MEETING THE NATION'S NEED FOR WATER-QUALITY INFORMATION IN THE NEXT DECADE: PLANNED CONTRIBUTIONS FROM THE NAWQA PROGRAM

GROUNDWATER MONITORING & MODELING
GROUNDWATER MONITORING & MODELING

OBJECTIVES

• Assess the quality of groundwater used for domestic and public supply

• Assess the impact of legacy contamination on the quality of surface water

• Assess changes in groundwater quality
GROUNDWATER MONITORING & MODELING APPROACH

• Monitoring of groundwater in new and existing NAWQA networks
  monitoring wells, domestic wells, public supply wells

• Modeling at multiple scales
  statistical, flow & transport, hybrid
  National, Principal Aquifers, Regional, Local

• Time series sampling in selected networks
  continuous monitoring and periodic sampling
GROUNDWATER MONITORING & MODELING

SCALE

Land use, 100-1000 km²
monitoring wells <10 m

MAS, 1000-10,000 km²
Domestic wells 20 – 50 m

PA, 10,000-100,000 km²
public supply wells 50 – 200 m

Flow path studies, multi-scale

GROUND WATER RESOURCE: 82% PUBLIC SUPPLY, 18% DOMESTIC
<table>
<thead>
<tr>
<th>SCIENCE PLAN</th>
<th>CURRENT FUNDING</th>
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<tbody>
<tr>
<td>• 24 Principal Aquifers</td>
<td>• 16 Principal Aquifers</td>
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<tr>
<td></td>
<td>~ 2880 public supply wells</td>
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<tr>
<td>• 42 Major Aquifer &amp; 52 Land Use Studies (~2820 wells)</td>
<td>• 39 Major Aquifer &amp; 47 Land Use Studies (~2580 wells)</td>
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<tr>
<td>• 40 Flow Path Studies (~800 wells)</td>
<td>• 8 Flow Path Studies (~160 wells)</td>
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<tr>
<td>• Time Series Sampling</td>
<td>• Time Series Sampling</td>
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<td>• Finished water sampling</td>
<td>• Finished water sampling</td>
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<tr>
<td>• Full analytical schedule</td>
<td>• Targeted analytical schedule</td>
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<tr>
<td>• ~12,000 groundwater samples</td>
<td>• ~5,000 groundwater samples</td>
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Principal Aquifers are the primary organizational unit. 20 principal aquifers account for 90% of pumping for public supply.
ASSESS QUALITY OF GROUND WATER USED FOR DOMESTIC AND PUBLIC SUPPLY

NITRATE, "PUBLIC SUPPLY AQUIFER"

Sacramento Valley
- 87% Low
- 10% Moderate
- 3% High

San Joaquin Valley
- 78% Low
- 17% Moderate
- 5% High

Tulare Basin
- 77% Low
- 16% Moderate
- 7% High

High
Moderate
Low

Kilometers
ASSESS QUALITY OF GROUND WATER USED FOR DOMESTIC AND PUBLIC SUPPLY

NITRATE CONCENTRATIONS IN SHALLOW GROUNDWATER
(Nolan and Hitt, 2006)

WHAT IS THE DISTRIBUTION OF NITRATE IN GROUNDWATER USED FOR PUBLIC SUPPLY?
FLOW MODELS PROVIDE INPUT FOR STATISTICAL MODELS

FLUX AT 50 FOOT DEPTH

Orange – upward flows
Green & yellow – downward flow

STATISTICAL MODELS ARE IMPROVED IF DATA FROM FLOW MODELS IS INCORPORATED

Faunt, written communication
Nolan, written communication
ASSESS THE IMPACT OF LEGACY CONTAMINATION ON STREAMS
REGIONAL SCALE FLOW MODELS PROVIDE ESTIMATES OF ARRIVAL TIME DISTRIBUTIONS TO STREAMS

Sanford, written
communication

MODELS + DATA
FPS / IWS

Sanford, written
communication
KEY OUTCOMES FOR ALL GW MODELING STUDIES

• Use models to identify factors that have explanatory power for mapping groundwater quality

• Explanatory factors (ideally) should be identifiable in the absence of quantitative groundwater flow (& transport) models

• What are the surficial/landscape surrogates for the explanatory factors?

• Develop maps at regional, Principal Aquifer, & National scales
Detection of trends requires sufficient number of sample pairs.

STATISTICALLY SIGNIFICANT CHANGES IN CHLORIDE, DECADAL SAMPLING
GROUNDWATER MONITORING AND MODELING

• Data + modeling will be used to map the quality of groundwater at the depth zone used for domestic supply and the depth zone used for public supply.

• Data + modeling will be used to assess impacts of legacy contamination on streams → Integrated Watershed Studies

• Data + models will be used to assess changes in groundwater quality with time.

• Models will be used to forecast groundwater quality under different scenarios of projected change in driving forces → Forecasting.
GROUNDWATER MONITORING AND MODELING QUESTIONS?