RECLAMATION

Managing Water in the West

TRUCKEE BASIN STUDY

Technical Advisory Group
Water Supply Workshop

June 24, 2013

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

TMWA

PCWA
water • energy • stewardship

TRUCKEE RIVER FLOOD PROJECT

TAHOE REGIONAL PLANNING AGENCY

Agenda

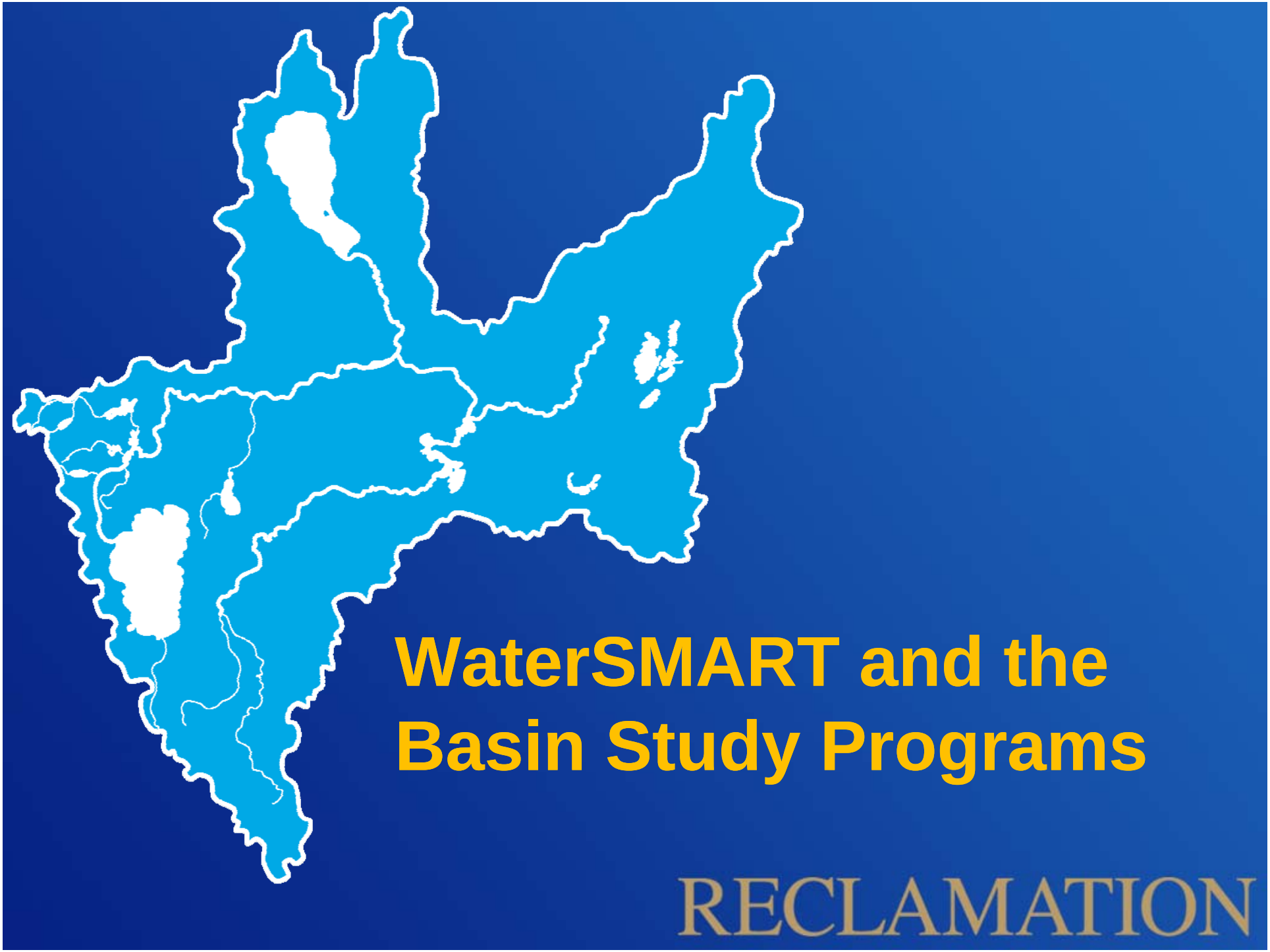
- Welcome and Introductions
- WaterSMART and Basin Study Programs
- Truckee Basin Study Overview
- Workshop Focus: Water Supply Scenarios
- Technical Advisory Group Discussion
- Ongoing and Future Basin Study Activities

RECLAMATION

Meeting Format

- Participants will be on “silent” mode, except during discussion period.
- Participants can ask questions at any time by using the webinar “chat” function.
- Reclamation will respond to questions during the meeting and, if needed, post follow-up responses on the Basin Study website.
- Technical Advisory Group discussion will follow a presentation on supply.
- Webinar, voice and chat are being recorded, and will be posted online along with other materials.

RECLAMATION


WaterSMART and the
Basin Study Programs
RECLAMATION

WaterSMART Program

- **Implements SECURE Water Act, Public Law 111-11**

- **Established in 2010 by Secretary Salazar to…**
  - **Help water resource managers make sound decisions about water use**
  - **Develop strategies to ensure sufficient water supplies for multiple uses**
  - **Develop adaptive measures to climate change**
  - **Improve water conservation**
  - **Promote sustainability**

RECLAMATION

Basin Study Program

- **West-Wide Climate Risk Assessments**

- **Basin Studies**
  - **Basin Studies**
  - **Secure Water Act follow-up Feasibility or Special studies**

