SAN MATEO PLAIN GROUNDWATER BASIN ASSESSMENT

STAKEHOLDER WORKSHOP#3

NOVEMBER 21, 2016

Erler & Kalinowski, Inc.

TODD GROUNDWATER

HYDROFOCUS INC.
Solutions for Land and Water Resources

PRESENTATION OVERVIEW

- Introductions
- Project Overview
- Stakeholder Outreach Efforts
- Summary of Basin Numerical Model

SAN MATEO PLAIN GROUNDWATER BASIN ASSESSMENT

- Funded through Measure A
- Project Objectives:
  - Increase Public Knowledge
  - Evaluate Hydrogeologic and Groundwater Conditions
  - Evaluate Risk of Undesirable Results
  - Develop Potential Groundwater Management Strategies
- http://green.smcgov.org/san-mateo-plain

THE PROJECT IS BEING EXECUTED IN THREE PHASES

Phase 1

- Stakeholder Coordination and Public Outreach
- Data Compilation, Unification, and Sharing
- Develop Initial Basin Conceptual Model
- Develop Basin Groundwater Numerical Model
- Evaluate Potential Basin Management Strategies
- Prepare Phase I Report

Apr 2016 – Jan 2017

Phase 2

- Public Outreach
- Fill Selected Data Gaps
- Update Database
- Update and Refine Conceptual and Numerical Models

Jan 2017 – Dec 2017

Phase 3

- Public Outreach
- Conduct Scenario Evaluations
- Prepare Final Report

Sep 2017 – Apr 2018

STAKEHOLDER WORKSHOPS IN PHASE 1

- ***Workshop #1***
  - May 17, 2016
  - Project Introduction and Overview
- ***Workshop #2***
  - September 7, 2016
  - Basin Conceptual Model
- ***Workshop #3 –***
  - November 21, 2016
  - Groundwater Flow Model
- ***Workshop #4*** (forthcoming)
  - December 6, 2016
  - Basin Management Options

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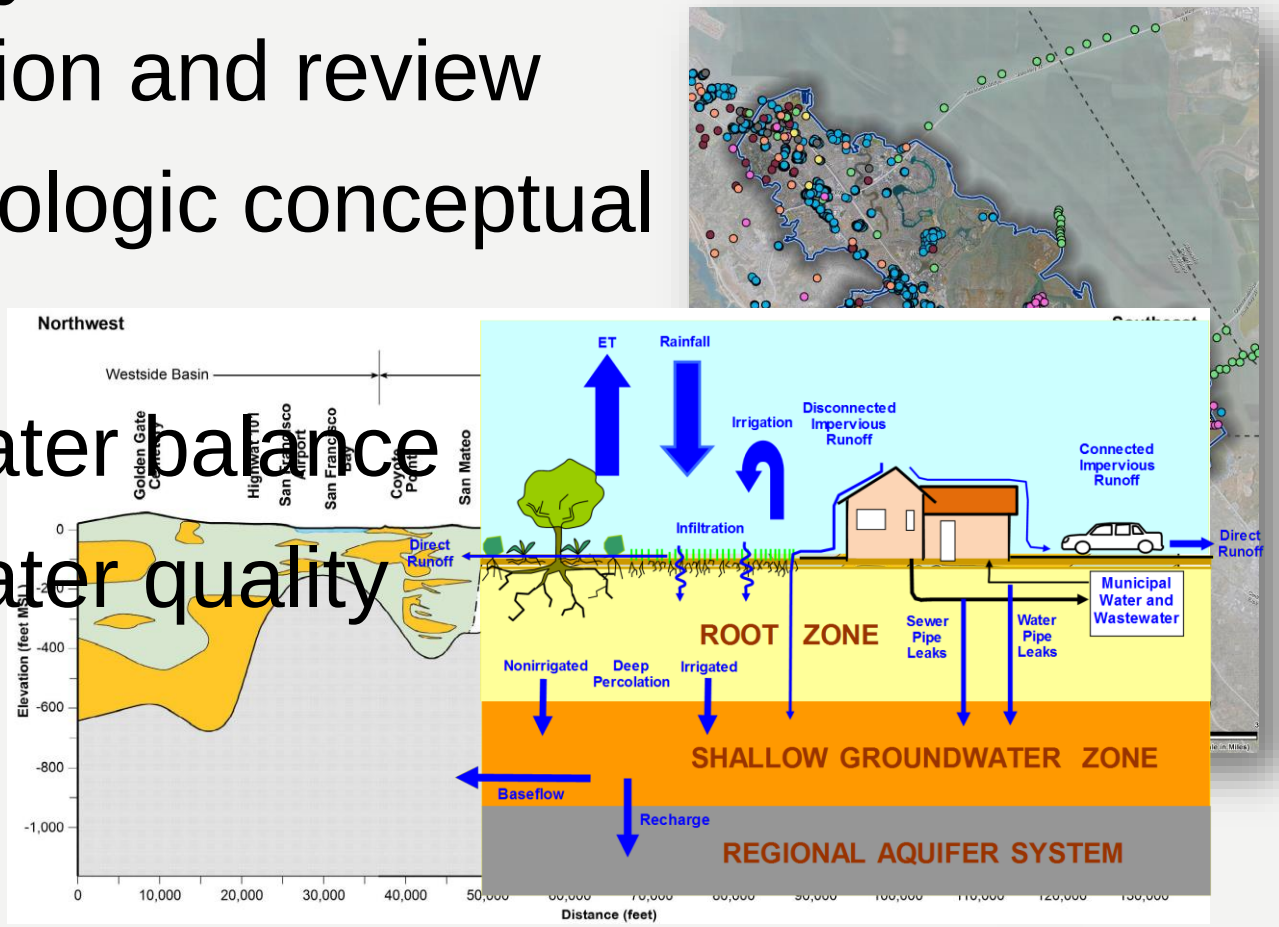
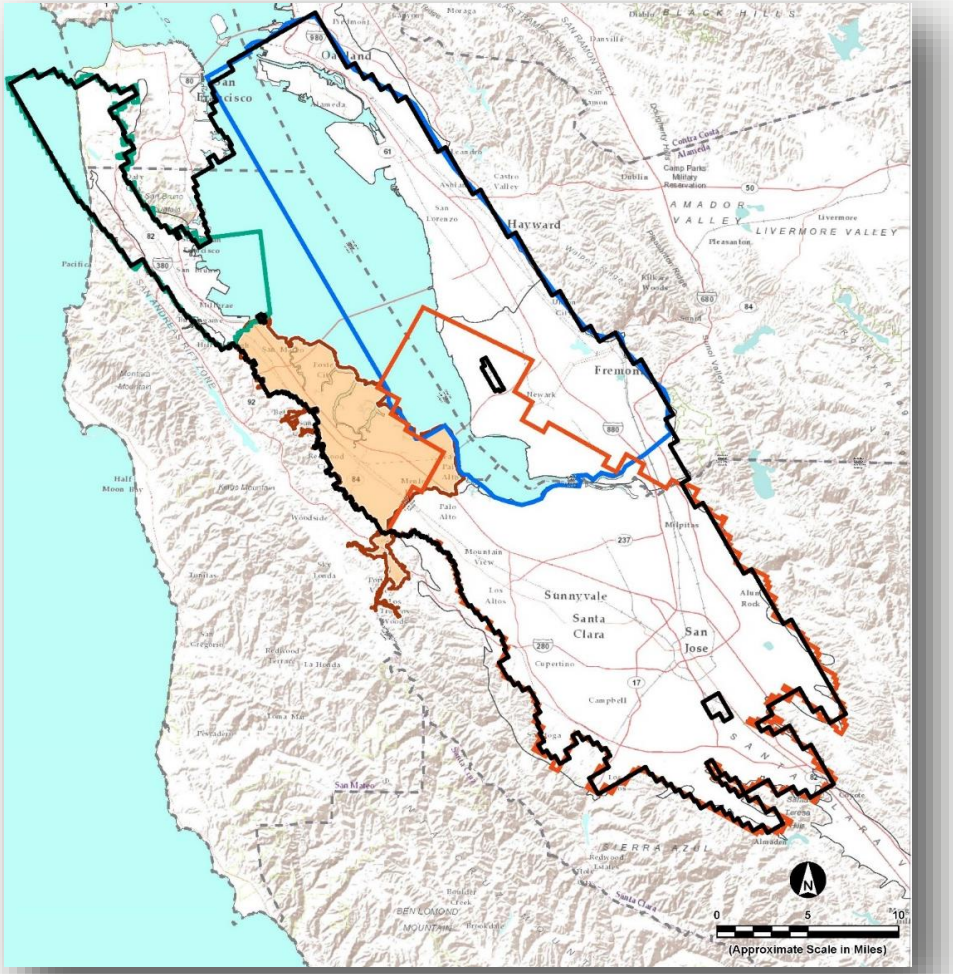
STAKEHOLDER WORKSHOP #2 SEPTEMBER 7, 2016

- Summary of data compilation and review
- Hydrogeologic conceptual model
- Basin water balance
- Basin water quality



BASIN NUMERICAL MODEL IS A POWERFUL TOOL

- Model represents a significant contribution
- Quantitatively understand how the Basin functions as part of regional system
- Future evaluation of implications of management and hydrologic scenarios



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PRESENTATION OVERVIEW

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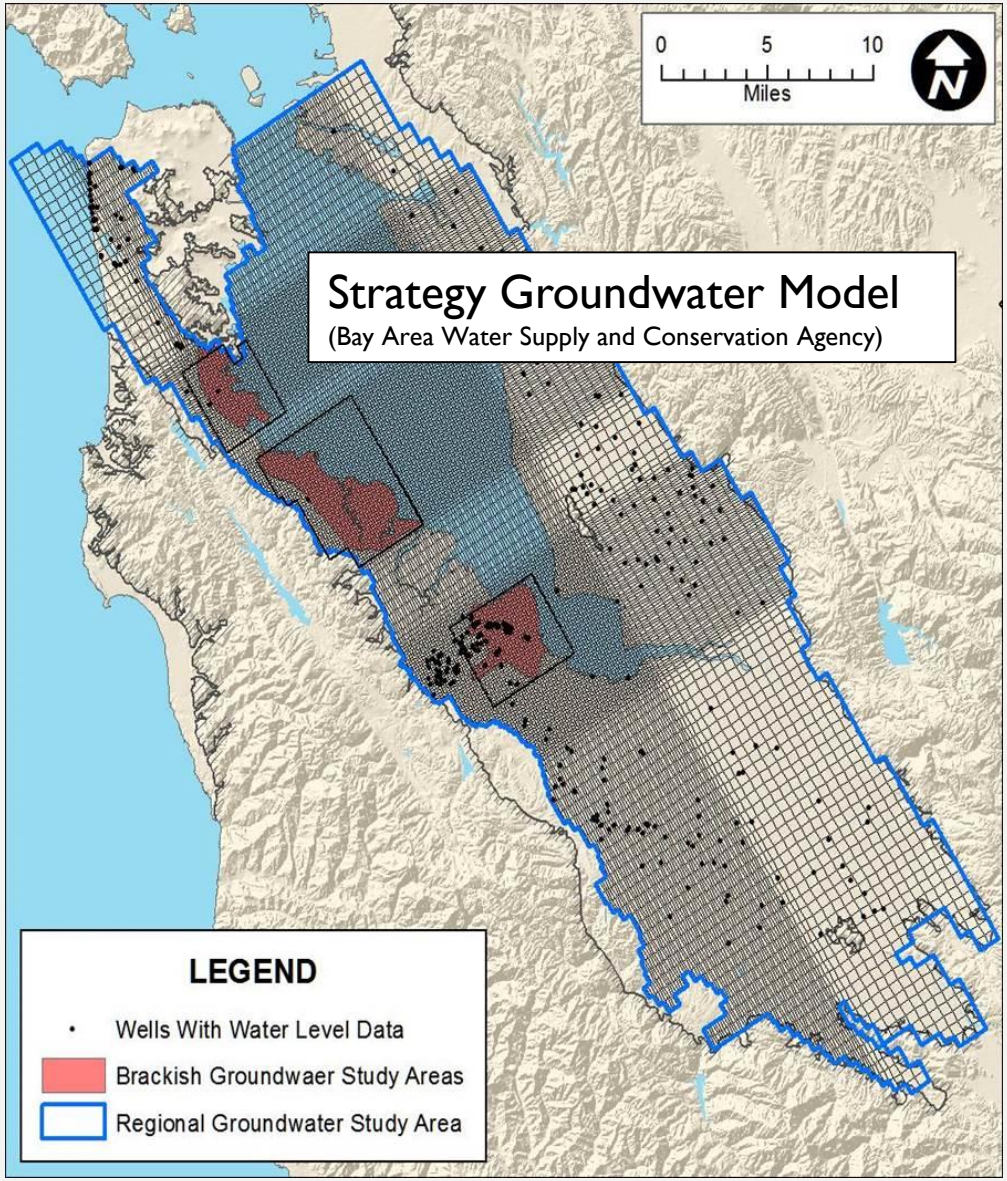
QUANTITATIVE ASSESSMENT OF BASIN CONCEPTUAL MODEL



