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Submission to the Steering Committee

for the

Middle Rio Grande Regional Water Plan Update

June 9, 2015

Part Three

Water Issues to Be Addressed

Water Issues to Be Addressed – Overview of Technical Data

This part of the Water Assembly' submission presents detailed technical data gathered from multiple sources. Those data point out serious issues that should be addressed in the continuing update for the Middle Rio Grande Regional Water Plan. This page summarizes the issues that are embedded in or surfaced by the data that appears on the following pages.

- The Administrative Water Supply (AWS) promulgated by the NMISC is not useful for meaningful pater planning in the Middle Rio Grande Region
    - Extrapolating from zero supply/demand gap is 2010 is contrary to fact
    - Withdrawals do not reflect the Region's compact-driven water supply constraints
    - The Rio Grande Compact allows 405 kafy depletion between Otowi and Elephant Butte
    - Riparian evapotranspiration and open water evaporation are significant in the region
- Climate assessment for the Rio Grande predicts significant reductions in surface water supply below 2010.
    - Even without climate change, records show frequent occurrences of multi-decadal drought.
    - The planning must deal with great year-to-year variability in available surface water.
    - The planning should acknowledge the likelihood of frequent intense events – storms, droughts, wildfires
- New Mexico's compact credit balance has dropped to zero for the first time since the early 1990s
- We will have wet water shortages
    - Substantial population growth is predicted and is seen to be economically important to the Region
    - Overpumping/subsidence drove the Region to use surface water to offset some pumping
    - All available San Juan / Chama surface water is already claimed and in use
    - Reversion to previous pump rate will cause infrastructure damage from increased land subsidence.
    - Water obligations to meet Endangered Species Act Biological Opinion will add wet water stress.
- We will have paper water shortages
    - Groundwater pumping permits carry requirements to retire surface water rights and uses when impact reaches the river
    - Existing promises to retire rights already match all irrigated acreage in the Compact region, including Native American acreage.
- The Region must plan for further use reduction and/or larger quantities of re-use.
- The planning needs to emphasize the 2004 Plan's recommendations that are still valid.
- The Plan should establish the institutional framework for vigorous implementation and coordination of its recommendations.

Technical Data - Updating the Middle Rio Grande Regional Water Plan

Addressing The Issues With A Focus

Preface: The purpose of the Regional Water Plan Update is "to focus on identifying strategies that will address the gap between supply and demand." Addressing this purpose, members of the Water Assembly, formed to develop and implement the *Middle Rio Grande Regional Water Plan*, have prepared the following information to submit as a part of the *MRG Regional Water Plan Update*.

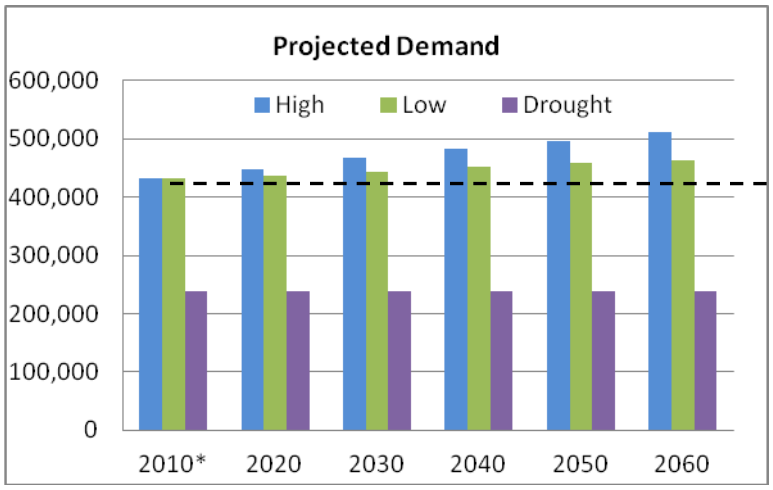
While we appreciate the need to have a Common Technical Platform, the MRG has the benefit of scientific studies that other regions may not yet have, and we cannot ignore those. The Update Handbook allows for this: "The region may provide the state with other studies or data, if available, that the region believes would improve the quantification of water use." Otherwise, what basis do any resultant recommendations have?

Following the summary of problems and issues, are some ideas and a conceptual path forward on page 13, and some background information, beginning on page 16, which contains snips from the RWP Update Handbook, the Administrative Water Supply and the MRG Water Supply Study (2004). On page 27 is the Water Budget Update and a Water Balance Idea.

Closing the Gap

Problems and Issues

In updating the regional water plans, the regions are to use the same technical data, called the Administrative Water Supply (AWS). The AWS for the MRG was presented on 1/23/15:



Black dashed line is the administrative water supply
In the materials, a red dashed line on the chart represents the "Severe Drought Impacted Administrative Water Supply = based on the ratio of the minimum drought of record to the 2010 administrative water supply." I added the purple column to replicate the line, estimating it to be 55% of the 2010 AWS.

From the Update Handbook:

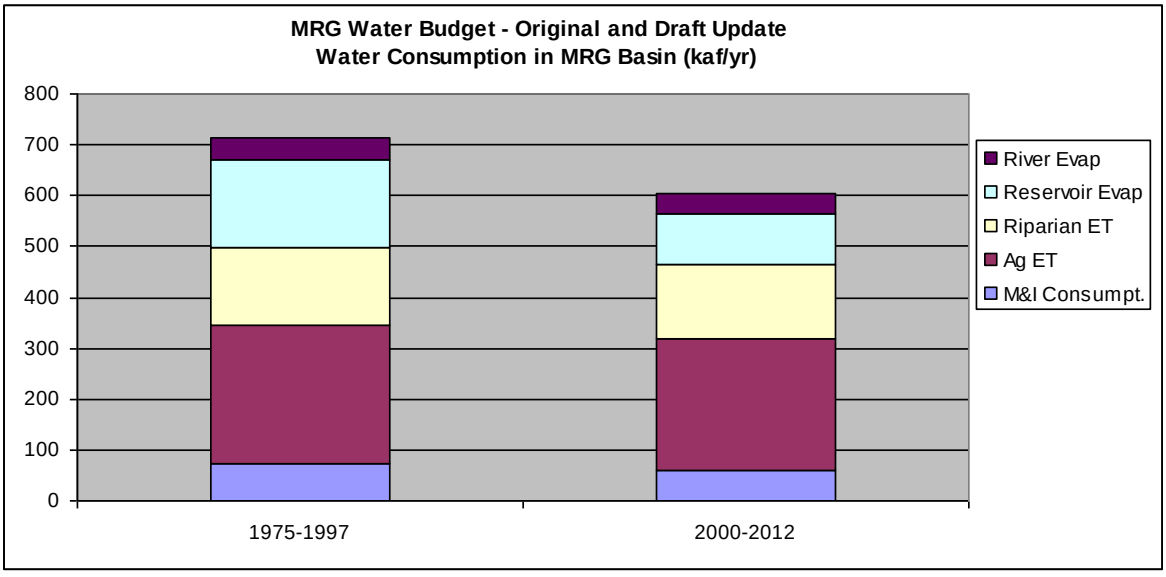
In almost all areas of the state of New Mexico, projected demand is expected to exceed available supply, and therefore, the update should continue to focus on identifying strategies (projects, programs, and policies) that will address the gap between supply and demand.

The purpose of the regional water plan updates is to calculate the gap between supply and projected demand and to identify strategies (projects, programs, and policies) that address that gap and other water management issues identified by the regions.

When one looks at the Administrative Water Supply (AWS), included in more detail in the Background Information below, there is no gap as of 2010. Rather, it assumes that supply equaled withdrawals equaled use equaled demand in 2010 -- not exactly the conclusion in the draft updated Water Budget, which was that the region been draining Elephant Butte by ~43 kaf per year to achieve that "balance."

Middle Rio Grande Water Budget - Draft
Dr. Bruce Thomson, et al
6/25/2014

Note that the average water budget deficit of 48 KAF/yr for the period 2008-2012 is close to the 40 KAF/yr deficit estimated for the year 2000 by SSPA (2004). Although significant decreases in M&I consumptive use has been achieved and water diversion for irrigation has been reduced the overall water supply for the MRG basin remains out of balance with the demand. It is clear that further measures for reducing basin wide consumptive use will be required to bring the basin into balance based on current water uses. Furthermore, even more aggressive measures will be required in the future to meet the conflicting situations of increased demand due to projected growth and decreased future supplies as a result of long term drought and climate change.

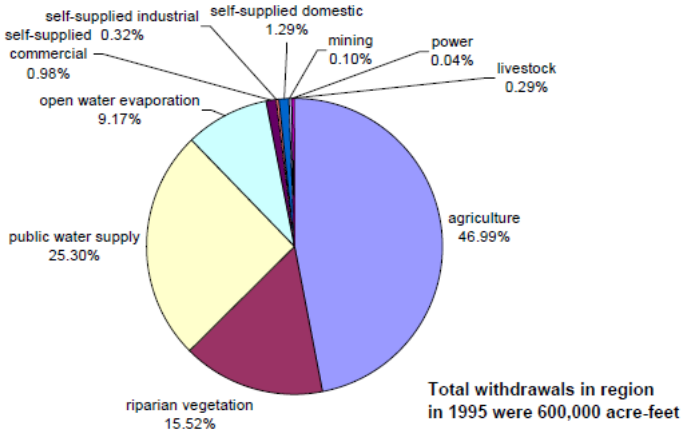


That gap is also quite similar to the gap found in the 1997 Water Assembly's Water Budget and the 2004 Water Budget prepared for the ISC (see Background Information).

