Forecasting Republican River Basin Water Supply To Ensure Dry-Year Compact Compliance

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Introduction

- Republican River Compact allocates Virgin Water Supply (VWS)
  - Streamflow
  - Surface Water Use
  - Groundwater Use
- Nebraska's allocation is approximately half of the Virgin Water Supply
- Under Settlement accounting uses Computed Water Supply (CWS)

Compact Compliance

- Normally measured on a 5-year average
  - Current restrictions on development and existing users ensure compliance during these average and wet periods
- Dry conditions can trigger Water Short-Year Administration
  - Compliance measured on a 2- or 3-year average
  - Reduced water supply can result in the necessity for additional action to ensure compliance

A Forecast is Essential

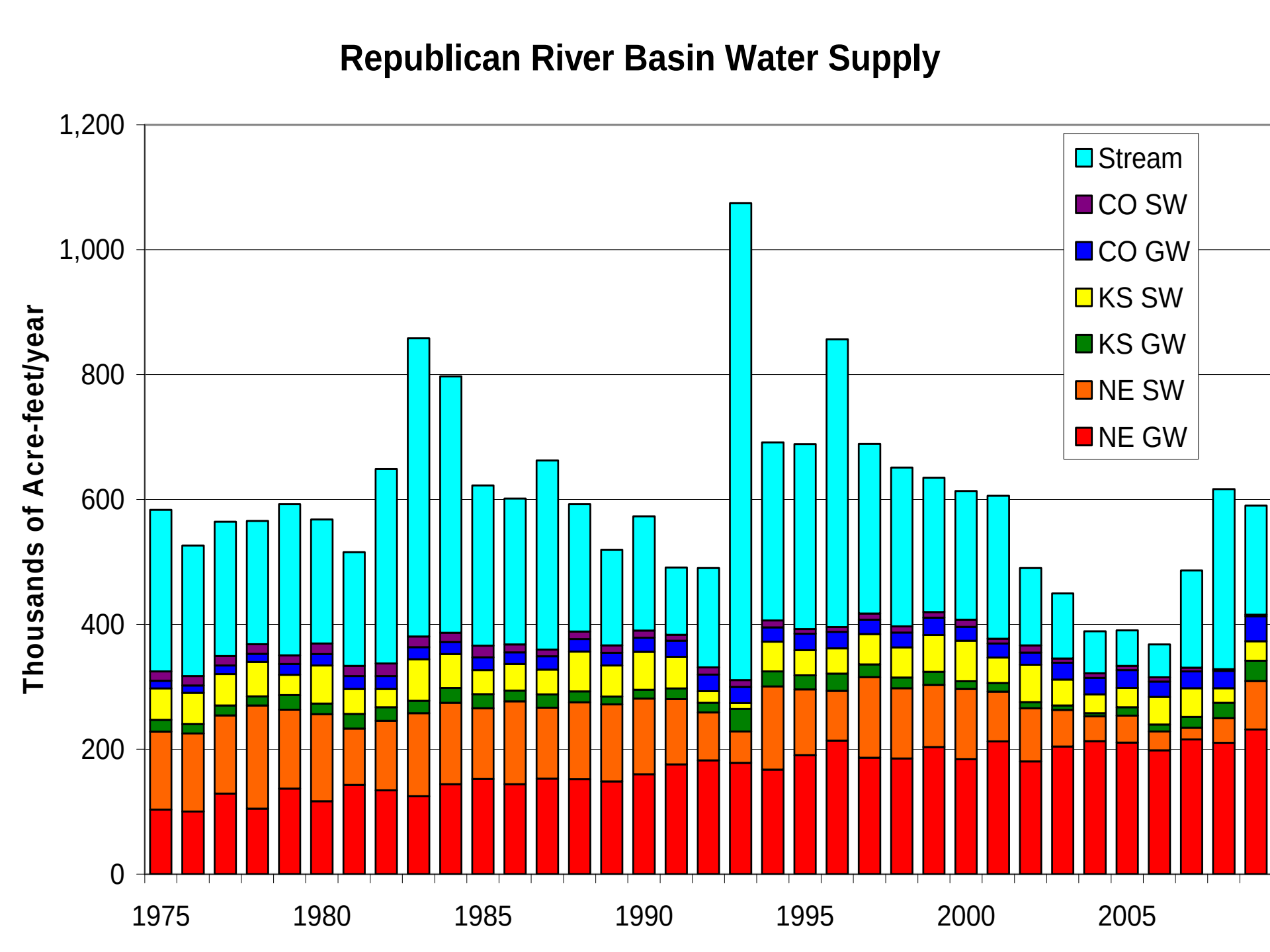
- Compact accounting is after-the-fact
- The 2-year average under Water-Short Year Administration is the current and previous year (3-year looks back one extra year)
- With a forecast of dry-year accounting for the current year, can react in time to take any additional action that may be needed

Simplified Accounting for Forecast

- CWS – Output from Republican River Compact Administration accounting procedures and spreadsheet, input data count is ~250
- Republican River Basin Water Supply (BWS) – An estimate of the CWS using consumptive use totals and total streamflow at the basin outlet

