Interbasin Transfer Projects: Impacts on Communities & Ecosystems

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Introduction

- The Problem - Increasing demand for water resources and possibly diminishing supplies
- The constraints
  - Precipitation patterns
  - Evaporation
  - Uncertainty
    - Natural variability
    - Climate change?
  - Population growth
  - Regulatory/Legal/Policy concerns

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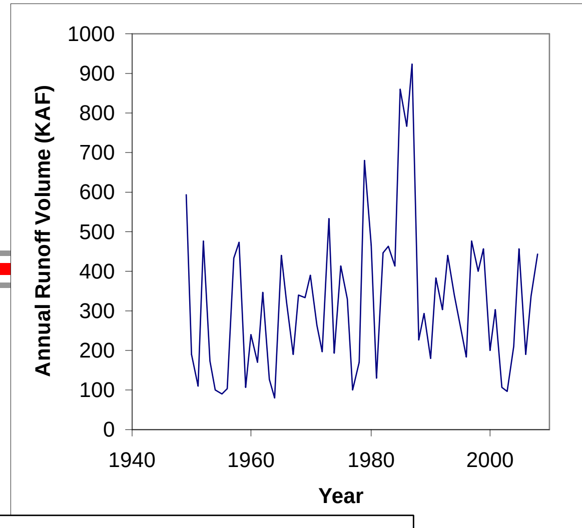
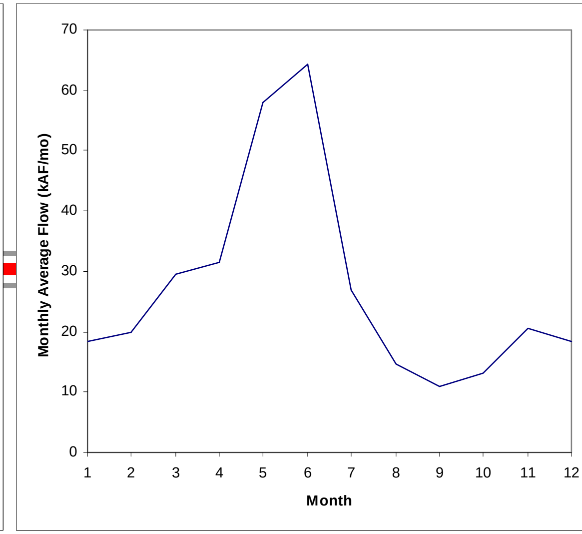
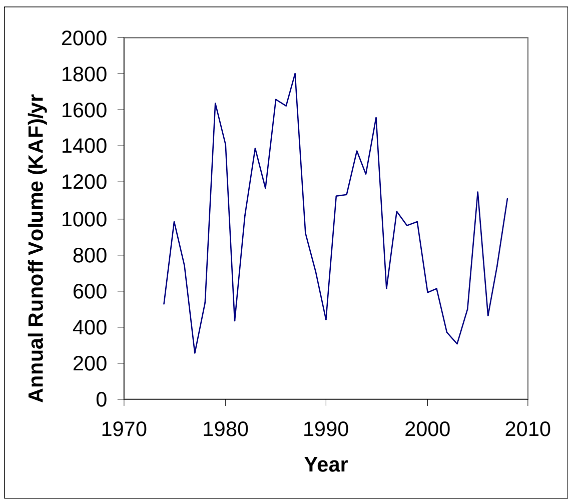
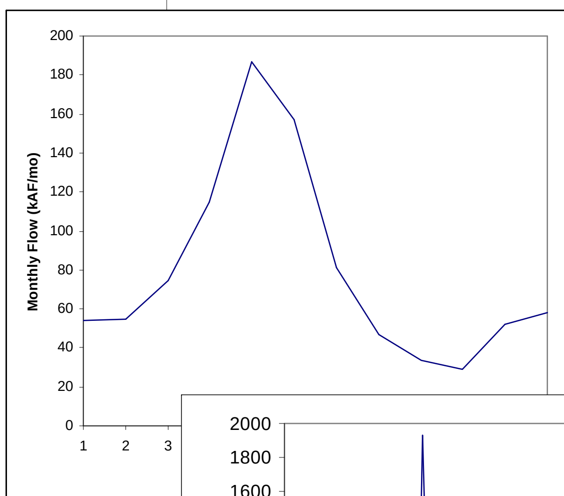
Rio Grande Hydrology



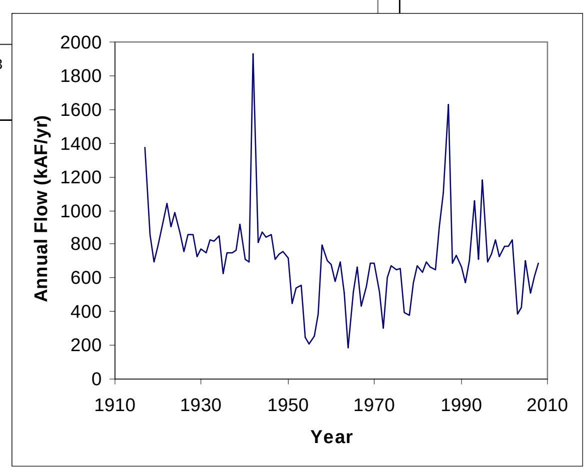


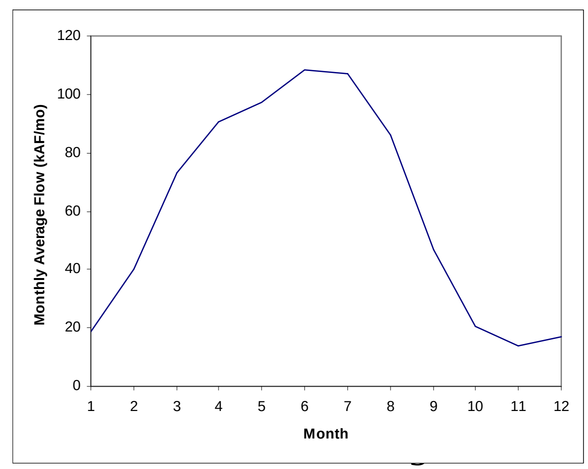
R.G. at Cerro





R.G. at Albuquerque





R.G. at El. Butte

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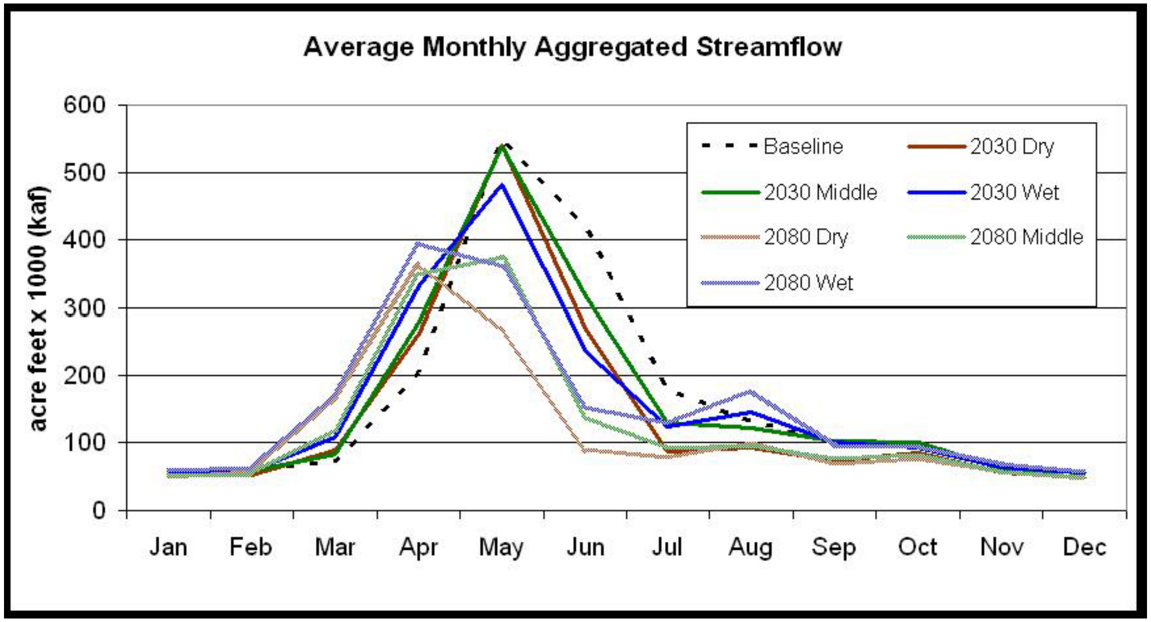
Impacts of Climate Change

