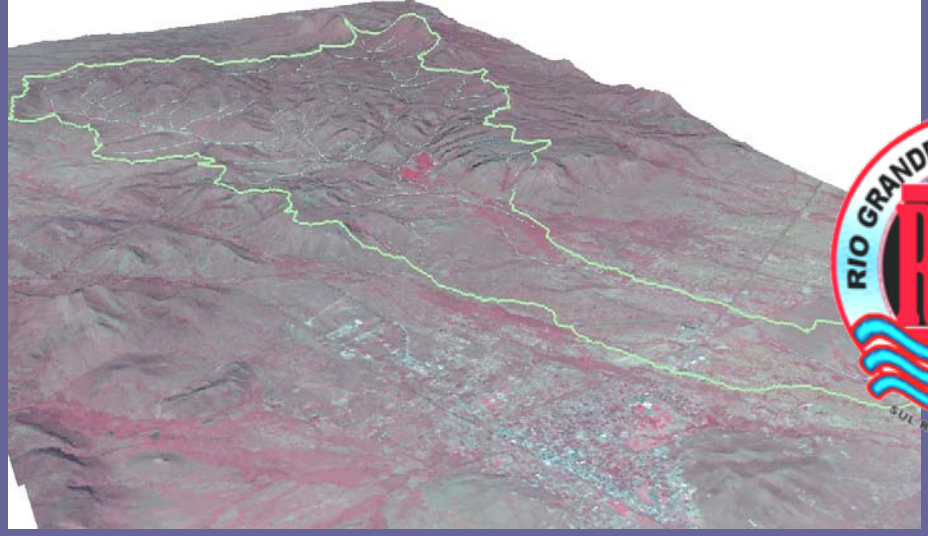


Aquifer Characterization in the Sunny Glen area near Alpine, Texas

Kevin Urbanczyk, Adelina Beall

Rio Grande Research Center, Sul Ross State University, Alpine, TX

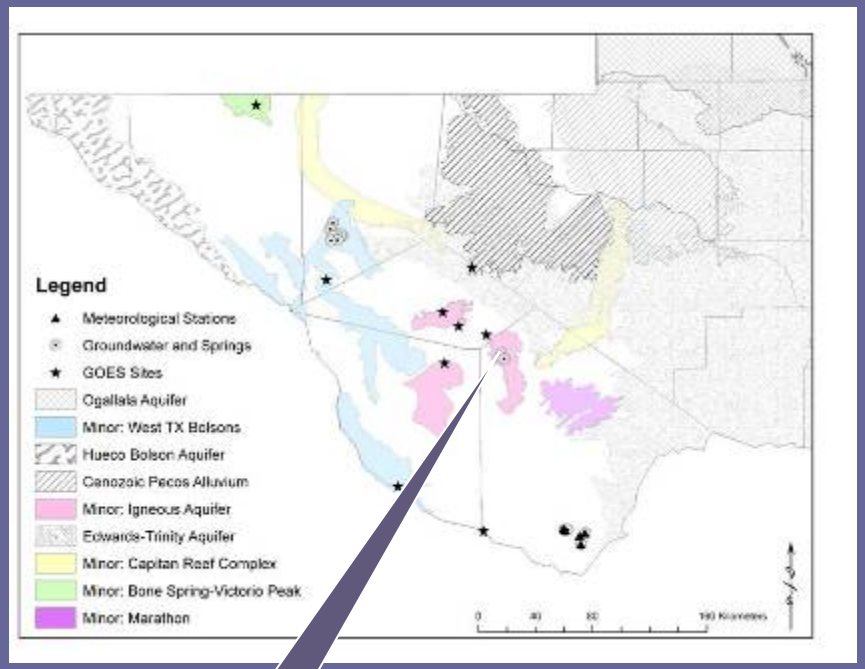
Steve Finch

John Shomaker and Associates, Albuquerque, NM

Location, Setting

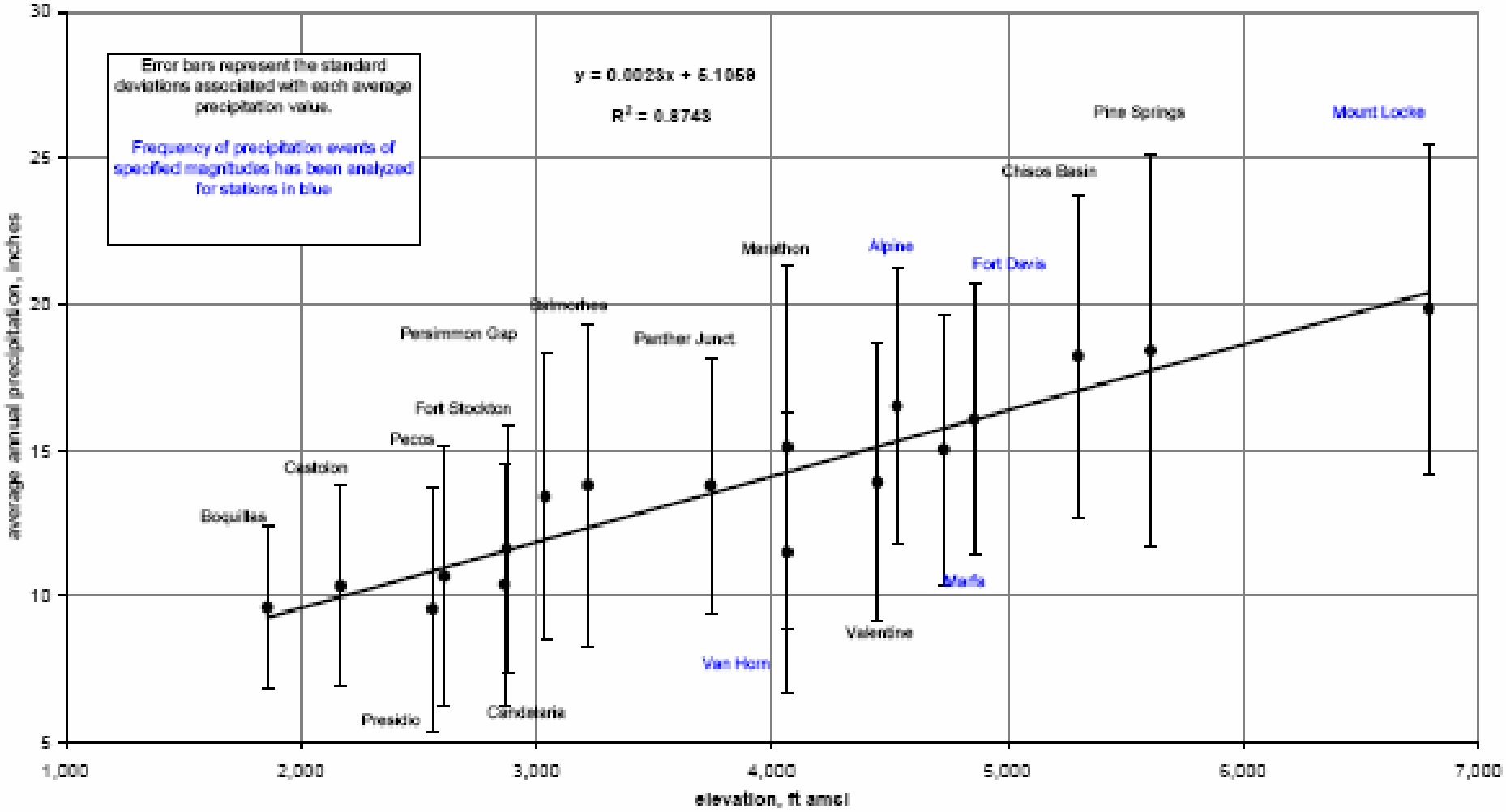
- Far west Texas
- Northern Chihuahuan desert; annual precipitation = 16 inches
- Region E, Far West Texas Water Planning Group (TWDB)
- Municipal water supply 100% groundwater

Groundwater and Atmospheric monitoring stations



Alpine

Precipitation



City of Alpine Well Fields

Sunny Glen Watershed:

23,000 acres / 9300 hectares

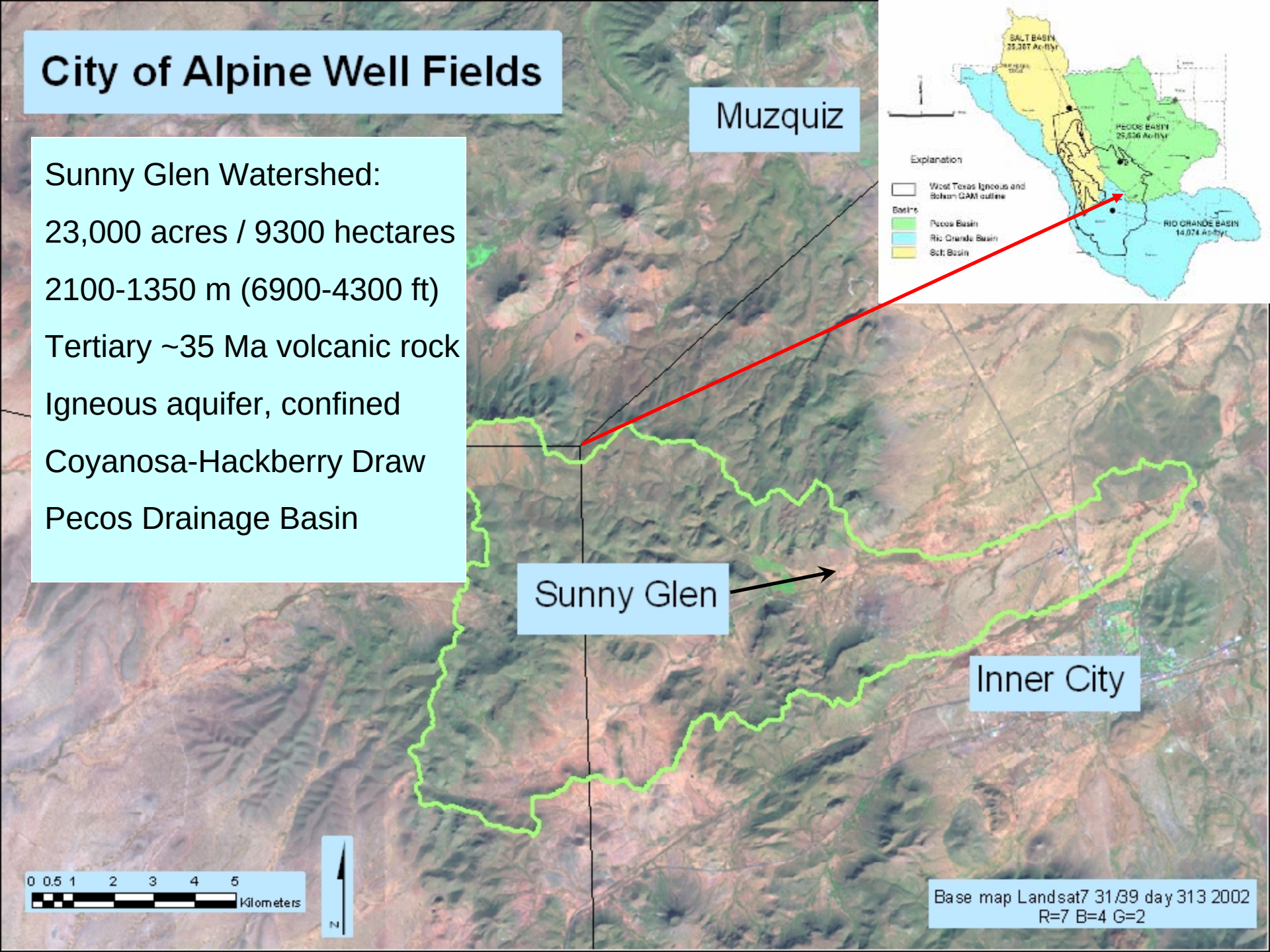
2100-1350 m (6900-4300 ft)

Tertiary ~35 Ma volcanic rock

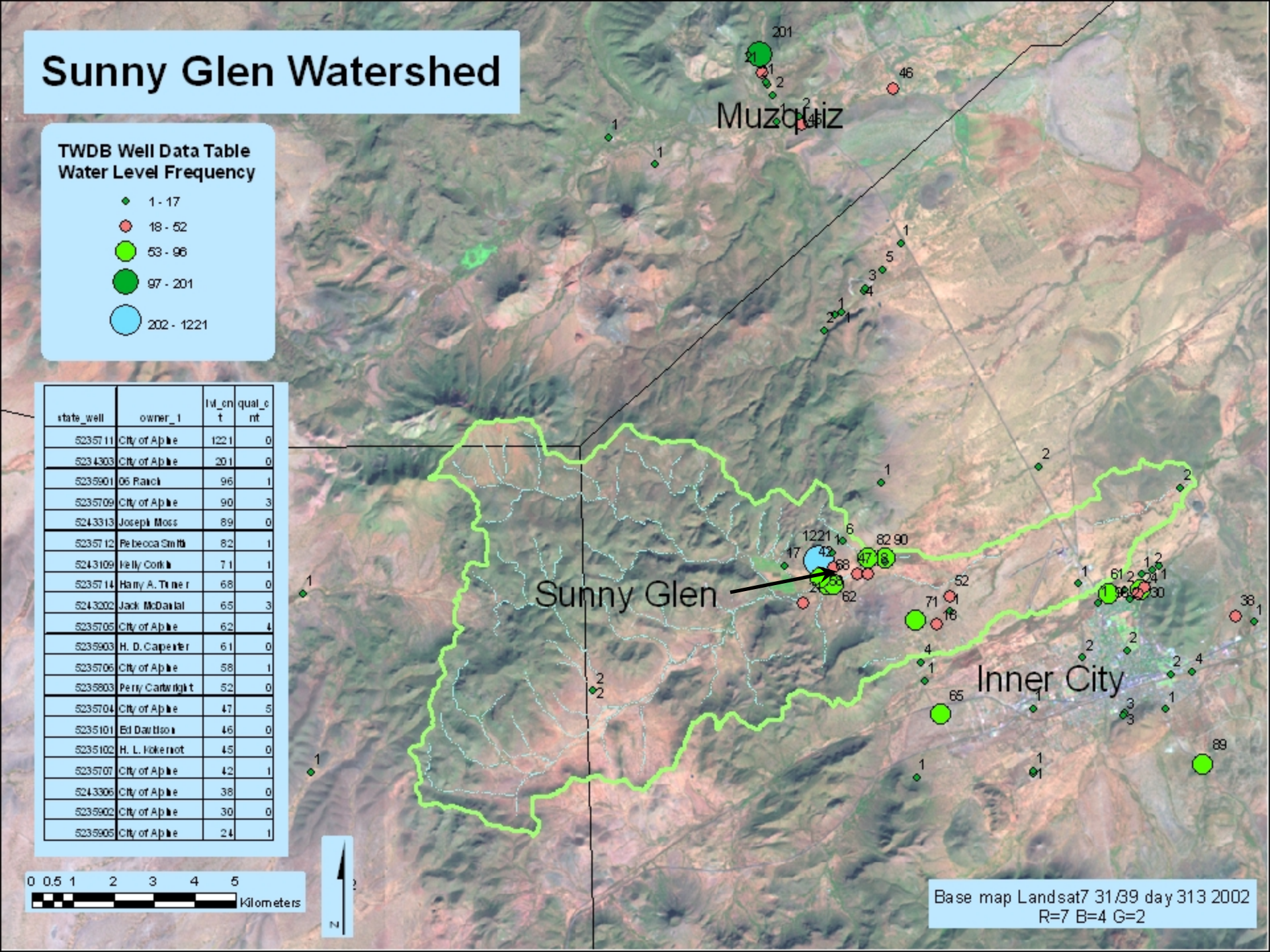
Igneous aquifer, confined

Coyanosa-Hackberry Draw

Pecos Drainage Basin

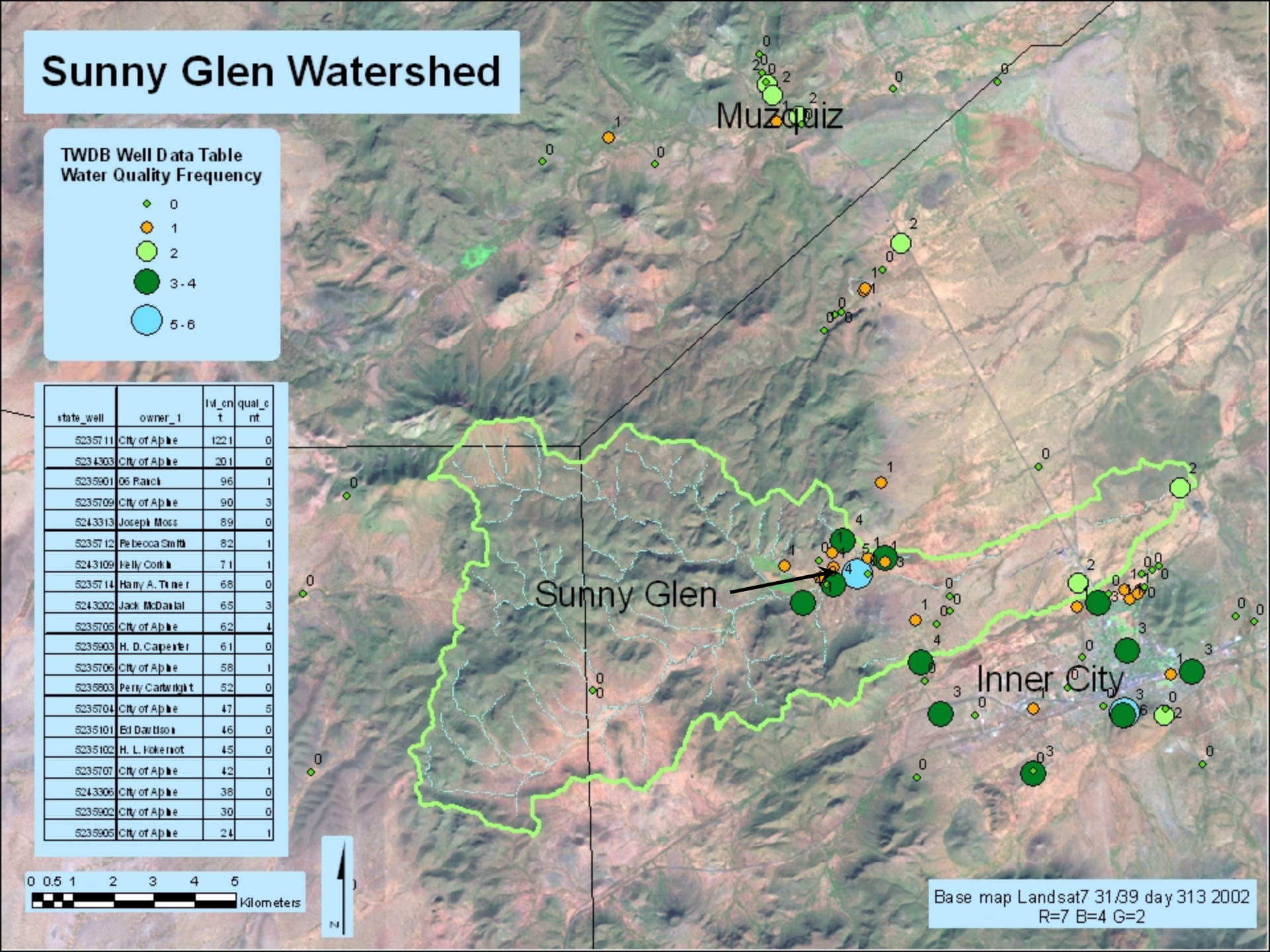


Sunny Glen Watershed



state_well	owner_1	lvl_cnt	qual_cnt
5235711	City of Alpine	1221	0
5234303	City of Alpine	201	0
5235901	06 Ranch	96	1
5235709	City of Alpine	90	3
5243313	Joseph Moss	89	0
5235712	Rebecca Smith	82	1
5243109	Kelly Corkill	71	1
5235714	Harry A. Turner	68	0
5243202	Jack McDaniel	65	3
5235705	City of Alpine	62	4
5235903	H. D. Carpenter	61	0
5235706	City of Alpine	58	1
5235803	Perry Cartwright	52	0
5235704	City of Alpine	47	5
5235101	Ed Davidson	46	0
5235102	H. L. Kokernot	45	0
5235707	City of Alpine	42	1
5243306	City of Alpine	38	0
5235902	City of Alpine	30	0
5235905	City of Alpine	24	1

