



AGENDA

IDAHO WATER RESOURCE BOARD

Cloud Seeding Committee Meeting No. 1-26

Tuesday, July 21, 2026

1:00 p.m. (MT) / 12:00 p.m. (PT)

Brad Little
Governor

Jeff Raybould
Chairman
St. Anthony
At Large

Jo Ann Cole-Hansen
Vice Chair
Lewiston
At Large

Dean Stevenson
Secretary
Paul
District 3

Dale Van Stone
Hope
District 1

Albert Barker
Boise
District 2

Brian Olmstead
Twin Falls
At Large

Marcus Gibbs
Grace
District 4

Patrick McMahon
Sun Valley
At Large

Water Center
Conference Rooms 602 C – D
322 E. Front St.
BOISE

Livestream available at <https://www.youtube.com/@iwrp>

1. Introductions and Attendance
2. Public Comment - Not to Exceed 30 Minutes
3. Senate Bill 1269
4. Authorization and Reporting Criteria *
5. Bear River Cloud Seeding Update
6. State of Utah Cloud Seeding Update
7. Bear River Basin Year 2 Pilot Project Proposal (2026/2027) *
8. Other Items
9. Adjourn

Committee Members: Chair Marc Gibbs, Jeff Raybould, Al Barker, and Pat McMahon.

Public Comment: To provide an opportunity for public participation, comments may be submitted either in person at the meeting or in writing. Written comments should be submitted by email to mlin.ream@idwr.idaho.gov by July 27, 2026. The Committee Chair may limit individual comments to 3 minutes to accommodate all speakers. All comments, whether submitted in writing or presented in person, will become part of the public record.

* Action Item: A vote regarding this item may be made at this meeting. Identifying an item as an action item on the agenda does not require a vote to be taken on the item. **Americans with Disabilities:** The meeting will be held in person and online. If you require special accommodations to attend, participate in, or understand the meeting, please make advance arrangements by contacting Department staff by email mlin.ream@idwr.idaho.gov or by phone at (208) 287-4800.

MEMO

To: IWRB Cloud Seeding Committee (Committee)
From: Planning and Projects Bureau Staff
Date: July 16, 2026
Subject: Public Comment



INFORMATIONAL ITEM

This agenda item provides an opportunity for the public to provide comments related to Cloud Seeding. The Committee Chair may limit individual comments to 3 minutes to accommodate all speakers. All comments will become part of the public record.

Attachments:

- *None*

MEMO



To: IWRB Cloud Seeding Committee (Committee)
From: Nick Banish, Cloud Seeding Program Manager
Date: July 21, 2026
Subject: Senate Bill 1269 - Updated Idaho Cloud Seeding Code - Implications for the IWRBs Authorization and Reporting Criteria

INFORMATIONAL ITEM

Purpose of the Legislation

Senate Bill 1269 updates Idaho's statutory framework for cloud seeding to strengthen oversight, expand program capacity, and ensure transparent reporting. The bill clarifies definitions, formalizes reporting requirements, outlines the Idaho Water Resource Board's responsibilities, and establishes liability protections.

The Legislature notes that cloud seeding has already increased water supplies in participating basins, but *"additional research and analysis is necessary to determine the precise nature and extent of those increases"* (p. 1). The bill aims to support continued research and responsible expansion.

Key Policy Changes

1. Updated Definitions

The bill adds a new definitions section (42-4302), clarifying:

- **Cloud seeding** – all acts to artificially create nuclei in cloud masses to induce precipitation; excludes fog suppression and frost prevention. *"Cloud seeding... means all acts undertaken to artificially distribute or create nuclei in cloud masses..."* (p. 2)
- **Methods used for cloud seeding** – includes ground generators, airplanes, drones, and other application methods.
- **Operational period** – typically October 1 to April 30.

2. Board Responsibilities

The Idaho Water Resource Board ("the Board") is assigned expanded oversight duties:

Program Authorization & Development

- The Board "shall authorize, and may sponsor or develop, local or statewide cloud seeding programs" (p. 3).
- May contract with individuals or organizations for program development or research.

Public Transparency

- Must conduct public meetings under Idaho's open-meeting laws.
- Meetings must include opportunities for written and oral public comment.

Annual Reporting

The Board must publish an annual report including:

- Operational data (dates, locations, methods used)
- Environmental impacts and “state of the science”
- Public meeting documentation and comments
- Effectiveness metrics such as snowpack increases

Compliance Oversight

- The Board may suspend authorization for operators who fail to meet reporting requirements.

Funding Eligibility Determination

- State funds may only be used in basins where water supplies are insufficient to support existing water rights, water quality, recreation, or fish and wildlife.

3. Monthly Reporting Requirements for Operators

During the operational period, each operator must submit a monthly report to the Board including:

- Locations of ground generators
- Flight paths
- Amount and type of cloud seeding activities
- Amount and type of seeding materials used
- Any suspension periods
- Methods of operation

4. Liability and Permitting

The bill provides liability protection for state-authorized cloud seeding:

- Cloud seeding authorized or funded by the state cannot be the basis for liability claims, except in cases of gross negligence or willful misconduct. *“Not be the basis of any claim of liability... except when such claims arise from acts of gross negligence or willful misconduct”* (p. 4)
- No state or local permits are required for authorized cloud seeding activities.

5. Exclusions

The bill does not apply to cloud seeding conducted for:

- Rain enhancement
- Hail mitigation
- Fog dispersal
- Frost prevention These activities are explicitly excluded from the chapter’s provisions.

6. Effective Date

The act takes effect **July 1, 2026**.

Attachments:

- *PowerPoint Presentation: Updated Idaho Code - implications for the IWRBs Authorization and Reporting Criteria for the State’s Cloud Seeding Program*

IWRB Cloud Seeding Committee Meeting

Updated Idaho Code - Implications for the IWRBs Authorization and Reporting Criteria



Nick Banish, IWRB Cloud Seeding Program
Cloud Seeding Committee Meeting
July 21, 2026

Photo Courtesy of Idaho Power Company

1

Slideshow Overview

- What the new Code does
- Key updates to the Authorization and Reporting Criteria
- Here's how we're meeting the Code
- What you need to know



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What the new Code does:

- **SB1269 Statement of Purpose:**

“This legislation updates Idaho's cloud seeding statutes by placing clear **definitions, authorization, and reporting mechanisms** into law to improve transparency and accountability. It provides for public meetings and reporting on cloud seeding operations environmental considerations and program effectiveness under an existing program.”



3

What the new Code does:

- SOP - Laws to improve transparency and accountability
- Supports continued research and analysis in cloud seeding §42-4301(1.d)
- Establishes the Board's authority to set forth and enforce conditions of authorization §42-4303(5)
- Defines an operational period (Oct 1 – April 30) §42-4303(2)
- Defines methods of cloud seeding §42-4303(3)
- Requires public meetings and public comment periods §42-4303(2)
- Establishes Reporting Requirements for the IWRB and for Operators §42-4303(3), §42-4303(4)



4

Key Updates to Authorization and Reporting Criteria

- Through the new Code, the IWRB is assigned expanded oversight and reporting duties
- IDWR staff folded these into the Authorization and Reporting Criteria to meet code
- Adds ability for IWRB to revoke an active authorization



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Brass Tacks of What the new Authorization and Reporting Criteria Does:

To receive authorization:

- Explain project in detail
- List project infrastructure and weather instrumentation
- Methods proposed, estimate of AgI release
- Provide Certifications, Qualifications/ Experience
- Suspension Criteria



6

Brass Tacks of What the new Authorization and Reporting Criteria Does:

To maintain authorization:

- Monthly reporting requirements that fulfill letter of the Law
- Bookkeeping, keeping IDWR/IWRB current
- Upon request, present to Staff or Board
- Upon request, share data that may be used by a third-party for analysis



7

Brass Tacks of What the new Authorization and Reporting Criteria Does:

Operator must submit a monthly report to the Board including:

1. Locations of ground generators
2. Flight paths
3. Amount and type of cloud seeding activities
4. Amount and type of seeding materials used
5. Any suspension periods
6. Methods of operation



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Here's how we're meeting the Code

- Staff worked with legal, stakeholders, the Board, management, to ensure what we're asking for is reasonable
- Applying the terms and conditions of the Authorization and Reporting Criteria
- Cloud Seeding Meetings to fulfill Public Meeting & Comment requirements
- Curation and tabulation of monthly operator data feeds into the generation of an annual report...



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Here's how we're meeting the Code

- Reporting requirements in Authorization and Reporting Criteria facilitate IWRB annual report containing:

1. Operational data (dates, locations, methods used)
2. Environmental impacts and "state of the science"
3. Public meeting documentation and comments
4. Effectiveness metrics



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Questions?



Nick B (208) 287 4862

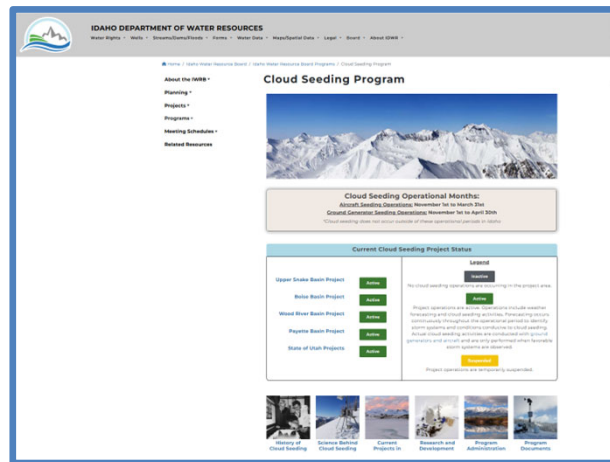


cloudseedingprogram@idwr.idaho.gov



IDWR.IDAHO.GOV

Board → Programs → Cloud Seeding Program



MEMO



To: IWRB Cloud Seeding Committee (Committee)
From: Caitlyn Swanson, IDWR Program Manager
Date: July 17, 2026
Subject: Bear River Basin Year 1 Pilot Project Report Summary

INFORMATIONAL ITEM

Executive Summary

During the 2025/2026 winter season, the Idaho Water Resource Board (IWRB) partnered with the Utah Division of Water Resources (WRe) to conduct an innovative, interstate cloud seeding pilot project in the Bear River Basin (BRB) utilizing Unmanned Aerial Systems (UAS), otherwise known as drones. The pilot was funded through a collaborative cost-share agreement, with the IWRB contributing \$450,000 and the WRe contributing \$3.5 million.

