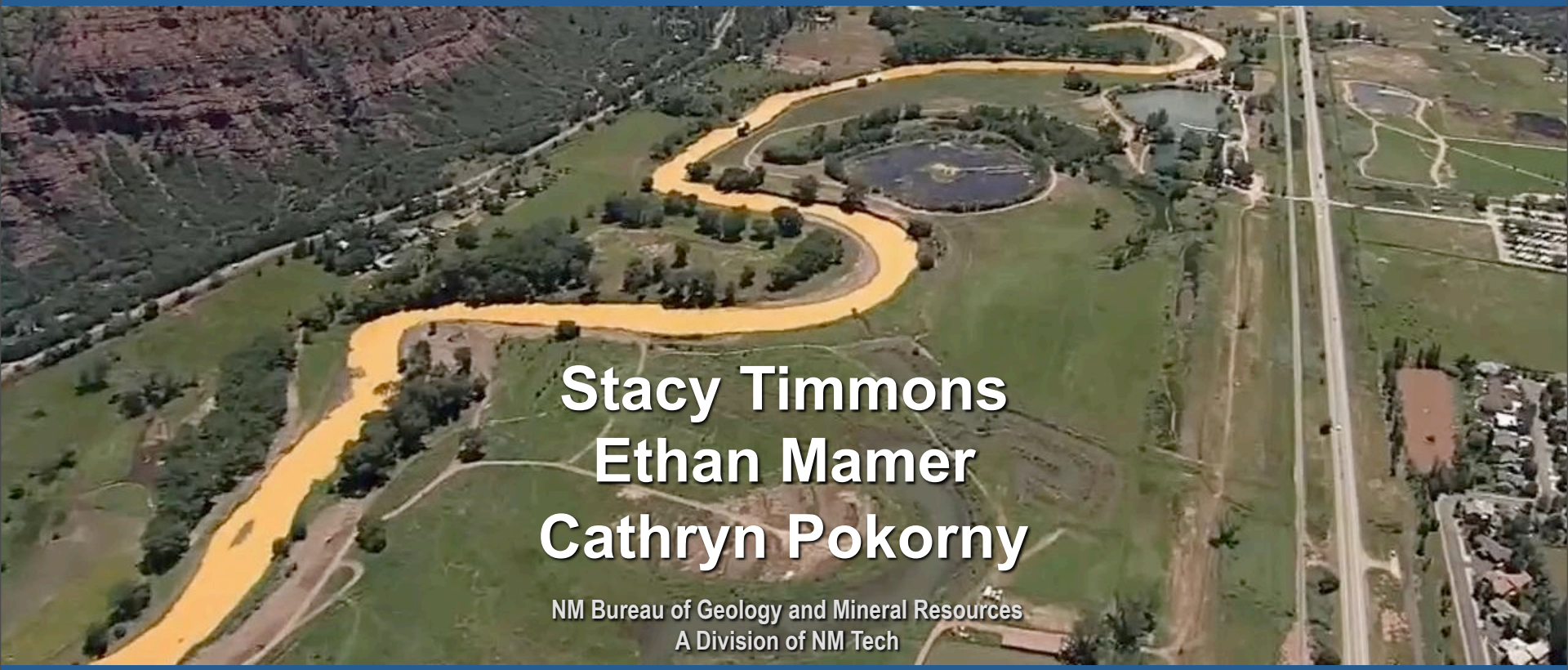
Monitoring the Animas River Alluvial Aquifer

GROUNDWATER CHEMISTRY

after the Gold King Mine 2015 Mine-Water release



Stacy Timmons
Ethan Mamer
Cathryn Pokorny

NM Bureau of Geology and Mineral Resources
A Division of NM Tech

New Mexico Bureau of Geology and Mineral Resources
New Mexico Tech
Earth Science for the 21st Century

New Mexico Tech

AQUIFER MAPPING PROGRAM

With funding from NM Environment Department

NEW MEXICO ENVIRONMENT DEPARTMENT

GKM spill August 5, 2015

- Orange water containing high concentrations of metals including As, Cd, Fe, Pb, Mn, Hg and Zn
- Sediments now deposited along river

