



# **BMO Threshold Development and Recharge Mapping: Project Update**

Sacramento Central Groundwater Authority

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**Presenter:**

Jim Blanke, RMC



Complex Challenges | Innovative Solutions

[rmcwater.com](http://rmcwater.com)

# Funding Acknowledgement

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Local Groundwater Assistance Fund grant  
from the  
California Department of Water Resources



# Agenda

- Background and Need
- Project Update
  - Groundwater Elevation BMO Threshold Development
  - Recharge Mapping
  - Recharge Field Study
- Next Steps

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- **Background and Need**
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# Project Team

- SCGA – Project manager / Grant recipient
- SCGA Member Agencies – Sampling assistance
- California Department of Water Resources – Funding entity
- RMC Water and Environment – Technical consultant
- HydroFocus – Technical consultant

# Project Background

- Two Major Components
  - **Groundwater Elevation BMO Threshold Development**
  - Recharge Mapping

# Background: Thresholds

# CENTRAL SACRAMENTO COUNTY

## GROUNDWATER MANAGEMENT PLAN

FEBRUARY 2006



# Background - BMOs

1. Maintain a long-term average groundwater extraction rate of 273,000 AF/year.
2. Establish specific minimum groundwater elevations within all areas of the basin consistent with the Water Forum “Solution.”
3. Protect against any potential inelastic land surface subsidence.
4. Protect against any adverse impacts to surface water flows.
5. Develop specific water quality objectives for several constituents of concern.



# Need – BMO No. 2

1. Actions defined
2. Triggers defined
3. Approach to implementation defined
4. Need to implement approach

Will also support SGMA

Table 4-1. Monitoring Actions and Trigger Points (continued)

Monitoring Action	Trigger Points	Recommended Action
BMO No. 2. Maintain specific groundwater elevations within all areas of the basin consistent with the Water Forum "solution."		
A monitoring methodology to meet specific objectives in managing groundwater levels requires a systematic, repeatable, and scientific approach. The objective of this monitoring program is to take measurements from selected monitoring wells that have sufficient construction and hydrogeologic data. Wells will be assigned to represent the polygon areas defined in <b>Appendix B</b> , and may be grouped within the basin in areas that are sufficiently distinct in the makeup of hydrogeology and land use. Monitored groundwater levels for a well will be compared with the designated upper and lower groundwater level threshold for each polygon that is assigned to the well. The upper and lower thresholds are termed the "bandwidth" of the polygon.	Trigger Point 1. A 25 to 50 percent encroachment into the designated bandwidth of a polygon.	Alert stage that informs the basin governance body and the overlying groundwater extractor(s) that a specific polygon area is being compromised. Activation of this trigger will take place only after the cause of the condition is thoroughly investigated.
	Trigger Point 2. A 50 to 75 percent encroachment into the designated bandwidth of a polygon.	In the event groundwater level measurements hit Trigger Point 2 without first initiating Trigger Point 1, the recommended actions of Trigger Point 1 still apply. Additionally, this stage initiates a requirement to collect a fee to secure supplemental water supplies or to reduce pumping in a predefined area(s).
	Trigger Point 3. A 75 to 100 percent encroachment into the designated bandwidth of a polygon. This indicates continuously declining groundwater levels in an area even during wet and normal hydrologic cycles, indicating that excessive pumping is the probable cause.	Well owners with operating wells in the affected area(s) will be identified and notified of the basin's condition in their area. An assessment will be levied against those owners who continue to pump at the higher level. Every attempt will be made by the governance body to ameliorate the impact assessments to private domestic groundwater pumps.
	Trigger Point 4. Over 100 percent encroachment into the designated bandwidth of a polygon.	If the recommended actions from the first three trigger points do not result in an improvement to the affected area(s), the basin governance body will need to consider which of two actions it will take. The first is to consider whether a lower groundwater level in the area is acceptable. If so, the basin governance body has the ability to adapt to the actual monitoring data and change the model-based thresholds for management in the area.  If lower groundwater levels are deemed unacceptable, the second action would require finding supplemental water supplies and construct infrastructure for the area(s) and reduce pumping to allow groundwater levels to recover to acceptable levels. Fees in addition to Trigger Point 3 fees will be assessed to cover costs associated with this action.