Operational activities took place from November 1, 2025, to April 30, 2026. The project utilized UAS technology and advanced meteorological instrumentation to conduct cloud seeding operations. Operations and evaluation services were conducted by Rainmaker Technology Corporation (Rainmaker), Utah's designated operator. A review of Rainmaker's operational results, physical validation metrics, and statistical analysis are detailed below.

Project Objectives and Goals:

1. **UAS Efficacy:** Demonstrate the utility and efficacy of using UAS technology to target seedable atmospheric conditions previously accessible only by ground-based generators or aircraft.
2. **Physical Validation:** Produce unambiguous seeding signatures, verified by radar and satellite, to physically validate the effects of seeding on precipitation.
3. **Dispersion Method Determination:** Identify the most effective seeding material dispersal method for future UAS operations.

Operational Summary:

- **Field Operations:** Up to 10 drone teams across the Lower Bear River Basin region
- **Seeding Events:** 40 seeding events designated as Intensive Operating Periods (IOPs) consisting of 740 total flights
- **Dispersion Method:** Aerosol Dispersion System (ADS) dispersed dry silver iodide (AgI) from November through February, and flares dispersed AgI from February 11th through April
- **Material Dispersed:** 12,343 grams of dry powder AgI released and 319 flares used

Rainmaker's Evaluation and Results:

- Physical Radar Validation and Quantitative Precipitation Estimates (QPE):
 - o **Unambiguous Seeding Signatures:** 15 unambiguous seeding signatures identified using radar from the 40 IOPs
 - o **Rainmakers' Volumetric Yield (QPE):** Estimated 29.56 Acre-Feet (AF) of total water produced from the combined 15 unambiguous signatures using ensemble-based reflectivity-to-snow-rate algorithms
- Target-Control Statistical Analysis (Single and Multi Linear Regression Analysis):
 - o **Rainmaker's Reported Calculated Precipitation Increase:** 10.2% to 19.8% increase in precipitation
 - o **Rainmaker's Reported Volumetric Yield:** 354,602 AF to 635,977 AF
 - o **Statistical Significance:** The statistical analysis failed to reach mathematical significance due to the limited sample size of a single pilot season

Attachments:

- *Rainmaker PowerPoint Presentation*

BEAR RIVER BASIN

CLOUD SEEDING PILOT PROGRAM Y1 REPORT



July 21, 2026




RAINMAKER

Review of Initial Pilot

Start Date: September 1, 2025

End Date: April 30, 2026

Teams: 10

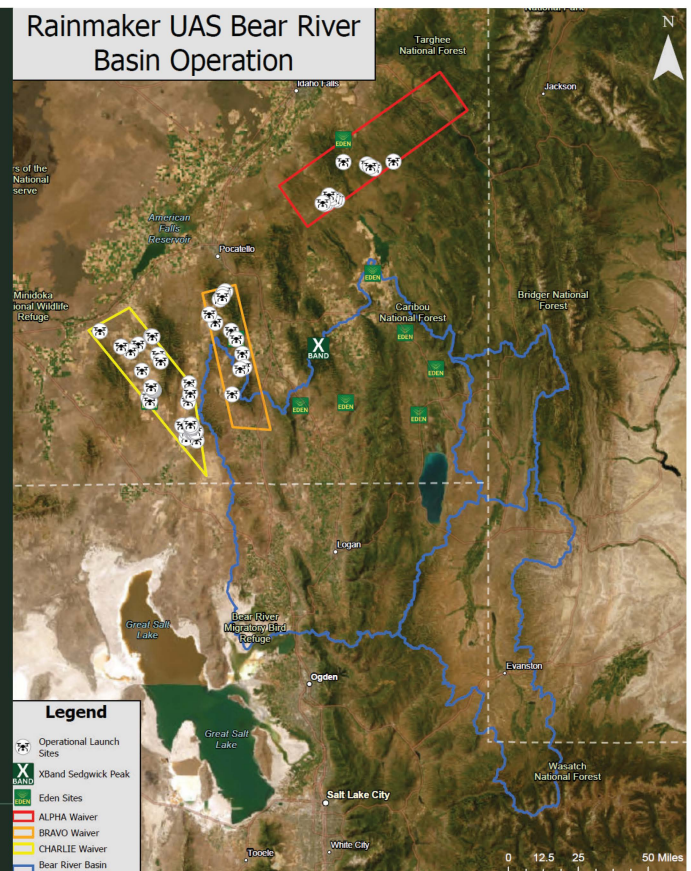
Operational Sites: >40

Pocatello KSFX NEXRAD Radar

CSU SPLASH X-Band Radar at Sedgwick Peak

10 Rainmaker Eden field stations

Rainmaker UAS Bear River Basin Operation



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Review of Objectives

OBJECTIVE #1: Demonstrate the efficacy of UAVs in seeding conditions previously accessible only by ground-based generators or manned aircraft.

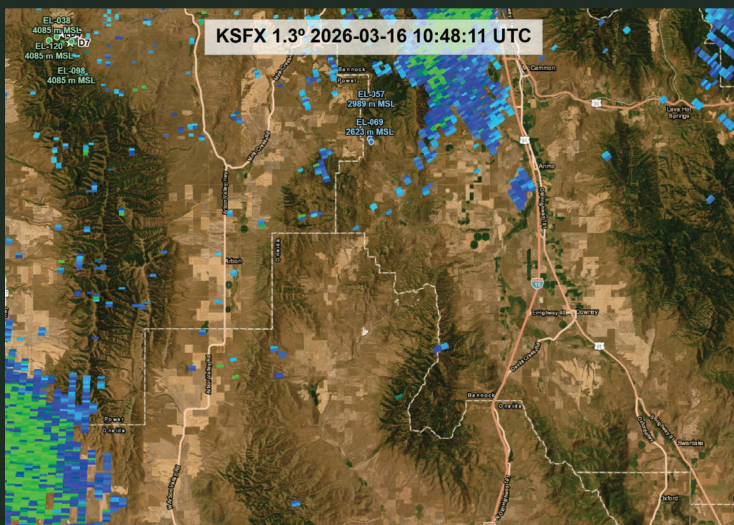
OUTCOME: Rainmaker successfully ran 740 drone flights across 40 intensive operating periods (IOPs) between September and April, successfully delivering seeding materials into SLW up to 15,000 ft.



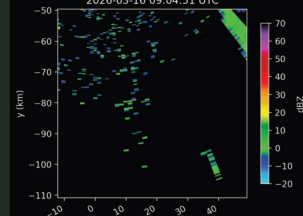
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OBJECTIVE #2: Verify unambiguous seeding signatures with radar and satellite, proving the impact of Rainmaker's operations on precipitation.

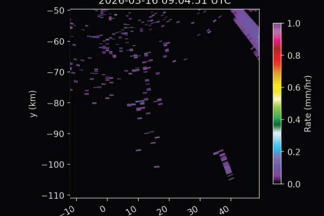
OUTCOME: Rainmaker successfully obtained 15 radar- and satellite-based seeding signatures in the Bear River Basin, corresponding to 29.56 acre-feet of validated precipitation. Target-control analysis shows a 354,602 to 635,978 acre-feet increase across target sub-basins.



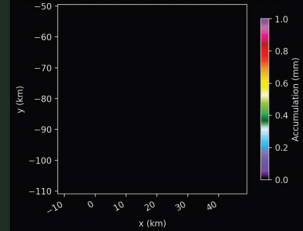
KSFX_20260316_BR-032: Composite reflectivity
2026-03-16 09:04:51 UTC



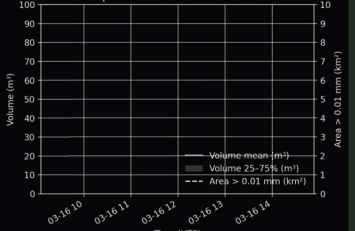
KSFX_20260316_BR-032: Instantaneous precipitation rate
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KSFX_20260316_BR-032: Total OPE
2026-03-16 09:04:51 to 2026-03-16 09:04:51 UTC



KSFX_20260316_BR-032: Polygon-integrated precipitation
up to 2026-03-16 09:04:51 UTC



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OBJECTIVE #3: Identify the optimal seeding material and dispersal method for glaciogenic cloud seeding.

OUTCOME: Rainmaker has determined AgI flares as the optimal seeding modality, improving both the validation and magnitude of precipitation enhancement.



AgI flares are now mounted onto our Elijah V3 drones.



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Transparency

1. Monthly operations meetings with IDWR

Met with Nick Banish and Caitlyn Swanson monthly (if not weekly) to discuss operations, seeding signatures, and address questions or concerns across all stakeholders.

2. Mid season and final season reports

Provided mid-season and final season reports with in depth discussion from meteorologists and scientists around seeding signature events. Discussed operational challenges and mid season improvements.

3. Transparent validation methodology

Provided all seeding signature results and methodology with nuanced discussion explaining how we know the signatures were created from seeding. Provided all data for historical target-control analysis.