Sunny Glen Watershed



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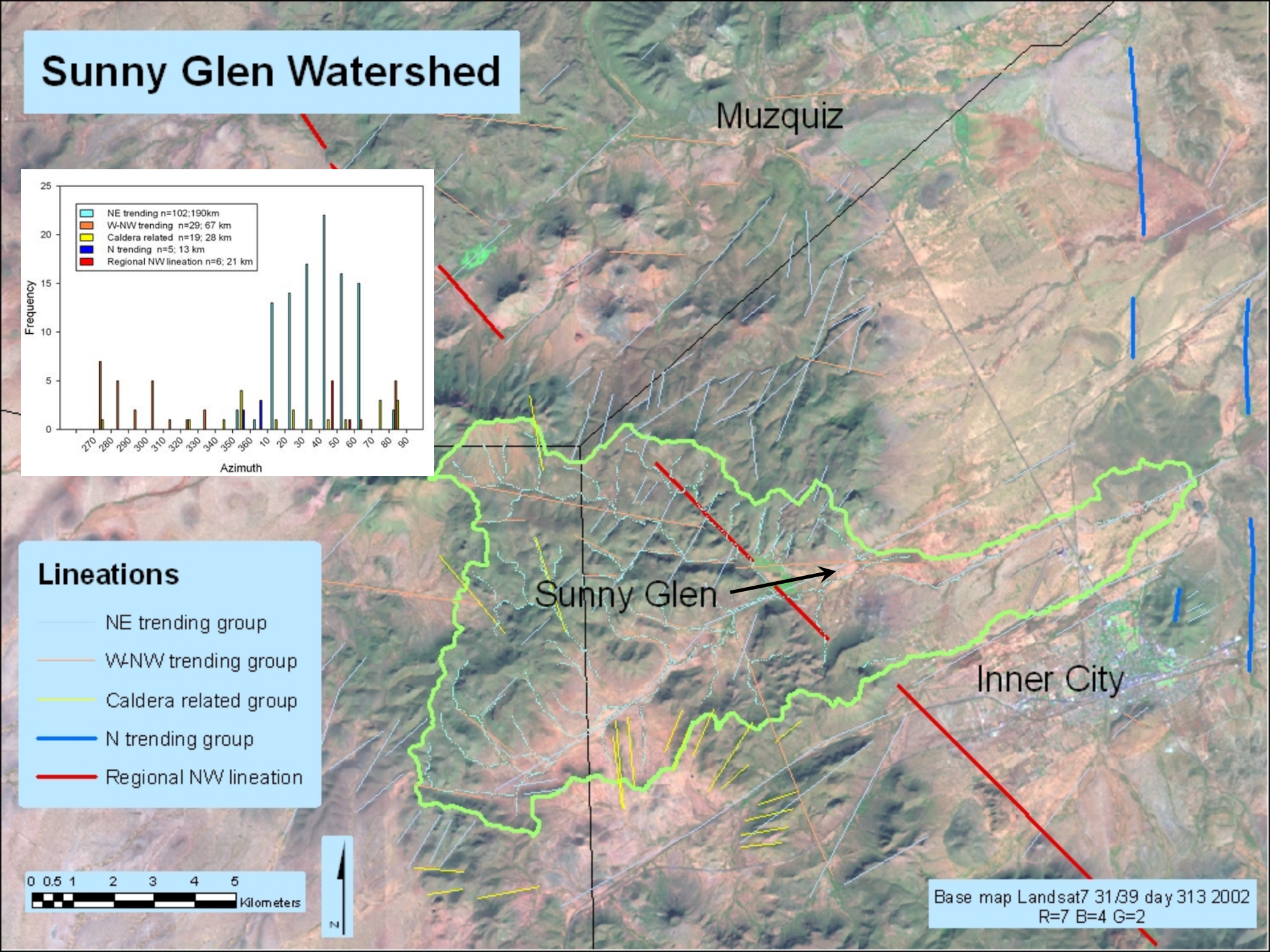
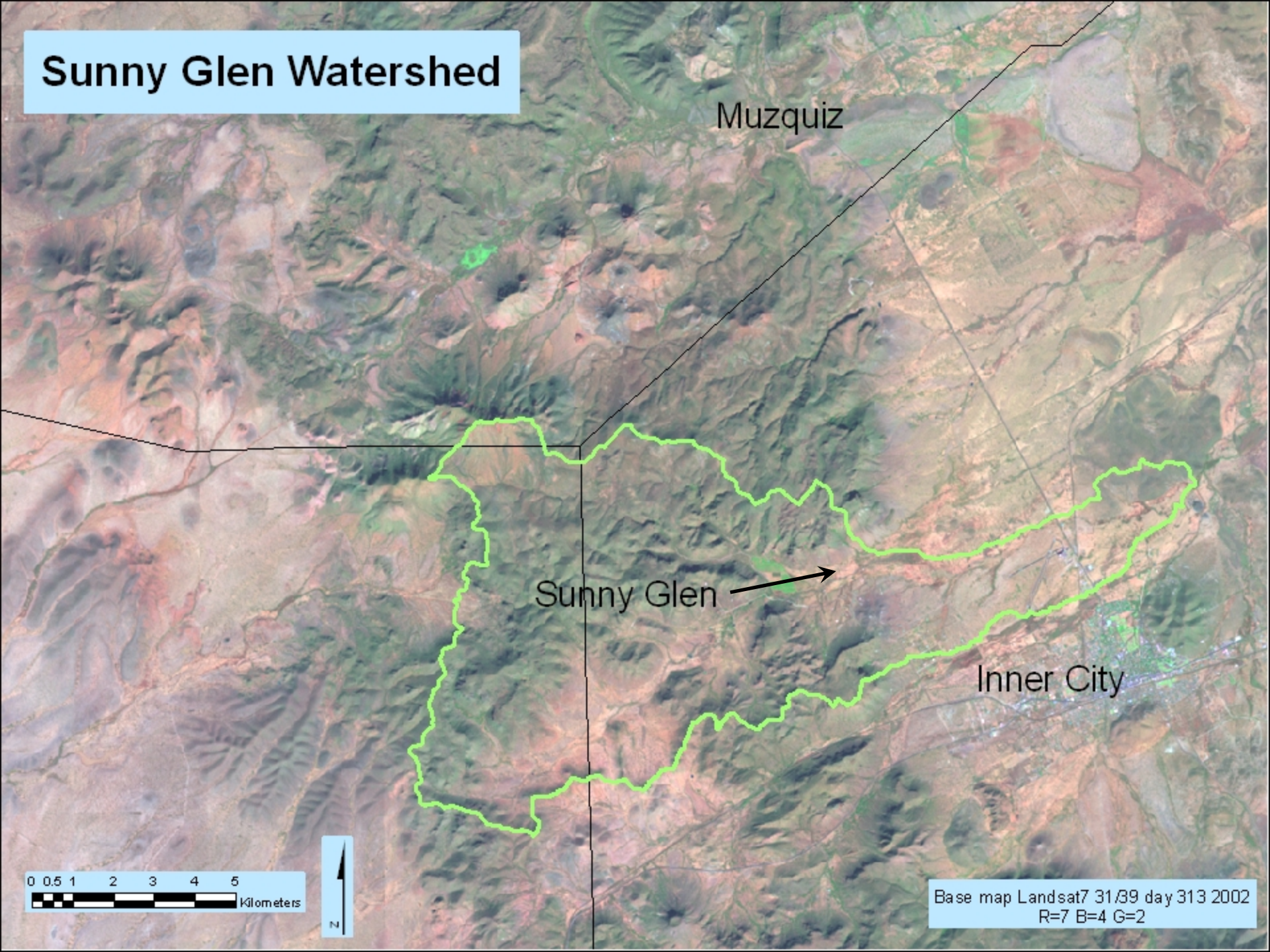
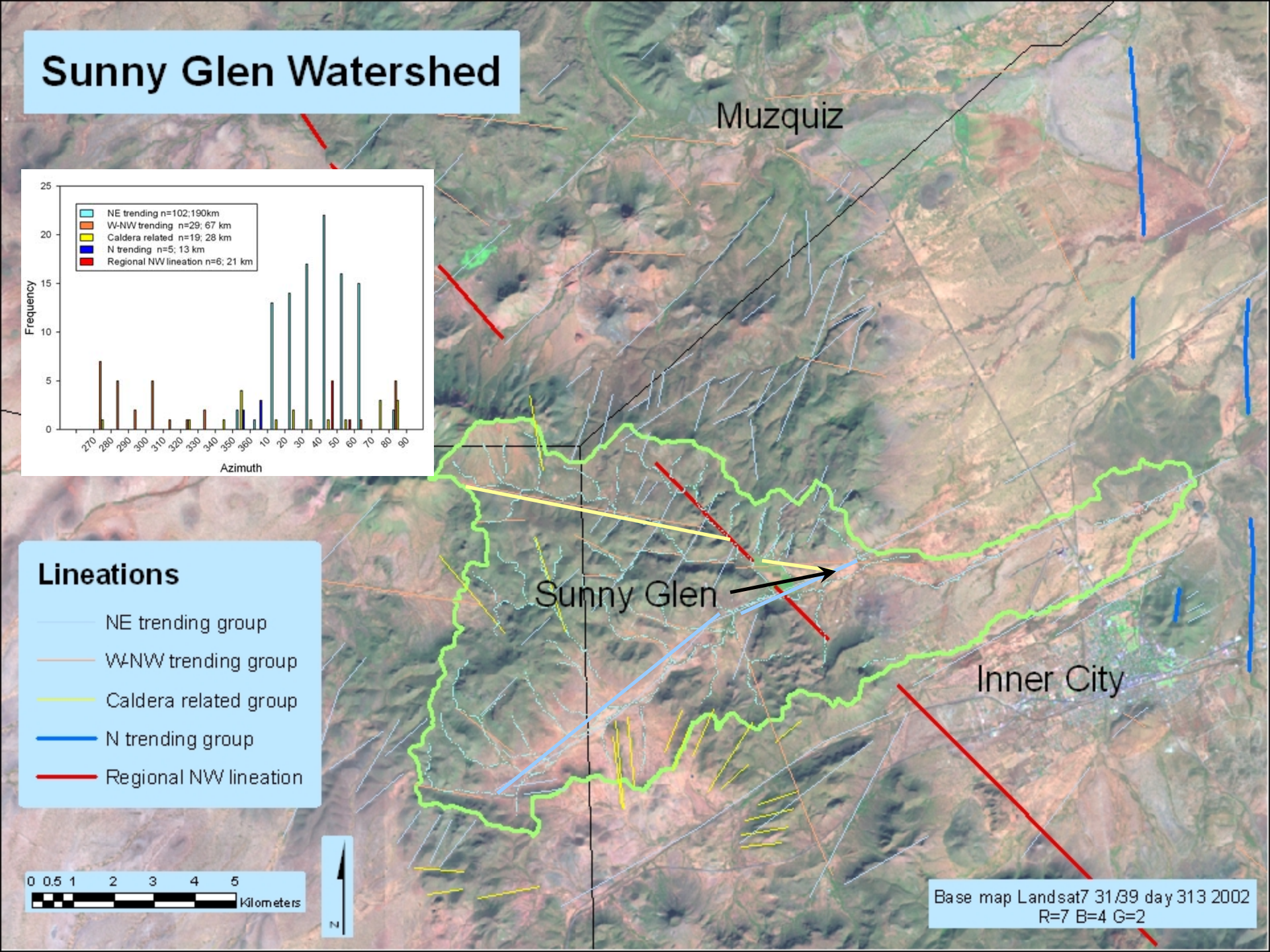
Sunny Glen Watershed

