What Can the Colorado Learn from the Rio Grande?

The San Luis Valley and the Closed Basin, an analog for the Colorado River Basin

OR

"Can We See Our Future in the Rear View Mirror?"

Presentation to the Water Resources Review Committee
of the Colorado Legislature

October 9, 2013

Prepared By

The Colorado River Water Conservation District
PO Box 1120
Glenwood Springs, CO 81602
www.crwcd.org
(970) 945-8522

Presented By

John Currier, P.E.
CRWCD Chief Engineer

1 Introduction

On October 9th the Interim Water Supply Committee heard extensive testimony about the long and difficult history of water administration in the San Luis Valley. You heard about the status and efforts of the Rio Grande Water Conservation District to restore sustainable equilibrium to the Closed Basin unconfined aquifer through the SB04-222 subdistrict process. The focal point was subdistrict No. 1 and the effort to restore balance between available water supplies and current levels of water use so that the San Luis Valley continues to remain a stable, sustainable agricultural community.

You heard from the State Engineer and you also heard passionate testimony from local proponents saying "*the process is working, give it time*" and equally passionate testimony from the detractors saying" *the process is broken, abandon it, implement Rules and Regulations and enforce strict administration now*".

Needless to say, bringing the Closed Basin into sustainable equilibrium is painful, difficult, slow and fraught with understandable contention. The subdistrict No. 1 goal to "undevelop" by removing from irrigation 40,000 of the 170,000 acres in the subdistrict is very difficult.

The pain, difficulty and contention is intensely magnified by the drought that has gripped the Rio Grande Basin for the last 10+ years. It can only be called "epic". Not just to the San Luis Valley, but to the entire Rio Grande River basin. The Rio Grande needs a few good water years to provide some relief and breathing room for the process to work.

So, why bring this up again? **Because the situation in the Colorado River basin as a whole looks just like the one in the Closed Basin.** You've seen the pain and difficulty in the Rio Grande. You've also seen it in the Arkansas, the S. Platte and elsewhere. **As a State, let's learn from the Rio Grande and the Closed Basin and not be forced into the same painful solution in the Colorado Basin in the future.** Not to discount the complexity of the Rio Grande, but can you imagine what Compact administration would look like in the Colorado River basin? Lots of very knowledgeable, intelligent people have tried. The answer is nobody really knows. But because of the sheer number of States, Tribes and stakeholders it promises to be incredibly difficult and contentious.

So let us proceed very cautiously as we discuss future development of the Colorado. We do not want to risk, and we should do everything reasonably within our power to avoid a Compact call. The cost is simply too high. Please, let's take to heart the hard, expensive, painful lessons from the Rio Grande, Arkansas and S. Platte.

2 Rio Grande History in a Nutshell – Divisiveness and Shortage

The Rio Grande Basin has a long, difficult history of administration dating back well over 100 years, far earlier than completion of the Rio Grande Compact in 1938 . At the October 9th Committee meeting the State Engineer presented an excellent *San Luis Valley Water Resource Development Timeline* that is far better than any I could prepare. With Dick Wolfe's permission I have included it here again. While the timeline captures most events it can't capture the upheaval and uncertainty some of those events caused. I would like to briefly recap two events and some of the surrounding uncertainty. The first is project financing uncertainty; the second is water supply uncertainty.

Project Financing Uncertainty

G.E. Radosevich and R.W. Rutz highlighted early project financing difficulties in their excellent 1979 paper[1] as they discussed the conflict and uncertainty raised by early irrigation development in the San Luis Valley.

Extensive irrigation development occurred between **1880-1891**, including the major ditches that feed the Closed Basin. There was immediate conflict as increased upstream use resulted in decreased downstream supply. Radosevich and R.W. Rutz report:

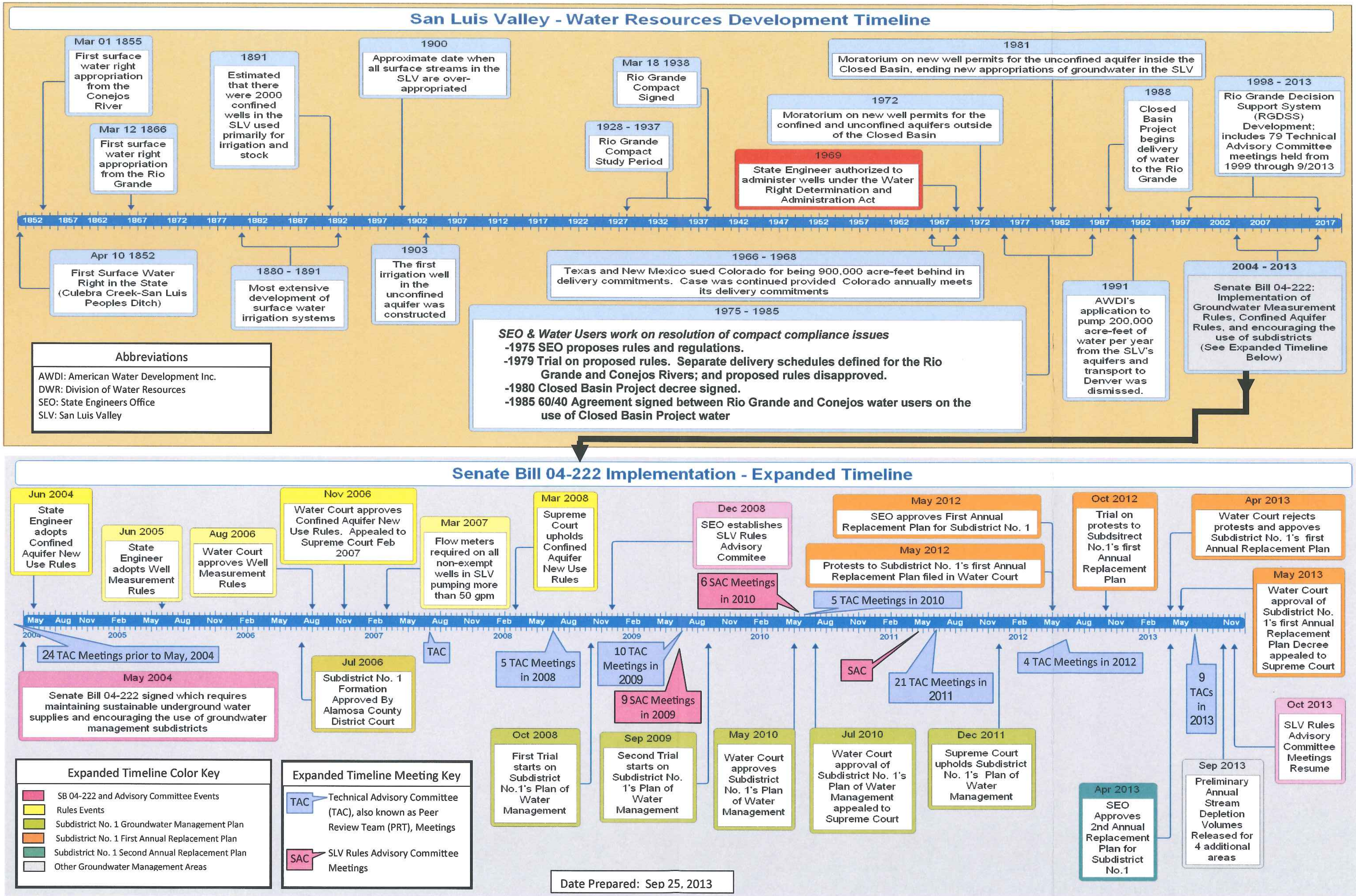
> *"But along with the surface water development within the San Luis Valley, serious conflicts developed among Colorado, New Mexico, Texas and the Republic of Mexico. As diversions of water increased in Colorado, shortages began developing down river. In an effort to restrict further development,* ***the Department of Interior on December 5, 1896, stopped granting rights- of-way over public lands for the construction of reservoirs.***
>
> *A decade later on May 21, 1906, the United States and the Republic of Mexico signed a treaty which provided 60,000 acre feet of water a year to the Republic of Mexico. To meet this commitment, the United States in 1916 constructed the Elephant Butte Reservoir in New Mexico with a storage capacity of 2,600,000 acre feet. But even after construction of the reservoir, it was another nine years until Colorado was successful in having the federal government remove its embargo on the rights-of-way over public lands.* ***But money to construct the reservoirs could not be raised because of threatened litigation."***[2] (emphasis added).

I have to leave the finer historical details to others more knowledgeable than I, but it is clear that the early development in the San Luis Valley created uncertainty that persist to this day.

---

[1] *San Luis Valley Water Problems: A Legal Perspective*, G.E Radosevich and R.W. Rutz, Colorado Water Resources Research Institute, Information Series Report No. 34, January 1979

