

## MEMORANDUM

July 31, 2015

TO: Mike Gibson, Chairman  
Rio Grande Basin Round Table

CC: Rep. Ed Vigil, Vice Chairman  
Colorado Legislative Water Resources Review Committee

FROM: Charles Spielman & Nicole Langley  
With primary data and project suggestions by permission from Eric Harmon and  
With support and/or contributions from Ed Nielsen, John Noffske, Cory Off, and  
Kirk Thompson

RE: A Rio Grande Basin Action Plan

Mike --Thank you for distributing the article which appeared July 3, 2015 in the *Colorado Independent* titled "Waiting for Chapter Ten: What's the Plan in the State's Water Plan?" The article is posted here: <http://www.coloradoindependent.com/154285/waiting-for-chapter-10-whats-the-plan-in-the-state-water-plan>. The concerns expressed in that article relate to the first draft of the Colorado Water Plan. As Jim Lochhead, CEO of Denver Water, is quoted, "It's a nice compendium of issues and subject matters of all things water in Colorado, but it's not an action plan.... It doesn't set an agenda for what Colorado needs to do in order to meet the challenges facing the state."

Since early in April of this year a number of us have been discussing the fact that the Rio Grande Basin Implementation Plan (RGBIP), in all of its drafts and revisions, is also not a plan. Given the seriousness of this Basin's water situation, we decided to create a true Action Plan for the Rio Grande Basin Roundtable (BRT). This document is an initial step, suggesting projects to be undertaken and funded in accordance with the Basin's most serious water problem – the unsustainable management of surface/ground water.

You have established and often articulated that priority, Mike, stating it in every summary letter which you send to CWCB as you transmit the Roundtable's recommendation to fund a project: "The Rio Grande Inter-Basin Roundtable has determined that **the single, most critical water issue confronting the Rio Grande Basin is the current unsustainable management of surface and ground water.** The RGBRT has made the decision that water activities that address this issue be favorably considered for funding from the Water Supply Reserve Account, SB 2005 - 179 (WSRA Funds)..."

The consistency and frequent repetition of this message has established, at least tacitly, that the policy of this Basin is to give top priority to resolving this problem. The RGBIP, as presently drafted, does not reflect the policy or the priority, and does not contain an action plan to address either.

In addition, as anyone familiar with the water situation in this Basin knows, it is critically important to address the striking imbalance, or gap, which exists between the amount of water required to maintain the health of the region's agricultural economy versus the decreasing availability of water in the Basin's streams, reservoirs, and aquifers.

We believe this Action Plan will assist the Roundtable to improve the efficiency and effectiveness of the WSRA grant-review process, ensuring that priority projects receive priority consideration in funding.

Mike, we ask the RGBRT to endorse and support this Action Plan, and we hope that it will be used as a starting point for implementing and prioritizing relevant projects, following the guidelines we suggest.

We also are asking Rep. Ed Vigil, Vice Chair of the Legislative Water Resources Review Committee (and our own State Representative from House District 62), to distribute this document to the members of the WRRRC in anticipation of their upcoming visit to the San Luis Valley.

We hope this action plan will be included in the Rio Grande Basin Water Implementation Plan (RGBIP), either by incorporation or by reference as an actionable companion document. In either case, please refer to this grass-roots contribution to the Roundtable's important work as "The Rio Grande Basin Action Plan."

Thank you very much.

Sincerely,



## REASONS & BASIS FOR A RGB ACTION PLAN

The essential elements of any plan require (1) establishing a set of general guidelines for compiling the plan; (2) establishing a set of appropriate objectives within those guidelines; (3) listing the steps or series of steps or actions necessary to achieve these objectives; (4) setting a specified time frame or schedule in which to achieve those actions; and (5) identifying the potential or designated resources required to carry out the plan.

Evaluated on the basis of these parameters, it is obvious that the existing RGBIP lacks an overall guiding coherence or philosophy; it does not identify the Basin's diminished aquifers as a priority for further study nor does it suggest projects aimed at mitigating the imbalance between water supply and agricultural needs. The RGBIP establishes no prioritized approach to facilitating critically needed projects which might help solve the Rio Grande Basin's water crisis. As a result, the Basin Implementation Plan compiled by DWC consists of a valuable collection of interesting and pertinent information, but it does not meet the above stated requirements of a plan.

This Action Plan identifies and prioritizes water issues – current and proposed -- which will directly or indirectly assist in restoring the aquifer and/or will ensure the sustainable management of surface and ground water, with special attention to prospering the health of the San Luis Valley's farming/ranching activities.

Because of the importance of agriculture in the economy of the San Luis Valley, the Action Plan should focus on identifying **actions** which will (1) increase the water available for agricultural use; (2) improve the efficiency and management of water delivery to farm and ranch land; (3) increase the effectiveness of agricultural water use by studying and applying different farming methods and crops; and, importantly, (4) provide information and data through hydrologic and geologic studies to guide the Basin's actions to restore and maintain the Basin's aquifers.

Taken together, projects in these four areas of focus, if proactively funded and implemented, will help to carry out the Basin's stated policy priorities and thus sustain a thriving agricultural economy. We hope this Action Plan assists the Roundtable to identify, prioritize, and support high priority projects for CWCB/WSRA funding.

This Action Plan does not presume to replace or duplicate the good work or the worthy projects already underway or anticipated, either by existing water groups, or in the BIP. Instead, it suggests a framework within which the Roundtable can more effectively support and fund a wide range of critically needed current and future studies, activities and projects.

In particular, this document is not intended to criticize or downplay the efforts of the many individuals and entities who have worked for many years to mitigate the water shortage in the Rio Grande Basin. The projects and studies recommended by the Action Plan are intended to follow, improve on, or complement past efforts and currently planned work.

There is an element of facilitation and assistance that should be incorporated into the Action Plan, however, that goes beyond the current efforts of the RGBRT, at least up to now, i.e. an enhanced level of grant-applicant facilitation. As we have suggested previously, this might be accomplished in one of several ways: (1) by helping project proponents, as needed, to navigate the guidelines and procedures necessary to obtain funding; (2) by eliminating unnecessary delays in the Roundtable review process; (3) by seeking out entities to apply for and carry out worthy projects; and, (4) perhaps, in some cases, by designating or forming a group capable of undertaking a water project or water study and meeting the application requirements established by the SB-179/WSRA guidelines.

