

## New Mexico's Statewide Water Assessment: Data Collection and Delivery to Meet Stakeholder Needs

Sam Fernald, NM Water Resources Research Institute

*Sam Fernald was appointed director of the New Mexico Water Resources Research Institute (NM WRI) in July 2013 after having served as interim director since January 2011. As director, he will lead the institute in its mission to develop and disseminate knowledge that will assist the state, region, and nation in solving water resources problems. The NM WRI, one of 54 water institutes in the nation, encourages university faculty statewide to pursue critical areas of water resources research while providing training opportunities for students, and transfers research findings to the academic community, water managers and the general public. Professor Fernald also is a faculty member in the Department of Animal and Range Sciences at New Mexico State University.*



*Dr. Fernald's earned degrees include a 1987 B.A. in international relations from Stanford University, an M.E.M. in 1993 in water and air resources from Duke University, and a Ph.D. in watershed science from Colorado State University in 1997. His primary research interests include water quality hydrology; land use effects on infiltration, runoff, sediment yield, and nonpoint source pollution; and effects of surface water/groundwater exchange on water availability and water quality. Dr. Fernald received a Fulbright Scholarship to Patagonian National University, Trelew, Argentina in 2008, and another Fulbright Scholarship to the University of Concepcion, Concepcion, Chile in 2000. Dr. Fernald currently is leading a multi-institutional, five year, \$1.4 million water research project funded by the National Science Foundation. In addition to NMSU, partners in the study include the University of New Mexico, New Mexico Tech, Sandia National Laboratories, the New Mexico Acequia Association, and the Maxwell Museum.*

Good morning everybody, it's a beautiful day here in Santa Fe. I'm just going to talk a little while until everyone shows up, so you're not going to miss anything. First, I'm Sam Fernald, this is Scott Verhines, and I need to thank our conference committee for putting this together, *New Mexico's Water Future: Connecting Stakeholder Needs to Water Information* and we need to thank our sponsors, Los Alamos Lab, and Sandia National Laboratories. Thank you very much! So, yeah great, give them a round of applause. Also thanks to my dad who is here, which is great, Fred Fernald and all the other luminaries and everyone who has shown up.

I guess I'll start with an anecdote while people are still coming in, standard technique, right? So, I had to go from Santa Fe to Albuquerque yesterday and my work truck started to make an awful noise, like a rumble strip, and I'm running down the highway so I limped off to the side and I called for backup. We had a team in Alcalde that had just finished their morning work, and started back to pick me up. I saw the rest area out there, right where you come over the hill to Santa Fe, so I went up along the shoulder, there's an official turnout. I waited until there was no traffic and crept into that rest area. About 150 feet from that rest area there's a

huge clunk, and the transmission totally gave out. I got out of the truck, looked around, and this is what I saw (Figure 1).

I dropped a drive shaft right in the parking lot. First of all, it was a small problem, because I was lucky this didn't happen while I was crossing the interstate, so I count my lucky stars, and I was able to call and get help. I called the office back in Las Cruces, and the guy said, "Okay, I want you to put it in 4-wheel drive," and I went "ah-ha!" Basically,



Figure 1. Drive shaft dropped from work truck.

of course the back wheels didn't work, but I still had the front wheels. This is the theme for this conference, we are trying to get stakeholders together and communicate the history of the water conference. Maybe we can turn a problem here into a new solution. With that spirit, I would like to move into our water conference.

I'm going to talk a little bit about our Statewide Water Assessment, but first I'm going to start off talking about the history of the Water Resources Research Institute. A lot of you don't know this, but we actually have a lot of people who are founding members of the Water Resources Research Institute. Let's look at the establishment of the institute with what was happening with water supplies in the late 1950s and early 1960s. Look at the trajectory on the bottom of Figure 2. We have Elephant Butte storage, in acre-feet, of course an acre-foot is an acre covered in a foot of water. In the early years the reservoir filled in 1915 until it actually spilled in the 1940s, and we hit drought in the 1950s, and what happened? People got together. They said, "We need to have a meeting. We have got to get together and talk about these issues and do something about this water situation," and in 1956 held the first annual New Mexico Water Conference, and today we are in the 59<sup>th</sup>. In 1963, the New Mexico Water Resource Research Institute was established. In 1964, Senator Clinton P. Anderson, took this great idea to Washington, and actually got the Water Resources Research Act passed, which made institutes in all 50 states, 3 territories and the District of Columbia (Figure 3). The idea was to harness the brain power of the universities and water-related agencies to manage our water resources better, and in 1966, a memorandum of agreement was prepared with the WRRI, New Mexico State University, the University of New Mexico, and New Mexico Tech to work together on research to support and improve water management (Figure 4).