(Hurd & Coonrod, 2007)

- Less snow pack
- Earlier snow melt
- Increased evaporation

- Earlier peak runoff
- Up to ~29% reduction in runoff by 2080



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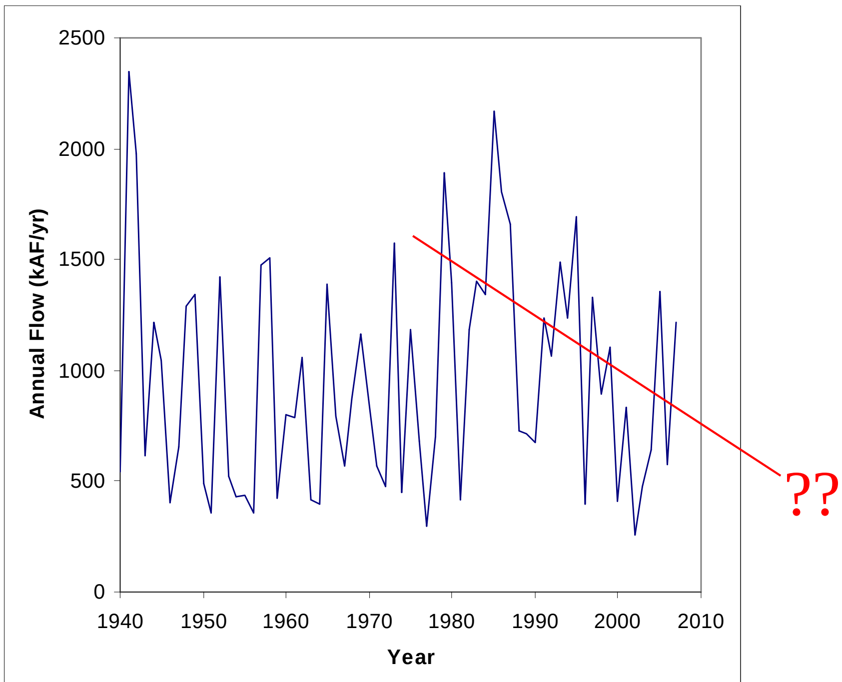
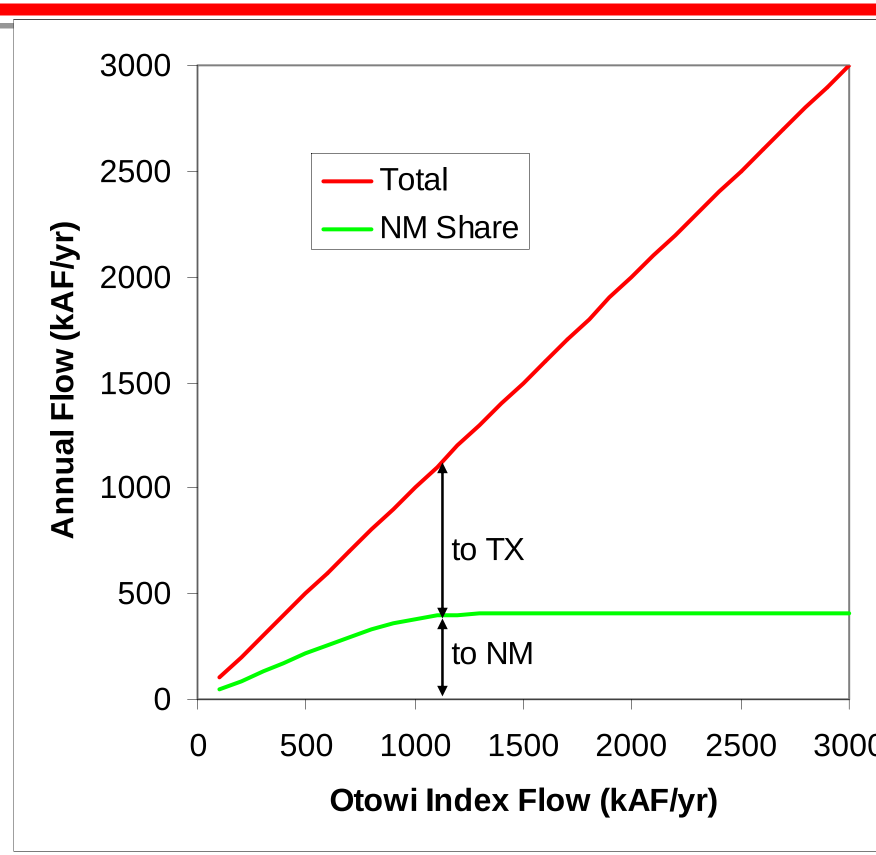
Index Flows at Otowi Gage

- Requires delivery of water to TX based on flows at Otowi gage



Otowi Index Flows



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Interbasin Transfers

- “New” sources of water?
  - Form of reallocation
- Familiar examples
  - Eastern NM Rural Water System (Ute Pipeline)
  - San Juan Chama Project
  - San Agustin Ranch
- Another source
  - Backish & saline ground water

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Objective

- Discuss principal issues related to interbasin transfers through use of 2 case studies:
  - Ute Pipeline
  - Estancia basin brackish water desalination project