Start with existing "SGM"

- Refine Model Grid.
  - Area (cell dimensions)
  - Depth intervals (layers)
- Update recharge and pumping
- Calibrate using measured water levels
- Assess Basin Water Budget

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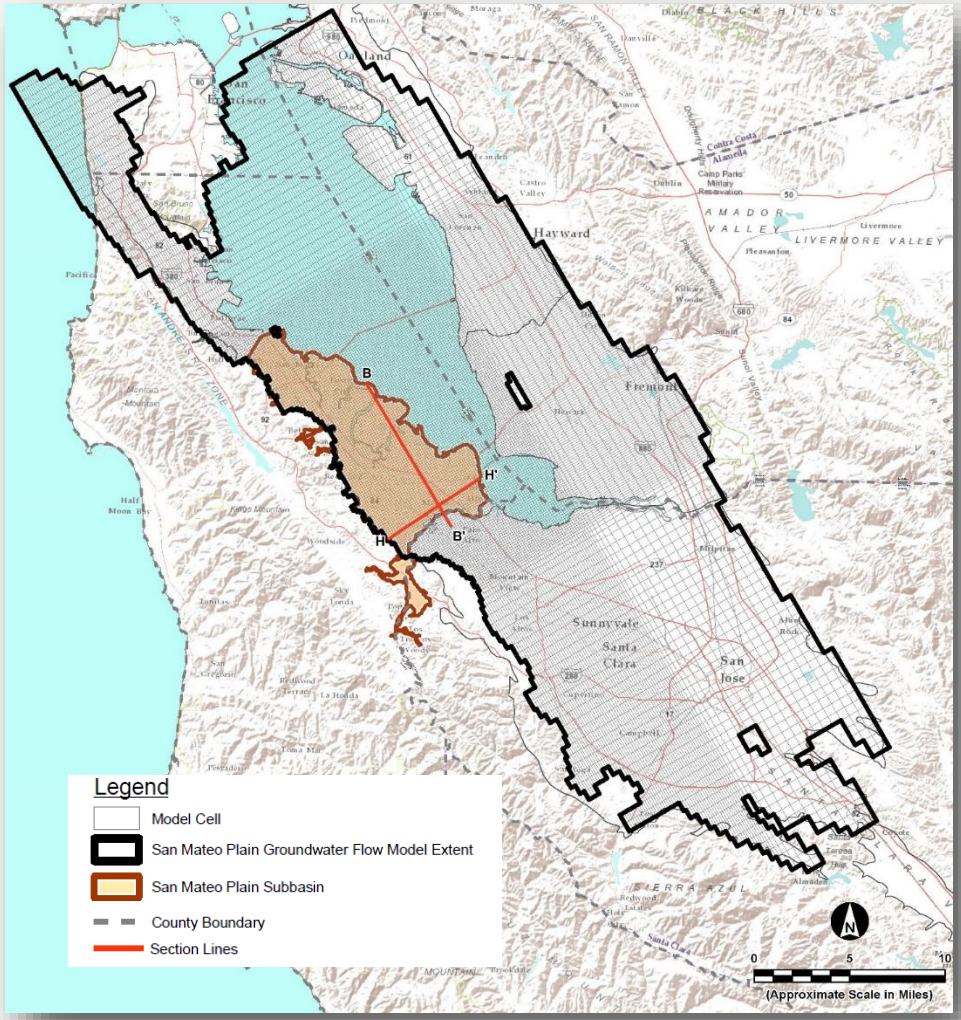
BASIN MODEL – ACTIVE GRID
(LAYER 1)

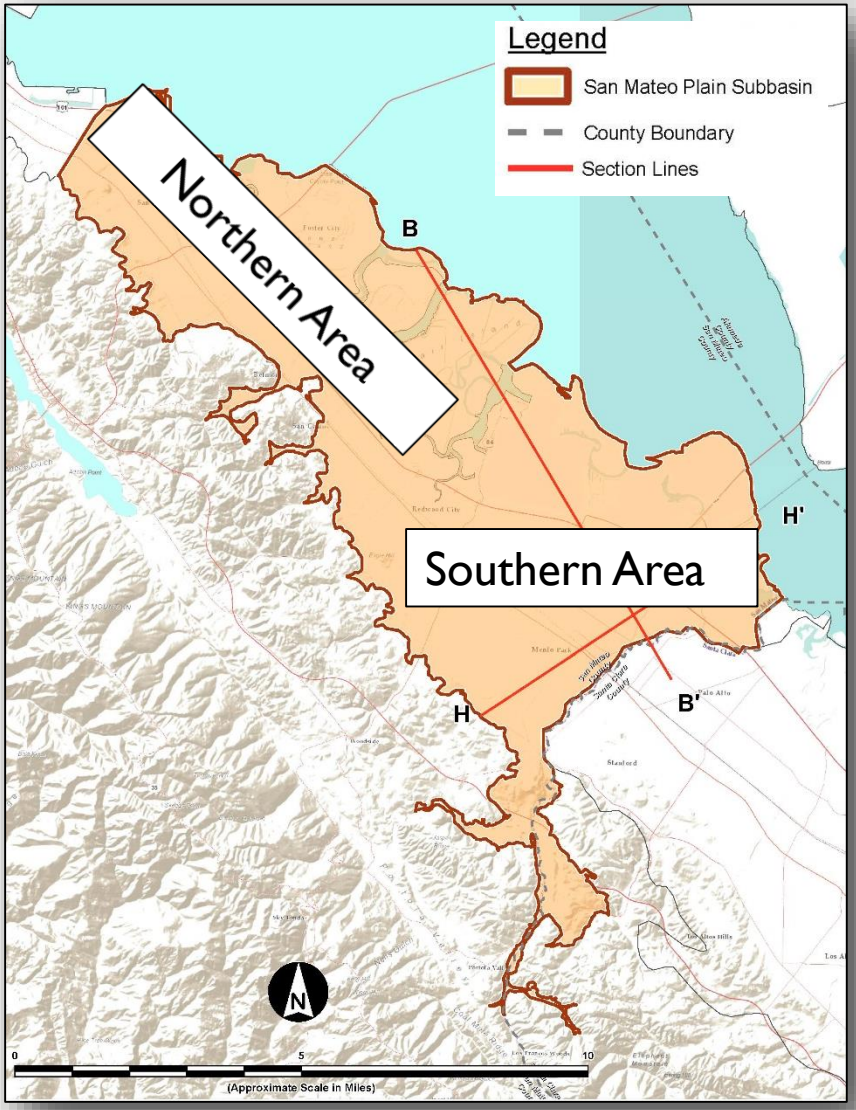


- Physical boundaries
- Cell dimensions
  - Basin focus

    660 ft^2 (10 acres)
  - Surrounding areas

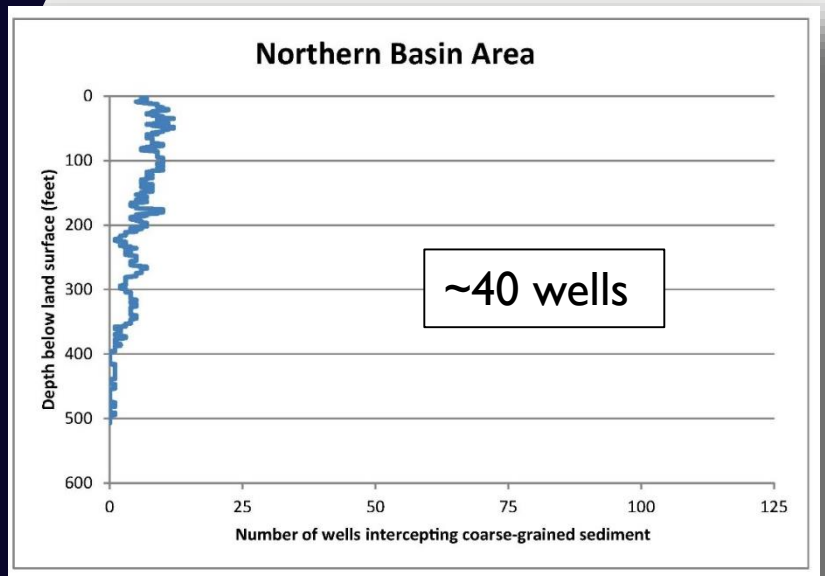
    Variable (up to 160 acres)

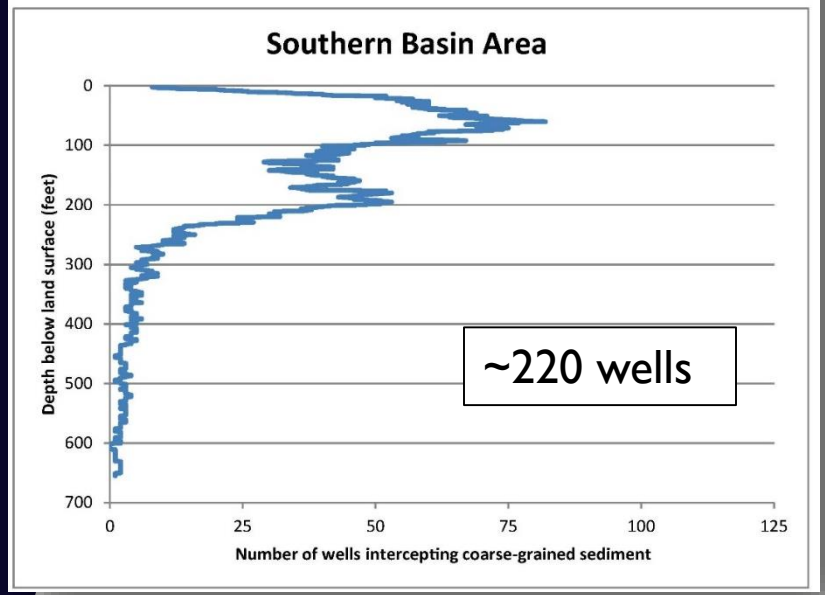
CONSIDERATIONS FOR LAYERING



- Coarse-grained sediment intervals in well boreholes.
- Interpretive cross sections

WELL COUNT - COARSE GRAINED SEDIMENT BY DEPTH





- Approximately uniform distribution with depth.
- Two peaks
  - <100 feet bls. (SHALLOW)
  - >150 feet bls. (DEEP)