Republican River BWS

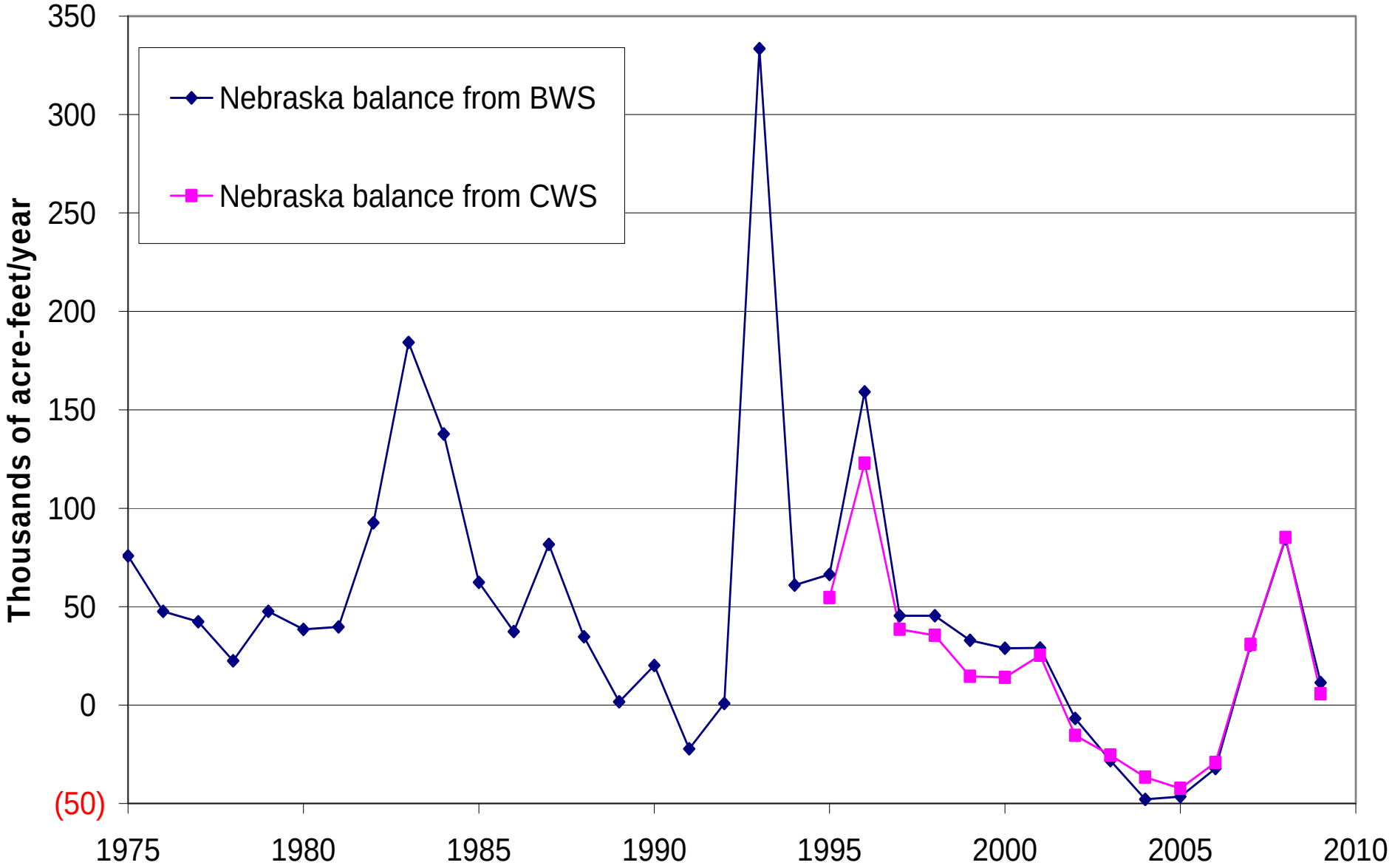
- CO GW use
- KS GW use
- NE GW use
- CO SW use
- KS SW use
- NE SW use
- Streamflow: Hardy + Courtland Canal


Republican River Basin Water Supply
Thousands of Acre-feet/year
1,200
1,000
800
600
400
200
0
1975
1980
1985
1990
1995
2000
2005
Stream
CO SW
CO GW
KS SW
KS GW
NE SW
NE GW

Nebraska's Annual Balance

- Nebraska's Water Supply
  - The total BWS multiplied by 0.5
  - The Imported Water Supply (IWS) Credit
- Nebraska's Water Use
  - NE GW use
  - NE SW use

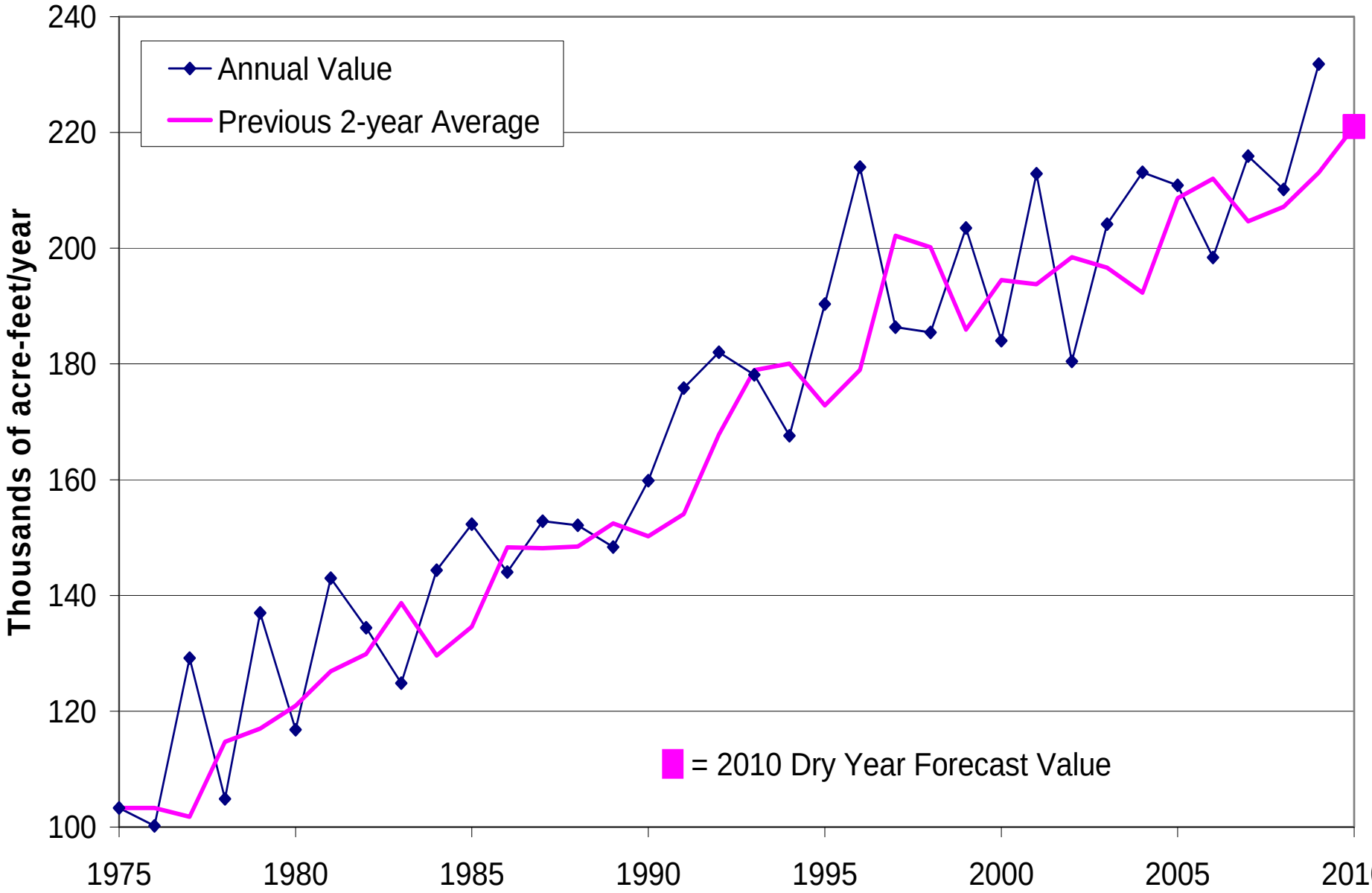
Nebraska's annual balance of water use and water supply



