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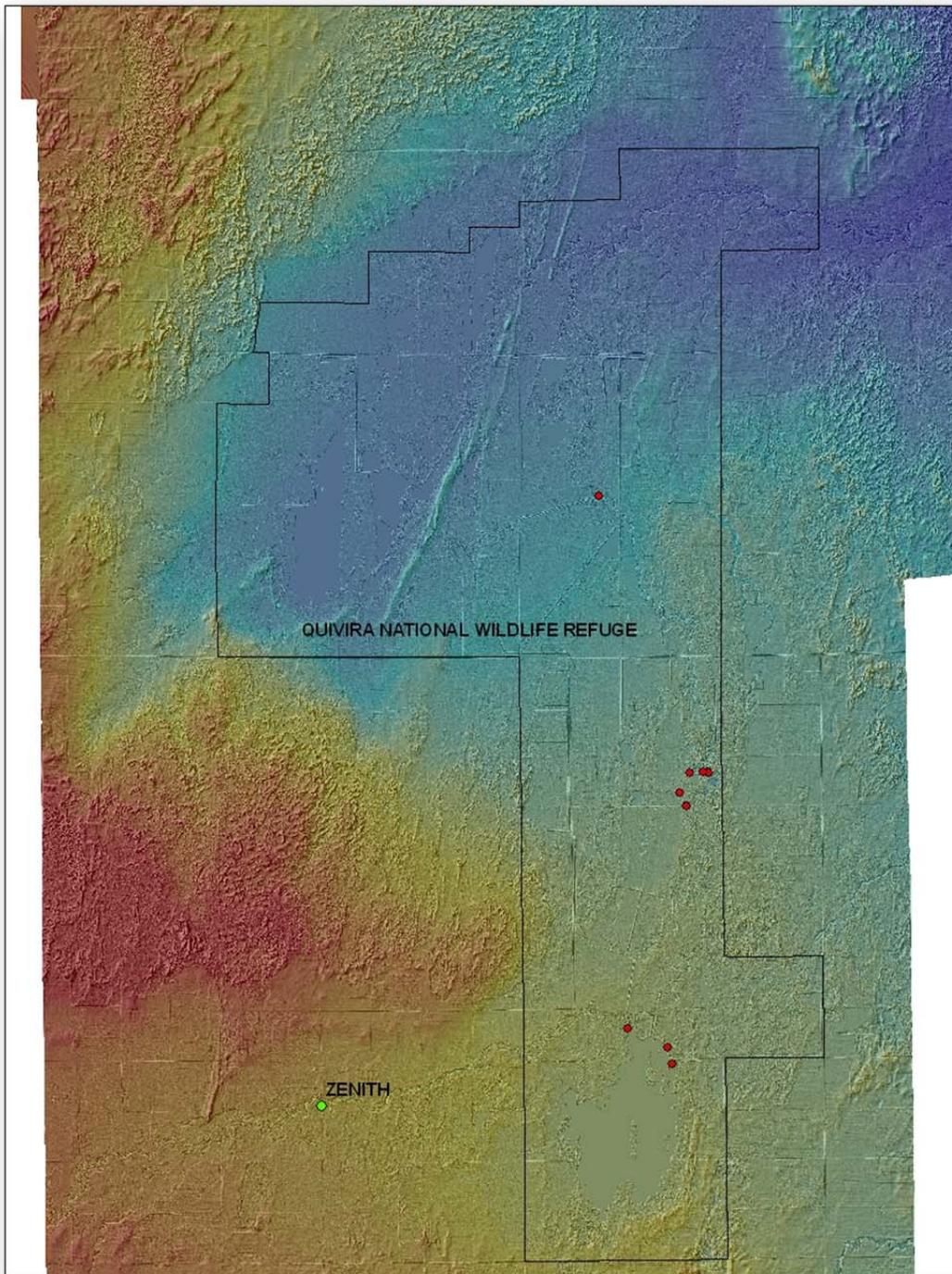
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*Hydrologic Observations in Preparation for RCP-12.2*