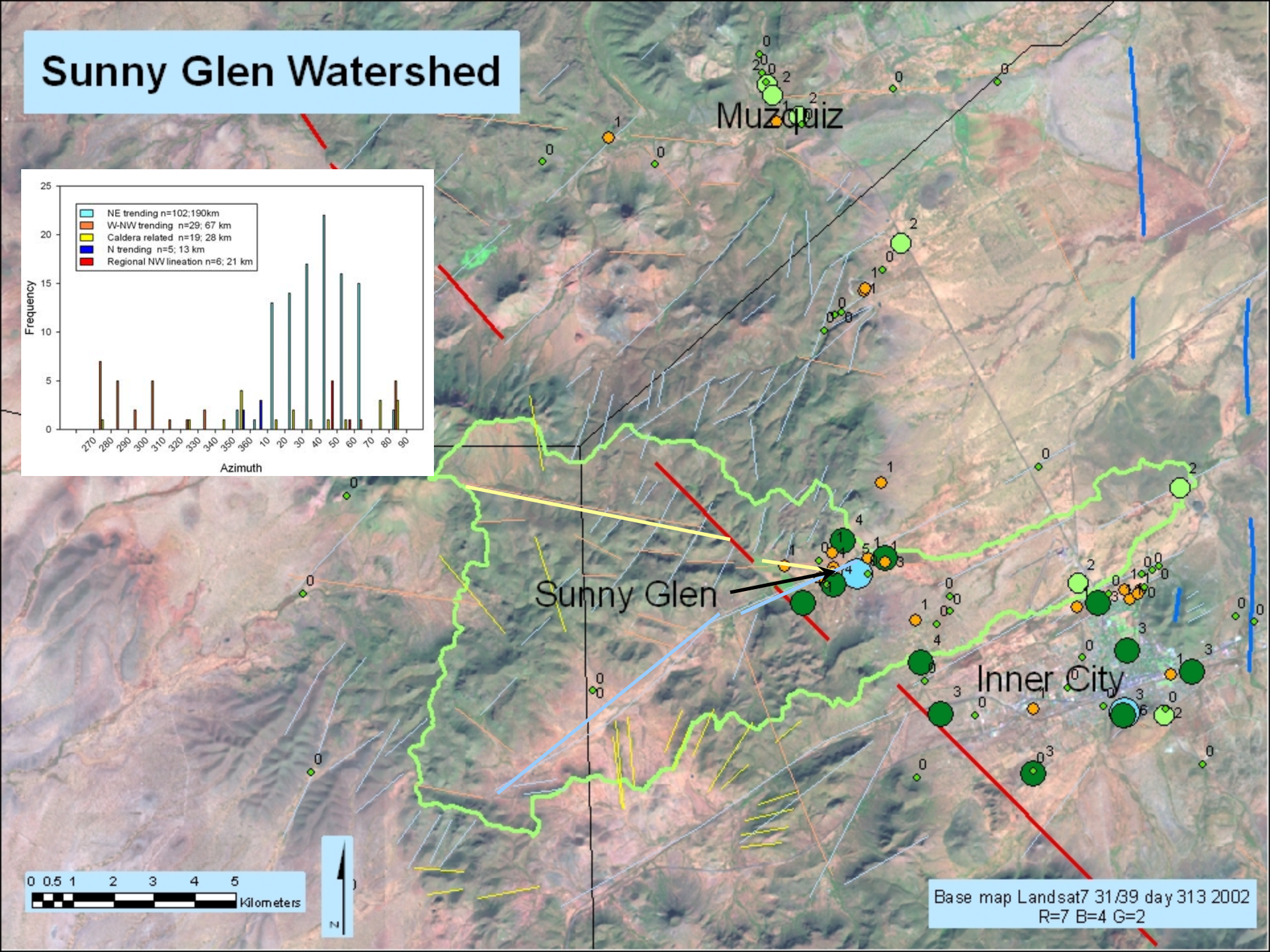



Sunny Glen Watershed
Muzquiz
Sunny Glen
Inner City
0 0.5 1 2 3 4 5
Kilometers
N
Base map Landsat7 31/39 day 313 2002
R=7 B=4 G=2