**REVIEW & ANALYSIS OF PROJECTS UNDERTAKEN TO DATE**

As a precursor to compiling an Action Plan for the Rio Grande Basin, (RGB) it is informative to examine the activities and projects undertaken under the auspices of the RGBRT, and the results of this effort, in terms of meeting Basin/State priorities thus far. To clarify, “under the auspices” means that projects were either encouraged, or supported, by the RGBRT and were funded through WSRA and/or other sources, as the Roundtable itself is not an eligible entity for undertaking a project on its own.

Since its inception in 2006, the RGB has approved and recommended CWCB funding of 52 projects and activities, per Senate Bill 179 guidelines. Generally these projects and activities relate to improving or enhancing water supply, storage, management, and use in the basin. A summary of these projects and activities follows:

Funding of the projects has been provided approximately in this manner:

Basin Funds	\$ 2,660,000
Statewide Funds	<u>\$ 9,949,000</u>
Subtotal	\$12,609,000
Matching funds from Applicants	<u>\$31,008,000</u> (Cash & In-kind Contributions)
Total Funding	\$43,617,000

The summary table on the following page provides further detail about the projects, classified according to their primary purposes. These statistics encapsulate the activities of the RGBRT and program applicants over the history of the Roundtable thus far, grouped according to the priorities stated by the applicants in their project summaries.

SUMMARY TABLE – RGB PROJECTS FUNDED & STARTED OR COMPLETED  
2006 – JUNE, 2015

Project Type	No.	WSRA Funding	Basin Funds	State Funds	Match
IMPROVE/INCREASE WATER STORAGE	11	\$ 5,013,600	\$ 476,000	\$ 4,537,600	\$ 7,960,386
IMPROVE AQUIFER STORAGE	3	\$ 218,250	\$ 76,250	\$ 142,000	\$ 38,000
WATERSHED RESTORATION	7	\$ 1,776,700	\$ 447,200	\$ 1,329,500	\$ 2,616,600
IMPROVE WATER MANAGEMENT	13	\$ 2,281,980	\$ 572,700	\$ 1,709,280	\$ 1,114,605
PROTECT/IMPROVE WATER QUALITY	4	\$ 439,435	\$ 239,435	\$ 200,000	\$ 1,790,700
PUBLIC EDUCATION/OUTREACH	4	\$ 97,337	\$ 97,337	\$ -	\$ 277,338
MINIMIZE/IMPROVE WATER USE	2	\$ 138,200	\$ 138,200	\$ -	\$ 5,519,492
GENERAL & ADMINISTRATIVE	3	\$ 433,918	\$ 287,975	\$ 145,943	\$ 2,500
CONSERVE RIVER-BORDER PROPERTY	4	\$ 2,145,000	\$ 260,000	\$ 1,885,000	\$ 11,688,000
IMPROVE STREAM FLOW	1	\$ 64,500	\$ 64,500	\$ -	\$ -
	52	\$ 12,608,920	\$ 2,659,597	\$ 9,949,323	\$ 31,007,621

Farming and ranching constitute one of the primary economic and social activities in the Basin. Considering the serious shortage of water for agriculture, the figures show that the RGBRT has appropriately emphasized and funded a number of projects designed to improve/increase water storage and improve water management.

However, the figures illustrate a very low-key commitment to projects aimed specifically at studying or addressing aquifer water storage issues (\$218,250) and/or minimizing/improving water use (\$138,200) by such measures as improved farming methods and researching or growing crops that require less water.

This project summary indicates a relatively large commitment of funds to watershed restoration (\$2.6MM) and to creating environmental conservancies of river-border property (\$11.7MM). Although both of these project types are worthwhile activities, neither contributes significantly to reducing the agricultural water shortage. Whether watershed restoration and land conservancies represent a net economic benefit to water users in the RGB is a question which might be addressed in an economic study, perhaps as a project of the Action Plan. The point to be noted, however, is that the Roundtable's past allocation of funds has not been driven by any strategy or policy.

Under the recommended Action Plan, WSRA funds should be appropriated with a sense of urgency and targeted to address more of the core water crises faced by the Rio Grande Basin. Roundtable members and other Basin water experts have the experience and capability to ensure that more such projects do get organized; that they get adequately and appropriately funded; and that every effort be made to close the gap between present and future water needs and available water resources.

A review of approved RGB projects from a **chronological** perspective discloses another data set of interest:

**SUMMARY TABLE – APPROVAL CHRONOLOGY OF RGB PROJECTS  
2006 – JUNE, 2015**

<b>FUNDING APPROVED IN YEAR</b>	<b>Number of projects</b>	<b>WSRA FUNDING</b>	<b>BASIN FUNDING</b>	<b>STATE FUNDING</b>	<b>MATCH</b>
2007	5	\$ 576,950	\$ 184,950	\$ 392,000	\$ 478,600
2008	6	\$ 2,732,400	\$ 722,000	\$ 2,010,400	\$ 10,370,300
2009	4	\$ 546,500	\$ 196,500	\$ 350,000	\$ 1,379,945
2010	4	\$ 267,000	\$ 169,000	\$ 98,000	\$ 663,900
2011	7	\$ 453,743	\$ 171,600	\$ 282,143	\$ 735,510
2012	5	\$ 3,346,244	\$ 274,564	\$ 3,071,680	\$ 3,971,275
2013	15	\$ 3,867,883	\$ 674,783	\$ 3,193,100	\$ 6,918,766
2014	5	\$ 668,200	\$ 246,200	\$ 422,000	\$ 5,594,324
2015 SO FAR	1	\$ 150,000	\$ 20,000	\$ 130,000	\$ 895,000
<b>TOTALS</b>	<b>52</b>	<b>\$ 12,608,920</b>	<b>\$ 2,659,597</b>	<b>\$ 9,949,323</b>	<b>\$ 31,007,621</b>

As indicated, there were 15 projects approved for funding in 2013, and an average of 5 projects funded each of the other years, 2007-2014. The drop back to only 5 projects in 2014, and only one approved so far in 2015 indicates a critical need to refocus Roundtable efforts to encourage more applicants to seek funding, especially if they directly relate to resolving the Basin’s critical water issues.