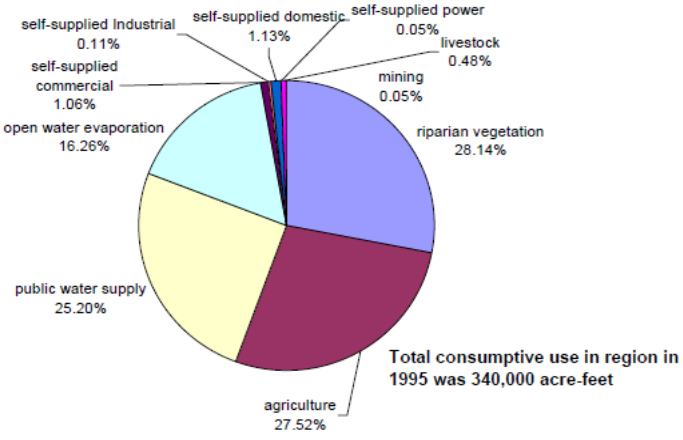
In the AWS, agricultural demand remains at the same amount through 2060, drought or no drought. Does that make sense? The Climate Assessment done for the Rio Grande shows that surface water supply will certainly be reduced from what it was in 2010. Over the next 40 years, many water rights will have been transferred. Likely, that's why the urban usage goes up over that same time period -- water is serving a growing population.

No accounting is included for the consumptive uses by the riparian areas or open river water evaporation, although according to John Shomaker's report done for the original regional water plan, those amounted to some 25% of withdrawals and 44% of depletions in our planning area in 1995.

Distribution of withdrawals by category in total region, 1995



Distribution of consumptive use by category in whole region, 1995



Historical and Current Water Use in the Middle Rio Grande Region
Prepared by John Shomaker & Associates, Inc. and PioneerWest, June 2000
http://www.waterassembly.org/archives/MRG-Plan/H-Rio%20Grande%20Supporting%20Documents/SH%201-11%20Third%20Party%20Documents-Reports-Etc/SH-4%20%20Nims%20et%20al%20%28Shomaker%29.pdf

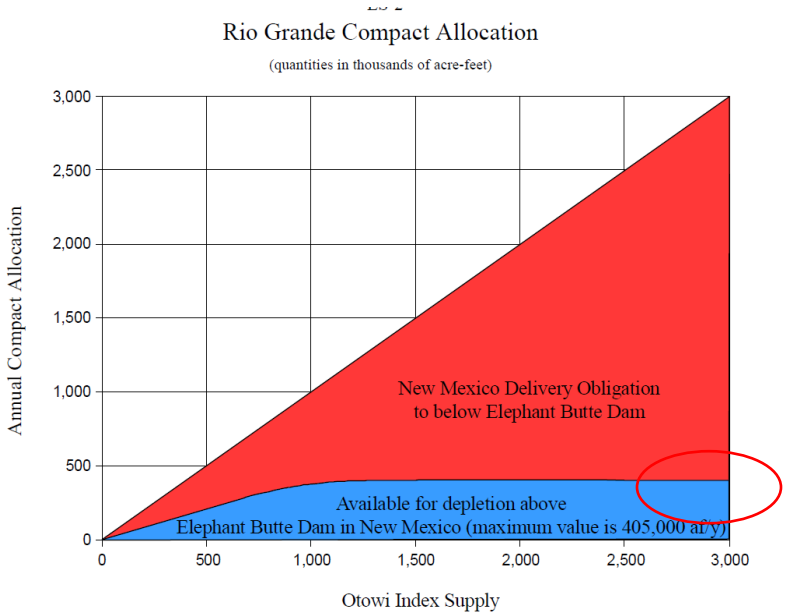
The various water budgets done for our region, including the one done for the ISC and the one being updated now, include riparian areas or open river water evaporation.

> Although those uses remain unquantified, since they are not included in either the supply or demand determination, they will not substantially affect the quantification of the gap.[1] (Update Handbook)

It would be useful to have the supply and demand numbers to see if there is a gap to address. Still, since the surface water supply is declining, uses reliant on it will face stresses different than those which can use groundwater supplies. (Which increased reliance on will face other constraints, such as increasing the potential for land subsidence, costs to desalinate, and need to acquire additional water rights.) Having a clearer idea of the sources of supply can help in directing recommendations. What might be done to limit the demands on the aquifer? If stormwater --which supplements our allotment from the Rio-- were to be treated as a supply source, what changes might be needed to policies, infrastructure, etc.?

Given the percentage that such unquantified uses represent of overall consumption, ignoring such use, and thus not planning for it, may well lead us into the type of troubles the State is facing in the Lower Rio Grande.

The Rio Grande Compact constrains how much we in the MRG, plus those in Socorro, Sierra and Santa Fe Counties, can consume – included or not in the OSE categories. Consumption tops out at 405 kaf (see Background Information for more detail).



If one were to just use the AWS, without knowing the source of the supply, it would appear that our region alone withdrew / demanded / used / consumed more than the maximum allowed under the Compact!

[1] Such unquantified consumption must be occurring or else why would the ISC spend so much time and treasure on winnowing the bosque and dredging the channel into Elephant Butte? Provides habitat and reduces depletions, ensuring deliveries! Furthermore, if there is no usage, how can we justify asking for funds to address the alternatives in Chapter 10.2.6 Bosque and Other Riparian Habitats?

Table 6-5. Projected Water Use, 2020 through 2060 Middle Rio Grande Water Planning Region

		Water Use (acre-feet)					
Use Sector	**Projection**	**2010***	**2020**	**2030**	**2040**	**2050**	**2060**
Total regional demand	High	431,640	447,972	467,016	482,412	496,723	511,064
	Low	431,640	436,313	444,421	451,670	457,911	464,069

Groundwater, SJC water and precipitation below Otowi Gage are all sources of water in addition to the River. While not broken out in the AWS data presented in January, the 2010 data set used to establish the baseline is found in *New Mexico Water Use by Categories 2010.*[2] In the report, surface and groundwater withdrawals are reported. Of note, while groundwater withdrawals in Bernalillo County represented 48% of its total, they were only 13% in Valencia County.

MRG 2010 (af)	WSW	WGW	TW
Sandoval County	53,789	25,330	79,120
	67.98%	32.01%	
Bernalillo County	88,466	81,502	169,967
	52.05%	47.95%	
Valencia County	160,262	23,225	183,488
	87.34%	12.66%	
MRG	302,517	130,057	432,575
	69.93%	30.07%	

Key: WSW=withdrawal, surface water; WGW=withdrawal, groundwater; TW=total withdrawal

Clearly, solutions to reduce consumptive uses or to augment existing supply will impact users differently depending on the source.

We share the responsibility of meeting the Compact obligations with two other planning regions. Like with the unquantifieds, we have not been given data to see whether all of the basin's demands exceed the allowable amount. The 2010 Water Use Report shows:

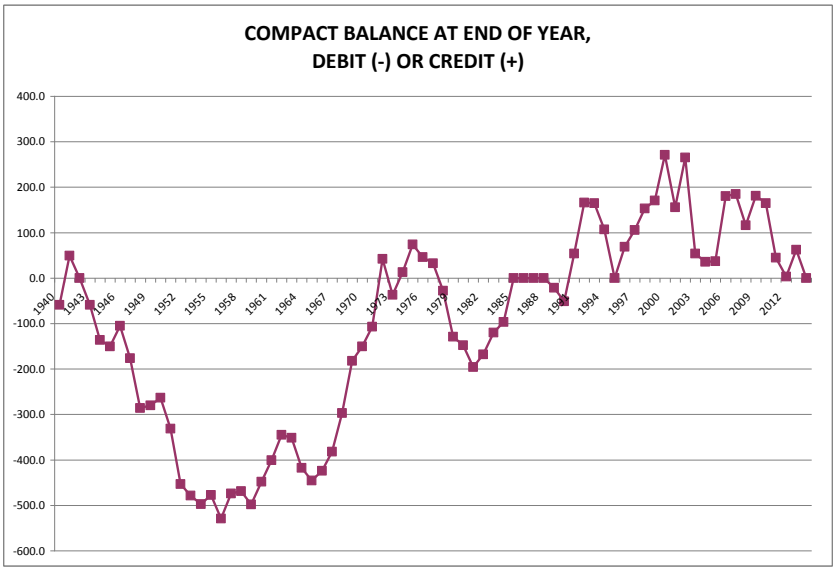
	WSW	**WGW**	**TW**
Sierra County	122,045	27,761	149,806
Socorro County	118,470	35,444	153,914

67% of Sierra County's total is evaporative loss from Elephant Butte Reservoir

Looks like the use of surface water alone in the basin, even after removing the SJC water, is more than 405 kaf. If this is the case, what might we do about it? Should we have any recommendations? After all, how else can we justify projects to reduce the evaporative loss from the reservoir?

In line with the draft Water Budget Update cited above, one result of our basin's over-consumption has been the dramatic lowering of water levels in Elephant Butte Reservoir, lessening Sierra County's consumptive use but reducing the State's credit balance to zero.