- **Landscape Conservation Cooperatives**

RECLAMATION

West-Wide Climate Risk Assessments

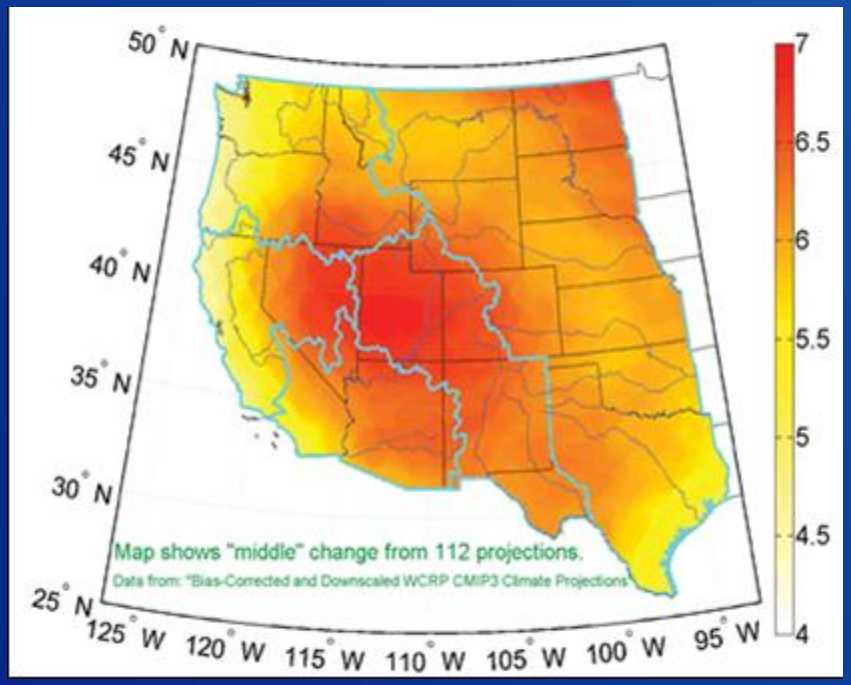
- Conducted by Reclamation
- Reconnaissance-level water supply and demand analyses in eight Reclamation river basins
- Projections of climate change impacts to water supply and demand and baseline risk assessments to evaluate impacts of climate change to water uses
- Baseline for more in-depth analyses performed through Basin Studies

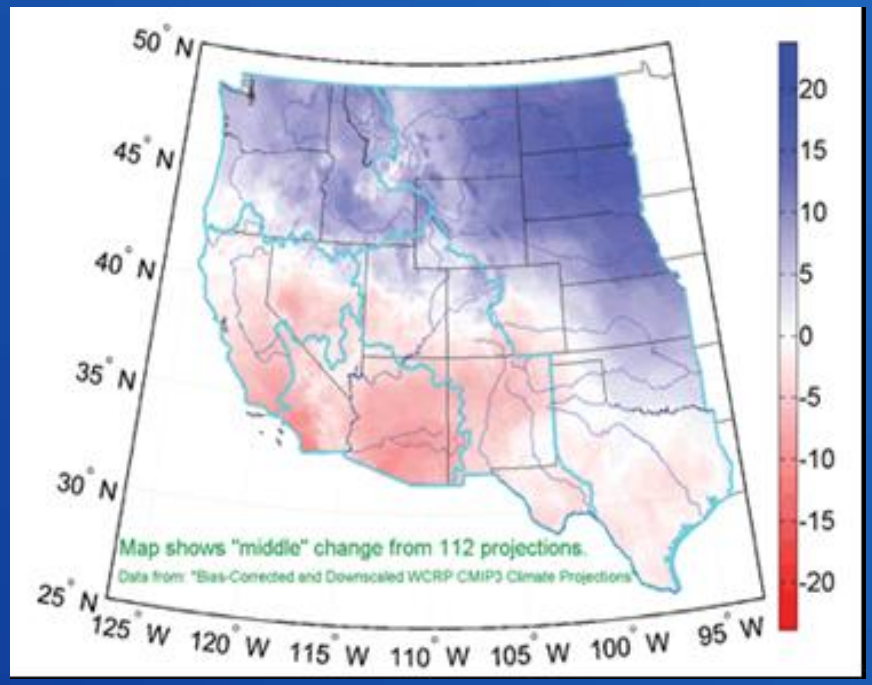
RECLAMATION

SECURE Water Act Section 9503(c) – Reclamation Climate Change and Water – April 2011

RECLAMATION

SECURE Water Act Section 9503(c) – Reclamation Climate Change and Water – April 2011





Projected median temperature (°F) and precipitation (%) changes at the end of 21st century (2070–2099) relative to historic conditions (1950–1979)

RECLAMATION

Basin Studies

As guided by the SECURE Water Act (Public Law 111-11, Title IX, Subtitle F):

- **Purpose**
  - **Work with state and local partners in 17 Western States to evaluate future water supply and demand imbalances in a changing climate**
- **Outcomes**
  - **Assessment of current and potential future water supply and demand in the basin, taking into account risks to water supply from climate change.**
  - **Analysis of water supply reliability given potential future conditions, such as population and climate change.**
  - **Potential strategies and options to address basin-wide water supply imbalances.**
  - **Analysis of the options identified (performance, cost, environmental impact, institutional requirements, etc.) and formulate solutions.**
  - **Potential subsequent feasibility or special studies.**

Truckee Basin Study Overview

RECLAMATION

Basin Study Partners

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

TRUCKEE MEADOWS WATER AUTHORITY
Quality. Delivered.