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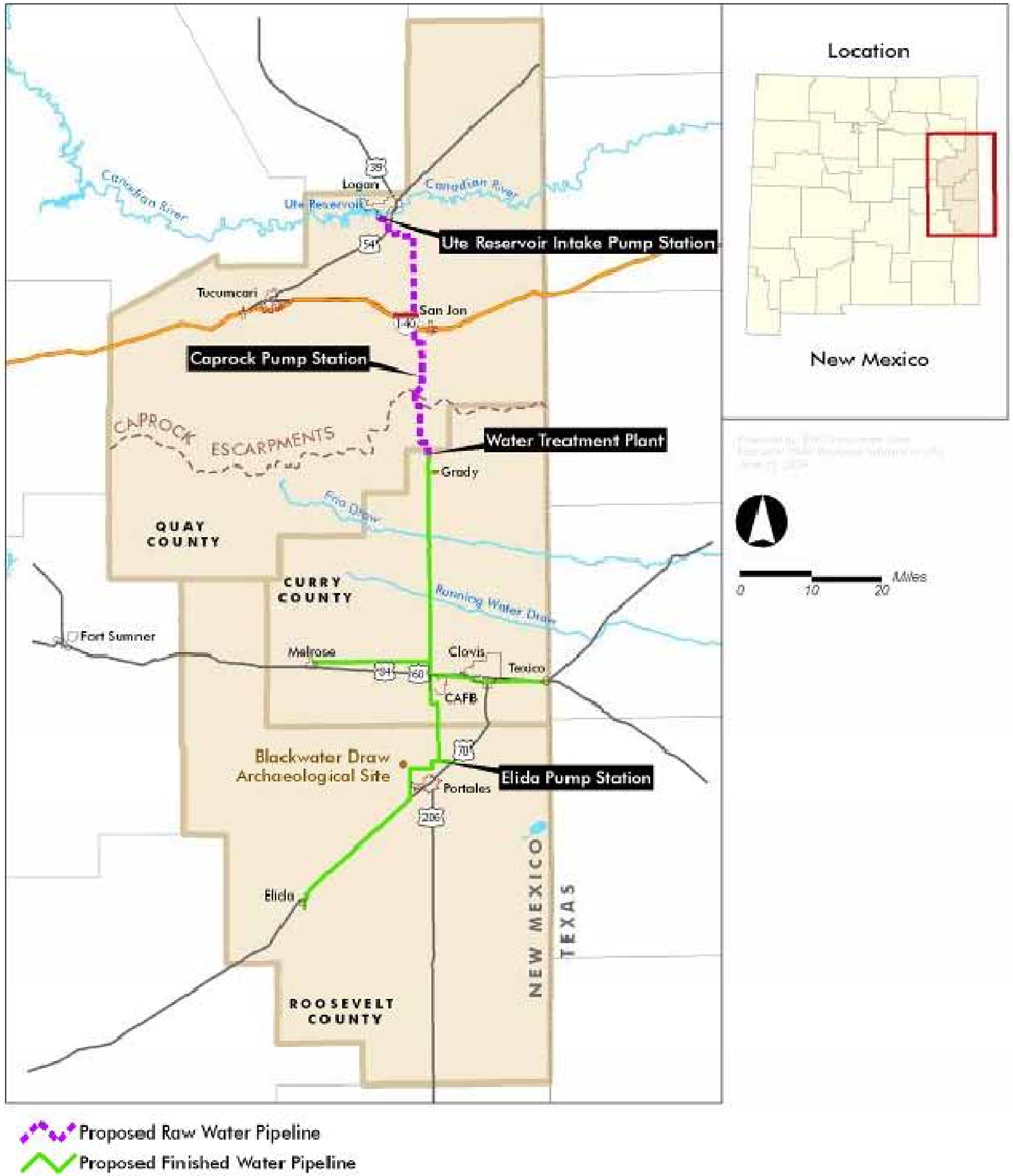
Ute Pipeline
(Draft EA, 2010)



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Issues with Current Supply

- Falling ground water elevations (1 to 3 ft/yr)
  - Decreased well capacity
  - Higher pumping costs
  - Thinner saturated zone hence requires more wells to produce same flow
- Water quality
  - High hardness
  - Elevated concentrations of As, F & other constituents in some supplies

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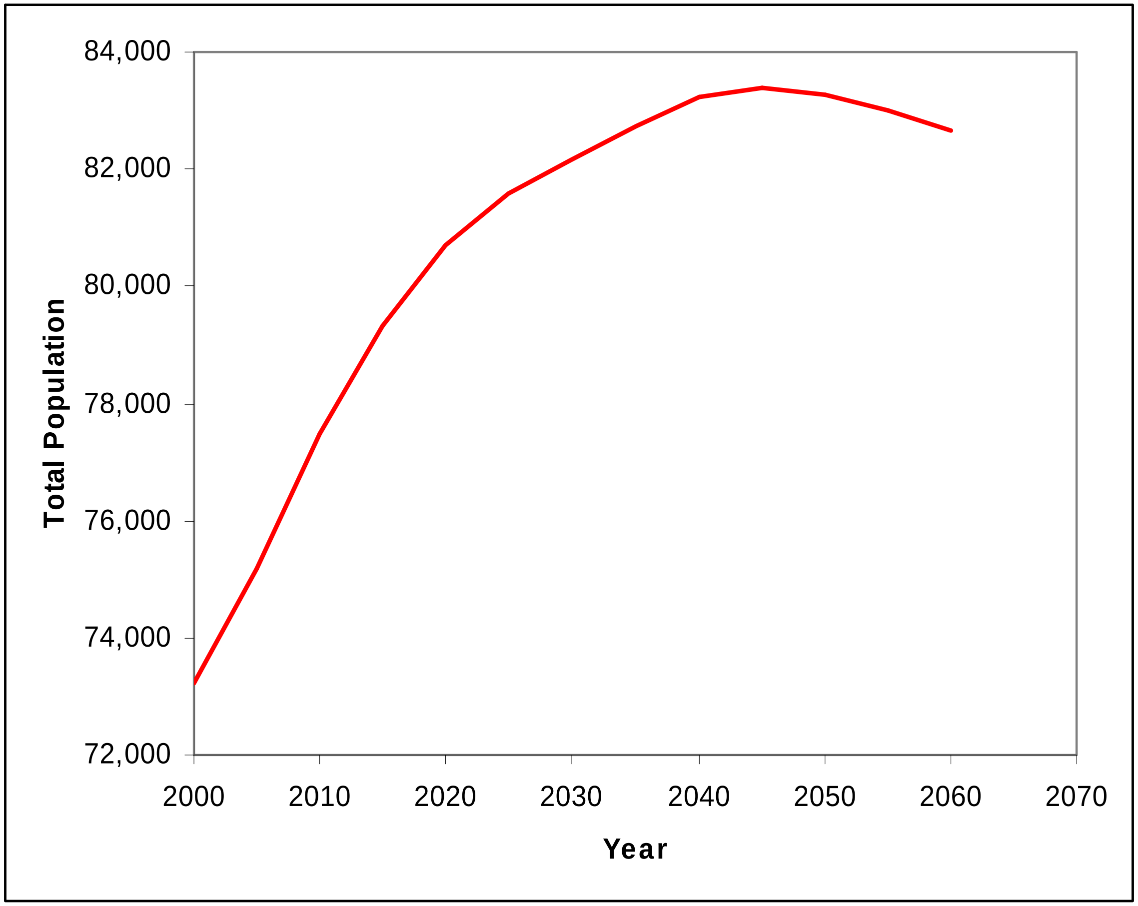
Population for Curry, Quay & Roosevelt Counties
(BBER, 2008)