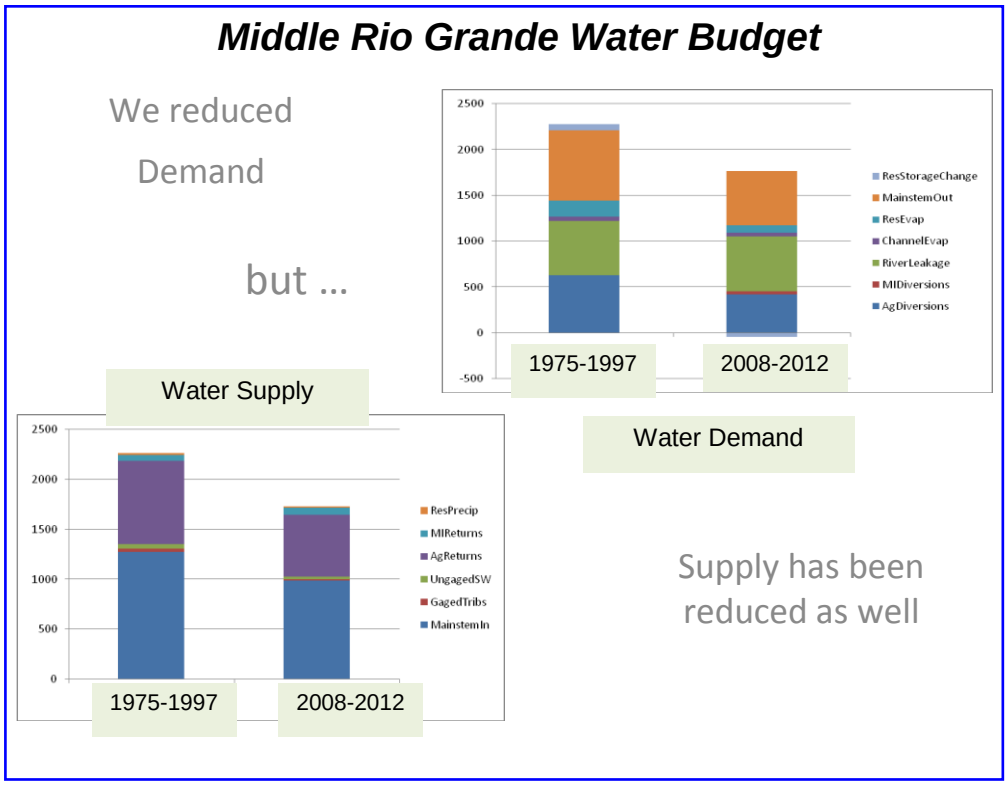
[2] Longworth, John W., P.E.; Valdez, Julie M.; Magnuson, Molly L., P.E.; and Richard, Kenneth, New Mexico State Engineer Office, Technical Report 54, October 2013. http://www.ose.state.nm.us/Pub /TechnicalReports/TechReport%2054NM%20Water%20Use%20by%20 Categories%20.pdf)



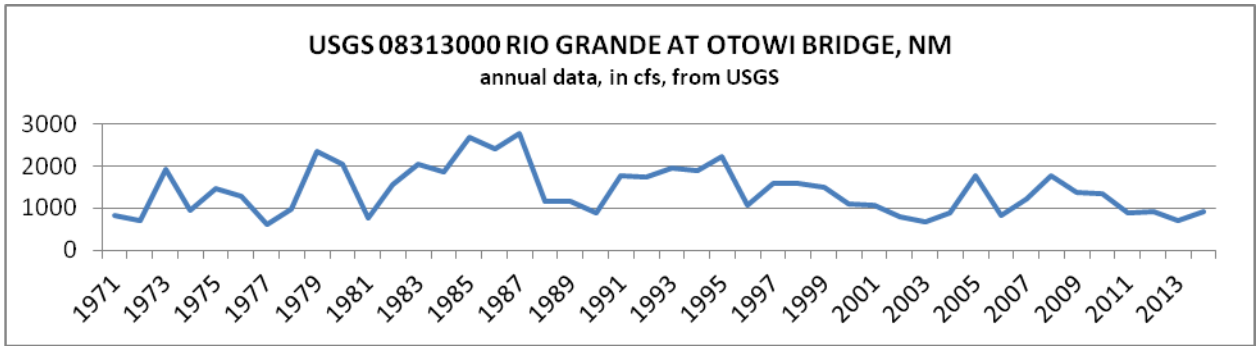
5/1/15 - ISC, using NM's proposed accounting method (Method 2)

While we can go into debit spending, should conditions continue as projected, that may be a hole we cannot dig our way out of without some real hardship. With a Special Master from the US Supreme Court already investigating Rio Grande water accounting issues below Elephant Butte, it is not difficult to see his jurisdiction expand to include the Middle Rio Grande Basin should there be Compact issues.

The draft updated Water Budget shows that while we have reduced our consumption since the earlier version, supply has likewise declined.



The availability of surface water is highly variable year to year, which is not captured when using one data point.



Regional Water Planning has to take into account that variability, rather than use a stationary data point.

Climate Change must be Considered!

Climate change undermines a basic assumption that historically has facilitated management of water supplies, demands, and risks: the idea that hydrologic variables in future time periods will be similar to past time periods. Such assumptions are problematical if not risky. In the recently-approved *Futures 2040 MTP* for our region, climate change was discussed as it related to transportation, housing and water. Included in the materials was a presentation on what changing climate conditions mean with respect to water supply, and from which are included a few slides:

Futures 2040: The Metropolitan Transportation Plan
for the Albuquerque Metropolitan Planning Area
April 2014
http://www.mrcog-nm.gov/images/stories/pdf/transportation/2040MTPScenario_Planning/spring-14-futures-2040-meeting-presentation-2.pdf

Upper Rio Grande Impact Assessment

- All 112 scenarios result in higher temperatures
- Earlier snowmelt runoff
  - Changes in timing of river flows
- Higher temperatures increase water demands for irrigated agriculture
- Precipitation is highly variable
- More intense droughts and more extreme events

Water Availability in 2100

According to the Upper Rio Grande Impact Assessment:
- Rio Grande flows decrease by 1/3
- San Juan-Chama flows decrease by 1/4

Water Consumption

- How we grow impacts how much water we consume

• Analyze consumption patterns by land use and housing mix
• Daily residential consumption dropping locally and nationally
  ▫1994: 250 gallons per capita
  ▫ Today: ~135 gallons per capita *Source: Albuquerque Bernalillo County Water Utility Authority*

Water Sustainability / Environment

Look at ways to improve water conservation through reuse, delivery and development patterns. Better understand the current water resources and future availability and how transportation decisions affect our environment.

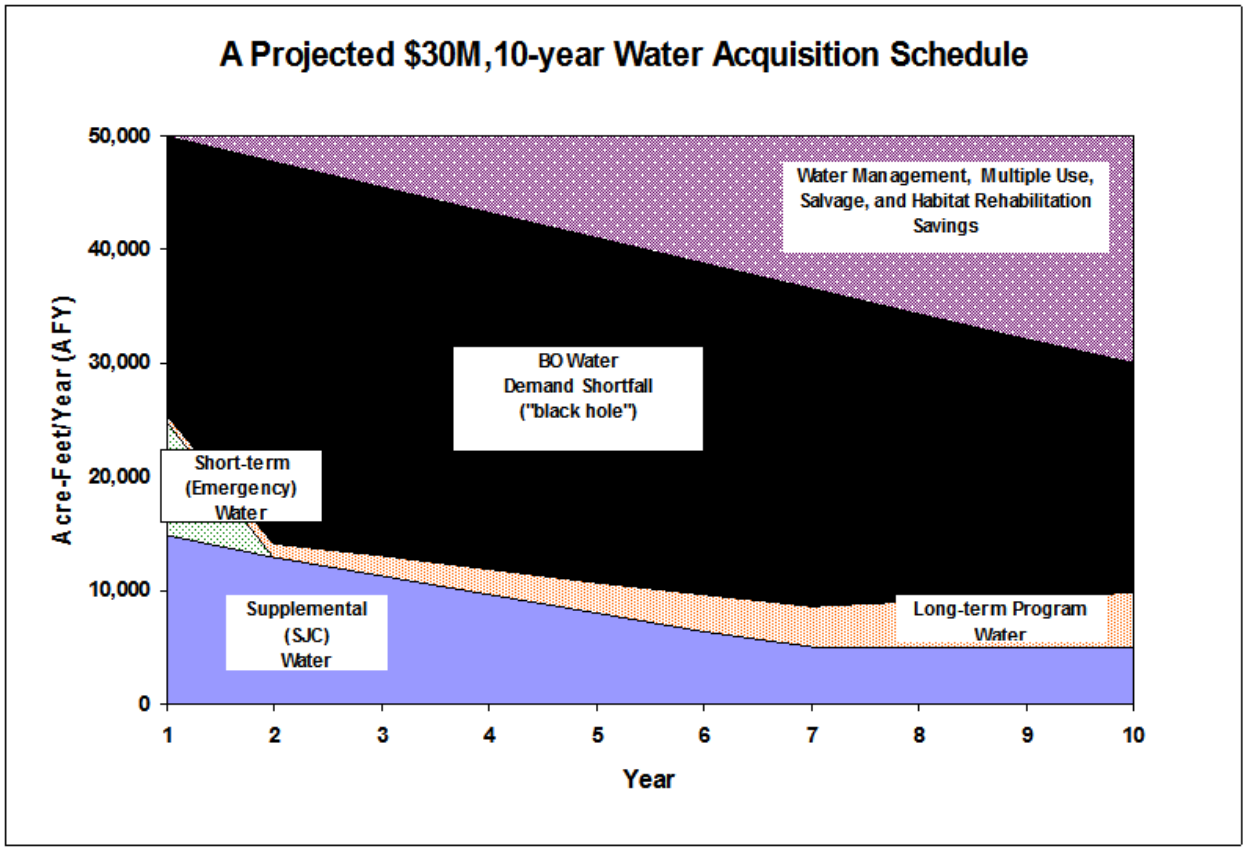
Some Other Considerations

_Mesa del Sol has a 38,000 housing unit build out
_Albuquerque's core could densify considerably in major centers and transit corridors.
_Sandoval is projected to grow by 100%
_Los Lunas has adopted TOD supportive zoning
_Belen has annexed 5,000 vacant acres
_Edgewood/Moriarty low density, rural character

Not included in the AWS is any acknowledgement of the water requirements to satisfy the 2003 Biological Opinion (BO) issued by the USFWS for water operations along the middle Rio Grande (MRG). In 2005 the Water Acquistion and Management Subcommittee (WAMS) of the Middle Rio Grande Endangered Species [Act] Colaborative Program (Program) produced its final report, before that subcommittee was subsequently dissolved by the Program and the water management part of their function assigned to a new workgroup. The final WAMS' 2005 report presented its assessment methods and findings of water volume needss, source options, acquistion alternatives, and management approaches to meet the 2003 BO. It included the results from a team of hydrologic modelers from NMISC, USBR, USACE, MRGCD, and other experts from the region that projected water volumes needed to meet that BO. In short, modeling wet, average, dry, and Rio Grande Compact Article VII water years for good, average, and poor snowmelt runoff years and for wet, average, and dry monsoon years, the model projected an avervage annual requirement of 50,000 acre feet. The maximum water requirement (97,000 acre-feet) would occur during a year under Article VII with poor snowmelt runoff and a dry monsoon season. The minimum requirement (21,000 acre-feet) would occur in a wet year with good runoff and a wet monsoon season. As apparent in these results, the 2003 BO required supplemental water supplied to the MRG even under the wettest climatic conditons. That 10-year BO has now expired and its replacement has not been produced. Whether the replacement BO will include similar water requirements is unknown.