[2] Ibid, pgs 3,4


San Luis Valley - Water Resources Development Timeline
Mar 01 1855 First surface water right appropriation from the Conejos River
Mar 12 1866 First surface water right appropriation from the Rio Grande
1891 Estimated that there were 2000 confined wells in the SLV used primarily for irrigation and stock
1900 Approximate date when all surface streams in the SLV are over-appropriated
Mar 18 1938 Rio Grande Compact Signed
1928 - 1937 Rio Grande Compact Study Period
1981 Moratorium on new well permits for the unconfined aquifer inside the Closed Basin, ending new appropriations of groundwater in the SLV
1972 Moratorium on new well permits for the confined and unconfined aquifers outside of the Closed Basin
1969 State Engineer authorized to administer wells under the Water Right Determination and Administration Act
1988 Closed Basin Project begins delivery of water to the Rio Grande
1998 - 2013 Rio Grande Decision Support System (RGDSS) Development: includes 79 Technical Advisory Committee meetings held from 1999 through 9/2013
1852 1857 1862 1867 1872 1877 1882 1887 1892 1897 1902 1907 1912 1917 1922 1927 1932 1937 1942 1947 1952 1957 1962 1967 1972 1977 1982 1987 1992 1997 2002 2007 2017
Apr 10 1852 First Surface Water Right in the State (Culebra Creek-San Luis Peoples Ditch)
1880 - 1891 Most extensive development of surface water irrigation systems
1903 The first irrigation well in the unconfined aquifer was constructed
1966 - 1968 Texas and New Mexico sued Colorado for being 900,000 acre-feet behind in delivery commitments. Case was continued provided Colorado annually meets its delivery commitments
1975 - 1985
SEO & Water Users work on resolution of compact compliance issues
-1975 SEO proposes rules and regulations.
-1979 Trial on proposed rules. Separate delivery schedules defined for the Rio Grande and Conejos Rivers; and proposed rules disapproved.
-1980 Closed Basin Project decree signed.
-1985 60/40 Agreement signed between Rio Grande and Conejos water users on the use of Closed Basin Project water
1991 AWDI's application to pump 200,000 acre-feet of water per year from the SLV's aquifers and transport to Denver was dismissed.
2004 - 2013 Senate Bill 04-222: Implementation of Groundwater Measurement Rules, Confined Aquifer Rules, and encouraging the use of subdistricts (See Expanded Timeline Below)
Abbreviations
AWDI: American Water Development Inc.
DWR: Division of Water Resources
SEO: State Engineers Office
SLV: San Luis Valley
Senate Bill 04-222 Implementation - Expanded Timeline
Jun 2004 State Engineer adopts Confined Aquifer New Use Rules
Jun 2005 State Engineer adopts Well Measurement Rules
Aug 2006 Water Court approves Well Measurement Rules
Nov 2006 Water Court approves Confined Aquifer New Use Rules. Appealed to Supreme Court Feb 2007
Mar 2007 Flow meters required on all non-exempt wells in SLV pumping more than 50 gpm
Mar 2008 Supreme Court upholds Confined Aquifer New Use Rules
Dec 2008 SEO establishes SLV Rules Advisory Commitee
6 SAC Meetings in 2010
5 TAC Meetings in 2010
May 2012 SEO approves First Annual Replacement Plan for Subdistrict No. 1
May 2012 Protests to Subdistrict No. 1's first Annual Replacement Plan filed in Water Court
Oct 2012 Trial on protests to Subdsitrect No.1's first Annual Replacement Plan
Apr 2013 Water Court rejects protests and approves Subdistrict No. 1's first Annual Replacement Plan
May 2013 Water Court approval of Subdistrict No. 1's first Annual Replacement Plan Decree appealed to Supreme Court
May Aug Nov Feb May Aug Nov Feb May Aug Nov Feb May Aug Nov Feb May Aug Nov Feb May Aug Nov Feb May Aug Nov Feb May Aug Nov Feb May Aug Nov Feb May Nov
2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
24 TAC Meetings prior to May, 2004
May 2004 Senate Bill 04-222 signed which requires maintaining sustainable underground water supplies and encouraging the use of groundwater management subdistricts
Jul 2006 Subdistrict No. 1 Formation Approved By Alamosa County District Court
TAC
5 TAC Meetings in 2008
10 TAC Meetings in 2009
9 SAC Meetings in 2009
SAC
21 TAC Meetings in 2011
4 TAC Meetings in 2012
9 TACs in 2013
Oct 2008 First Trial starts on Subdistrict No.1's Plan of Water Management
Sep 2009 Second Trial starts on Subdistrict No. 1's Plan of Water Management
May 2010 Water Court approves Subdistrict No. 1's Plan of Water Management
Jul 2010 Water Court approval of Subdistrict No. 1's Plan of Water Management appealed to Supreme Court
Dec 2011 Supreme Court upholds Subdistrict No. 1's Plan of Water Management
Apr 2013 SEO Approves 2nd Annual Replacement Plan for Subdistrict No.1
Sep 2013 Preliminary Annual Stream Depletion Volumes Released for 4 additional areas
Oct 2013 SLV Rules Advisory Committee Meetings Resume
Expanded Timeline Color Key
SB 04-222 and Advisory Committee Events
Rules Events
Subdistrict No. 1 Groundwater Management Plan
Subdistrict No. 1 First Annual Replacement Plan
Subdistrict No. 1 Second Annual Replacement Plan
Other Groundwater Management Areas
Expanded Timeline Meeting Key
TAC Technical Advisory Committee (TAC), also known as Peer Review Team (PRT), Meetings
SAC SLV Rules Advisory Committee Meetings
Date Prepared: Sep 25, 2013

Water Supply Impacts and Uncertainty – Platoro Reservoir

A poster child of Compact administration impacts and resulting uncertainty on junior water rights is the US Bureau of Reclamation's San Luis Valley Project and Platoro Reservoir. Platoro is a 57,500 acre-foot reservoir on the Conejos River intended to provide much needed supplemental irrigation water within the Conejos River basin as well as flood control benefits. It was authorized by Congress in 1939 (one year after the Rio Grande Compact was signed) and construction was completed in 1954. It first filled and spilled in 1958 and 20,000 acre-feet was made available to irrigators that year as Colorado had its first Compact credit in several years[3]. The following year 30,000 acre-feet from Platoro was used for irrigation but Colorado ended up with a 20,000 acre-foot Compact deficit. Colorado's debit status under the compact continued until the mid-1980's when the debt was finally wiped out and water could be stored in the Platoro Reservoir for irrigation use[4]. **That represents almost 30 years that Platoro Reservoir could not be used for its intended purpose of providing supplemental irrigation water.**

Risk of a "Platoro Reservoir" equivalent in the Upper Colorado River basin due to Compact administration is NOT something we want to see.

