From the Ground Up

Agronomy News

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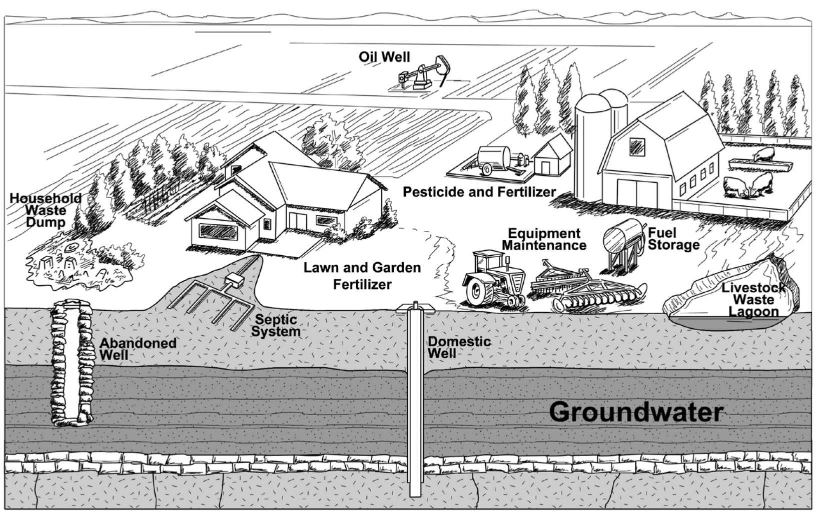
Pesticide Mixing and Loading and Your Family's Water Supply

Troy Bauder – Extension Specialist

Groundwater is an important resource in Colorado, supplying approximately 17 percent of the total water diverted in the state. Nineteen (19) of Colorado's 64 counties rely solely on groundwater for drinking water and domestic uses, and private wells are the primary source of water for many Colorado families, farms and ranches. In fact, there are more than 150,000 residential and household wells permitted in Colorado. Protecting these private water supplies is essential to the welfare of those who depend upon groundwater; good quality water is an invaluable resource. Protection of private well water quality begins at the well head and is the sole responsibility of the well owner. No government agency has authority or responsibility to protect private well water supplies.



Spring and early summer are generally the active seasons for spraying pesticides and fertilization. In most situations, when following all label directions and advisory statements, the risk of contamination of groundwater from routine pesticide applications is low. However, farmstead wells are often the source of water for mixing pesticide and fertilizer solutions. Mixing, storing and loading activity near wellheads greatly increases the risk for groundwater contamination. To reduce this risk, consider the following suggestions:

- Whenever feasible, use a nurse tank for water and mix and load pesticides and fertilizers in the field, away from water sources.
- Never store pesticide, fertilizer or other hazardous chemicals within 100 feet of your well. Never, ever store these chemicals in a well shed or pit.
- Store pesticides in a secure building with a concrete floor, separate from other activities.
- Triple rinse and properly dispose of used pesticide containers. Never allow used containers to accumulate near the wellhead.
- Properly dispose of rinse water by:
  - Spraying rinse water on the target area just treated, if application rates and amounts will not be exceeded;
  - Apply rinse water to other sites listed on the product label, if allowed by product label restrictions or
  - Reuse rinse water to dilute the next batch of formulation, as long as the site to which the rinse water is applied is a labeled site.
- Do not keep or accumulate waste, unwanted, or off-label chemicals. Utilize the Colorado ChemSweep Pesticide Waste Collection Program to dispose of unwanted pesticides. See: http://www.colorado.gov/ag/GW, click on the pesticide waste disposal link.
- Pay attention to where you park your fertilizer shuttle tanks. Is your well nearby? Park the tanks at least 100 feet away and down gradient of the well to minimize risk of contamination from spills.
- If you must mix and load near a wellhead:
  - Utilize a float valve to prevent overfilling the tank and an antibacksiphon device to prevent siphoning back to a well.
  - Use a hose to achieve a 100 foot buffer.
  - Consider installing an impermeable mixing and loading pad to contain spills and reduce risk of contamination
  - Know how long it takes to fill your tank and use a timer to remind you to check when it will be full. Better yet, remain present to ensure you don't overfill.