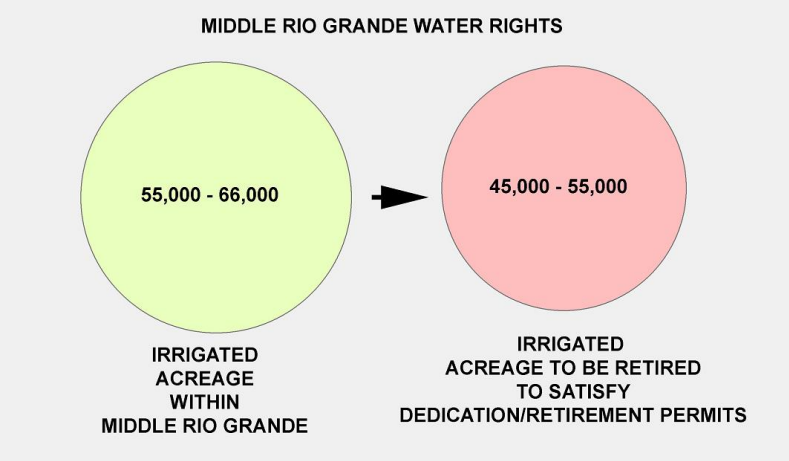
In 2005 the Program's management projected a total of $30 million as being available to meet the cost of water to meet the BO requirement. In response,the WAMS produced 10-year "ballpark water costs" using three sets of assumptions based on 2005 water costs and alternative potential water sources to the MRG. Sources considered included varying combinations of potential options existing in 2005: (1) supplemental San Juan-Chama (SJ-C) water; (2) short-term, emergency drought water; (3) long-term water expected to be purchuse by the Program or other to meet the BO; (4) potential increased water yield to the river from agricultural forbearance and mucipal conservation; and (5) potential increased water yield to the river due to improved water management, multiple use, water salvage, and habitat rehibilitation savings. Projected costs (without consideration of inflaction after 2005) for the three assessed alteratives to meet the BO ranged from nearly $57 to $190 million for 10 years.

The WAMS also produced a $30 million 10-year water acquistion schedule that assumed declining short-term water transfers, no forebearance benefits, 5 percent inflation on water rights purchases, and a decreasing SJ-C water flow-through supply to meet the avearage water year demand for the BO (50,000 acre feet). The results of this assessment is summarized in the following fiigure. In considering that figure, it should be additional recognized that the top wedge was consider by the WAMS members then, which continues true today, as highly speculative. As suchs, that volume can reasonably be added what is called the water supply “black hole” in the figure. How this average annual 35,000 acre-feet gap in water supply to meet the 2003 (and possible future) BO requirements using water sources to the MRG has not been resolved.



Also not included in the discussion on supply are paper water permits. However, the State has handed out more permits to allow groundwater pumping to cities than there is wet water to offset the resultant depletions. And that's without even considering the projected reduction in surface water supply due to climate change.

A former State Engineer, Tom Turney, and the current Rio Grande Basin Manager for the Interstate Stream Commission (ISC), Rolf Schmidt Petersen, have both publicly stated that it will take nearly all of the lands currently irrigated between Cochiti Reservoir and Elephant Butte Reservoir to satisfy the outstanding permits already issued by the State Engineer to urban areas.



Tom Turney, former State Engineer
NM Water & Natural Resources Interim Legislative Committee (September 20, 2008)

See also***, A Basin-wide Approach to Water Management in the Middle Rio Grande Valley,*** Rolf Schmidt-Petersen, NMISC Rio Grande Basin Manager, August 22, 2007, http://nmwaterdialogue.org/library/documents/schmidt-petersen-8-22-07.pdf/at_download/file

Removing lands which are irrigated by Pueblo members but from which water cannot be transferred to satisfy water permits, removing lands which do not have senior transferable water rights, and accounting for those lands from which water rights have already been sold and transferred, the resultant acres available to service outstanding water permits are reduced even further.

Justice Kennedy from the New Mexico Court of Appeals, in writing the decision in the Drinking Water Protest, summed up what needs to be done:

> **Footnote 5** We note that some analysis of detriment, conservation of water, and concerns for public welfare, relative to the SJCP water being used for a new purpose than groundwater recharge under RG-960, is part of the administrative and district court review of the Permit. This review gives us pause to consider **that there are substantial issues awaiting consideration with regard to future policies governing water that has yet to be developed.** Owing to our rulings in this Opinion, these issues concerning future overall management of the Rio Grande Basin and its water resources remain largely unresolved by this action. Protestants' desire for a global review in this case of meta-issues regarding the effects of a growing population, changing water needs, and methods of delivery to that population, and the ultimate effect of diminishing resources, full allocation and increasing demand are limited to the issues raised, preserved, and briefed herein. (emphasis added)

John Carangelo, Assessment Payers Association Of The Middle Rio Grande Conservancy District, Amigos Bravos, and Rio Grande Restoration, Protestants-Appellants, v.Albuquerque-Bernalillo County Water Utility Authority, Applicant-Appellee, and New Mexico State Engineer, John R. D'antonio, Jr., Respondent-Appellee, 320 P.3d 492 (2013), 2014-NMCA-032, http://www.nmcompcomm.us/nmcases/NMCA/2014/14ca-032.pdf

Conceptual Path Forward

When the MRG RWP was presented to the ISC in August 2004, it was also given a list of a list of unresolved issues in the region. On March 3rd, Bob Wessely gave a presentation to the Steering Committee which included this list. Issues include "Coordination of Actions," "ESA Requirements" and "Lack of Completed Adjudications." More than ten years later, those issues have not been resolved. Several issues were also presented by the ISC team in January, including "Compact compliance" and "Already permitted water rights requiring water right transfers for offsets." (Both lists can be found in the Background Information section.)

1. Water Budget/Water Assessment/Water Balance: The original MRG Water Budget, combining surface water and groundwater, found that we were running a substantial deficit --at least 55,000 af annually-- which in turn provided the rationale for our regional water plan. After learning about the deficit, we focused our attention on reducing demand and/or augmenting supply. *Balance Use With Renewable Supply* became the mantra, and Chapter 10's Recommendations started off with the *Urgent Shortfall Reality*.

In the fifteen years since the Water Budget was developed and accepted, significant changes have been made, as was shown in the draft Water Budget Update. But it still shows a gap, contrary to the AWS. While laudable in the ideal to create a common technical platform, the AWS is clearly inadequate for closing the gap.

WRRI at NMSU and other universities are currently developing a statewide water assessment, funded by the State Legislature:

> http://www.nmlegis.gov/Sessions/15%20Regular/firs/SB0156.PDF
>
> With FY15 state funding, the NM WRRI is now developing a statewide water assessment. The statewide water assessment is a data resource and planning tool that provides easily accessible integrated data for precipitation, evapotranspiration, groundwater, recharge, surface flows, produced water, return flows, brackish groundwater, and reused water. The data will be used to develop system dynamics models with scenario testing for managing existing water and developing new water sources. The statewide water assessment is crucial to helping the state plan for a sustainable water future. It will deliver data for informed water management decisions that complements and augments the work of existing state agencies such as the Office of the State Engineer. NM WRRI cooperators on current related projects include New Mexico State University, University of New Mexico, New Mexico Tech (including the NM Bureau of Geological and Mineral Resources, and the Petroleum Recovery Research Center), Sandia National Laboratories, U.S. Geological Survey, and the NM Office of the State Engineer.

As Dr. Thomson explained it:

> The Statewide Water Assessment is an accounting exercise not a simulation model. It uses existing data on water supply, precipitation, and diversions, together with calculated estimates for unmeasurable flows (i.e. ET) to provide an accounting of how water is being used. By the middle of the summer, it will provide a water budget for any period in the past ranging from decades to one month. Its present stage of development is to provide a water balance for each of the river basins in the state (Rio Grande, Pecos, Upper Colorado, etc.). Disaggregating the data to the county & water planning region will be next year's task but it will take a lot of work. At present I don't think there are any plans to develop the tool

into a forecasting model that would enable prediction of impacts of climate change or changes in water use/demand.

What with such resources being expended, this looks to be a reasonable effort to be engaged with. While not yet ready for the regions, such a robust tool will enable decision making to be done with realistic numbers. Why not wait until the Water Assessment is done for our region before we try to analyze programs, policies and projects as we update the regional plan? (Or at least use the "Severe Drought Impacted Administrative Water Supply" to plan with.)

2. Develop an institutional framework: While the Water Assessment is being worked on, why not focus on the building blocks needed to create a way that the various players could work together? Why not tackle the lack of a common structure with which to use the assessment?