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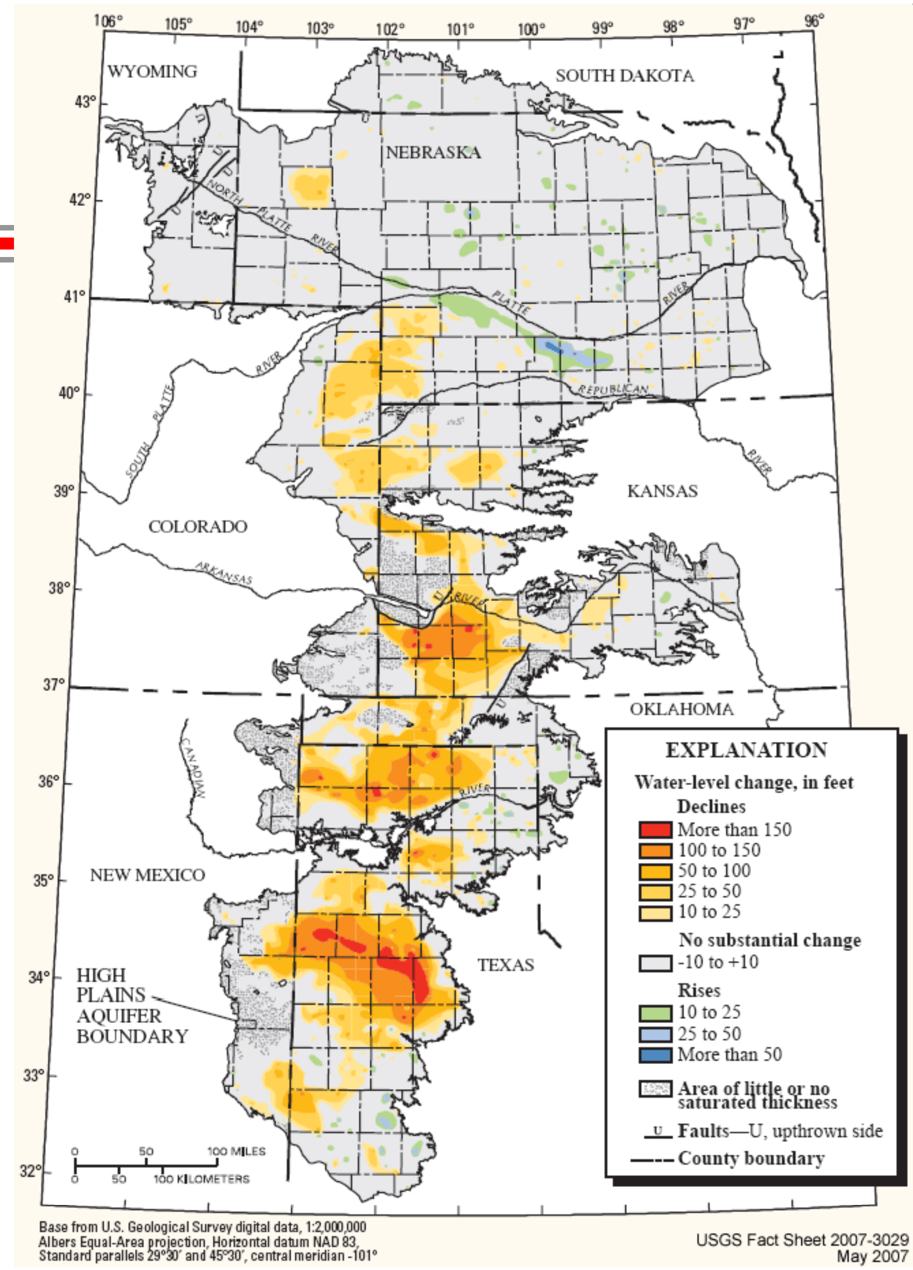
High Plains/Ogallala Aquifer



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Water Use for Curry, Quay & Roosevelt Cos.

(Longworth et al., 2008)

	Surface Water	Ground Water	Total
Commercial (self-supplied)	0	820	820
Domestic (self-supplied)	0	1031	1031
Industrial (self-supplied)	0	0	0
Irrigated Agriculture	37632	324833	362465
Livestock (self-supplied)	332	18905	19237
Mining (self-supplied)	0	143	143
Power (self-supplied)	0	14	14
Public Water Supply	0	11889	11889
Reservoir Evaporation	26181	0	26181
Totals	64145	357635	421780

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Community Participants in Ute Pipeline

Participating Communities	Amount (AF/yr)	Existing Use (AF/yr)
City of Clovis	12,292	6,162
Village of Elida	50	49
Village of Grady	75	21
Village of Melrose	250	141
City of Portales	3,333	4,217
Town of Texico	250	171
Curry County	100	1,013
Roosevelt County	100	1,776
Cannon AFB		1,121
Quay County Entities (nonparticipants)		
Village of San Jon	150	
City of Tucumcari	6,000	
Quay County	1,000	
Total	23,600	14,671

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Ute Pipeline Components

- Raw water intake
- Water treatment plant(s) – 30 Mgal/d
- Finished water conveyance & storage
  - ~87.5 miles of transmission line
  - ~94.8 miles of lateral lines
  - ~1000 ft elevation from Ute lake to caprock
- Cost ~$500 M
  - 75% federal
  - 15% state
  - 10% local

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Project Impacts

- Sustainable supply for communities
- Environmental issues
- Economic impacts
  - Ute Reservoir
  - Communities

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Benefit to Communities

- Sustainable future supply (?)

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Environmental Issues

- Endangered/threatened species
  - Arkansas River Shiner – present below Ute dam
  - Others – Least tern, Black footed ferret, Lesser prairie chicken

- Environmental impact appears to limited & manageable (Draft EA, 2010)

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Economic Impacts Near Ute Reservoir

- Project will decrease water stored in lake
- May affect
  - Property values
  - Tourism

Description	Output	Jobs	Labor Income
Direct Impact	$12.3M	263	$3.8M
Total Impact	$16.0 M	306	$3.9 M

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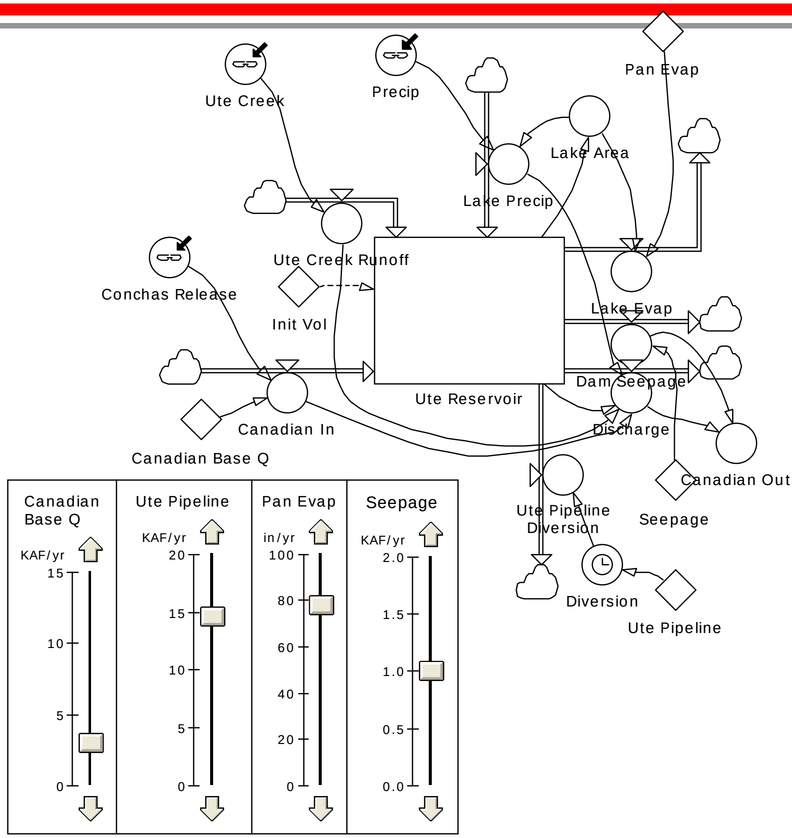
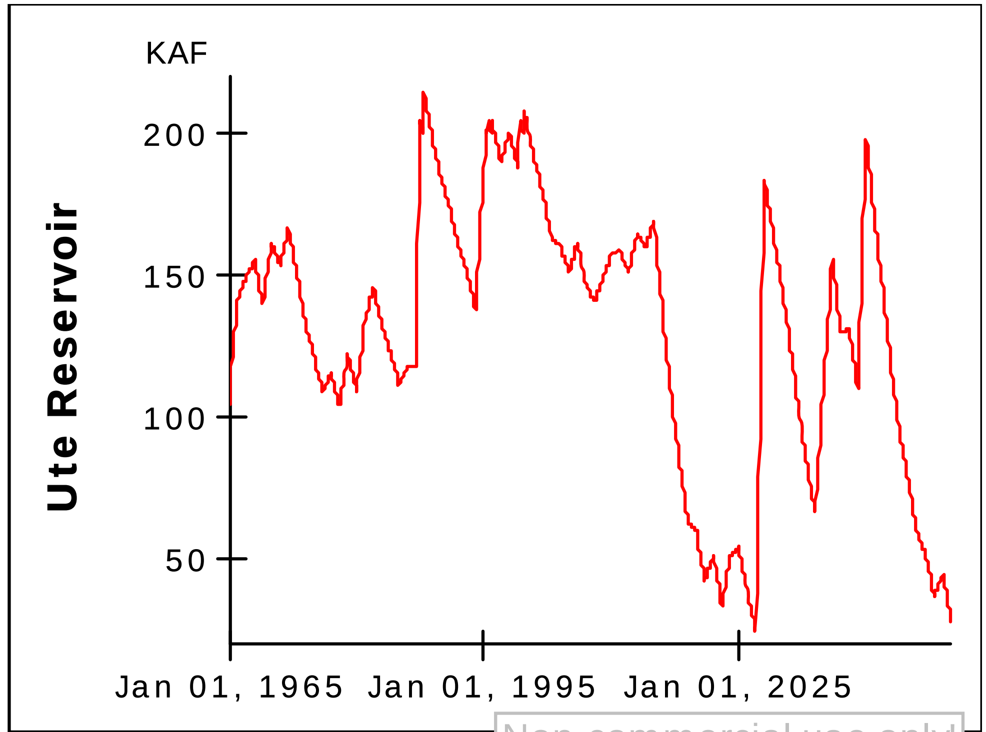
Simulated Ute Reservoir Capacity Through 2050