For the 1980s and 1990s, if you look on the bottom timeline here, it shows some of the wettest time periods in 2000 years, and there wasn't a lot of activity. Then in about 2002, we went into drought again (Figure 5). That definition, of course is up for discussion, but if you look at the Elephant Butte signature, storage is low. In coming back to our timeline, we actually have a statute of the purposes

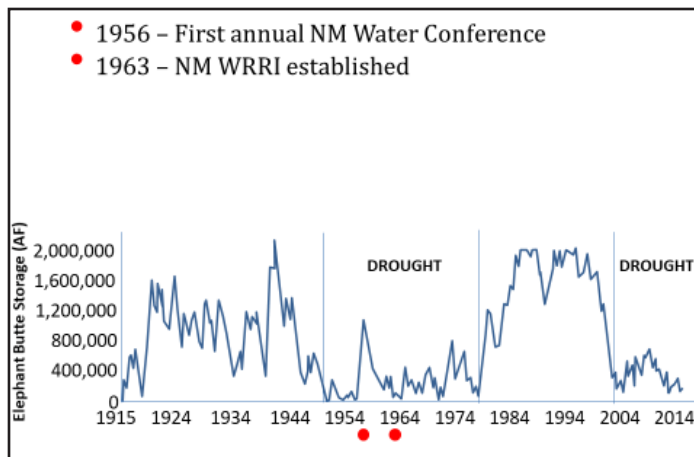


Figure 2. NM WRRI established in response to drought.

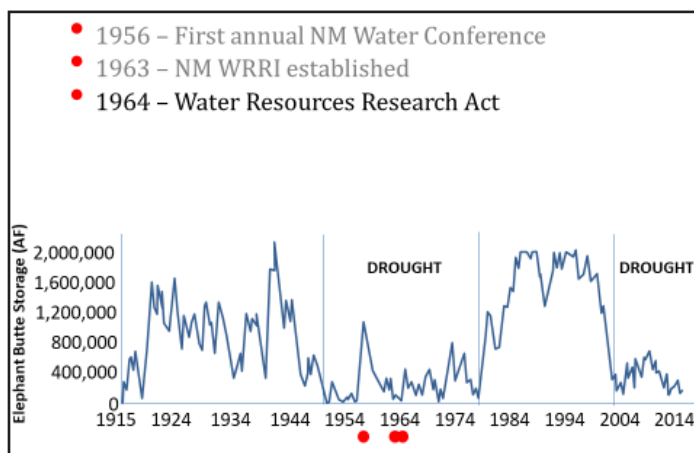


Figure 3. National Water Institutes modeled on NM WRRI.

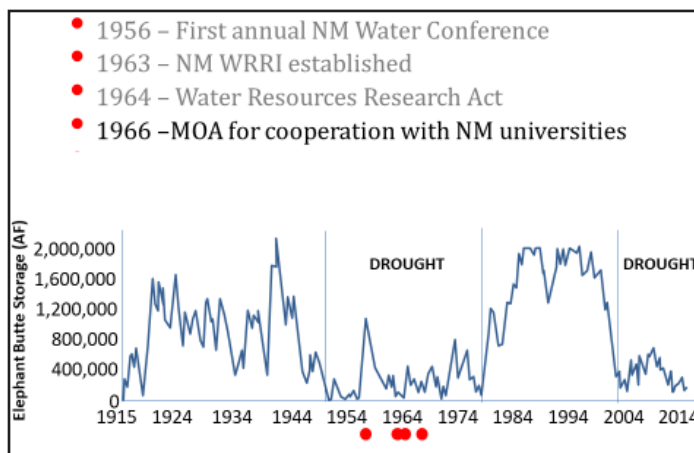


Figure 4. Harness the brainpower of universities.

of the water institute: research and training, cooperation with agencies and stakeholders, dissemination of information, and providing expertise. That's what we are doing with this water conference, and what we are focusing on.

In 2014, the legislature dedicated a million dollars to a statewide water initiative, and a big part of that is a Statewide Water Assessment (Figure 6). I just want to give you a few ideas about why we are doing it, and then leave it up to our speakers. We have great speakers, we have an amazing poster session with over 50 posters tomorrow, so hopefully I won't steal anyone's thunder. In the spirit of the Annual New Mexico Water Conferences, work together, talk to each other, exchange ideas and thoughts. We have a drought, which is a little bit of a problem, but maybe it will help us fix our long-term approach to dealing with water scarcity.