Consider the number of the Recommendations in the 2004 RWP which have to do with allocating, planning and modeling:

R2-1—Adjudication and Water Rights Settlement (A-71)
Regional Water Planning Program (A-58)
R2-6—Water Resource Database (A-73)
R2-7—Watershed Management Plans (A-66, A-33)
R2-8—Comprehensive, Integrated, and Continued Water Planning (A-53)
R2-9—Storm Water Management Plans (A-34)
R2-10—Cooperative Regional Water Management (A-67)
R2-12—Land Use Management and Planning (A-52, A-30, A-28, A-144)
R3-1—Measure All Water Uses (A-7, A-8, A-73)
R7-4—Water Modeling (A-38, A-143, A-144)

Zoom forward to 2015, where the recently-adopted *Futures 2040 MTP* recommends:

• Coordinate regional water plans and the 2040 MTP
• Facilitate regional dialogue about balancing agricultural and residential/commercial water consumption
• Provide information to policy makers, planning commissions, and agency staff on scenario planning efforts and the impact of growth patterns on the natural and built environment
• Facilitate a regional dialogue about the link between land use patterns and water consumption
• Increase coordination with water utility organizations on regional planning efforts
• Analyze water infrastructure costs associated with different growth patterns
• Support the use of grey or recycled water in parks, golf courses, and other open spaces
• Investigate the most efficient methods to conserve and reuse water in the region

Zoom backward to 2009, where a recommendation was made that the region had to "work on the challenges of meeting long-term demand" and "to be strategic about how to meet the future needs of this urban area."

http://uttoncenter.unm.edu/pdfs/Urban_Water_Admin.pdf

DECISION-MAKERS FIELD GUIDE 2009
Water: A limiting factor

Urban Water Administration in the Albuquerque Urban Area

Susan Kelly, Utton Transboundary Resources Center, University of New Mexico School of Law

The ABCWUA strategy—to rest the aquifer for a period of time after the start of the project to divert and treat San Juan–Chama water for drinking water—will provide some time and space to allow the divergent interests in the Albuquerque urban area to work on the challenges of meeting long-term demand. **We will have an opportunity to refine and implement plans and to be strategic about how to meet the future needs of this urban area.** The Albuquerque area is part of the Rio Grande growth corridor and vital to the New Mexico economy. We can work with the state and other communities in the larger region to sustain our water supply, quality of life, and treasured natural environment.

While there have been plans developed by specific entities, the regional coordination envisioned clearly has not happened. In fact, seemingly going in the other direction, the Water Resources Board became an advisory committee to the MRCOG. In the ten+ years since the Plan was accepted, there has been no movement toward determining ownership of water rights or of quantifying Pueblo's present and future rights. Without such consideration, how can plans be made to simply reduce a certain percentage of use? There is no one database to work from to consider the impacts and benefits of proposals, nor is there any regional compilation of approved projects with concomitant promises. Without such basic tools, there is little to no way to show whether an existing policy, program, project or plan makes any difference, much less a new one.

In addition to summarizing the efforts that have been made in the interim, the proposal is to proceed to implement those cited recommendations from the MRG RWP and from the *Futures 2040 MTP* and creat a common infrastructure for water planning. Rather than proposing new projects to be built, what that could mean would be to create some sort of framework which would be necessary to use the water assessment tool in regional efforts. That task would consider how to incorporate issues such as water rights ownership, lack of common data sets and the lack of a common institutional framework. It could move on to consider ways to link local land use decision makers with available water resources, and include impacts of climate change. It should include considering changes to the institutional arrangements for water governance. Then, with the water assessment in hand, options to either decrease demand or increase supply could be evaluated and decided upon using a scientifically based approach together.

Utilitizing what we have been given, evaluating the feasibility of any plan, program, project or policy will make little sense. Developing a better framework would make future evaluations possible!

Background Information

http://www.ose.state.nm.us/Planning/RWP/documents/Revised%20RWP%20Handbook%20ISC_Dec_2013_Final.pdf

Update Handbook

snippets

F. Water Supply (Prepared by the State) The state will prepare the administrative water supply summary for each region based on the NMOSE Water Use by Categories report. The state will confer with regional planning stakeholders to obtain input from the regions and ensure that additional relevant data and studies from the region are identified and made available to the state.

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G. Water Demand (Prepared by the State) The state will confer with regional planning stakeholders to obtain input from the regions and ensure that relevant regional data and studies are identified and made available to the state. The information listed in each section below will be addressed.

G.1 Present Uses Given that the administrative water supply will be based on current water usage, there will be some inherent redundancy between Sections F.5 and this section. However, while Section F.5 will examine the water supply based on overall current uses, this section will address specific categories of uses in greater detail to provide the basis for projecting anticipated future demands.

• Water diversions by category of use as follows:

- Commercial (self - supplied)
- Domestic (self - supplied)
- Industrial (self - supplied)
- Irrigated agriculture
- Livestock (self - supplied)
- Mining (self - supplied)
- Power (self - supplied)
- Public water supply
- Reservoir evaporation

Information for all the above categories will be obtained from the most recent NM OSE Water Use by Categories reports. Riparian and open water evaporation (i.e., for rivers that are not included in the reservoir evaporation category) are not included in these reports . The NM OSE Water Use by Categories reports provide diversions, and statewide depletion data are currently not available. Where depletion data are available and important for Compact accounting or other purposes, those data will be discussed, but the quantification based on diversions will provide a consistent, statewide methodology for use in the state water plan update.

• Water use information presented in the most recent NM OSE Water Use by Categories report will be used to define regional water use. The region may provide the state with other studies or data, if available, that the region believes would improve the quantification of water use. The region should provide an explanation as to why the new data improves or clarifies the NM OSE
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data. Where the water use information provided in the NM OSE Water Use by Categories report does not match the geographical boundaries of a planning region, the state will sort the source data into the appropriate geographical units.

G.3 Water Conservation To assist the region in understanding its water use and developing goals for future reduction in demand to be achieved through conservation, this section will identify current per capita demand, based on the most recent NM OSE Water Use by Categories report, for public water suppliers in the region. Additional discussion of water conservation is provided in Section I.1

H. Identified Gaps between Supply and Demand (Prepared by State)

…

The state will compare the estimated water supplies and projected demands for each region to provide an overview of the water needs for the regions and the state. This overview may not reflect local shortages or region-specific issues. The regions will have an opportunity to consider whether additional studies or scenario planning may be needed and, if so, they may include them when they develop their lists of funding priorities.

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MRG RWP Data from ISC Presentation

January 23, 2015

Table 6-5. Projected Water Use, 2020 through 2060 Middle Rio Grande Water Planning Region

		Water Use (acre-feet)					
Use Sector	**Projection**	**2010***	**2020**	**2030**	**2040**	**2050**	**2060**
Total regional demand							
Public water supply	High	132,572	145,553	160,083	171,429	181,770	192,666
	Low	132,572	139,197	145,406	150,791	155,268	159,932
Domestic (self-supplied)	High	8,599	9,913	11,573	13,039	14,432	15,640
	Low	8,599	9,057	9,622	10,160	10,664	11,123
Irrigated agriculture	Low/High	266,481	266,481	266,481	266,481	266,481	266,481
Livestock(self-supplied)	High	1,250	786	906	1,011	1,074	1,136
	Low	1,250	648	773	887	950	1,011
Commercial (self-supplied)	High	12,077	14,039	16,380	18,394	20,369	22,188
	Low	12,077	12,990	13,951	14,862	15,703	16,452
Industrial (self-supplied)	High	4,469	4,787	5,104	5,422	5,740	6,057
	Low	4,469	1,627	1,850	2,074	2,296	2,520
Mining (self-supplied)	Low/High	543	543	543	543	543	543
Power (self-supplied)	High	472	647	672	757	897	897
	Low	472	597	622	697	832	832
Reservoir evaporation	High	5,170	5,220	5,270	5,331	5,411	5,451
	Low	5,170	5,170	5,170	5,170	5,170	5,170
Total regional demand	High	431,640	447,972	467,016	482,412	496,723	511,064
	Low	431,640	436,313	444,421	451,670	457,911	464,069

* Actual use (Longworth et al., 2013)
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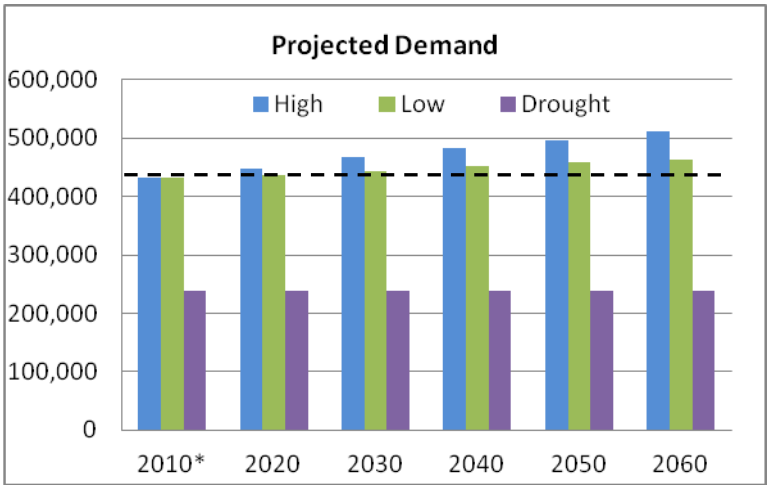

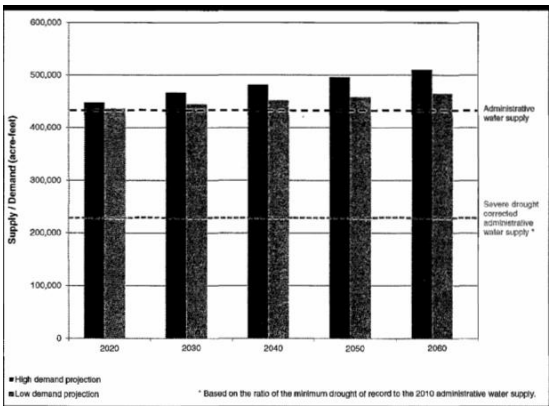

Black dashed line is the administrative water supply
emh added purple column, which is 55% of 2010 AWS to represent the "Severe Drought Impacted Administrative Water Supply = based on the ratio of the minimum drought of reocrd to the 2010 administrative water supply." (red dashed line on chart in materials (right))

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New Mexico Water Use by Categories 2010 by Longworth, John W., P.E.; Valdez, Julie M.; Magnuson, Molly L., P.E.; and Richard, Kenneth, New Mexico State Engineer Office, Technical Report 54, October 2013. (http://www.ose.state.nm.us/Pub/TechnicalReports/TechReport%2054NM%20Water%20Use%20by%20 Categories%20.pdf)