1: Rattlesnake Creek with Zero Flow, 2011, Credit: D.Severson/USFWS

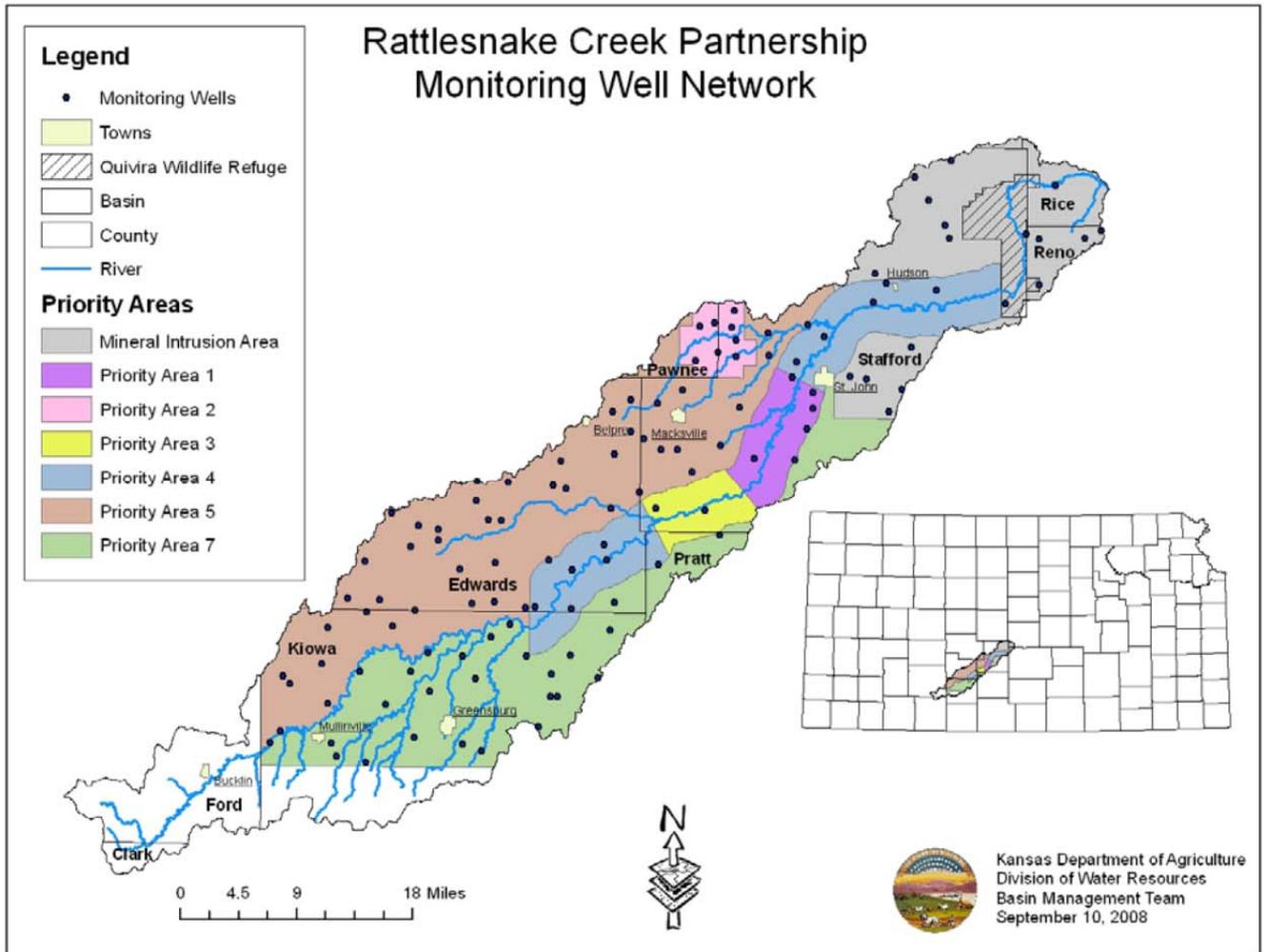
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2: Quivira National Wildlife Refuge - Points of Diversion

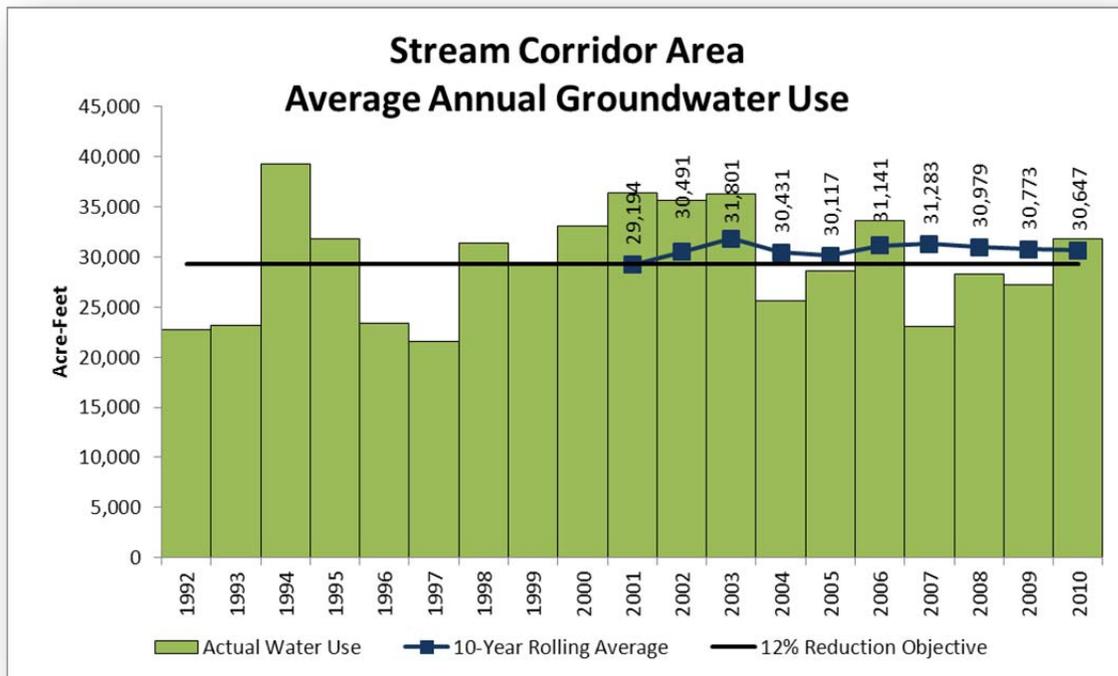
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### Map of Rattlesnake Creek Sub-Basin and Priority Areas