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RAINMAKER

Y1 Summary

40

IOPs

740

drone flights

319

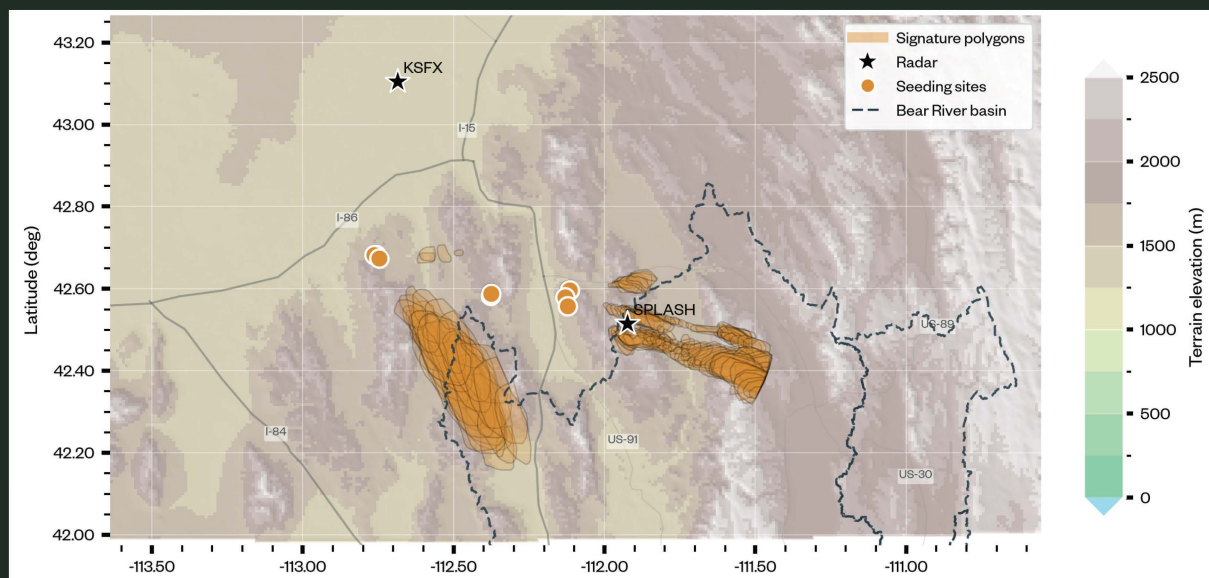
flares

15

signatures

354k-635k

acre-feet produced



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Challenges

LESSONS LEARNED FROM ONE YEAR OF DATA

1. RADAR VIEWSHED

Mountainous terrain directly south of Pocatello NEXRAD significantly limited our ability to track seeding plumes and monitor for increased reflectivity. CSU X-band helped but was lower power and had limited sensitivity at range. Improving the radar viewshed for seeding missions will significantly improve quantity of unambiguous signatures and quantitative precipitation estimates derived from radar.

2. OPERATIONAL DEPLOYMENTS

Operational deployment and setup times significantly improved throughout the season. Initial setup time started around 1 hour upon arrival onsite and moved to approximately 10 minutes. Proximity to base operations center was a challenge and it is recommended to place a central operations center closer to launch sites.

3. TARGETING OROGRAPHIC VS STRATIFORM CLOUD DECKS

Launch site and targeting is different depending on the type of storm opportunities. Orographic cloud decks are more common but ideally have launch sites closer to mountainous terrain. Stratiform was less common but easier to target from a variety of locations.



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RAINMAKER

Next Steps

TECHNICAL IMPROVEMENTS FOR IDAHO'S BENEFIT

1. INCREASE PRECIPITATION

flowing into the Bear River. The program will expand operational coverage compared to Y1, increasing responsiveness to high-confidence seeding opportunities and refining operational workflows.

2. SCALE PHYSICAL VALIDATION

methodology across the entire target area, building on the successes of Y1. Through radar- and satellite-based validation, Rainmaker can provide assurance to IWRB that its investment yields measurable benefits.

3. MAXIMIZE RESIDENCE TIME (IN-CLOUD)

through technical improvements, including multi-UAV coordination, flare deployment, and improved conditions targeting.



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RAINMAKER

Questions?



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RAINMAKER

MEMO



To: IWRB Cloud Seeding Committee (Committee)
From: Caitlyn Swanson, IDWR Program Manager
Date: July 17, 2026
Subject: Bear River Basin Third Party Analysis – Contract and Scope of Work Update

INFORMATIONAL ITEM

The Idaho Water Resource Board (IWRB) appropriated \$500,000 to fund an independent third-party evaluation and validation of Unmanned Aerial System (UAS) precipitation enhancement in the Bear River Basin (BRB). This project is currently in the contracting process with the National Center for Atmospheric Research (NCAR).

The upcoming analysis will build directly upon the foundational findings from the 2022 *Bear River Basin Feasibility and Design Study* (BRB F/D Study) completed by NCAR and funded by the IWRB. The primary objective of this new study is to evaluate the effectiveness of UAS-based seeding and compare its projected precipitation outcomes against traditional aircraft and ground-based Silver Iodide (AgI) dispersion mechanisms.

2022 BRB F/D Study Accomplishments:

- **Feasibility Assessment:** Evaluated the atmospheric and geographic viability of cloud seeding in the Bear River Basin using traditional aircraft and ground-based generators.
- **Climatological Frequency:** Identified how often suitable meteorological conditions occurred to support these traditional seeding methods.
- **Numerical Modeling:** Simulated historical cases to determine which traditional delivery methods yield the greatest physical benefit in the basin.
- **Program Design:** Provided the IWRB with a structured, operational blueprint for a regional cloud seeding program.

Justification for the Revised Scope of Work (SOW):

The proposed Scope of Work (SOW) has been revised to better understand the seasonal effectiveness of drones rather than evaluate one year of partial operational data.

Revised SOW Objectives:

Task 1: UAS Climatological Analysis

- Assess the frequency and characteristics of atmospheric conditions in the target region specifically suitable for UAS operations.
- Completion Date: 4 months after contract execution

Task 2: WRF-WxMod Model Setup

- Modify the model code to simulate the unique flight behaviors of UAS platforms and the specific characteristics of the UAS flares.
- Completion Date: 10 months after contract execution

Task 3: Comparative Sensitivity Simulations & Seasonal Extrapolation

- Simulate sensitivity cases from the BRB F/D Study.
- Compare the precipitation volumes generated by all three primary delivery mechanisms (aircraft, ground generators, and UAS)
- Extrapolate these findings to estimate a range of full-season volumetric water yields for each method
- Completion Date: 18 months after contract execution

Attachments:

- None

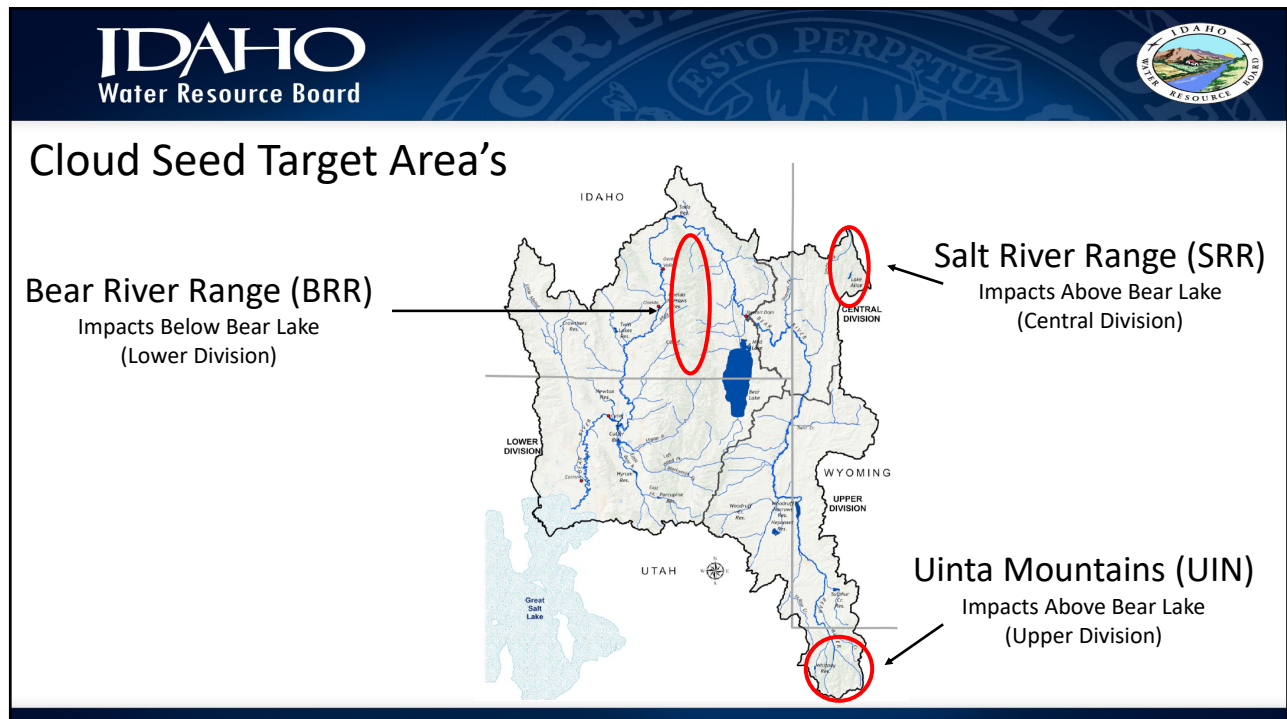


Bear River Basin System Overview

Caitlyn Swanson
Water Planning and Projects Section

July 21, 2026

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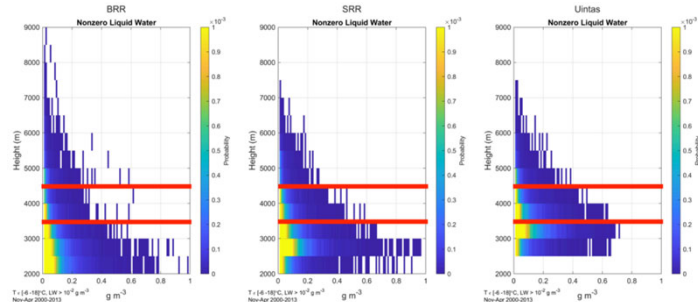
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NCAR BRB Feasibility and Design Study Key Take Aways