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Direct Economic Impacts

- Little industrial water use
  - Dairy processing
  - Beverage bottling
- Cannon AFB

- USBR Projections:
  - $100 million in regional economic output
  - $25 million in employee compensation
  - 1500 jobs will be generated by the project

- Economic model currently under development

Brackish/Saline Water Development: Estancia Basin

- Reynolds estimated that 75% of NM ground water is brackish or saline
- Not subject to NM administration until 2009
- Several projects have been proposed to develop resource, desalinate, & use as resource
- Example is Estancia Basin
  - Proposal to provide 7200 AF/yr to Santa Fe

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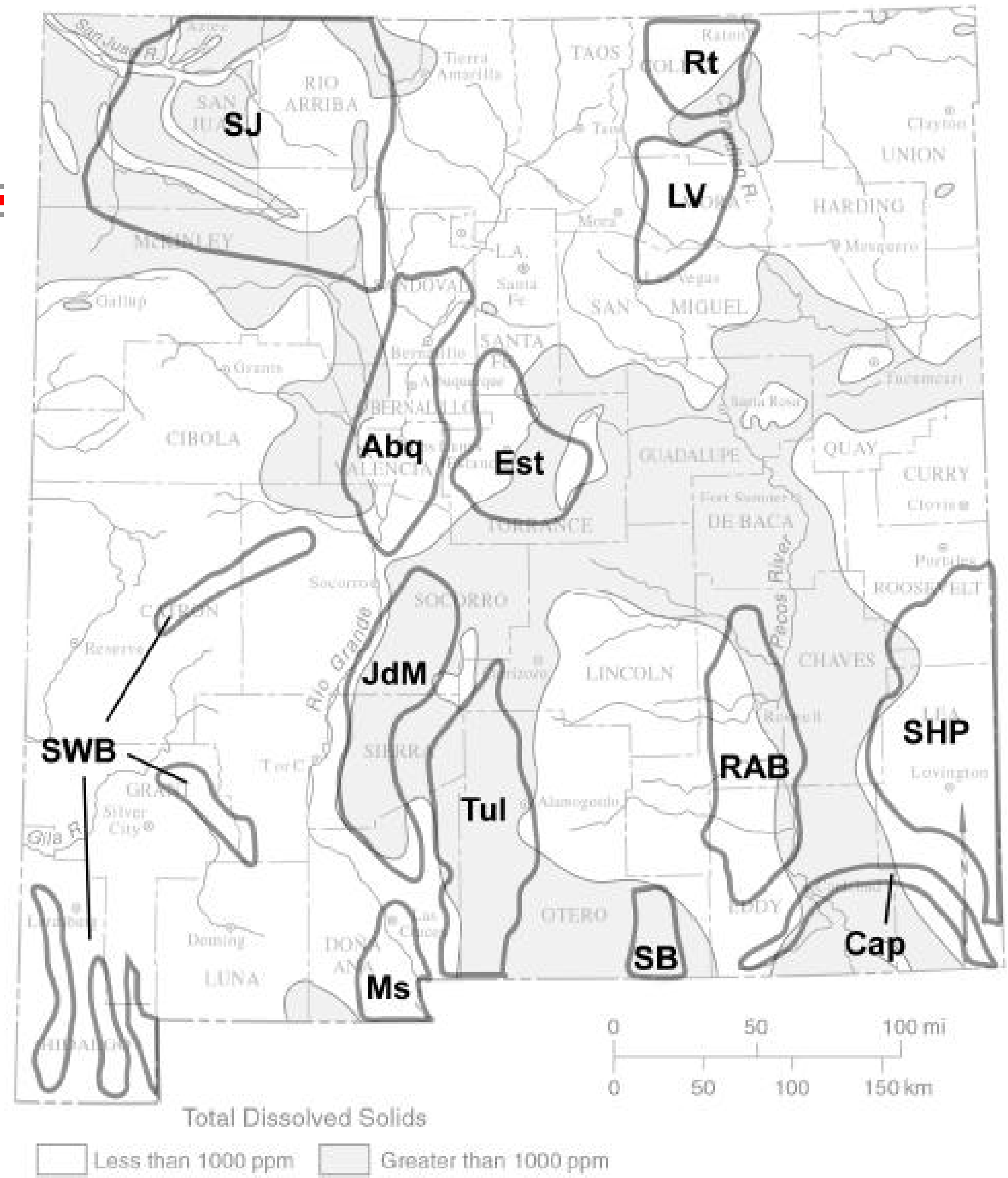
Saline Water Resources in NM



