

Cloud Seeding Program



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Report on WY2011 Tahoe Cloud Seeding Project



- Project goal**
- Project sponsors**
- Project description**
 - **Scientific basis**
 - **Past research results**
 - **Seeding generators and locations**
- 2011 Results**
 - **Seeding operations – events, hours**
 - **Weather data during seeding events**
 - **Estimation of SWE augmentation and cost**
 - **Comparison with prior years**
- Plan and budget for WY2012**

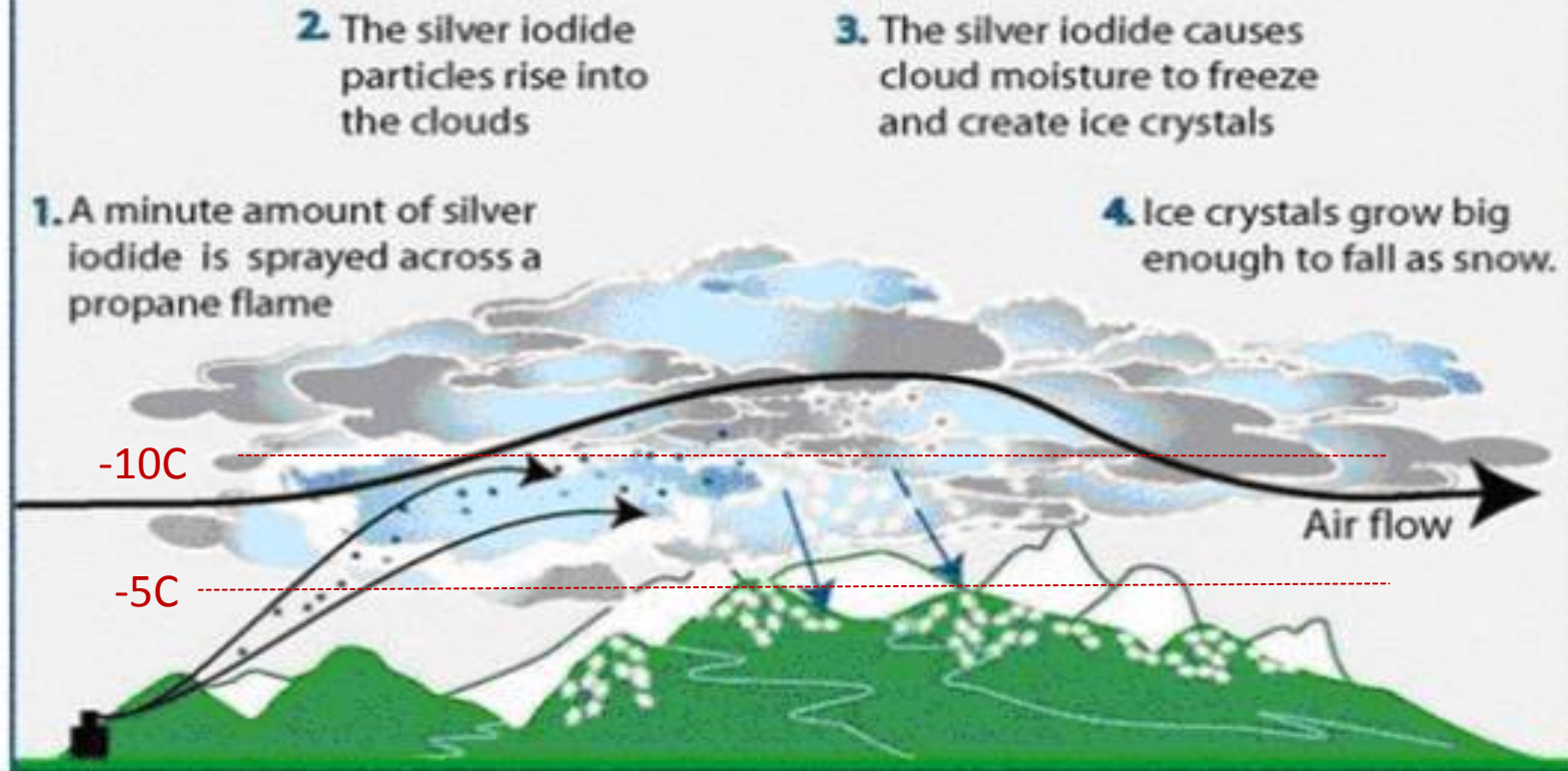
Cloud Seeding Project for the Tahoe and Truckee Basins for WY2011