3: Map of Rattlesnake Creek Priority Areas, (Basin Management Team, 2009)

## Stream Corridor - Priority Areas 1, 3, 4



### 4: Stream Corridor Area, Average Annual Groundwater Use, (Basin Management Team, 2012)

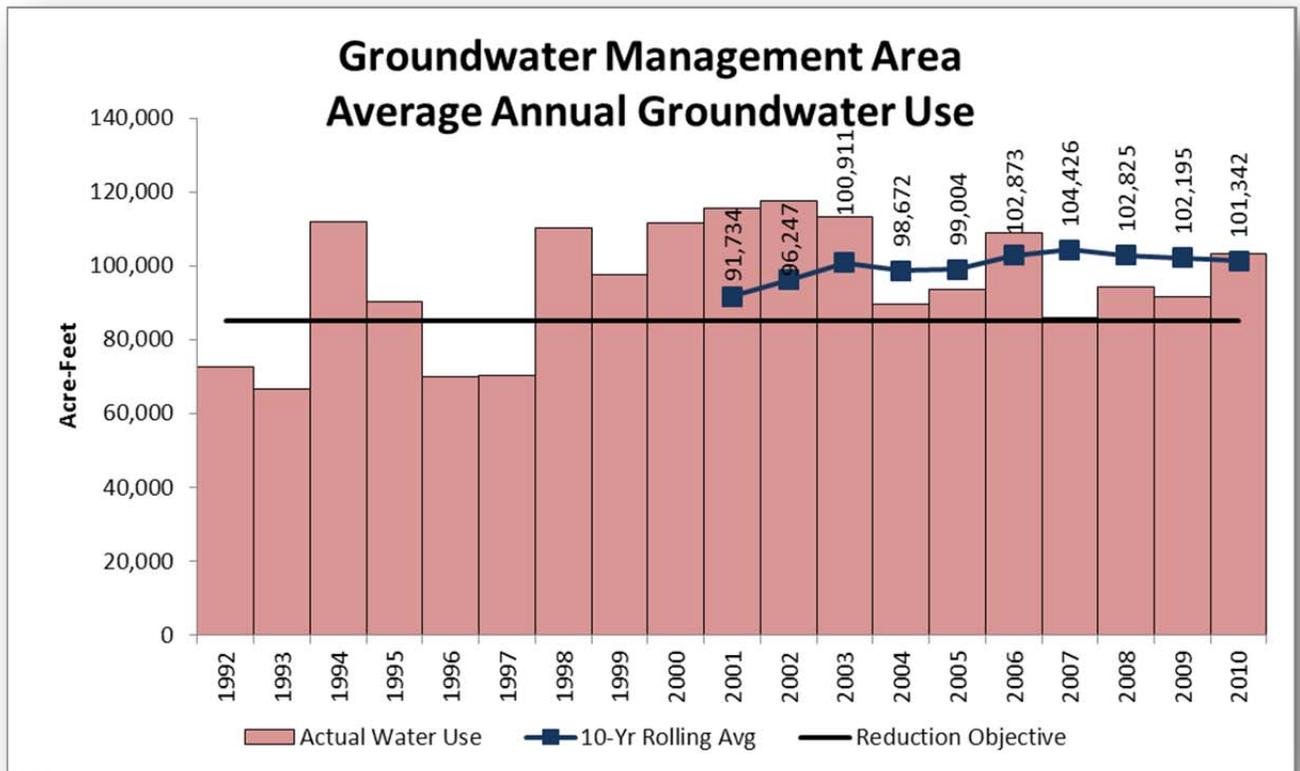
#### 12-Year Review

- Stream Corridor includes Priority Areas 1, 3, and 4.
- Management Objective is 29,284 acre feet/year, a 12% reduction
- 10 year moving avg between 2000 to 2010 increased 5%
- Average groundwater use 2001-2012= 30,647.....105% of Management Objective

#### Summary

- Management Objectives were not met.
- Hydrologic Conditions moved further away from goals.
- Management Programs are ineffective.