PCWA
water • energy • stewardship

Truckee River Flood Management Authority

TAHOE REGIONAL PLANNING AGENCY

50-50 cost share between Reclamation and partners

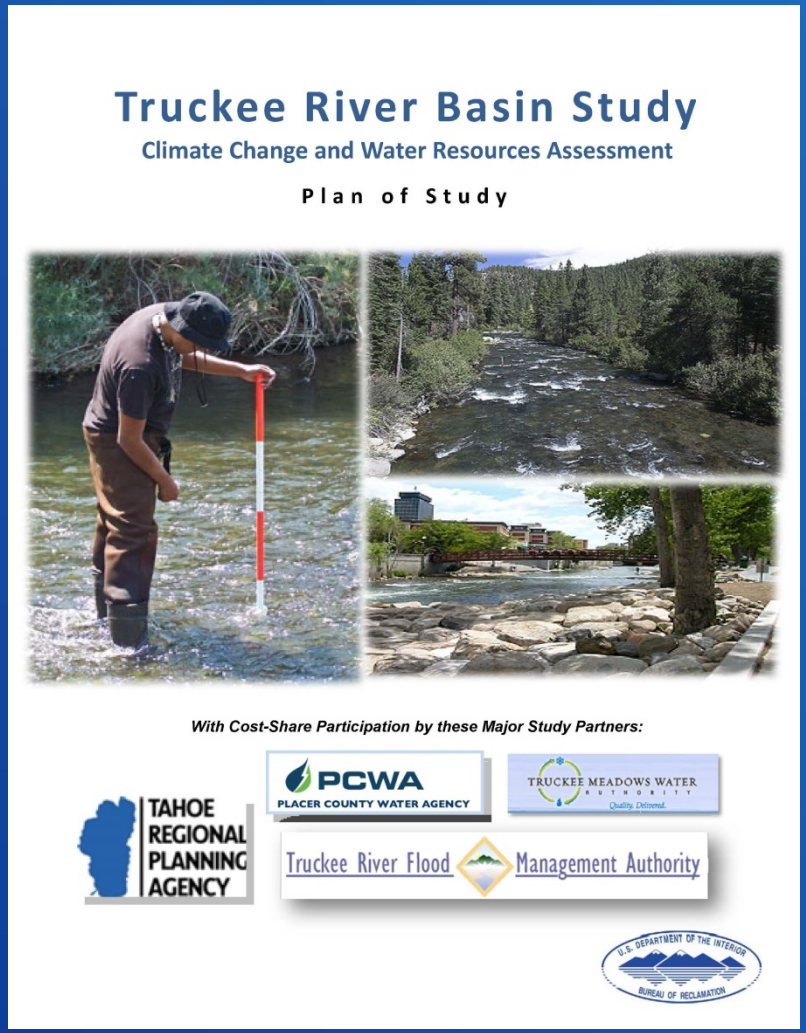
RECLAMATION

Study Management Structure

RECLAMATION

Basin Study Phases

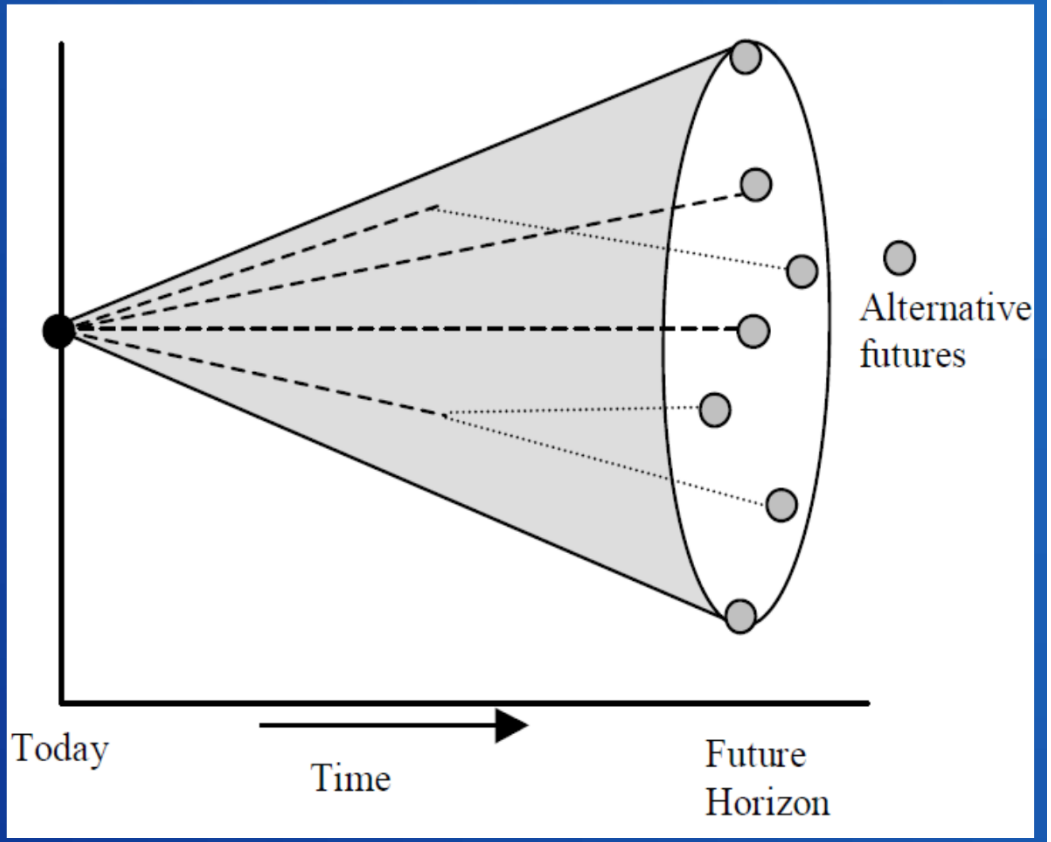
- **Phase I & II**
  - Assess Basin Supplies
  - Assess Basin Demands
- **Phase III**
  - Evaluate Reliability
  - Assess Risks
- **Phase IV**
  - Review of Adaptation Options
  - Recommendation of Strategies



RECLAMATION

Phase I: Scenario Development

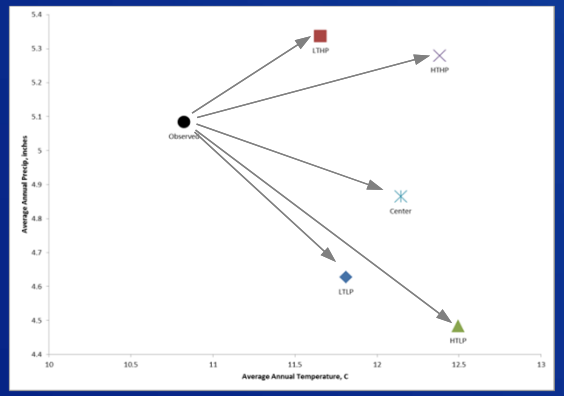
- **Effective treatment of uncertainty is key to Basin Study**
- **Uncertainty is addressed through 'Scenarios'**