# Project Background

- Two Major Components
  - Groundwater Elevation BMO Threshold Development
  - **Recharge Mapping**

# Background/Need: Recharge Mapping

- Water Code, through AB359, required a map of recharge areas in GWMPs
- Now, SGMA requires a map of recharge areas
- Important to understand recharge from
  - Precipitation and applied water
  - Rivers
  - Subsurface flow at boundaries

# Background/Need: Recharge Mapping

- Recharge is estimated
- Calibrated groundwater model
  - Tool for developing realistic estimates
  - Limitations due to similar recharge sources, results in non-unique solutions
- Sampling will improve the understanding of the contributions of the rivers vs. other sources
- Better understanding will improve models and assist management decisions

# Agenda

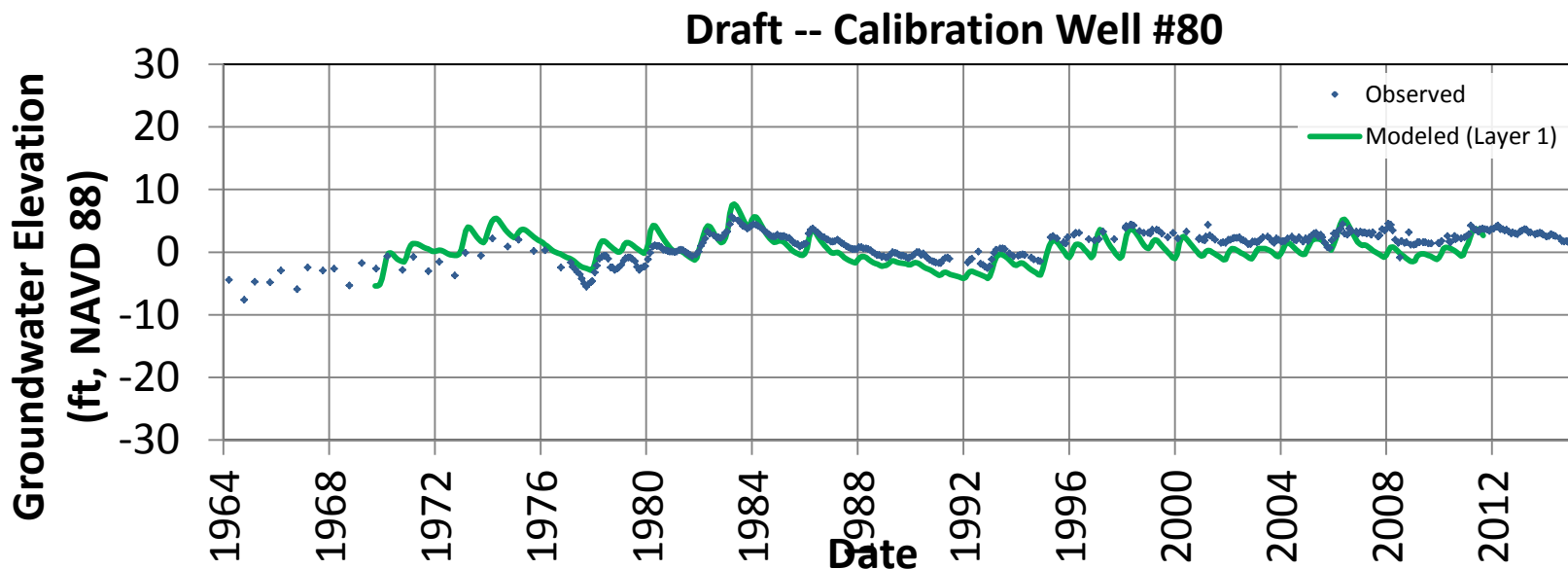
- Background and Need
- **Project Update**
  - **Groundwater Elevation BMO Threshold Development (Model Update)**
  - Recharge Mapping
  - Recharge Field Study
- Next Steps

# Groundwater Elevation BMO Threshold Development (Model Update)

- Update to the Baseline, to form the basis for the BMO analysis, incorporating:
  - **Land use/Cropping** from Basin Management Report
  - **Pumping** from Basin Management Report
  - **Diversion records** from Reclamation and SWRCB
  - **Precipitation** from NOAA and CIMIS
  - **Streamflow** from USGS
  - **Future land use** from General Plans
  - **Future water supplies** and demand from UWMPs