- Consider testing your well water for pesticides if contamination is suspected. All wells should be tested regularly for nitrate and bacteria, but pesticide testing is much more expensive and should only be needed when contamination is suspected.

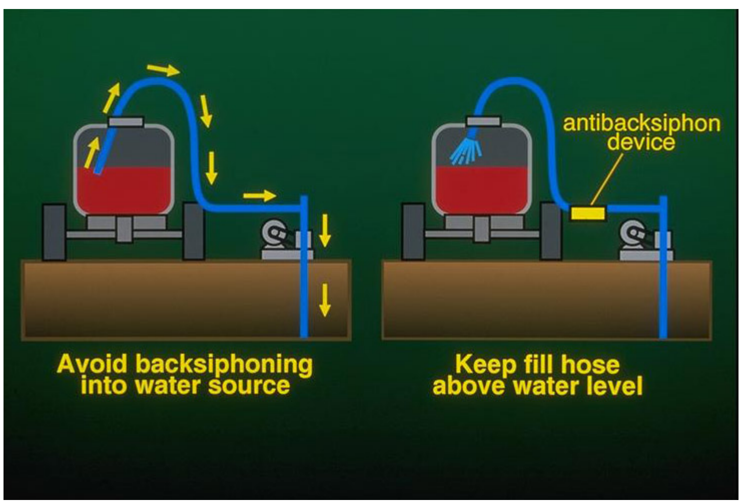
Groundwater contamination from pesticides and fertilizers during mixing and loading is expensive to correct and is a completely preventable situation. Remember, the most vulnerable area for contaminating your family's drinking water source is near the well. Why take the risk?

Additional Resources:
Colorado Environmental Pesticide Education Program: http://www.cepep.colostate.edu/index.htm

Colorado State University Extension Water Quality Program:
www.csuwater.info

Protecting Your Private Well:
http://www.ext.colostate.edu/PUBS/CROPS/xcm179.pdf

Best Management Practices for Pesticide and Fertilizer Storage and Handling: http://www.ext.colostate.edu/PUBS/CROPS/xcm178.pdf



Rules for On-Farm Storage, Mixing, and Loading of Agriculture Chemicals

Rob Wawrzynski – Colorado Department of Agriculture

While all farms should practice best management practices when handling pesticides and fertilizers around their wellhead, some farming operations may handle and/or store enough pesticide and/or fertilizer to place them under rules for storage facilities and mixing and loading areas. These rules are only relevant when *quantities exceed set minimum thresholds*, but apply to *all operations*, regardless of whether the operation is commercial or private. The rules, which are enforced by the Colorado Department of Agriculture, establish performance standards for the construction and operation of secondary containment of bulk liquid pesticide and fertilizer storage facilities; pesticide and fertilizer mixing and loading areas; and bulk dry pesticide and fertilizer storage. The following questions can help you decide whether your operation requires these special facilities.

Pesticides – Secondary Containment:

1. Do you store pesticides in containers larger than 55 gallons for liquid pesticides or 100 pounds for dry pesticides for more than 15 consecutive days?

→ *If you answered no to question 1, secondary containment is not required, skip questions 2 and 3.*

2. Do you store pesticides in containers larger than 55 gallons that are not Department of Transportation 57 or MACA 75 approved?
3. Do you store pesticides in containers larger than 660 gallons?