Another approach to support that planning goal would be to use the outreach function of the Roundtable to spark public interest in issues which the Roundtable considers critically important and worth funding; to demonstrate funding patterns which directly address real issues faced by (mostly) farmers and ranchers in the Basin; and to simplify and facilitate the grant application process by reducing a potential applicant’s obstacles or difficulties. The RGB Action Plan suggests the best remedy is to bring more requests for funding to the Roundtable; to improve the overall quality of applicant requests; and to ensure that those proposals, when funded, will significantly contribute to increasing our understanding of the Basin’s aquifers and/or closing the gap between the Basin’s water needs and the diminishing availability of water.

**GUIDING PRINCIPLES**

As a totally volunteer and grass-roots research and writing effort, we have established some guiding principles, providing a framework for the Action Plan – a set of parameters for considering and including individual plan elements.

We felt that the present BIP does not establish any such criteria, and we believe it is important to do so. The following Guiding Principles have been used to compile and implement the Action Plan.

1. The plan should be “consistently flexible” and readily amendable as conditions or Roundtable/Basin objectives change. As the Roundtable sees the benefits of working with the Action Plan, and as its usefulness is tested and becomes evident, we believe an increased participation by Basin water users will develop.
2. The plan should require and offer a more proactive engagement with critical water issues. The current BIP does not offer any planned course correction for the Roundtable’s random approach to the review and the recommendation for funding of projects. Proactive engagement with critical water issues will help to prioritize, select and fund projects which best address them.
3. The plan should seek a simplified and effective way to facilitate the selection and approval of funding requests. There should never be a double standard, with some applicants allowed to slide through or ignore established protocols while others are held to very strict standards. A uniform set of requirements should be required equally from any and all applicants for funding.
4. The plan should prioritize critical projects. Given the serious and likely increasing shortage of water for farming in the Basin, projects designed to improve water storage, to evaluate the relevance and accuracy of various models, to improve water management, and to optimize agricultural water use should be given very high priority for both near- and long-term planning.
5. The plan should proactively seek ways to bring more of these critical projects to the Roundtable and assist their proponents in seeking WSRA (and other) funding. Some ideas might prove to be of little value, and would need to be weeded out, but others might suggest experimental or perhaps even “risky” ideas which might break new ground. Diversity and an increase in the volume, relevance and quality of funding requests will ultimately help the Roundtable – and all of us -- find solutions to the Basin’s unsustainable surface water and groundwater management.
6. The plan should promote outreach and education efforts which interactively engage communities throughout the entire Valley. Publications and distributed material should reduce the amount of top-down state-issued PR language and increase exposure to/from locally relevant issues.

7. Outreach efforts should emphasize the critical needs of the Basin and spread the word that WSRA funding is available, accessible, and important for solving problems right here, in our own communities.

## RECOMMENDED PROJECTS & ACTIVITIES

The RGBIP includes a number of DiNatale Water Consultant Project Sheets describing current, pending or proposed projects to be funded. That is a start, but we maintain that a number of more critical projects need to be given priority.

Following is a preliminary list of proposed and, in some cases, already anticipated projects which we believe should be prioritized for funding. This list has been compiled in accordance with the foregoing discussion and premises. We regard it as a work in progress, anticipating additions and revisions as the Roundtable and other interested parties become familiar with, and involved in, the Action Plan process.

As it turns out, many of the recommended projects are for data-gathering or inventorying, which indicates a need for more information and a greater emphasis on research and study to guide future water use decisions.

Projects are presented in two groups: (1) those considered for more immediate implementation are sequentially listed for 2015-2016; (2) projects anticipated under an extended timeline are grouped according to common aspects of their scope and content, and/or their bearing on the currently unsustainable water management situation. These are general and somewhat arbitrary scheduling notes, but they convey the relative urgency of these projects. By specifically listing these projects we hope to encourage more of a similar nature, injecting a continuum of high priority projects into the WSRA funding stream.

The project list has been compiled by the primary authors of this proposed Action Plan, Charles Spielman and Nicole Langley, with important primary data from Eric Harmon and with additional input, guidance, suggestions and/or written communication from the supporters and contributors mentioned on Page 1 of this memorandum. With his permission, we have included his cover letter and recommendations at the end of this document. Cory Off also submitted written recommendations which have been incorporated into the list.

Several supporters of the Action Plan have suggested conducting a study of the economy of the RGB, with an emphasis on the impacts of water scarcity on the agricultural sector. We believe that conducting such a study, with expertise drawn from the RGBRT and other local sources, could have a significant impact on decisions affecting our agricultural industry and on optimizing its use of water.

In our opinion, the water shortage is sufficiently severe in the RGB that the RT cannot afford the luxury of passively waiting for projects, waiting for applicants to come forward, or reactively reviewing water projects as they happen to come before the membership for approval. We believe this Action Plan provides some helpful suggestions on how best to take advantage of the WSRA funding that Colorado makes available to our Basin.

We hope the Rio Grande Basin Roundtable will consider the recommendations of this Action Plan and adopt this document, either as part of the official RGBIP or as an **actionable** companion document to the present RGBIP.

(list of projects on the following page)