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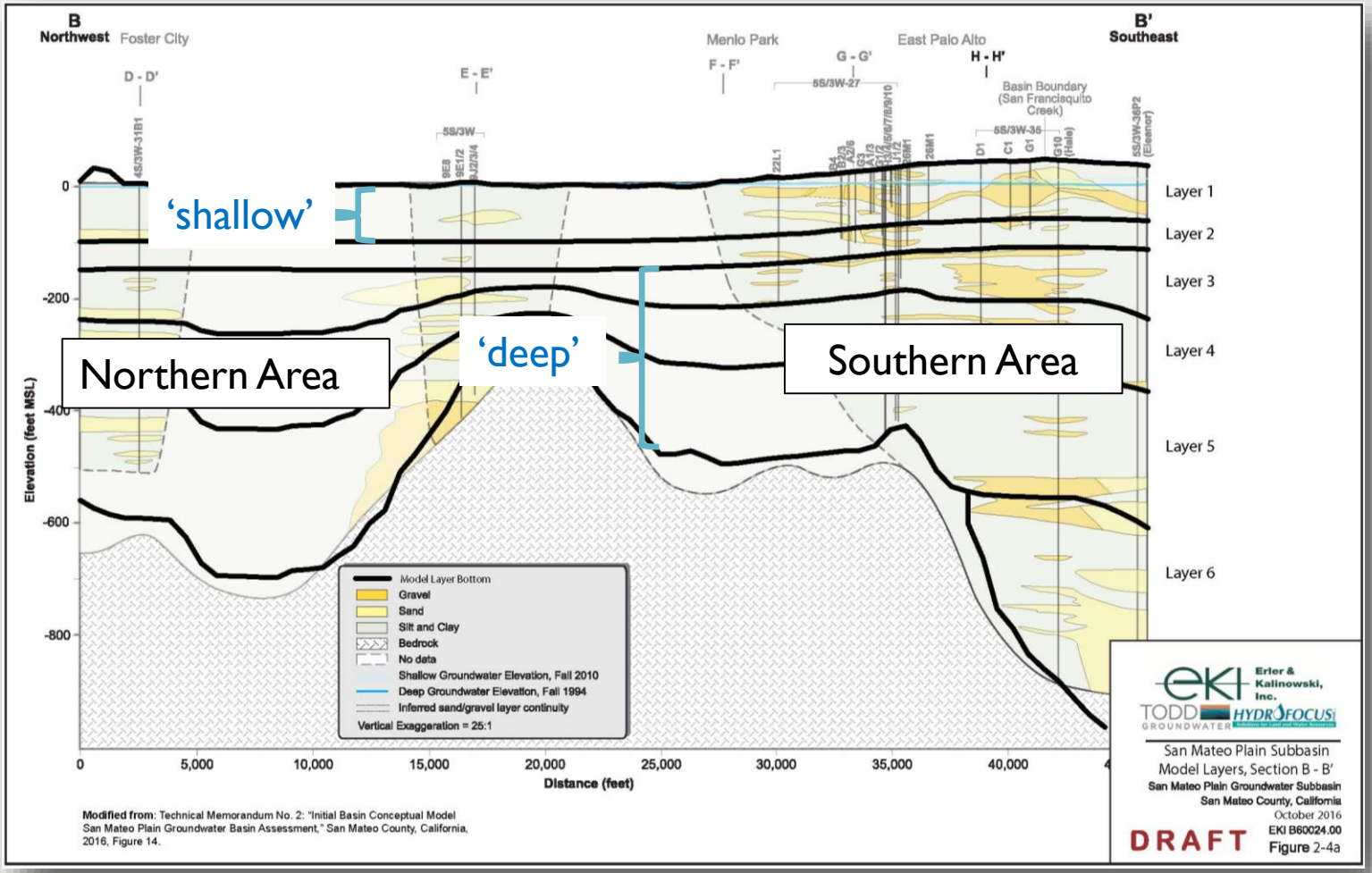
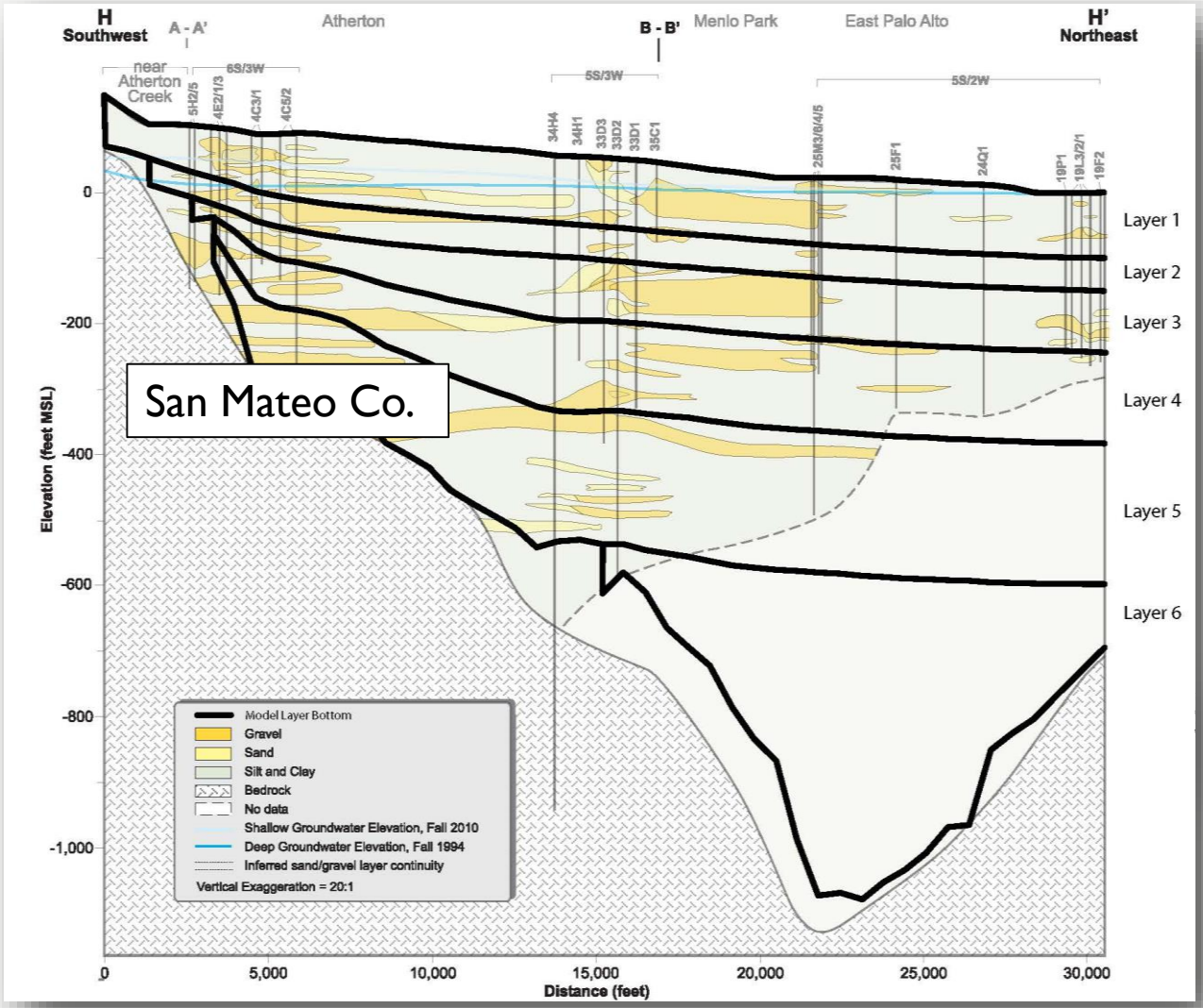
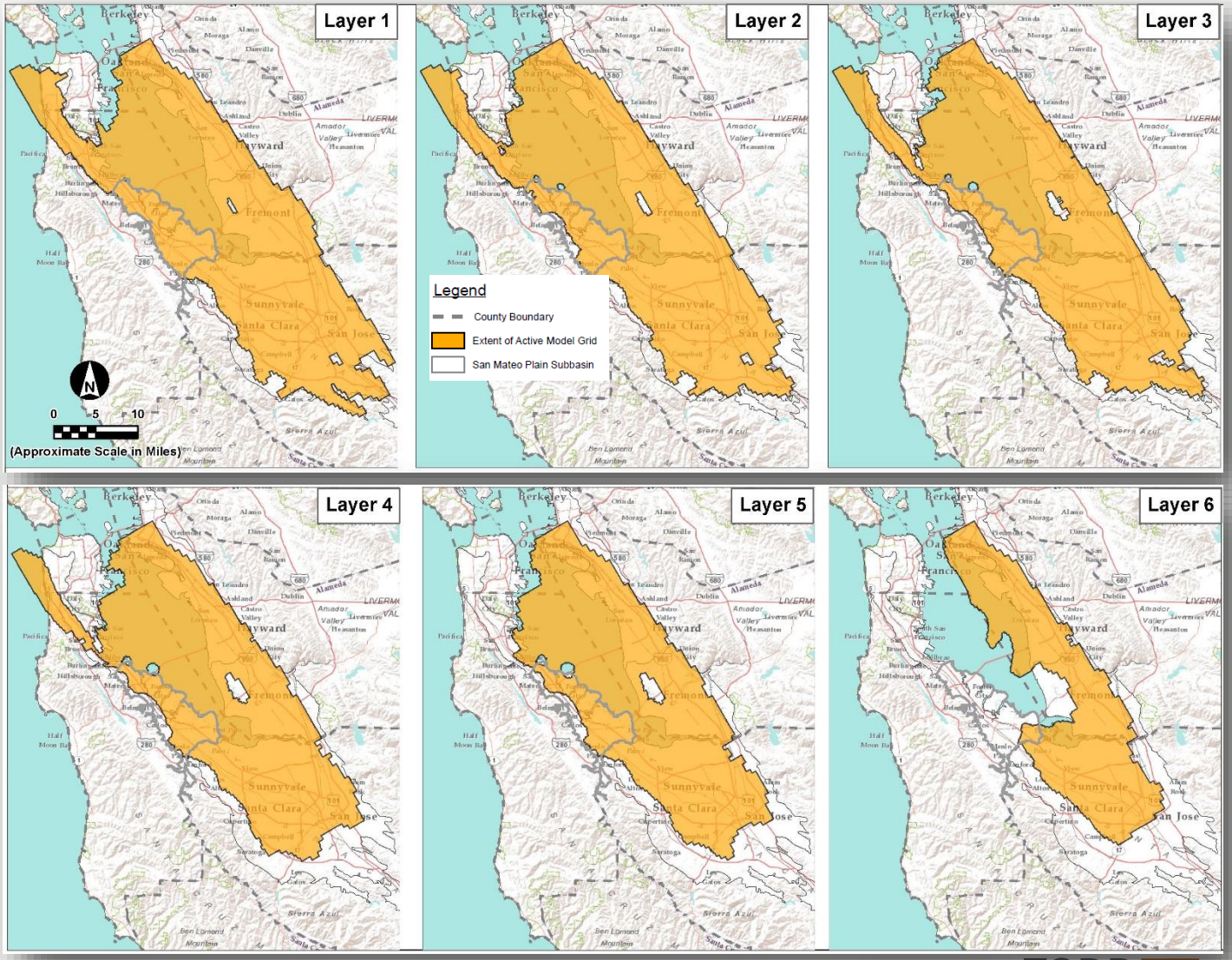
LAYERING (NORTH – SOUTH)



LAYERING (WEST – EAST)



DEPTH DISTRIBUTION OF ACTIVE MODEL GRID



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TEMPORAL MODELING APPROACH
(AVERAGE 1987-1996 CONDITIONS)

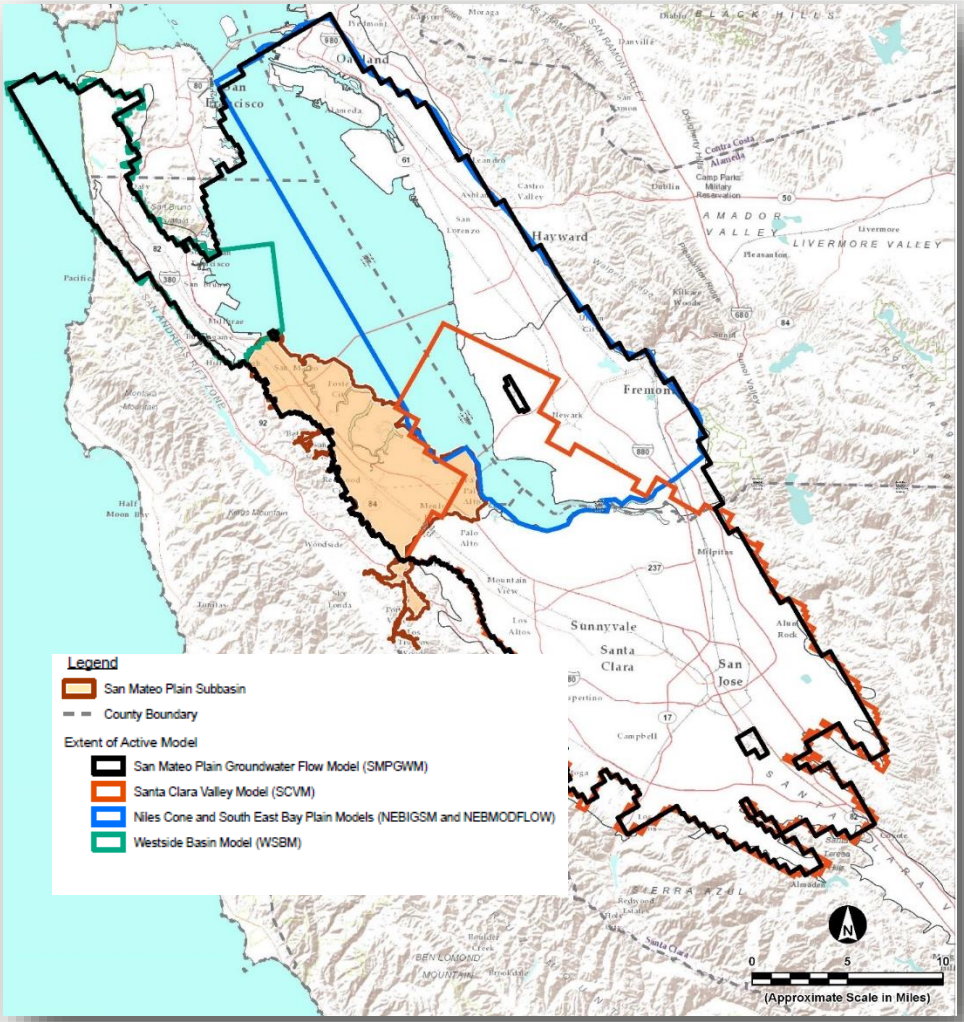
Groundwater levels approximately constant and storage changes are essentially zero (steady-state).

- Recharge, pumping, and subsurface flows are all in balance (IN = OUT).
- Conceptual model represents average hydrologic conditions.
- Easier to construct because they do not require time-varying input of recharge, pumping, and boundary conditions.