Aircraft Potential: October to May

Ground Potential: November to April

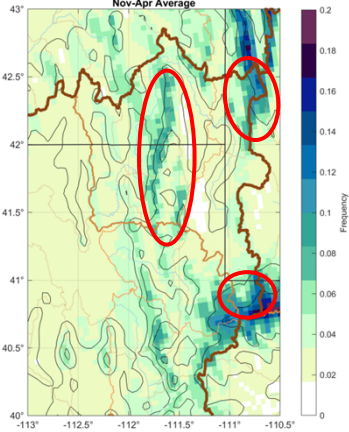
- Most SLW in the Mid Elevation Range
 - Ground Limitation: Inversions
 - Aircraft Limitations: Minimum Flight Elevation Requirements
 - Use Case for Drones
- Aircraft Recommended Over Ground Generators
 - More frequency due to less inversions



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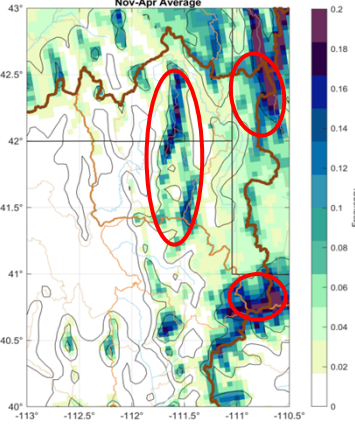
NCAR BRB Feasibility Study Frequency of Seedable Conditions

Frequency of AS LWC $> 0.01 \text{ g kg}^{-1}$ & $-18^{\circ}\text{C} < \text{AS T} < -6^{\circ}\text{C}$
 CONUS-I Current Climate
 Nov-Apr Average



Aircraft

Frequency of GS LWC $> 0.01 \text{ g kg}^{-1}$ & $-18^{\circ}\text{C} < \text{GS T} < -6^{\circ}\text{C}$
 CONUS-I Current Climate
 Nov-Apr Average

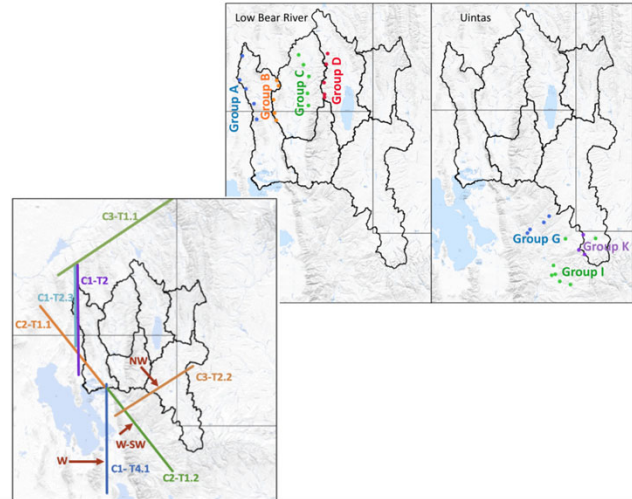


Ground Generators

4

NCAR BRB Feasibility and Design Study Key Take Aways

- Targeting Lower Bear (SRR and BRR) together has 5-6x more potential seeding impact than the UIN
- 50% of Storms Last 6 Hours or Longer
 - Recommend 2 aircraft to hit whole duration of storm



5

Cloud Seeding the Uinta Mountains

Cloud Seeding Location: Uinta Mountains

Location of Water Produced: Above Bear Lake

Division Benefitted: Upper Division (Uinta Mountains to Pixley Dam)

- NCAR Feasibility Study Findings:
 - Targeting this region is challenging
 - Would impact other river basins
 - Good seeding conditions but geographically limited



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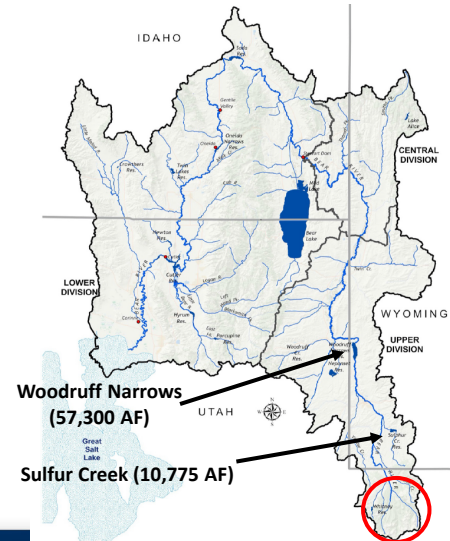
Bear River Basin Storage

Bear Lake

- Total Reservoir Storage: 1,422,000 AF
- Annual Storage Allocation: 235,000 AF
 - Annual Storage Use: Idaho (35%) Utah (65%)
- Multi-Year Storage Reservoir

Upper Reservoirs (Woodruff Narrows and Sulfur Creek)

- Above Bear Lake
- ~100,000 AF Combined
- Reservoir space can be filled when the water level in Bear Lake is above 5,913.75 ft
- Carryover Most Years



7

Where Does the Water Go in the Upper Division?

During Spring Runoff (Unregulated):

- Small Amount: Irrigation Diversions (UT/WY)
- <100 KAF: Upper Reservoir Storage (UT/WY)
- Most: Bear Lake (UT/ID)

During Water Right Regulation:

- When flow is <1,250 cfs, all flow in the Bear River is allocated to UT/WY
- All flow goes to irrigation diversions for UT/WY users (ID does not get any)



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Cloud Seeding the Salt River Range

Cloud Seeding Location: Salt River Range

N Portion flows into Upper Snake, S Portion flows into Bear

Location of Water Produced: Above Bear Lake

Division Benefitted: Central Division (Pixley Dam to Stewart Dam)

- NCAR Feasibility Study Findings:
 - Get impact from BRR seeding
 - Recommend seeding the BRR and SRR together
 - Good seeding conditions

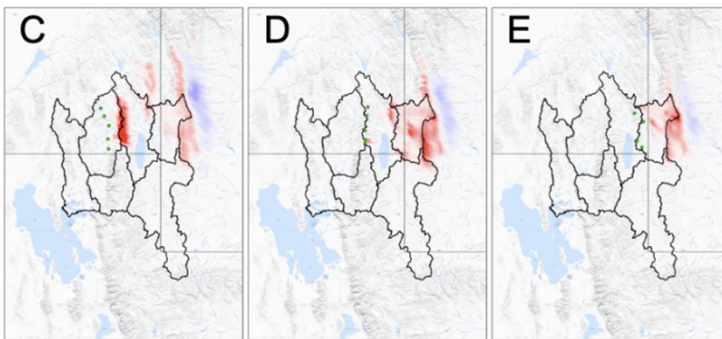


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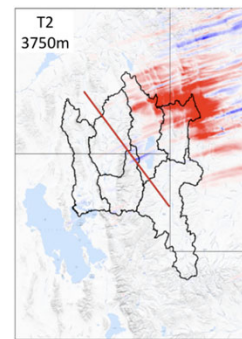
Cloud Seeding the Salt River Range

Other Considerations:

- Water goes to multiple places (Upper Snake ID and Colorado WY)
- Need to seed in BRR in ID to target the SRR (need WY approval to seed in WY)



Ground Generator Simulation



Aircraft

10

Where Does the Water Go in the Central Division?

During Spring Runoff (Unregulated):

- Small Amount: Irrigation Diversions (ID/WY)
- Most: Bear Lake (UT/ID)

During Water Right Regulation:

- When divertible flow is <870 cfs or the flow at Border Gage is <350 cfs, all flow in the Bear River is allocated to ID/WY in the Central Division
- This occurs most years (May-July)
- All flow to irrigation diversions: ID (57%) WY (43%)



11

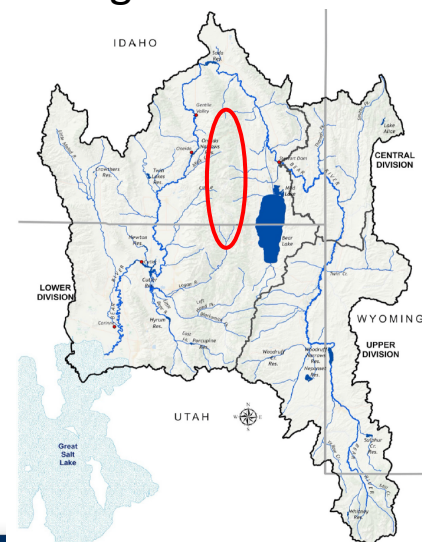
Cloud Seeding the Bear River Range

Cloud Seeding Location: Bear River Range

Location of Water Produced: Below Bear Lake

Division Benefitted: Lower Division (Stewart Dam to Great Salt Lake)

- NCAR Feasibility Study Findings:
 - Seeding here impacts SRR subsequently
 - Good seeding conditions in mid and low elevations below 4 km (lower elevation range)



12

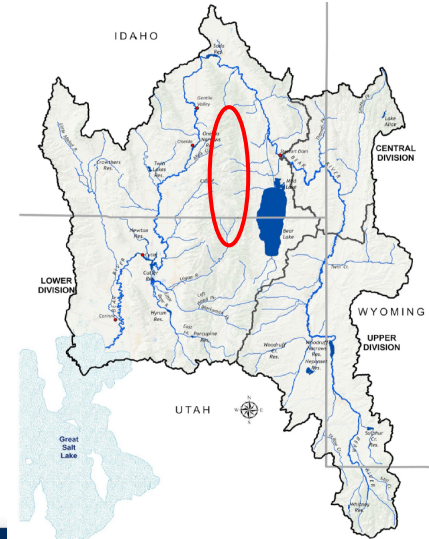
Where Does the Water Go in the Lower Division?