PRLIMINARY PROJECT LIST - RGB ACTION PLAN 2015-2016				
SUGGESTED INITIATION SCHEDULE	CATEGORY	PROJECT DESCRIPTION	PROPONENT OR AGENCY	COMMENTS
2015-Q3	GEOL/HYDRO	INSTITUTE PROGRAM TO REQUIRE GEOPHYSICAL LOGGING OF ALL NEW OR REWORKED WATER OR MONITOR WELLS	DIV 3 WATER ENGINEER	RGBRT TO RECOMMEND THIS PROGRAM BE INSTITUTED BY COLO STATE ENGR. Funding to help support compliance
2015-Q3	GEOL/HYDRO	PREPARE AN INVENTORY REPORT W/ MAPS SHOWING STREAMFLOW & WATER STORAGE IN RGB	DIV 3 WATER EGR , RGBRT, & SLVWCD, ETC	COOPERATIVE PROJECT BY ENTITIES LISTED, AS BACK-GROUND FOR OTHER STUDIES
2015-Q3	WATER STORAGE	INCREASE STORAGE CAPACITY IN TRUJILLO MEADOWS RESERVOIR	CONEJOS WATER CONSERV ANCY DISTRICT	TOTAL PROJ EST COST IS \$15.5MM; EST COST IN 2015 IS \$1.0MM FOR INIT. STUDIES
2015-Q3	WATER STORAGE	MOUNTAIN HOME RESERVOIR DAM OUTLET REPAIR	TRINCHERA IRRIGATION CO	TOTAL PROJ EST COST IS \$500,000; \$270,000 in 2015 & \$230,000 in 2016
2015-Q4	GEOL/HYDRO	DEVELOP AND CARRY OUT PROGRAM TO IMPROVE ACCURACY OF DRILLER'S LOGS	CONSULTING GEOL. FIRM	SEEK/SELECT/FUND GEOL. CONS. FIRM TO EXECUTE PROG
2015-Q4	GEO/HYDRO	PRODUCE A COMPREHENSIVE MAP OF BLUE CLAY OCCURRENCE ALL ACROSS EGB	GEOL. CONS. VARIOUS FIRMS & ENTITIES	COORDINATE STAKEHOLDER INPUT, ADMINISTER/FUND RESEARCH PROJECT
2015-Q4	AGRICULTURE OPERATIONS	CONDUCT A COMPREHENSIVE & IN-DEPTH STUDY OF THE RGB ECONOMY W/ EMPH. ON AG SECTOR	MONTE VISTA ECONOMIC DEV CORP	PROVIDE FUNDING/SUPPORT FOR STUDY & INCORPORATE INPUT FROM MANY CONTRIBUTORS; Local expertise and modeling resources used to reduce cost.
2016-Q1	GEOL/HYDRO	CONDUCT A COMPREHENSIVE STUDY OF GROUND WATER INFLOW AROUND VALLEY RIM	GEOL. CONS. FIRM	SEEK/SELECT/FUND GEOL. CONS. FIRM TO EXECUTE PROGRAM.
2016-Q2	GEOL/HYDRO	CONDUCT A COMPREHENSIVE STUDY OF WATER GAIN/LOSS FROM CANALS ALONG VALLEY PERIMETER	GEOL. CONS. FIRM	PROVIDE SEEK/SELECT/FUND GEOL. CONS. FIRM INCLUDE OTHER AREAS, PROVIDE ADMIN SUPPORT IF NEEDED
2016-Q2	GEOL/HYDRO	UNDERTAKE PROGRAM OF INSTALLING PIEZOMETERS TO MONITOR FLUCTUATIONS IN CONFINED AQUIF.	FOLLOWING LEAD OF CONEJOS WATER USERS ASSOC, OTHER STAKEHOLDERS & HYDOL. CONS. FIRM	PROVIDE SEEK/SELECT/FUND HYDROL. CONS. FIRM, INCLUDE OTHER AREAS, PROVIDE ADMIN SUPPORT IF NEEDED
2016-Q3	WATER DEVELOPMENT/ MGMT	INVENTORY ALL RESERVOIR SITES & RESERVOIRS IN RGB; INVESTIGATE OPER, ECON, & LEGAL FEASIBILITY OF CONSTR./ENLARGING RESERVOIRS	HYDROL. CONS. FIRM	SEEK/SELECT/FUND HYDROL CONS. FIRM TO EXECUTE PROGRAM. 1 YR PROGRAM
2016-Q3	AGRICULTURE OPERATIONS	CONTINUE INVESTIGATION OF WAYS TO REDUCE AG WATER USE. (SOIL QUALITY, DRIP IRRIGATION, DIFFERENT CROPS, MAGNETIZED WATER, ETC.)	WATER USERS CONSERVANCY DISTRICTS, ETC	SEEK OUT NEW PROJECTS PROVIDES ADMIN/FUNDING ASSISTANCE, PROVIDES COMMUNITY OUTREACH & TECHNICAL INREACH, ASSISTS IN RESEARCH, DOCUMENTATION, REPORTING, ADMINISTRATION

**SUPPORTING DOCUMENTATION & INPUT – On following pages**

# HRS WATER CONSULTANTS, INC.

8885 West 14th Avenue  
Lakewood, Colorado 80215  
(303) 462-1111  
Fax: (303-462-3030

CONSULTANTS IN  
HYDROGEOLOGY AND  
WATER RESOURCES

ERIC J. HARMON, P.E.  
eharmon@hrswater.com

April 19, 2015

900-PB

Rio Grande Basin Water Plan – M & I Subcommittee

Attn: Ms. Nicole Langley

Re: Rio Grande Basin Water Plan hydrogeology and  
ground water related projects and activities

Dear Subcommittee Members:

At the invitation of Mr. Charles Spielman, I have reviewed and considered the draft Rio Grande Basin Water Plan (7/31/2014) and Mr. Spielman's 4/11/2015 memorandum on the draft Plan. I have prepared this letter, with attachment, to offer my initial thoughts as to suggested direction and content for specific ground water-related projects, activities, and efforts for the Basin Water Plan.

Please understand that although I have been aware of the time-consuming efforts expended by the Rio Grande Basin Roundtable, the Basin Water Plan consultants, stakeholders, and interested individuals since the inception of the Plan studies, I have not, until this time, offered comment. As context for your consideration of my comments, you should know that my firm, HRS Water Consultants, Inc., has ongoing contractual relationships with the Colorado Division of Water Resources / CWCB for the RGDSS and the Ground Water Rules, and the National Park Service (Great Sand Dunes). HRS also represents public water suppliers, private water user groups, irrigationists, and others in the San Luis Valley. In addition, HRS, at times in the recent past, has acted in a consulting capacity on ground water related activities on behalf of RGWCD, Conejos WCD, Rio Grande County Commissioners, and others in the basin. The comments and thoughts offered in this letter are my own, and do not represent the opinions, thoughts, or positions of any individual or entity that my firm represents now, or has represented in the past.

My comments are twofold: first, I would like to comment briefly on Mr. Spielman's April 11, 2015, memorandum. Second, I offer my initial thoughts on specific projects and activities related to ground water that I feel are needed to fill gaps in our understanding.