The long history of divisiveness and shortage in the San Luis Valley may best be summed up by the following statement made by Radosevich back in 1979:

> *"The San Luis Valley stands at the crossroads of its economic future. Because of the existing water distribution system in the Valley and the superimposed legal system and legal constraints, a deep insecurity has arisen among the people. Suspicion and economic fear are facts of life. As a result, a number of lawsuits have been filed during the past year, thereby deepening the division already present and draining large amounts of money out of the Valley to law firms located primarily in Denver[5]"*

While great strides have been made and great credit is due to foresighted thinkers in the San Luis Valley, the Valley is still standing at the crossroads of its economic future and there is still deep insecurity almost 25 years later.

---

[3] *San Luis Valley Project,* Wm. Joe Simonds

[4] Ibid

[5] *San Luis Valley Water Problems: A Legal Perspective*, G.E Radosevich and R.W. Rutz, Colorado Water Resources Research Institute, Information Series Report No. 34, January 1979

3 Hydrology, The Colorado Basin – Closed Basin Connection

The Closed Basin unconfined aquifer is a reservoir just like any other. It is filled from natural, tributary inflow and with water imported from the Rio Grande River. It is emptied by natural and irrigated crop evapotranspiration and by exports back to the Rio Grande via the Closed Basin Project.

Since settlement of the Valley, storage in the Closed Basin reservoir has waxed and waned depending on the hydrology and irrigation practices. Early irrigation practice was either by sub-irrigation where the water table is raised to the level is can be used by crops or by flood irrigation. These methods are not highly efficient and significant return flow accrued to the aquifer raising the overall storage in the reservoir. **In short, storage was being filled faster than it was being released and the reservoir was spilling.**

The US Bureau of Reclamation reported:

> *"By 1910, a rising water table was causing serious damage to the valley lands. This seeped condition was accelerated by large irrigation diversions. Drainage to reclaim seeped lands began about 1911, and by 1921 eight drainage systems serving about 90,000 acres of land had been constructed. These drainage systems have reclaimed a considerable amount of land in the western area of the Closed Basin, but large areas to the east remain to be reclaimed[6]."*

This "overfilling" of the unconfined aquifer reservoir paved the way for the Closed Basin Project; borne out of an excess water supply in Closed Basin but continued shortages elsewhere and an on-going need to meet Rio Grande Compact commitments.

The storage in the Closed Basin reservoir headed towards decline with the advent of center pivot irrigation in the late 1960s and its rapid adoption throughout the 1970s. This allowed expansion of irrigated acreage, increased water use efficiency, increased consumptive use and decreased return flow. Even as the Closed Basin Project was coming on line, much of the water that the project was intended to deliver back to the Rio Grande to satisfy Compact requirements was being consumed within the Closed Basin. **In short, the pendulum swung: demands from storage were outstripping supply and the reservoir started declining.**

---

[6] San Luis Valley Project Description, USBR, http://www.usbr.gov/projects/Project.jsp?proj_Name=San%20Luis%20Valley%20Project

3.1 Closed Basin Unconfined Aquifer Storage

Since 1976 the Rio Grande Water Conservation District (RGWCD) has been tracking storage in the Unconfined Aquifer "reservoir" by monitoring water levels in a grid of observation wells located throughout the Closed Basin. The figure on the following page, provided courtesy of the RGWCD and their consultant, Davis Engineering Services, shows the trends with water levels rising during wet cycles and falling precipitously during dry cycles. But overall, storage is dropping and recovery hasn't been able to keep pace; short term gains are overwhelmed by continued drought period demands. As you well know from the earlier presentation to this Committee, it is unsustainable and this the driving force behind the goal of removing 40,000 acres, nearly 25% of the irrigated acreage, from irrigation in the RGWCD subdistrict #1.

3.2 Colorado Basin Storage

The pattern of reservoir storage in the Closed Basin is remarkably similar to the storage in the Colorado Basin.

Combined, Lake Mead and Lake Powell store almost 50 million acre-feet of water. Individually, Lake Mead with 25 million acre-feet serves the Lower Basin states of Arizona, California and Nevada, while Lake Powell with 24+ million acre-feet serves the Upper Basin states of Colorado, Wyoming, New Mexico and Utah[7]. Storage in these reservoirs since 1976 is shown in Figure 3.

