

# Hydrologic Processes in the Shifting Climate of the Arid Southwest

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# Agenda

- Setting - Issues
- The need for basic data collection
- Mojave Desert spring survey
- Amargosa River / Springs Investigations
- Conclusions
  - Resource-related
  - Conceptual and Programmatic

# Setting – Issues that affect Management

- Rapid growth and competition for water resources in an area with limited precipitation
  - Population growth
  - Ecological requirements
  - Groundwater export, renewable energy development, mining and other uses
- Many small but important ecological features are overlooked or written-off as not susceptible to impact
- Project-specific focus of inquiry – left huge data gaps
- Lack of regional data – need for baseline understanding of hydrologic processes

Prior to recent efforts, how up-to-date was our knowledge of springs in the Mojave Desert?”



This is common to many areas of California!



## Need for Basic Data Collection -Why?

- Greater understanding of hydrologic regime – groundwater/surface water interactions
- Provides a basis for water resources management (Identification of system changes due to water development)
- Leads to reduced uncertainty (uncertainty = risk)



## Regional Understanding

Transition Habitat Conservancy Spring Survey  
San Bernardino, Los Angeles, Kern & Inyo Counties, CA



## Cooperative Effort – A Key To Success

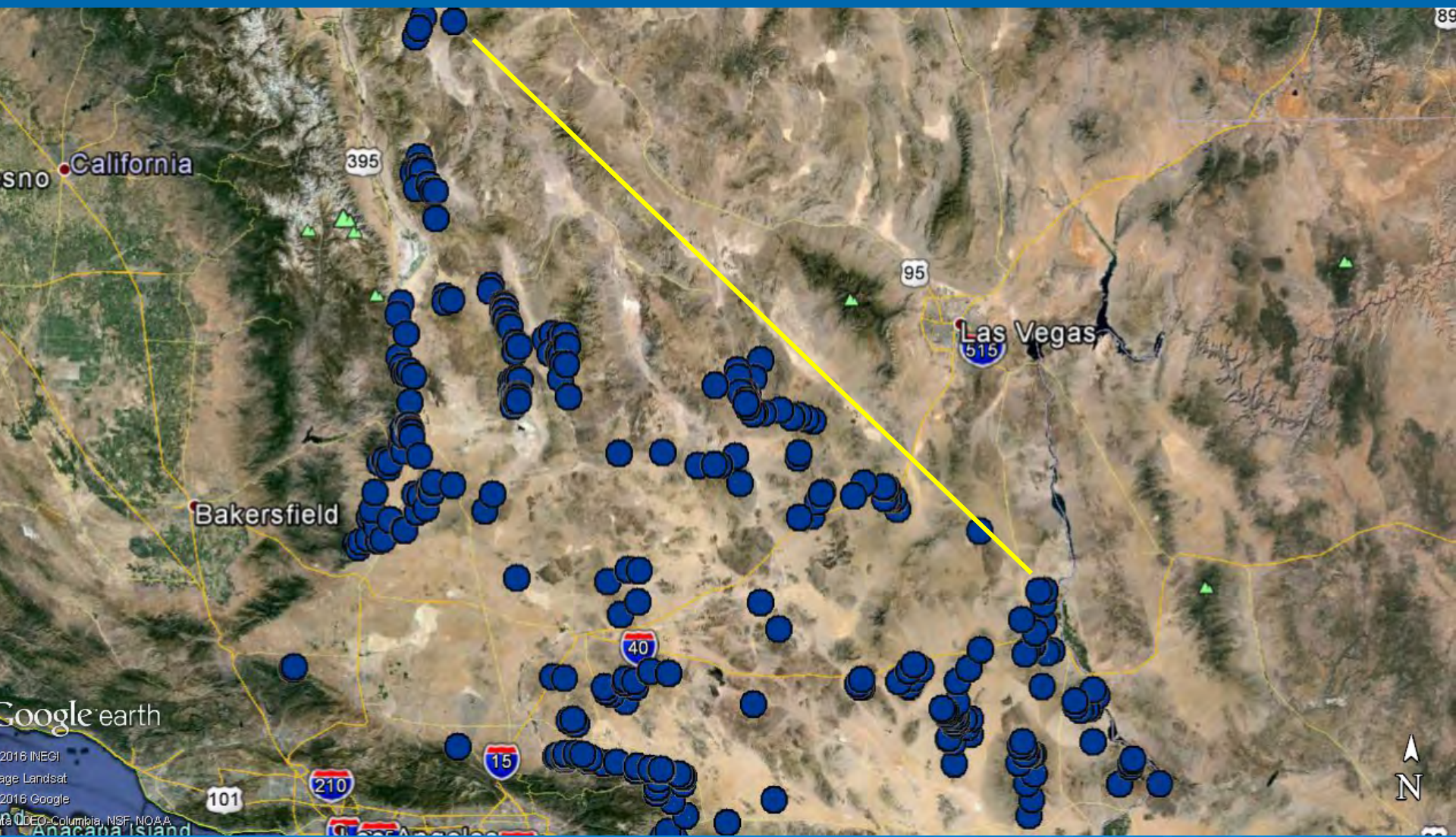
- U.S. Bureau of Land Management (Funder)
- The Nature Conservancy (Funder)
- Transition Habitat Conservancy (Project Applicant)
- Mojave Desert Land Trust
- Amargosa Conservancy