## Comments on April 11, 2015, Memorandum

The overriding impression I sense from Mr. Spielman's memorandum is frustration at a long process that appears, as yet, to offer little in the way of specific direction for a Rio Grande Basin Water Plan. From my own, admittedly brief, review of the draft Rio Grande Basin Water Plan

(DiNatale Water Consultants, “DWC”, 7/31/2014) I generally agree with this view. This is in no way a criticism of DWC or the process. From past involvement in a number of planning and policy level studies, I have an understanding of the stakeholder participation process. However, I find it disappointing that the majority of the draft document is devoted to developing an overview and background for the basin, with relatively little emphasis on the immediate and overriding issue: how to address and correct unsustainable water use in the San Luis Valley. In addition, the majority (although not all) of the projects identified in Section 6 of the draft document do not address what I consider key issues:

- What data or studies are needed to fill major data gaps, or gaps in our understanding, of the San Luis Valley aquifers in terms of ground water recharge, discharge, and interactions between ground water and surface water?
- What baseline of information, and what ongoing measurements or monitoring, will provide the best and most robust understanding that can be incorporated into the RGDSS ground water model (or a successor model in the future) and efforts at achieving aquifer sustainability.

As a high-level policy guidance document, it may be argued that the draft Basin Water Plan need not propose projects or activities at a detailed level. I disagree. Although a clear policy direction unquestionably must be articulated in the Basin Water Plan, I feel, in addition, that specific projects or tasks should be identified that address the issues noted above. I think the document needs to specify items, tasks, or projects that can be implemented now or in the very near future to help address these issues.

Mr. Spielman’s memorandum contains a “starter list” of tasks and projects, in several categories. In regard to geology and hydrology, several suggestions are made as to studies and projects needed, and a model of the ground water system. Having been involved in the RGDSS development and refinement process since its inception, I can say that these components, tools, and documentation, for the most part, already exist. However, the fact that there is still a call for these basic documents and studies suggests that some of the RGDSS documents and tools are so technical or complex that it is difficult for even a well-informed and interested public to understand their content and workings. Or, perhaps, it may be that many of the RGDSS documents are simply too hard to find. It appears to me from Mr. Spielman’s list, and also from my participation in public presentations, peer review meetings, and various forums on the RGDSS over the past 17 + years, that there may be a need for an improved documentation and communication process.

The RGDSS calibrated ground water model is the culmination of extensive, specific hydrologic and hydrogeologic studies and investigations, the results of which have been incorporated into model development, calibration, and refinement, in a phased and continually peer-reviewed process over many years. As with any model, and particularly for a regional model designed to simulate a large and hydrogeologically complex basin, there are now, and probably will continue to be, data gaps that should be filled, refinements needed, and a need for improved understanding of the aquifers.

## Ground Water Projects & Activities

Attached to this letter is my initial list of suggested tasks or projects. My suggestions are all ground water related, as this is my area of expertise and experience.<sup>1</sup> This is not to suggest that other, interrelated issues are of lesser importance, or should necessarily be accorded lower priority in the context of the overall Basin Water Plan.

In the attachment that follows, I have tried to convey my initial thoughts on projects or tasks that would produce data or information that will be immediately useful to enhance our understanding of the aquifer system of the Valley, as the water users and managers try to move toward sustainability. Some of these ideas have been discussed by members of the RGDSS Peer Review Team as possible activities for future enhancements to that project, and some are ideas that I have not previously discussed with anyone. This is not a comprehensive list, as I've had only a few days to consider the matter. I expect that upon further consideration, the list will grow and become refined. Please consider it a draft list at this time. I have not attempted to assign a relative priority or an estimated cost to these ideas, as there simply has not been time to do so. The ideas are not presented in any particular order.

I look forward to the Subcommittee's comments and questions.

Very truly yours,  
HRS WATER CONSULTANTS, INC.

*/s/ Eric J. Harmon*

Eric J. Harmon, P.E.  
Principal

Attachment: SLV Ground Water Project Ideas

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<sup>1</sup> The Law of the Instrument: "If your only tool is a hammer, the whole world looks like a nail." - attributed to Abraham Maslow.

**San Luis Valley Ground Water Project Ideas**  
**Eric J. Harmon, P.E.      April 19, 2015**

1. Activity or Project: Canal gain/loss measurements

Affected Area: Major canals, particularly in alluvial fan / SLV edge areas, where canals are thought to be relatively leaky, and where little or no leakage data presently is known to exist.

Need: Improved canal leakage data is needed to better define this component of recharge for the RGDSS model. Significant recharge to the unconfined and the confined is thought to take place through canal leakage in Valley-edge areas, where the confining clays are thin or nonexistent, and where surface soils are coarse and permeable.

Summary of Activity:

- Perform initial time-concurrent measurements by current meter at accessible points on canals where insufficient data now exists.
- Identify locations for future staff gauges and data loggers for future time-series canal loss data.
- Design and install staff gauges / data loggers.
- Maintain, record, and document the canal leakage data.

Time Frame:

- Initial measurements: one irrigation season.
- Design / installation: one year.
- Measurements: ongoing.

Desired Outcome: Improved understanding and database of ground water recharge from canal leakage.

Follow-up Activity: Ongoing measurements and reporting by ditch & canal companies.

Relative Priority:

Estimated Cost:

Comments / Notes: Several canal companies and water management entities (e.g. Conejos WCD) are already engaged in this type of project in their areas.

2. Activity or Project: Improved network of confined aquifer and nested (i.e. multi-aquifer) piezometers (monitoring well) and head measurements.

Affected Area: Valley-wide.

Need: Improved understanding of confined aquifer head changes over time are needed to help provide a sufficient database for aquifer sustainability, and for an improved understanding of interactions between aquifer layers.

Summary of Activity:

- Identify locations for installation of new confined aquifer or multi-completion piezometers (i.e. unconfined and confined head measurements at the same location).
- Secure needed easements or landowner permission.
- Design and install piezometers and data loggers.
- Maintain, record, and document the confined and unconfined head data.

Time Frame:

- Initial site identification: 6 months to 1 year.
- Design / installation: one year.
- Measurements: ongoing.

Desired Outcome: Improved understanding and database of ground water head changes, ground water in storage, water table and head gradients, and aquifer layer interactions.

Follow-up Activity: Ongoing measurements and reporting by Subdistricts or management entities (e.g. Conejos WCD, RGWCD)

Relative Priority:

Estimated Cost:

Comments / Notes:

- Colorado DWR (and the Division 3 Engineer's Office), Conejos WCD and RGWCD have initiated efforts and discussions for an improved piezometer network.
- Piezometers are particularly needed in areas of high ground water pumping and high seasonal head fluctuations, and also in edge areas of the Valley, to understand layer interactions where confining clays are thin to non-existent.