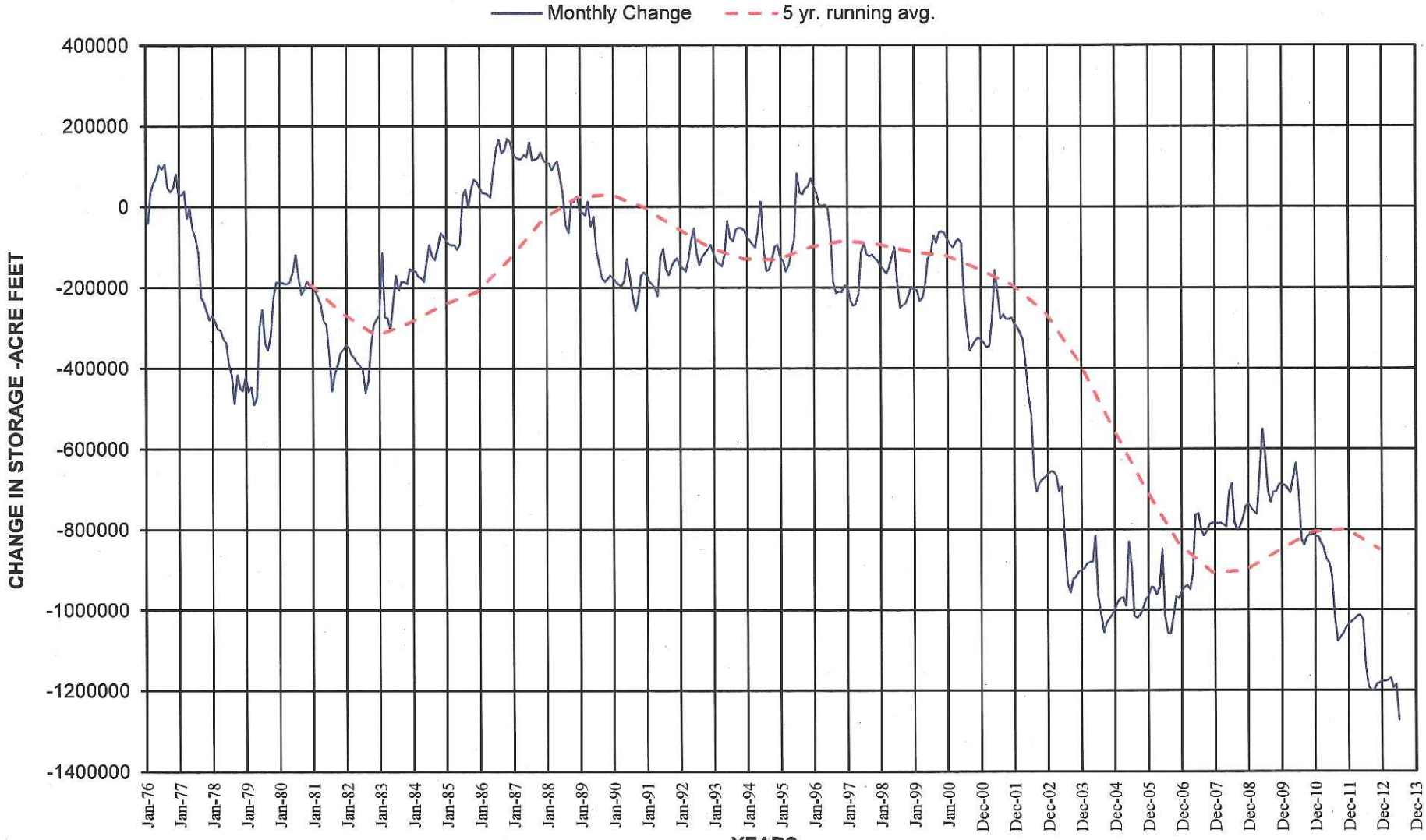
Figure 4 overlays the change in combined Mead and Powell storage with the Change in storage in the Closed Basin unconfined aquifer. The overall trends are remarkably similar; there is some recovery in the wet periods followed by significant decline in the dry periods.

In the wet years of the early 1980s the combined Mead – Powell system filled and spilled (Figure 3). The system filled and spilled again in the late 1990s; essentially at the end of 1999 the system was full. But it has been in decline since 2000 as the same drought gripping the Rio Grande basin continues to grip the greater Colorado River basin and system demands exceed the supply. The average annual undepleted flow at Lee Ferry for 2000 – 2013 has been 12.1 million acre-feet, increasing slightly to about 13.2 million acre-feet below Lake Mead. This is far less than the current demand level of about 15 million acre-feet and the difference has coming out of storage.

By the end of 2013 the combined Mead, Powell storage is expected to be down to 44% of active capacity at approximately 21.8 million acre-feet. The Colorado Basin has had to dig deep into its storage and water providers are looking forward with anxiety. Southern Nevada Water