# Model Update

- Historical calibration model updated
  - Groundwater levels nearly verified
  - Final edits being made



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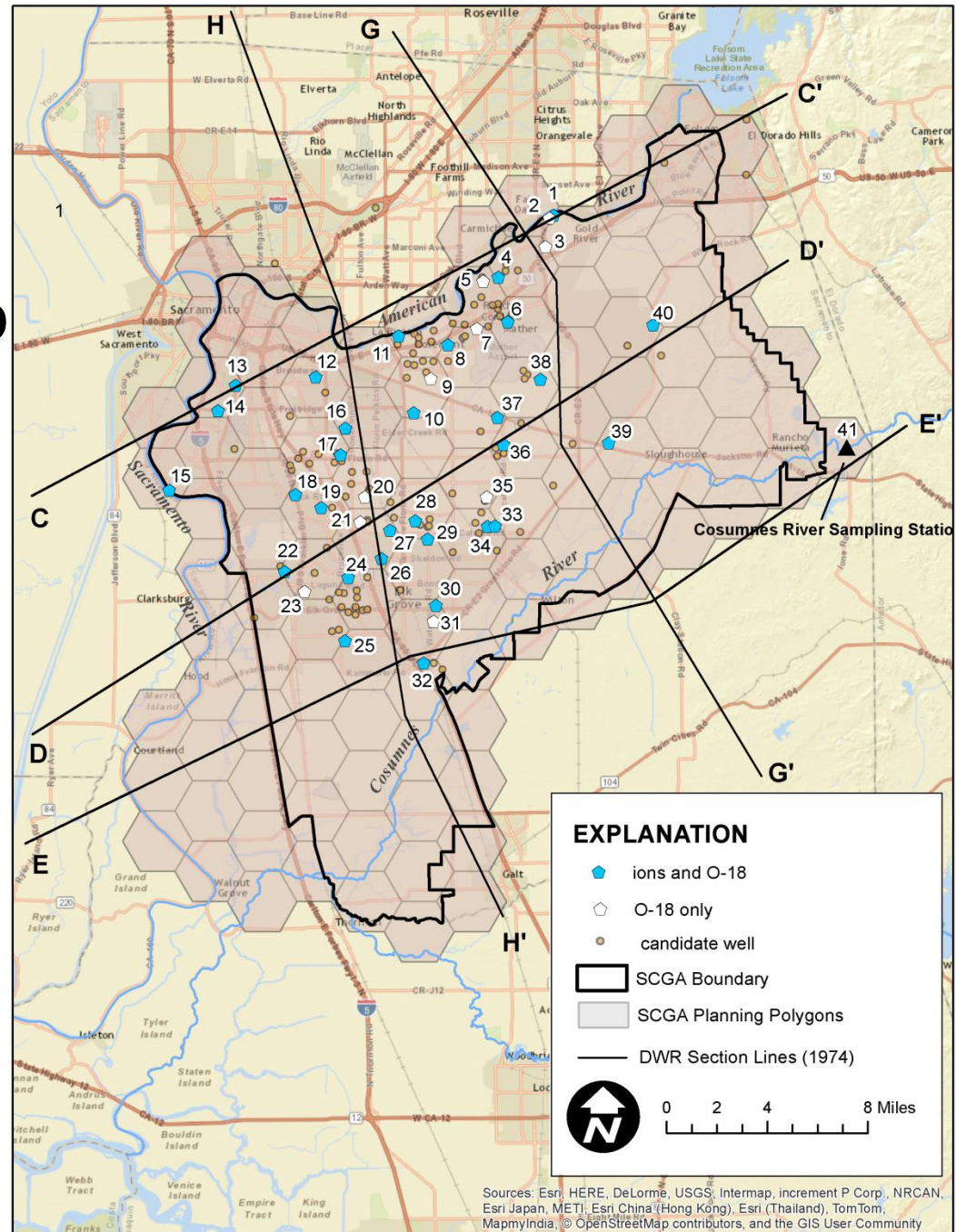


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# Recharge Field Study Sampled Wells