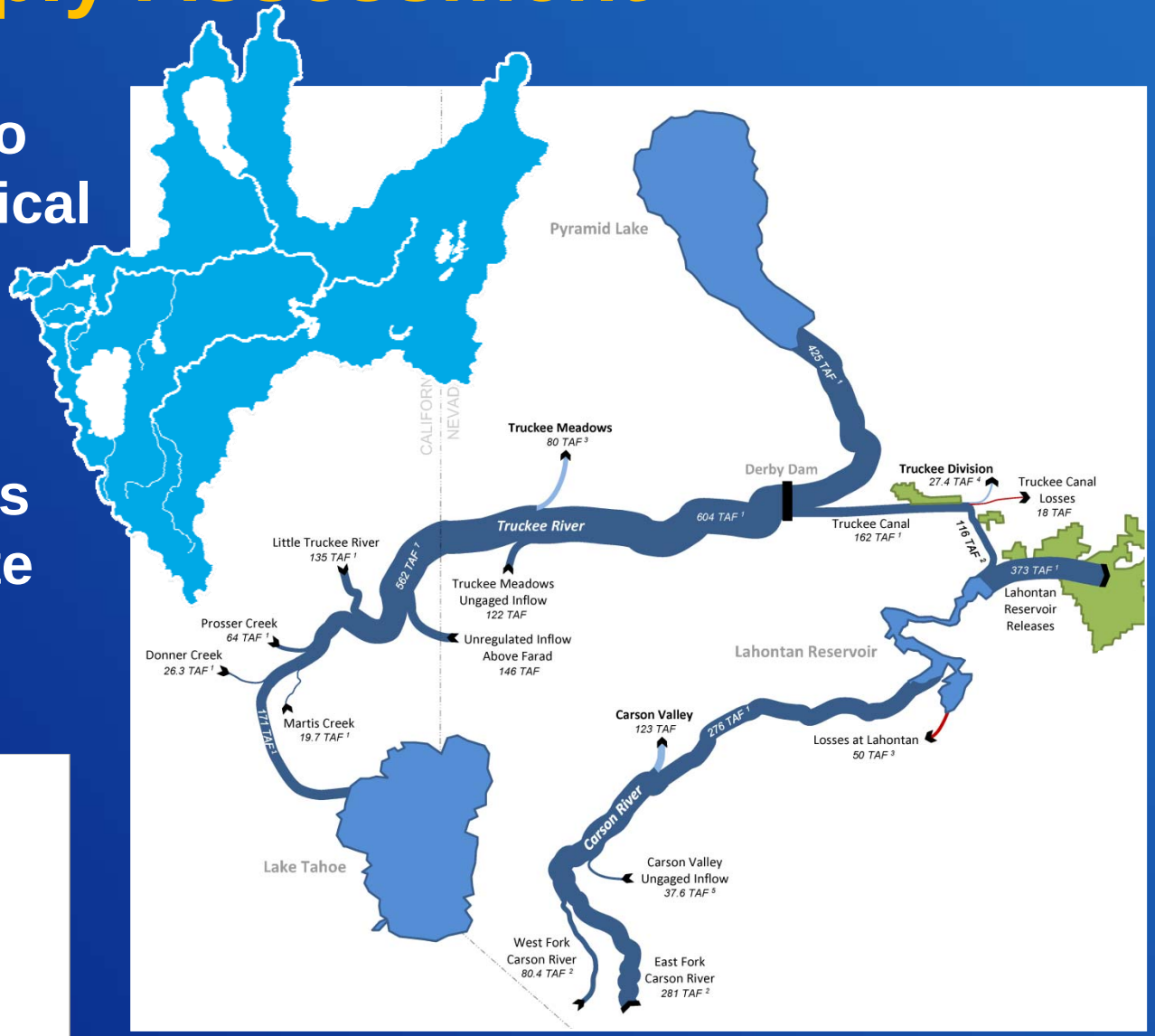


RECLAMATION

Water Supply Assessment

- **Current scenario based on historical gage records**
- **Future scenarios based on climate projections**