1987-1996 selected because:

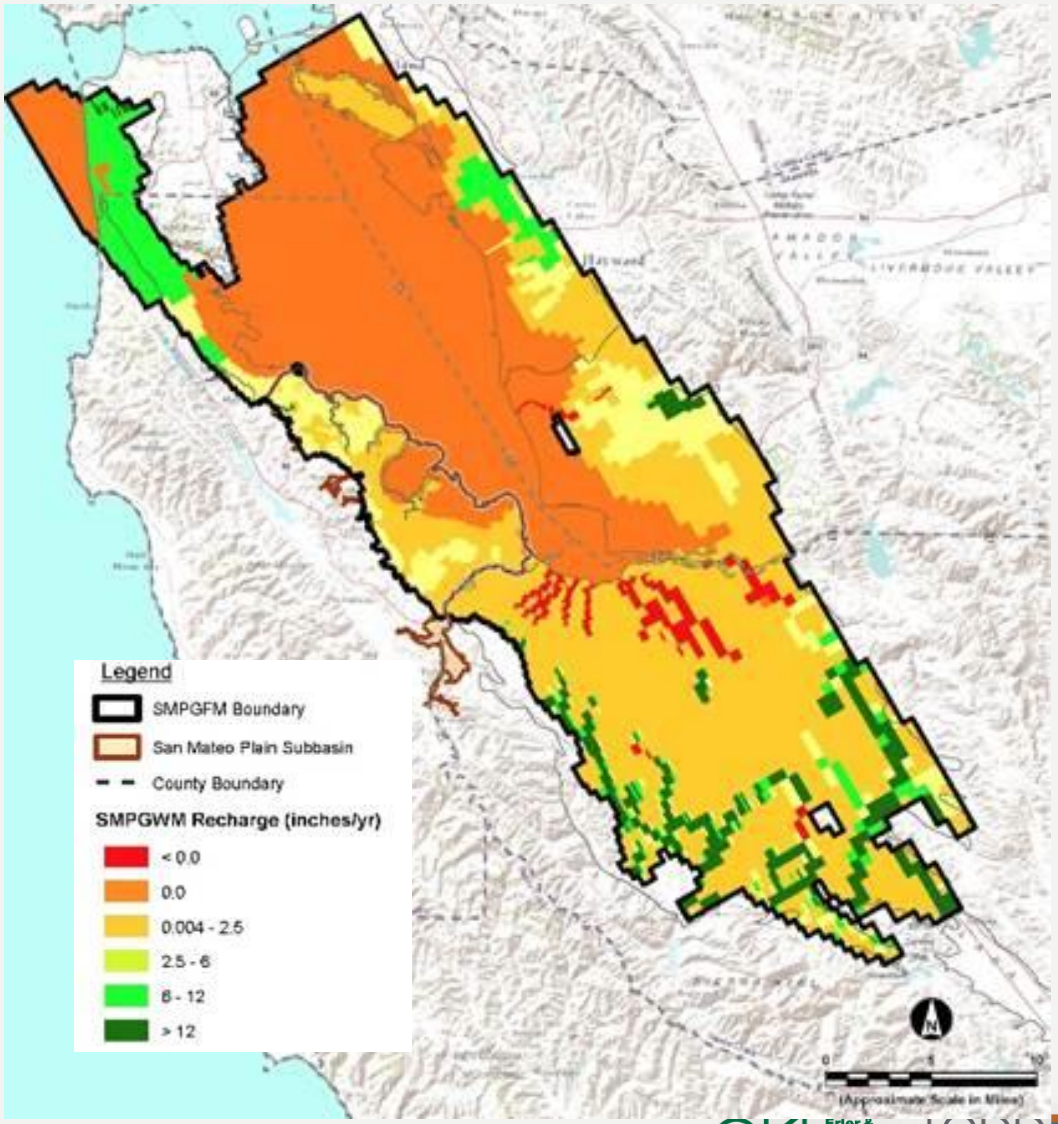
- Average rainfall at five stations was about the same as the long-term average
- The period includes wet, normal, and drought years.
- Historical water use are within four percent of the 34-year average.
- Land use not likely to be significantly different from current conditions.

UTILIZE EXISTING MODELS AND PROJECT DATABASE FOR RECHARGE AND PUMPING DATA



- Westside Basin Model (1959-2009)
- Niles Cone and South East Bay Plain Integrated Groundwater Surface Water Model (1965-2000)
  - MODFLOW (EBMUD)
  - IGSM (ACWD)
- USGS Santa Clara Valley Model (1970-1999)
- Project Data Base and Conceptual Model

MODELED WATER TABLE RECHARGE



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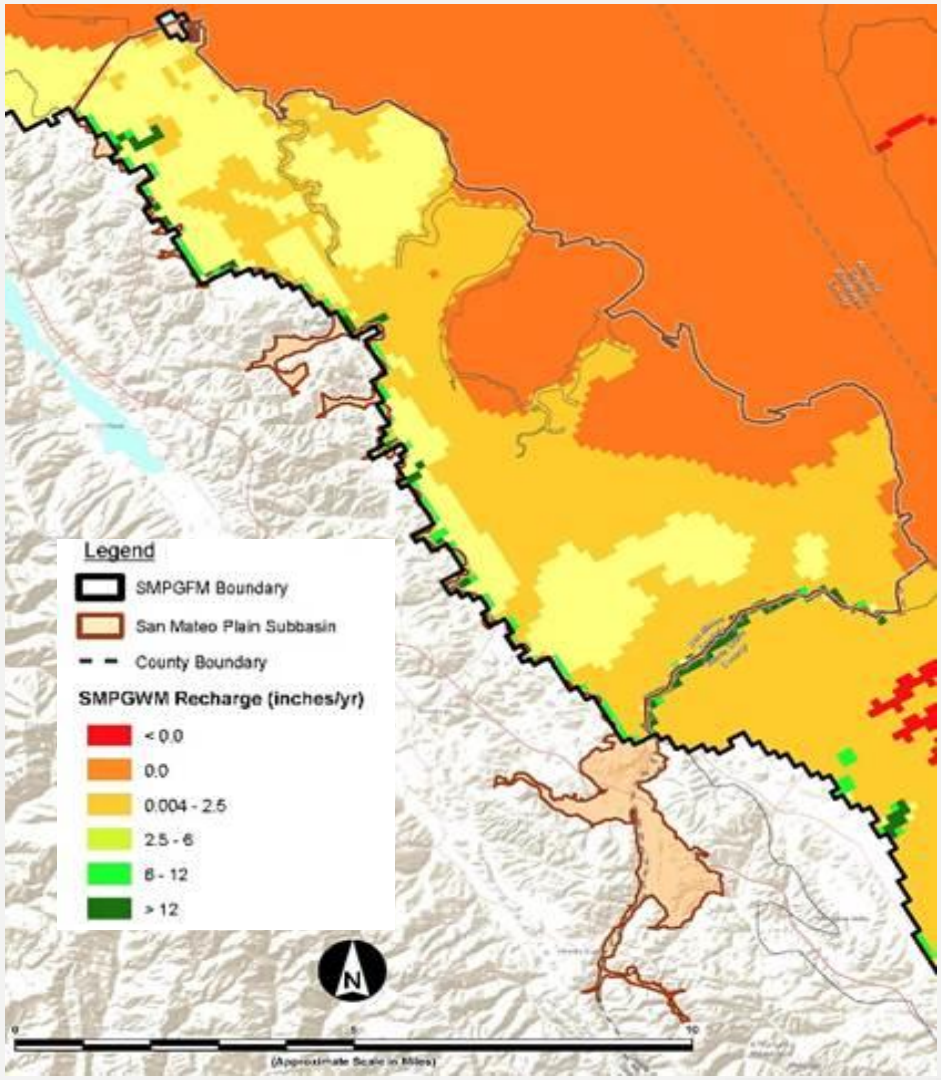
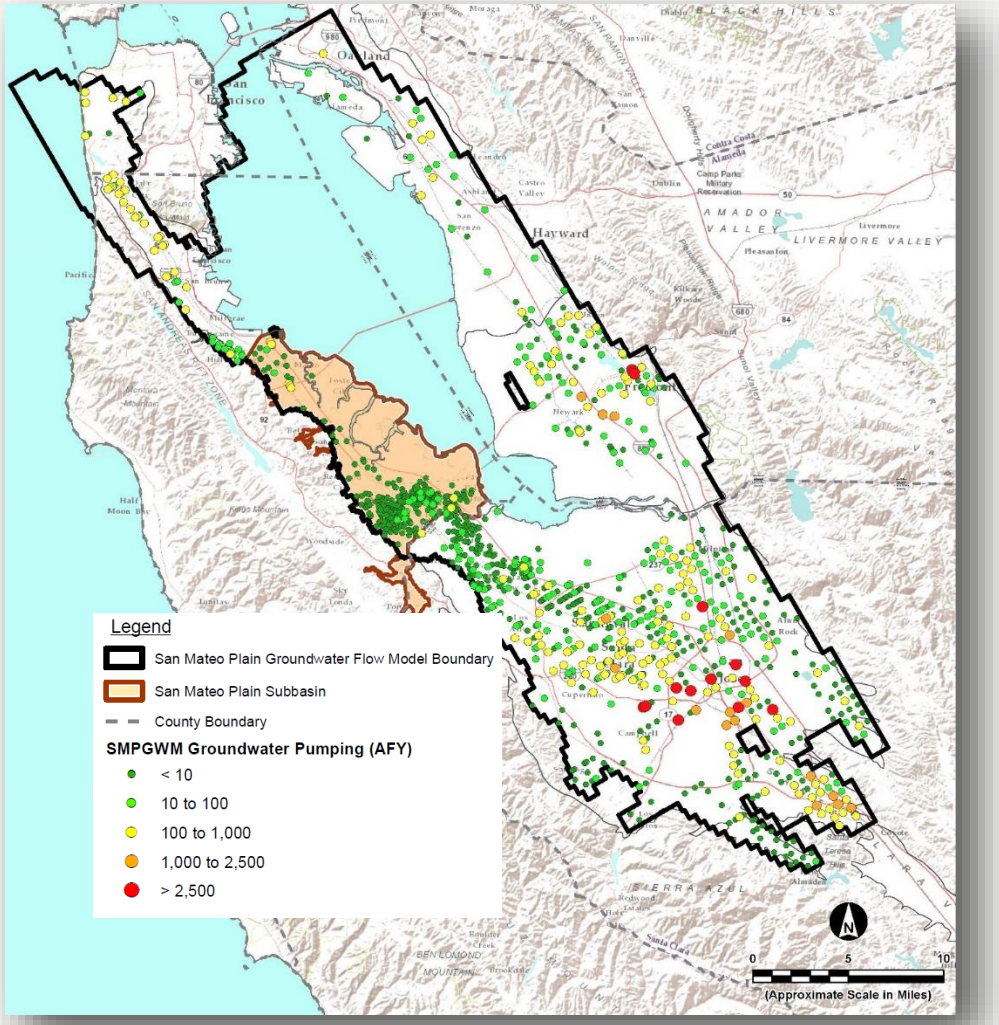
MODELED WATER TABLE RECHARGE - BASIN