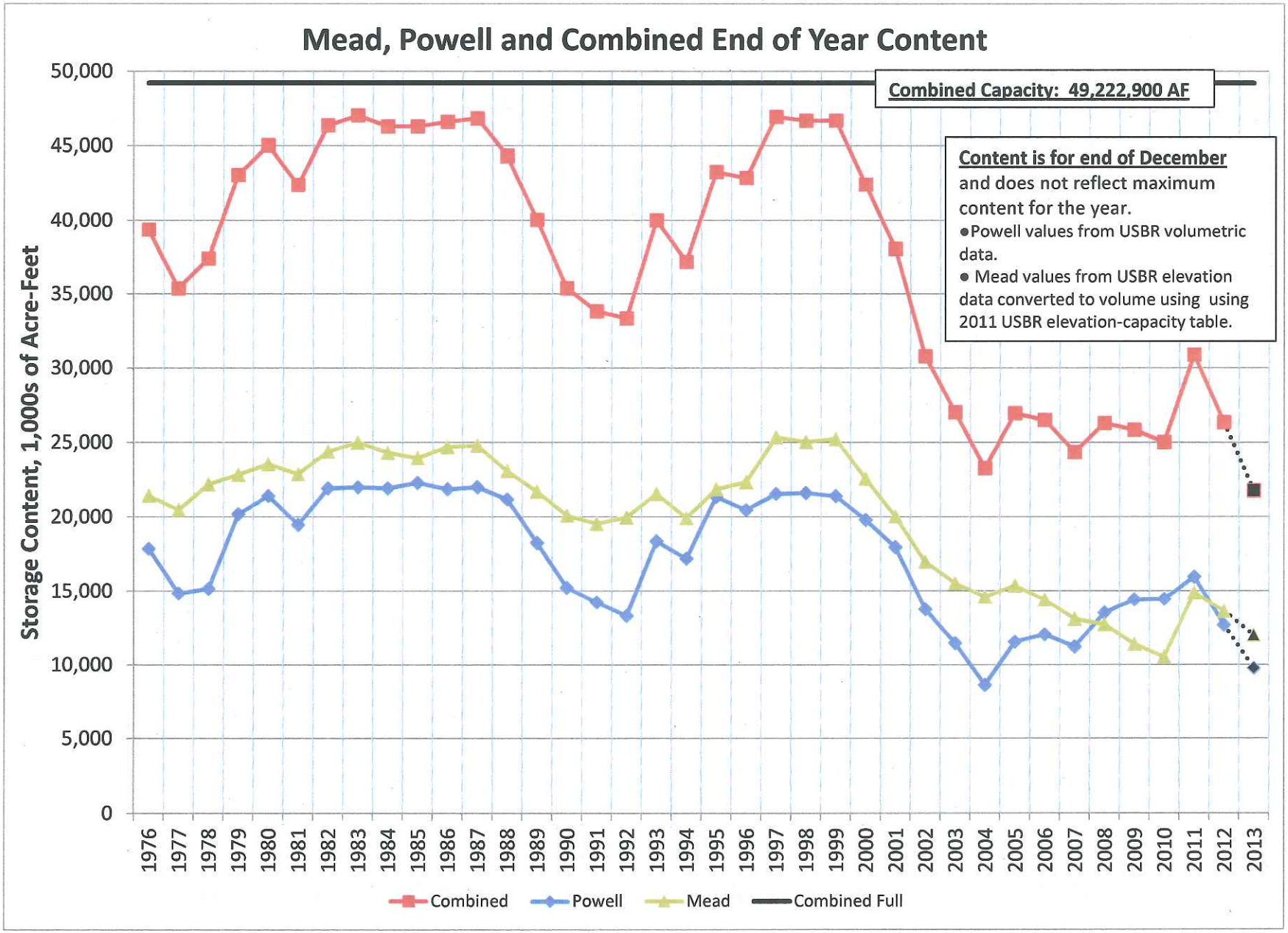
[7] This paper makes no distinction between the Upper and Lower basins and is not intended to imply or suggest any Compact administration obligations for either the Upper or the Lower basins. The intent is to look at the Colorado Basin as one hydrologic whole and compare that to the San Luis Valley Closed Basin

CHANGE IN UNCONFINED AQUIFER STORAGE
WEST CENTRAL SAN LUIS VALLEY



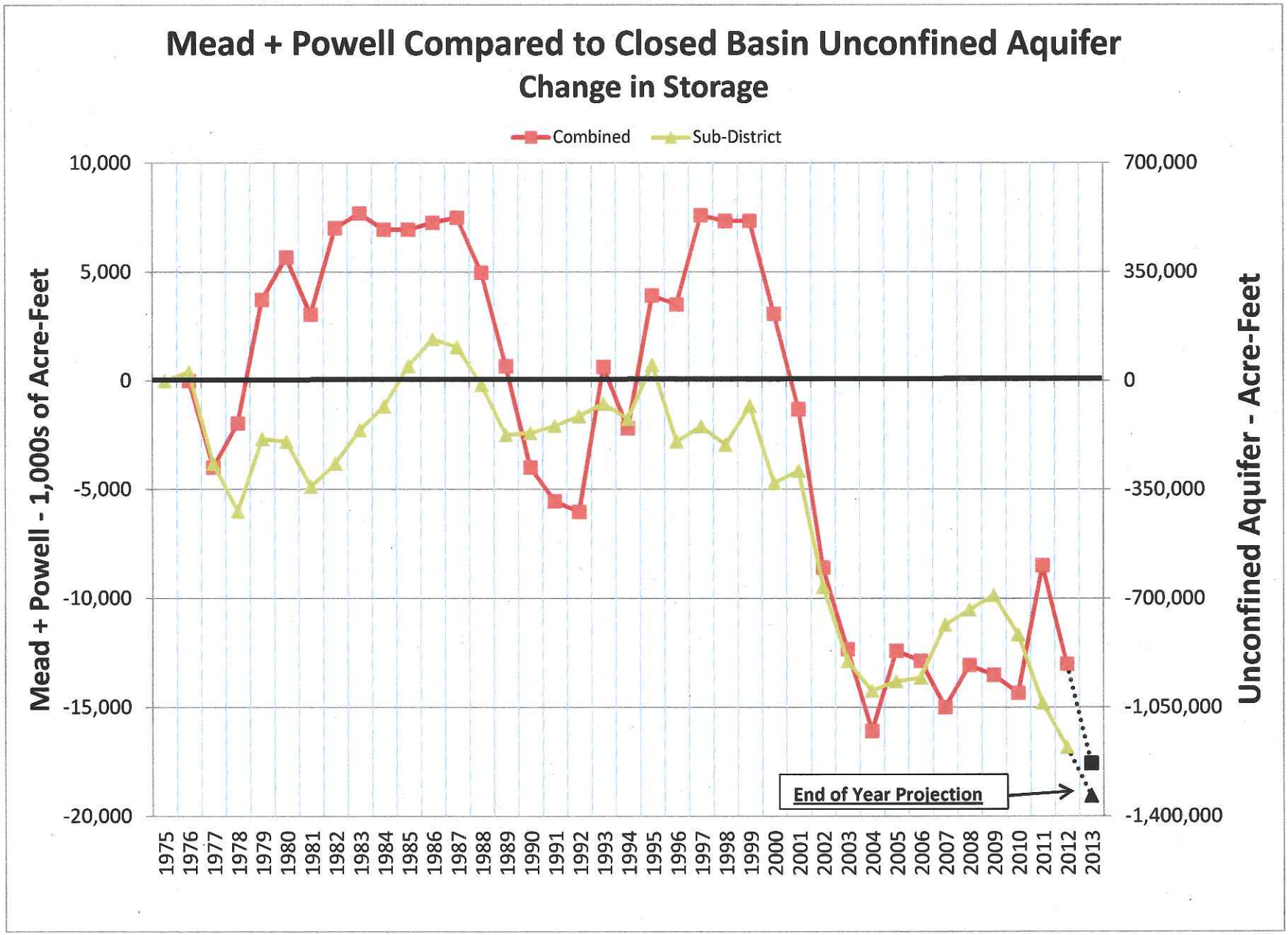
DRAFT - July 10, 2013
Data through July 8, 2013