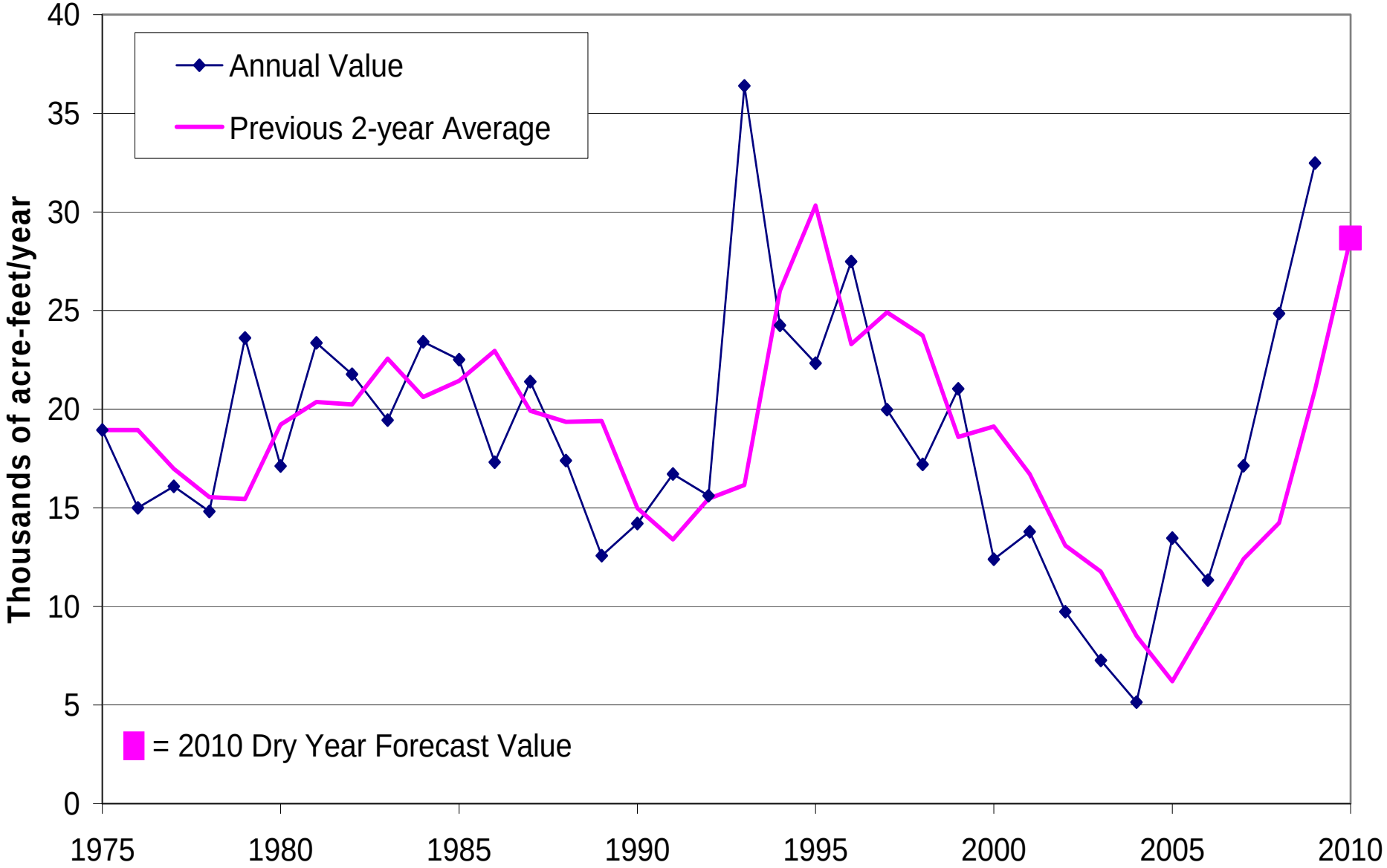
Using BWS for Dry-Year Forecast

- Nebraska must always assume that next year will be dry
- To forecast, we need to estimate the BWS during the upcoming year, assuming that year will be dry
- Additional actions would then be taken if forecast predicts non-compliance assuming the upcoming year is dry