Table 5. Summary of water use in acre-feet in New Mexico counties, 2010. (acre-feet)

Use Sector	WSW	WGW	TW
Sandoval County			
Public water supply	219	15,696	15,915
Domestic (self-supplied)	0	2,743	2,743
Irrigated agriculture	48,322	624	48,946
Livestock(self-supplied)	62	79	141
Commercial (self-supplied)	17	2,848	2,865
Industrial (self-supplied)	0	3,066	3,066
Mining (self-supplied)	0	275	275
Power (self-supplied)	0	0	0
Reservoir evaporation	5,170	0	5,170
Total	**53,789**	**25,330**	**79,120**
	67.98%	**32.01%**	**100.00%**
Bernalillo County			
Public water supply	45,152	64,991	110,143
Domestic (self-supplied)	0	2,996	2,996
Irrigated agriculture	43,309	2,604	45,913
Livestock (self-supplied)	4	252	257
Commercial (self-supplied)	0	9,032	9,032
Industrial (self-supplied)	0	1,072	1,072
Mining (self-supplied)	0	89	89
Power (self-supplied)	0	466	466
Reservoir evaporation	0	0	0
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Total	**88,466**	**81,502**	**169,967**
	52.05%	**47.95%**	**100.00%**
Valencia County			
Public water supply	0	6,554	6,554
Domestic (self-supplied)	0	3,686	3,686
Irrigated agriculture	160,215	11,407	171,622
Livestock (self-supplied)	47	841	888
Commercial (self-supplied)	0	221	221
Industrial (self-supplied)	0	331	331
Mining (self-supplied)	0	179	179
Power (self-supplied)	0	6	6
Reservoir evaporation	0	0	0
Total	160,262	23,225	183,488
	87.34%	12.66%	100.00%

Key: WSW=withdrawal, surface water; WGW=withdrawal, groundwater; TW=total withdrawal

MRG 2010	**WSW**	**WGW**	**TW**
Public water supply	45,371	87,241	132,612
Domestic (self-supplied)	0	9,425	9,425
Irrigated agriculture	251,846	14,635	266,481
Livestock (self-supplied)	113	1,172	1,286
Commercial (self-supplied)	17	12,101	12,118
Industrial (self-supplied)	0	4,469	4,469
Mining (self-supplied)	0	543	543
Power (self-supplied)	0	472	472
Reservoir evaporation	5,170	0	5,170
Total	**302,517**	**130,057**	**432,575**
	69.93%	**30.07%**	**100.00%**

Table 5. Summary of water use in acre-feet in New Mexico counties, 2010.

	WSW	**WGW**	**TW**
Sierra			
Public water supply	0	1,668	1,668
Domestic (self-supplied)	0	168	168
Irrigated agriculture	21,397	23,662	45,059
Livestock (self-supplied)	28	536	564
Commercial (self-supplied)	0	1,709	1,709
Industrial (self-supplied)	0	0	0
Mining (self-supplied)	0	17	17
Power (self-supplied)	0	0	0
Reservoir evaporation	100,620	0	100,620
Totals	**122,045**	**27,761**	**149,806**

Socorro			
Public water supply	0	2,294	2,294
Domestic (self-supplied)	0	356	356
Irrigated agriculture	110,836	30,385	141,221
Livestock (self-supplied)	63	988	1,051
Commercial (self-supplied)	0	1,348	1,348
Industrial (self-supplied)	0	51	51

Mining (self-supplied)	0	23	23
Power (self-supplied)	0	0	0
Reservoir evaporation	7,570	0	7,570
Totals	**118,470**	**35,444**	**153,914**

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http://www.ose.state.nm.us/Basins/RioGrande/MRGWSS/Executive-Summary.pdf

Middle Rio Grande Water Supply Study

Prepared by S.S. Papadopulos & Associates, Inc.
November 2004
S. S. PAPADOPULOS & ASSOCIATES, INC.

Summary of Conclusions

Key water supply and hydrologic concepts illustrated or derived from this study, with implications for water planning are:

• On average, *the historically available water supply is not adequate* (including San Juan-Chama Project water and groundwater withdrawals) to meet the present demands in the Middle Rio Grande region.

• To achieve a balance between *renewable supply* and Year 2000 demand, a minimum of 71,000 acre-feet per year, and perhaps as much as 110,600 acre-feet per year of additional supply or reduction in demand is required.

• Given the historic variability of water budget terms, under Year 2000 conditions Rio Grande Compact *debit conditions are expected to occur 3 out of every 5 years.*

• *Under conditions of increased water use in any sector, a reduction of water use from other sectors is required* to avoid increasing the Rio Grande Compact debit.

• The groundwater supply within the Study Area is not an independent, disconnected water supply. *Use of groundwater, regardless of location, results in diminished flows of the Rio Grande* that will occur in the present and continue into the future.

• *The water supply is only depleted by consumptive use*; reductions in diversions and return flows resulting in better delivery efficiency do not necessarily improve the water supply.

• *Under drought conditions, annual Compact debits increase in frequency and magnitude,* and water availability limits irrigated agricultural usage 1 year out of every 5.

• Assuming implementation of regional water planning alternatives, Compact deliveries are significantly improved, with Compact deliveries being met at the 50th percentile. However, *implementation of the joint alternatives as proposed and included in the planning region reports will be challenging, if feasible*.

In summary, the water supply of the Middle Rio Grande is marked by limitation and variability. Supply appears inadequate to meet demand, and though the regional water plans are a strong
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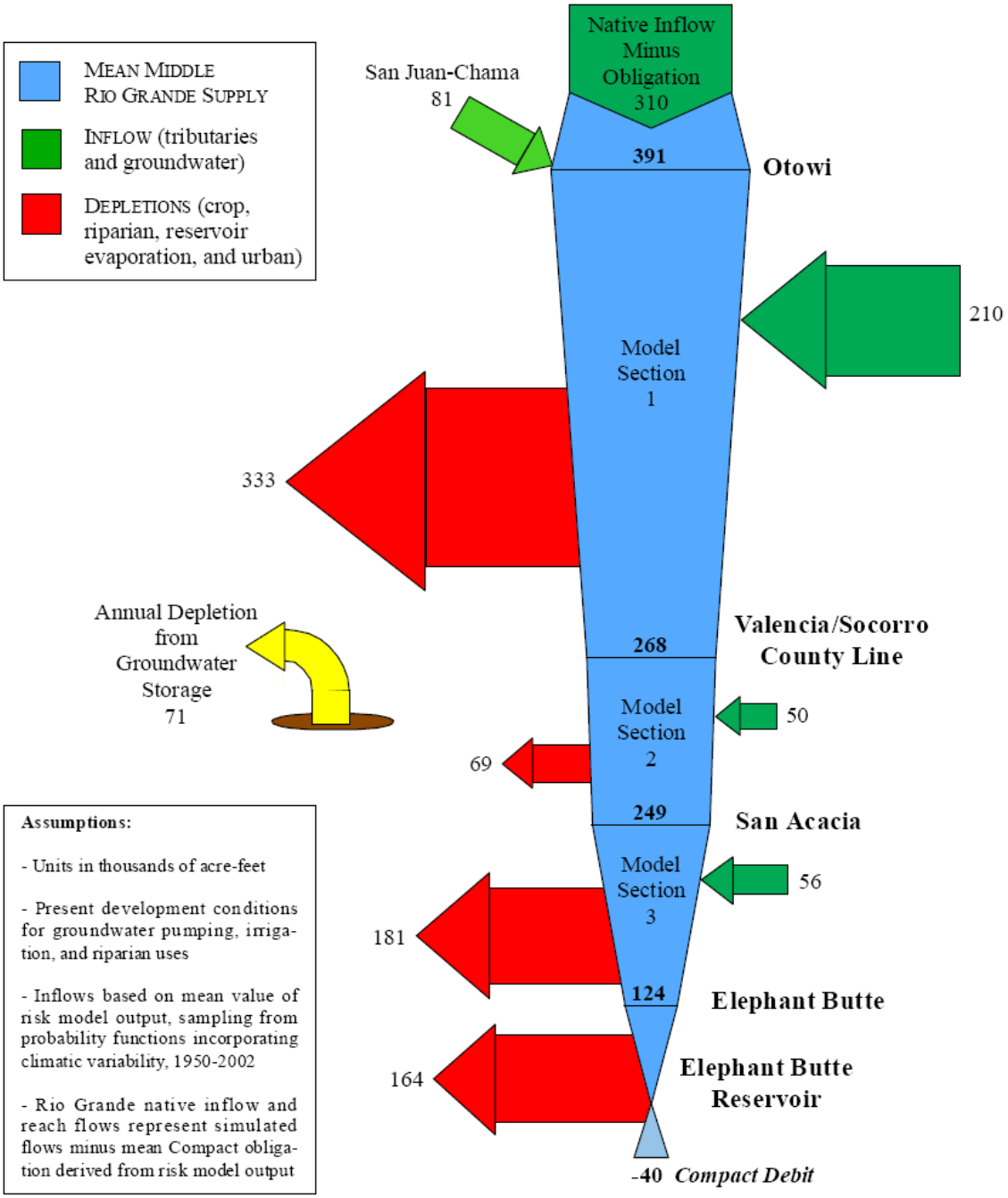
beginning in addressing regional water issues, further measures will probably be required to meet regional demand in 2040.