# Scope

- Reconnoitered ~320 spring/seep features; gathered info on ~420
- Springs within Barstow, Ridgecrest, Needles Districts of Bureau of Land Management and limited in Southern Nevada
- Springs on land owned by The Nature Conservancy, Transition Habitat Conservancy and Mojave Desert Land Trust
- Some access issues:
  - Locked gates / private land issues
  - Allotment issues
- Another ~100 spring/seeps not visited are included in report
- Refined locations
- Field water quality, flow, isotope sampling, channel characteristics, general flora and fauna descriptions, water rights, cultural history, etc.





**Bonanza Spring, Clipper  
Mountains, San Bernardino  
County, CA**







**China Garden Spring, Argus Range, Inyo County, California**





**Big Morongo Springs, Little San Bernardino Mountains**



# Wild & Scenic Amargosa River – Designated 2009





# Key Issues

- Importance of spring habitats (ecological, recreational, and economic)
- Small watering holes frequently overlooked in larger regional management evaluations
- Local and regional overdraft condition (decades of groundwater level decline)
- Long-term pumping with new development
- Future development?

# Cooperative Effort – Different Objectives

- U.S. Bureau of Land Management
- The Nature Conservancy
- Amargosa Conservancy
- Nye County, Nevada
- Inyo County, California
- U.S. Geological Survey