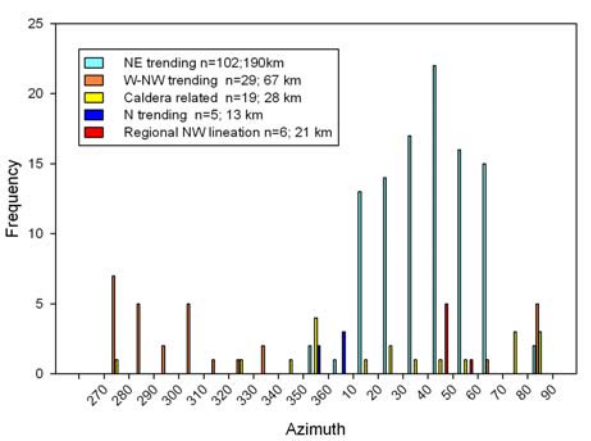
Sunny Glen Watershed

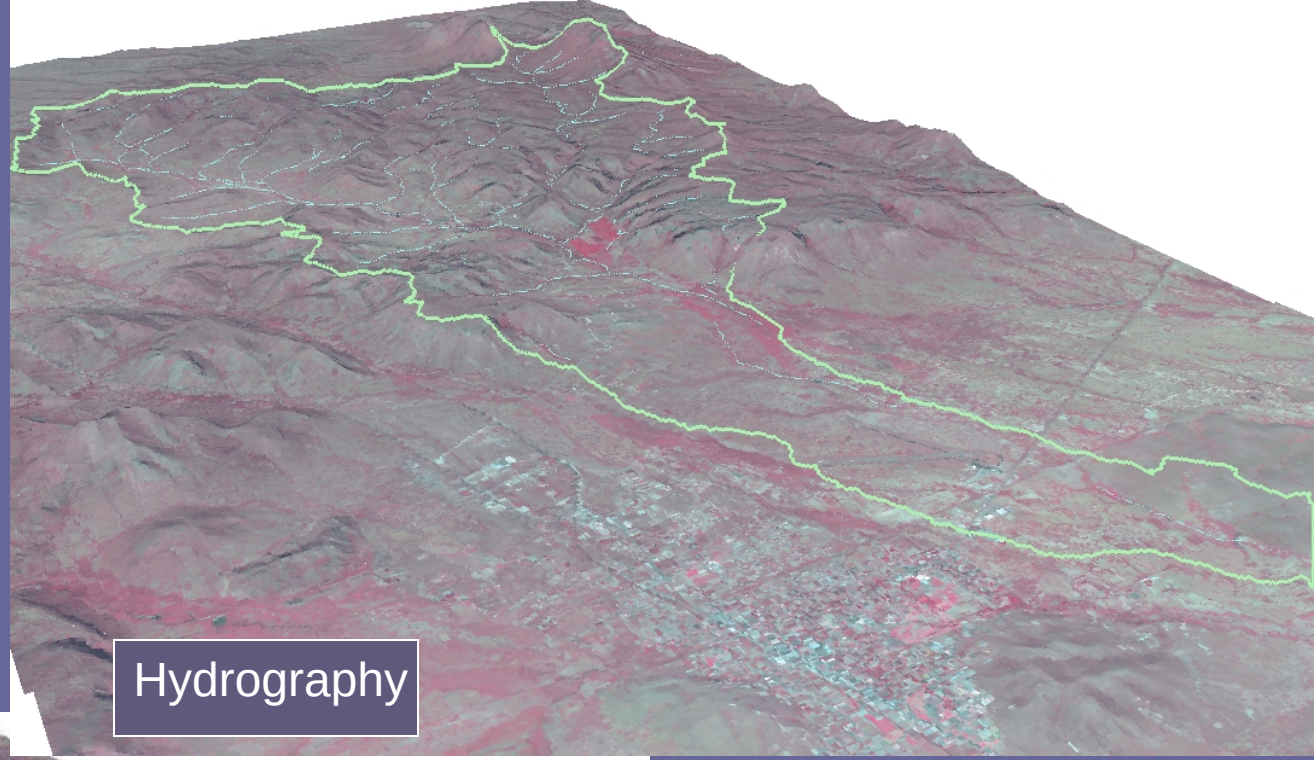


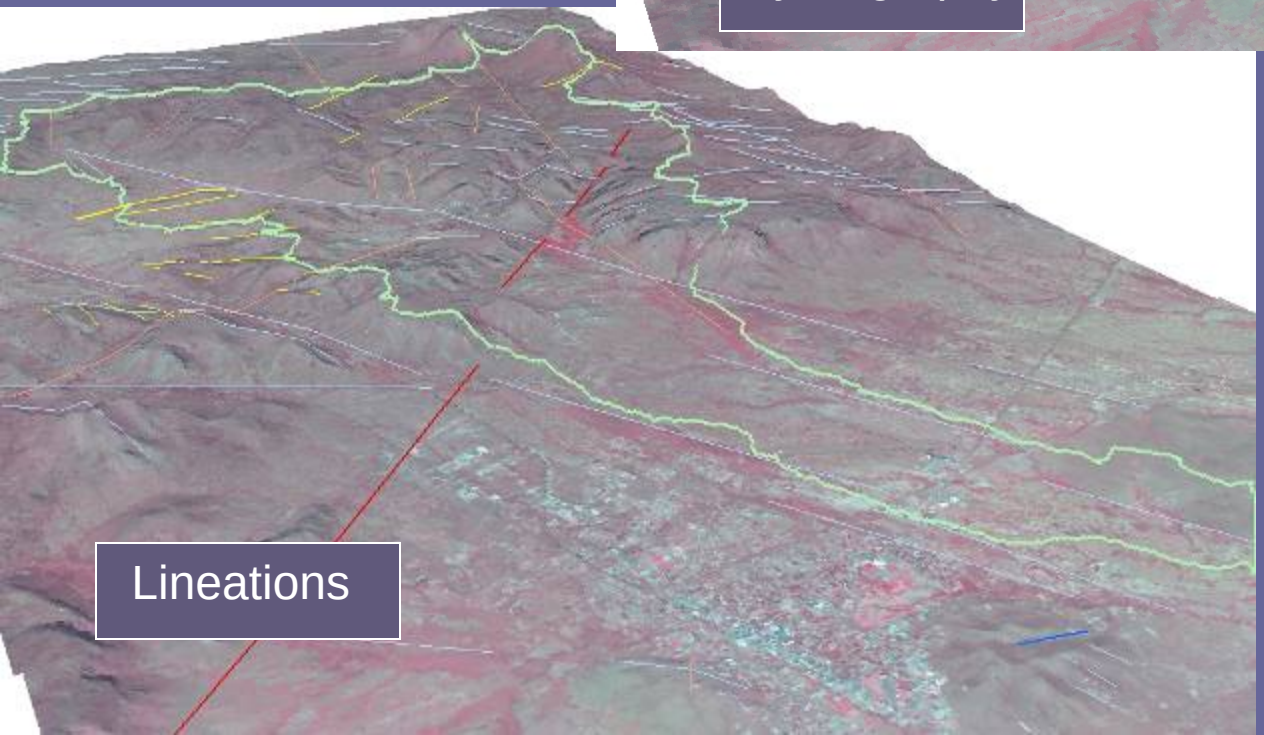
Sunny Glen Watershed



Sunny Glen Viewshed



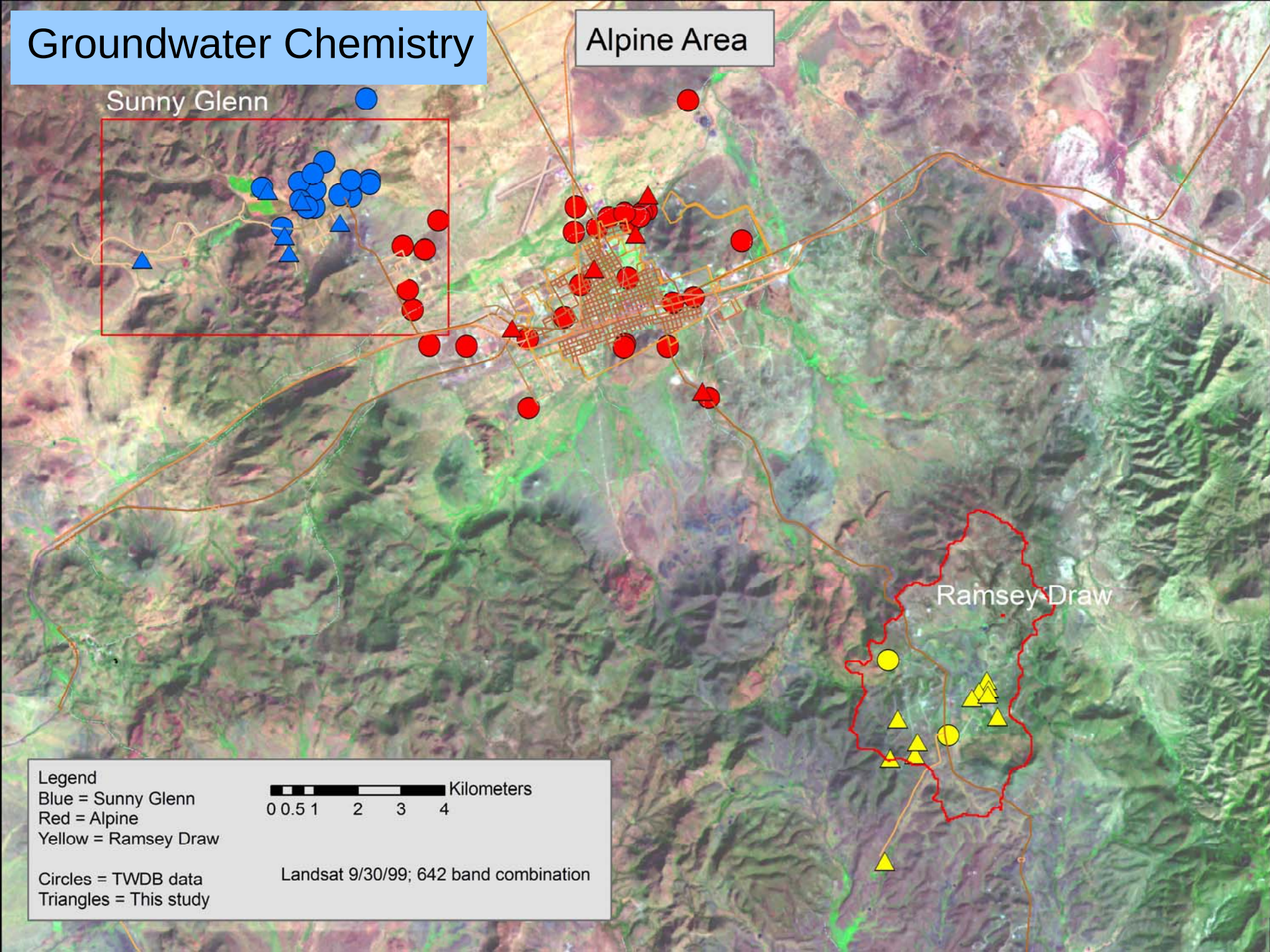




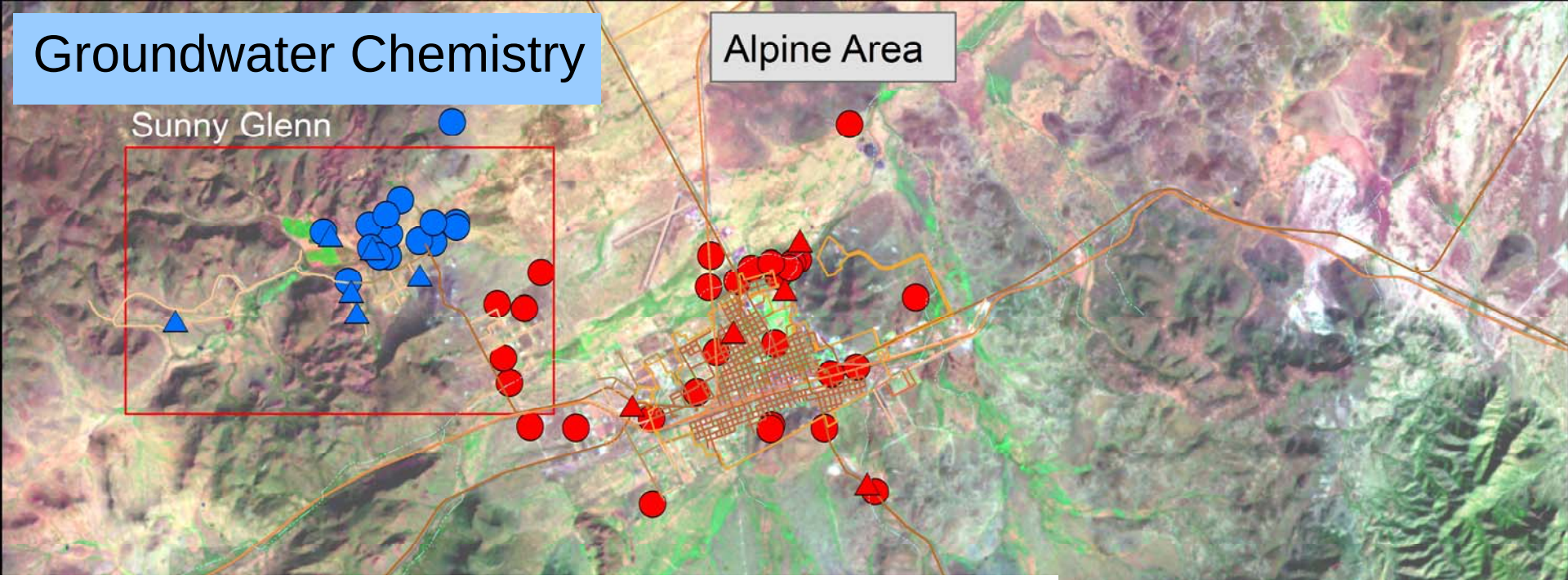
N

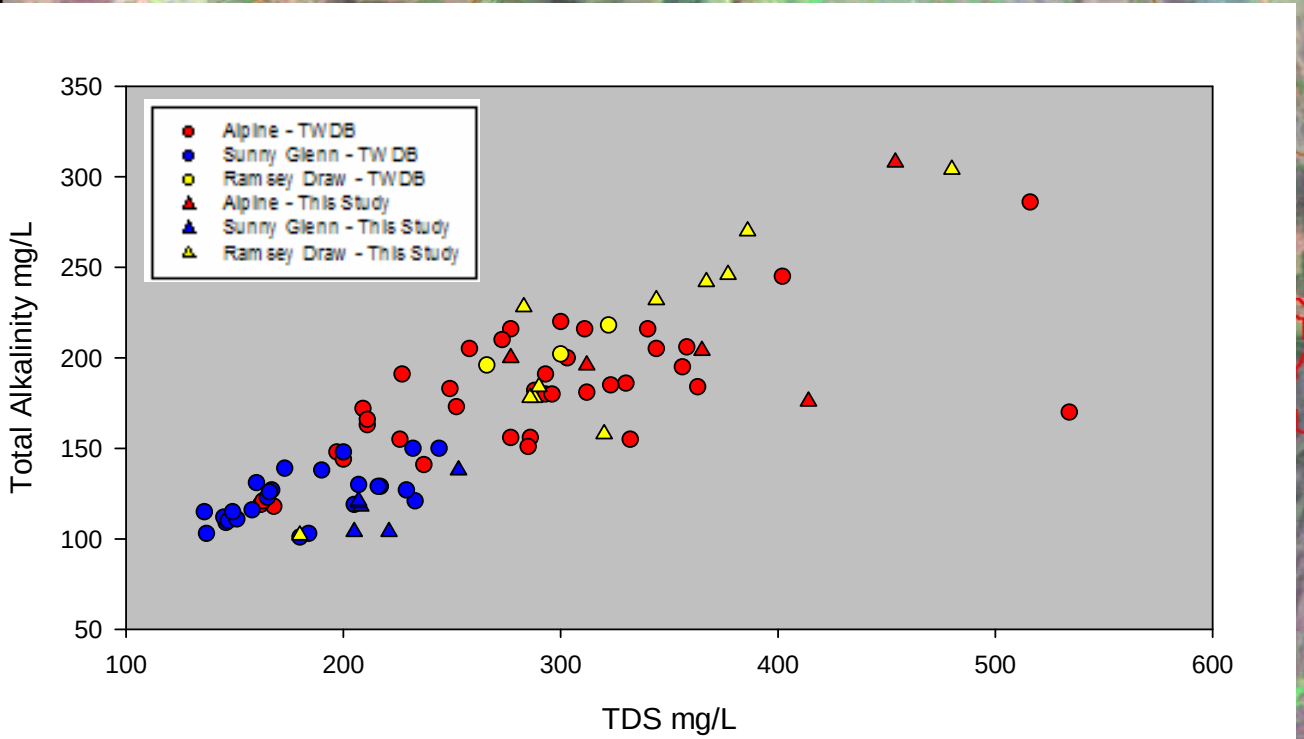
NAIP 2004 CIR images

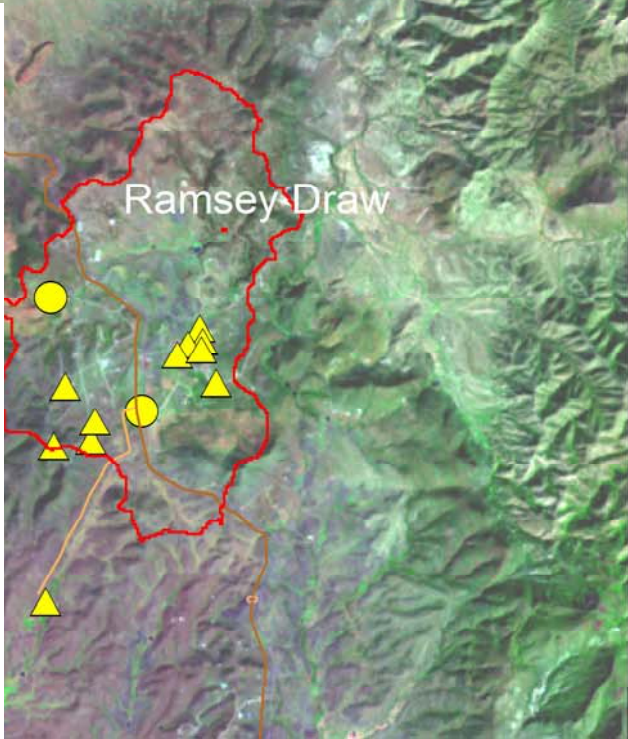
Groundwater Chemistry