Figure ES-2
Mean Annual Middle Rio Grande Water Supply
Present Development Condition



Presentation of March 3, 2015

A. List of Unresolved Issues (Copied from presentation to ISC, August 2004)

1. Primarily Local Issues

- Inter-Jurisdictional Coordination of Actions (intra- and multi-level)
- Public/Political Support for Making Difficult Choices/Decisions
- Economic and Wet Water Impacts from Water Rights Transfers
- Export/import to/from Other Regions
- Shortage of Local Resources to Implement Needed Actions

2. Primarily State and/or Federal Issues

- Means to Resolve Impending Rio Grande Compact Shortfall
- ESA Requirements (e.g., silvery minnow, willow flycatcher)
- Ambiguity of Native and Non-Native Americans' Water Rights
- Lack of Completed Adjudications
- Fundamental Policies such as Domestic Wells, Use It/Lose It
- Appropriate Methods/Constraints for Transferring Water Rights
- Authorization for Albuquerque Drinking Water Project
- Funding Mechanisms for Local Plans and Projects

B. What's Changed? Why Update?

- Urban Use of Surface Water (ABCWUA / DWP)
- MRGCD Water Diversion Upgrades
- Improved User Conservation – Agricultural and Urban
- Population Changes – Quantity and Distribution
- Legal Decisions and Statutory Changes
- Improved Hydrological and Climate Knowledge
- Experience with Periodic NM Drought and Climate Change
- Impending and Approved Development Projects
- Known Shortfalls in 2004 Plan; e.g., implementation
- Stationarity Assumptions Flawed; Plan for Extremes

C. Objectives for RWP Update

- Manage Water to Maintain Our New Mexican Values

Sustainable Water Supply for the Region - At Reasonable Price, Very Long Term
Identify and Account for Infrastructure, Behavioral, Informational and Attitudinal Changes Since 2004

- Deal with Known, Unaddressed Items in 2004 RWP
- Address and Adapt to Climate Change Impacts

Guide Managers and Others to Cooperate and Coordinate Land Use and Water Plans and Actions

Key Issues in the Region

- Rio Grande Compact limitations
- Already permitted water rights requiring water right transfers for offsets
- Drought, especially in 2011, 2012, 2013
- Kirtland Air Force Base jet fuel spill
- Watershed and Bosque health
- Many small drinking water systems with infrastructure needs outside of ABCWUA
- Endangered Species Act compliance

• Others?
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Other Data Source Suggestions
very initial draft

Assessment of Climate Change in the Southwest United States*,* 2014*,*
http://www.swcarr.arizona.edu/

West-Wide Climate Risk Assessment: Upper Rio Grande Impact Assessment*,* December *2013,* http://www.usbr.gov/WaterSMART/ wcra/docs/urgia/URGIAMainReport.pdf

Report from Town Hall on Water Planning, Development & Use*,* May 2014,
http://nmfirst.org/LiteratureRetrieve.aspx?ID=207920

Hard Choices: Adapting Policy and Management to Water Scarcity*,* Policy Options Report from the 57th Annual New Mexico Water Conference, April 30, 2013,
http://www.tomudall.senate.gov/files/ documents/SenUdallWaterConferenceReport.pdf

Senate Memorial 8 - **Maximizing the Middle Rio Grande Water Supply Study**, 2014,
http://www.mrcog-nm.gov/images/stories/pdf/water/senate-8-water-study-2014.pdf

The City of **Flagstaff's *Resiliency and Preparedness Study*** addressed the question of how to reduce vulnerability to and build local resilience against risk from climate variability and weather related impacts? http://www.flagstaff.az.gov/documentcenter/home/view/38841

Middle Rio Grande Water Supply Study
Prepared by S.S. Papadopulos & Associates, Inc. for the New Mexico State Engineer and Interstate Stream Commission
November 2004
http://www.ose.state.nm.us/Basins/RioGrande/MRGWSS/Executive-Summary.pdf

Middle Rio Grande Water Assessment Final Report - 1997**,** by Steve Hansen & Chris Gorbach, Albuquerque Area Office, U.S. Bureau of Reclamation)

Falk, S.E., Bexfield, L.M., and Anderholm, S.K., 2011, **Estimated 2008 groundwater potentiometric surface and predevelopment to 2008 water-level change in the Santa Fe Group aquifer system in the Albuquerque area, central New Mexico:** U.S. Geological Survey Scientific Investigations Map 3162, 1 sheet,
//pubs.usgs.gov/sim/3162/downloads/SIM3162.pdf

other usgs studies

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Framework For Public Input To A State Water Plan
Prepared By The New Mexico Office Of The State Engineer And The Interstate Stream Commission, December 2002, http://www.seo.state.nm.us

" Many groundwater users, including municipalities and industries, in the Middle Rio Grande were allowed to begin pumping without securing water rights. Because of return flows of treated wastewater and the delayed impact of groundwater pumping on river depletions, this practice has not resulted in net river flow diminishment. However, the accumulated eventual need for groundwater users to acquire and transfer water rights is very large and exceeds the quantity of currently transferable water rights. Under current practices, only pre-1907 water rights can be transferred. The 1930 water rights developed by the Middle Rio Grande Conservancy District have never been available for transfer. Further, the ability of return flows from pumped groundwater to offset river depletions caused by pumping depends on ever increasing groundwater pumping. When pumping levels off, which it must, return flows will no longer be sufficient to offset the depletion of the Rio Grande caused by historic pumping."

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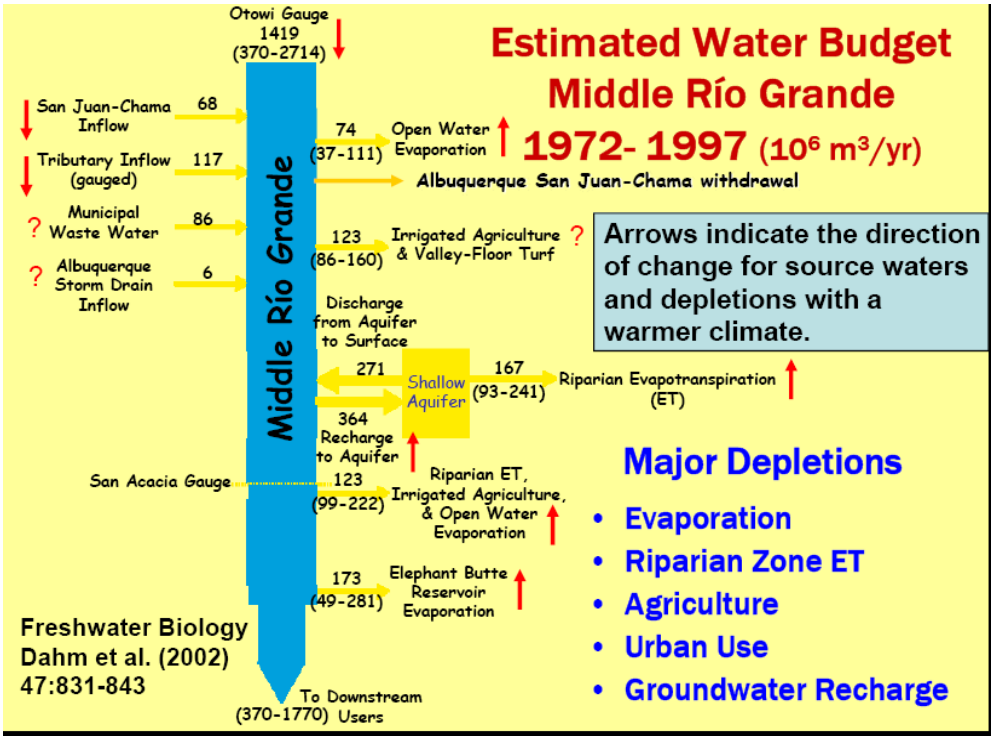
Dr. Clifford Dahm modified the Water Assembly Water Budget to account for climate change's impact on the surface water supplies.



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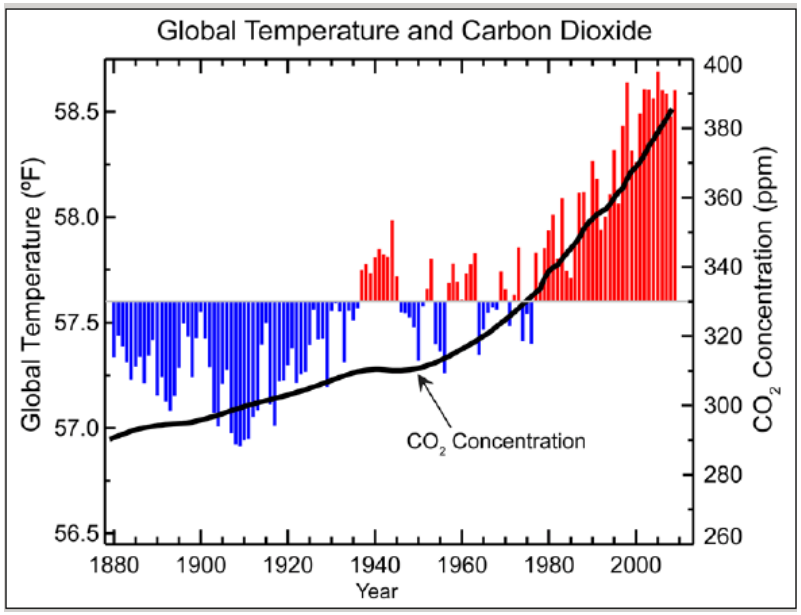
Futures 2040: The Metropolitan Transportation Plan for the Albuquerque Metropolitan Planning Area

April 2014

http://www.mrcog-nm.gov/images/stories/pdf/transportation/2040MTPScenario_Planning/spring-14-futures-2040-meeting-presentation-2.pdf

Changing Climate Conditions

Rio Grande Basin (1971-2011)
• Average temperature increased by 0.7^0 F per decade
• Twice the global average