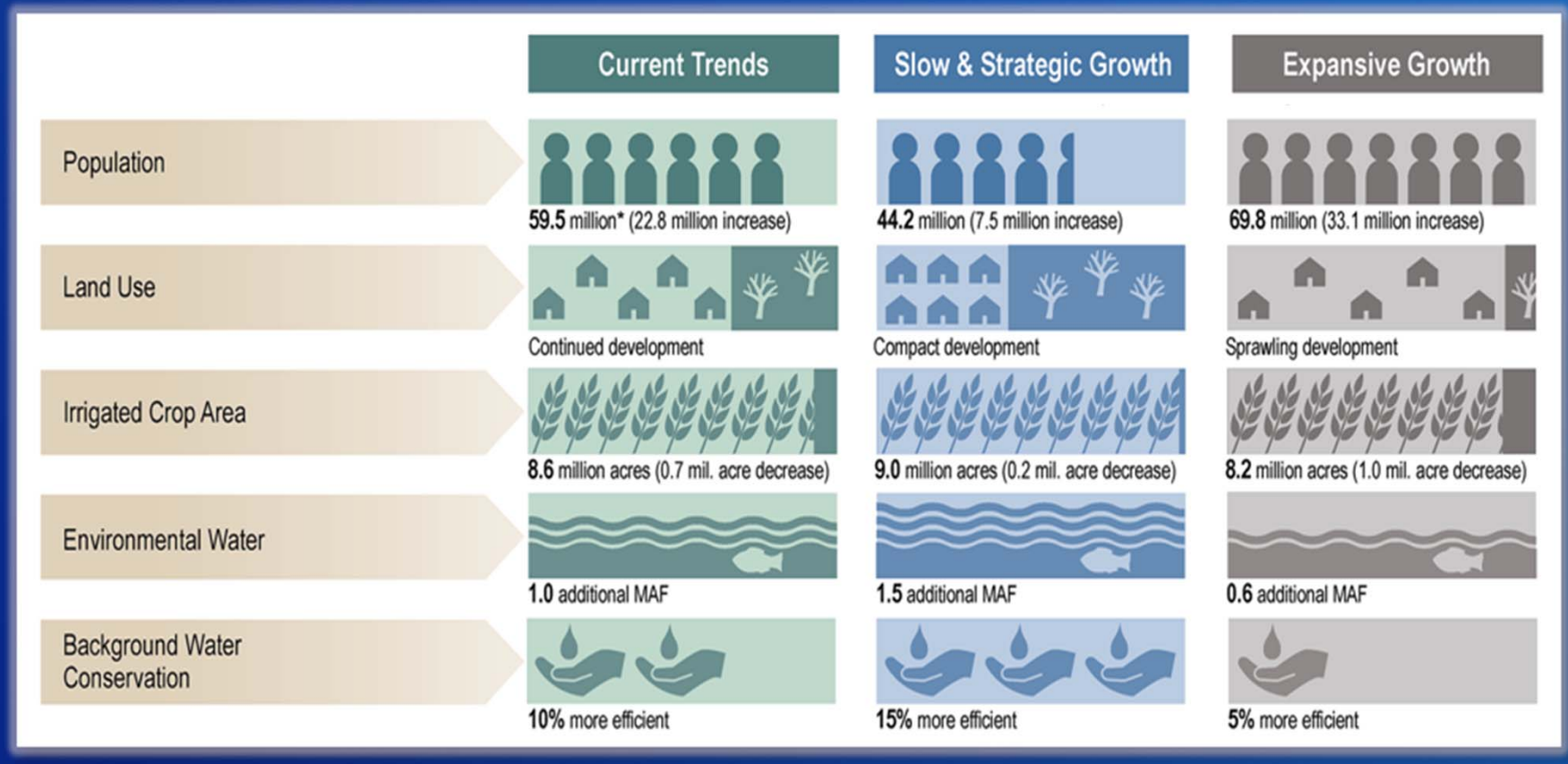
RECLAMATION

Water Demand Assessments

- **Current Scenario based on information from a regional water supply Planning Model**
  - **Developed collaboratively by regional stakeholders**
  - **Intended for use in TROA studies**
- **Future Scenarios to be developed in Phase II**
  - **Will consider various sources of demand**
  - **Will establish up to three “Storylines”**
  - **Basin Study Team will seek input on Demand Storylines from Cost-Share Partners and Technical Advisory Group**

RECLAMATION

Water Demand Scenarios (example)



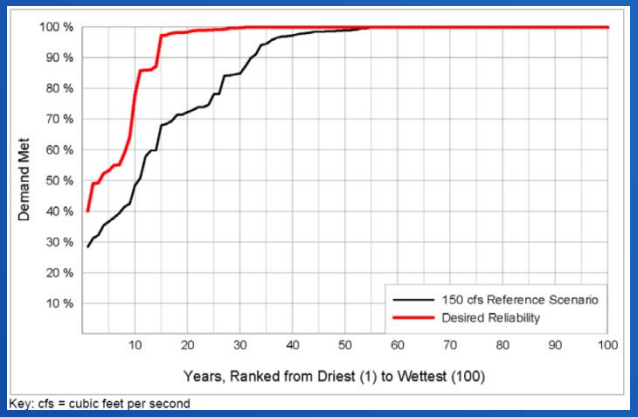
** Example taken from 2009 California Water Plan Update*

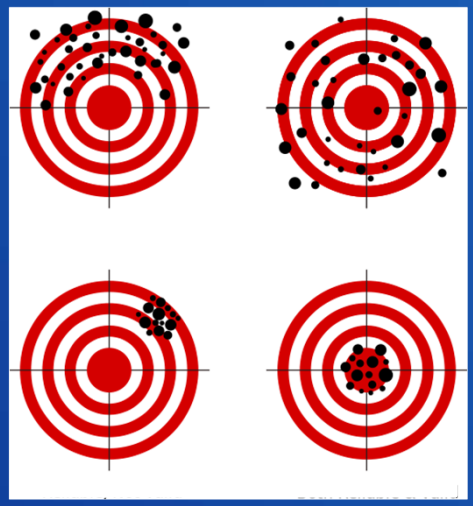
RECLAMATION

Phase III - System Reliability and Risk Assessment

- Identify system reliability metrics with Cost Share Partners and this Technical Advisory Group

- Evaluate reliability for metrics, across combination of Supply and Demand scenarios