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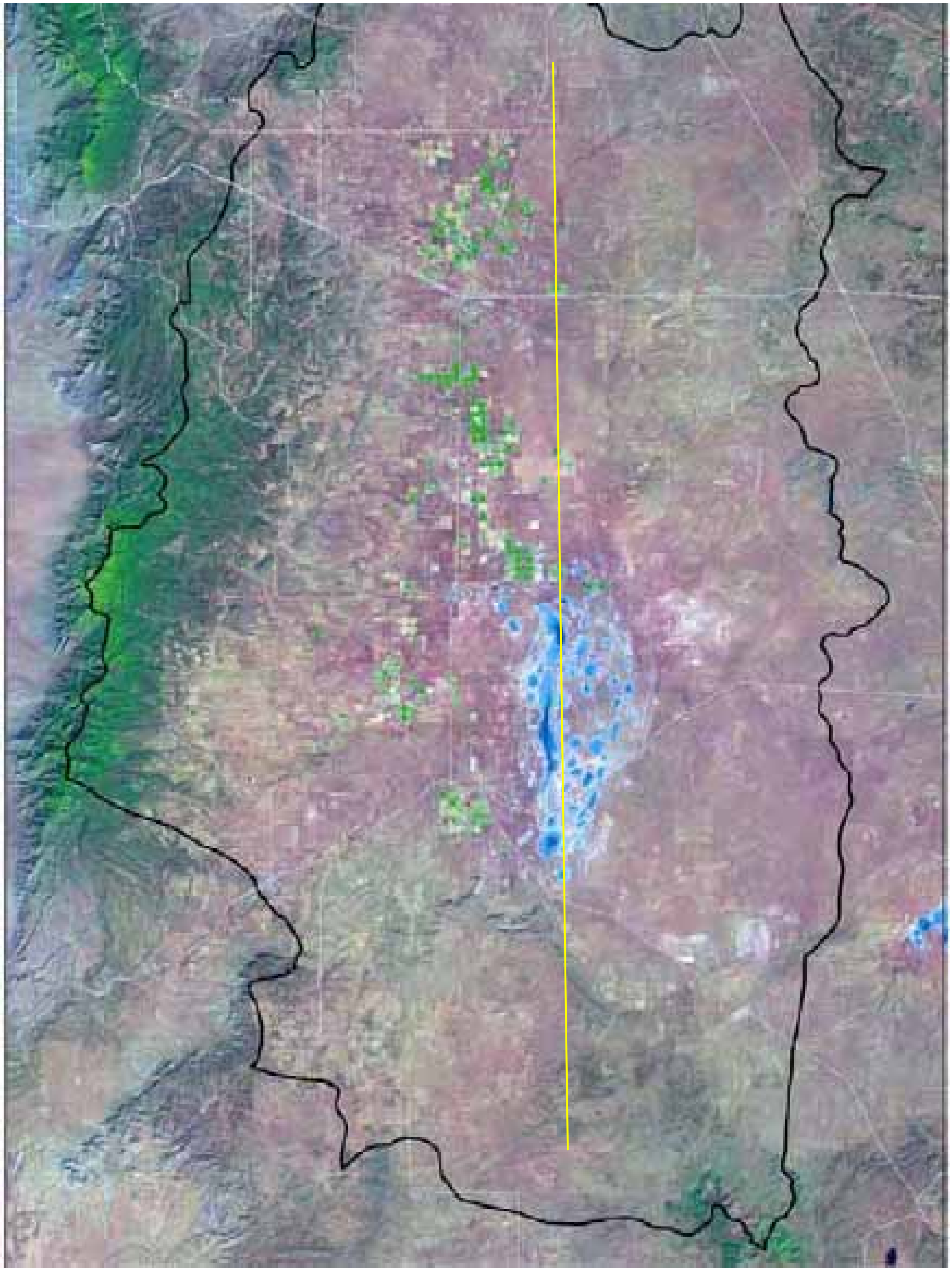
Estancia Basin



From Estancia Basin Water Plan

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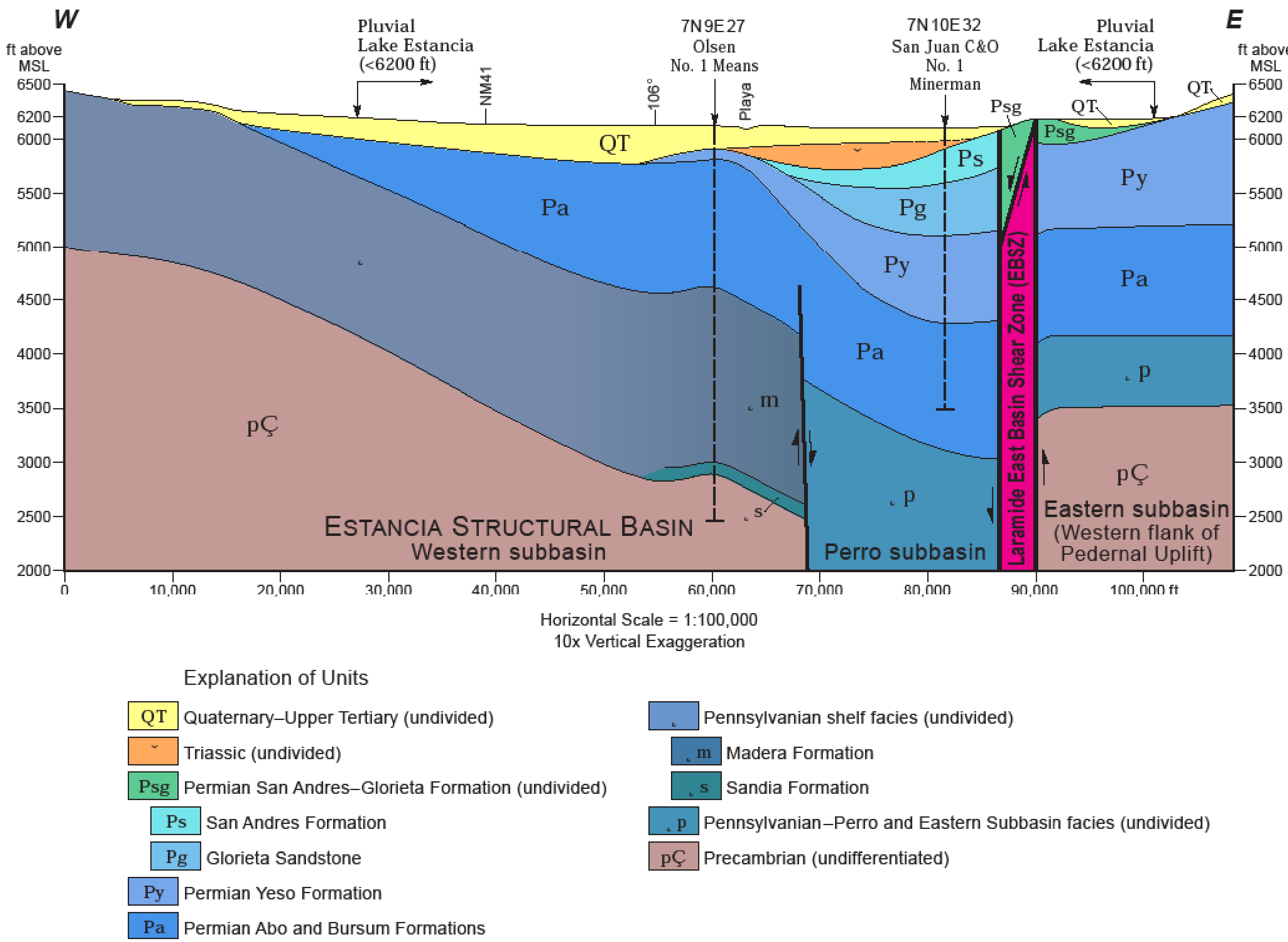

PLATE 2. Hydrogeologic section of the central Estancia groundwater basin (EGWB)

Current Depletion Rate
(Estancia Basin Plan Update, 2006)

Water Bearing Unit	Ground Water in Storage (MAF)	Depletion Rate (KAF/yr)
Valley Fill	6.58	52.1
San Andres Limestone	.067	N/A
Glorieta Sandstone	5.85	N/A
Yeso Formation	23.8	N/A
Abo Formation	44.9	N/A
Madera Group	11.1	61.2