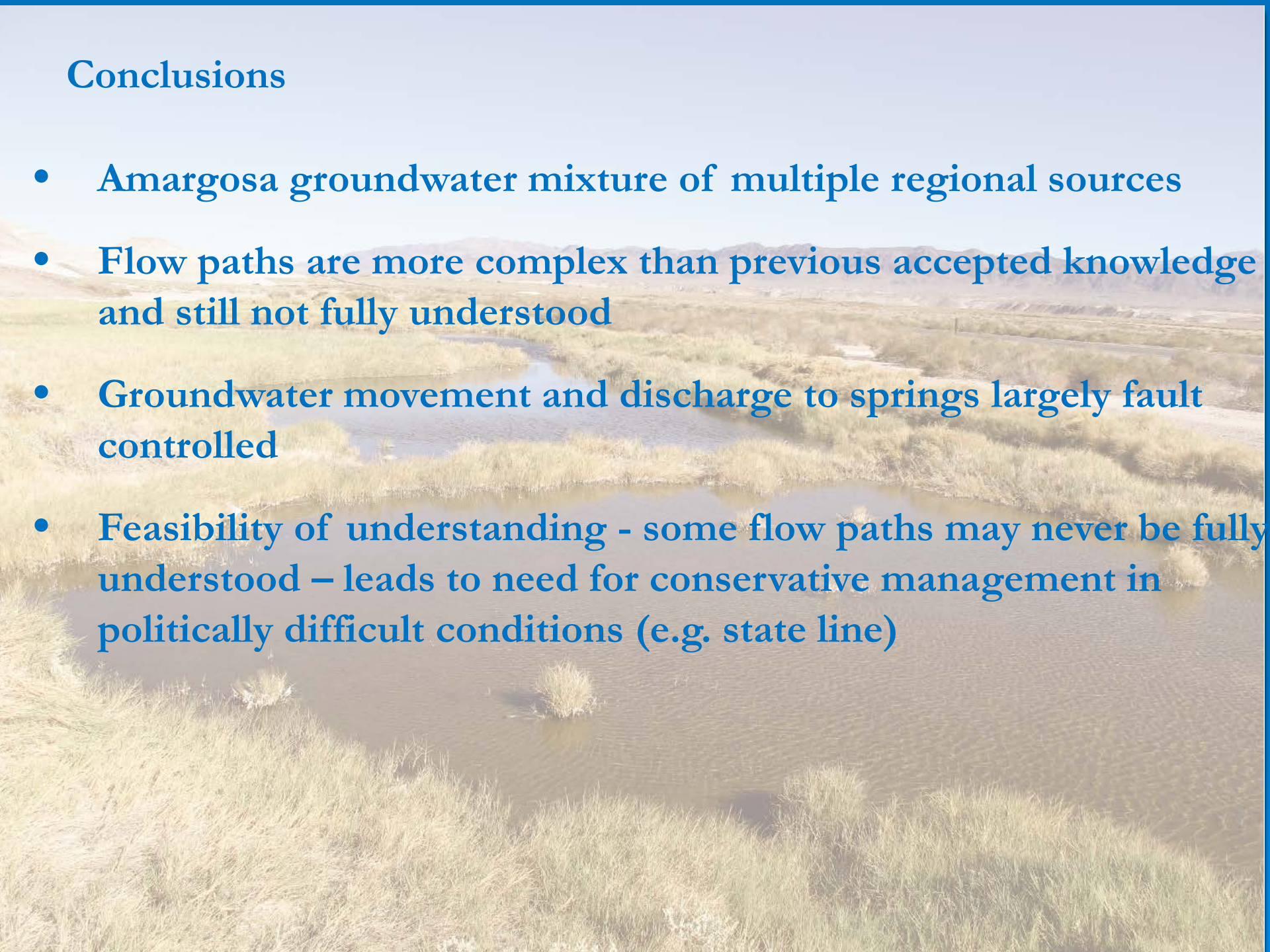


# Tasks by TNC/AC Consultants

- Cataloging of springs and accessible wells
- Well-canvassing to identify future monitoring locations
- Periodic broad-based spring surveys, river gaging, groundwater level monitoring
- Installation of monitoring wells with continuous data collection
- Geochemical analyses including isotopic analyses
- Documentation: Production of State of the Basin Reports (comprehensive) and other monitoring reports

## Conclusions

- Amargosa groundwater mixture of multiple regional sources
- Flow paths are more complex than previous accepted knowledge and still not fully understood
- Groundwater movement and discharge to springs largely fault controlled
- Feasibility of understanding - some flow paths may never be fully understood – leads to need for conservative management in politically difficult conditions (e.g. state line)





## *So....lessons learned – resource related!*

- The ecology of the Mojave Desert region is in a state of change (and is the case in most places!!)
- Change happens slowly – can be imperceptible
- Impacts can continue to heighten after stress on system removed
- Most springs have been altered (particularly larger springs)
- Many spring “improvements” have provided short-term increased spring yield, resulting in long-term impacts (some appear irreversible).
- Even some of the smallest waterholes are key for regional wildlife (e.g. Ahn Spring, McDonald Well) and may be reflective of regional groundwater movement susceptible to impacts from regional groundwater use



Pachalka Spring, Clark Mountain, San Bernardino County, CA





# Big Picture and Programmatic

- Good planning and communication to a public that is largely unaware of arid California is critical
- Think big – it may be possible to identify a problem and fix it before it hits you!
- With increasing difficulty and competition in obtaining funding collaboration and focus on answering specific questions over broad areas
- Avoid “group think” – acceptance of new data and the story it tells...
- Have properly licensed professionals work using professionally-accept methods on your projects - defensibility