→ *If you answered yes to either question 2 or 3 secondary containment and a mixing and loading pad is required.*

Pesticides – Mixing and Loading Pads:

4. Do you mix and load at one site annually (any site within 300 feet of another site is considered one site for these regulations) more than:
   a. 500 gallons of liquid formulated product (concentrate as it comes from the supplier) OR
   b. 3,000 pounds of dry formulated product, OR
   c. 1,500 pounds of active ingredient of a combination of liquid and dry product

→ *If you answered yes to any part of question 4, a mixing and loading pad is required.*

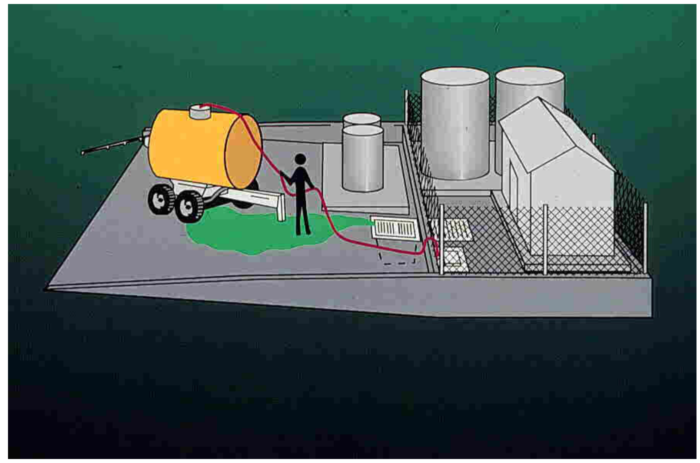
Field mixing and loading of pesticides is exempt from these rules so that is another incentive to conduct this activity in the field whenever feasible.

Fertilizers – Secondary Containment:
1. Do you store liquid fertilizer in a container or series of interconnected containers with a capacity of greater than 5,000 gallons for period of 30 consecutive days or more?

2. Do you store bulk (containers larger than 100 pounds) dry fertilizer in quantities of 55,000 pounds or more for a period of 30 consecutive days or more?

→ *If you answered yes to either question 1 or 2 secondary containment and a mixing and loading pad are required.*

For more information on these rules, you can contact Rob Wawrzynski at (303) 239 – 5704 or rob.wawrzynski@ag.state.co.us or visit the following web page: http://www.colorado.gov/ag/GW



Links and Resources

Institute for Livstock and the Environment:
www.livestockandenvironment.info

Ammonia Best Management Practices:
www.ammoniabmp.info

Rocky Mountain Compost School:
www.rockymountaincompostschool.info

Colorado State University's Crops Testing Program:
www.csucrops.com

Manure Management Program at CSU:
www.manuremanagement.info

CSU Extension Water Quality Program:
www.csuwater.info

CSU Extension Precision Agriculture:
www.precisionag.colostate.edu

Meet the Faculty- Dr. Jay Ham

I joined the Department of Soil and Crop Sciences in August of 2008 with an appointment that includes research, teaching, and extension responsibilities.

Prior to joining the faculty at CSU, I led a program in Micrometeorology and Environmental Physics for 18 years at Kansas State University (KSU). My interest in air and water issues originated while growing up near Garden City, Kansas where my father was a cattle feedlot manager. Irrigated agriculture, fed by the Ogallala aquifer, remains the economic lifeblood of the farming and livestock economies. While working on farms in the summer, I was very interested in water management and evapotranspiration (ET). I also watched the flow in the Arkansas River near my home dwindle and then cease completely, mostly due to heavy pumping from the aquifer along the river. I learned at a young age that water management, or the lack thereof, was something of real consequence. I also witnessed firsthand increasing public concerns surrounding air and water issues at cattle feedlots. Interest in air, water, soils, and meteorology has been a theme throughout my training.

I received my undergraduate degree in Agronomy at KSU and got my Masters degree at Oklahoma State University with an emphasis in Soil Physics. For my doctoral work, I attended Texas A&M University and focused on micrometeorology and ET.

My current research and extension efforts include: (1) the effects of animal feeding operations on air, water, and soil quality; (2) micrometeorological studies of water and crop water use; and (3) development of new measurement systems and best management practices (BMPs) for improving air and water quality. My initial efforts at CSU are studies of ammonia emissions from cattle feedlots and dairies. We want to develop practical and economically viable BMPs to reduce emissions and help producers with new environmental reporting rules on ammonia.