2 weeks after

Groundwater sampling

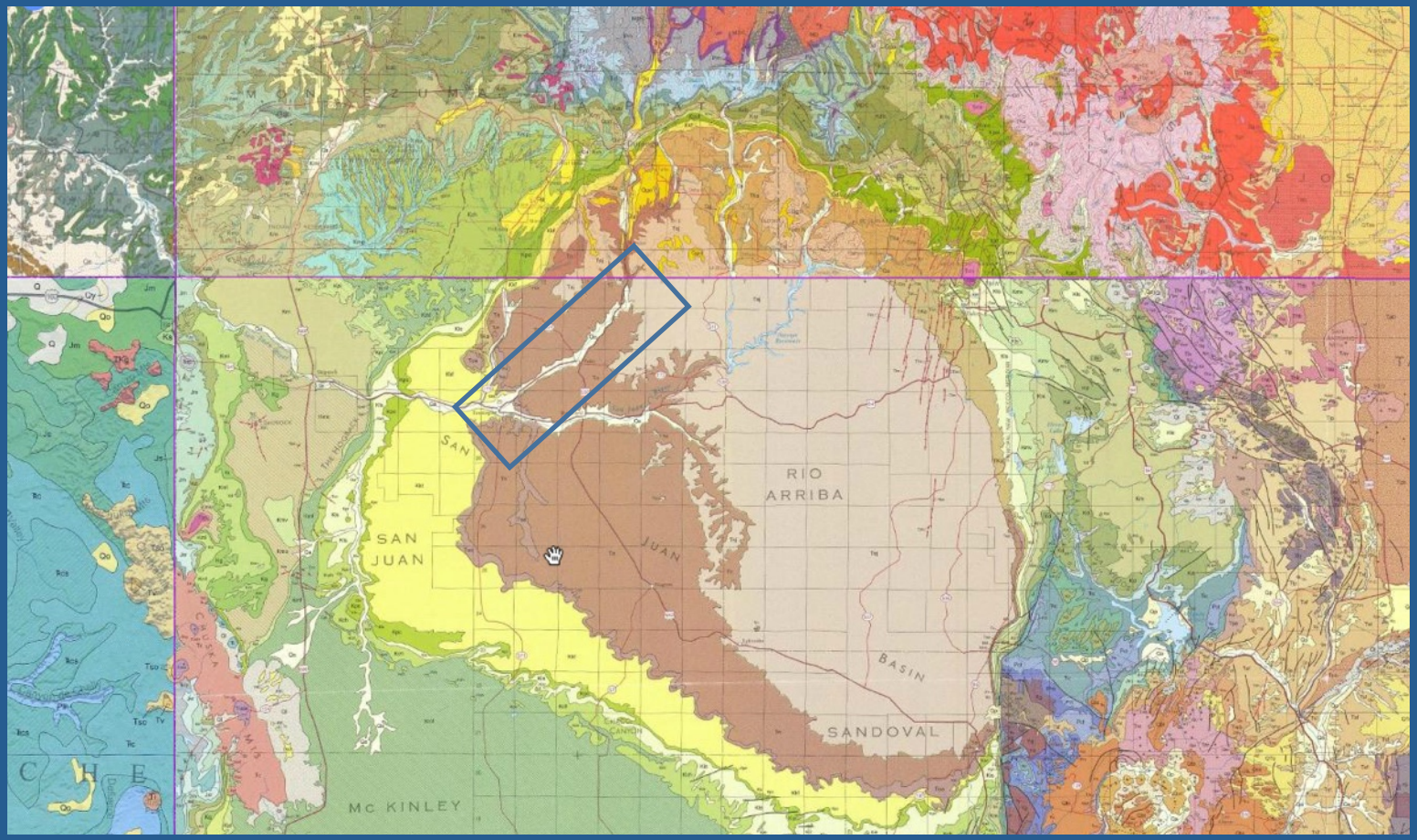
- **August 2015:** EPA and contractors 266 groundwater samples
- **January 2016:** NMBGMR 16 wells sampled, criteria:
  - **Proximity to river or irrigation ditches**
  - **Previous samples from EPA**
  - **Well owner cooperation**

NMBGMR Goal: Identify gaining/losing reaches and provide long term monitoring for any groundwater chemistry effects from the GKM spill along the Animas River in NM

Water quality concerns

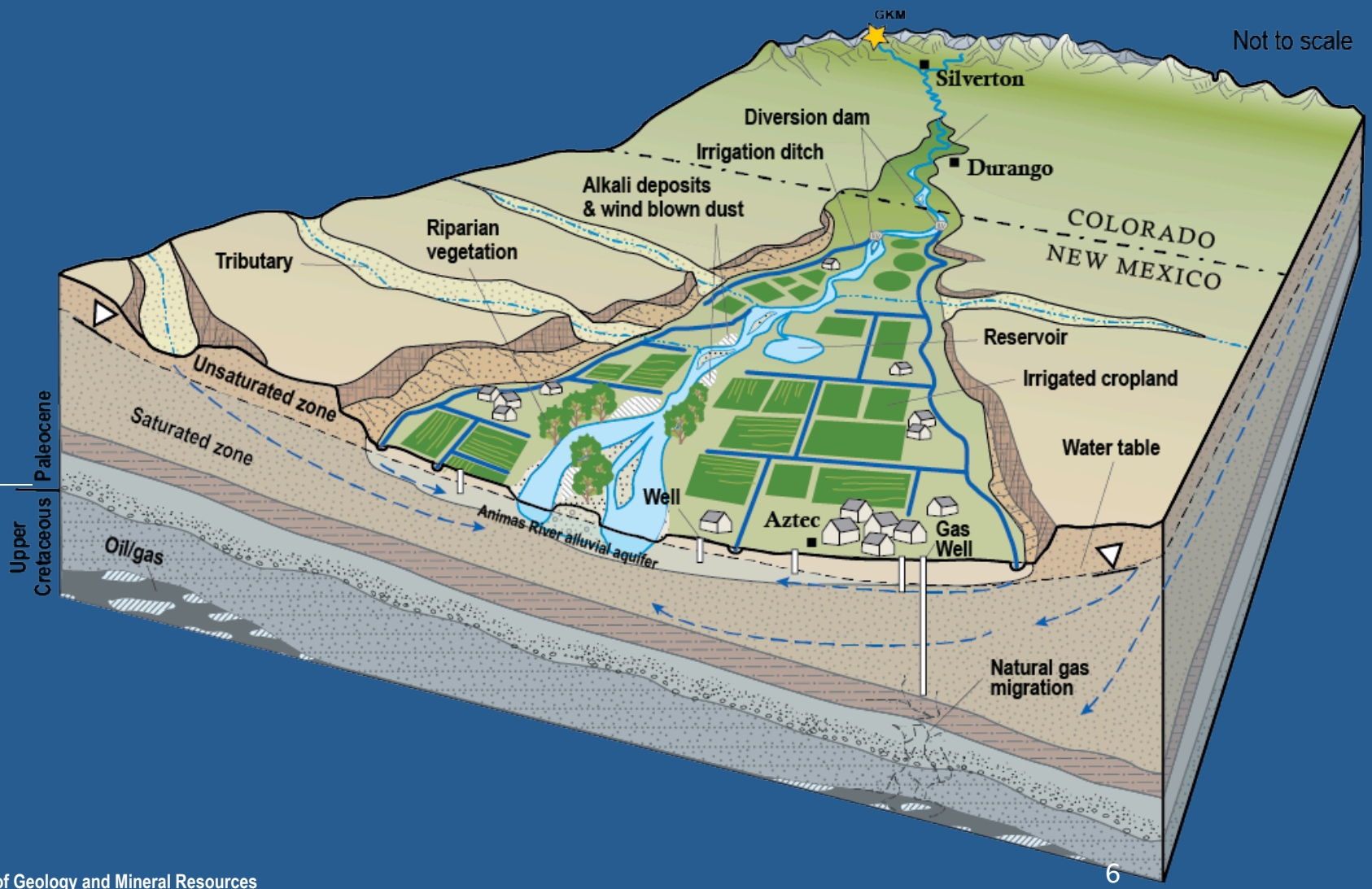
- Private domestic wells are **NOT REGULATED** for water quality
- Wells adjacent to Animas River are very shallow
- Some sections of river are low gradient and losing

