Attachment to Part B - Western Weather Consultants, LLC Operational Plan (cited numerous times in Part B)

Roosevelt Soil and Water Conservation District (RSWCD Program) 2021-2022 Winter Cloud Seeding Program

Includes seeding for the following regions:
Sangre de Cristo Mountains from Red River south to Santa Fe, NM

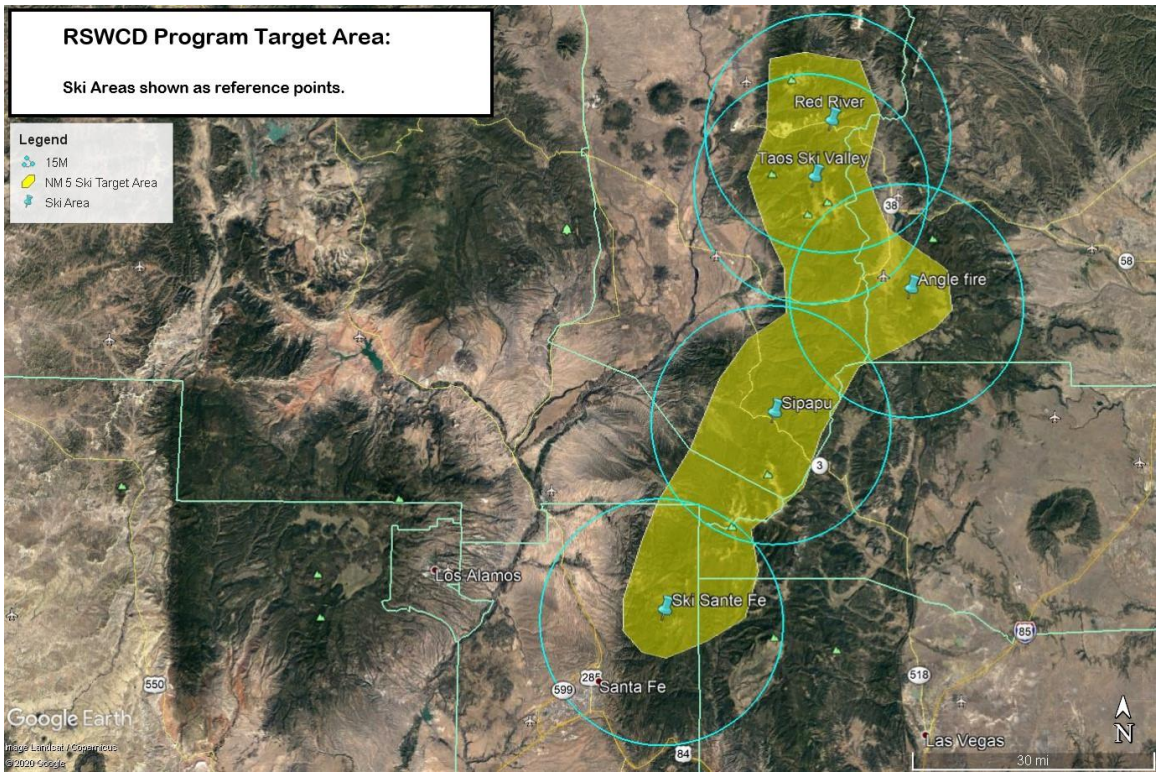
State of New Mexico Weather Modification License # (TBD)

Operational Plan

The 2021-2022 RSWCD Program is licensed to operate from December 13, 2021, to February 28, 2022, and will be operated by Western Weather Consultants LLC (WWC). Seeding can begin December 1, 2021, only after a NM license has been issued. At all times, WWC shall operate the RSWCD Program in compliance with all applicable State and Federal laws and regulations governing weather modification activities and other applicable laws. Up to 7 Cloud seeding Nuclei Generators (CNG) can be used for the RSWCD Program.

Target Area

The primary target area for the RSWCD Program is defined as follows: The Sangre de Cristo Mountains above 9,000 feet mean sea level mainly targeting the upper regions of the Pecos Headwaters, Rio Grande-Santa Fe, Mora, Upper Rio Grande, and Cimarron River Basins within Taos, Santa Fe, Rio Ariba, Mora, and Colfax County's in the State of New Mexico. The RSWCD Program is designed, operated, and intended to affect only the Target Area. The Target Area will cover most of the sections within the following Townships and Ranges: 30N 13E-15E, 29N 13E-15E, 28N 13E-15E, 27N 13E-15E, 26N 13E-15E, 25N 13E-16E, 24N 13E-16E, 23N 12E-14E, 22N 12E-14E, 21N 11E-west half of 14E, 20N 11E-13E, 19N 11E-13E, 18N 10E-12E.