I think air and water issues in Colorado make CSU one of the best places in the country to develop a new research and extension program. My family and I love Fort Collins and the surrounding community. If not at work or taking care of family matters, you are likely to find me "Standing in a River Waving a Stick" as aptly described by noted fly fishing author John Gierach. I'm an avid fly fisher, so if you have a project that might take me near a trout stream, please give me a call.

"We have a finite amount of time. Whether short or long, it doesn't matter. Life is to be lived."

- Randy Pausch

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We need your input!!!

We are conducting a survery about our newsletter. Please help us to continue improving the quality of our newsletter by providing us your opinion.

The survey is very short (only 8 questions) and should take under 5 minutes.

To take the survey go to: http://www.surveymonkey.com/s.aspx?sm=bGP0DXx4C53c2hSSfbHZeg_3d_3d

Your comments and input are very valuable and we appreciate your time. Thank you!

If you have any comments or suggesstions please feel free to email them anytime to : Kierra.jewell@colostate.edu. She can also be reached via phone at (970) 491-6201.

Colorado's Chemigation Program

Don Gallegos, Chemigation Coordinator

The chemigation program was enacted in 1989 through the Colorado Chemigation Act to protect groundwater and surface water from agricultural chemicals such as fertilizer and pesticides that are applied through a closed irrigation system. A closed irrigation system is defined as a pipe or conduit two inches or larger that is connected directly to any source of groundwater or surface water that is used to irrigate agricultural or horticultural crops. Typically, these closed systems are center pivot irrigation systems largely used in eastern Colorado or the San Luis Valley.

The Colorado Department of Agriculture (CDA) issues permits to owners or operators of these systems annually at a cost of thirty-five dollars for each system. If a producer chooses not to apply agricultural chemicals through their irrigation system they can submit an affidavit of non-chemigation at no cost. The CDA issues approximately 4000 permits annually statewide and inspects half of these systems every year. Inspectors with the Division of Plant Industry check permitted systems to insure all the proper back flow prevention devices are installed and functioning properly. These back flow prevention devices are designed to prevent the mixture of water and chemicals back into the water supply if a power failure occurs. The chemical injection system is shut down and the water chemical mixture that is in the pipeline is held there by a back flow valve.

Chemigation is a very cost effective method to apply chemicals and when properly employed, is environmentally friendly. Because fertilizer can be applied in smaller amounts during the growing season and periods of high crop uptake, it enhances fertilizer use efficiency. This practice helps avoid the possibility of nitrogen leaching past the root zone of the crop and into the groundwater.

The deadline to purchase a chemigation permit and avoid the penalty fee is March 31st. However permits can be purchased at any time prior to chemigating. For more information you can call 303-239-4149.

Events

Wheat Field Days

June 8: Walsh, Lamar, Brandon
June 9: Burlington, Genoa, Roggen
June 10: Yuma, Julesburg, Haxtun
June 17: Akron
See www.csucrops.com for more information.

Fertigation

Joel Schneekloth, Regional Water Specialist

Fertigation is the application of nutrients through irrigation systems. This is a common practice with applications of nutrients, particularly for nitrogen (N). Utilization of fertigation can reduce fertilizer application costs and the total amount of N applied. The amount of fertilizer applied can usually be reduced when N is applied during the rapid uptake periods when the plants most need the nutrient.

Nitrogen is the most commonly applied nutrient with fertigation for several reasons. First, once in the soil, all N fertilizer forms are eventually converted to nitrate. Nitrate is highly soluble, not bound by the soil, and thus moves readily downward with water. When applying all the N as a pre-plant operation, the amount of time that the nutrient is in the soil prior to crop uptake increases the possibility of leaching N below the rootzone, unavailable for plant uptake. For example, from emergence to early July, corn uptake of N is only 20% of the total (Figure 1). Within the next 30 days the plant will have up taken 60% of the total needed. Until mid July, 80% of the applied N is still in the soil and has a potential to leach. With fertigation, more of the N can be applied during that rapid uptake period and less will be available to leach during the early growing season.

