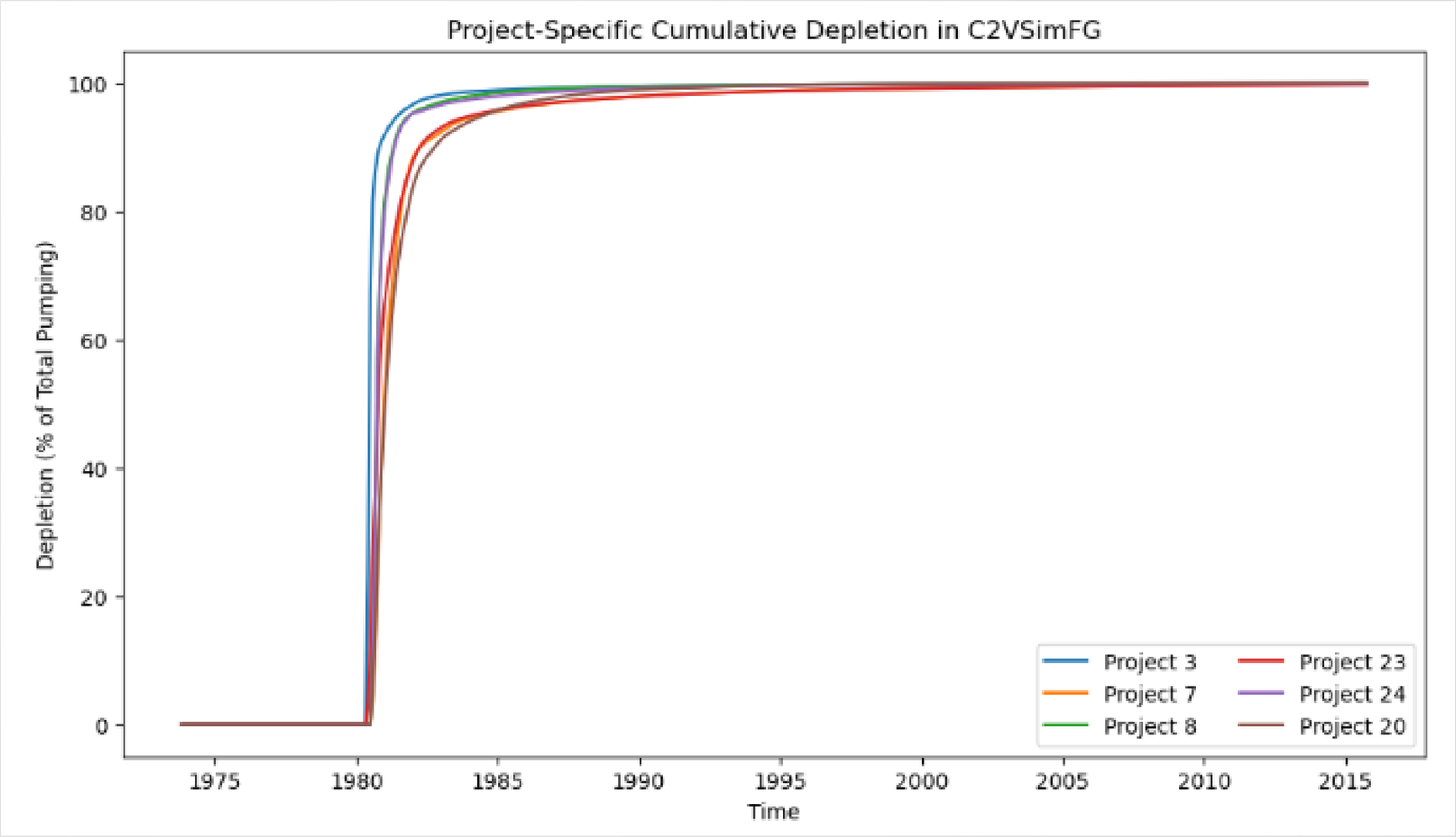
C2VSimFG Depletion Curves

Wells distance from major water body:

<1 mile



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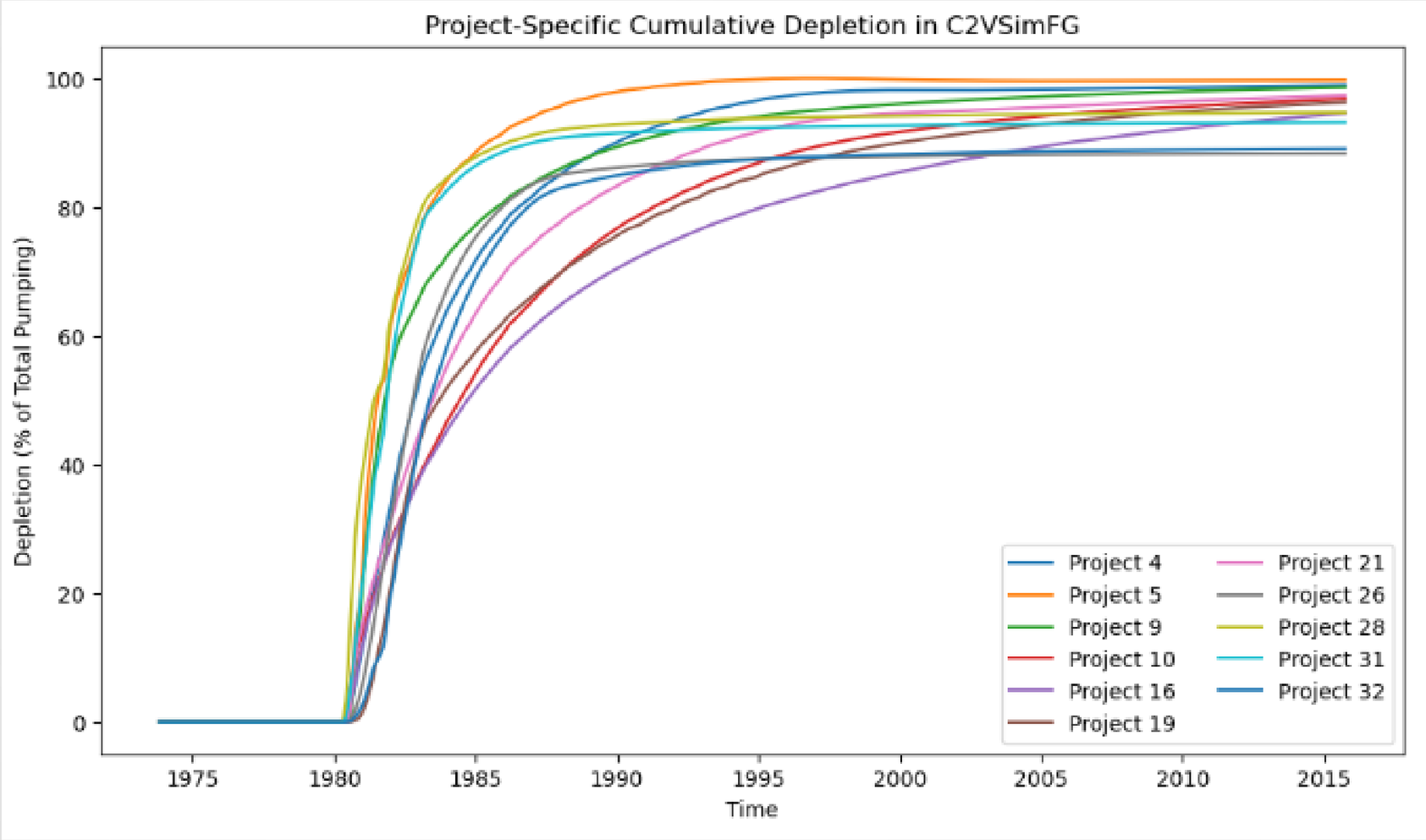
C2VSimFG Depletion Curves