## Groundwater Management Area – Priority Areas 2, 5, and Mystery River



### 5: Groundwater Management Area, Avg Annual Groundwater Use, (Basin Management Team, 2012)

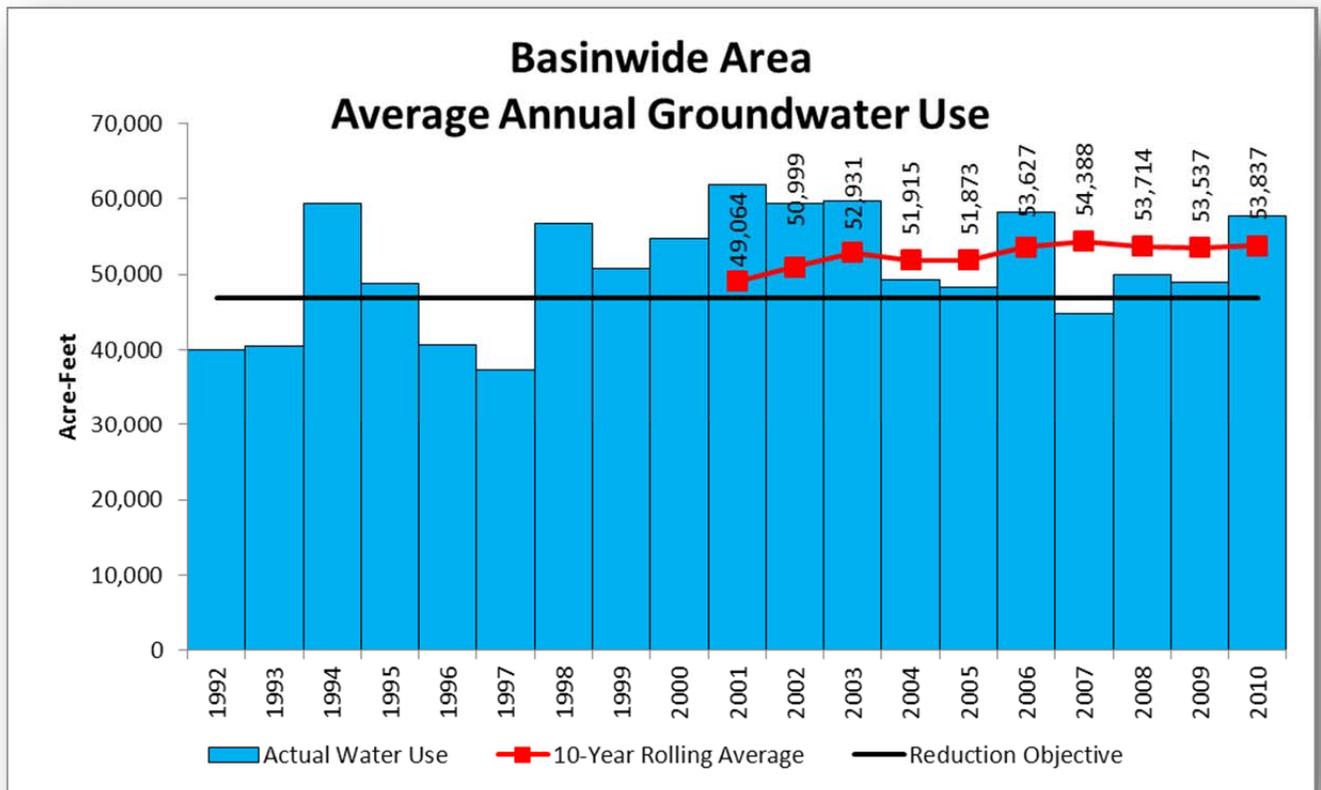
#### 12-Year Review

- Groundwater Management Area includes Priority Areas 2 and 5, and the Mystery River Area
- Groundwater use reduction goal is 84,996 acre feet/year
- 10 year moving avg from 2000 to 2010 increased 10%
- 10 year moving avg in 2010 is 16,346 acre feet above the reduction objective
- Year 2002 had the highest groundwater use: 117,637 acre feet
- Average groundwater use 2001-2012 is 101,342= 120% of Management Objective

#### Summary

- Management Objectives were not met.
- Hydrologic Conditions moved further away from goals.
- Management Programs are ineffective.