During Spring Runoff (Unregulated):

- Small Amount: Irrigation Diversions (ID/UT)
- Most: Great Salt Lake (UT)

During Water Right Regulation:

- Water Right Accounting is used to administer water by priority to ID/UT in all years
- All water produced is natural flow
- Annual average natural flow diversions
 - ID (40%) UT (60%)



13

Conclusion

Uinta's Mountains (Upper Division):

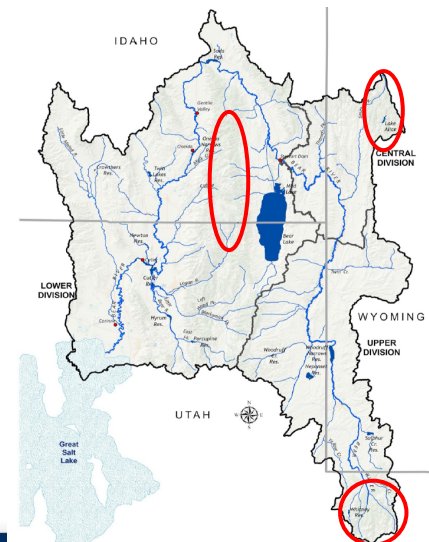
- Runoff: Bear Lake ID (35%) UT (65%)
- Regulation: Irrigation UT WY

Salt River Range (Central Division):

- Runoff: Bear Lake ID (35%) UT (65%)
- Regulation: Irrigation ID (57%) WY (43%)

Bear River Range (Lower Division):

- Runoff: Great Salt Lake UT
- Regulation: Irrigation ID (40%) UT (60%)



14



Questions?



MEMO



To: IWRB Cloud Seeding (Committee)
From: Planning and Projects Bureau Staff
Date: July 17, 2026
Subject: State of Utah Cloud Seeding Update

INFORMATIONAL ITEM

Jonathan Jennings of the Utah Division of Water Resources will provide an informational update on Utah's Cloud Seeding Program at the Committee's July 21, 2026, meeting.

Attachment(s):

- *PowerPoint Presentation*

Utah's Bear River Basin Cloud Seeding Program

JONATHAN A. JENNINGS

Meteorologist

Utah Division of Water Resources, Salt Lake City, UT

21 July 2026 – Boise, Idaho



Utah Division of Water Resources

water.utah.gov

1

Regulatory

- Require Operators to Apply for a License and Permit per Utah Code 73-15
- Permit
 - 3-Week Public Notice of Intention
 - Proof of Liability Insurance
 - Operations Plan with Embedded Suspension Criteria
 - Reporting Requirements (also at the federal level)
- License
 - Qualified Operators (5-years or more of experience)



RAINMAKER



**RAIN ENHANCEMENT
TECHNOLOGIES**



Emery Water Conservancy District



Utah Division of Water Resources

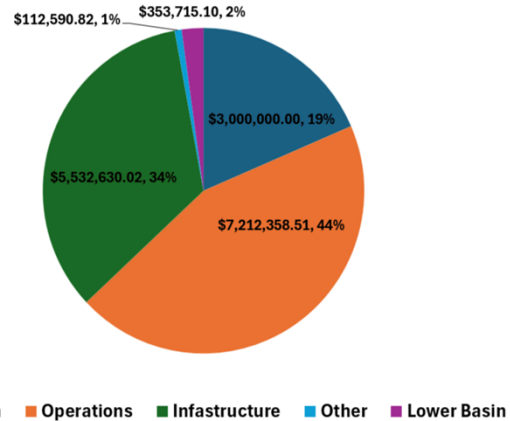
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Funding

- Operations
 - 187 Remotely Operated Ground-Based Generators
 - Bear River Basin Drone Program
 - Utah N/S Drone Program
 - Emery County Liquid Propane Operations
- Research
 - SNOWSCAPE
 - Environmental Study
 - Modeling
- Infrastructure
 - Ground-Based Units
 - Ceilometers

Utah Cloud Seeding FY26 Program Spending



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Importance of the Bear River Basin

- Great Salt Lake
 - 60% of Inflows into the GSL come from the BRB
 - Ecological Impacts
 - Human Health Impacts
 - Industrial
- Agriculture
 - ~20% of Utah's Irrigated Land (210,000+ acres)
- Municipal and Industrial
 - Brigham City, Logan, Tremonton and Many Others Rely on the Bear River.

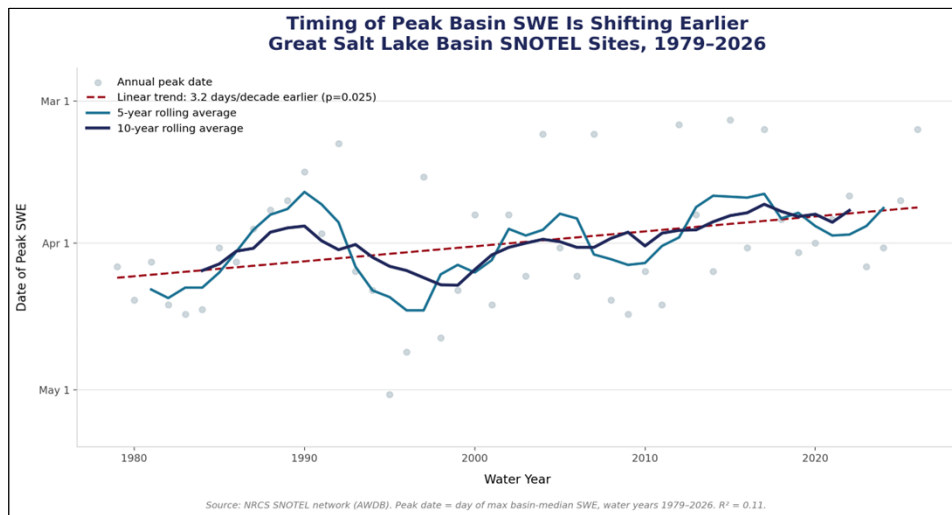


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Climate Variability in the GSL Basin



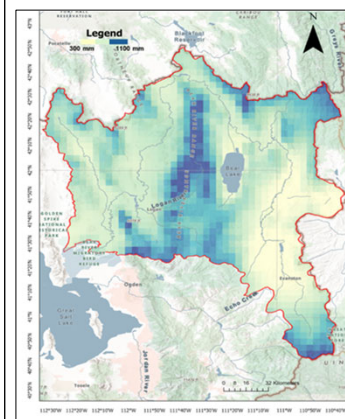
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Short-Term in the Bear

- **Lessons Learned from WY26**
 - Seeding Agents & Dispersion Methods
 - Optimized Targeting
 - Physical Validation is possible, but difficult (limited instrumentation)
- **WY27 Focus**
 - Targeting for fallout over mountain ranges
 - Bear River Range
 - Full Physical Validation using Satellite & Radar
 - With Idaho's involvement, a Radiometrics Radiometer will be placed within the Bear River Basin of Idaho (targeting & evaluations)
 - Continue Basin Focused Approach
 - Continued Support in our Ground Program across Northern Utah and the Western Uinta Mountains



10-Year Average Winter Precipitation using gridded PRISM Data.



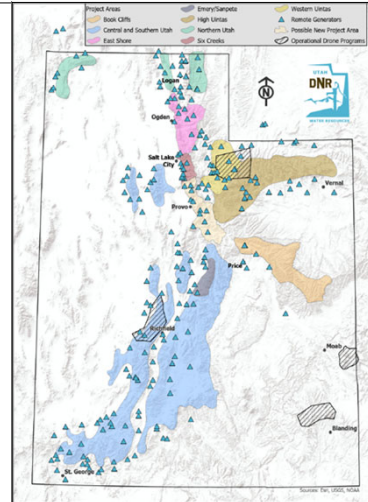
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Long-Term in the Bear

- **Ongoing Fund**
 - Current \$2M Ongoing for GSL Cloud Seeding
 - Focal Point within the State for both Operations and Physical Validation
 - Bear River Range East of the Cache Valley will be the focus
- **Beyond WY27**
 - Expansion of Ground-Based Program into Idaho (agreements with Forest Service ongoing)
 - Gap Filling Weather Radar as part of the Utah 2034 Olympics Weather and Snow Preparedness Working Group Plan
 - Physical Validation + SNOWSCAPE results should provide a much more realistic outcome on ROI



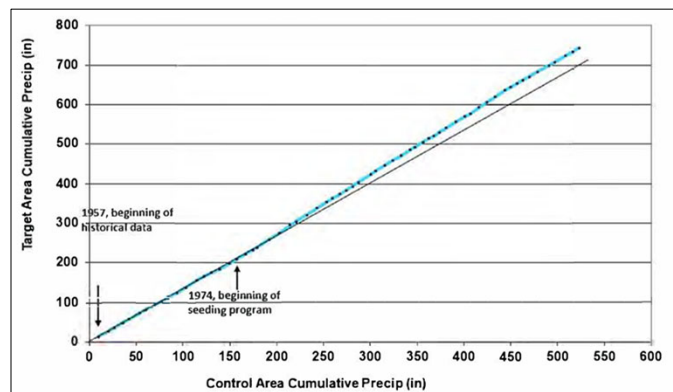
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Evaluation of Operational Winter Programs

- **Biggest Challenge in our field!**
- **Winter Programs:**
 - Target and Control of highly correlated SNOTEL observation sites
 - Linear Regression Method
 - Utah shows a 6-12% increase in SWE
 - Translates to roughly 200,000 AF of additional water supply via streamflow
 - Other winter programs are in the 10-15% range using similar, but slightly different evaluation methods



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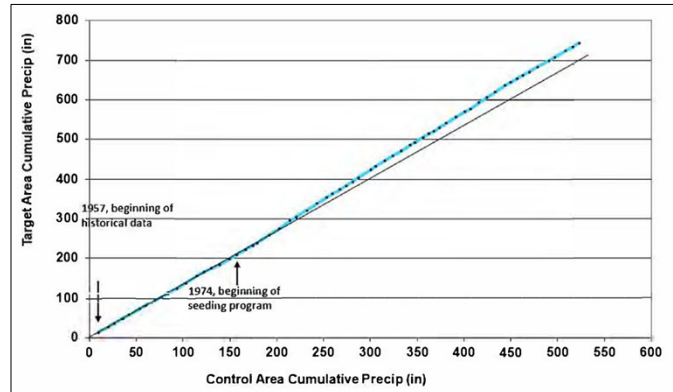
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Evaluation of Operational Winter Programs