Geology along Animas River



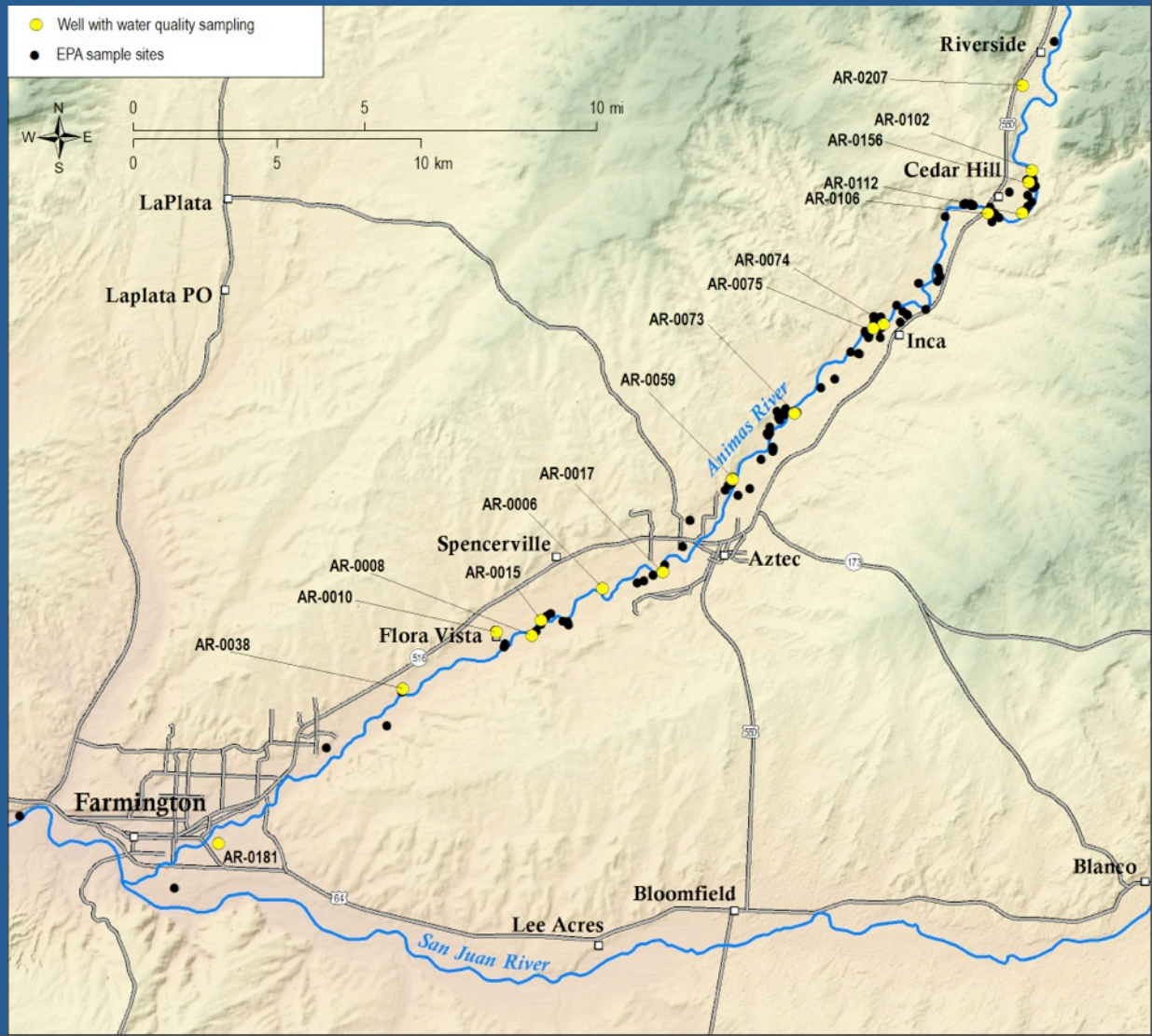
http://ngmdb.usgs.gov/maps/mapview/

Conceptual model

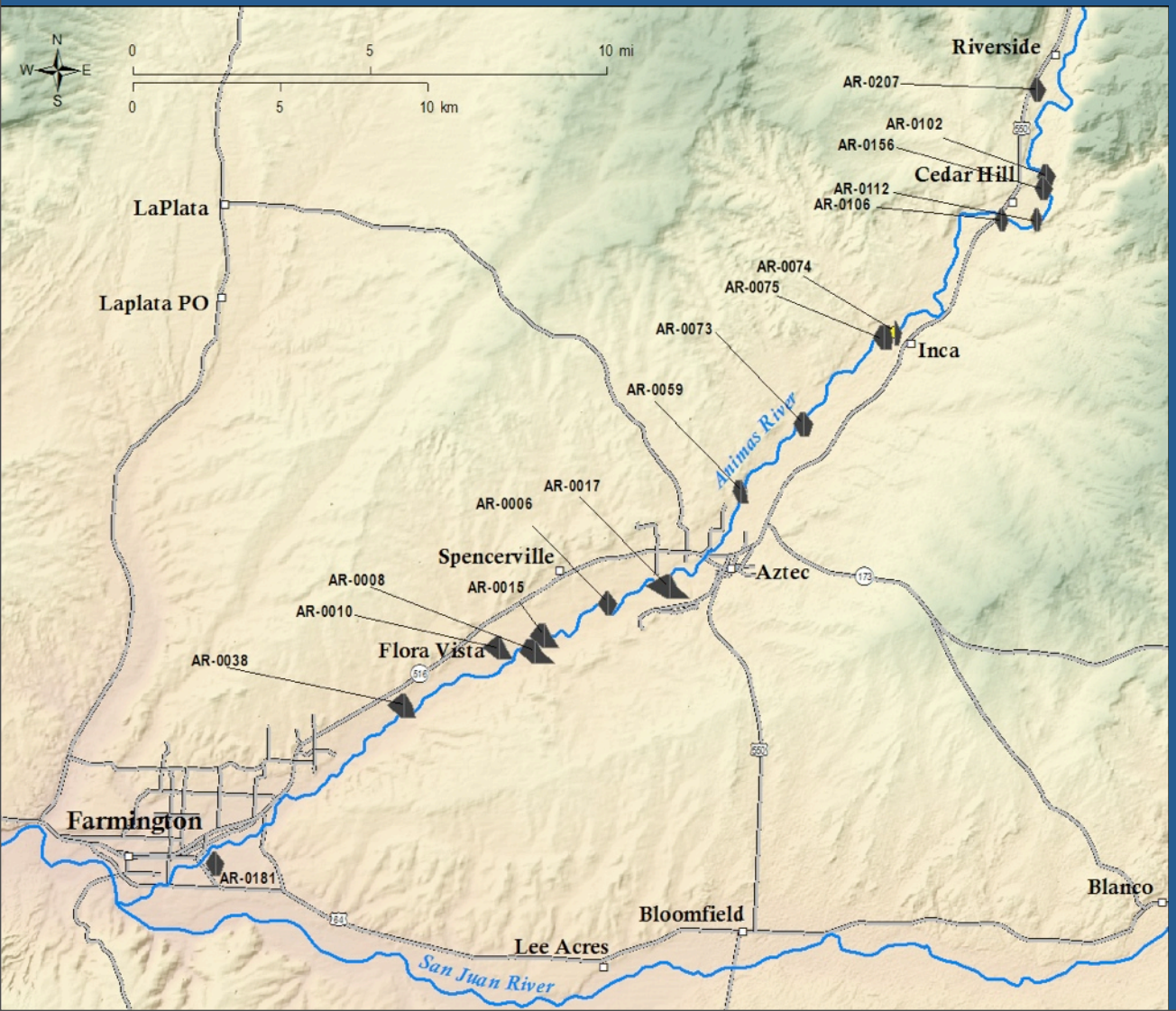


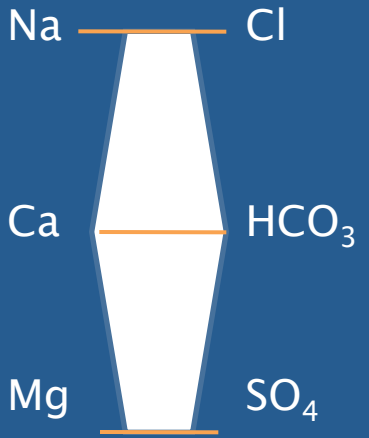
Sample locations

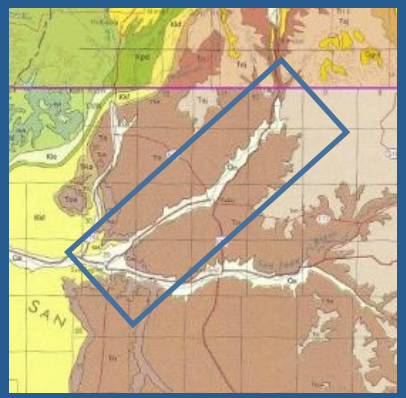
- 16 NMBG wells
- 266 EPA samples (some repeated locations)