Estimates vary for the potential fertilizer savings when fertigating. The University of Nebraska corn N recommendations suggest a reduction of applied N by 5% when more than 30% of the total N is delayed till peak uptake. Delaying application of N is more beneficial on sandy soils and years with above average spring precipitation. Application amounts of N should be small enough to not cause salt injury to plants. Generally several applications are recommended in 30 lb per acre increments.

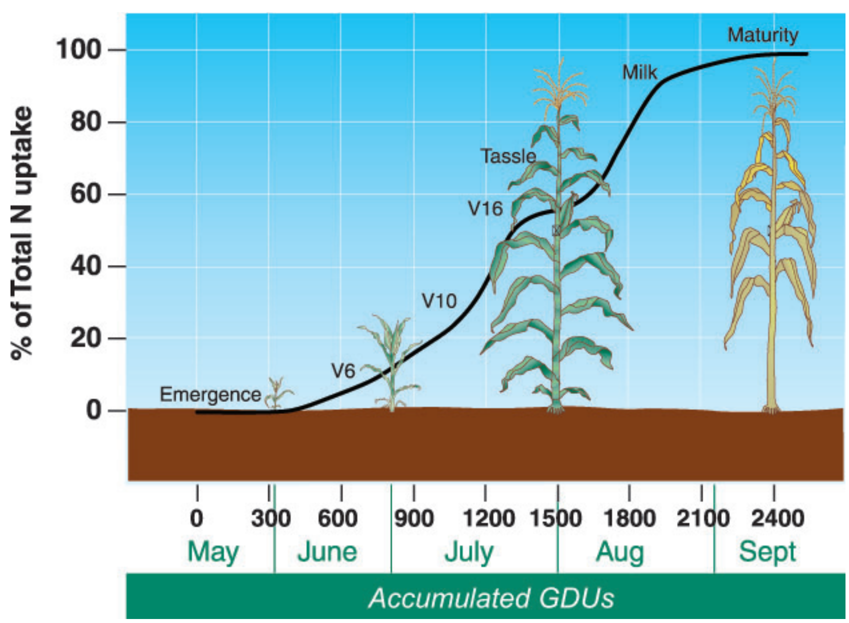


Figure 1. Corn uptake of N

The recommended fertilizers for fertigation are urea-ammonium (UAN) solutions, because this N source will stay in solution. Volatilization of UAN is minimal thru sprinklers when sufficient water is applied. Anhydrous ammonia can be distributed in irrigation water, but is not recommended. Anhydrous ammonia causes the pH of the water to rise and salts will precipitate out in the water. Volatilization potential is also high with anhydrous ammonia.

A fertigation system has several key components (Figure 2). An injection pump can be either a piston or diaphragm pump. A piston pump is generally used with higher pressure systems. The pump injects fertilizer or other chemicals into the irrigation system after water flows thru a backflow prevention valve. A fertigation system has several safety systems to prevent fertilizer or chemical from being injected into the system when water is not flowing and preventing that fertilizer from entering the water source.

The major reason to keep the fertigation system well maintained is to prevent fertilizer from entering the well and contaminating the groundwater. Fertigation systems must be inspected by the Colorado Department of Agriculture (see Gallegos article) to be sure they are installed and maintained properly for compliance and groundwater safety. One safety feature is a low pressure sensor that shuts off the injection pump if the irrigation turns off for any reason. Additionally, a check valve or back flow prevention system prevents water from the pipe that has had fertilizer injected into the system from draining back into the well after the irrigation well has shut off.