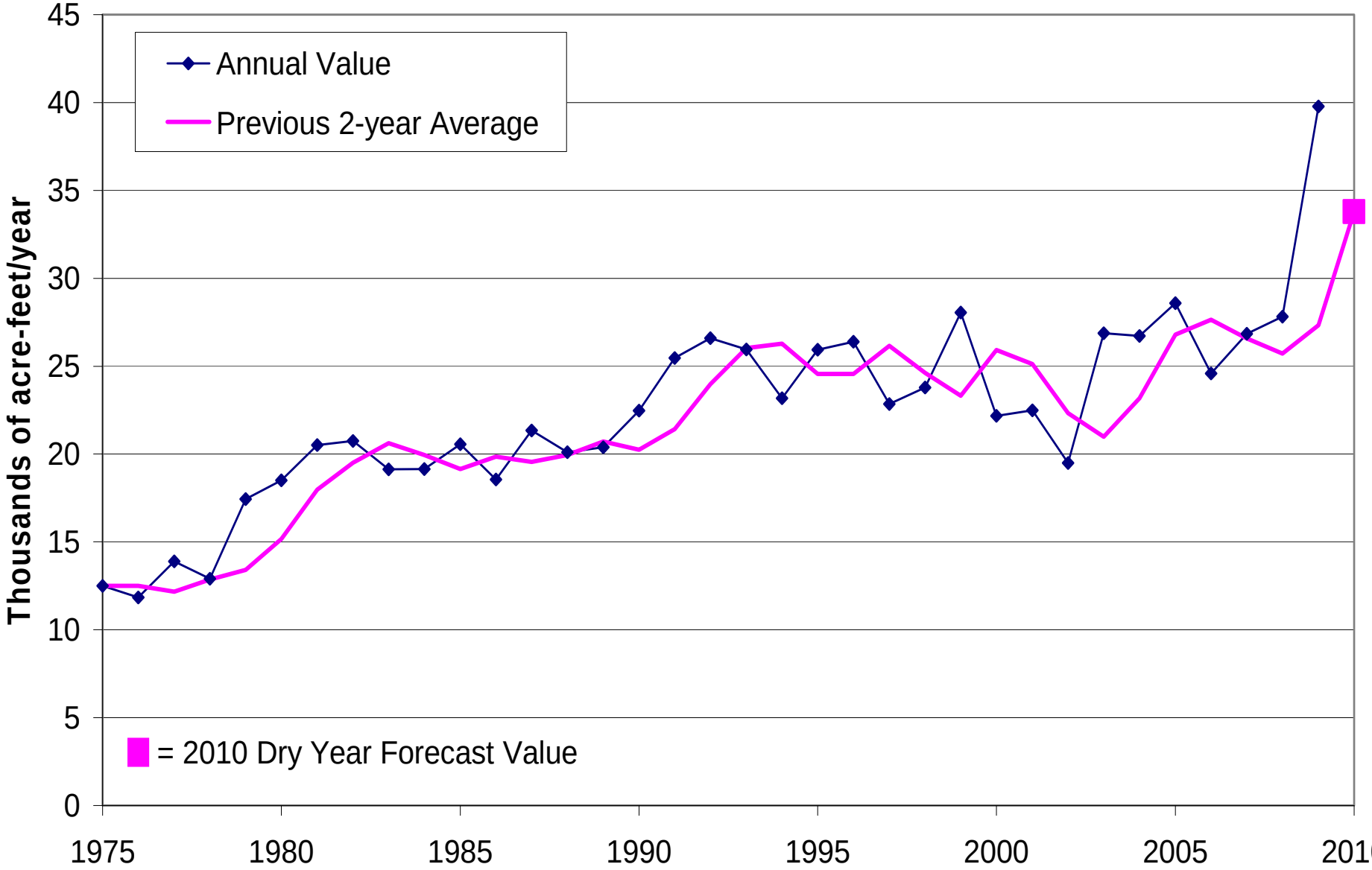
Nebraska groundwater CBCU



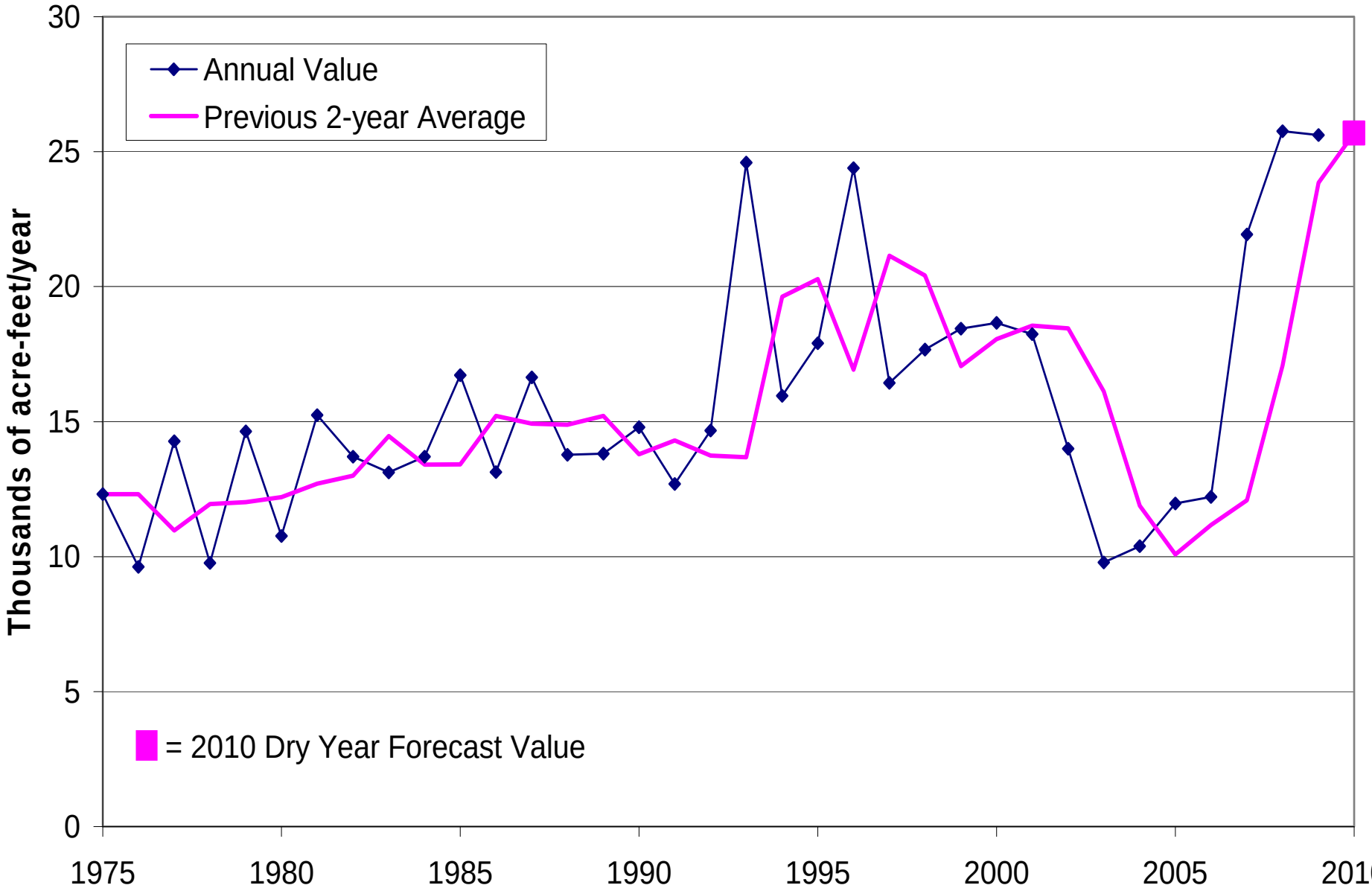
Kansas groundwater CBCU



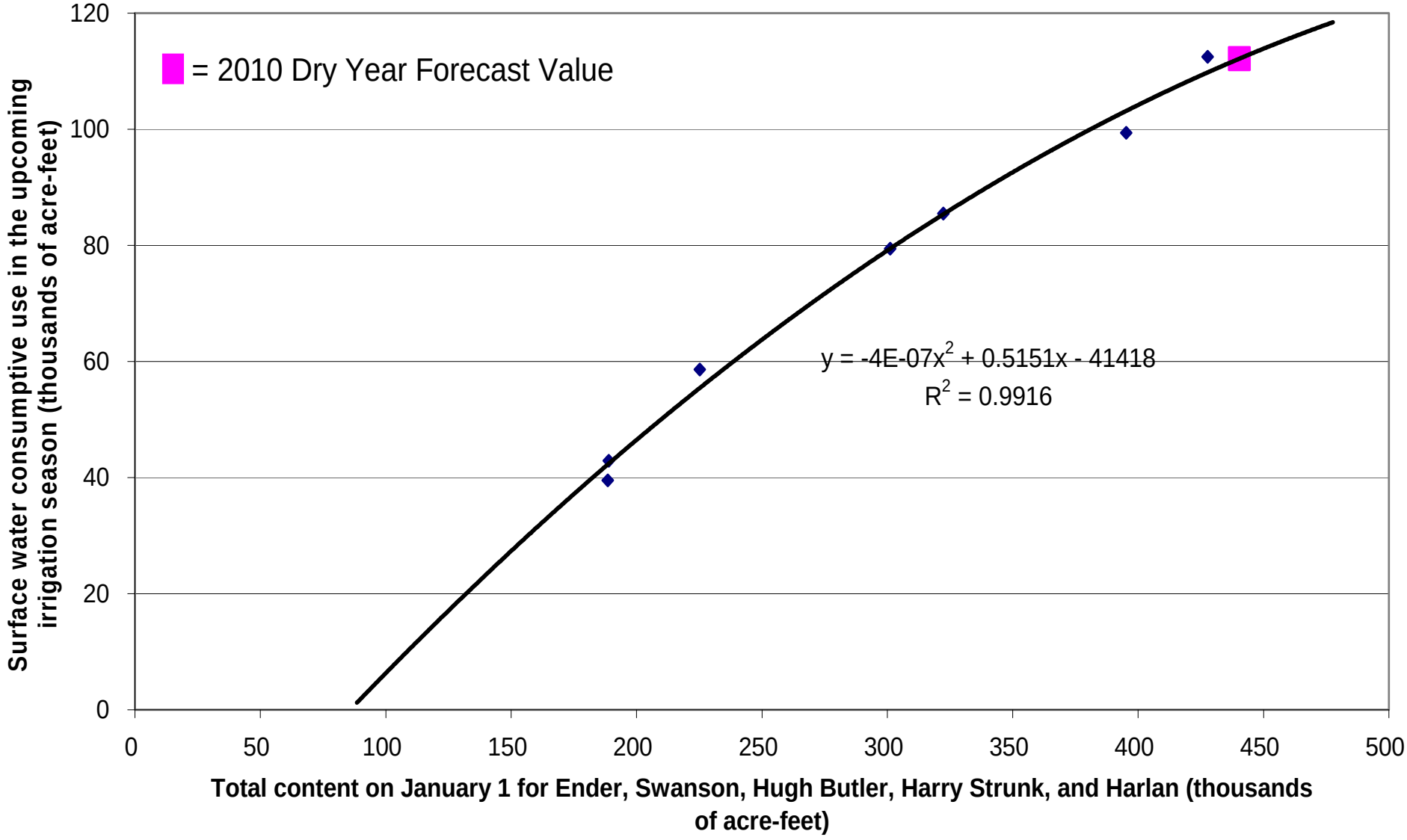