For the second part of this introduction, why are we doing all this? That's what I would like to talk a little bit about, and what it would look like. The Office of the State Engineer, John Longworth, and the other staff do a great job of quantifying the administrative supply (Figure 7). About 4 million in acre-feet, give or take, are tied to water rights, but remember that number. That's the water rights in New Mexico, withdrawals for water rights, from surface water return flows back to surface water or groundwater.

There is all this water moving through the state that is not well quantified up to 100 million acre-feet. There is around 10 million acre-feet of precipitation in a good year, and maybe 50 million acre-feet of evaporation. We don't know about recharge, we don't really know about inflows and outflows. We need a better assessment of our water resources. They're dynamic, so the graph actually shows precipitation in the middle. We determined that the PRISM system is a good precipitation data set. Evapotranspiration (ET) is also highly variable, but we don't know. We can look at statewide coverage of ET models, but we are not yet able to have a good sort of absolute number for ET. It's either high or low, and actually on this graph if you look along the bottom, that's the water use by

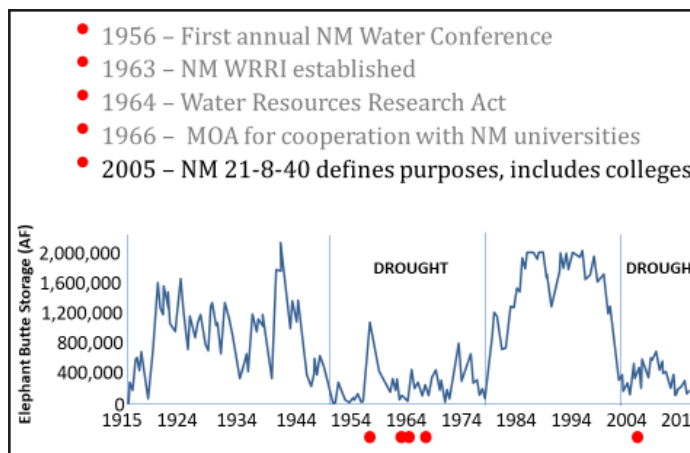


Figure 5. Purposes are research, transfer, expertise, cooperation.

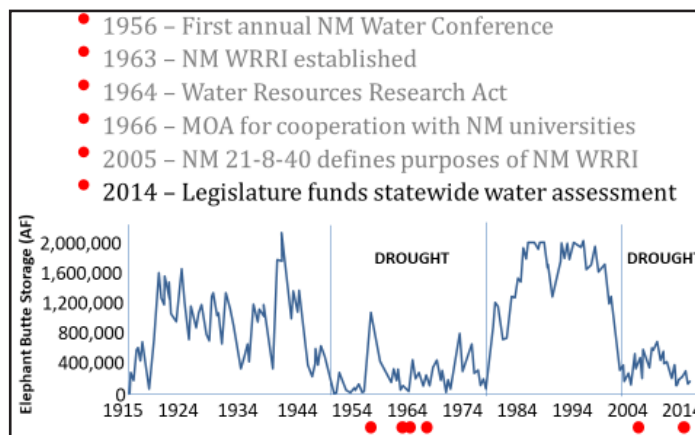


Figure 6. \$1 M water initiative - Thanks to legislators, governor, universities, stakeholders, supporters.

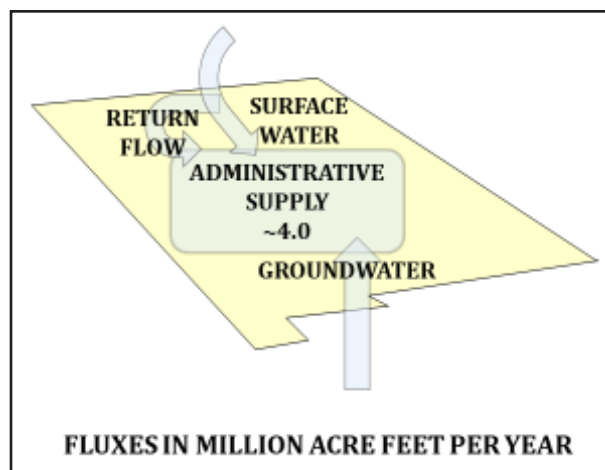


Figure 7. The administrative supply is well known.

category every year, or actually every five years, as quantified by the Office of the State Engineer (Figure 8).