Injection pumps are run with percent of maximum application ratings for the pump. Generally

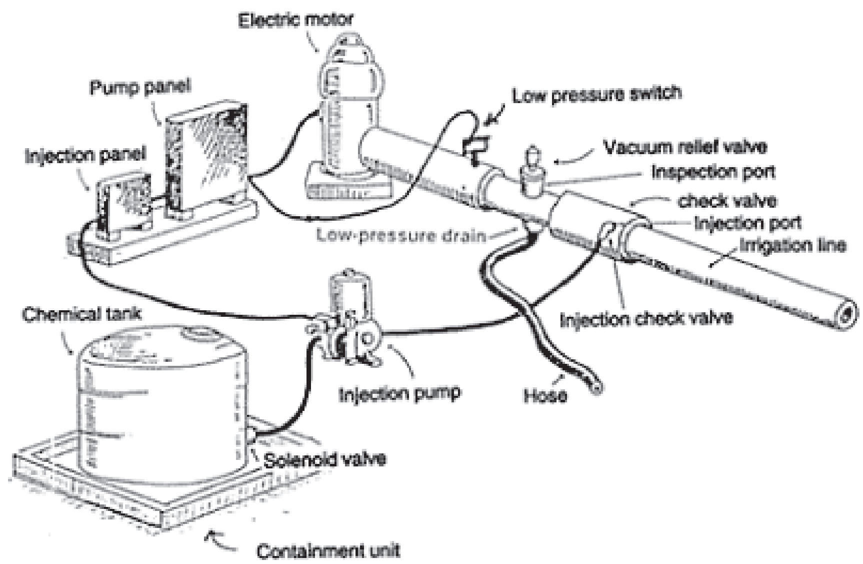


Figure 2. Fertigation injection system with components listed.

injection pumps are run at relatively high capacities in gallons per hour. Calibration can be done several ways. Many times, systems have calibration tubes on the side of the system. For center pivots, you need to know how long the system takes to make one complete rotation at the speed you are running for the fertigation and the volume of material needed for the irrigated area. You can then calculate the injection rate in gallons per hour or gallons per minute. You can then use the calibration tube to check the injection rate. If your system does not have a calibration tube, using a bucket with a known volume of water will work as well. Place the suction line for the injection pump in the bucket and record the time it takes to inject the desired volume of liquid and adjust the injection rate accordingly.

Fertigation with surface irrigation systems such as furrow is not recommended, because uniformity is often poor. Areas of the field will infiltrate more water and subsequently more N is applied as compared to other areas of the field. Also, tailwater that has N injected into the water has to be contained on the field and not allowed to reenter the water system.

Colorado Snow Survey and Water Supply Forecasting Program

Mike Gillespie
Snow Survey Supervisor with the NRCS

The Cooperative Snow Survey Program

Since 1935 the Natural Resources Conservation Service's (NRCS) Snow Survey and Water Supply Forecasting Program has monitored mountain snowpack and climate variables in the Western United States to forecast spring and summer water supplies. The earliest snow measuring sites in Colorado date back to the 1930s. At that time, a network of manual snow courses was implemented across the state. In the late 1970s, NRCS began installing automated SNOTEL (SNOwpack TELemetry) monitoring stations throughout the West. Today, Colorado NRCS coordinates the Federal-State Cooperative Snow Survey Program which includes 107 manually sampled snow courses and 104 SNOTEL stations in Colorado. (West-wide there are 1,200 manually sampled sites and about 700 SNOTEL stations.) This network provides the snowpack and climate data required to forecast spring and summer water supplies at 90 locations affecting Colorado water users. A wide variety of economic decisions, totaling many millions of dollars annually, are dependent on the snowpack data collected and water supply forecasts issued by the NRCS.