Colorado groundwater CBCU



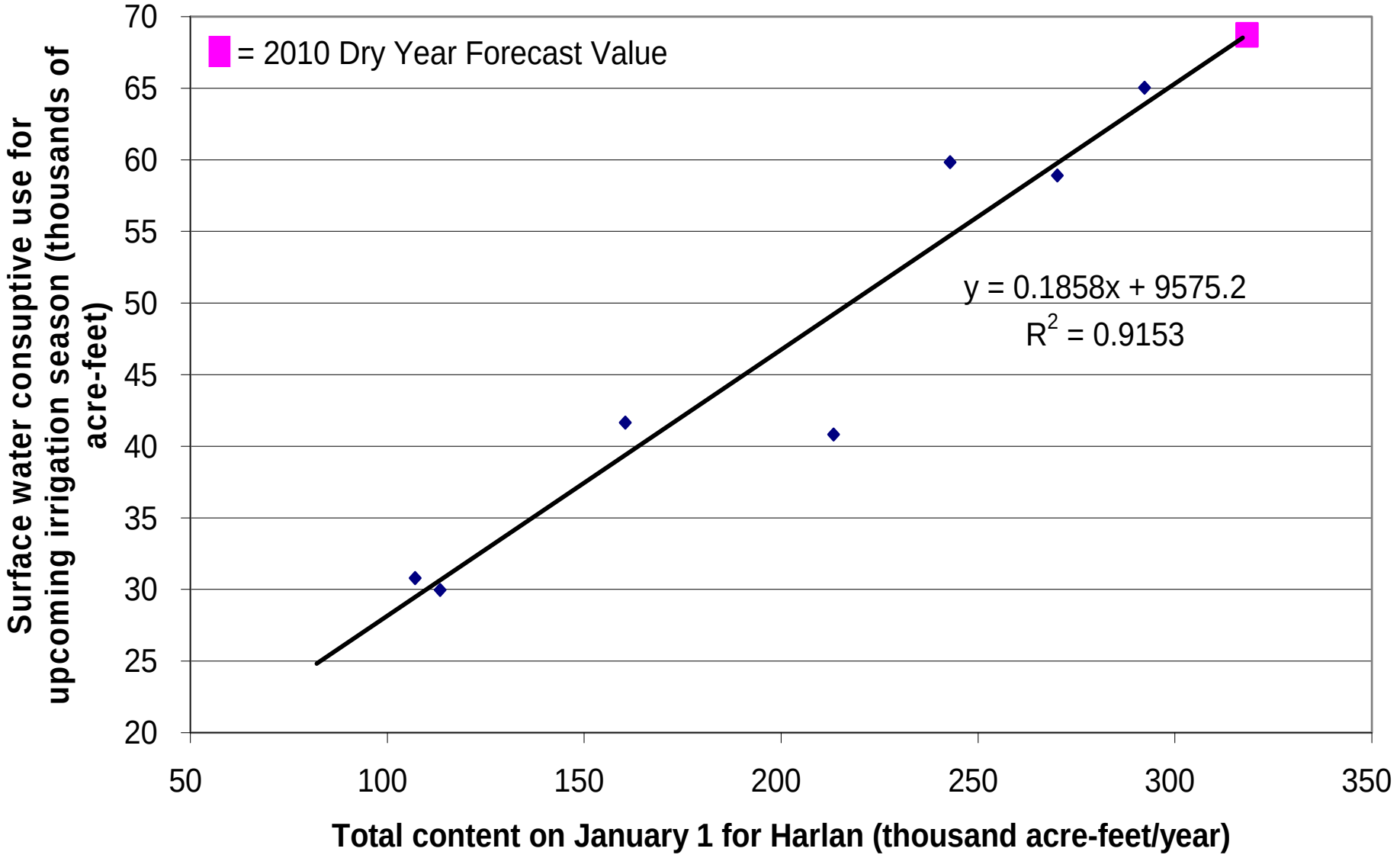
Imported Water Supply Credit

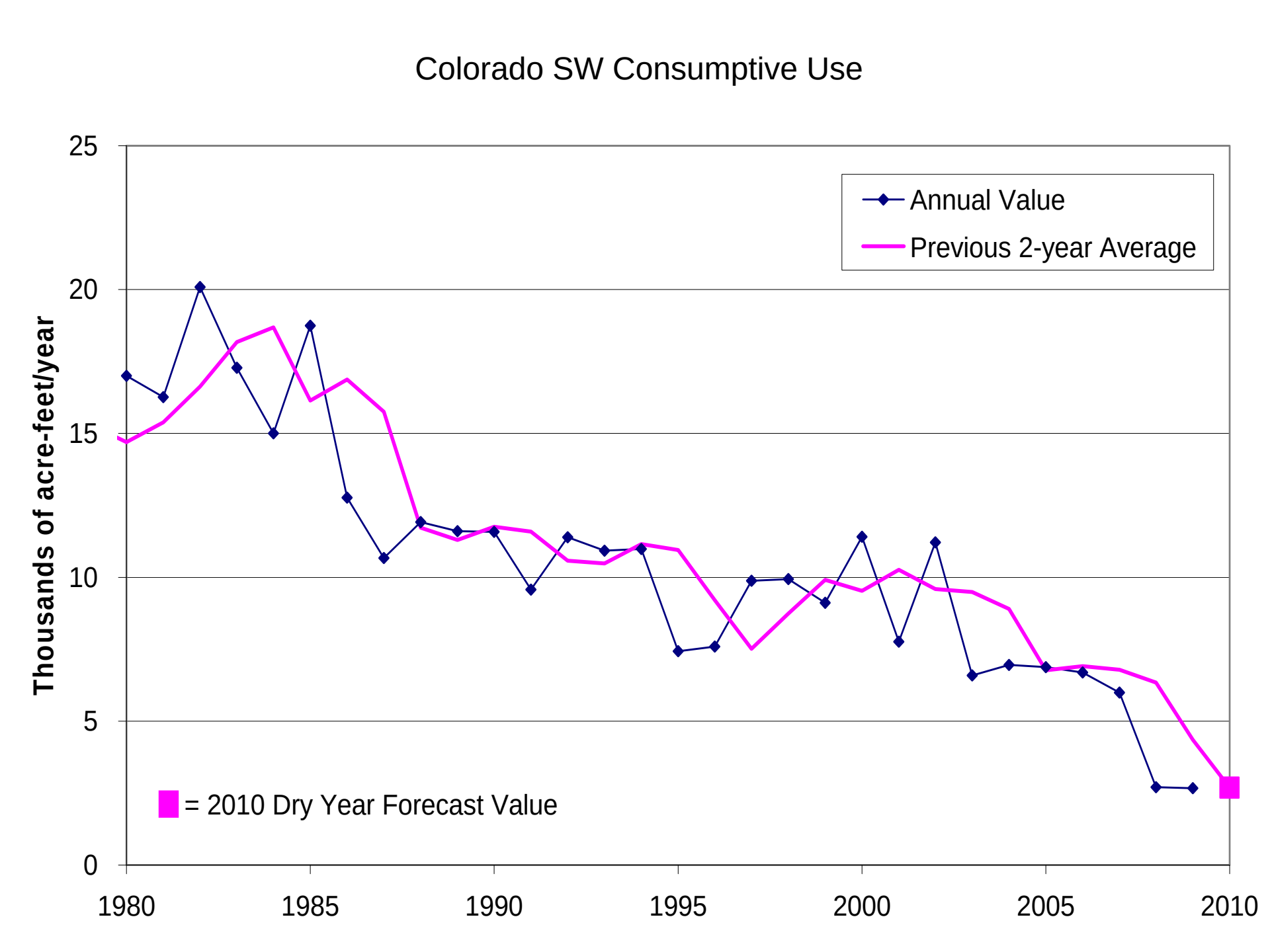