>95% of water used for agriculture

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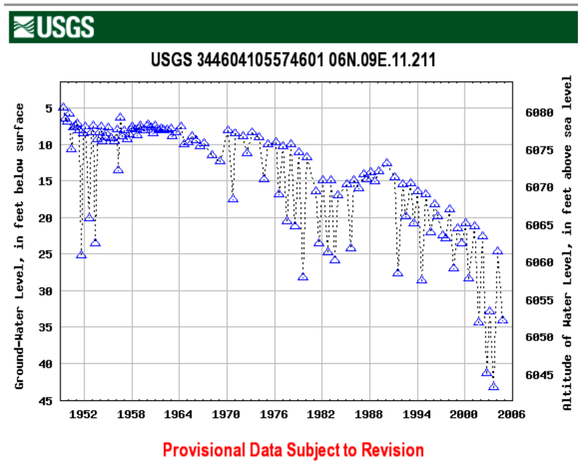
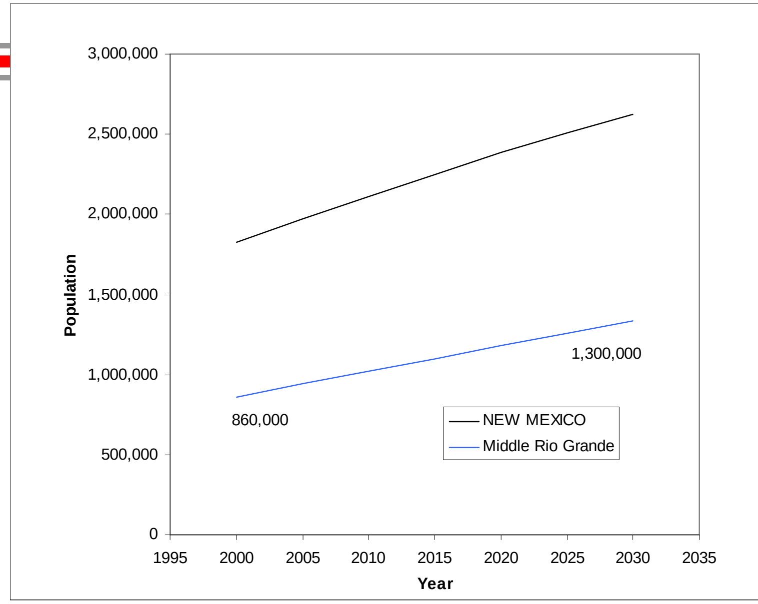
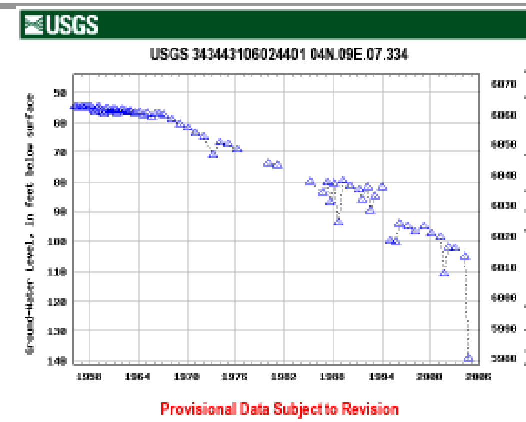
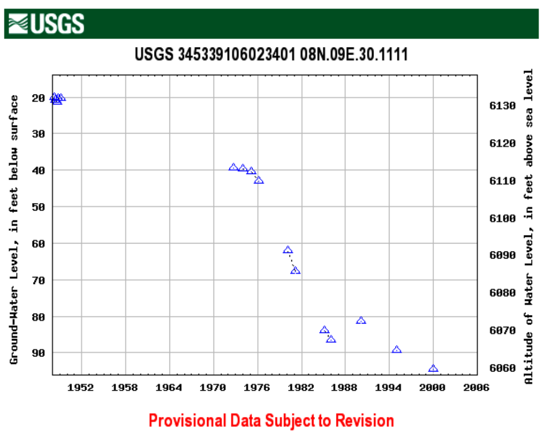
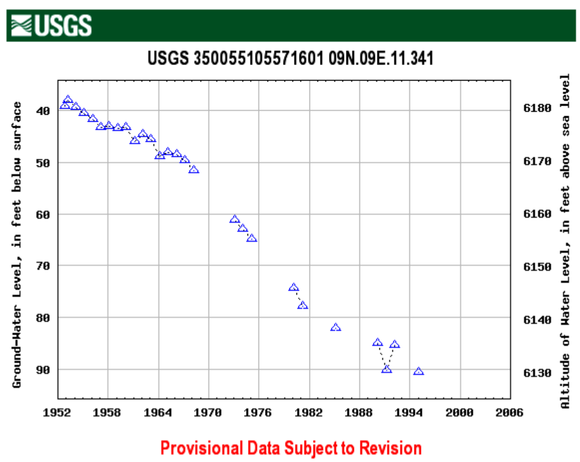
Declining Ground Water Levels

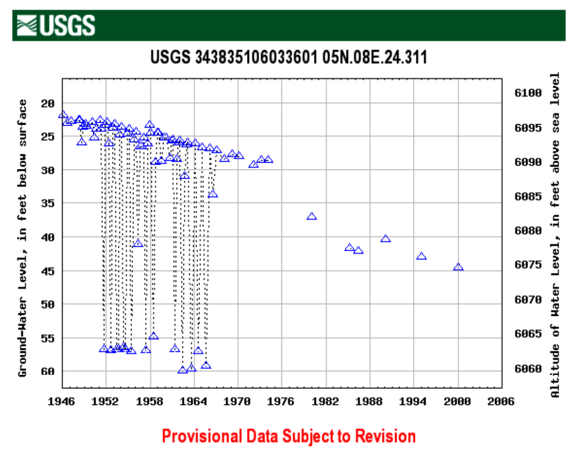












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Potential Impacts

- Ground water depletion
- Salinity encroachment
- Impacts of desalination
  - Energy consumption
  - Brine disposal
  - Cost