- City of Sacramento
- SCWA
- Golden State
- CalAm
- Private CASGEM



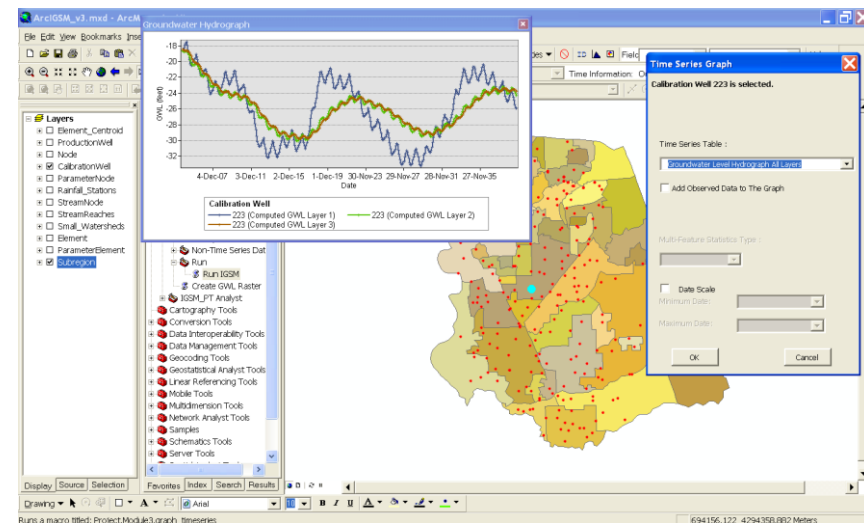
Date: 1/22/2015

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  - Recharge Mapping
  - Recharge Field Study
- **Next Steps**

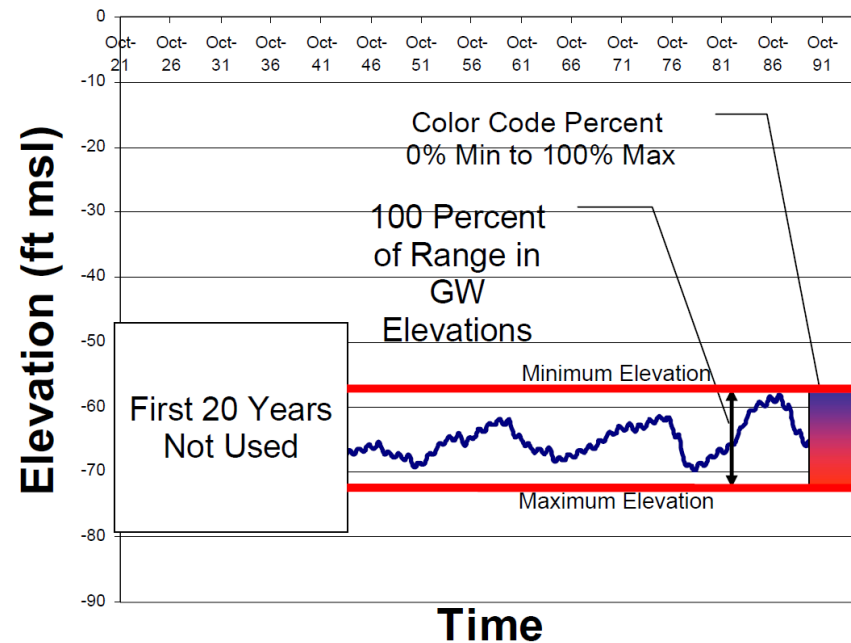
# BMO Threshold Development – Next steps

- Incorporate into extended Future Conditions Baseline
- Extract hydrographs for each grid area from model