## Priority Areas 7 and Mineral Intrusion Area



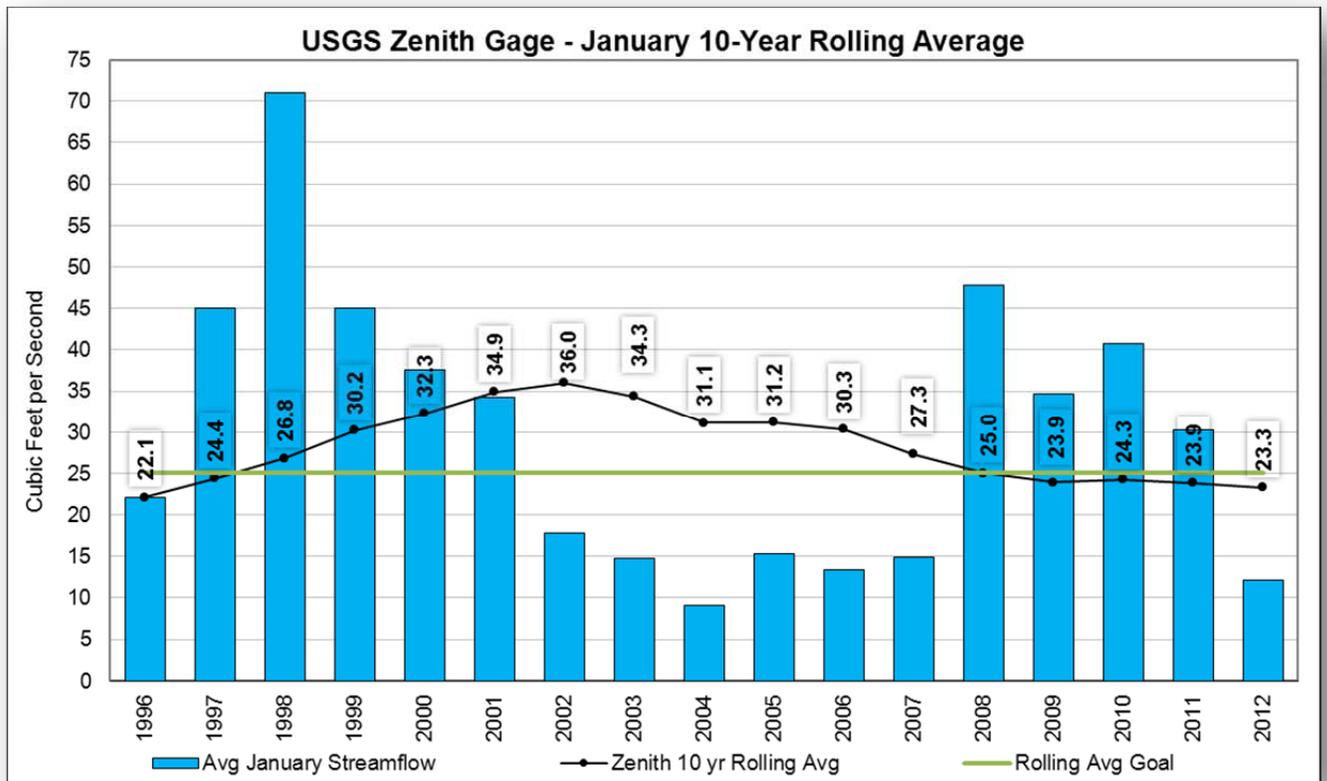
### 6: "Basin-wide" Area, Average Annual Groundwater Use, (Basin Management Team, 2012)

- Area includes Priority Area 7 and the Mineral Intrusion Area
- Groundwater use reduction goal is 46,906 acre feet/year
- 10 year moving avg from 2000 to 2010 increased almost 10%
- 10 year moving avg in 2010 is 6931 acre feet above the reduction objective
- Year 2001 had the highest groundwater use: 61,848 acre feet
- Average groundwater use 2001-2012 is 53,837=115% of Management Objective

#### Summary

- Management Objectives were not met.
- Hydrologic Conditions moved further away from goals.
- Management Programs are ineffective.