There is a lot of water moving through New Mexico that we are not accounting for, and what happens when you don't have surface water? In the Mesilla Valley and every year in the 1980s and 1990s, even in the early 2000s, groundwater is recharged every year by irrigation seepage, and then it goes down and comes back up every year. Well, in 2002 the water table dropped and here in 2011, 2012, 2013 we are falling off a cliff (Figure 9). If you look at the basins starting in the north moving south, they are recharged every year in the north, but you get to the Mesilla Valley and we are starting to reach this threshold where groundwater is dropping. If you look at El Paso, they reached this threshold back in the 1950s; they went off a cliff, and they are essentially mining their aquifer instead of managing it as a sustainably connected river and aquifer system. Therefore, we need a better updated groundwater assessment. The best maps of brackish water for example are from the 1960s, and there are a lot of gaps in our groundwater information, but if you go visit a ranch on our tribal and pueblo lands there are windmills in almost every section, that we can get some data from. We need to work with

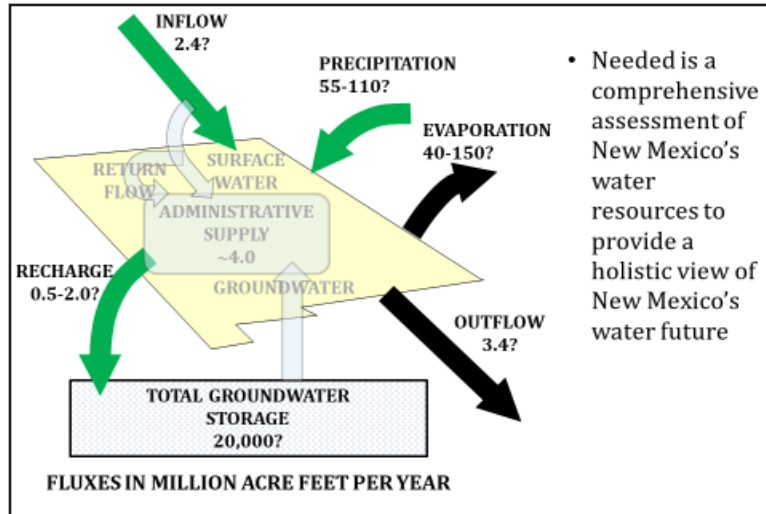


Figure 8. The total supply is not well known.

our stakeholders both to meet their information needs, but also to gather the information and fill in the gaps.

On the issue of scale, the water institute's goal is to be fully objective and provide information that people can use, such as topics on acequia seepage. You might be inefficient at your farm scale and let water go to the groundwater, but that actually puts it in the aquifer, reduces evaporation, and provides late return flow downstream, which is good for users. In the Plains of San Augustin, there's a groundwater issue, but it's tied to the legal process

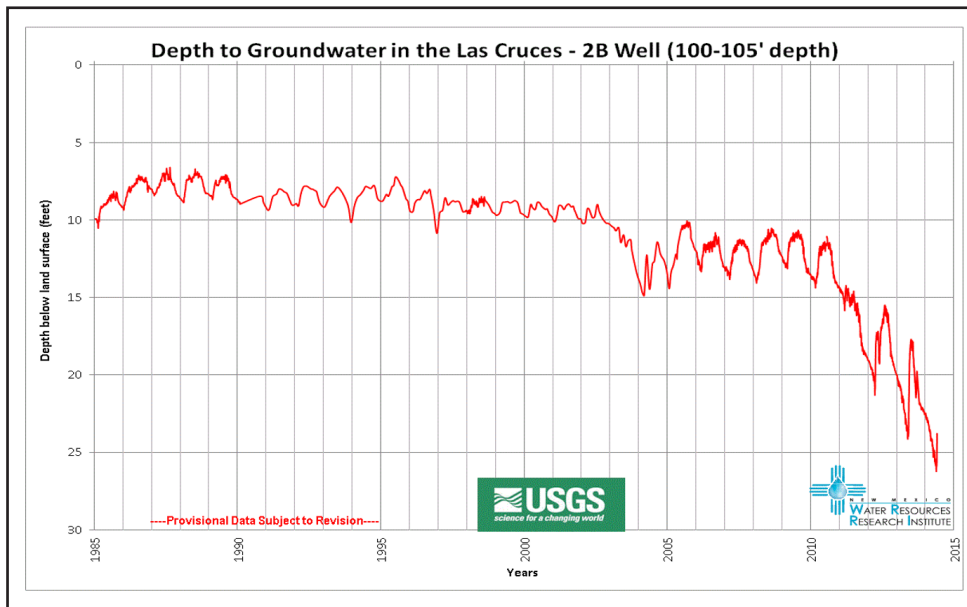


Figure 9. Groundwater drops with less surface water.