MODELED WELL LOCATIONS AND PUMPING RATES



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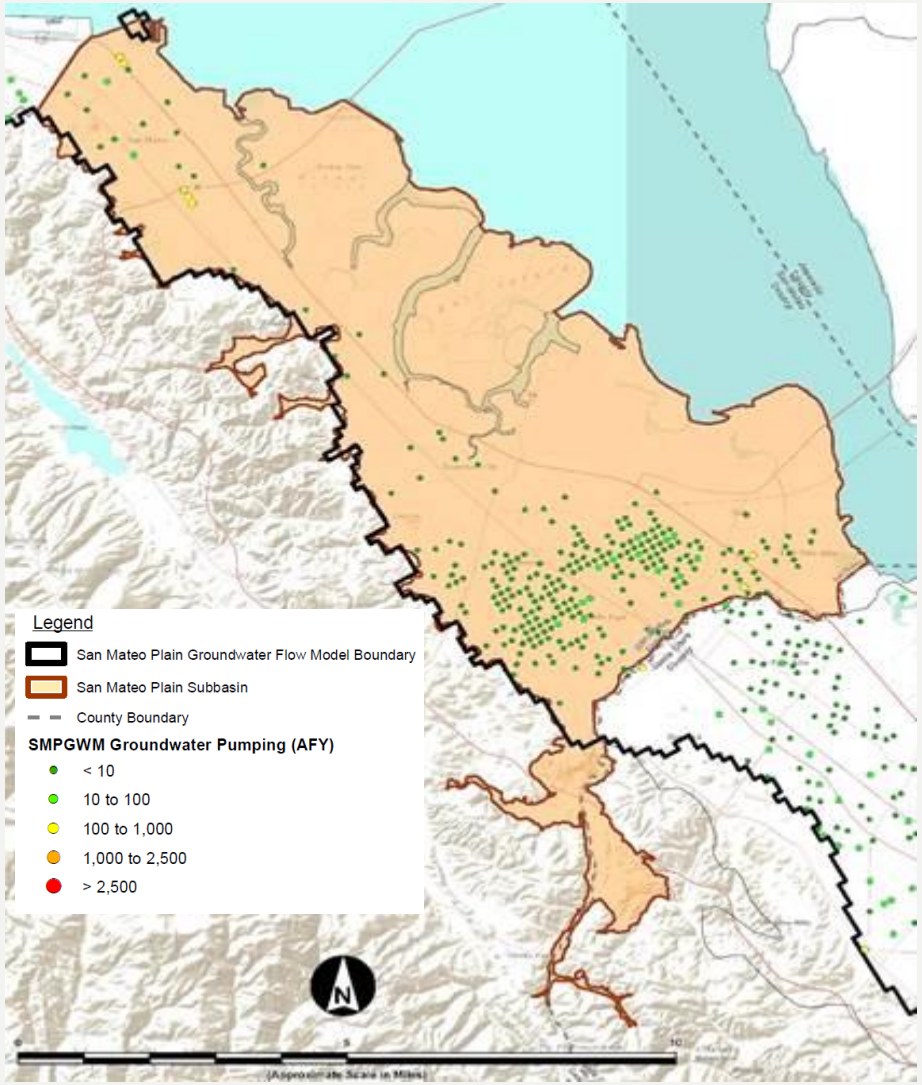
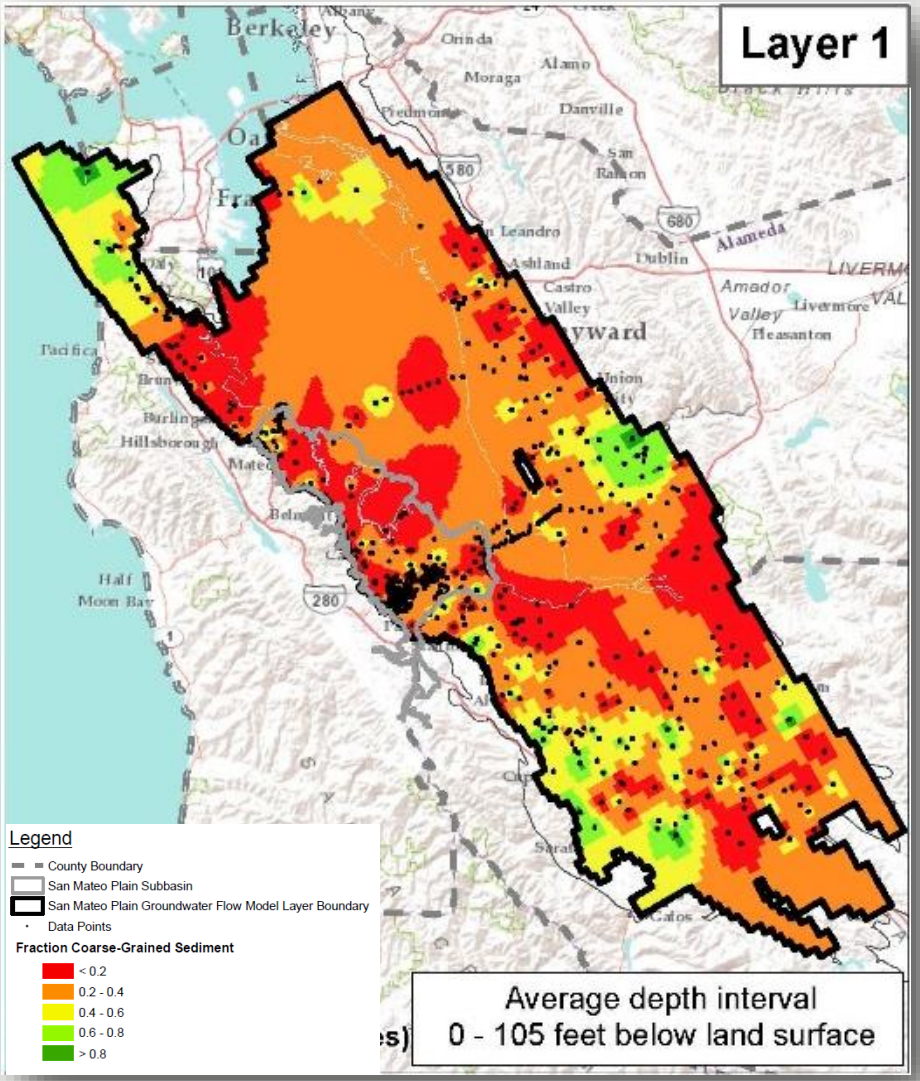
MODELED WELL LOCATIONS AND PUMPING RATES - BASIN

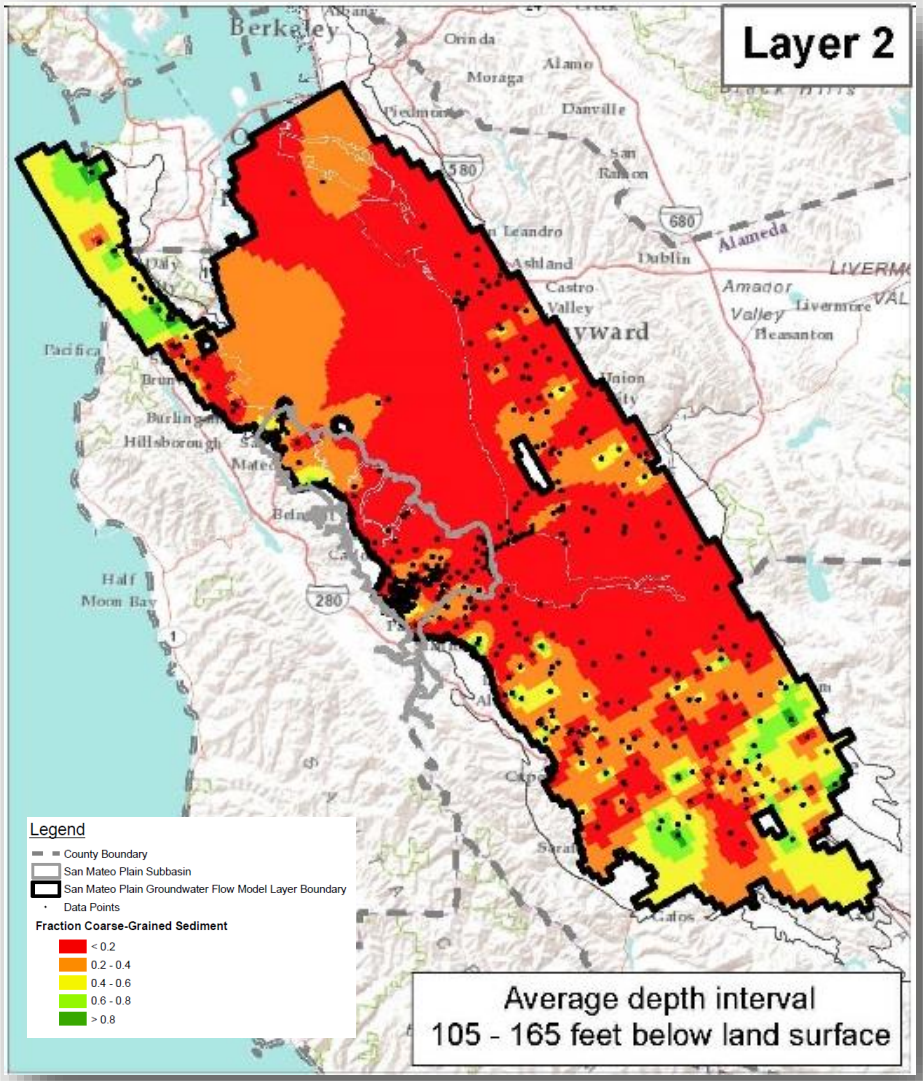


FRACTION COARSE-GRAINED SEDIMENT



- Used to model spatial distribution of hydraulic conductivity

FRACTION COARSE-GRAINED SEDIMENT

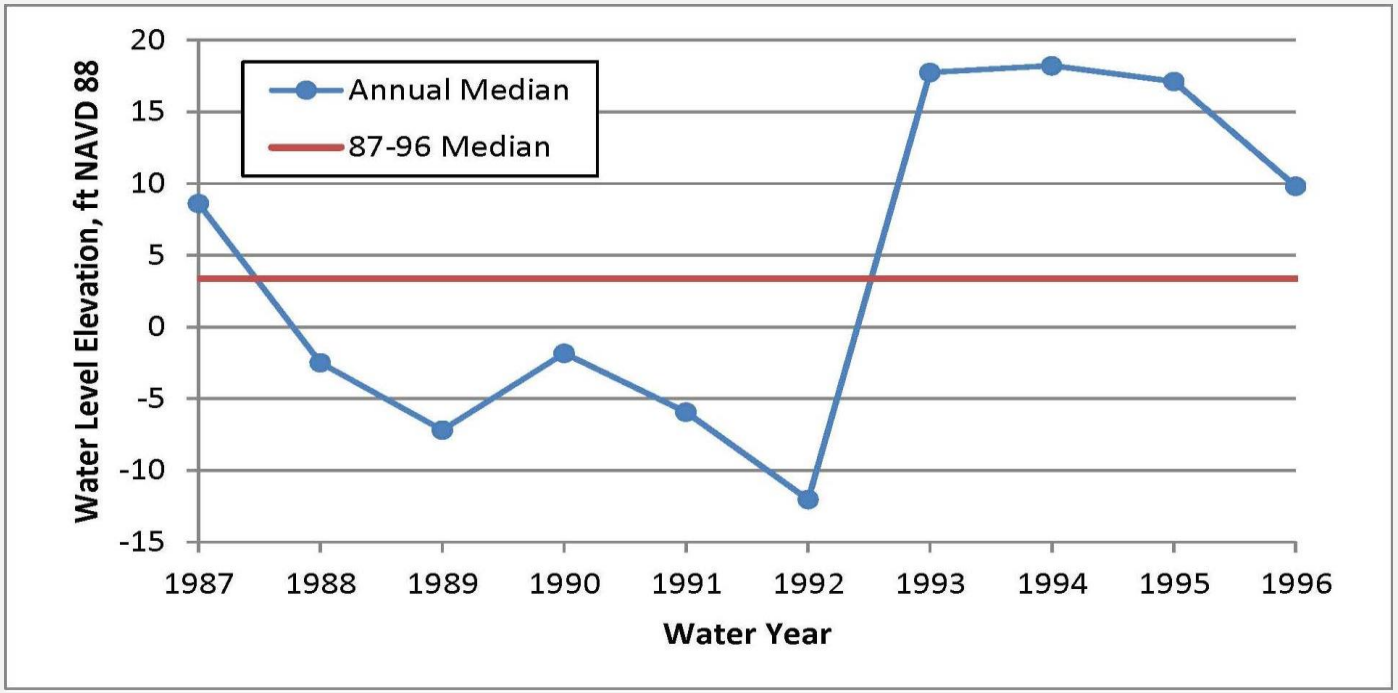


- Used to model spatial distribution of hydraulic conductivity

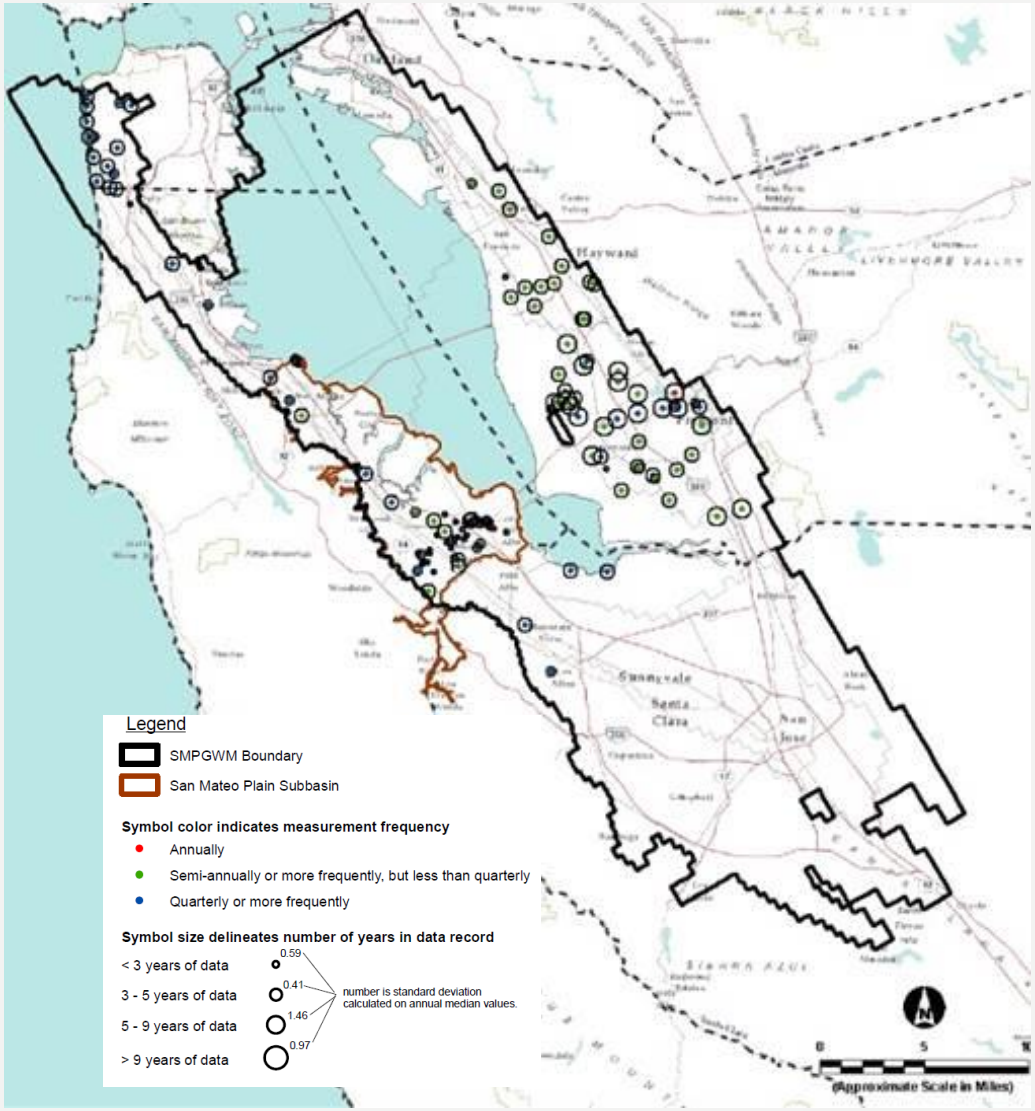
TEMPORAL MODELING APPROACH
(AVERAGE 1987-1996 CONDITIONS)