## Zenith 10 Year January Rolling Average



### 7: Zenith 10 Year January Moving Average, (Basin Management Team, 2012)

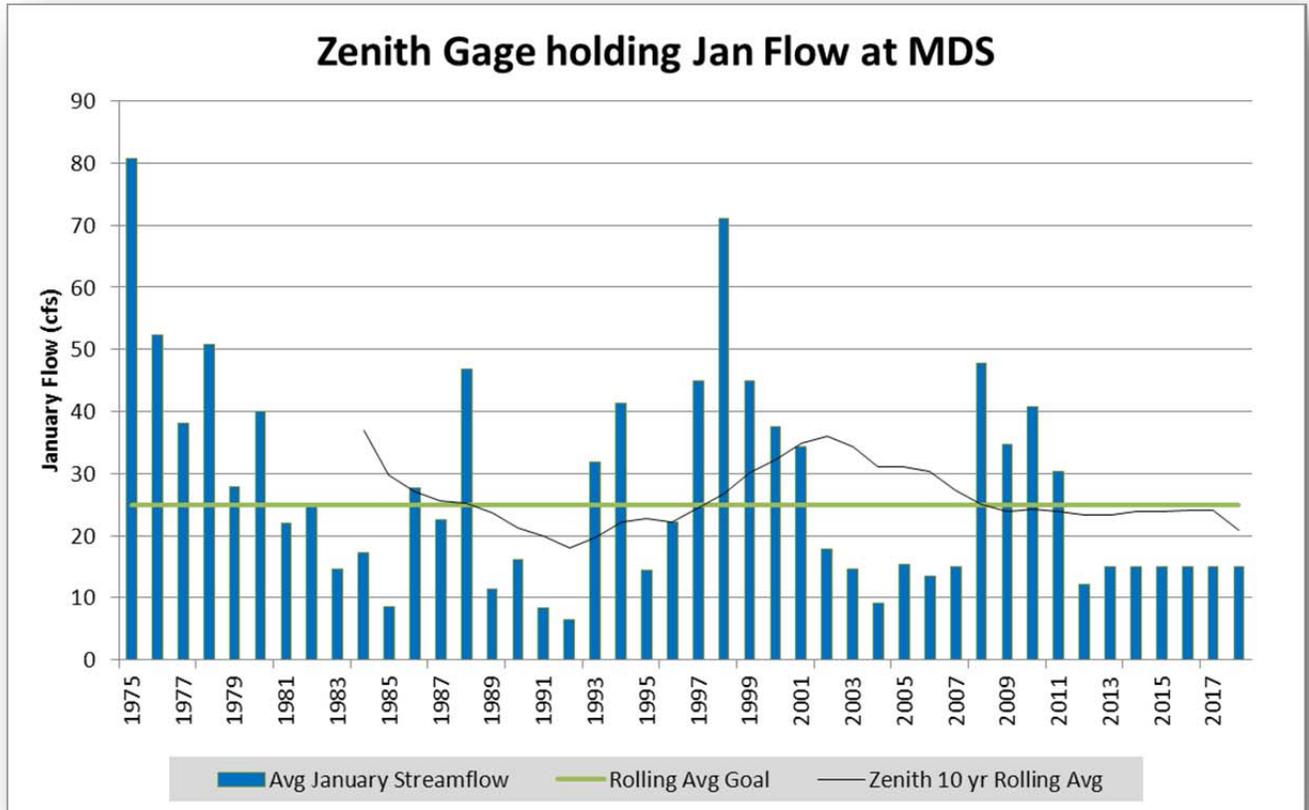
#### 12-Year Review

- Management goal for January 10 year rolling avg is 25 cfs
- Goal has not been met since 2007 despite wet years in 2007, 2008, 2009, and 2010
- 10 year moving average has declined steadily since 2002

#### Summary

- Management Objectives were not met.
- Hydrologic Conditions moved further away from goals.
- Management Programs are ineffective.

## Zenith 10 Year January Rolling Average- Projected



### 8: Zenith Gage Projected Flow

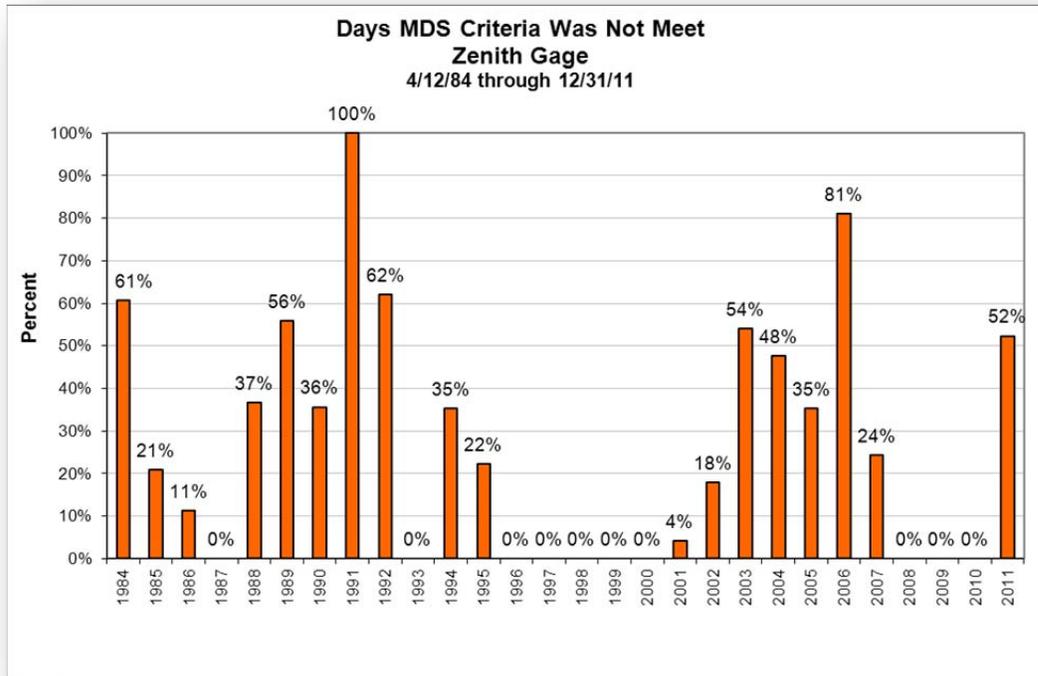
#### 12-Year Review

- Holding January flow at the 15 cfs MDS criteria (2013 to 2018) does not raise the 10 yr rolling avg above the 25 cfs mandate
- More than MDS flows are needed to bring the rolling avg above 25 cfs rolling avg in January

#### Summary

- Management Objectives were not met.
- Hydrologic Conditions moved further away from goals.
- Management Programs are ineffective.