3. Activity or Project: Refine estimates of ground water inflow to the SLV from the San Juan and Sangre de Cristo mountain fronts.

Affected Area: Eastern and western rims of the SLV.

Need: Improved understanding of the annual volume of water that enters the Valley as ground water (as distinct from what is termed 'rim inflow'). Currently, the ground water inflow estimate in the RGDSS model for the San Juans is a very general and approximate value, and for the Sangre de Cristos is effectively zero.

Summary of Activity:

- On a sub-basin basis, identify and develop a GIS database of water level measurements from existing driller's reports and USGS measurements. Also from the 2012 Rio Grande County Hydrogeology Study (Davis Engineering, GeoLogical Solutions, and HRS Water).
- Secure well owner permission, and fill data by making new measurements of water levels in wells in bedrock formations near the rim of the Valley.
- Use the GIS to establish a range of water table gradients to the Valley.
- Use existing well data, geophysical logs, and geologic mapping to estimate ranges of hydraulic conductivity for sub-basins tributary to the Valley.
- Use Darcy's Law to estimate sub-basin annual ground water contributions to the Valley.

Time Frame:

- Initial GIS database development: 3 to 6 months.
- Field water level measurements: 2 field seasons.

Desired Outcome: Improved understanding and database of water table gradients and annual contribution of water that enters the SLV as ground water.

Follow-up Activity: Measurements: contemplate refreshing the database periodically (5 years?). If significant annual changes in snowpack / runoff occur, annual measurements are advised.

Relative Priority:

Estimated Cost:

Comments / Notes:

4. Activity or Project: Geophysical logging of new or replacement confined aquifer wells; in combination with a comprehensive geophysical log database of the SLV.

Affected Area: Valley-wide.

Need: For refinement of aquifer layer maps and the RGDSS, there is a need for improved understanding of aquifer layer boundaries, thickness, porosity; improved understanding of the lateral extent of confining clay layers; and improved understanding of ground water quality changes with depth.

Summary of Activity:

- Initiate a rule that requires a basic suite of geophysical logs to be run in every new water well, including monitoring wells, that penetrate, or are likely to penetrate, a confining clay layer. Logs contemplated are, at a minimum, SP, gamma ray (i.e. natural gamma), and either induction or short & long normal resistivity.
- Inventory existing geophysical logs of water wells, mineral test holes, and O & G wells in the Rio Grande Basin (including tributary areas outside the Valley proper).
- Develop a central public-record database of Rio Grande Basin geophysical logs.
- Digitize the existing geophysical logs that presently exist only in paper form.

Time Frame:

- Initiate a rule: CDWR rules presently call for geophysical logging when a confining layer is penetrated. This may need to be reviewed, and revised as needed for the Rio Grande Basin.
- Log inventory, database development, and log digitizing: 1 to 2 years.
- Database maintenance and refresh: ongoing.

Desired Outcome: Make a robust database of geophysical logs available for enhanced understanding of aquifer layers, regional hydrologic changes, and water quality.

Follow-up Activity: Continue collecting and maintaining the public-record database of geophysical logs.

Relative Priority:

Estimated Cost:

Comments / Notes: HRS Water has many of the geophysical logs in the Rio Grande Basin, although many logs presently exist only in paper form. The Rio Grande Hydrogeology Study (Davis et al, 2012) discussed many of the available logs in the San Juan Mountains west of the Valley.

5. Activity or Project: Install recording equipment on existing or new confined aquifer extensometers, to monitor aquitard compaction.

Affected Area: Confined aquifer of the SLV.

Need: As described by the Water Court in the Confined Aquifer Rules case, many of the clays that comprise the confining layers are relatively undercompacted, and loss of confined aquifer head by overpumping may result in irreversible aquitard compaction and resulting land subsidence. In addition, extensometer data, combined with confined aquifer head data, may be used to improve present estimates of confined aquifer specific storage, needed for model calibration.

Summary of Activity:

- Inventory the existing 14 (of 15 total) RGDSS piezometers at which extensometer pipes also were installed in the 1999 – 2000 timeframe, and check to see if these are still viable for measurement or whether corrosion has rendered them unusable.
- Select up to three piezometer / extensometers for installation of extensometer recording equipment. Check existing ROW / permission for adequacy for extensometer equipment (e.g.. Tuffshed™- sized instrument shelters).
- Design and install extensometer recording equipment.

Time Frame:

- Inventory of extensometers and provide recommendations: 2 months.
- Design and install extensometer instrumentation: 1 year.
- Extensometer and head data analysis: initially 1 year; repeat / refresh as required.

Desired Outcome: Develop an improved understanding of the susceptibility of confining clays to irreversible aquitard compaction. Develop more accurate values of specific storage. Input to the RGDSS model as necessary.

Follow-up Activity: Continue collecting and maintaining the extensometer data, as an early warning against signs of irreversible aquitard compaction and resulting land subsidence.

Relative Priority:

Estimated Cost:

Comments / Notes: For the CWCB / CDWR, HRS designed 14 of the 15 RGDSS piezometers with jacketed extensometer pipes. These were used during the RGDSS pumping tests, and provided valuable data on confined aquifer specific storage, as well as a direct demonstration that aquitard compaction occurs during pumping. (In my opinion an opportunity was lost in 1999 – 2000, when the decision was made not to fund permanent extensometer instruments. I suspect that irreversible aquitard compaction occurred in the 2001 – 2003 time frame due to severe and unprecedented head decline, but no measurements were made. – EJH)

6. Activity or Project: Geochemical studies of ground water in recharge areas of the SLV.

Affected Area: Mountain front and rim areas that provide recharge to the unconfined and confined aquifers of the SLV.

Need: A need exists for improved understanding, identification, and quantification of ground water recharge to the aquifers of the San Luis Valley from the mountain front areas and the alluvial fan areas that rim the Valley. This is particularly true because of the difficulty in understanding how much water recharges the confined as compared to the unconfined, in areas where confining clays are thin to nonexistent. Major-ion chemistry coupled with environmental isotope chemistry can provide an improved understanding of ground water recharge.