Operational Procedure

The operational procedures use ground-based cloud seeding generators to increase precipitation/snowpack water content in the Primary Target Area to benefit: the natural habitat, agriculture, municipal water, stock growers, recreational and tourism interests, and the area economy. To enhance the snowpack in the selected target area the CGN's will produce plumes of silver iodide crystals (artificial cloud nuclei) at rates between 5 and 28 grams per hour from multiple ground based CNG sites to be diffused by favorable wind flows into selected storms or cloud types suitable for precipitation increases meeting the seeding criteria over the Target Area. An analysis of low-level wind fields, cloud characteristics, stability parameters, terrain features, and synoptic meteorological features will determine the network of generators which will best seed the cloud system over the Target Area for each favorable weather system and will provide a method for adjusting the network as new weather information becomes available. Seeding events will be

limited to those portions of selected favorable weather systems that have expected or forecasted precipitation rates and associated augmentation potentials capable of producing additional precipitation at least at the rate of one-tenth an inch of water or more per 24 hours of seeded duration.

With a "best" initial network to seed an established weather system, the generator operators are notified to turn on their generator at a specific time and operate them at a specific burn rate. On the same call, they will be given a specific turn-off time, this could be subject to change if the meteorologist at WWC notices significant changes in the weather system during the seeding event. Incoming weather data into the forecast office allows a continuous monitoring of any changes in conditions and any adjustments or termination in the seeding operation. Following each seeding operation, each generator operator who was instructed to operate the nuclei generator will submit a written report on the actual observation times; verify the seeding rates and note weather observations or operational discrepancies during the required operating period. No aircraft will be used for seeding for this Program. The seeding criteria WWC uses for seeding operations are as follows:

- Cloud bases are at least 500 feet below the mean mountain barrier crest of the Target Area and are forecast to move lower in elevation from the onset of seeding and continue throughout the seeding period. The weather system has clouds that are forecast to have vertical heights and moisture content capable of producing natural precipitation.
- Temperatures at the height of 500 feet below the mean mountain crest within the Target Area are -5 degrees C. (23 degrees F.) or colder and are forecast to become colder if at -5 degrees C.
- Wind directions and speeds from the surface to cloud-base are observed and forecast to favor the movement into the intended Target Area of the silver iodide nuclei being released from the ground-based generator sites.
- There are no stable regions or atmospheric inversions between the surface and cloud-base that would prevent the vertical dispersion of the silver iodide particles from the surface to at least the -5 degrees C. (23 degrees F.) level or colder within the cloud system.
- The temperature at approximately 10,000 feet (700 MB level) is warmer than -16 degrees C. (3 degrees F.)

WWC routinely monitors the weather conditions throughout the contracted operating period for systems with cloud seeding potential. Most of the data used comes from the National Weather Service (NWS) websites, University of Wyoming, Pennsylvania and Texas A&M Weather websites, National Center for Atmospheric Research (NCAR) website, and National Oceanic and Atmospheric Administration

(NOAA), Pivotalweather.com for short and long-range model forecasts. There are numerous forecasting websites available beyond the previously listed that are used as well, but these tend to be the preferred forecasting sites. Other available resources are the New Mexico Department of Transportation (NM DOT) website to monitor road conditions and concerns, Avalanche.org website to view avalanche and potential avalanche conditions in and around the Target Area including the Natural Resources Conservation Service (NRCS) website to monitor snowpack in the Target Area as recorded by the network of SNOTELs in New Mexico. Snowpack accumulation is monitored from SNOTEL stations within the Target Area and the first detailed analysis of snow accumulation is completed using these measurements.

From these sites, we review and, at times, archive, weather data such as: surface and upper air data, synoptic surface maps, significant level maps, model forecast data, rawinsonde data, satellite and radar data, surface observations, web cam images, and other forecast aids. This data assists in selecting favorable storms for modification and monitoring suspension criteria.