Comparison of Nebraska SW use vs. Nebraska reservoir content, 1999-2005



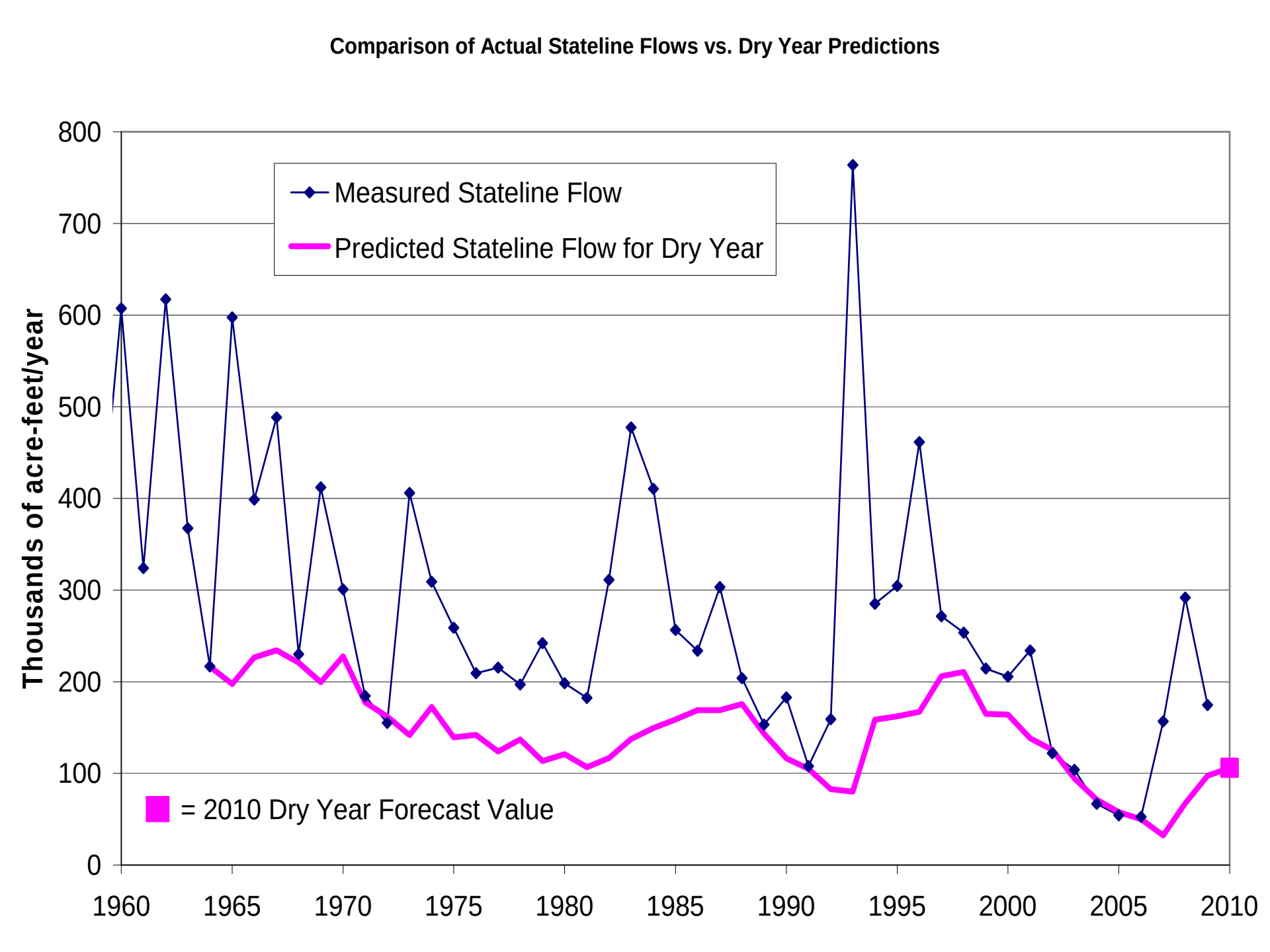
Comparison of Kansas SW use vs. Harlan County Lake content,1999-2005