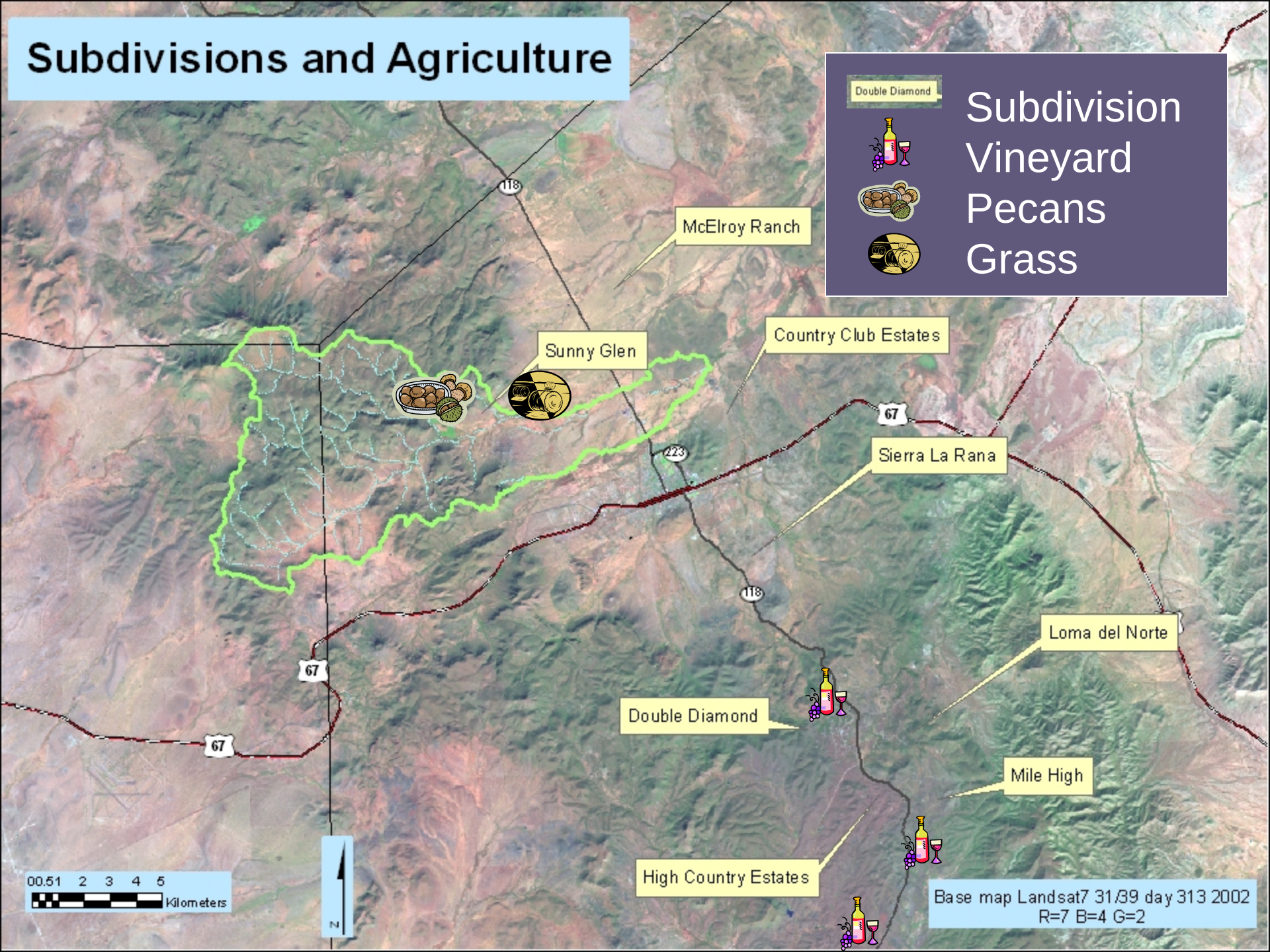
Groundwater Chemistry





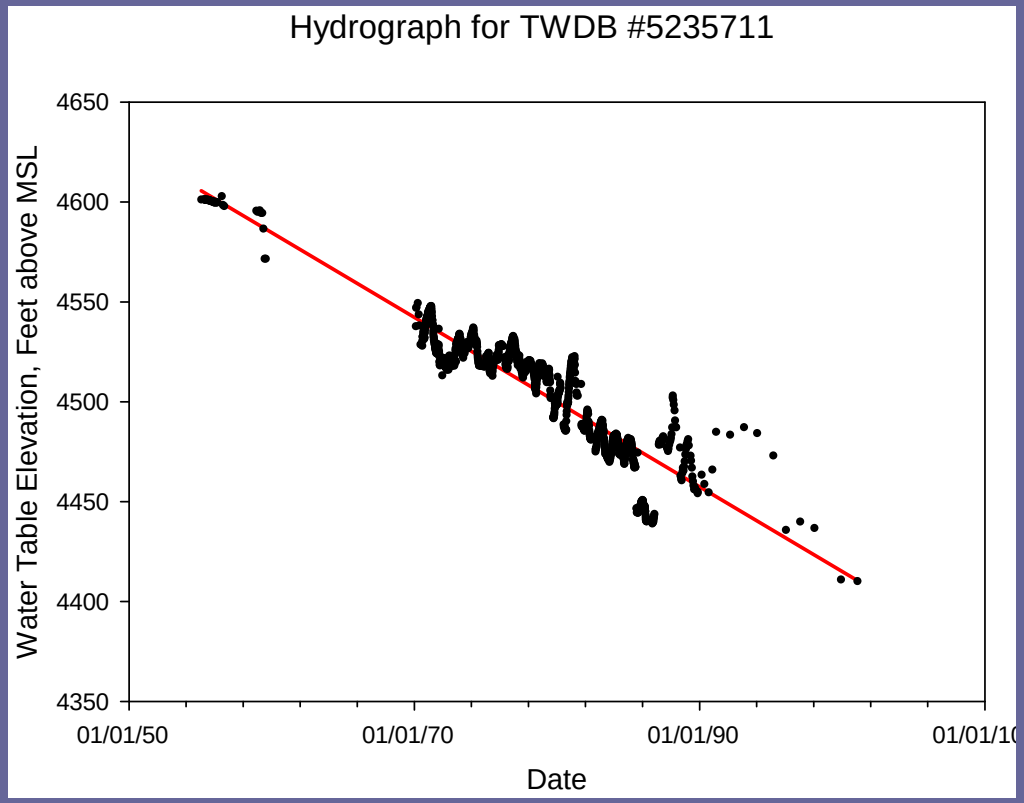


Subdivisions and Agriculture

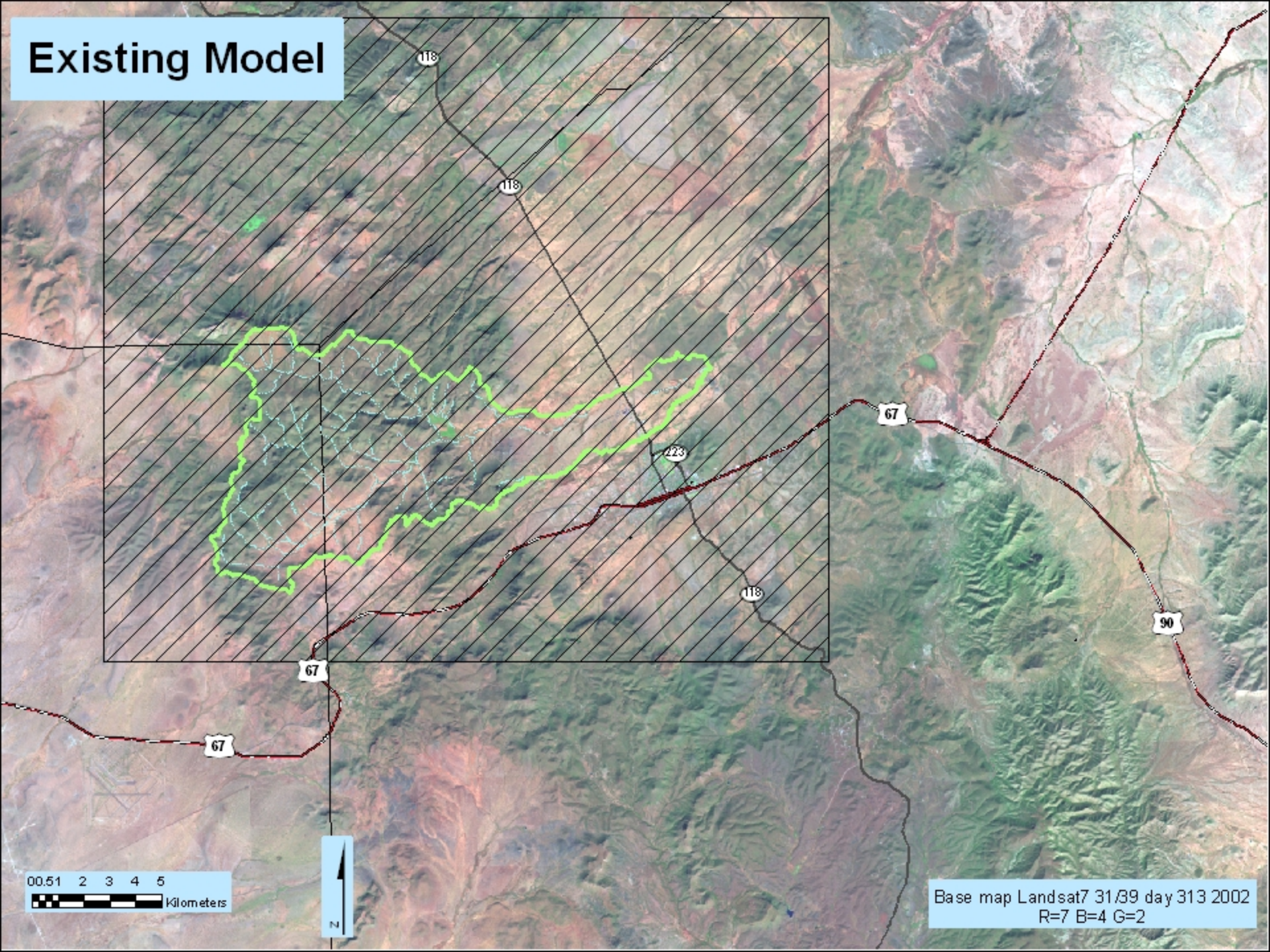


Summary of Stresses on the System

- Municipal
  - City of Alpine
  - Private
- Agricultural
  - Pecan orchard
  - Grass / livestock
  - Vineyards
- Many (not all) hydrographs show long term decline
  - Models show "sustainable" asymptotic behavior