Summary of Activity:

- Research and identify surface waters, spring waters and existing wells around the rim of the SLV, including in the mountainous areas that rim the Valley, that are conducive to chemical sampling.
- Sample each source at least once using standard collection / transport / handling protocols, and have a certified commercial laboratory analyze the samples for major anions and cations, TDS, pH, and selected environmental isotopes such as  $^{14}\text{C}$ ,  $^{18}\text{O}$ ,  $^3\text{H}$ .
- Analyze the lab results, and estimate ground water recharge pathways and travel times. Also, to the extent the results allow, estimate the relative amount and rate of recharge of the unconfined and confined aquifers from the Valley-edge recharge sources. Interpret the results in light of already existing information (e.g. Mayo and Davey, 2002).

Time Frame:

- Inventory of wells, springs, streams, and provide recommendations: 2 months.
- Sample each selected source: 1 field season.
- Laboratory analysis: 1 to 3 months for the initial sampling.
- Analysis and reporting of results: 2 to 3 months for the initial sampling.

Desired Outcome: Develop a more accurate areal and depth-dependent understanding of the amounts and rates of ground water recharge, the relative magnitude of recharge to the unconfined and confined aquifers, ground water travel pathways, and the age of the ground water in storage in the Valley aquifers.

Follow-up Activity: Follow-up sampling and analysis as needed to fill data gaps.

Relative Priority:

Estimated Cost:

Comments / Notes: Major ion water chemistry and environmental isotope chemistry of ground water provides valuable data on recharge amounts, time, and preferential pathways for ground water movement. References: Mayo and Davey, Journal of Hydrogeology, 2002 and USGS, Williams and Hammond, WRI-89-4040.

7. Activity or Project: Refined clay mapping in SLV aquifer recharge areas.

Affected Area: Valley rim and alluvial fan areas that provide recharge to the unconfined and confined aquifers of the SLV.

Need: A need exists for more accurate mapping of the areas where confining clays pinch out around the rim of the SLV. This is particularly true in the Rio Grande Fan area west of US 285. Current clay mapping is approximate in some areas, and is sourced from Emery et al (circa 1970), CDWR (Moravec and Schroeder, late 1980's) and HRS Water (1999 – 2002). With many well users proposing to deepen wells upon replacement, there is a need for a better understanding of the edge of the confining clays, and whether, and how, thin (i.e. 1 to 2 foot) 'non-blue' clays affect aquifer confinement and rim-area recharge.

Summary of Activity:

- Research existing driller's logs, geophysical logs, and geologist's descriptions of water wells and test holes in selected areas along the recharge / rim area of SLV, with emphasis on the Rio Grande Fan area west of US 285.
- Develop an improved GIS database of lithologic data, with emphasis on pinch-out and extent of thin clay layers and their effect on water levels, perching, and ground water movement.
- Develop a set of detailed hydrogeologic cross-sections and/or isopach (thickness) maps of the confining clays at and near the recharge areas.
- Where data is inadequate or contradictory, locate and drill a series of geologist-observed test holes, geophysically logged to ascertain the clay layers and characteristics. (Note: this could be combined with completion of certain test holes as permanent piezometers).

Time Frame:

- GIS database development, lithologic log interpretation, and cross-section and maps development: 1 year.
- Test hole drilling, logging, documentation: 1 field season plus 3 months for analysis and documentation.

Desired Outcome: Develop a more accurate understanding of the nature and extent of thin clays at and near the edges in the recharge areas around the rim of the SLV (emphasis on area west of US 285).

Follow-up Activity: Fill data gaps with further test drilling, as needed.

Relative Priority:

Estimated Cost:

Comments / Notes: Since the onset of the 2000 + drought, there have been a number of proposed deeper well replacements for unconfined aquifer wells. Understanding of potential effects on the confined aquifer needs to be improved.

8. Activity or Project: Workshops for improved drilling contractor understanding of importance of accurate lithologic descriptions of aquifers drilled in the Rio Grande Basin.

Affected Area: Rio Grande Basin.

Need: The present aquifer mapping in the SLV and other areas of the Rio Grande Basin are highly dependent on the existing database of driller's descriptions of formations encountered in drilling. Although most drillers' descriptions are greatly improved from past years, a need still exists to educate water well contractors who are active in the Rio Grande Basin as to the geology and rock types they will encounter, and the importance of identifying thin clay layers and other formation changes.

Summary of Activity:

- Partner with the Colorado Water Well Contractors Assn. (CWWCA) and CDWR / Water Division 3 well inspectors, and develop a series of half-day to one-day workshops specifically for drillers who practice in the SLV and elsewhere in the Rio Grande Basin.
- Each workshop should be led by one or more experienced hydrogeologists, and should show rock and formation samples, and discuss the stratigraphy, structure and general extent of the formations drillers may expect to encounter in various areas in the basin.
- Develop a set of graphics and handouts for the participants.

Time Frame:

- Workshop development: 6 months.
- Workshop presentation: twice, over two years, to be presented at regular CWWCA meetings.

Desired Outcome: Develop in the licensed drilling contractors a more accurate understanding of the formations they will encounter in the SLV and elsewhere in the Rio Grande Basin, and educate the drillers on the importance of accurate lithologic descriptions.

Follow-up Activity: Refine the workshop materials and offer the workshop periodically as needed.

Relative Priority:

Estimated Cost:

Comments / Notes: In many instances, closely adjacent wells show highly contradictory lithologic descriptions. Although improvements have been seen in recent years, a need still exists for the drilling contractors to be correct and accurate in their lithologic descriptions as reported on water well completion reports.

**FOLLOWING IS THE “INITIAL LIST” CIRCULATED BY CHARLES SPIELMAN** – Some of the points raised were challenged, but this basic document elicited the high level of interest which led to the formation of an informal, ad-hoc, spontaneous coming together of those who felt that more substance was needed in the Basin Implementation Plan.

Cory Off, President of Senior Water Users of the Rio Grande, made a number of critical observations to this document, and his comments are included here. Since flexibility and inclusiveness are part of the process of creating this Action Plan, Cory’s input, provided via this exchange, is entered into the record. This is an example of the self-correcting and mutual-learning process which has been greatly appreciated by the main compilers of this Action Plan, neither of whom claims to be a water expert. The suggestions and the constant corrections of data, concepts and ideas, we believe, show the kind of “education and outreach” generated by the work of the Aquifer Support Group. Profound thanks to Cory Off and to all other very patient participants who criticized, agreed/disagreed, edited, added and otherwise contributed to this process.