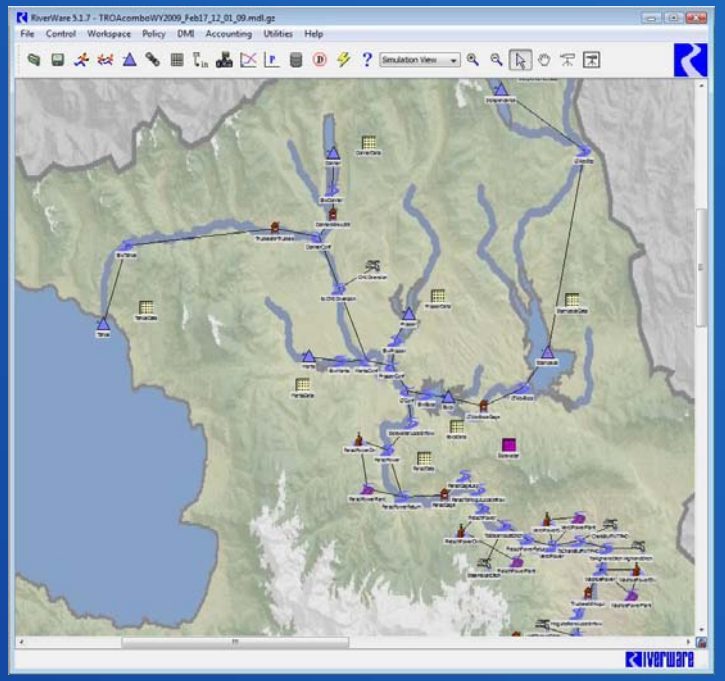




RECLAMATION

Planning Model

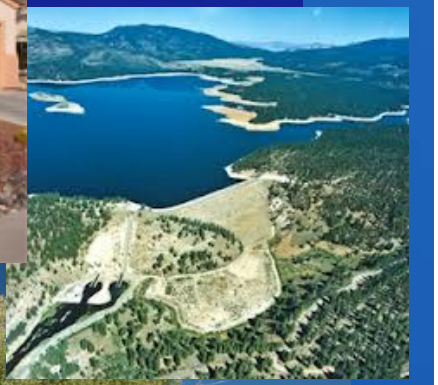
- **Platform – RiverWare**
  - 100+ years in extent
  - Has been used for Reclamation Studies
- **Collaborative Development (2009-present)**
  - USBR – Lahontan Basin Area Office
  - Truckee Meadows Water Authority
  - State of California (Dept. Water Resources)
  - State of Nevada (State Engineer)
  - Pyramid Lake Paiute Tribe
  - Federal Water Master
  - City of Fernley
  - Precision Water Resources Engineering
- **Models all significant operations in the basin**
  - Pre-TROA regulatory conditions are available
  - TROA regulatory conditions will be available in 2014
- **Appropriate for characterizing risks for Basin Studies**
  - Supply and Demand Scenarios are inputs
  - Operations and infrastructure are customizable



RECLAMATION

Development and Evaluation of Adaptation Strategies

- Identify and screen potential options
- Assess the multi-resource reliability of each short-listed options
- Evaluate the relative benefits of each option and portfolios of options (strategies)



RECLAMATION

Workshop Focus:
Water Supply Scenarios

RECLAMATION

Water Supply in the Truckee Basin Study

- Water Supply Scenarios developed for use in the Truckee Basin Study
- Context for use of Supply Scenarios in Risk and Reliability assessments
- Approach for Developing Supply Scenarios
  - Current Supply Scenario
  - Future Supply Scenarios

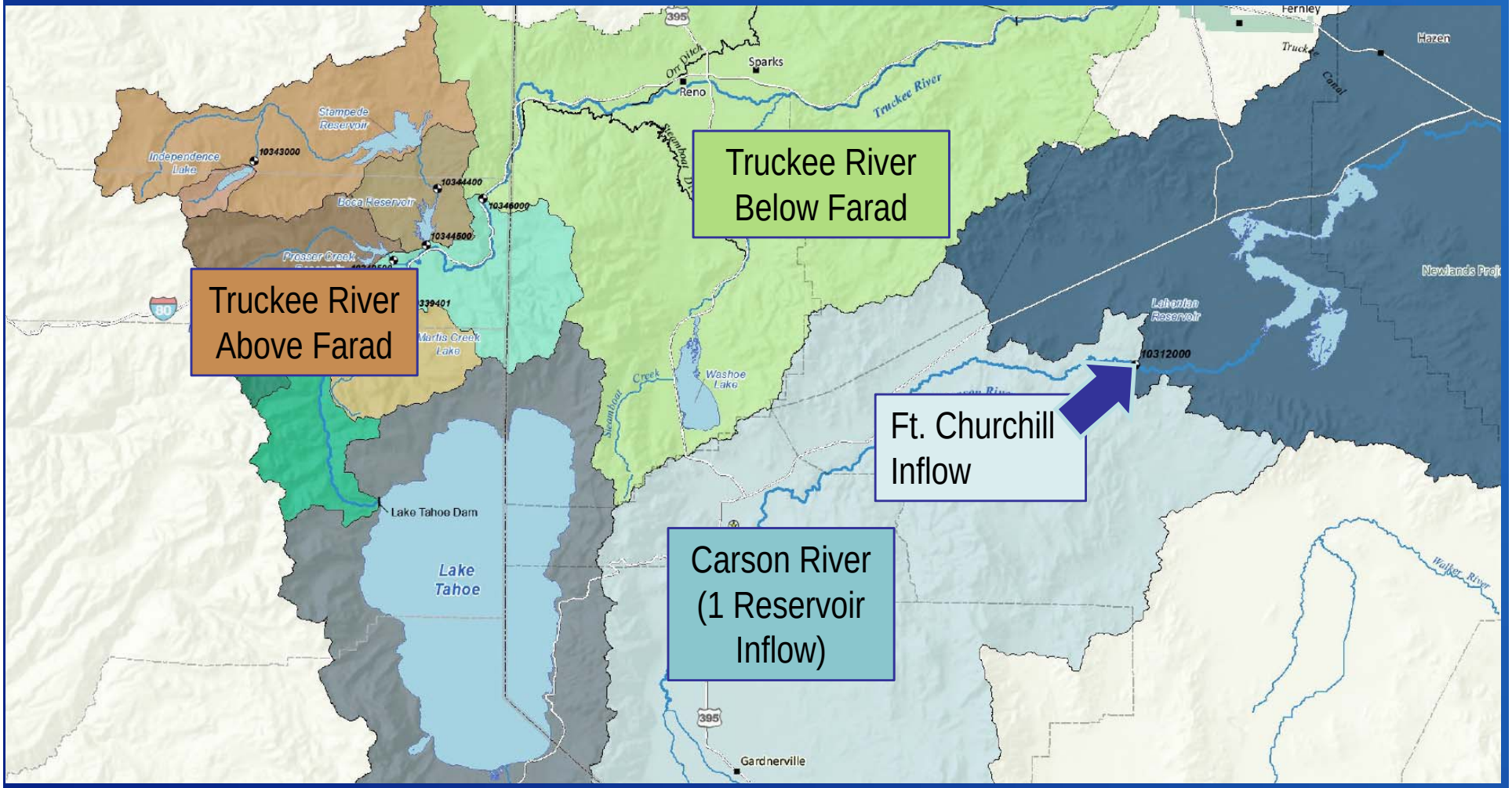
RECLAMATION

Supply Scenarios

- **Current Supply Scenario**
  - **Sets baseline for comparisons in risk and reliability assessments**
  - **Based on 100 years of historical flow gage records (1900-2000)**
  - **Considers hydrology at locations for important for infrastructure (i.e. dams) or operations (i.e. meeting Floriston rates)**
- **Future Supply Scenarios**
  - **Consider the range of potential future hydrologic conditions resulting from climate change**
  - **Based on 100 years of projected climatic conditions in the Truckee and Carson basins**
  - **Performed using refined hydrology model at UNR, Desert Research Institute**