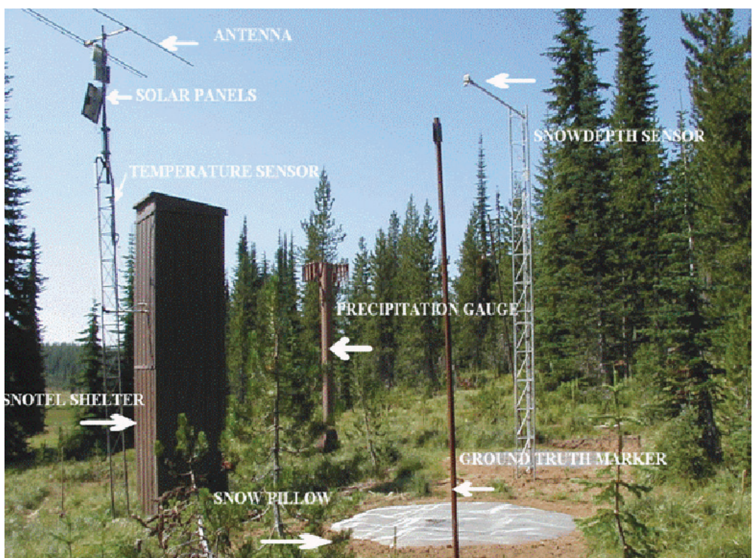


Figure 1. A typical remote SNOTEL site with snow pillow, snow depth sensor, a storage precipitation gauge, and an air temperature sensor.

The SNOTEL Data Collection System

The key to determining spring runoff is the timely and accurate monitoring of remote mountain snowpacks. SNOTEL sites are designed to operate in harsh winter conditions of the mountainous West. A typical SNOTEL site consists of measuring devices and sensors, an instrument shelter for the radio telemetry equipment, and an antenna that also supports the solar panels used to keep the batteries charged (Figure 1). A standard sensor configuration includes a snow pillow, a snow depth sensor, a storage precipitation gauge, and a temperature sensor. The snow pillow consists of a hypalon rubber bladder filled with a non-freezing solution. Snow pillows are 10 feet in diameter and are placed on leveled ground. A plumbing line connects the snow pillow to a manometer tube inside the instrument shelter. As snow accumulates on the pillow, the weight of the snow water content raises the fluid level in the manometer. A pressure transducer converts the fluid height into an electrical reading of the snow's water equivalent. The precipitation gauge measures all precipitation in any form that falls during the year. A second pressure transducer converts the accumulation of precipitation into an electrical measurement in a similar fashion as the snow pillow. A snow depth sensor is installed on a meteorological tower near the snow pillow. This is an ultrasonic depth sensor, which measures the time required for an ultrasonic pulse to travel to and from the snow surface. Also installed on the meteorological tower is the air temperature sensor. At midnight, a data logger computes the previous day's maximum, minimum and average temperatures. Nearly one-third of Colorado's SNOTEL sites are augmented to collect soil temperature, and soil moisture data. Sites equipped with these sensors typically have sensors placed at 4", 8" and 20" depths. Each sensor uses an electromagnetic signal propagated from the center tine of the probe to measure multiple parameters. Soil moisture data is becoming increasingly important in assisting streamflow forecasters estimate how much of the snowpack's water content will merely soak into the soil profile before contributing to runoff from that winter's snowpack

One of the most unique aspects of the SNOTEL system is the method of data transmission. The network utilizes the principle of meteor burst to relay data to water users. Meteor burst communication aims radio signals skyward where the trails of meteorites reflect the signals back to Earth (Figure 2). The meteor burst technique allows communications between two locations as much as 1200 miles apart. Two master stations - at Boise, Idaho, and Ogden, Utah - cover the 10 Western States, an area of about 1 million square miles. Via telephone lines, the master stations feed the data to the NRCS central computer in Portland, Oregon.