Employed Steady-State approximation for initial phase to:

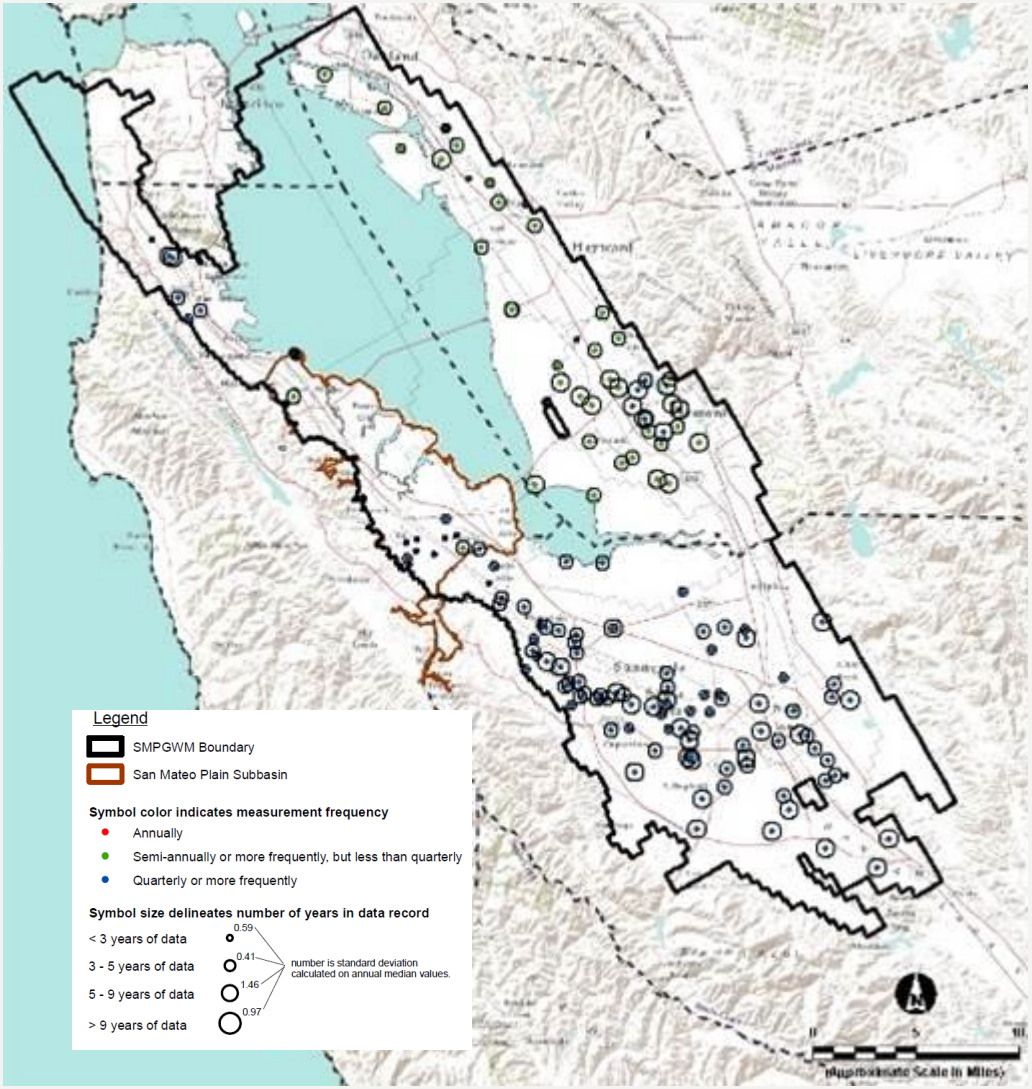
- Calibrate hydraulic conductivity.
- Assess hydraulic consistency of the Basin conceptual model.
- Evaluate average annual water balance.
- Average groundwater conditions represented by median measured water levels in wells.



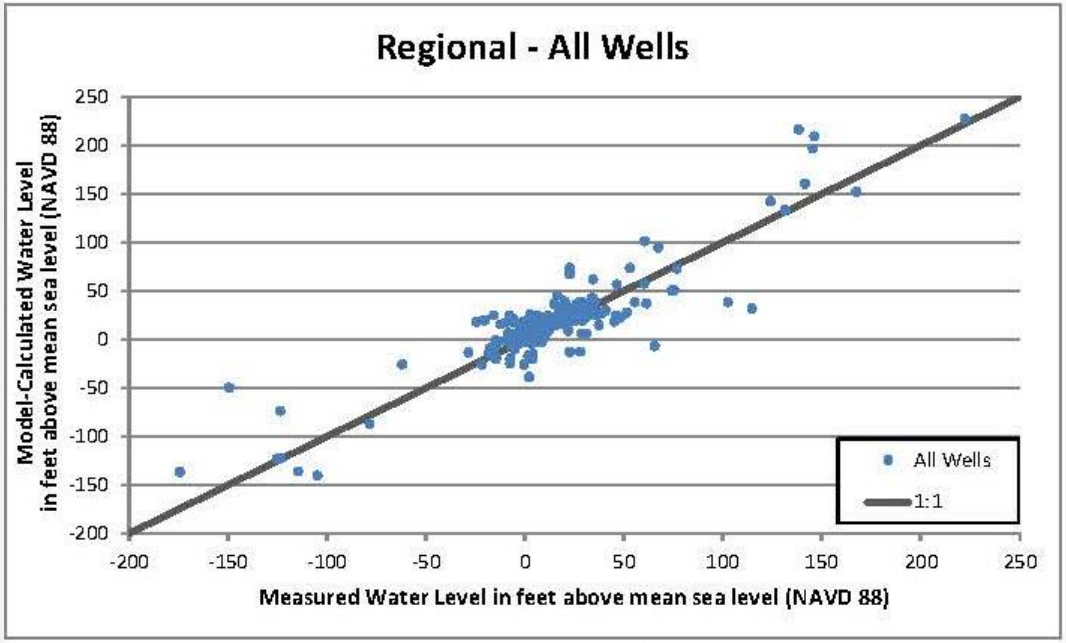
"SHALLOW" WELLS WITH MEASURED WATER LEVELS

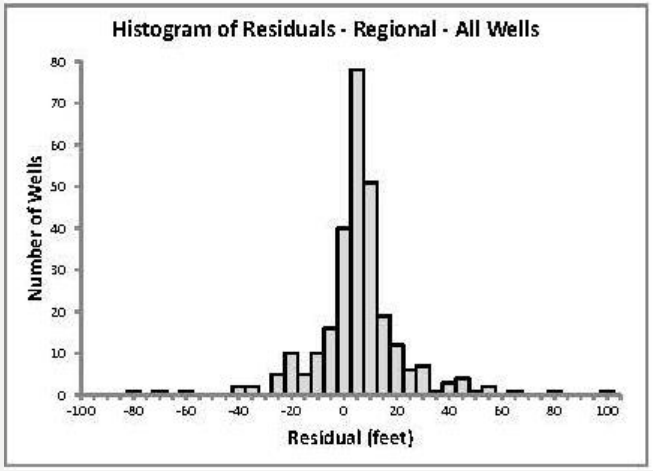


"DEEP" WELLS WITH MEASURED WATER LEVELS



MODEL-CALCULATED VS. MEASURED WATER LEVELS

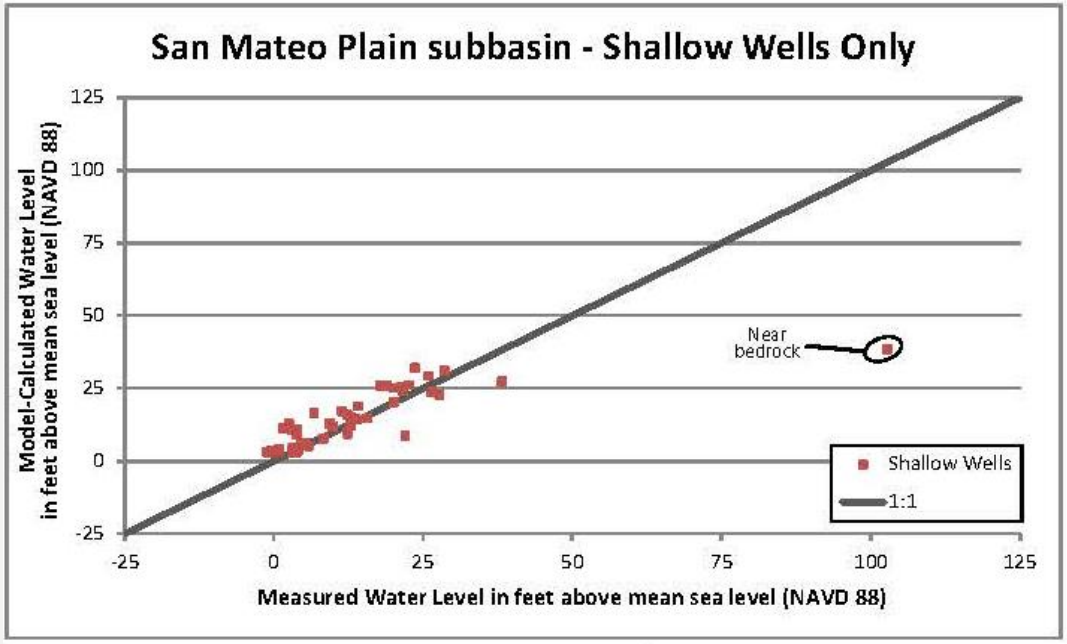


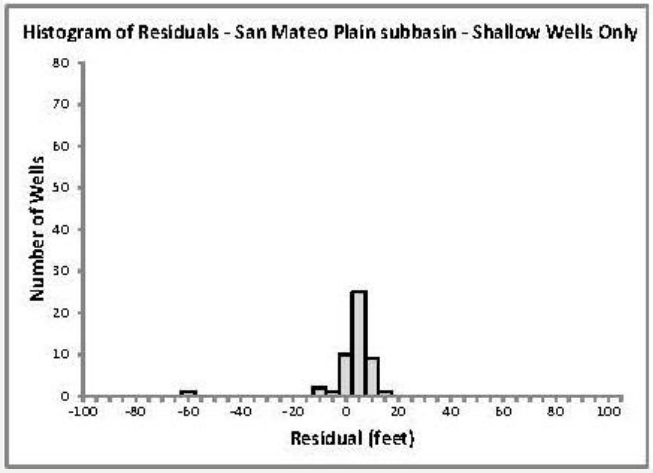


Error Statistics (in feet)

RMSE:	18.2
Min error:	-83.1
Max error:	99.4
Mean error:	3.3
Median error:	3.0

MODEL-CALCULATED VS. MEASURED WATER LEVELS (SHALLOW)





Error Statistics (in feet)