Existing Model

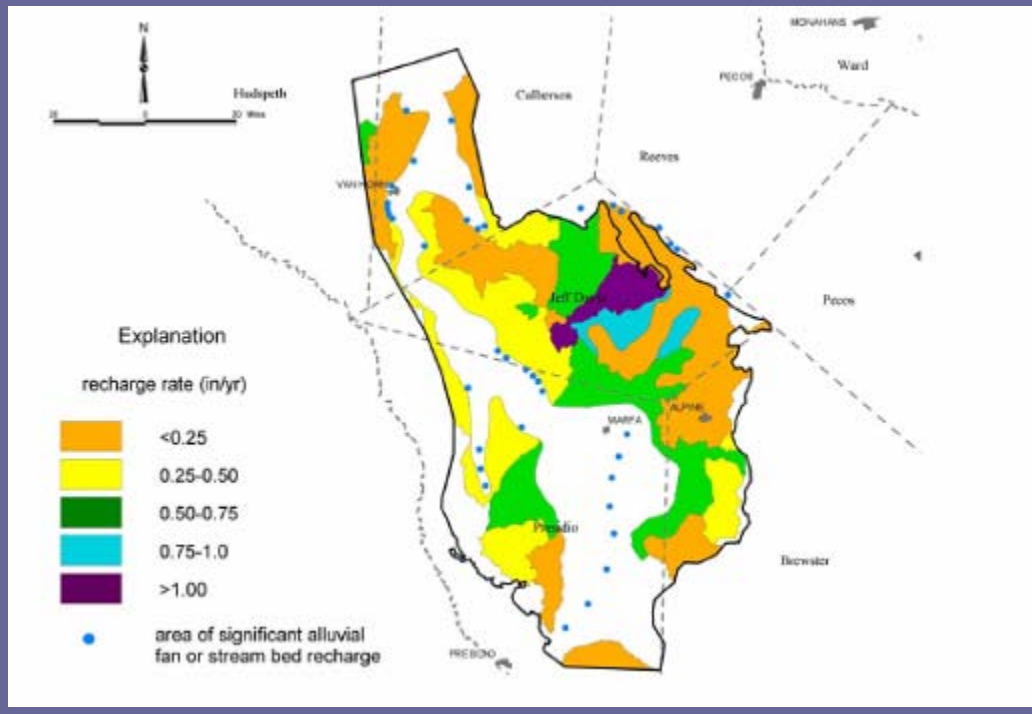


Existing Model – Single Layer

- Hydrogeologic data
  - Summary from historic data

Sunny Glen Well Field	Transmissivity	Transmissivity	Hydraulic Conductivity	Hydraulic Conductivity	Storage Coefficient
	(g/d/ft)	(ft^2/d)	($g/d/ft^2$)	(ft/d)	
Range	439 to 21,193	59 to 2,840	8 to 571	1 to 77	$3e^{-5}$ to $2.8e^{-4}$
Geometric Mean	4055	543	92	7	$1.7e^{-4}$