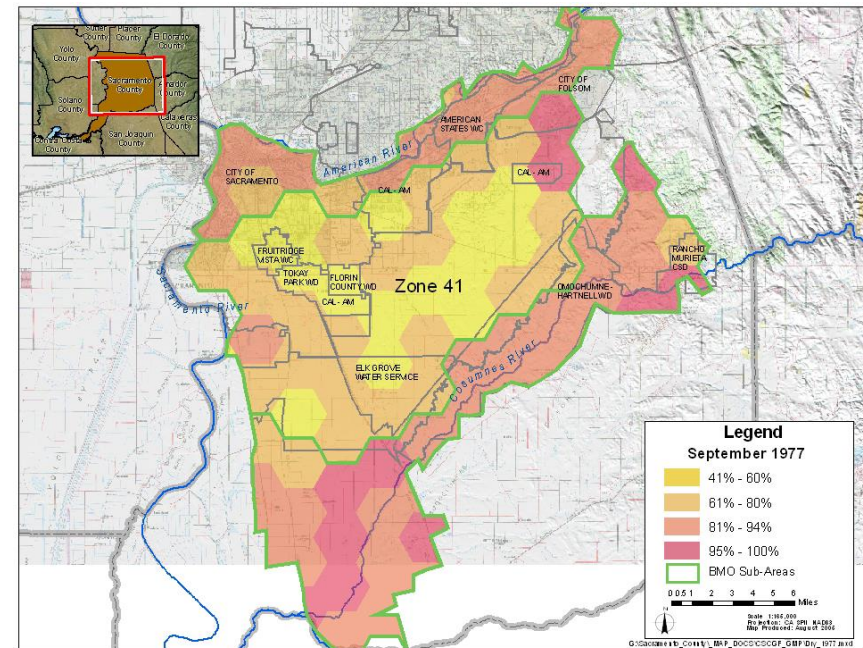
# BMO Threshold Development – Next Steps

Identify maximum and minimum modeled groundwater elevations.  
Values with 5% buffer define the bandwidth.



# BMO Threshold Development - Next Steps

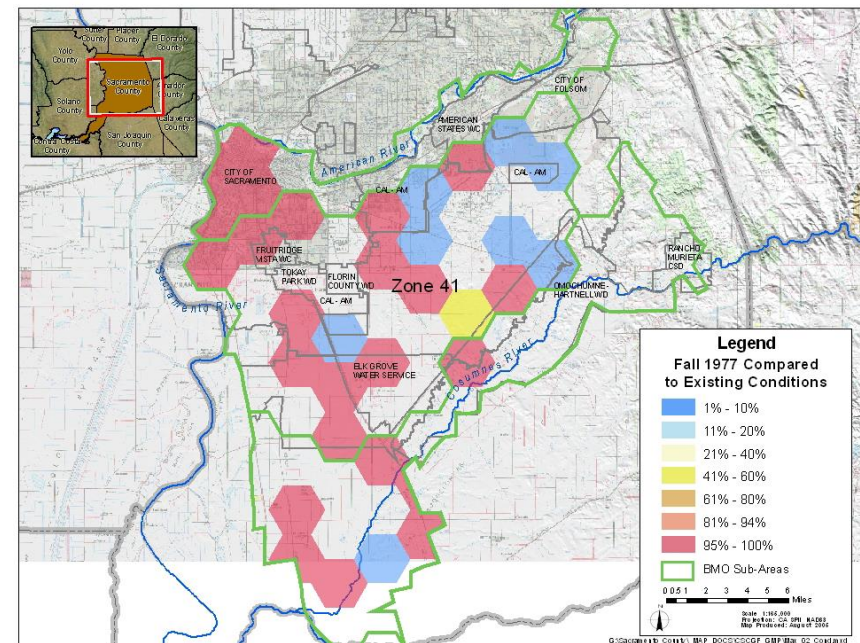
Aggregate polygons based on similar hydrologic responses



# BMO Threshold Development - Next Steps

## Ground truth the results

- 1977 measured conditions





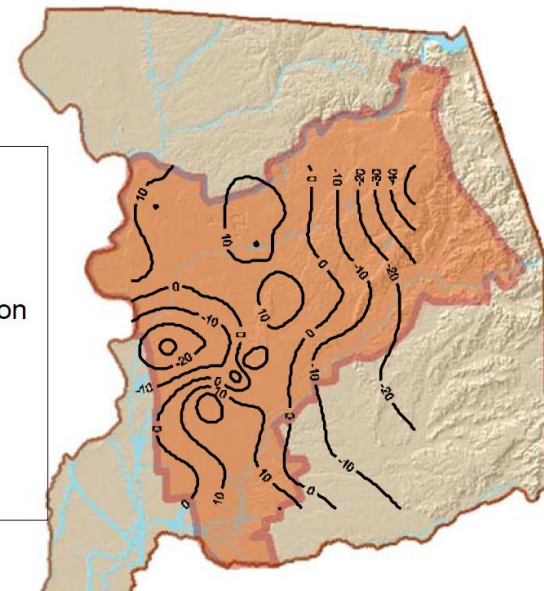
# BMO Threshold Development - Next Steps