RMSE:	5.0
Min error:	-13.5
Max error:	10.2
Mean error:	2.2
Median error:	2.6

Statistics exclude outlier near bedrock

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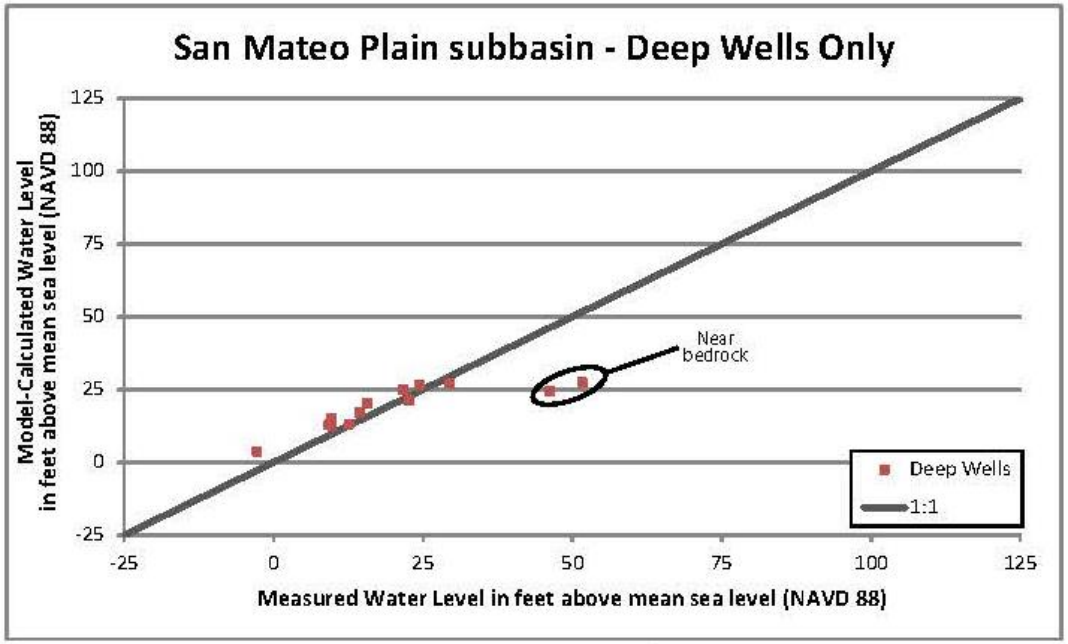
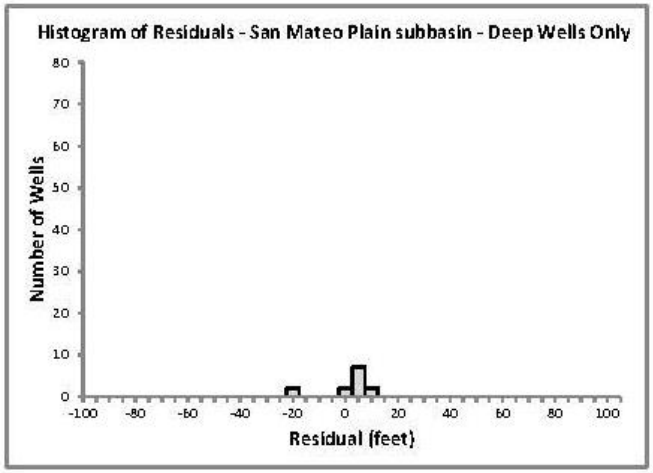
MODEL-CALCULATED VS. MEASURED WATER LEVELS (DEEP)





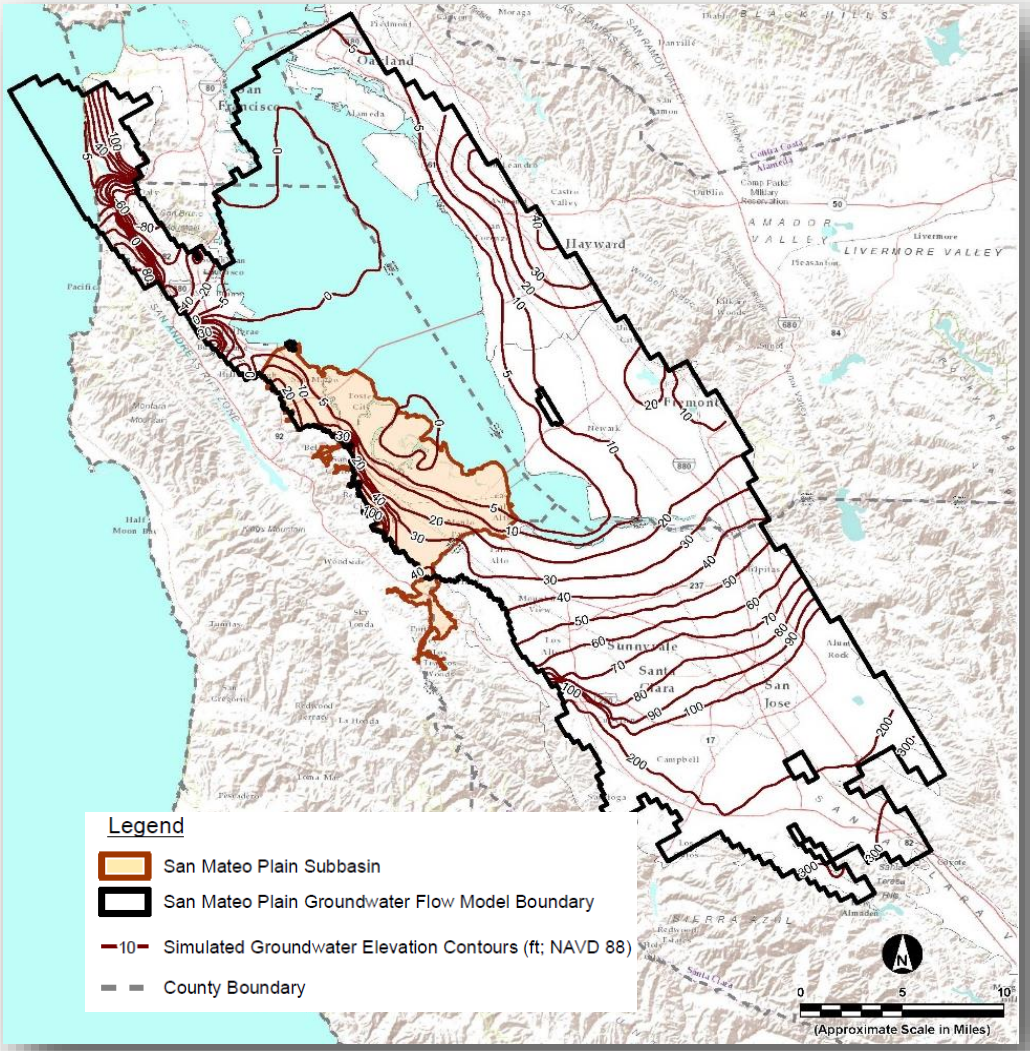
Error Statistics (in feet)

RMSE:	3.6
Min error:	-2.4
Max error:	6.5
Mean error:	2.5
Median error:	2.9

Statistics exclude outliers near bedrock

MODELED GROUNDWATER LEVELS "SHALLOW ZONE – LAYER 1"

(AVERAGE 1987-1996 CONDITIONS)



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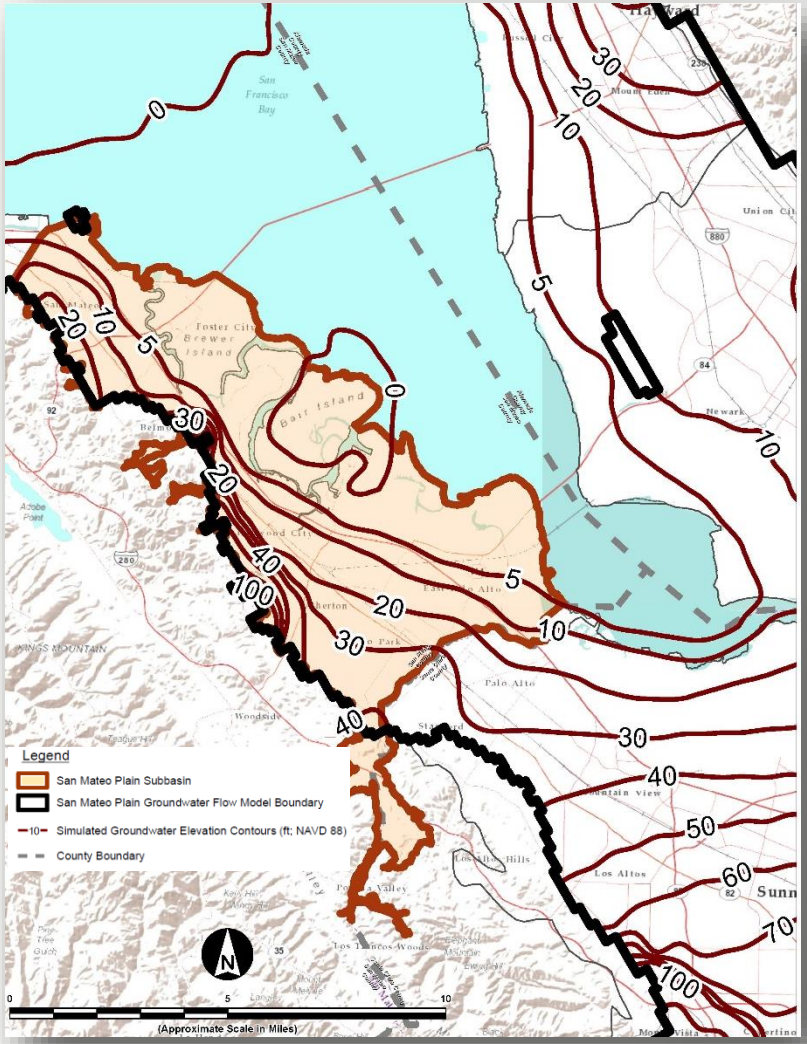
MODELED BASIN WATER LEVELS "SHALLOW ZONE – LAYER 1"

(AVERAGE 1987-1996 CONDITIONS)



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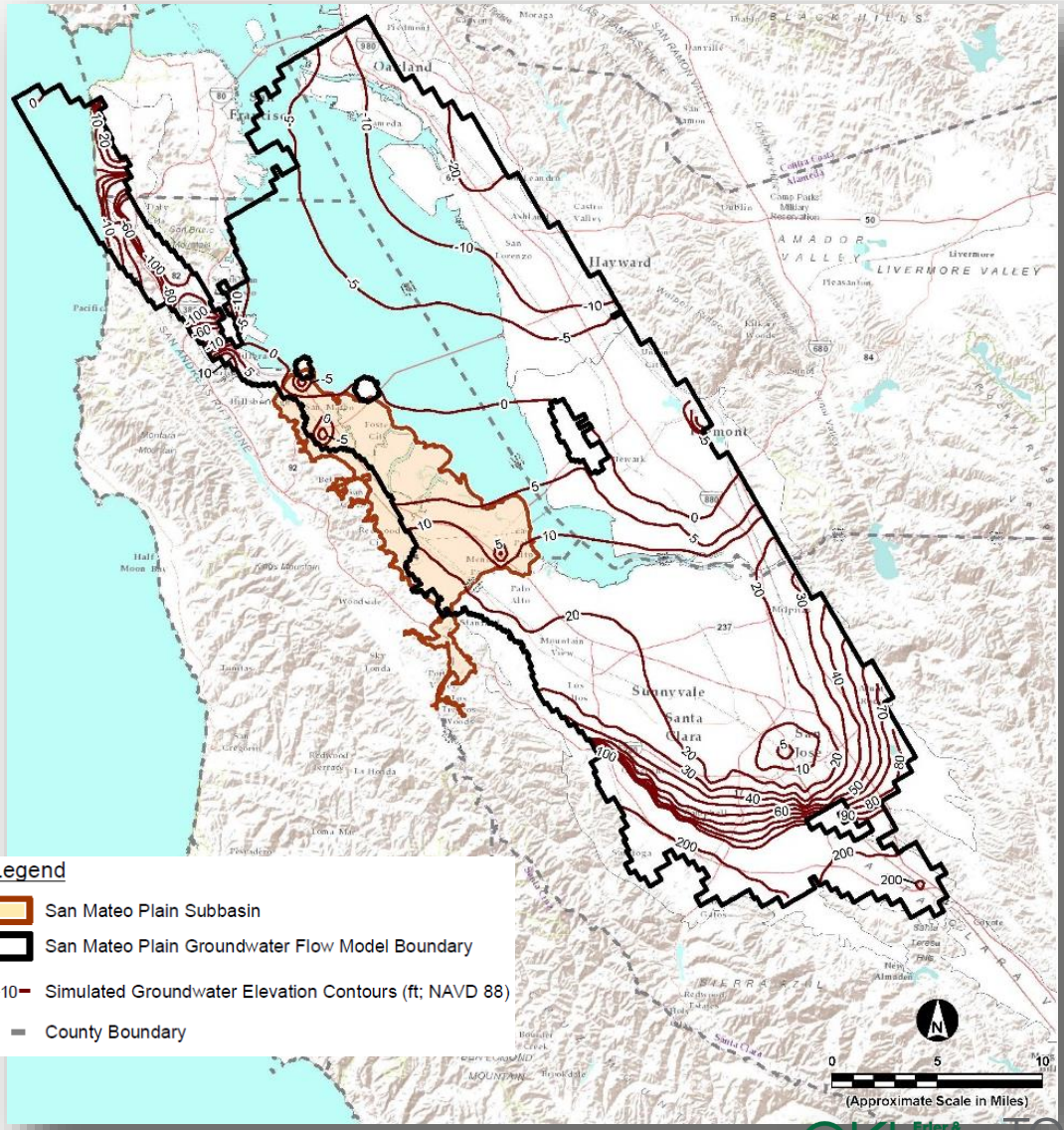
MODELED GROUNDWATER LEVELS "DEEP ZONE – LAYERS 3-5"