- Recharge
  - Estimate from regional GAM



- Pumping
  - Estimate from City of Alpine records, % of total

LBG-Guyton and Associates, 2007, Well Field Evaluation, City of Alpine, Texas
Beach and others, 2004, Groundwater Availability Model for the Igneous and parts of West Texas Bolson aquifers

Existing Model Predictions

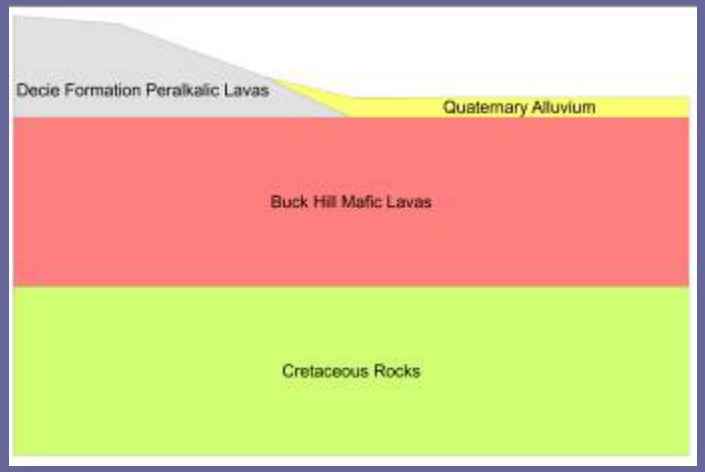
- Current production at Muzquiz field not sustainable
- Current production at Sunny Glen
- “sustainable” unless agricultural and private use increases
- Current production at Inner City wells “sustainable”, but model calibration data were sparse

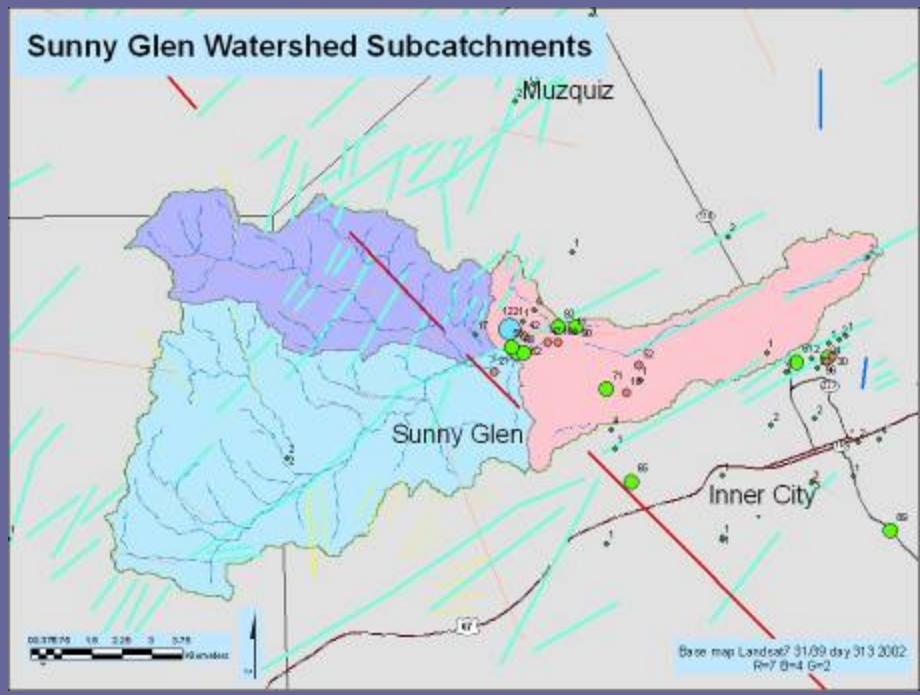
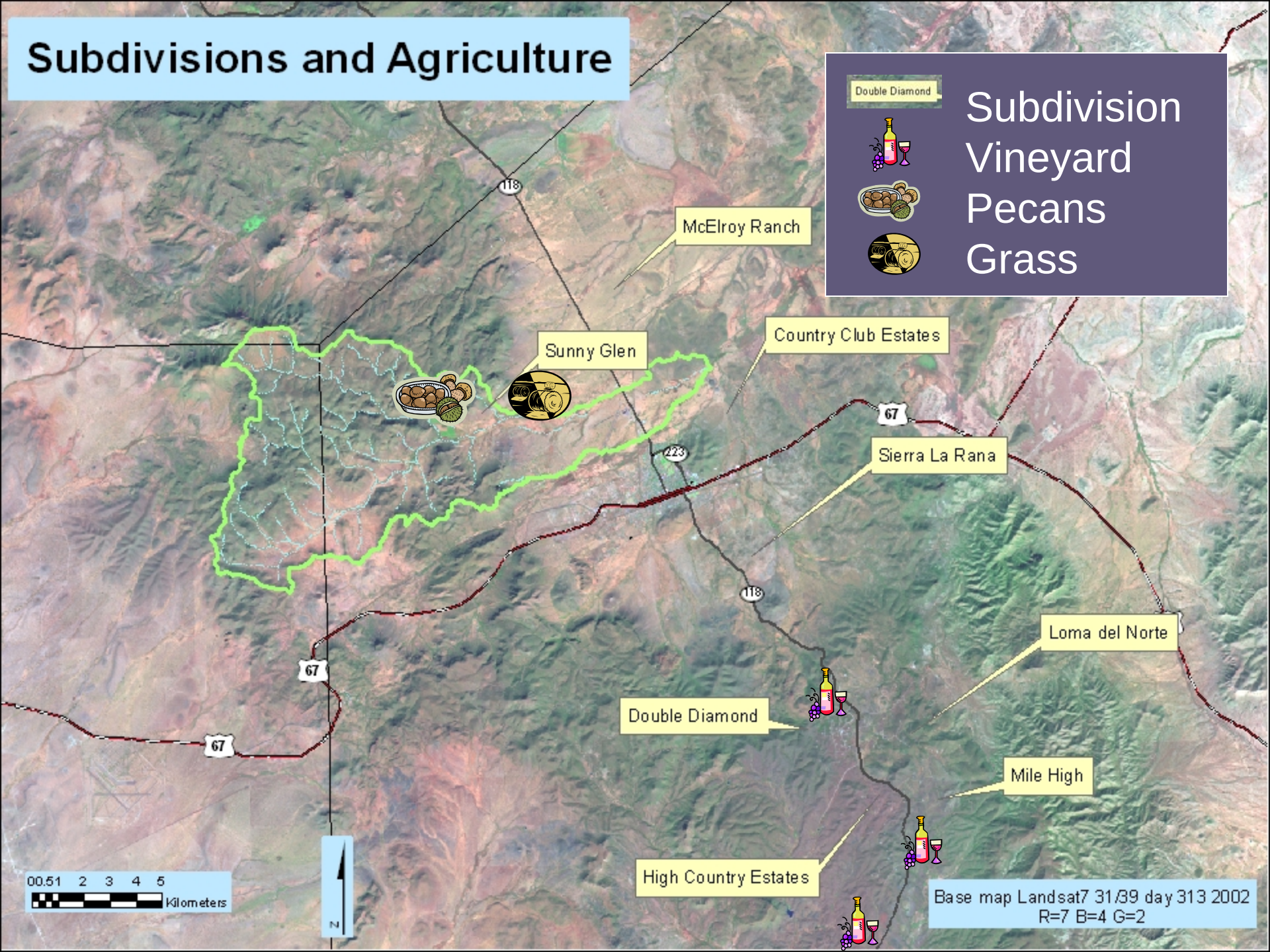
Summary of What We Know

- History of water level decline and expansion to new fields
- Water chemistry data suggest subtle differences in groundwater in sub basins
- A general model exists using sparse information on hydrogeologic parameters

What We Want to Know / Do

- Develop multilayer model
  - Detailed cross sections needed
- Develop better estimate of recharge, determined on a local scale
  - Detailed soils and geology needed
  - Observations of precipitation and runoff needed
- Develop better estimate of hydrogeologic parameters
  - More pumping tests
  - Incorporate lineament analysis, vary the parameters with buffers …
  - Better estimate of storage, steady state vs. transient model
- Develop general predictive model to apply to other local igneous systems





Subdivisions and Agriculture