Wells distance from major water body:

>3 miles



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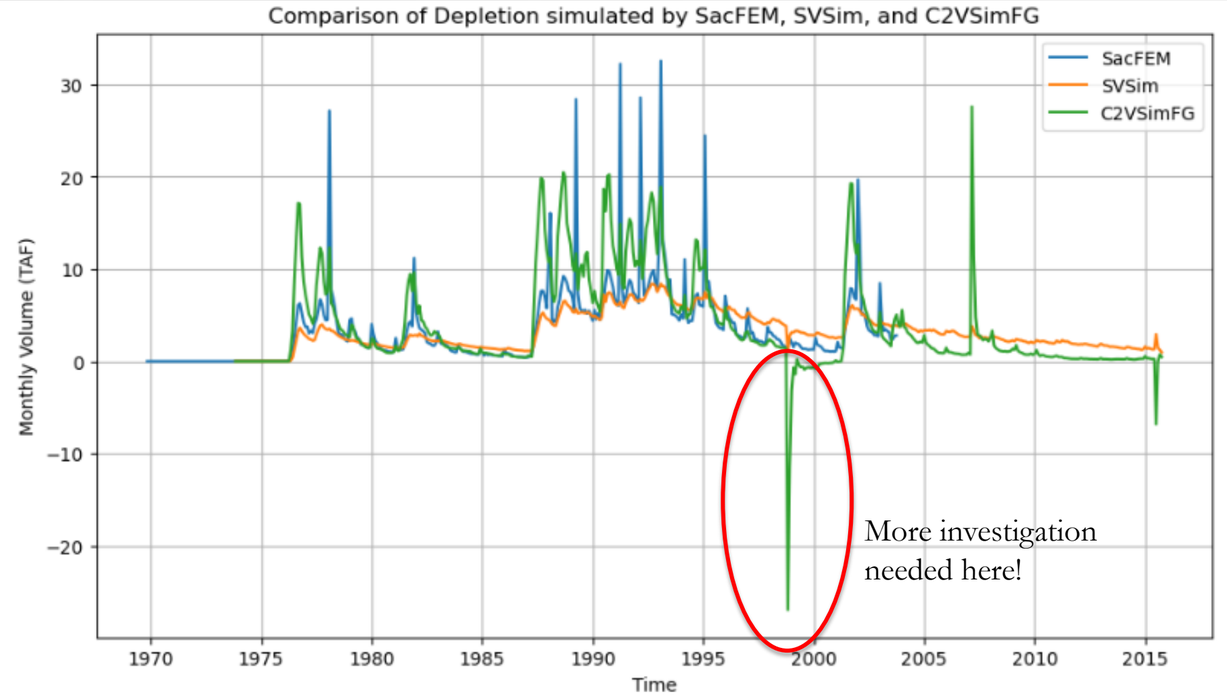
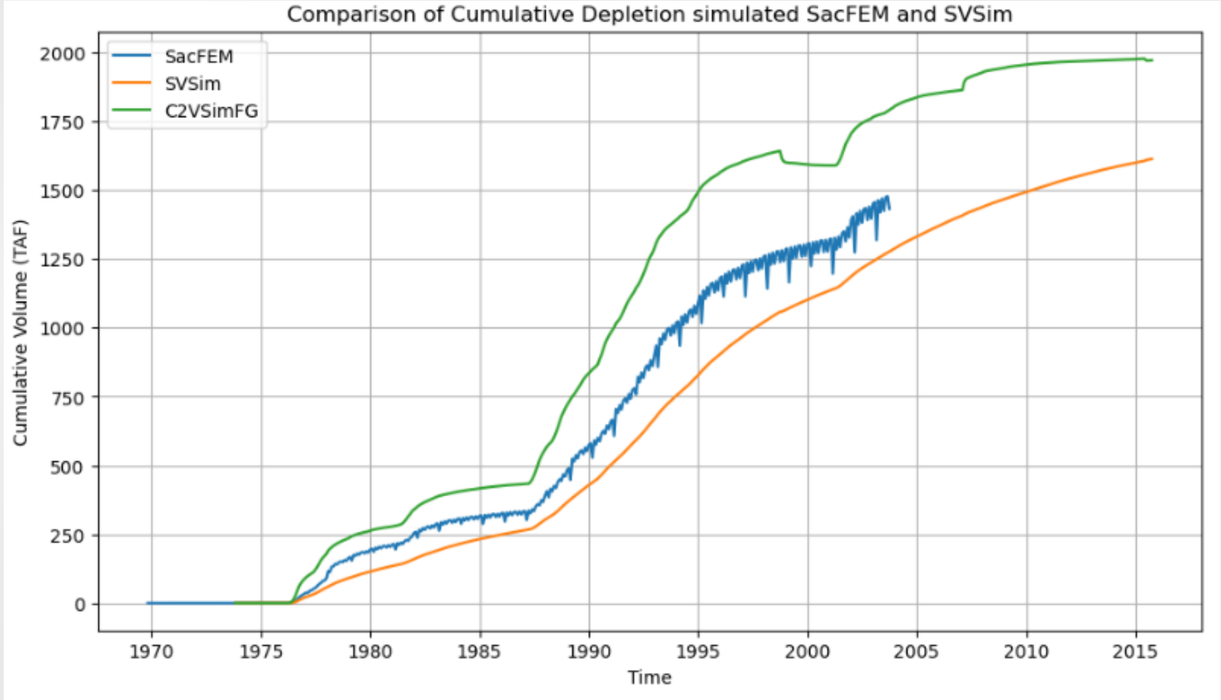
Modeling Stream Depletion in the Sacramento Valley: Comparison