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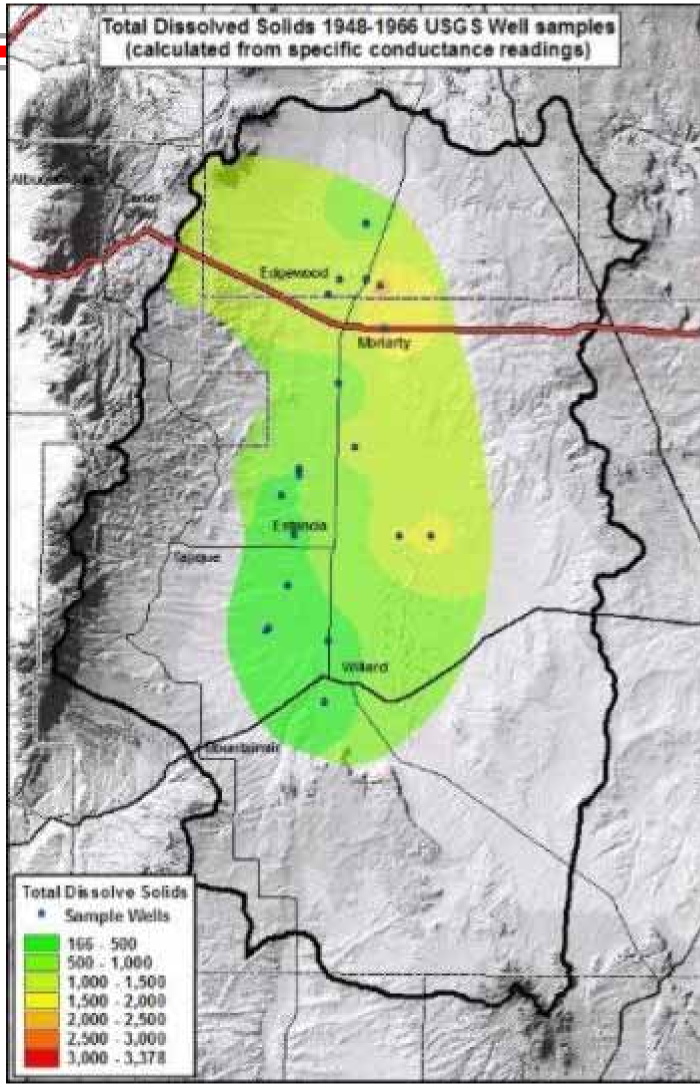
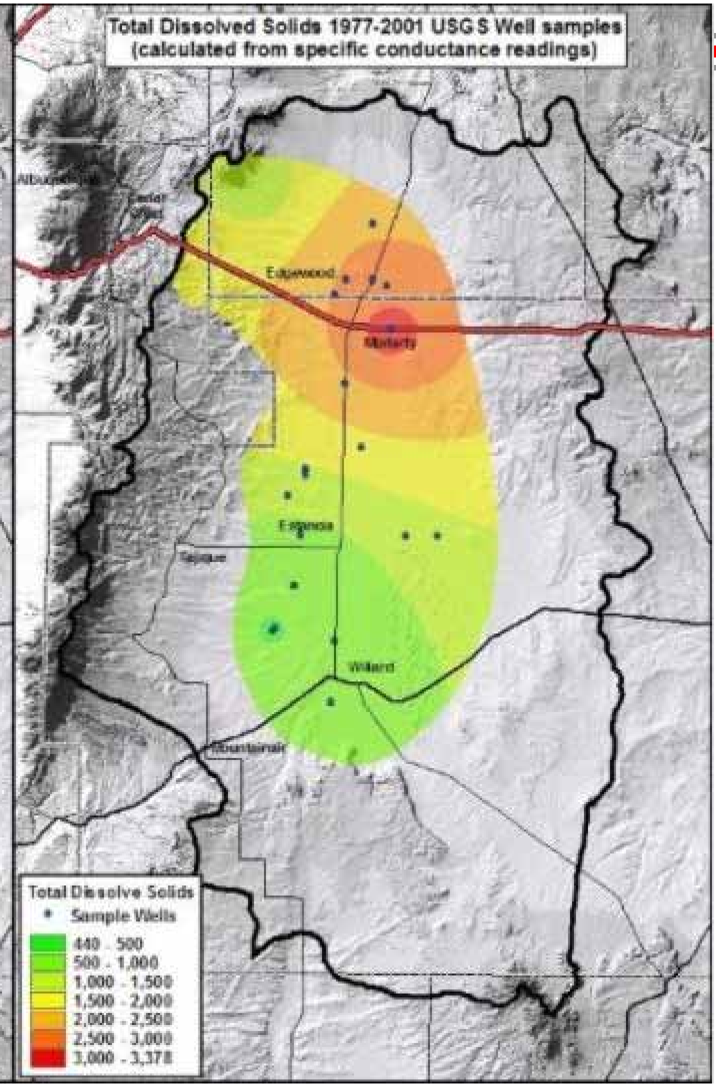
Salinity Encroachment from Current Pumping





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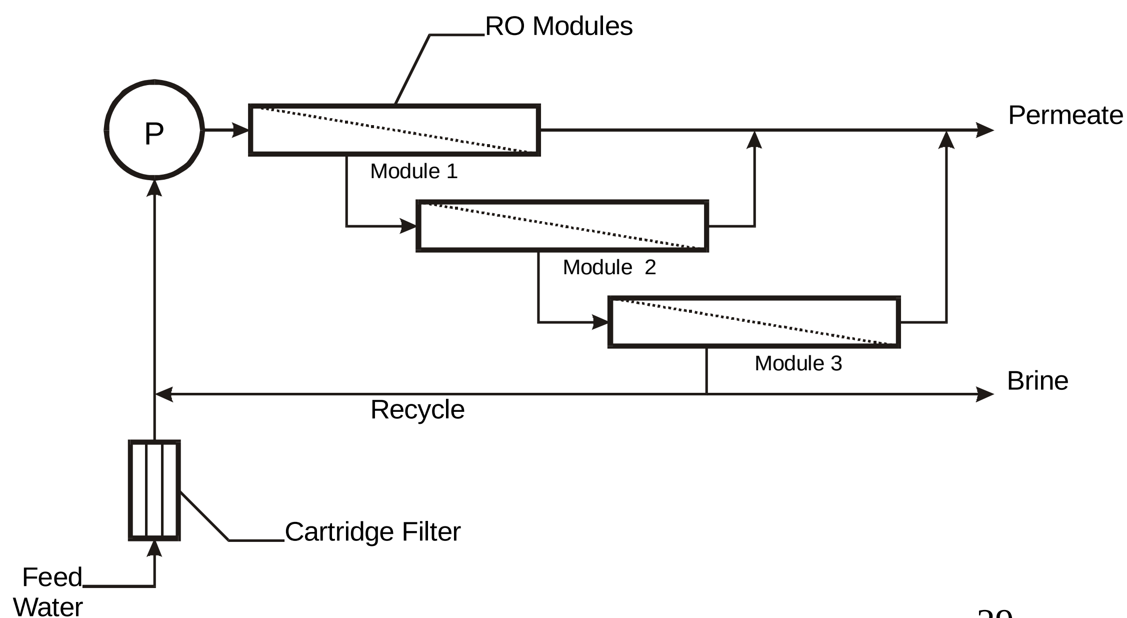
RO Process

- Important terms
  - Permeate - Water that passes through membrane
  - Concentrate (Brine) - Solution containing retained solutes
  - Recovery - Fraction of feed water recovered as permeate
  - Rejection - Fraction of solutes not passing through membrane



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Energy & Environmental Considerations

- A 5 MGD facility treating 2,000 mg/L TDS water to 85% recovery:
  - Feed pressure will be about 250 psi.
  - Power requirement for the feed pumps (85% eff) will be 12,600 kWh/day.
  - Using Albuquerque's electricity profile, CO_2 emissions will be 15,800 lbs CO_2/day.
- A 60 MGD facility treating 10,000 TDS water to 75% recovery:
  - 500 psi; 340,000 kWh/day; 430,000 lbs CO_2/day.

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Concentrate Disposal Considerations

- Very high TDS
  - Concentrated by 4x at 75% recovery
- High concentrations of toxic constituents present in feed water (As, Se, U, etc.)
- Reduced evaporation of salt saturated solutions
- High TDS solutions are corrosive
- Impacts on deep well injection process
  - Corrosion of equipment & well screens
  - Precipitation & cementing of subsurface formations

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Random Points

- Cost - Design study for 5 Mgd system in NM (TDS ~12,000 mg/L)
  - Capital cost =$143M
  - Total cost of water = $8.50/1,000 gal

- Caution
  - Should not design system based on consumptive use - must be based on water demand (i.e. water delivered to houses)
  - Can design for consumptive use if wastewater is recycled back to RO plant for reuse

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Benefits & Impacts of Estancia Basin Project

- Economic benefit (~$200 M) to owners
- Uncertain regional impacts on ground water resources
  - Increased drawdown
  - Water quality
- Significant carbon footprint
- Concentrate disposal

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Summary Remarks

- Opportunities for interbasin transfers are increasingly limited
- Considerations include
  - Technical, especially resource availability
  - Economic
    - Project costs
    - Benefits – direct & indirect
    - Funding
  - Regulatory/Legal/Political
  - Environmental
- Evaluation of transfers requires extensive dialog among managers, funding agencies & stakeholders

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Acknowledgements

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