(AVERAGE 1987-1996 CONDITIONS)



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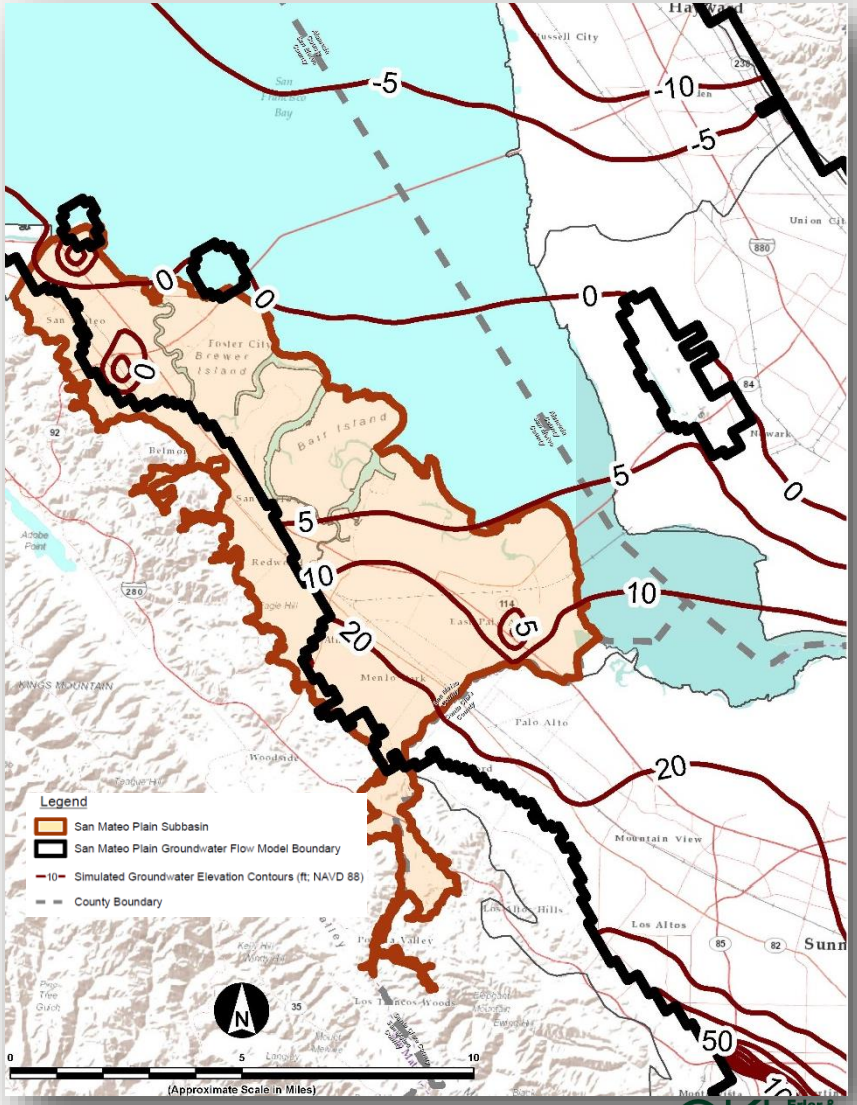
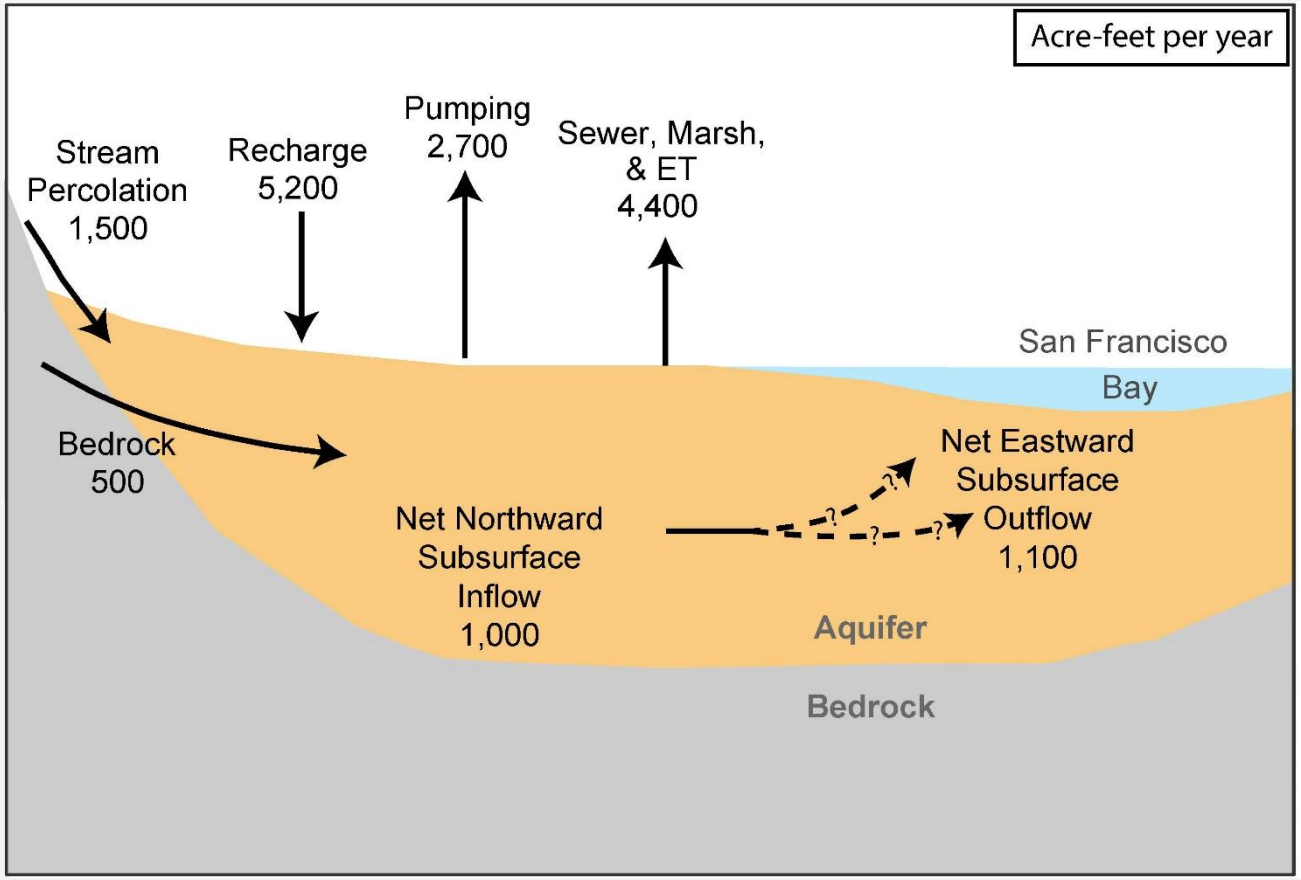
MODELED BASIN WATER LEVELS "DEEP ZONE – LAYERS 3-5"

(AVERAGE 1987-1996 CONDITIONS)



MODEL CALCULATED ANNUAL BASIN WATER BUDGET

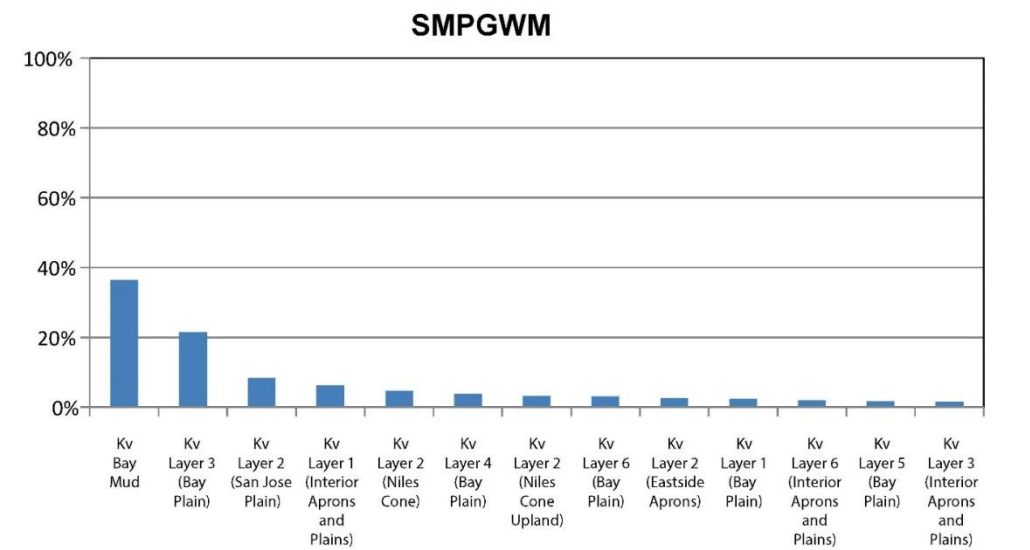
(1987-1996)

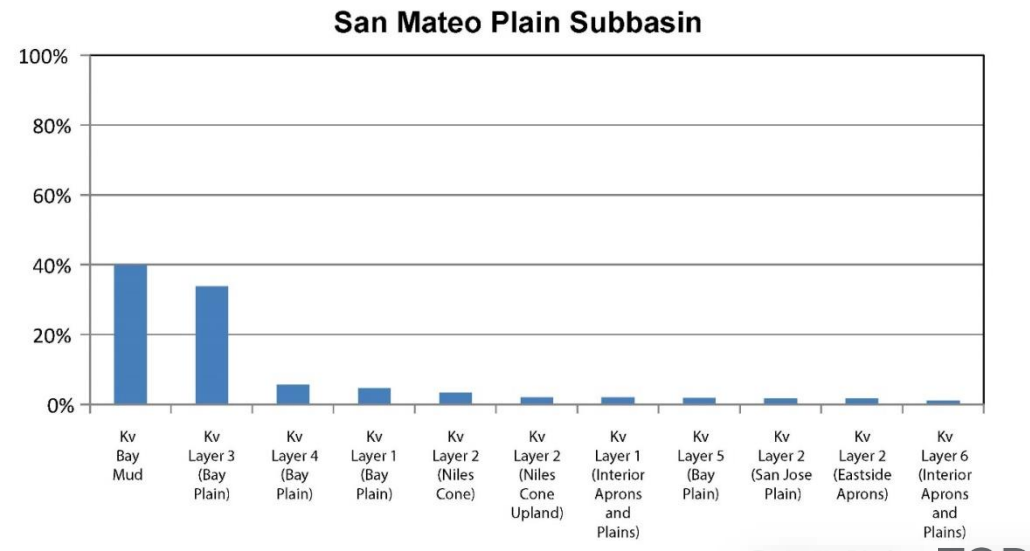


COMPARISON BETWEEN BASIN WATER BALANCE AND MODEL-CALCULATED WATER BUDGET

	Estimated Basin Water Balance			Model-Calculated Water Budget
	Average	Plausible Range		
Inflows (AFY)				
Dispersed Recharge	5,300	3,800	10,000	5,200[a]
Stream Percolation				
San Francisquito Creek	500	300	700	1,000[b]
San Mateo Creek	200	100	300	200
Other creeks	300	100	400	300
Bedrock Inflow	500	100	1000	500
Santa Clara Plain	700	100	1,100	1,100
Saltwater Intrusion	0	0	0	0
Total Inflow	7,500			8,300[c]
Outflows (AFY)				
Wells	2,700	2,100	4,200	2,700
Groundwater Seepage				
Riparian ET	100	100	100	2,300
Creeks and Tidal Wetlands	2,200	1,100	3,100	
Sewers	1,300	900	2,100	2,100
San Francisco Bay	1,200	700	2,100	1,200
Westside Basin	100	-100	100	
Total Outflows	7,500			8,300[c]

MOST SENSITIVE CALIBRATION PARAMETERS





SUMMARY AND CONCLUSIONS
(LIMITATIONS AND UNCERTAINTY)

- Steady-State Assumption
- Specified groundwater discharge (33%)
  - Pumping wells
  - Remediation and dewatering sites
- Modeled groundwater discharge
  - Seepage
    - Creeks and Tidal Wetlands (28%)
    - Sewers (25%)
  - San Francisco Bay (14%)
    - Vertical hydraulic conductivity of bay mud
    - Vertical hydraulic conductivity of “Deep” zone
- Model-calculated subsurface inflow

NEXT STEPS

- TM#4: Potential Basin Management Options
  - Stakeholder Workshop #4 – November / December 2016
- Phase 1 Report
  - Stakeholder Workshop #5 – January 2017
- Phase 2
  - July 2016 – December 2017