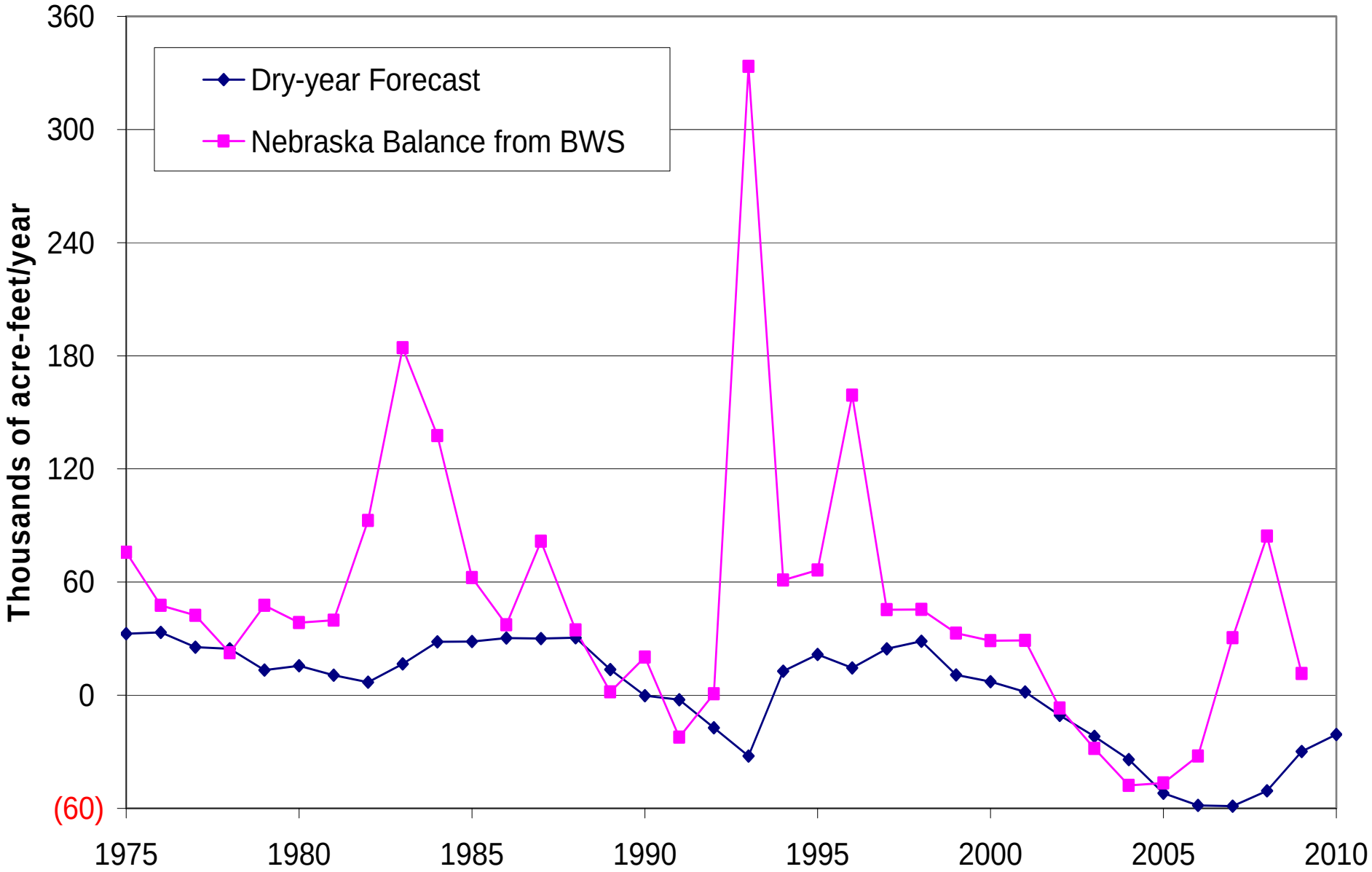

Colorado SW Consumptive Use
Thousands of acre-feet/year
25
20
15
10
5
0
1980
1985
1990
1995
2000
2005
2010
Annual Value
Previous 2-year Average
= 2010 Dry Year Forecast Value

Streamflow

- Need to be able to predict a dry-year streamflow value for the state line from existing data
- Used multiple linear regression with two variables:
  - Previous 5-year average state line flows (0.41)
  - January 1st Harlan County Lake content (0.23)
  - Constant = -27450


Comparison of Actual Stateline Flows vs. Dry Year Predictions
Thousands of acre-feet/year
800
700
600
500
400
300
200
100
0
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
Measured Stateline Flow
Predicted Stateline Flow for Dry Year
= 2010 Dry Year Forecast Value