• Point Observations:

- One small point as a representative of a very large area.
- Snow Redistribution
- Not all “increases” are the same, increase snow albedo in April has a greater impact then in January
 - Delaying runoff = more efficient runoff
- Expansion of target areas are eroding control sites
- Some programs have outlasted climatic periods (historical data now unrelated to current conditions)
- Correlations between target and control sites more likely due to large scale atmospheric oscillations



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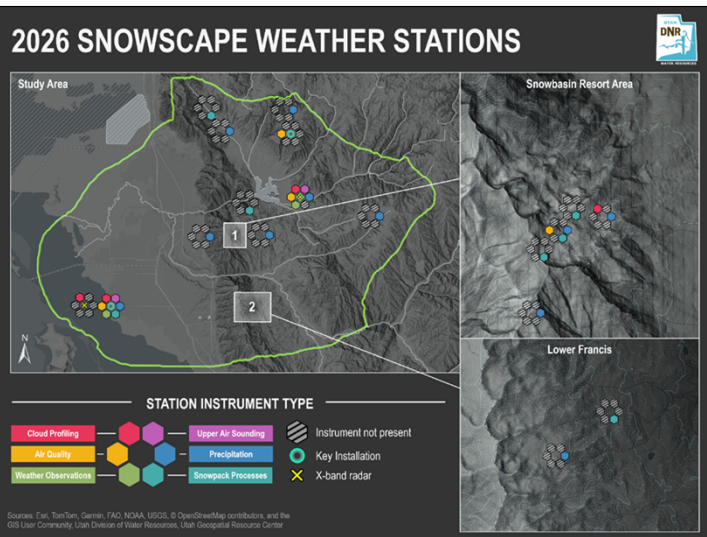
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How do we overcome these challenges?

• Modeling:

- WRF-WxMod (NCAR)
 - With better computational power and model capabilities, we can evaluate programs
 - Ingest data into WRF-WxMod to look at snowpack increases
 - Ensemble members can provide a “range” of benefit
- WRF-Hydro
 - Plug WRF-WxMod output into WRF-Hydro to simulate streamflow increases
 - What are the water resource implications from cloud seeding?



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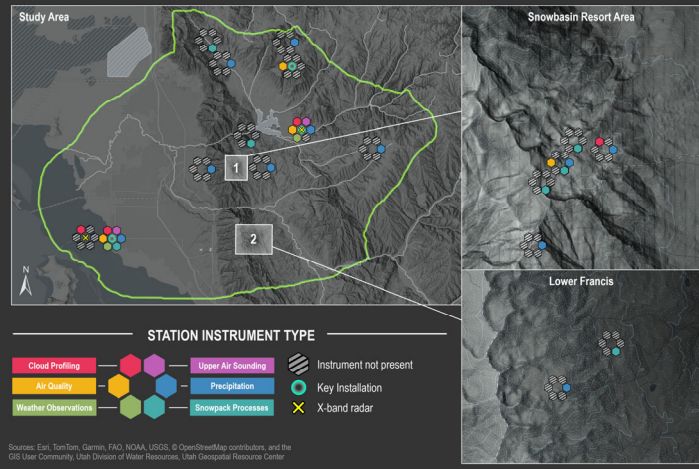
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SNOWSCAPE

- 2026 Field Campaign
 - High Resolution Precipitation
 - Radiometers (x2)
 - X-Band Mobile Radars (x2)
 - Ceilometers (x2 CL-31, x1 CL-61)
 - Quant Particle Counter (x4)
 - Radiosondes
 - Balloon & Drone
 - Streamflow Gauge (x6)
 - Energy Balance (x3)
 - Aerosol Trailer
 - PINE, CCNC, SMPS, APS
 - Environmental Study

2026 SNOWSCAPE WEATHER STATIONS



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Outcomes and Broader Impacts



- SNOWSCAPE will help **improve scientific rigor in cloud seeding evaluations**
- Policymakers will have a **more accurate ROI** and determine best budgeting practices
- Research to Operations**, especially looking at program optimization
- Strong collaboration** will allow for our campaign to impact more than just cloud seeding research
- Hope to **improve western states confidence in funding cloud seeding** as a water resource management and climate adaptation tool
- Compare and fill in gaps using **physical validation** via radar and/or satellite



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State of Utah Request

- Continue to display a Basin-wide approach to cloud seeding despite political boundaries
- Support advancement in the cloud seeding industry by investing in innovative technologies
- Continue to support research in the field of cloud seeding with an understanding that more knowledge in the field supports better decision making by Program Managers
- Help fund the Bear River Basin Cloud Seeding Program by the tune of \$1.2 million



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MEMO



To: IWRB Cloud Seeding Committee (Committee)
From: Caitlyn Swanson, Program Manager
Date: July 17, 2026
Subject: Bear River Basin Year 2 Pilot Project Proposal Summary

REQUESTED ACTION: Provide Recommendation to the Full Idaho Water Resource Board

Executive Summary

During the 2025/2026 winter season, the Idaho Water Resource Board (IWRB) partnered with the Utah Division of Water Resources (WRe) to execute an innovative, interstate cloud seeding pilot project in the Bear River Basin (BRB) utilizing Unmanned Aerial Systems (UAS), otherwise known as drones. The pilot project aims to mitigate drought conditions, provide additional water supply to water users, and assist in replenishing Utah's Great Salt Lake by deploying weather-resistant, high-altitude drones to enhance regional snowfall. The pilot project is funded through a collaborative cost-share agreement with the IWRB contributing \$450,000 and the WRe contributing \$3.5 million. Following the success of this initial phase, the WRe has proposed a second year of the pilot program. To support Year 2 of the BRB pilot project for the 2026/2027 winter season, the WRe is requesting \$1.662 million from the IWRB.

Proposed Project Budget and Participants:

The 2026/2027 pilot is structured as a \$5.662 million joint interstate project:

- **Utah Contribution (WRe):** \$4.0 Million (\$2 Million ongoing and a \$2 Million one-time contribution)
- **Proposed Idaho Contribution (IWRB):** Requested \$1.662 Million
 - o Rainmaker may offer a one-time discount to the IWRB
- **Project Operator:** Rainmaker Technology Corporation (Rainmaker)

Project Objectives and Goals:

1. **Optimize Targeting:** Target the Bear River Range (BRR) to maximize runoff flowing into the Bear River.
2. **Scale Physical Validation:** Use radar and satellite-based validation to track the physical process from seeding to precipitation, providing more accurate water yields.
3. **Optimize Delivery:** Refine multi-UAS coordination, flare deployment, and targeting conditions to maximize in-cloud residence time.

Operational Summary:

- **Operational Period:** November 2026 to April 2027
- **Field Operations:** 2 drone teams dedicated to the Idaho portion of the BRR and 5 drone teams dedicated to Utah portion of the BRR
- **Instrumentation:** 21 drones utilizing flares, 10 Eden weather systems, DOW radar, and advanced atmospheric sensing equipment
- **Validation:** Rainmaker plans to use physical validation using radar and satellite to quantify cloud seeding impacts and provide a benefit estimate using traditional target and control statistical analysis.
- **Estimated Precipitation Yield:**
 - o Idaho Portion: 16,170 – 24,255 AF (2 drone teams)
 - o Project Total: 56,595 – 84,892 AF (7 drone teams)
- **Cost Per AF:** \$69-\$103 per AF

Attachments:

- *Rainmaker PowerPoint Presentation*

BEAR RIVER BASIN

PROPOSAL FOR A CLOUD SEEDING PILOT PROGRAM (Y2)



July 21, 2026




RAINMAKER

Agenda

1. Year Two Proposal (2026-2027)

- Program Design
- Validation Approach
- Timeline
- Budget

3. Justification for Continued Operations

- Validated ROI
- Cost Efficacy
- Support from Idaho Constituents
- Alignment with NCAR F/D Study



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Proposal for Year Two Pilot, 2026–2027

(1) Operation Type:	UAV-Based, Glaciogenic Cloud Seeding
(2) Target Area:	Bear River Range
(3) Timeline:	One-year pilot program (Nov 2026 to Apr 2027)
(4) Benefits:	• Immediate and affordable freshwater for agricultural and industrial use • Increased water banking and storage
(5) Expected Yield:	16,170–24,255 acre-feet (from <u>two</u> teams, Idaho funding) 56,595–84,892 acre-feet (from <u>all seven</u> teams, Idaho <u>and</u> Utah funding)
(6) Validation Stack:	DOW, radiosondes, ceilometer, satellite, radiometer, in situ sensors
(7) Budget:	\$1.662 million IWRB contribution (out of total \$5.662MM UT+ID budget)



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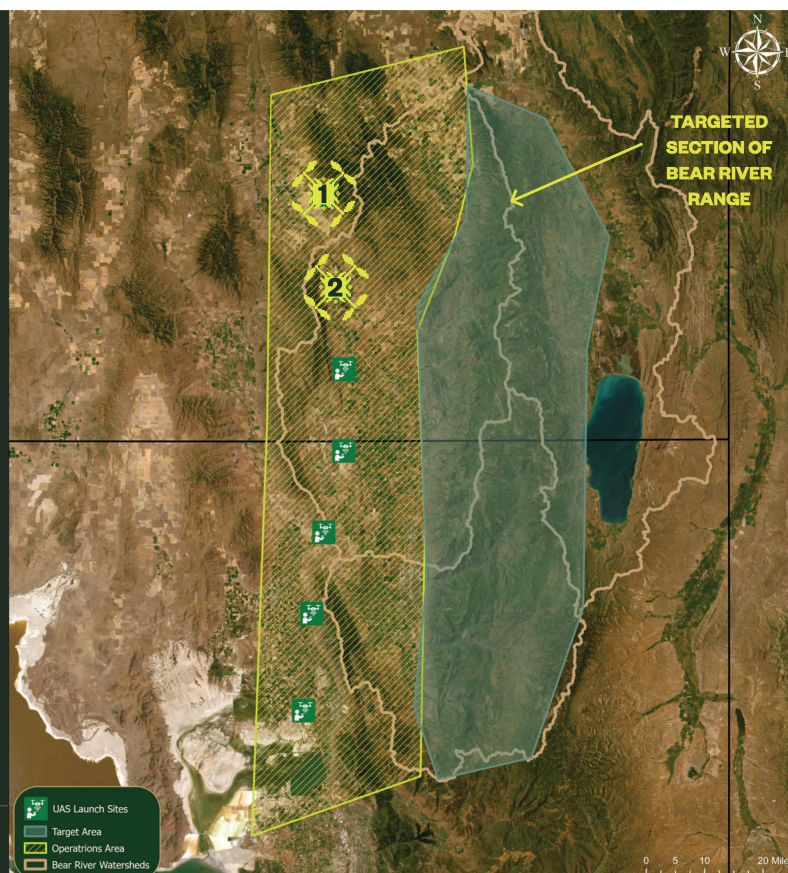
Target Area

Y2, 2026–2027

IWRB funding would support **2 dedicated drone teams** on the northern edge of the Bear River Basin, enhancing precipitation upriver of agricultural land in Idaho.