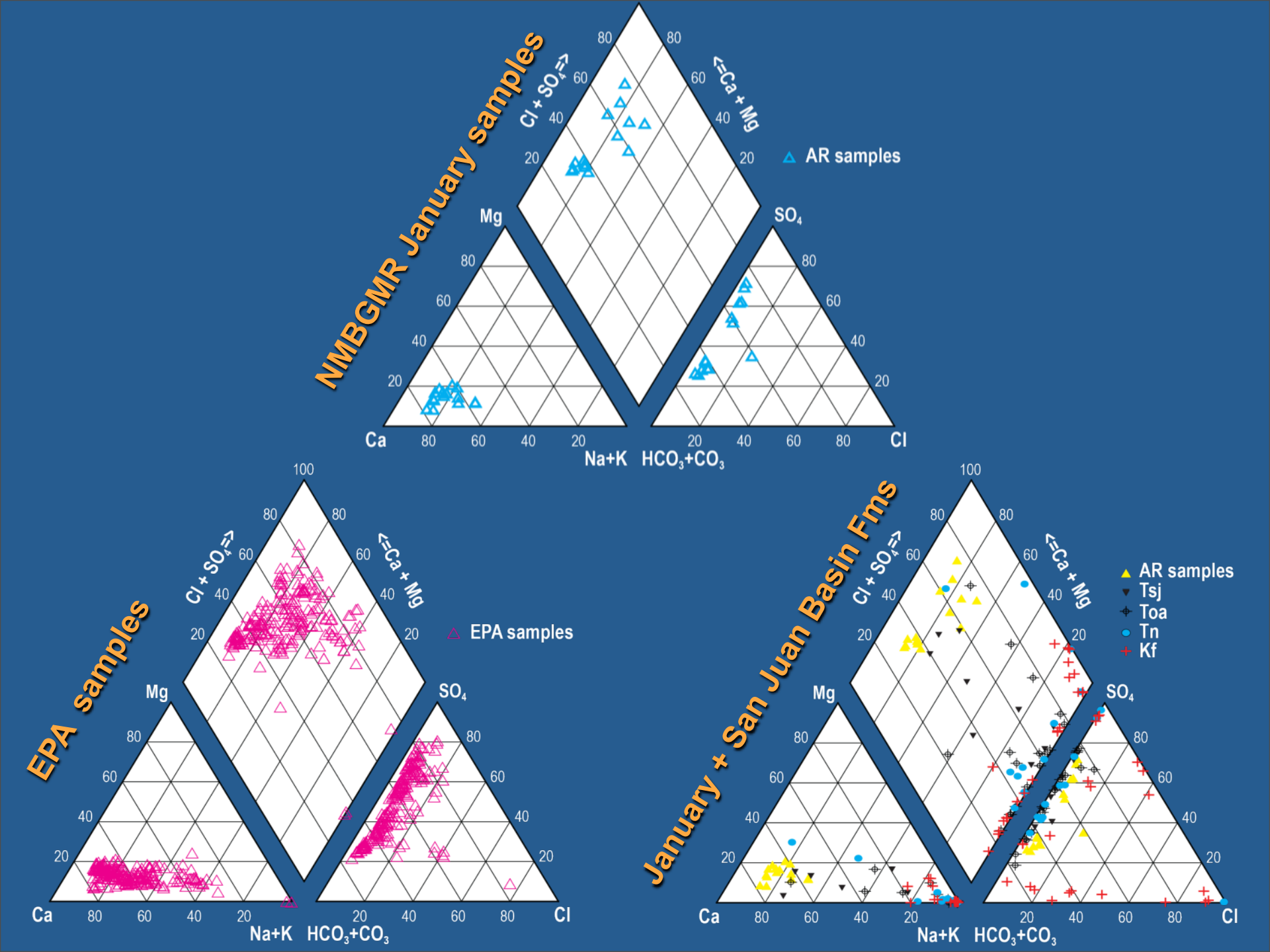
Water chemistry results: Major Ions



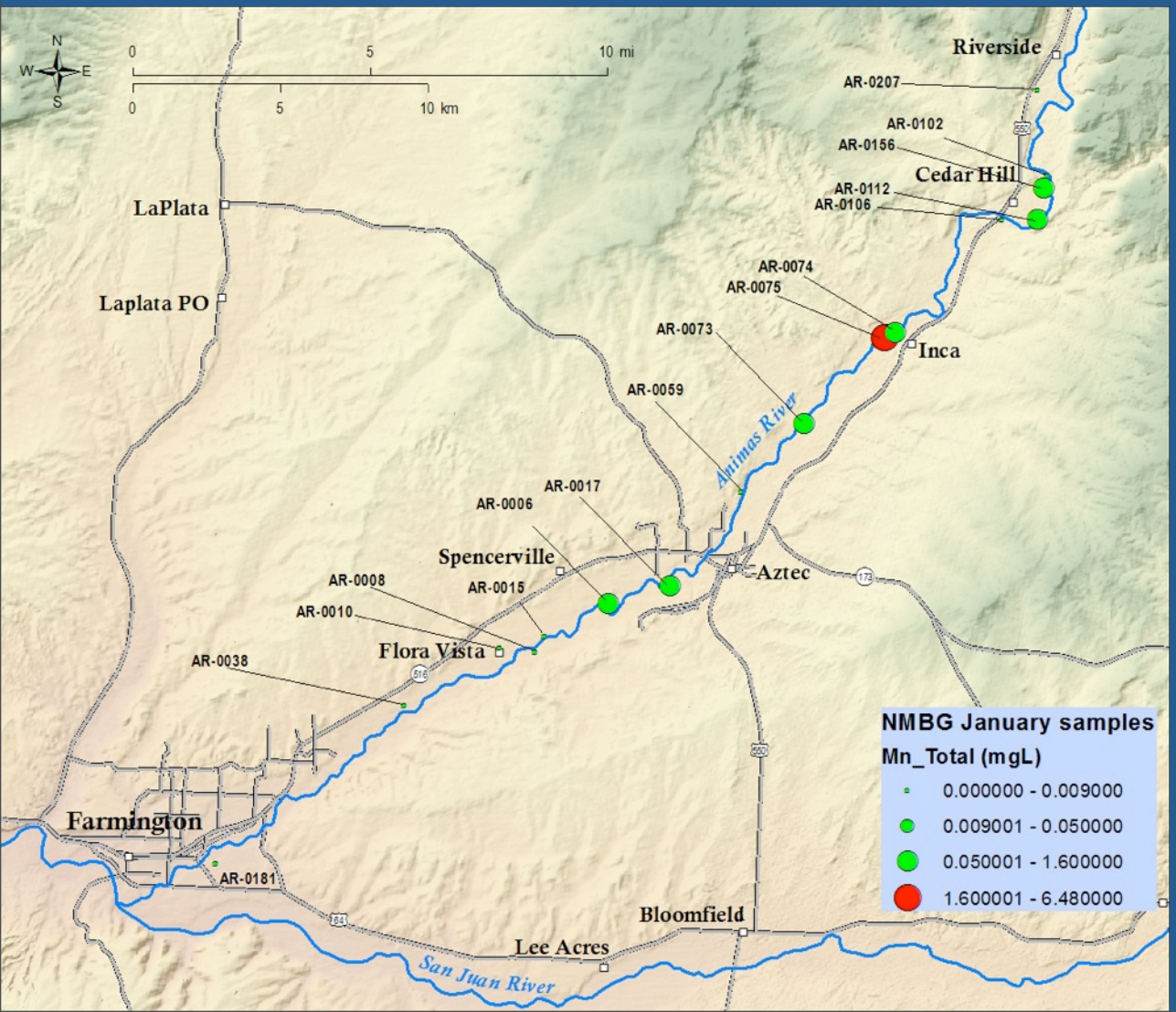




Surface water has lower TDS


NMBGMR January samples
AR samples
Cl + SO4=>
<=Ca + Mg
Mg
SO4
Ca
Na+K
HCO3+CO3
Cl
EPA samples
EPA samples
January + San Juan Basin Fms
AR samples
Tsj
Toa
Tn
Kf