Suspension Criteria

The proposed Suspension Criteria provides safeguards to the program to ensure that risks associated with cloud seeding have been addressed. WWC will retain the right to suspend operations during any period if the weather system is determined detrimental. Facilities will be maintained to gather and analyze weather data providing a continuing weather watch. WWC will maintain communications with the Program Sponsors, the National Weather Service (NWS), the U.S. Forest Service and Office of the State Engineer / New Mexico Interstate Stream Commission (NMISC) regarding potential adverse conditions. The forecast and operations center of WWC will monitor on a seven day per week basis the weather patterns over New Mexico and the Western United States during the winter operating period. Meteorologists licensed by the State of New Mexico to operate weather modification programs will determine if weather events are suitable for precipitation augmentation by cloud seeding.

Prior to initiating any seeding operations, a thorough hazard analysis will be evaluated a potential weather system judged suitable for seeding will be evaluated for its potential to develop into a blizzard, severe storm, or heavy precipitation possibly associated with a potential for major avalanche episode. Also, the effects of the weather event on ranching, agriculture, wildlife, highway travelers, municipal interests and industry will also be considered. This evaluation will be concentrated upon those areas to be seeded along with considerations of potential adverse effects to adjacent areas which may be influenced by augmented precipitation. No seeding will be initiated during a period determined to have a high potential hazard evaluation. Once a seeding operation

has been initiated, monitoring of existing and forecast weather conditions will continue throughout the duration of the seeding operation. All new meteorological information will be assessed as well as generator reports from generator operators, the State Patrol, and field maintenance personnel in the seeded areas. Changing weather conditions that would indicate the onset of potentially severe or hazardous weather conditions will result in the suspension of seeding operations throughout the duration of these potentially hazardous weather conditions. Snowpack accumulation will be monitored from SNOTEL stations from all SNOTEL sites within the target area and the first detailed analysis of snow accumulation will be completed using these measurements. Evaluations of snowpack indicate that minor flooding and stream flow problems can exist when late winter snowpack reaches 155% of normal. More substantial flooding problems can be anticipated when late winter snowpack is more than 175% of normal.

Since the RSWCD Program is designed for reasonable levels of snowpack enhancement for an outlook of adequately abundant summertime water supply for storage use, we propose to suspend seeding operations in any major portion of a seeding area when one or more of the following takes place: Snow Water Equivalent Thresholds exceed the following: 175% of average on December 1st, 175% of average on January 1st, 165% of average on February 1st, 155% of average on March 1st and 145% of average on April 1st. The following link can be used to see a map which will show the snowpack percentages of normal:

The NMISC Director or his or her designee will consult with WWC to determine where and how snowpack water equivalents are to be measured, including at selected "SNOTEL" sites. The NMISC Director or his or her designee may permit weather modification operations to continue in a portion of the operation target area where snowpack water equivalents are below these suspension criteria percentages, if the operation will not impact the area where snowpack water equivalents are above these suspension criteria percentages. These thresholds are designed to keep the seeding effect to within the realm of natural variability of the local climate as measured at each SNOTEL station. This comparative normal for these representative snow observation sites will be the long-term Snow Water Equivalent Medians data set from 1981 through 2010 as published by the Natural Resources Conservation Service (NRCS). WWC must suspend all weather modification operations whenever one of the following is issued by the NWS Hazardous Weather Statements that impacts any part of the Target Area:

a. An urban or small stream flood advisory.
b. A blizzard warning.
c. A flash flood warning; or
d. A severe thunderstorm warning.

Operations may resume after these statements expire.

Procedures and Methodology for Estimating Precipitation Increases

A Weather Modification Act was enacted by the State of Colorado in 1972. The early versions of this Act required permit holders to provide program participants with an annual estimate of the precipitation increases produced by the permitted seeding program. For this reason, WWC developed the detailed process used to evaluate the results of seeding activities. This Act went through various amendments and was extended for a seven-year period in 2011 following the completion of the Sunset Review. Earlier rules and regulations were revised effective July 1, 2012. Article 12 of the 2012 revised rules and regulations, annual reports state: "The permit holder must compile annual reports in accordance with section 36-20-117(3), C.R.S. (2011). Annual reporting for ground-based winter operations shall include, at a minimum, target versus control analysis of precipitation or snow water equivalent." From these rules, WWC's evaluation has utilized for estimating the precipitation increases produced by cloud seeding over a winter season. This evaluation has been used in previous reports and is based on two separate seeding program research analyses conducted by WWC (Colorado River Basin Pilot Project (research randomized seeding program), June 1976; and 10-and 16-year data sets from two separate precipitation sources for the Vail/Beaver Creek operational seeding program March 2001).