WRe is funding the additional 5 teams, which will enhance precipitation flowing into Utah.

NCAR analysis suggests that seeding over the Bear River Range may also produce snowpack in the Salt River Range, depending on weather conditions.



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Seedability

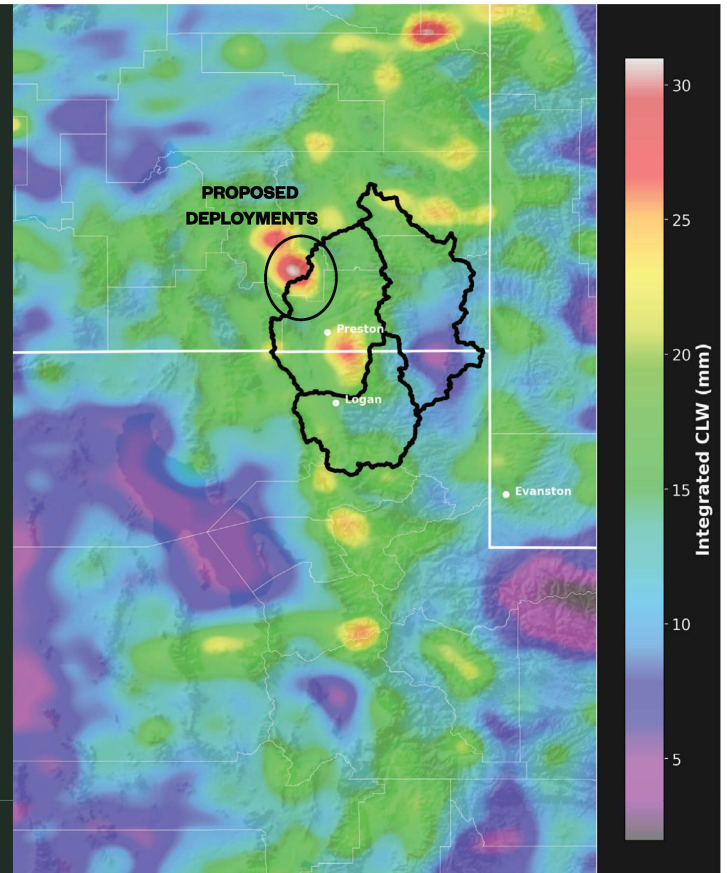
Y2, 2026-2027

The NOAR F/S study showed **strong seeding conditions** in the Bear River Basin.

Rainmaker's own satellite-based analysis supports these findings, showing **high prevalence of SLW** west (upwind) of the Bear River Range during the seeding season.

- Avg. 6-7 seedable days / mo
- Max 13 seedable days / mo

This is reflected by Rainmaker's actual operational deployments from the initial pilot season, with a total of 40 operational periods (~6-7 / mo).



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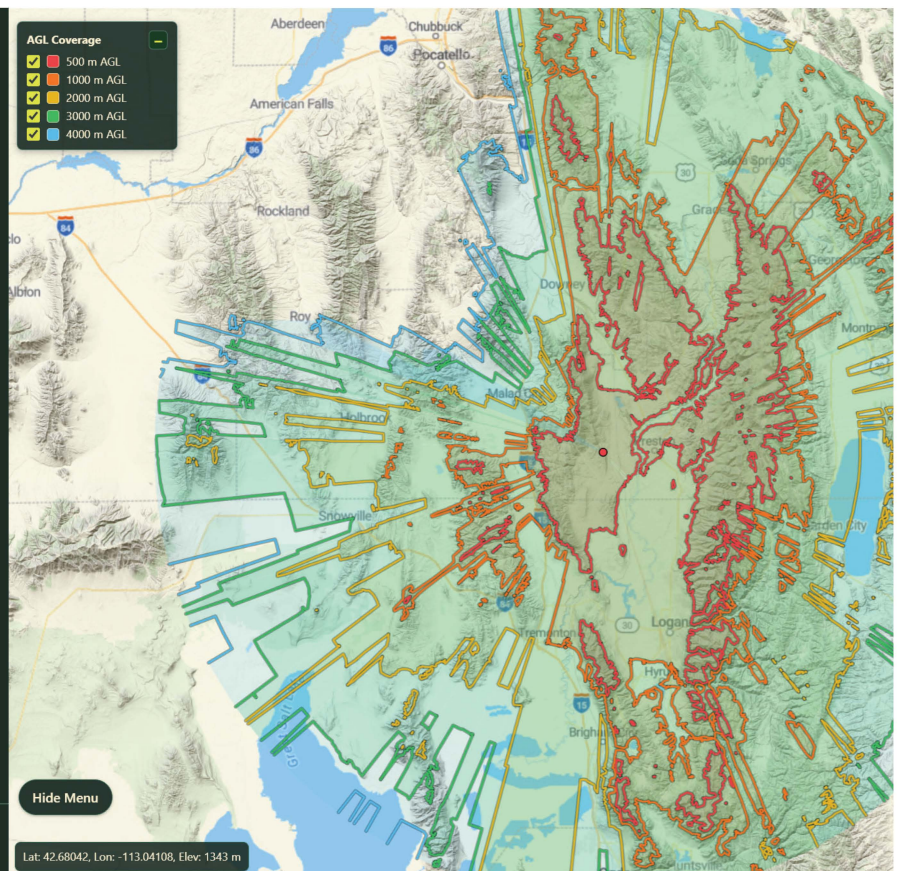
Validation Stack

Y2, 2026-2027

Instrumentation:

- NEXRAD KSFX & KMTX S-Band radars
- Doppler-on-Wheels X-Band radar
- Ceilometer
- Radiosondes
- Radiometer
- Satellite
- Elijah in situ measurements

Rainmaker aims to obtain physical signatures for all missions, regardless of weather conditions and background reflectivity.



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Expected Yield

Y2, 2026-2027

Rainmaker estimates that full-scale cloud seeding operations by **two teams** would yield **16,170-24,255 acre-feet** in the Bear River Basin. For reference, this is a portion of the total estimate of **56,595-84,892 acre-feet** for the **entire seven team** program.

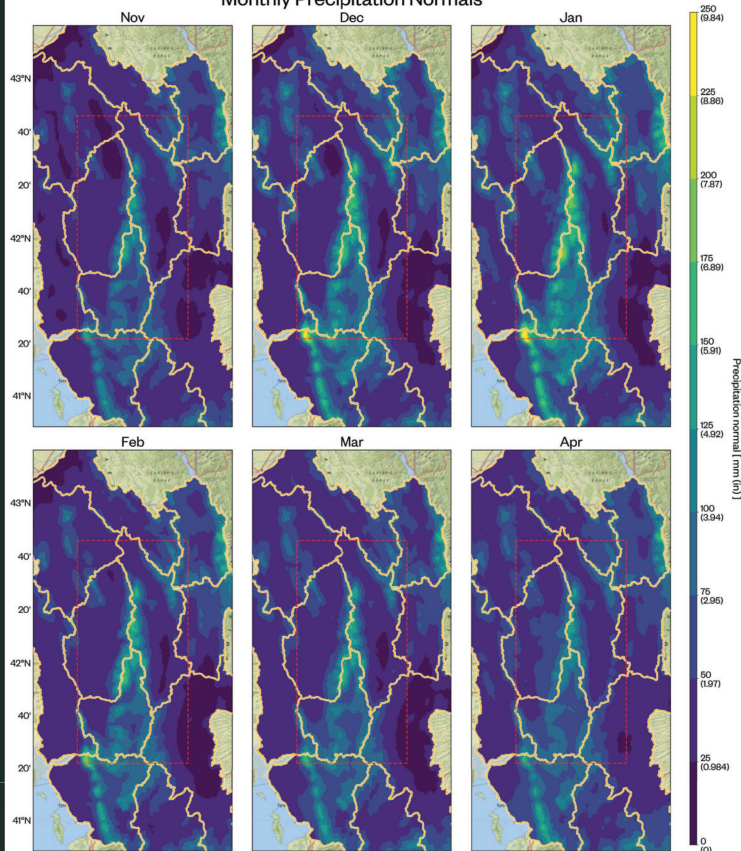
Who benefits?

- Water Right Regulation — **40% of natural flow diverted to ID** (and 60% to UT)
- Spring runoff (Unregulated) — Irrigation diversions (ID/UT) & Great Salt Lake



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Monthly Precipitation Normals



Timeline

Y2, 2026-2027

June - Oct 2026

CONOPS, SITING & STAFFING

- Develop CONOPS
- Site Identification
- Import & Installation
- Personnel Training
- Test Flights

April 2027

YEAR-END REVIEW & PROGRAM CONTINUATION

- Annual Report
- Year 3 Proposal

Now

RADAR & CLIMATE ANALYSIS

- Radar & Weather Station Analysis
- Climatological Analysis
- Personnel

Nov 2026 - Apr 2027

FULL-SCALE OPERATIONS

- Ongoing Maintenance
- Validation & QPE



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Dedicated Assets

Y2, 2026–2027



2 Dedicated Field Teams

Targeting seeding opportunities upstream of agricultural land in Idaho.