- ❑ **Primary funding: Truckee River Fund (TRF) grant (\$155,876)**
- ❑ **Supplementary funding: WRWC (\$100,000)**
- ❑ **Total cost: \$255,876 (\$20,224 less than WY2010)**
- ❑ **Project Goal: Enhance snowfall from winter storms and increase the snowpack in the Tahoe-Truckee Basins**
- ❑ **Measureable outcome: Estimate of snow water increase for the winter season**
- ❑ **Beneficiaries: All water users on the Truckee River System**

Conceptual Diagram of Orographic Cloud Seeding

Ground-based seeding with silver iodide



Scientific Basis and Research Results



- ❑ **Conceptual model has been validated**
 - **Plume dispersion has been measured and modeled**
 - **Ice crystal enhancement verified**
 - **Precipitation enhancement measured**
- ❑ **Precipitation increases from seeding found to be hundredths to >2 mm per hour**
 - **0.25 mm per hour used to assess operational seeding**
- ❑ **DRI trace chemical technique is a key evaluation tool used in past and current research experiments**
- ❑ **Trace chemical evaluation used in conjunction with statistical evaluation of Australian project that showed a 14% precip increase in seeded events (2011 publication)**

Seasonal impacts of wintertime seeding

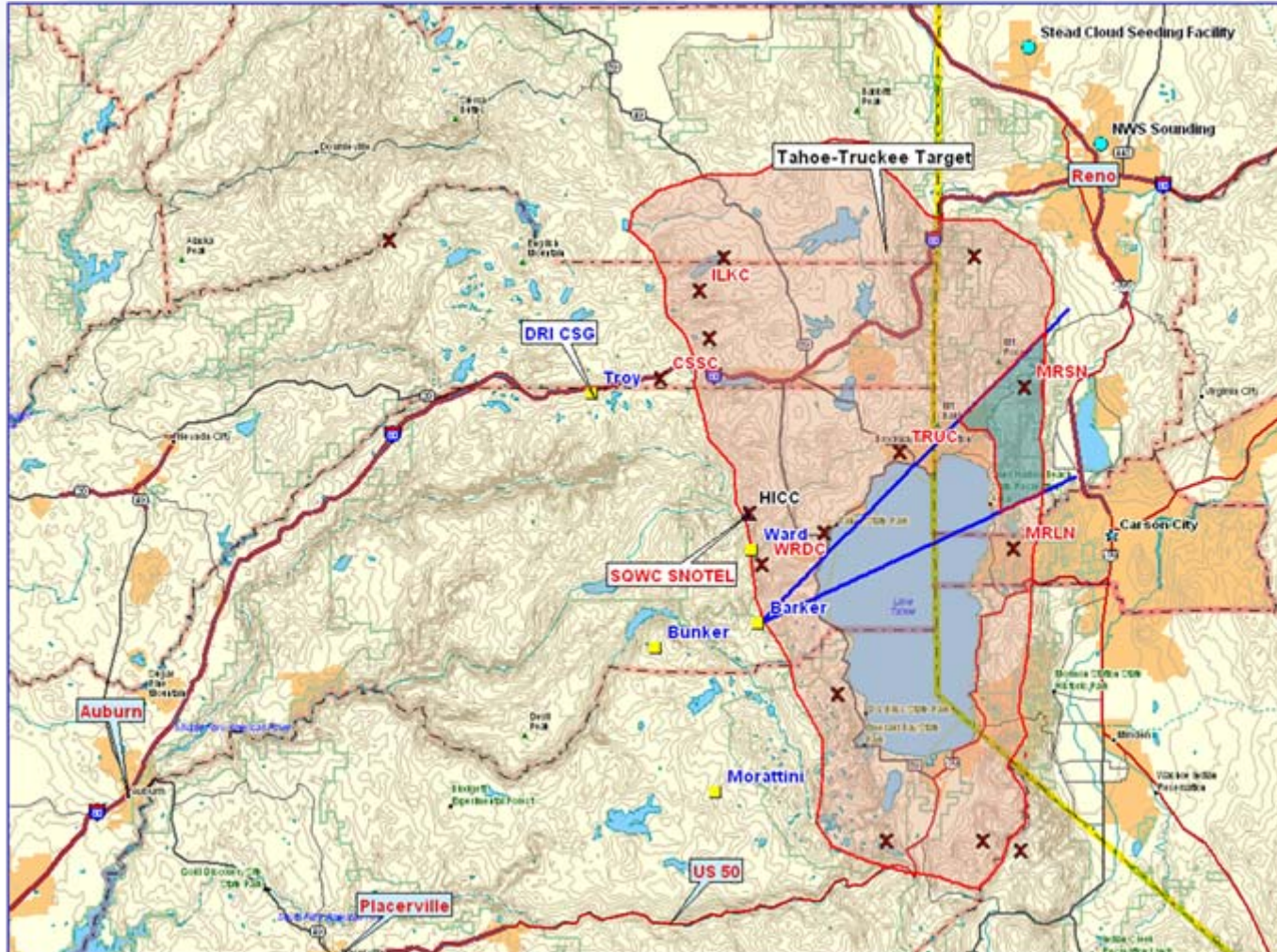


- ❑ **AMS statement indicates 10% enhancement feasible**
- ❑ **Observed 8% - >15% increases found in randomized research studies in the western U.S.**
- ❑ **DRI has estimated annual increases in total available snow water of 10,000-20,000 acre-ft in past Tahoe-Truckee Basin projects**
- ❑ **Difficult to know exactly what fraction of this increase will runoff to immediately augment streamflow, infiltrate to recharge groundwater, or be “lost” to evapotranspiration**