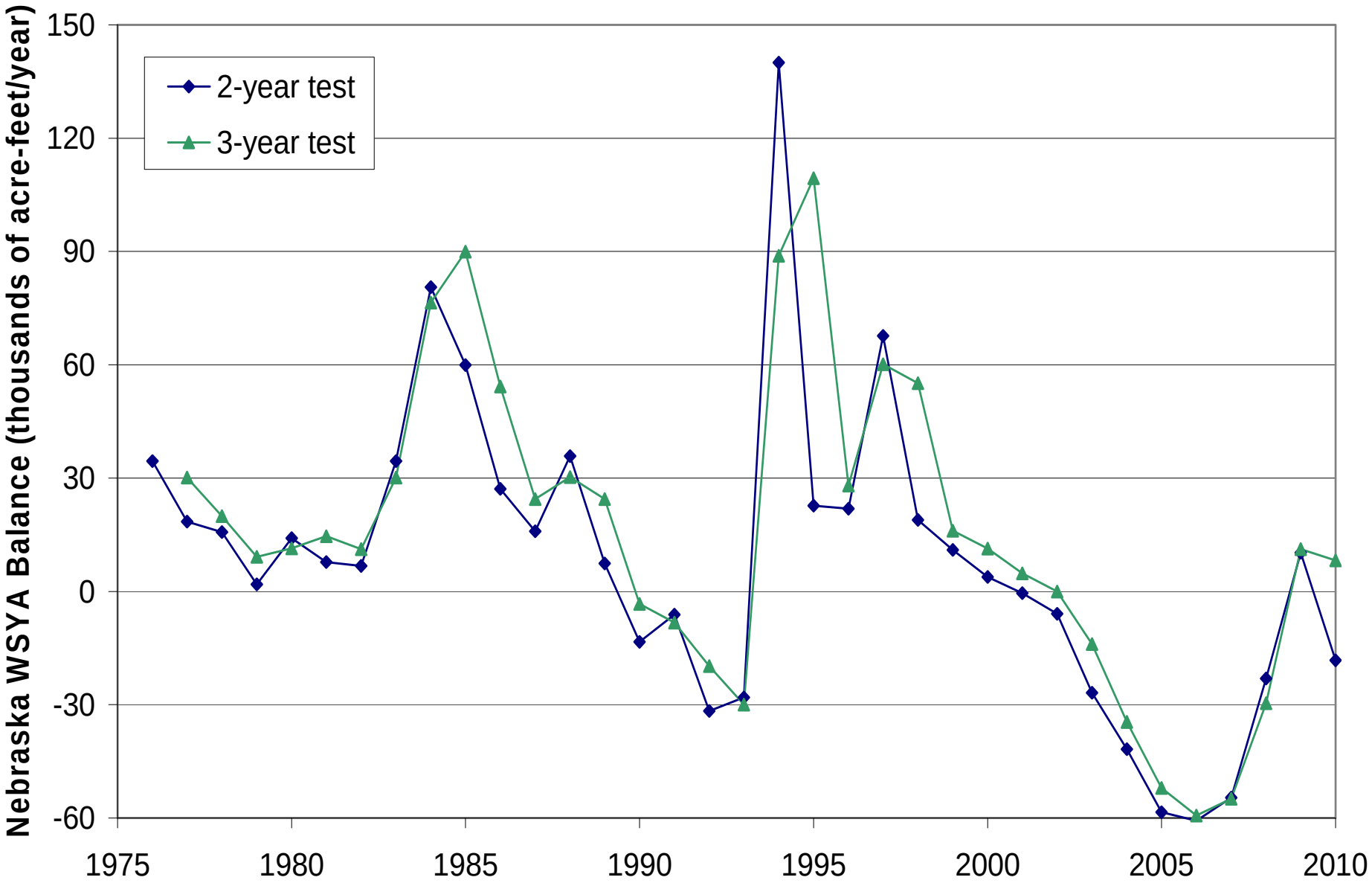
Comparison of Nebraska balance from BWS vs. dry-year forecast

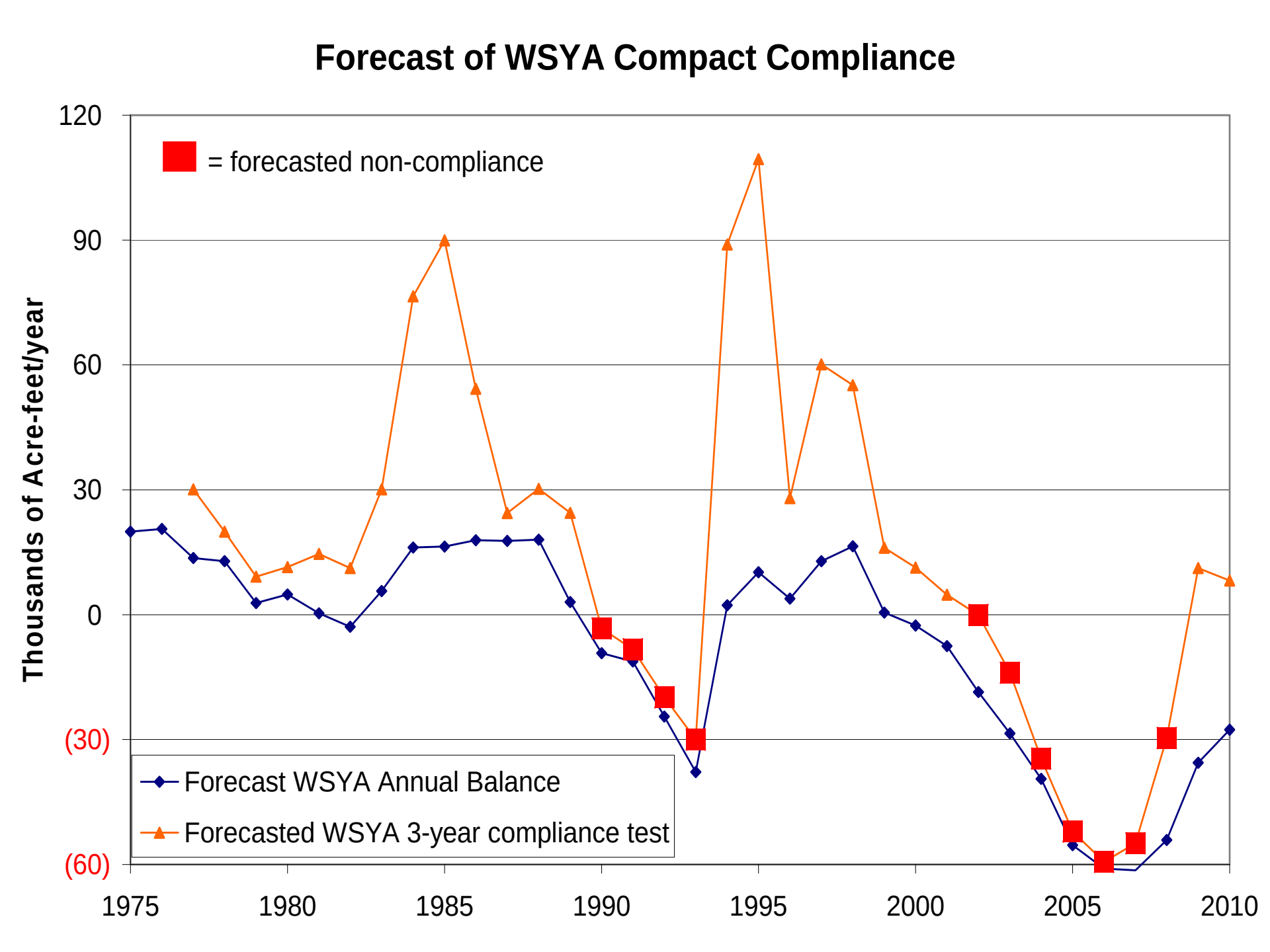


Utilizing the Forecast to Trigger Management Actions

- Combine the forecast with recent accounting results
- Builds in a cushion of 5,000 acre-feet per year
- Compute a 2-year or 3-year average with the forecast value for the most current year (t-0) and the actual accounting results for the previous years (t-1 and t-2)

Results of dry-year forecast incorporated into WSYA compliance tests




Forecast of WSYA Compact Compliance
120
90
60
30
0
(30)
(60)
Thousands of Acre-feet/year
= forecasted non-compliance
Forecast WSYA Annual Balance
Forecasted WSYA 3-year compliance test
1975
1980
1985
1990
1995
2000
2005
2010

Summary

- Future dry years may require additional action by Nebraska to maintain Compact compliance
- A forecasting mechanism has been developed that will provide Nebraska the advance knowledge to react to potential dry years, ensuring Compact compliance under all climatic conditions

Questions?