Prepared by Davis Engineering Service, Inc,
For Rio Grande Water Conservation Dist.



10/9/2013

Figure 3



10/9/2013

Figure 4

Authority is spending nearly $1 billion (yes, billion) to construct a lower intake under Lake Mead. Will they need it? The risk is too high to find out too late. At Powell, there is risk the water level will fall below the minimum needed to generate power. This puts programs that rely on that revenue, like the critically important endangered fish recovery and salinity control programs, at risk while raising the need for replacement power supplies.

Lake Mead and Lake Powell were constructed to buffer the natural and expected hydrologic variation which is absolutely necessary for water development security in both the Upper and Lower basins. And they have been doing their job marvelously. But they can only do that job so long as the long term system demand does not exceed the supply.

So what would the situation be like right now in the Colorado River basin if significant amounts of additional depletions had been occurring since 2000 when storage started to drop?

3.3 Consequences of Increased Depletions in the Colorado River Basin

The recent sophisticated and thorough Basin Study[8] by the Bureau of Reclamation has focused the spotlight on growing demand and potentially shrinking supply in the Colorado Basin. It has highlighted the need for demand management in the basin and / or alternatives for increasing supplies. Other sophisticated modeling efforts are underway that are evaluating the risk of compact curtailment and the effect of efforts such as water banking to mitigate that risk.

For illustrative purposes, the analysis presented here is much simpler but it gets to the same conclusion: **This is a zero-sum game and over the long haul we in the entire basin can only consume the amount that is supplied.**

The decline in storage shown in Figure 3 above is based on the current system demand of approximately 15 million acre-feet per year. This is less than the 17.5 million acre-feet allocated between the Upper Basin, Lower Basin and Mexico[9].

So in a very simple way, what would the Mead - Powell system look like if significant new depletions were occurring in the Colorado River Basin?

Figure 5 looks at what would have happened to the combined Mead – Powell storage if the overall depletion in the Colorado River Basin had been higher. For this simple exercise the increased depletions are assumed to start in the year 2000, the last time the system was full. Since reservoir storage has been dropping since year 2000 (just like the Closed Basin), all these new depletions, by definition, must come at the expense of storage; for every new acre-foot

---

[8] *"The Colorado River Basin Demand and Supply Study"*, US Bureau of Reclamation, December, 2012

[9] 7.5 MAF to the Upper Basin, 7.5 MAF + 1.0 MAF to Lower Basin, 1.5 MAF to Mexico. Current Upper Basin depletions are approximately 4.5 MAF depending on the year.