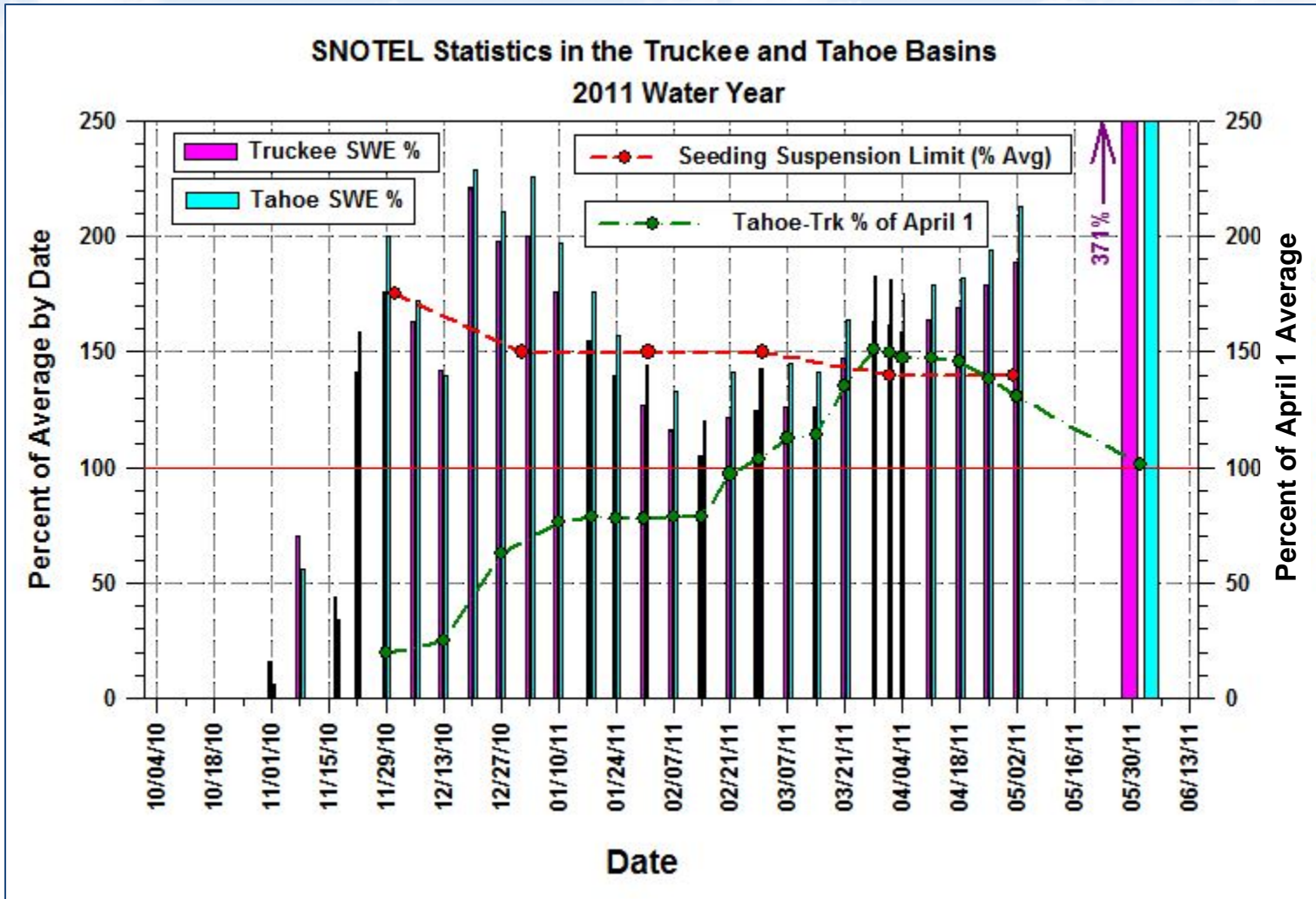
2011 Tahoe-Truckee Project Area



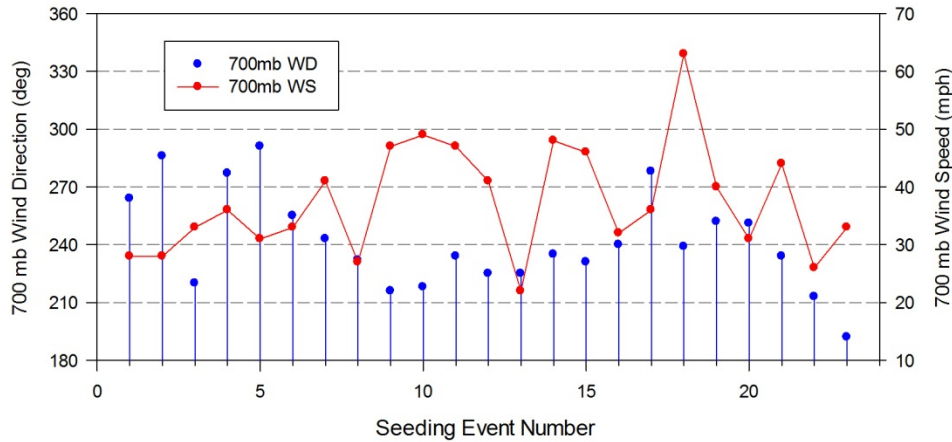
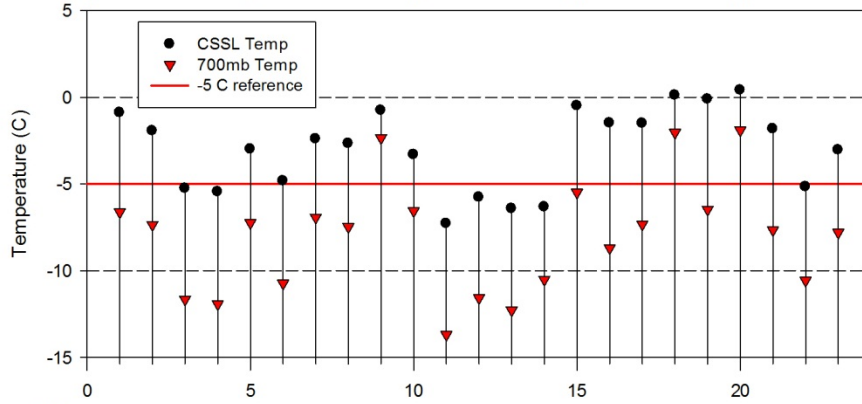
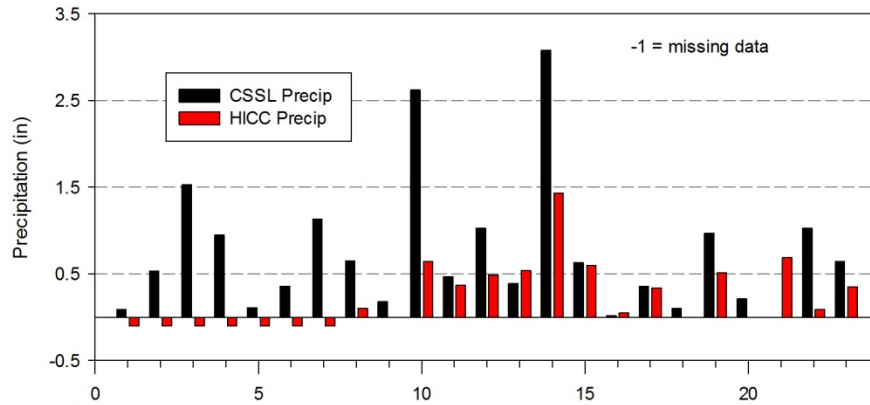
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Cloud Seeding in WY2011 limited by abnormally high snowpack