Trace metals results: Manganese



Mn secondary standard at **0.05 mg/L**;

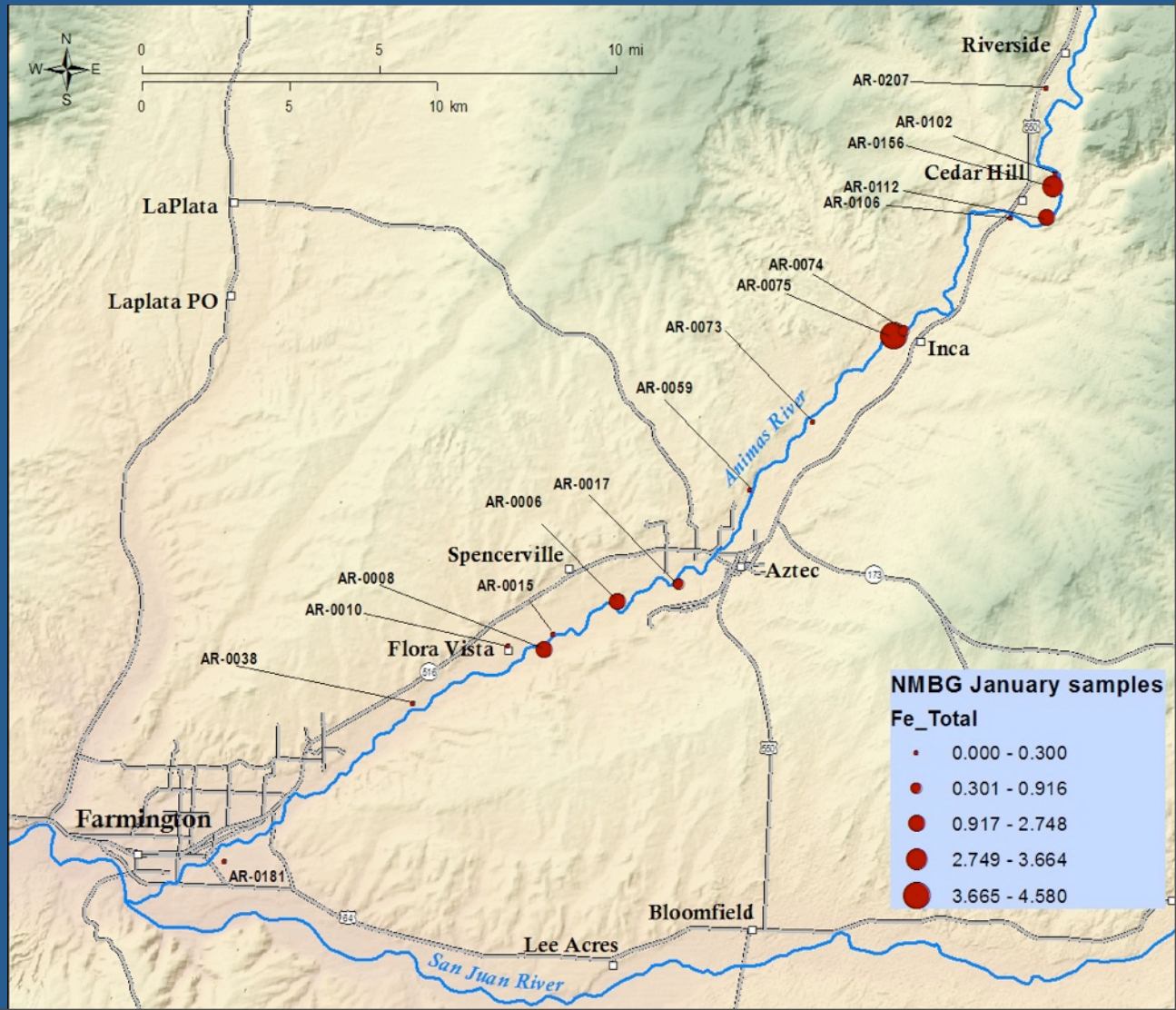
Health advisory at **1.6 mg/L**

As, Cd, Pb, Zn – low or not detected

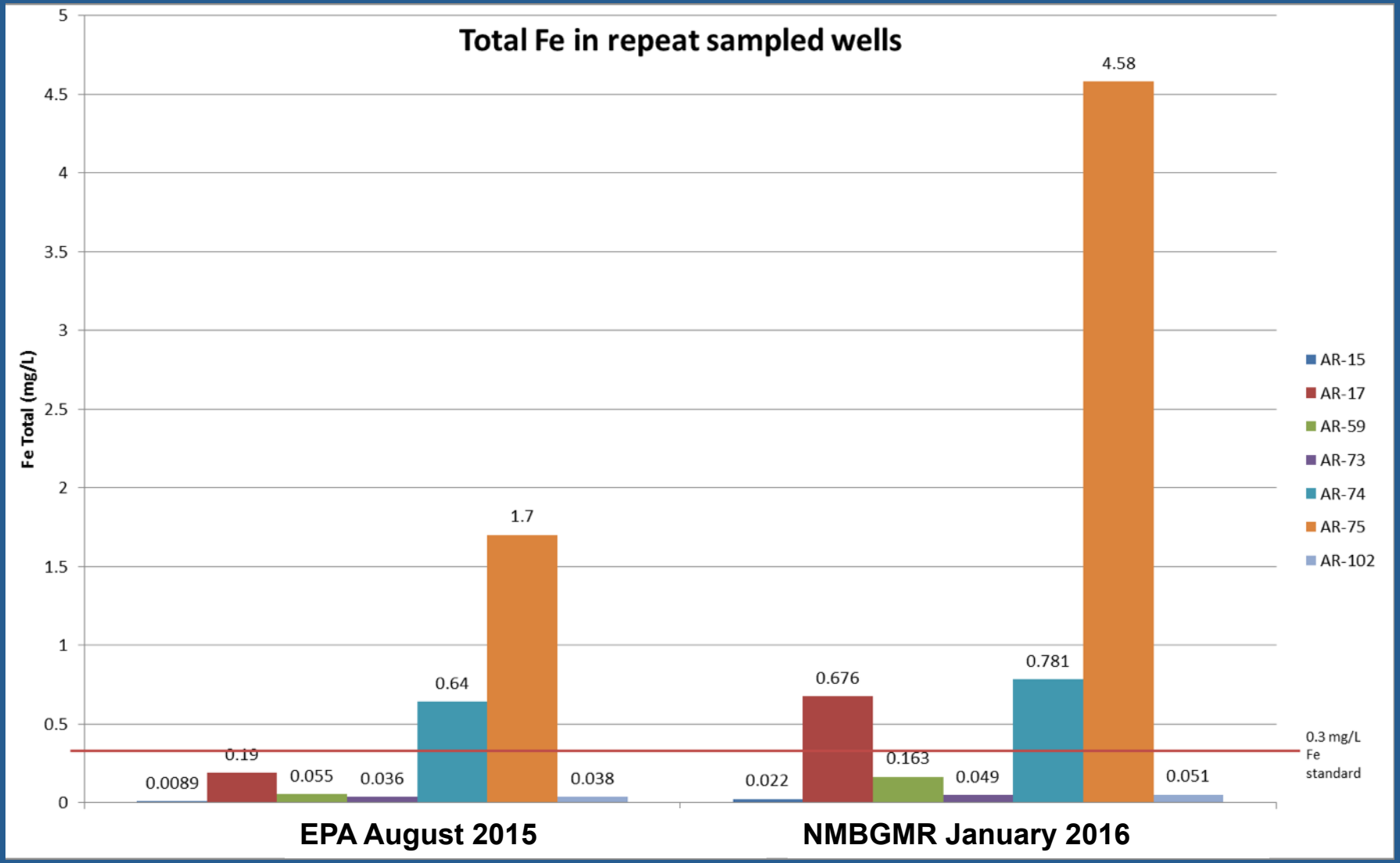
Trace metals results: Iron

Fe secondary standard at

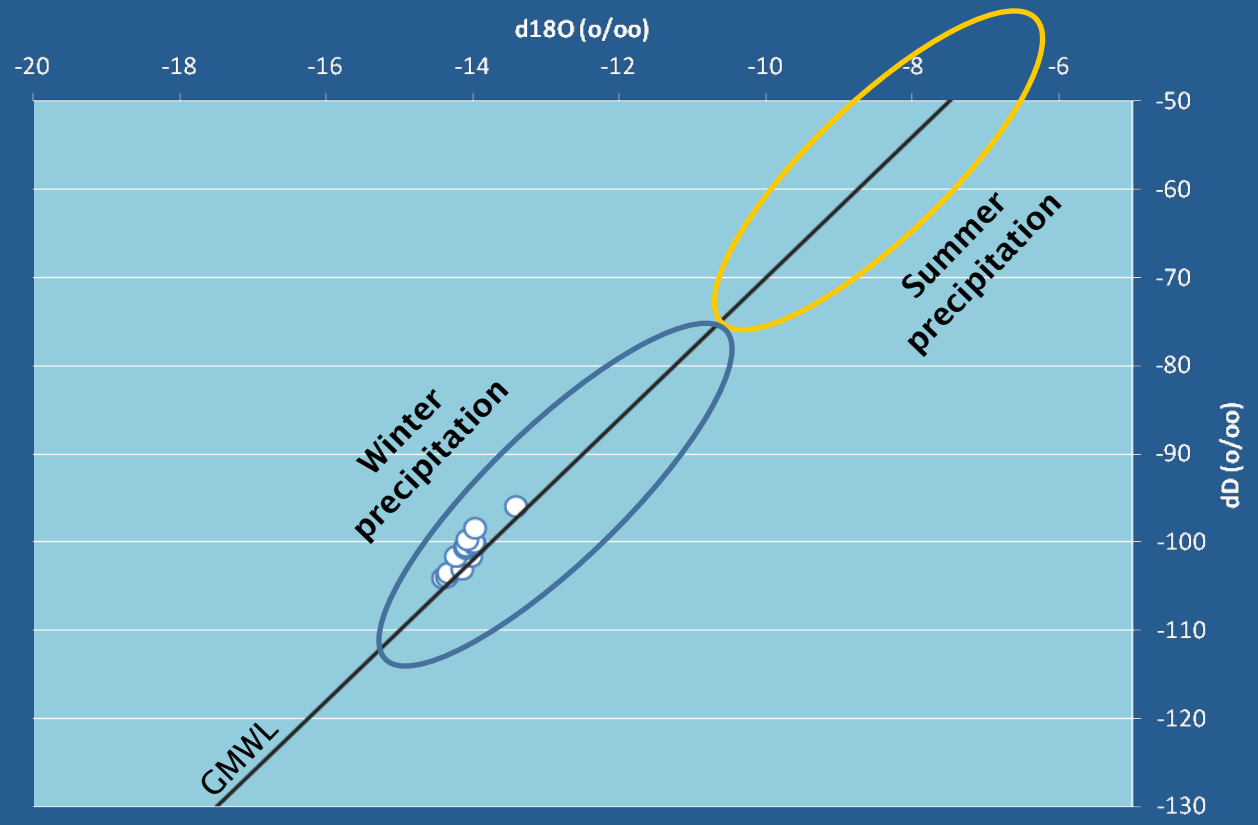
0.3 mg/L



August 2015 to January 2016: Iron



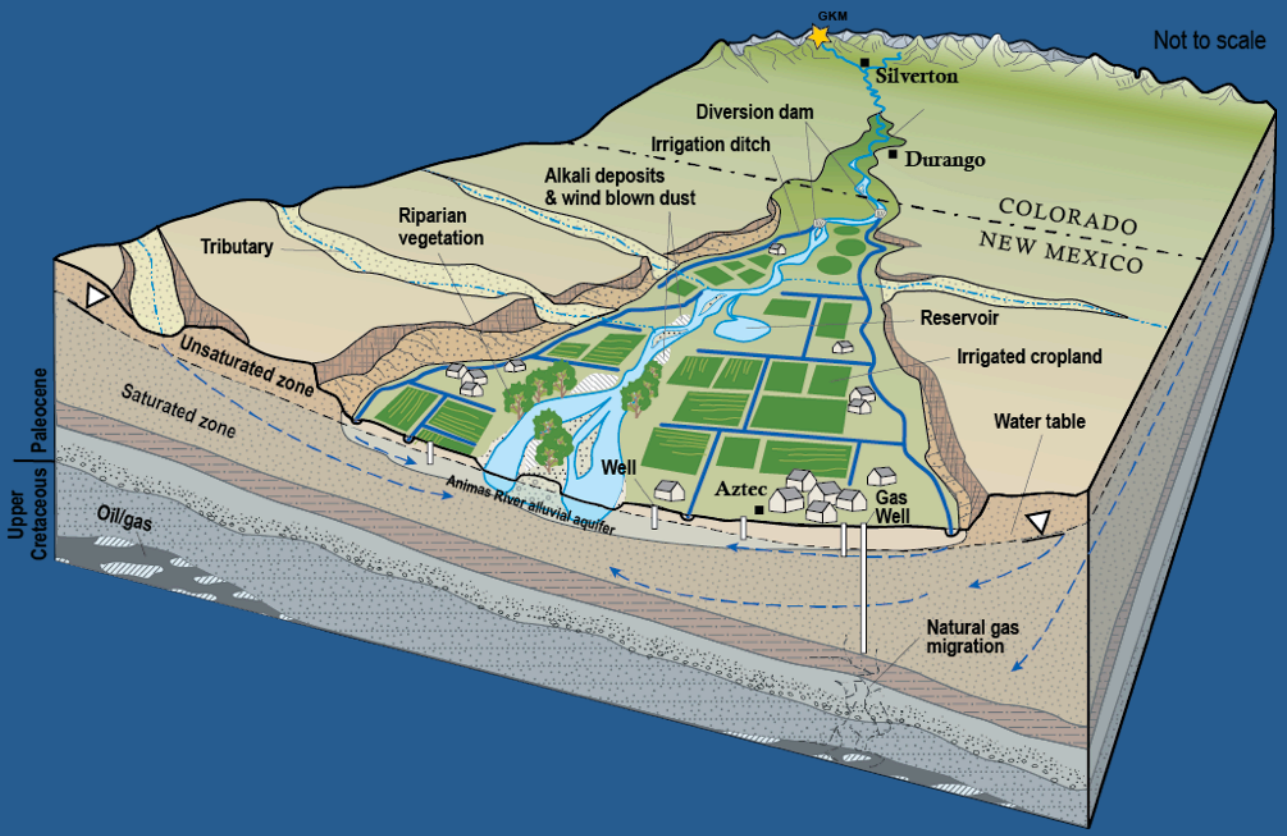
Stable isotope results



Very light ratios; little evaporation

Groundwater has a predominantly winter signature

Winter model



- Winter groundwater looks regional, not locally sourced at river