## Ground truth the results

- 1977 measured conditions
- Compare modeled to measured elevations for 1977

Groundwater Elevation Contours (ft msl)

Difference Between  
1977 Real Data  
and  
Water Forum Solution  
1977 Model Data  
(Negative Value  
Implies Model Data  
Shows Deeper  
Elevation)



# BMO Threshold Development - Next Steps

Develop framework for monitoring and management

- Contained in Section 4 of the GWMP

# BMO Threshold Development - Approach

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# Next Steps – Recharge Mapping

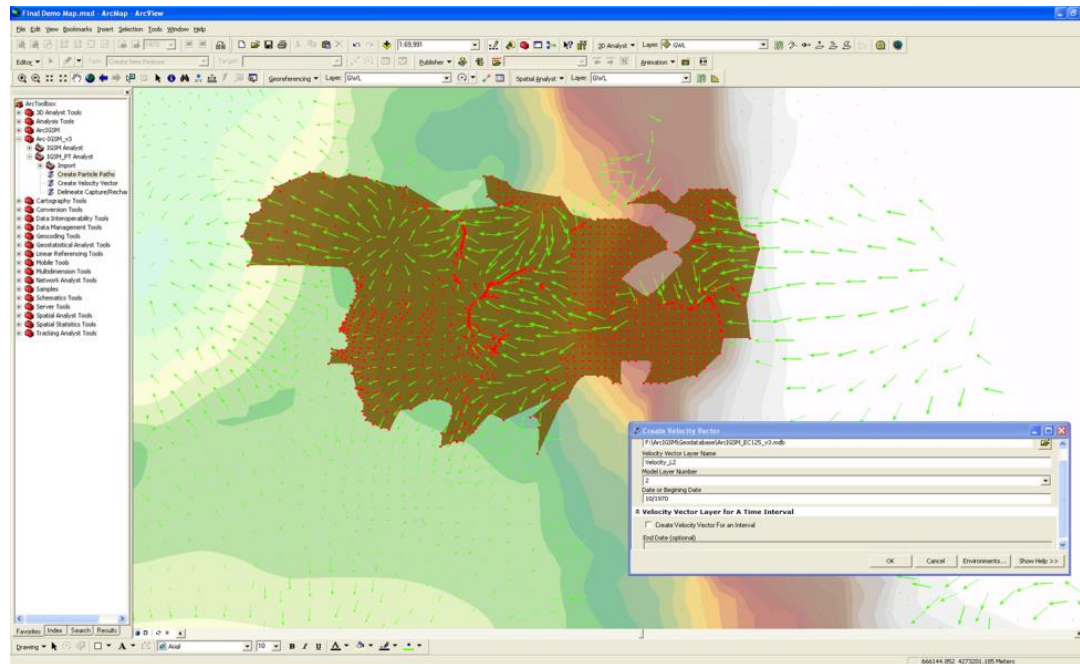
- Recharge map completed
- Sampling completed
- Next steps:
  - Receive, analyze, and interpret results
  - Verify model simulation of recharge, based on results

# Next Steps – Recharge Mapping

- Goal - provide information on source of recharge
- Focus on
  - Stable isotopes to help identify source water
  - Major anions and cations to distinguish between different waters

# Next Steps – Recharge Mapping Verification of Model

- Results from water quality study will be compared to simulated flowpaths to identify potential need for future model refinement



# Major Deliverables

- Draft and Final TMs
  - Threshold Development
  - Recharge Analysis
- Draft and Final Recharge Map

# Stakeholder Participation

- Four meetings are planned to keep stakeholders informed
  - Previous: Initial meeting to describe the project and to receive comments
  - Today: Project update, including model extension and sampling.
  - May 2015: Project update, including proposed thresholds
  - July 2015: Present the final results of the study.



# Contact Information

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