The two evaluation programs were conducted over the Colorado Mountains utilizing similar seeding applications and weather event identification criteria. Both analyses produced similar seeding response results. The research analyses utilized a conservative estimate of the seeding responses to the associated prevailing wind direction of the storm.

WWC has created a precipitation estimating procedure for seeding response using SNOTEL precipitation data collected at 1 AM each night for the preceding 24-hour period as follows:

1) Associate the operational seeding period for each seeding event with an observed 24-hour precipitation period. Examples: If a seeding event began a 6 AM and ended the same day at 10 PM, only the SNOTEL precipitation data for that event date will be evaluated for its representative precipitation increase. If a seeding event began at 8 PM on a date and continued until 10 PM the next day, the SNOTEL precipitation data for the starting event date and the next day would both be evaluated for its representative precipitation increase information.

2) Wind direction information is recorded by the WWC forecaster at the initiation of a seeding event and again for each six-hour period or portion thereof during the seeding event. Standard observation or data reporting times by the National Weather Service tend to be around 5 AM, 11 AM, 5 PM and 11 PM MST. If the seeding period goes into a 2nd or 3rd day, each portion of a seeding day or 6-hour period from a full seeding day, will be evaluated for an average wind direction. There will be a wind

direction determined for each seeding date by averaging the appropriate 6-hour average directions for that date.

3) The seeding response factor, from the Seeding Response Model discussed below, is then representative of this specific wind direction. A seeding response factor for the average 24-hour wind direction is multiplied by the 24-hour SNOTEL precipitation total to determine the average precipitation increase for that day at a specific SNOTEL site. (From the studies completed by WWC in 2001 for Vail Associates Inc. and previous information derived from the Colorado River Basin Pilot Project (CCBPP) data, referenced in the Project Information Section, there is an average seeding response that has been determined for each specific wind direction. We have included the Seeding Response Model as Image 1. This model shows the estimated seeding response by wind directions as the estimated percentage of observed seeding precipitation attributed to cloud seeding operations over Colorado Mountains by average prevailing targeting wind direction.)

4) This process of determining the daily estimated precipitation increase is then applied for each seeding day in a seeding event for this specific SNOTEL site as the precipitation created by the seeding program. All the daily precipitation increases are then summed up for each specific SNOTEL site for the entire season and this data is plotted on an estimated precipitation increase map.

This system of estimating the seeding effectiveness was originally performed following the 2003-2004 winter season for the Vail/BC program and has been used in all program evaluations from that time forward. This procedure of estimating the seeding responses within the Target Region allows the Program Participants to see a more detailed evaluation of the estimated increased in precipitation throughout their areas of interest both during the specific storm periods that were seeded and for the entire operational season as published for each year that the seeding program has operated in the end of the year program reports at the end of the “Evaluation of Seeding Results and Effectiveness". This presentation also allows for a breakdown of the estimated additional volume of water potentially available for runoff for each of the River Basins being seeded within the target area, understanding that not all the snow reported as an increase will in fact runoff.

Furthermore, in April 2009, Dr. Bernard Silverman did an independent target vs. control evaluation of stream flows from the target regions of the Vail operational cloud seeding program over its period of operations from 1977 to 2005 using ratio statistics and the bias-adjusted regression ratio. The water year (October-September) stream flows expressed in acre-feet (AF) from eight target area stream basins served as the response variable in this evaluation. The effects of seeding on the eight, closely spaced basins in the Vail watershed were evaluated. Evidence for statistically significant seeding effects ranging from 6.3% to 28.8% were found in the stream flows for 5 of the 8 seeding target

basins (Silverman, 2009). The three basins that indicated less than statistically significant increases in stream flows were on the northwest and southeast edges of the Vail Target Area. An analysis of the time evolution of these seeding effects suggests that the percentage change in streamflow at each of the target sub-basins was about the same from water year to water year (Silverman, 2009).

The results of this independent evaluation were like the precipitation evaluation completed by WWC in 2001 for this region where the increases in water content of the snowfall (precipitation) from the cloud seeding operations were in the range of 8.2% to 31.3% over the target region (Silverman, 2009). It is expected that the observed runoff from the snowpack in seeded regions will be slightly less than the actual observed precipitation from these seeded areas due to system losses. This is an independent confirmation that precipitation increases resulting from the operational seeding of favorable wintertime cloud systems results in observed increases in stream flows (Silverman, 2009).

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