- Use SacFEM pumping in SVSim and C2VSimFG as with-pumping scenario

- Use SVSim and C2VSimFG historical models as without-pumping scenario

Modeling Stream Depletion in the Sacramento Valley: Comparison





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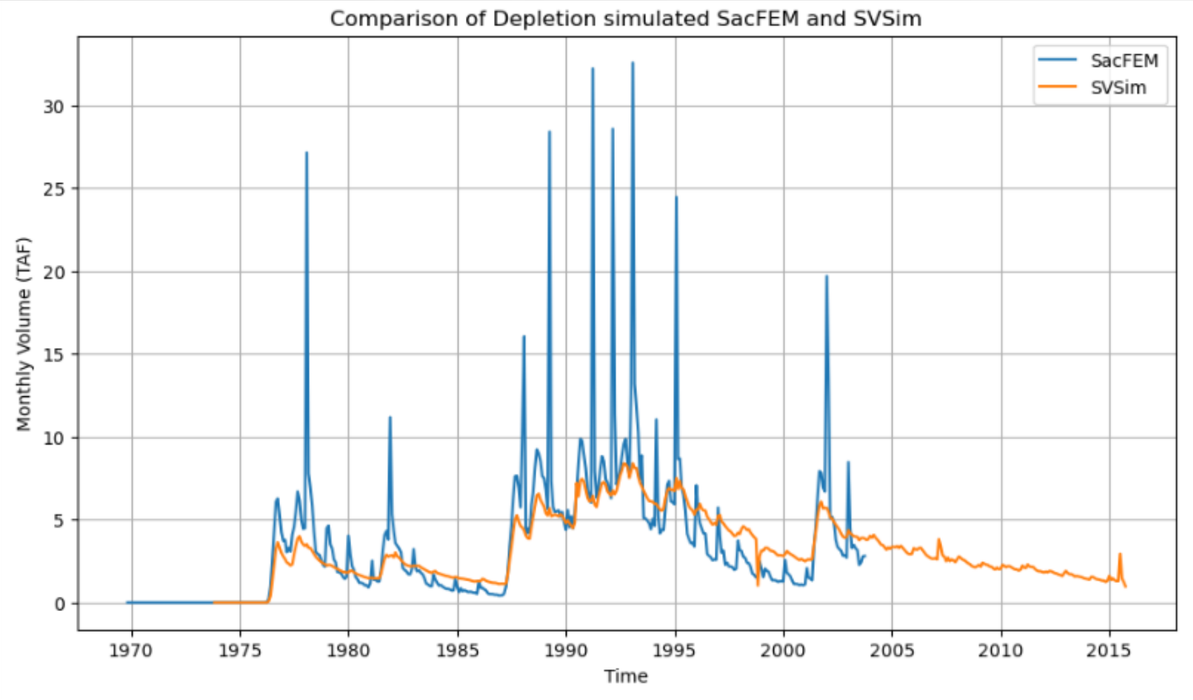
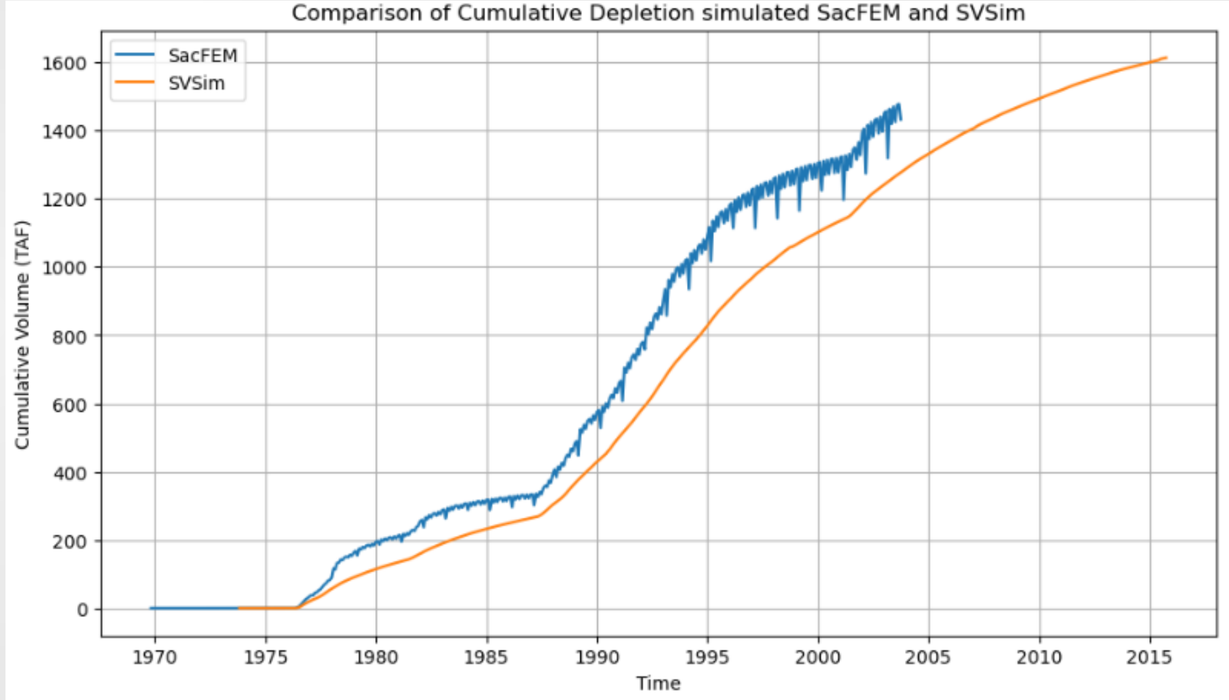
Modeling Stream Depletion in the Sacramento Valley: Comparison





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Other Common Stream Depletion Questions

- How do assumptions about aquifer connectivity affect timing of depletion at a regional scale?

- How do stream alterations or engineered channels affect depletion?

Other Common Stream Depletion Questions

- How does regional connection/disconnection play a role? Modeling assumptions for disconnection?

- When and where does depletion matter? What are the impacts?

Questions?

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