Tahoe Seeding Events WY2011



Weather data during WY2011 Tahoe Seeding Events

Tahoe –Truckee WY2011 Results

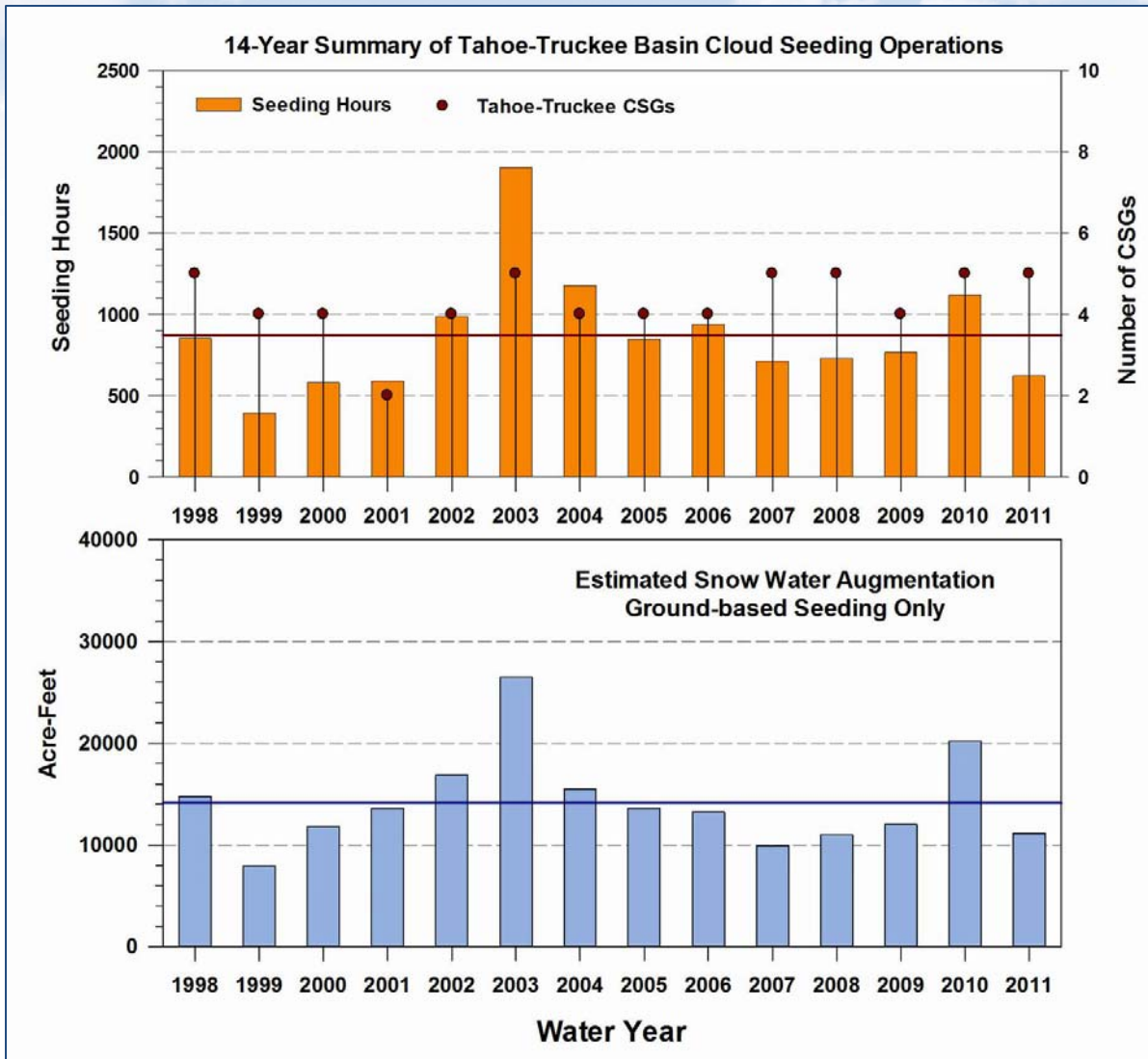


- ❑ 23 separate seeding events (30 is more typical)
- ❑ 624 hours of seeding generator operation
- ❑ Generator operational efficiency of 60%
- ❑ Estimated SWE increase of 11,120 Acre-feet
 - 0.01 inch rate increase during seeding
 - 35 sq. mile impact area per generator
 - Seeding hours during proper conditions
- ❑ Augmented SWE cost of \$22.1 per acre-ft
- ❑ State Program costs ranged from ~\$7 - \$19 per acre-ft

Comparison of WY2011 with 13 prior years



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Tahoe Program Funding Status



- ❑ **Considered other funding options for FY2012**
 - **\$37K cost share proposal to Heavenly Ski Resort was declined**

- ❑ **Current Funding Sources - Truckee River Fund and Regional Water Management Fund**
 - **WY2012 ground seeding project: \$254,815**
 - **FY2012 TRF funding award is \$154,815**
 - **Requesting cost share of \$100,000 from RWMF**

Summary

- ❑ **DRI's Cloud Seeding Program is on sound scientific footing**
- ❑ **The cloud seeding project for Tahoe-Truckee was successful in WY2011, but limited by suspensions**
- ❑ **\$254,815 needed to continue basic Tahoe-Truckee Project in WY2012**
- ❑ **\$154,815 funded by TRF - \$100,000 being requested from the Regional Water Management Fund**