- How will this change during snowmelt or irrigation season?

Preliminary findings

Q: Has the GKM spill affected groundwater?

A: Probably not

- **As, Cd, Pb, Zn** – low or not detected
- **Hg** – not analyzed
- **Fe, Mn** – increased in some wells, but that alone is not distinctive of GKM

Q: Will the GKM spill affect groundwater?

A: It is possible

- low gradient or losing reaches
- under different river flow regimes

Next Steps

1. **Very early phase of project**
2. **Repeat water quality sampling in same ~20 wells:**
    1. Major ion chemistry
    2. Trace metals
    3. Stable isotopes
3. **Additional comparisons**
    1. Surface water chemistry
    2. Deeper groundwater chemistry
    3. Sediment data
4. **With future funding, instrument wells with continuous conductivity monitoring**

ACKNOWLEDGMENTS

NM ENVIRONMENT DEPARTMENT: Dennis McQuillan and Diane Agnew

NMBGMR: Trevor Kludt, Scott Christenson, Geoff Rawling, Brigitte Felix

USGS NM WATER SCIENCE CENTER: Jesse Driscoll, Nicole Thomas, Lauren Sherson, and Amy Gallanter

NMOSE: Doug Rappuhn and Rob Pine

NM DEPARTMENT OF HEALTH: Miriam Wamsley

New Mexico Bureau of Geology and Mineral Resources
New Mexico Tech
Earth Science for the 21st Century

New Mexico Tech

AQUIFER MAPPING PROGRAM

NEW MEXICO ENVIRONMENT DEPARTMENT