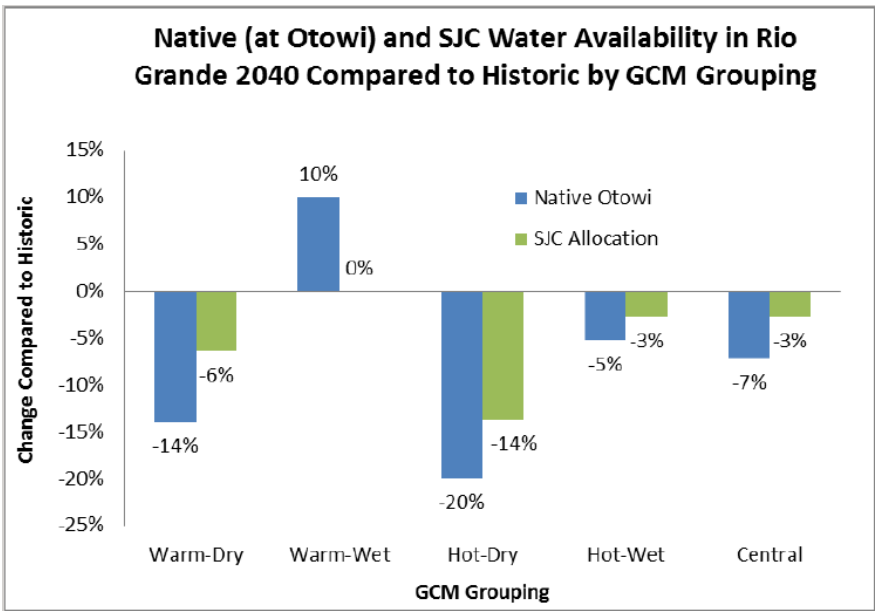


Source: NOAA

Upper Rio Grande Impact Assessment

• All 112 scenarios result in higher temperatures
• Earlier snowmelt runoff
  - Changes in timing of river flows
• Higher temperatures increase water demands for irrigated agriculture
• Precipitation is highly variable
• More intense droughts and more extreme events

Water Availability in ABQ Area: 2040



Water Availability in 2100

According to the Upper Rio Grande Impact Assessment:

•Rio Grande flows decrease by 1/3
•San Juan-Chama flows decrease by 1/4

Water Consumption

• How we grow impacts how much water we consume
• Analyze consumption patterns by land use and housing mix
• Daily residential consumption dropping locally and nationally
▫1994: 250 gallons per capita
▫ Today: ~135 gallons per capita
Source: Albuquerque Bernalillo County Water Utility Authority

Water Sustainability / Environment

Look at ways to improve water conservation through reuse, delivery and development patterns. Better understand the current water resources and future availability and how transportation decisions affect our environment.

Some Other Considerations

_Mesa del Sol has a 38,000 housing unit build out
_Albuquerque's core could densify considerably in major centers and transit corridors.
_Sandoval is projected to grow by 100%
_Los Lunas has adopted TOD supportive zoning
_Belen has annexed 5,000 vacant acres
_Edgewood/Moriarty low density, rural character

See also, *West-Wide Climate Risk Assessment: Upper Rio Grande Impact Assessment*, December *2013,* http://www.usbr.gov/WaterSMART/ wcra/docs/urgia/URGIAMainReport.pdf

Water Balance Idea

One lesson Frank Titus repeatedly repeated was that we needed to plan for extremes rather than averages. Averages don't exist, water wise. In its recent update, California created a water balance using ten consecutive years of water use and water supply to show the variability and plan for it.

With such a tool, long-range regional plans could consider options to deal with the long range effects of climate changes, water supply reductions, and intense monsoonal events while short term regional plans could be developed to be implemented depending upon a given set of seasonal or annual climatic conditions.

6/25/2014
Middle Rio Grande Water Budget - Draft
Bruce Thomson, Jesse Roach, Dagmar Llewellyn, Nabil Shafike, Dave Jordan,

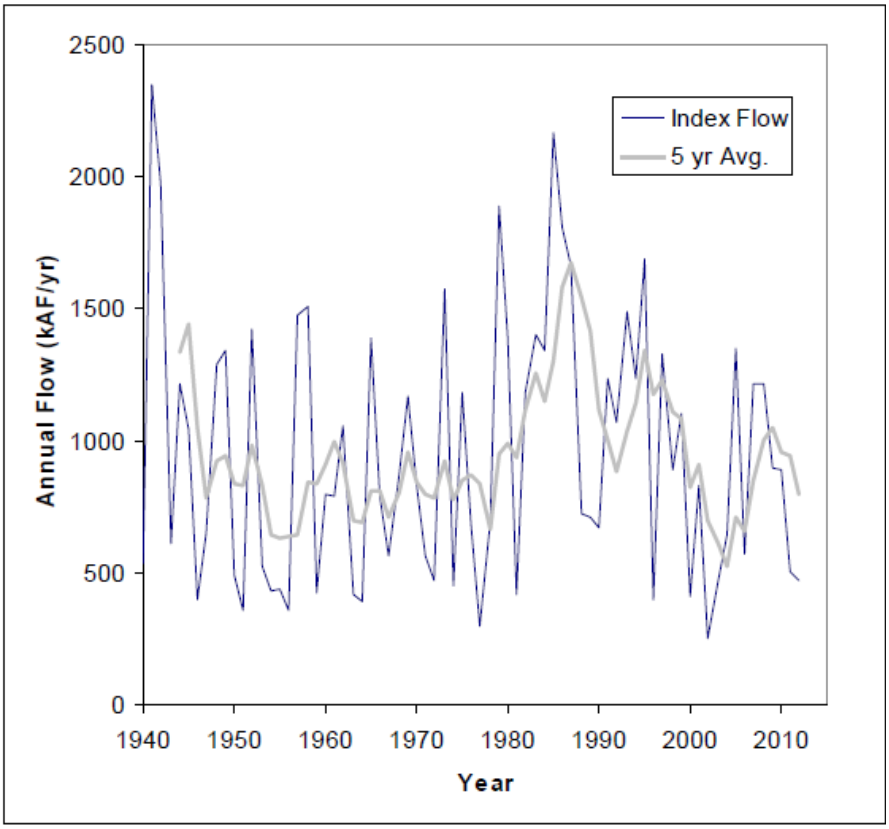


Figure 2 Annual index flows at Otowi gage together with the 5 year moving average (NM Interstate Stream Commission).

Although water budgets are necessarily constructed using averaged data, selection of the period over which data is to be averaged will influence the results. Although averaged data for weather and hydrologic conditions are used in everything from the weather page in the newspaper to technical hydrologic reports, it is apparent from data such as that in Figure 2 that there is no such thing as an average year. Weather, stream flows, reservoir operations, as well as water diversions change on daily, monthly, annual, and decadal scales. Although water

budgets are necessarily constructed using averaged data, selection of the period over which data is to be averaged will influence the results.

”The flow data in Figure 2 illustrates two important points. The first point and most obvious is the high degree of variability in the flows. It is not uncommon for annual flows at Otowi Gage to vary by a factor of three over a period of one or two years, from less than 500 KAF/yr to greater than 1,500 KAF/yr. This variability makes management of surface water resources very difficult since there are no large storage reservoirs on the main stem of the Rio Grande. The flow variability at Otowi also illustrates the conceptual difficulty of developing a water budget for the MRG basin as there is no such phenomenon as an “average year.” Thus, a water budget prepared for a single year or even a series of years will vary widely which introduces complexity and limits its utility as an educational tool. Previous budgets are based on average conditions and though inflows and outflows can be averaged to filter out annual variability, the process of averaging makes it difficult to identify long term trends. … The climate also changes over periods of time with periods of drought or wet weather influenced by oceanic and other cycles that are only now beginning to be understood.

“The second, and more subtle point illustrated by Figure 2 is that there may be a long term decline in Rio Grande flows over the last 2 decades. It will not be possible for years to determine whether this is simply due to natural climate variability or a trend that is a result of climate warming. But as with changes in water use by population growth and changes in human use it is difficult to detect or quantify changes in the hydrologic cycle using a water budget based on long term averages.”

October 29, 2014
RIO GRANDE VALLEY STATE PARK, CENTRAL TO MONTAÑO PROJECT:
ENVIRONMENTAL MONITORING PLAN AND BASELINE DATA REPORT

Prepared for City of Albuquerque Open Space Division
Prepared by SWCA Environmental Consultants

“Precipitation from summer rainstorms has little effect on overall Rio Grande flow rates (Western Regional Climate Center 2014). …

“Groundwater in the Albuquerque Reach has declined significantly due to pumping by municipalities. Historically, groundwater recharge was high as a result of increased irrigation within the floodplain. …

“Climate change is likely to significantly affect the MRG and its ecological function over the coming years as drought intensifies and temperatures increase across New Mexico. Recent key articles on changing Southwest and New Mexico climate by Gutzler (2013) and Llewellyn and Vaddey (2013) document how the climate of the Southwest is becoming warmer and less predictable, and how drought is becoming more common and more severe than in the past. The average annual ambient temperatures for the Upper Rio Grande Region of New Mexico (Colorado border to Truth or Consequences) has increased from 1971-2012 by 2.5º F, and in mountainous areas, that increase has been even greater at 2.7º F (Llewellyn and Vaddey 2013).

“Long-term episodic droughts have occurred in the Southwest region for centuries (Gutzler 2013), but the region is strongly affected by ongoing and projected century-scale climate

change (Llewellyn and Vaddey 2013). Gutzler (2013) and Llewellyn and Vaddey (2013) attribute this climate change to human-caused increases in greenhouse gases and report on a strong regional warming trend in recent temperature data that modifies natural drought/high precipitation fluctuations by enhancing evaporative losses and decreasing snowpack in mountainous regions to the north.

“As climate warms, intense storms are expected to increase in the region (Gutzler 2013), and a greater fraction of total annual precipitation is expected to come from single intense rainfall or snowfall events as compared to more frequent low-intensity events. The periodic drought and intense rainfall patterns projected for the region are expected to result in significantly diminished stream flow and drier surface conditions (Seager et al. 2008, Llewellyn and Vaddey 2013), causing the Southwest climate to become even more arid over the coming decades. The impacts of a warming and drying climate are likely to be significant for the MRG bosque, and likely far greater than other human caused environmental impacts.”