6 Elijahs (V4)

Advanced sensing capabilities and up to four seeding flares per drone.



DOW + Ground Sensors

Ground instrumentation will supplement radar imagery from nearby NEXRAD radars.



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Summary Budget

Y2, 2026–2027

2026–2027		
Program Development & Infrastructure	Total Cost	Idaho Portion
Rainmaker Elijah (UAVs)	\$1,061,500	
Additional Batteries	\$82,827	
Radiosondes	\$75,000	
Ceilmeters	\$100,000	
Ground Stations & FAA Communications Equipment	\$105,000	
DOW Radar	\$720,000	
Subtotal:	\$2,144,377	\$612,679
Validation & Software Services		
Rainmaker Stratus (Software)	\$75,000	
Quantitative Validation Services	\$75,000	
Subtotal:	\$150,000	\$42,857
Program Operations		
Field Operating Specialists	\$495,000	
Senior Operators	\$144,000	
Field Instrumentation Specialists	\$51,000	
Field Meteorologist	\$54,000	
Program Manager	\$60,000	
Radar Scientists	\$156,000	
Satellite Scientists	\$156,000	
Operational Overhead	\$1,179,557	
Seeding Material	\$1,072,564	
Subtotal:	\$3,368,120	\$1,006,961
Year Total:	\$5,662,497	\$1,662,497



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Proposed Budget Revision

Y2, 2026–2027

2026–2027		
Program Development & Infrastructure	Total Cost	Idaho Portion
Rainmaker Elijah (UAVs)	\$1,061,500	
Additional Batteries	\$82,827	
Radiosondes	\$75,000	
Ceilmeters	\$100,000	
Ground Stations & FAA Communications Equipment	\$105,000	
DOW Radar	\$720,000	
Subtotal:	\$2,144,377	
Validation & Software Services		
Rainmaker Stratus (Software)	\$75,000	
Quantitative Validation Services	\$75,000	
Subtotal:	\$150,000	
Program Operations		
Field Operating Specialists	\$495,000	
Senior Operators	\$144,000	
Field Instrumentation Specialists	\$51,000	
Field Meteorologist	\$54,000	
Program Manager	\$60,000	
Radar Scientists	\$156,000	
Satellite Scientists	\$156,000	
Operational Overhead	\$1,179,557	
Seeding Material	\$1,072,564	
Subtotal:	\$3,368,120	
Year Total:	\$5,662,497	\$1,200,000

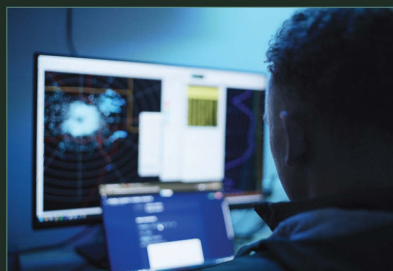


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Why Rainmaker?

Our technical and operational innovations are unmatched by any other cloud seeding provider. Custom-built UAVs, physical validation, and rapid deployment enhance the efficacy and reliability of our programs. To this day, we are **the only cloud seeding company with physically validated results.**



With every mission, we seek to obtain an **unambiguous seeding signature**. These physical markers prove our impact on precipitation and unlock Quantitative Precipitation Estimation (QPE).



Our **unique flight patterns** ensure that our effects are distinguishable from background clutter, leaving clear "seeding signatures" on radar and satellite.



We use a combination of remote sensing technologies (like NEXRAD radar, GOES satellite) for **maximum coverage and detection** of validation events.



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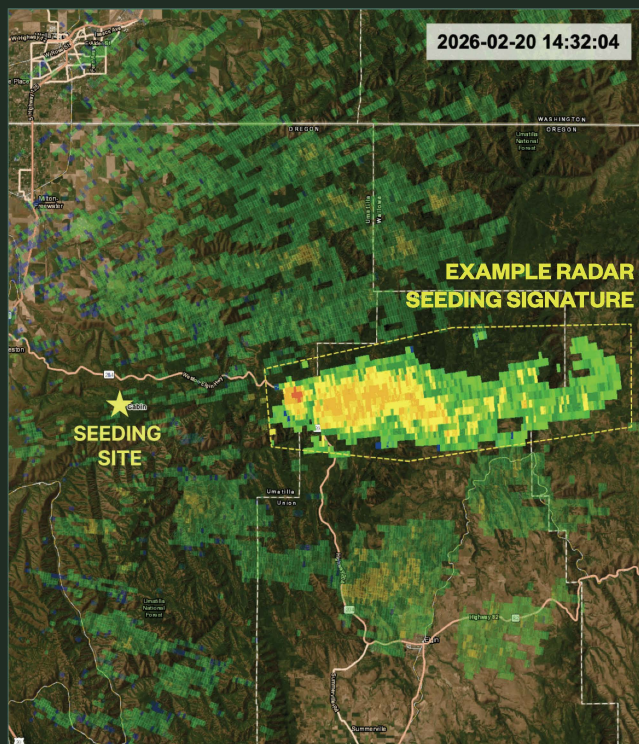
Physical Validation

We use physical "seeding signatures" to validate and qualify the impact of our operations.

Seen on radar and satellite, our signatures visibly distinguish natural from manmade precipitation.

What we look for:

- **Spatial consistency** — Appears downwind of seeding operations, consistent with wind vector.
- **Temporal consistency** — Appears at times consistent with flare ignition or AgI dispersal, generally with a 20-30 min delay.



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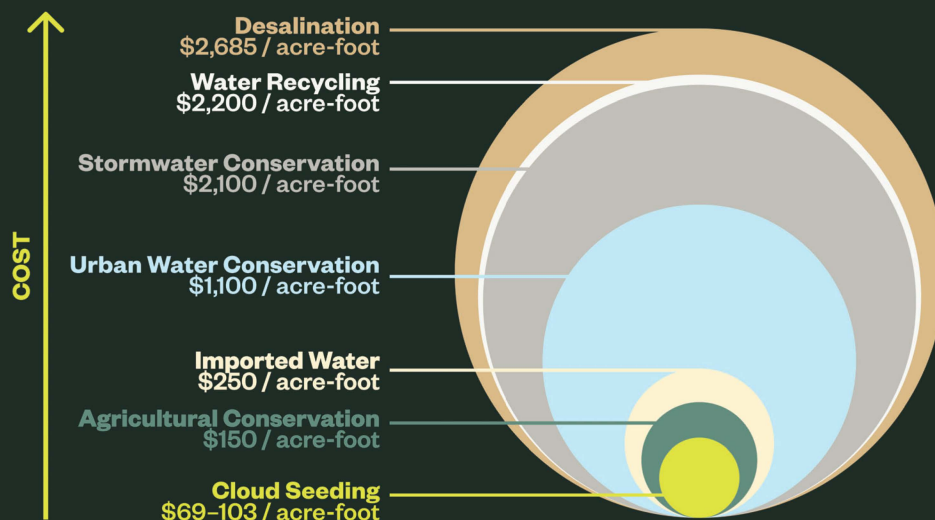
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Cost Efficacy

Our cost estimate is in line with other NCAR estimates, e.g. Medicine Bow cost projections from "\$56.15 - \$124.22/AF, with the ensemble mean at \$81.87/AF" - *Impacts of Cloud Seeding in the Medicine Bow & Sierra Madre Ranges*, NCAR, pg. 6.

What justifies the cost? We provide rigorous, physical validation to ensure Rainmaker is executing the stewardship of the public trust.

At the proposed discounted pricing, we estimate \$50-93 per acre-foot.



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Target Control vs Radar Validation

Target-Control Analysis:

- Low resolution
- Loses utility over large geographic areas
- Based on historic patterns (ignores climatological changes)
- Decades-old methodology

Physical Validation:

- Precise, high resolution
- Clear cause-and-effect relationship (directly attributable to seeding operations)
- Valid in any climate condition
- Incorporates modern sensing capabilities + best practices from NCAR SNOWIE campaign

Bottom Line: Physical validation is the new gold standard for evaluating the efficacy of cloud seeding operations. It provides enhanced certainty for customers and unlocks quantitative precipitation estimation (QPE) for individual storms.



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Support from NCAR F/D Study

1. Future climate scenarios favor airborne seeding over ground generators:

"The future climate showed increased supercooled liquid water content and frequency, with increased (warmer) temperatures... resulting in very little change in airborne seeding opportunities in the future climate... [and] decreased frequency of ground-based seeding opportunities in the future climate scenario." - Seeding Feasibility and Design Report for the Bear River Basin, NCAR, p. 6

→ Drones can target both low altitude and high altitude opportunities bridging the gap between the two legacy technologies



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Support from NCAR F/D Study

2. Storm patterns require large operational windows and multiple aircraft.

"This study also showed that 50% or more of the airborne seedable opportunities in this basin last for 6 hours or longer. Depending on the aircraft used to target this region, the on station time may not allow for seeding the entire periods of opportunity. Therefore, a second aircraft may be valuable or quick refueling turnarounds would allow for a second flight to continue seeding in the window of opportunity." Seeding Feasibility and Design Report for the Bear River Basin, NCAR, pg. 6-7

→ Drones can be automatically deployed over periods up to 16 hours (using a single operator).



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Support from Idaho Industry

Rainmaker has received Letters of Support from Idaho industry groups, including:



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Thank you for supporting our mission.



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contact@makerain.com

MEMO



To: IWRB Cloud Seeding (Committee)
From: Planning and Projects Bureau Staff
Date: July 16, 2026
Subject: Other Items

INFORMATIONAL ITEM

This item is included to allow the Committee an opportunity to bring forward and discuss any other matters.

Attachment(s):

- *None*