of surface water upstream. The lower Rio Grande groundwater is dropping because there are fewer surface water deliveries. It is really hard to manage at a local scale if your benefits are accrued at a larger scale without some kind of planning, but it is hard to do the planning if it's not integrated. Other states have their investments in water resources from \$2 to \$12 million a year to actually specialize point data as is in the case of Oregon, that's shown in the upper left corner of Figure 10. To use groundwater units for their water rights administration in Utah, or California, they have a common framework for all their water budgets.

We received the funding from the legislature, and I'm really happy about this graph (Figure 11). It shows that we have distributed the funding to our different partners. We have New Mexico Highlands University and Eastern New Mexico University doing projects through USGS, a consultant who used to work for a lab, the Water Resources Research Institute, New Mexico Tech, UNM, and NMSU. We are really harnessing the power of the universities to do this work (Figure 12).

Finally, we are covering the whole state. We are involving stakeholders, we are making it accessible, but it needs to be updated. The

point is if we use a statewide dataset, it's like remote sensing where we can get cutting edge information. The group out of Tech is doing a recharge analysis, so we can actually inform the watershed management groups about where they can thin forest, and have better recharge of the aquifers based on this recharge analysis. We are working together on these issues.

Of course, there are a lot of groups doing different components of the water budget you will hear about today. There are a lot of stakeholders impacted that mention oil and gas, community water supplies, businesses, ranching, and these are just a few examples. Which reminds me, did everyone get a survey? This survey is actually a way for us to find out what you would like to do at conferences in the future, and also includes some of your stakeholder water information needs. We put a list of stakeholders on there, but I'll leave it up to you to identify your group if it's not listed. Please fill out that survey today or tomorrow because we really could use that information. Of course, we have a water budget that puts us all together, we are going to have a database that is accessible to everybody, and we are going to have a model where we integrate these in a dynamically updated manner. With that, I'll close up my part and move into my introduction of the State

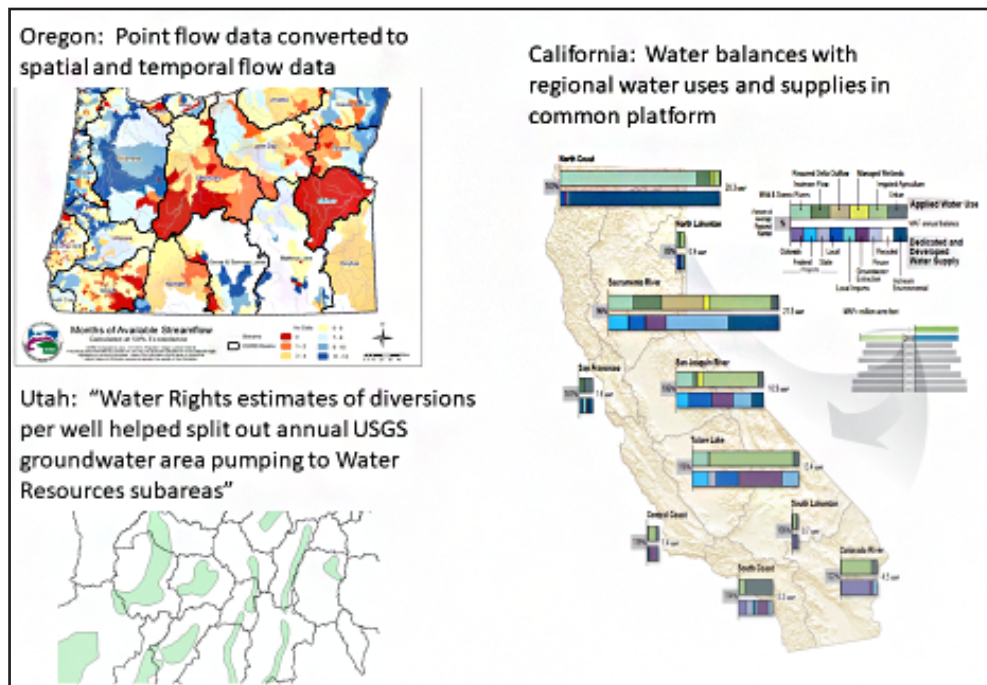


Figure 10. Other western states invest in water assessments.