RECLAMATION

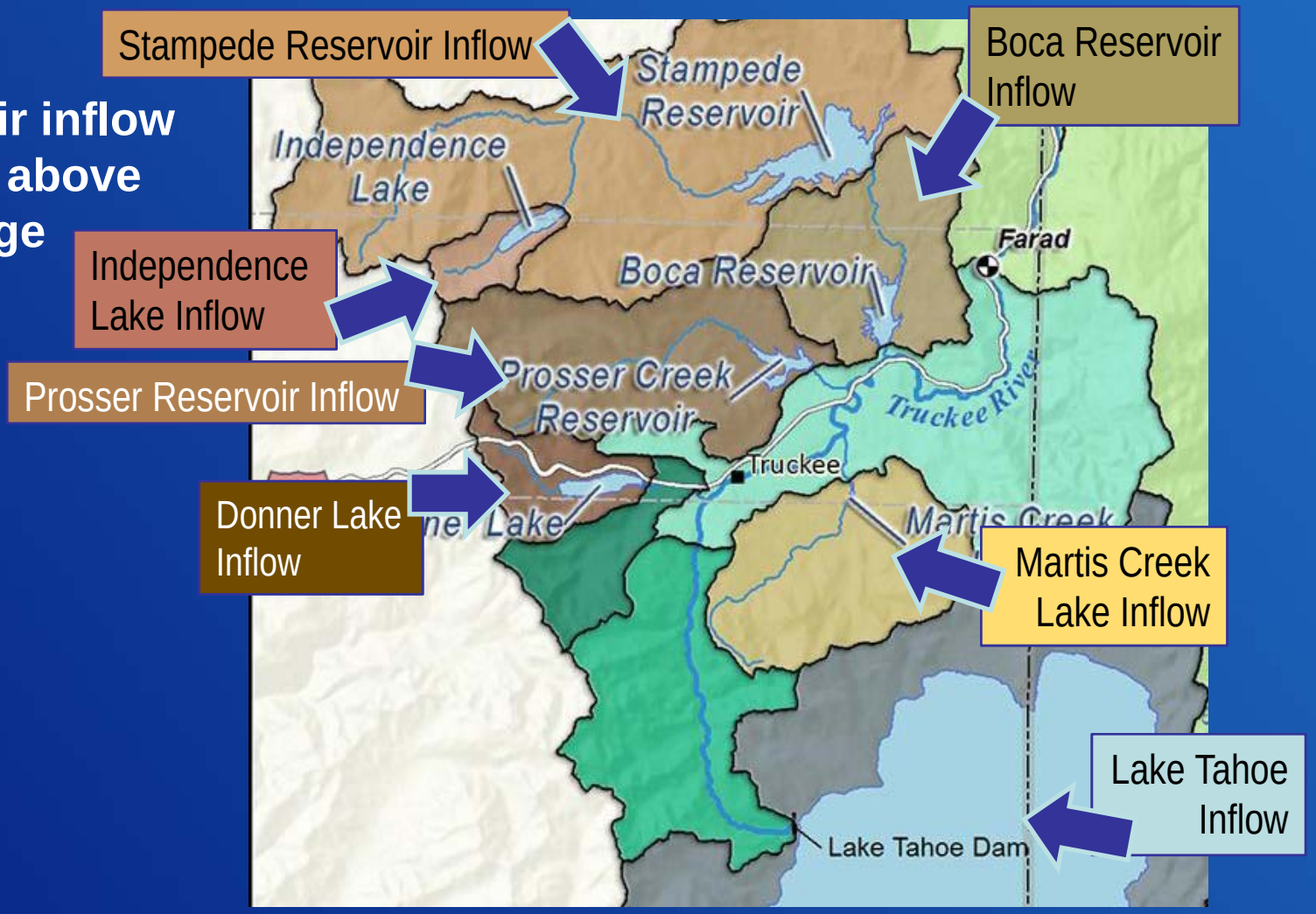
Supply in Planning Model



RECLAMATION

Supply in Planning Model (cont'd)

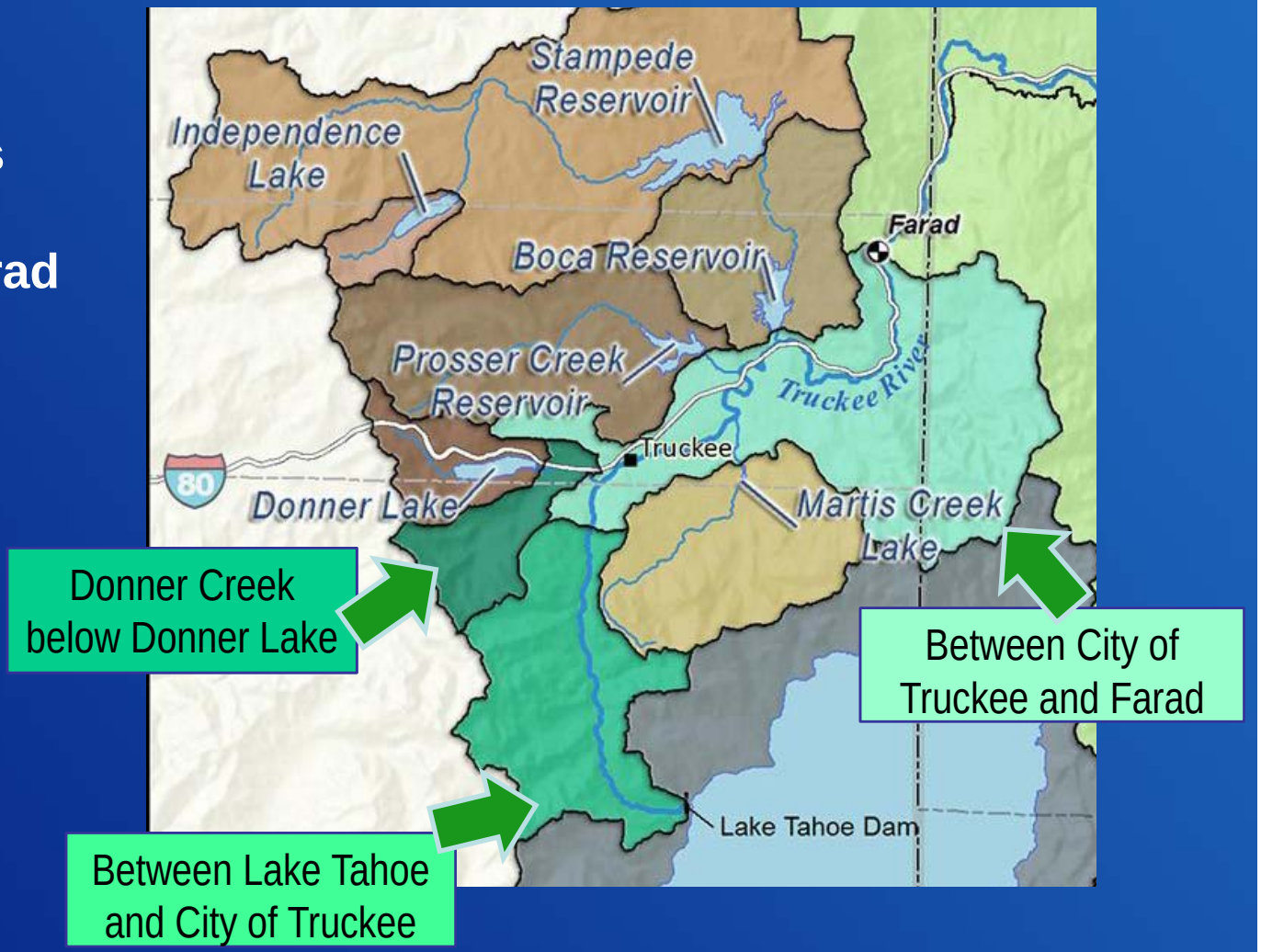
- **7 reservoir inflow locations above Farad Gage**