### **SUGGESTED TOPICS FOR INCLUSION IN RGBIP**

#### **GEOLOGY & HYDROLOGY**

Prepare a comprehensive report, or several reports, regarding the geology of the RGB, aimed at “filling in” blank spaces in the knowledge of the Basin’s geology.

Prepare a comprehensive report, or several reports, regarding the hydrology of the RGB, aimed at “filling in” blank spaces in the knowledge of the Basin’s hydrology.

**(Cory Off) This should also include the foothills and above the gauging stations(RE: Del Norte)**

Based on the results of the above two studies, recommend further research and/or field work regarding the geology and hydrology of the RGB.

Prepare an inventory of the stream waters entering and leaving the Basin – location, annual range of flows, and average flows, water flow rights governing stream use, etc.

Create a hydraulic model of the ground water system in the Basin showing subsurface water input into the ground water system, water stored in the aquifers, and water flowing naturally out of the aquifers. Show ranges and average annual quantities.

Install stream gages as necessary to make more accurate the above ground water system model.

Prepare an inventory of all the significant reservoirs and reservoir sites in the Basin: capacity, possible increases in capacity, water storage rights, and other factors affecting water storage. Describe for each reservoir the use to which the water storage right, and stored water, is being put.

Obtain data and prepare estimates of the loss, over time, of stored ground water in the pertinent aquifers in each of the Basin's sub districts, due to "over pumping" for irrigation of crops.

Research the value of electronic drillhole logging and require it on all new water wells and monitoring drillholes if justified by the results.

### WATER DEVELOPMENT & MANAGEMENT

Investigate the operational & economic feasibility of various methods of water development & management and select which to pursue and perfect, such as: installing remotely-operated headgates and flow measurement instrumentation; improving irrigation ditch diversions, restricting or preventing seepage out of irrigation ditches with the use of pipelines and ditch linings;

**(Cory Off) This would change return flows and affect next door neighbors**

Investigate the operational, economic, and legal feasibility of building small reservoirs, as possible new water storage facilities, at potential locations on several tributaries of the Conejos River and the Rio Grande;

**(Cory Off) New storage would be post compact and under article 4. Would expanding the size of a reservoir create water stored post compact. If you store water in the winter you have eliminated the water normally paid on the compact during the winter months. Also, how would this stored water be administered and who would benefit. The stored water could be released to benefit a certain group of water rights.**

Monitor and study recharge into the river and groundwater systems from various sources-irrigated fields, city wastewater systems, and industrial installations; install equipment to control this recharge to maximize beneficial results to the water systems; Investigate the feasibility and cost/benefit of constructing one or several low retention dams in the Conejos River or Rio Grande.

**(Cory Off) Would the state allow this. How would this effect return flows?**

### FARMING & RANCHING OPERATIONS

Conduct a comprehensive and in-depth study of the economy of the RGB, with emphasis on the agriculture industry, as part of the basis for recommending changes or modifications in farming and ranching operations in the Basin.

**(Cory Off) Would this include the economic tooling needed by the sub districts? At this time it is imperative that we conduct an economic study. This should start at the sub district level and create the tools needed to understand setting pumping fees. Include cause and effect of estimated surface water, commodity prices, etc. Also, the study should include the study of alternative ag uses for water. An example would be large scale greenhouses. They would use**

**a very controlled quantity of water, less evaporation, and have an added value for the produce grown. Also, we are within a one days travel from many large cites. The front range to Dallas, New Mexico and Arizona.**

Continue investigation of the benefits of reducing agricultural water use resulting from different farming and ranching methods;

Develop & settle on more accurate determination of the water demand and consumptive use of various farming and ranching practices – by crop, location, and situation;

Develop estimates of the acreage reductions indicated in each sub district necessary to maintain or restore water storage in the aquifers affected;

**(Cory Off) Why is this not happening now? This should be part of the economic study.**

Initiate a program of continuous and wide-spread searches for new crops to experiment with to reduce water use and/or increase farm income while holding water use constant;

#### MUNICIPAL & INDUSTRIAL CONSIDERATIONS

Provide a data base and guidance for RGB towns as they move to deal with shortcomings and problems in water supply and waste water systems.

Continue to study data regarding municipal and rural residential water requirements and consumptive use.

Study and compare the costs and benefits of industrial/commercial water demand and consumptive use vs. agricultural water demand and consumptive use;

Encourage and support new industrial/commercial projects, especially those that are efficient and/or low in water use, or which are careful to protect ground water quality;

#### ENVIRONMENTAL & RECREATION CONSIDERATIONS

Conduct a comprehensive study of water storage, stream flows, and water rights dedicated to environmental and recreational purposes in the RGB;

Conduct a comprehensive study of the dramatic decrease in bird populations in the RGB in the past 50 years; attempt to determine the cause of the decrease – farming practice? Pesticides/weed killers? Lack of surface water? Lack of suitable habitat? Predation?

**(Nicole Langley) Plenty of ornithological resources exist. Rather than starting from scratch, let's instead host a series of public talks on various topics. We would host a workshop or panel discussion and invite bird-watchers and avian experts. Folks appreciate the Roundtable as a place to learn about different issues, so we could help them do more of that.**

Study and compare the costs and benefits of environmental water demand vs. agricultural and industrial water demand;

Search for and undertake projects designed to increase or enhance the environmental or recreational benefits of RGB water use.

### WATER SUPPLY & RIO GRANDE COMPACT CONSIDERATIONS

Continue the current experiment of using radar and other data to improve river flow forecasts necessary for RG compact administration. Install that methodology permanently if it proves successful;

**(Cory Off) This should include lidar to estimate snow packs. This technology comes out of Jet Propulsion Laboratory in California.**

Improve the estimates of the costs associated with inaccurate forecasts of river flows in the RGB.

**(Cory Off) Currently funding for the snow courses is a battle. Who would pay for more accurate forecasts?**

Initiate and continue discussions, or perhaps negotiations, with New Mexico and Texas regarding the water savings (from reduced evaporation) that could result from storing RG water (in reservoirs or in aquifers) in Colorado instead of in Elephant Butte Reservoir in NM;

Insure that all existing RG reservoirs have been improved to allow storage at their maximum legal/operational capacities;

Review the current status of feasibility studies of bringing water west to Colorado from the Missouri-Mississippi drainage and decide whether to support further study, as proposed by other basins.

Examine the feasibility of transferring water from the SJB to the RGB – by transferring water rights, or by leasing water if available from the SJB,

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