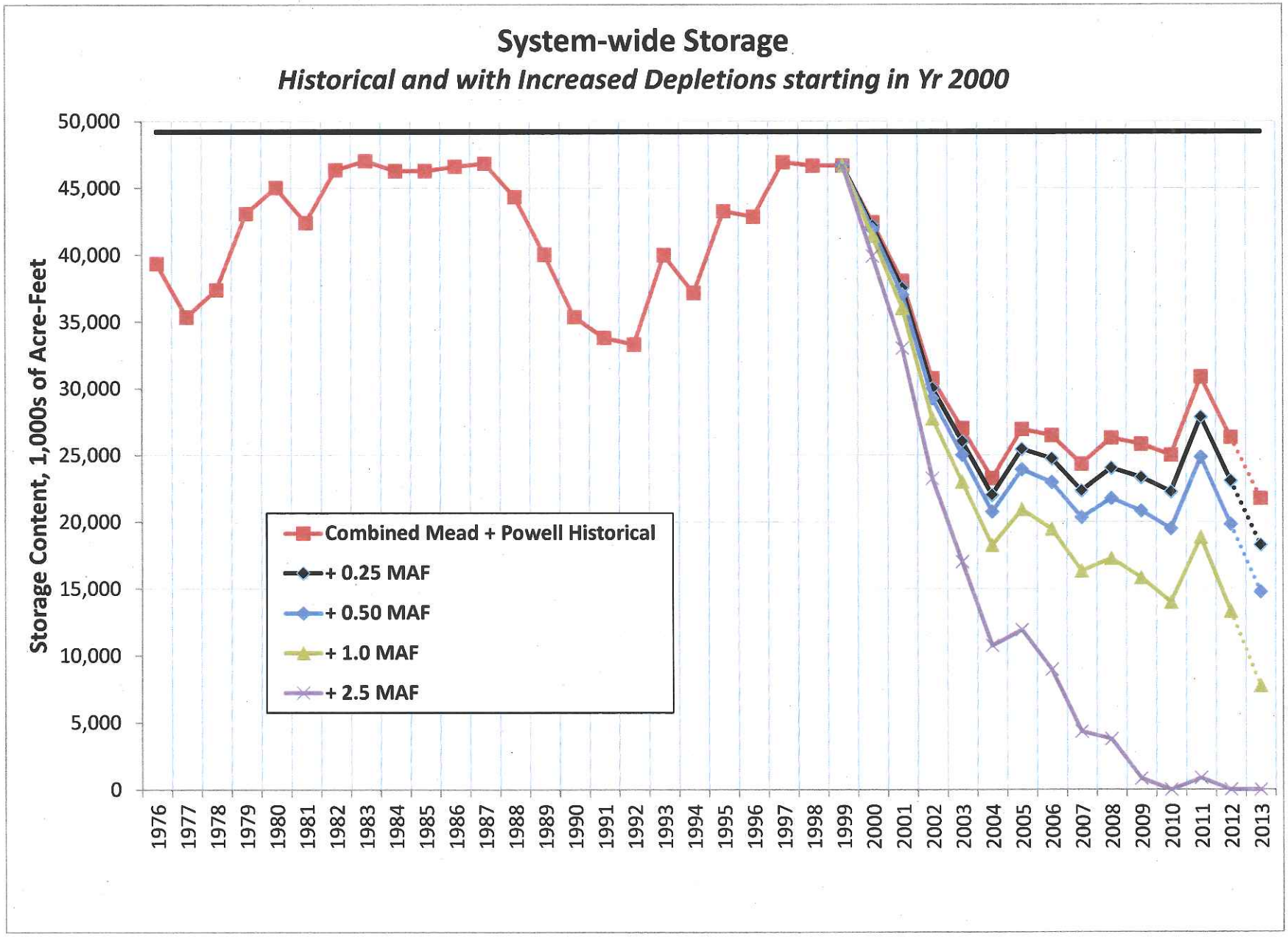

System-wide Storage
Historical and with Increased Depletions starting in Yr 2000
Storage Content, 1,000s of Acre-Feet
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
Combined Mead + Powell Historical
+ 0.25 MAF
+ 0.50 MAF
+ 1.0 MAF
+ 2.5 MAF

Figure 5

depleted, storage is reduced by an acre-foot. What is graphically shown on Figure 5 is also shown in the table below.

	Combined Mead - Powell Storage at the end of 2013
Existing System Demand	21.8 MAF
+ 0.25 MAF	18.3 MAF
+ 0.50 MAF	14.8 MAF
+ 1.0 MAF	7.8 MAF
+ 2.5 MAF	**0**

Simply put, if depletions were 2.5 million acre-feet higher the system couldn't have handled the current drought! Mead and Powell would have been empty by the end of 2010!

4 Lessons?

What lessons should be drawn from this look at the Rio Grande and the Closed Basin and the comparison to the Colorado Basin? I think there are a lot of lessons and my hope is that we, as a State can apply those lessons and not suffer the Rio Grande's chronic pain in the Colorado Basin.

- Lesson No. 1: Undeveloping is much harder than developing so be careful not to overdevelop. Quote: *"Whenever you come in to regulate something in full activity it is very difficult"*, Dick Wolfe, State Engineer, 9/26/2013, regarding development of Rules and Regulations for the San Luis Valley

- Lesson No. 2: Over development is expensive, litigious and time consuming. The Rio Grande has been dealing with this for over 100 years. Quote: *"It's easy to get into Compact violation but hard to get out of."*, Greg Tyner, Division II Assistant Division Engineer, 9/26/13 regarding compact administration in the Arkansas.

- Lesson No. 3: Compact administration is difficult and restrictive. We, as a State, should have learned our lessons. Let's do everything reasonably within our power to avoid compact administration in the Colorado.

- Lesson No. 4: Let's be very cautious how we move forward, as a State, with future development of the Colorado River. The cost of overdevelopment and the uncertainty it brings is far, far higher than the cost of very cautious, but certain development.