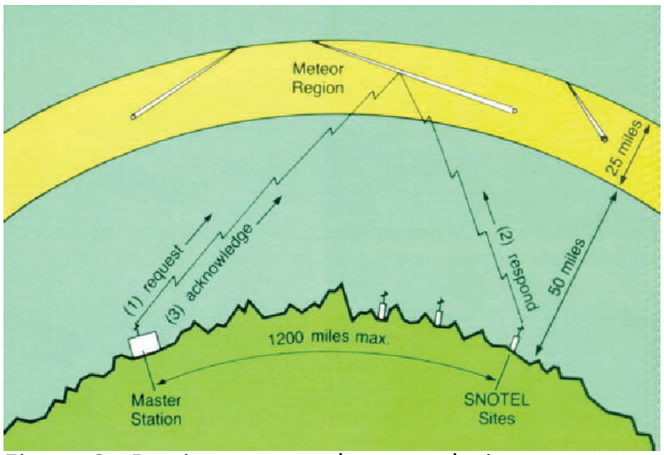


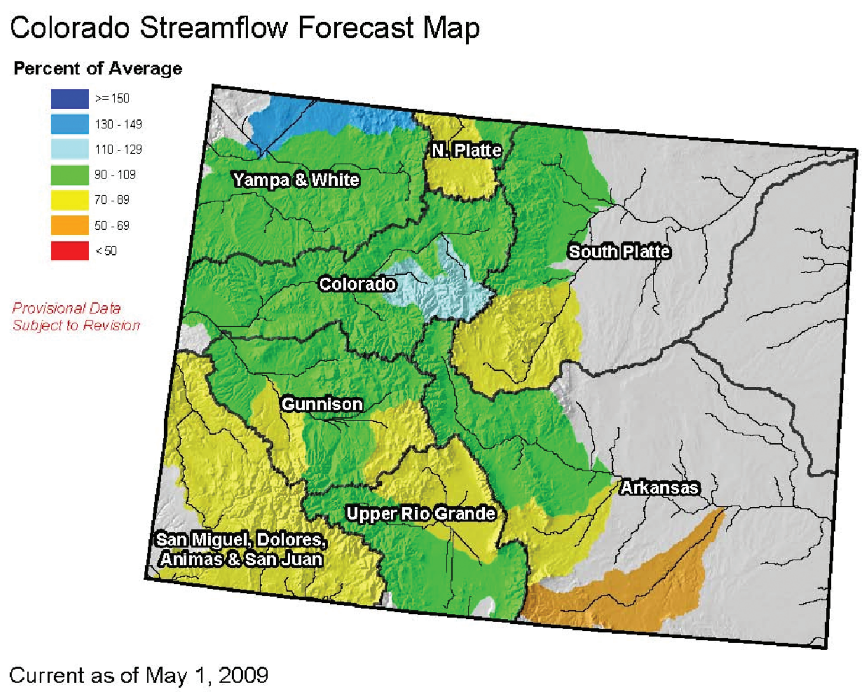
Figure 2. Depicts meteor burst technique.

The data is then made available to the public through various data products available on the Internet. The Colorado snow survey program's webpage hosts a comprehensive variety of data products, ranging from SNOTEL data reports to maps and graphs of snowpack data which is updated daily on current conditions. The web page can be accessed at: http://www.co.nrcs.usda.gov/snow.

Current Conditions in Colorado

The latest snowpack statistics for Colorado were compiled on May 1, 2009. The results were for the most part quite good. Colorado's snowpack reached a maximum seasonal accumulation on April 19 which is about one week later than normal. The total snowpack was 109% of the average maximum accumulation. After the peak snowpack was reached melt quickly decreased the snowpack totals back down to slightly below average by May 1.

With a near average snowpack across most of Colorado the prospects for runoff are good for most of the state. This year's spring and summer runoff (for the months of April through July) are expected to be slightly above average across the Colorado and Yampa river basins in northwestern Colorado. This area will most likely see the best runoff conditions this year as other areas of the state can expect to see average to slightly below average runoff. A few basins have not benefitted from some of the late season storms and can expect to see below average runoff this year. Those basins include the San Juan, Animas, Dolores and San Miguel river basins in southwestern Colorado. Runoff in these basins is expected to range from 70% to 80% of average this year.



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