## Zenith MDS

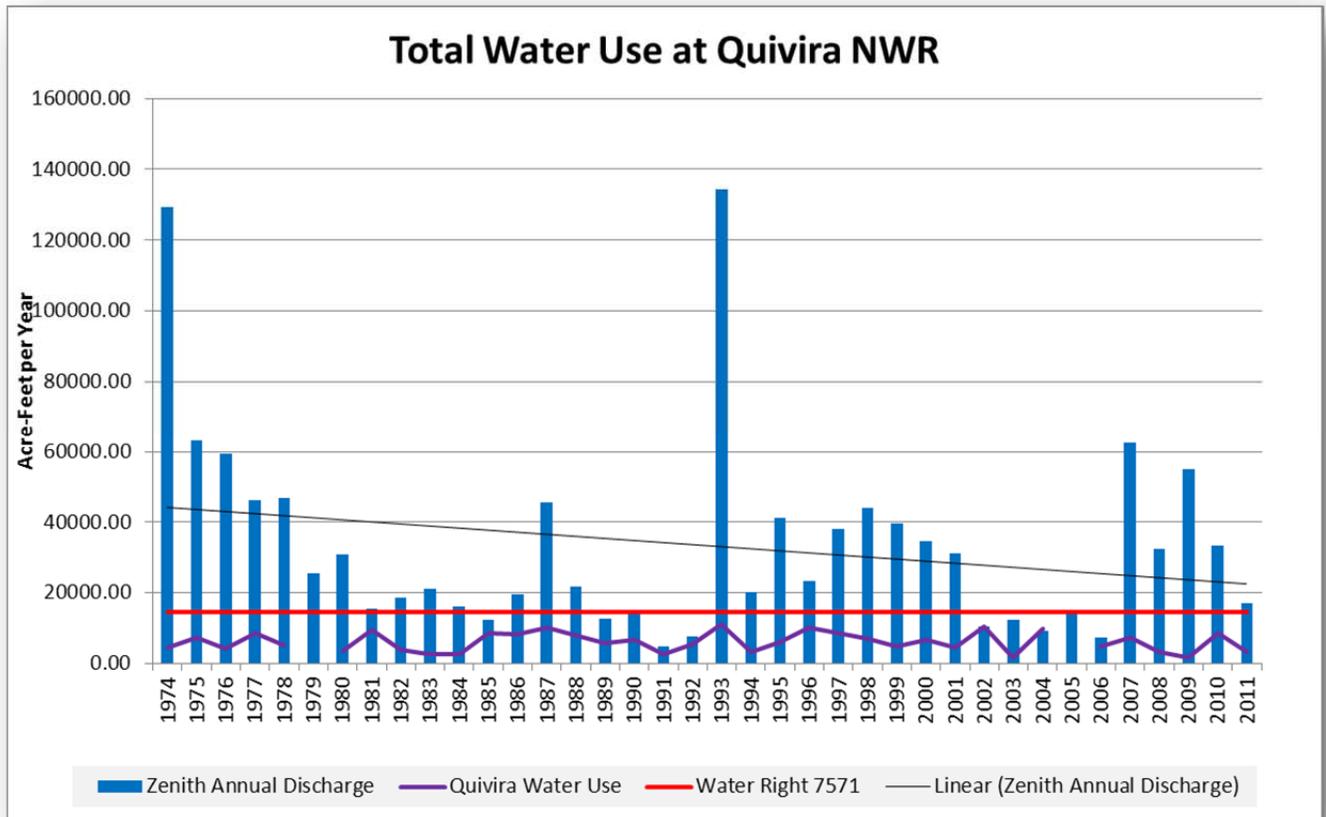


### 9: Zenith Gage MDS Violations, (Basin Management Team, 2012)

#### Consecutive Day Periods

- 11/2001      8 days
- 12/2001      12 days
- 06/2002      15 days
- 06/2002      8 days
- 12/2002      36 days
- 06/2003      8 days, 9 days
- 07/2003      22 days
- 08/2003      20 days
- 09/2000      35 days
- 11/2003      124 days
- 04/2004      45 days
- 05/2004      29 days
- 06/2004      8 days
- 01/2005      21 days
- 05/2005      11 days
- 11/2005      26 days
- 12/2005      10 days
- 12/2005      47 days
- 04/2006      31 days
- 05/2006      29 days
- 06/2006      18 days
- 07/2006      20 days
- 09/2006      10 days, 11 days
- 11/2006      50 days
- 12/2006      6days
- 01/2007      40 days
- 03/2007      18 days
- 06/2011      23 days
- 07/2011      31 days
- 08/2011      48 days
- 10/2011      22 days
- 11/2011      14 days
- 12/2011      67 days