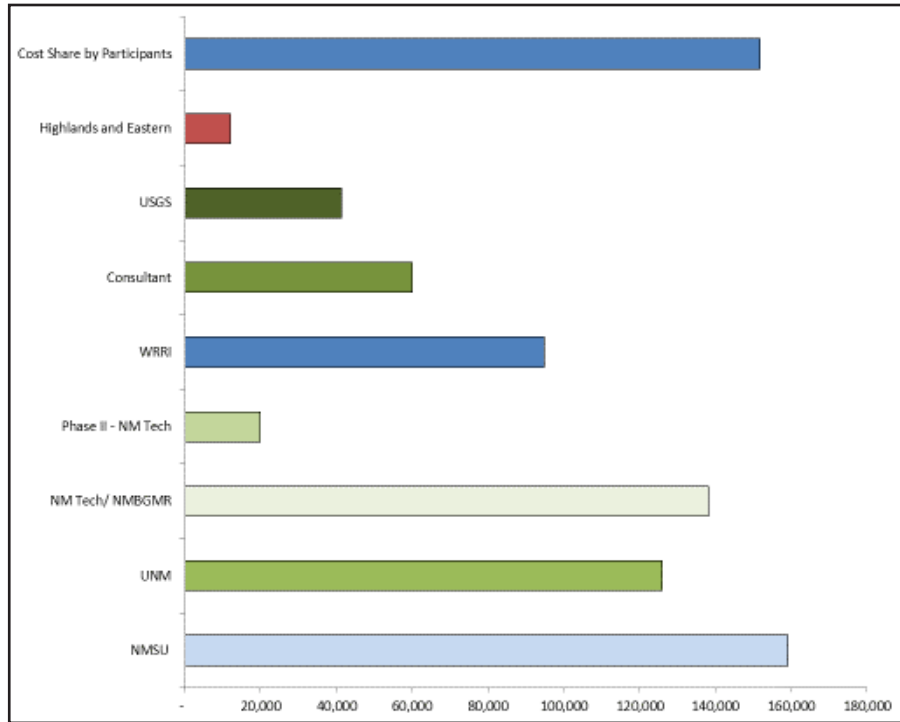


Figure 11. A graph of distribution of funds to partners.

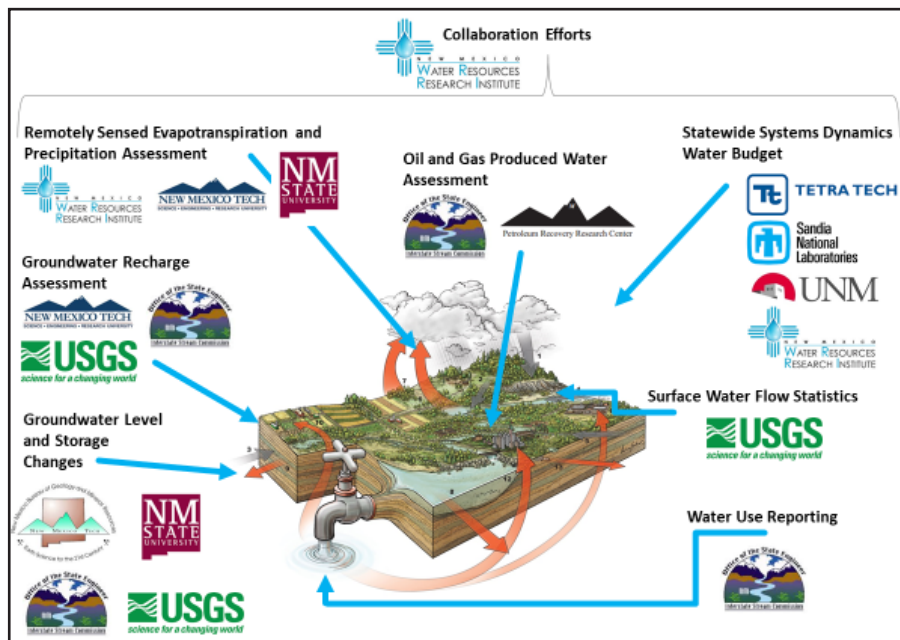


Figure 12. Statewide collaboration of multiple agency lead components.