## Total Water Use at Quivira



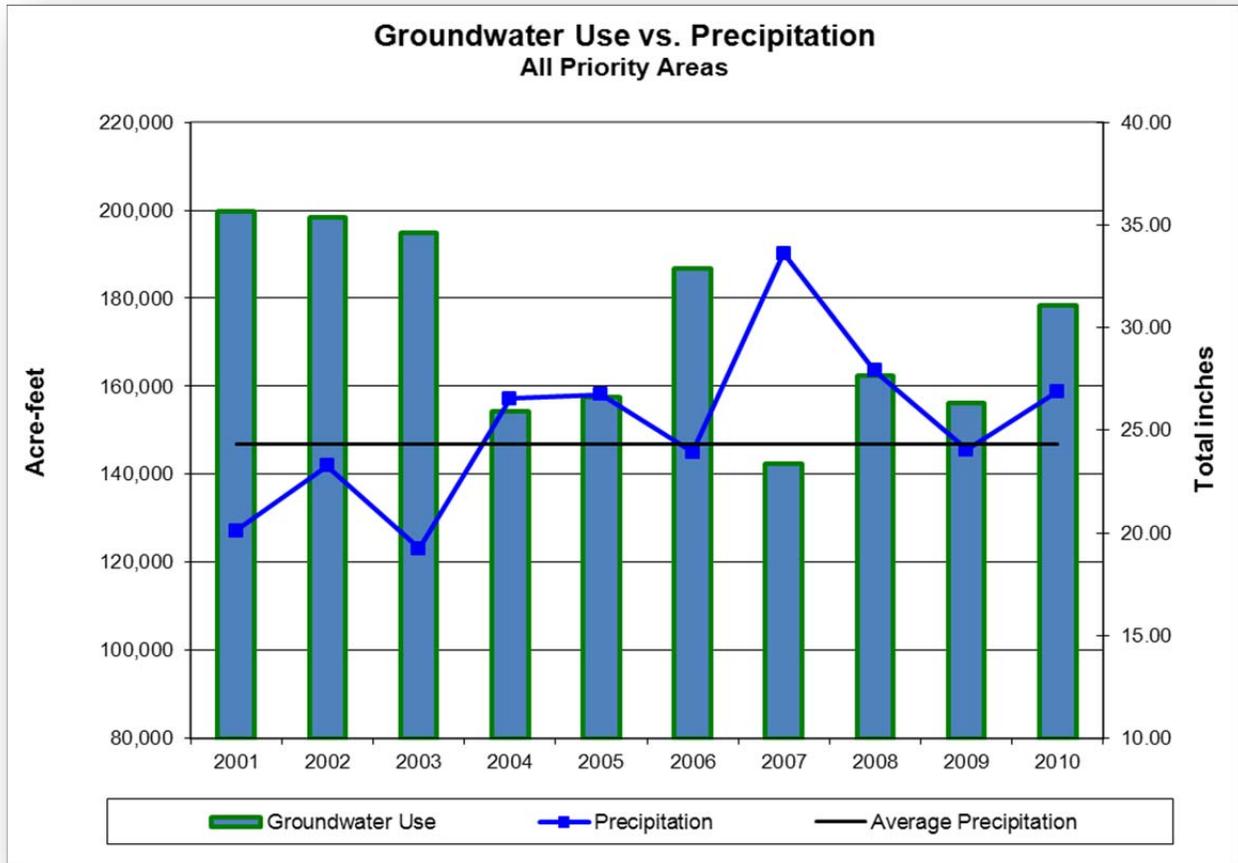
### 10: Total Water Use\* at Quivira NWR

#### 12 Year Review

- Total discharge past the Zenith gage from 1974 to 2011
- Linear trend line shows nearly 20,000 AFY decline in Rattlesnake Creek annual discharge
- 5 years (2002-2006) during the 12 Partnership Management years (2001-2012) , flow at Zenith Gage was less than Water Right 7571
- Quivira NWR Water Use Summary
  - Years with the greatest need have the lowest water available
  - Years with the greatest flows have the lowest needs for wildlife habitat management
  - Highest water use year at Quivira was 1993 with 11,213 AFY, 77% of water right 7571

\* Total water use does not include water used to refill Little Salt Marsh, ET or conveyance losses.

## All Areas- Groundwater Use vs Precipitation



### 11: Groundwater Use vs Precipitation, All Priority Areas

#### 12-Year Review

- Groundwater use reductions are a result of above average precip since 2003
- Groundwater Use Reduction Goal is 161,187 AFY
- Average groundwater use 2001-2010 was 173,056...11,869 acre feet above goal (107% of target)

#### Summary

- GW use meets target level only in above average precip years
- 2008 had 115% average annual precip, and GW use above target by 1000AFY
- Management Objectives were not met.
- Hydrologic Conditions moved further away from goals.
- Management Programs are ineffective.

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## Works Cited

- Basin Management Team. (2009). *Rattlesnake Creek Partnership, Second Four-Year Review of Management Program 2005-2008*. Topeka, KS: Kansas Department of Agriculture.
- Basin Management Team. (2012, March 01). *Rattlesnake Creek Subbasin Management Program 12-Year Review*. Retrieved March 07, 2012, from Kansas Department of Agriculture::Rattlesnake Creek: <http://www.ksda.gov/subbasin/content/201/cid/1974>

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