RECLAMATION

Supply in Planning Model (cont'd)

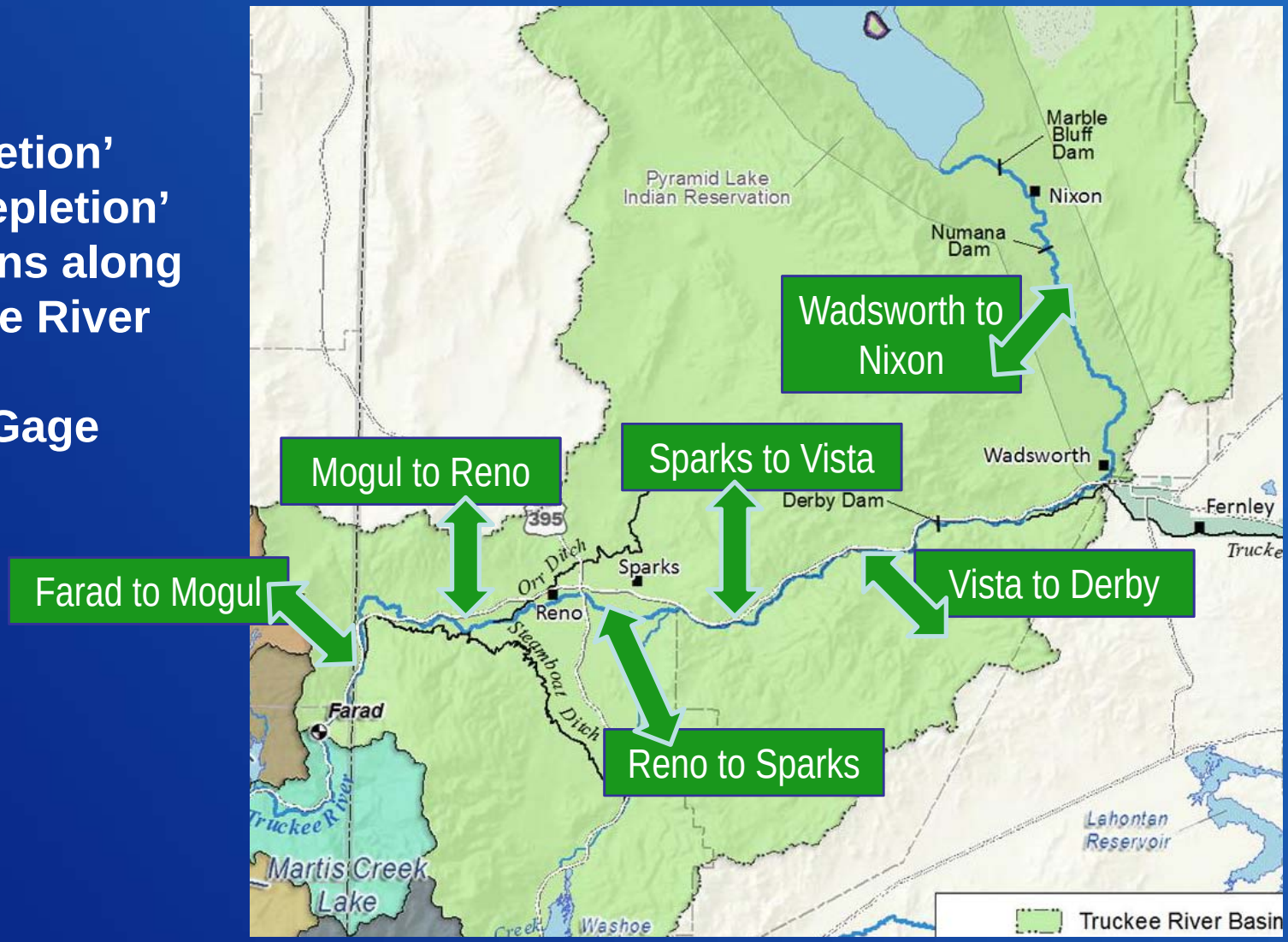
- **3 unregulated inflow locations along Truckee River above Farad Gage**



RECLAMATION

Supply in Planning Model (cont'd)

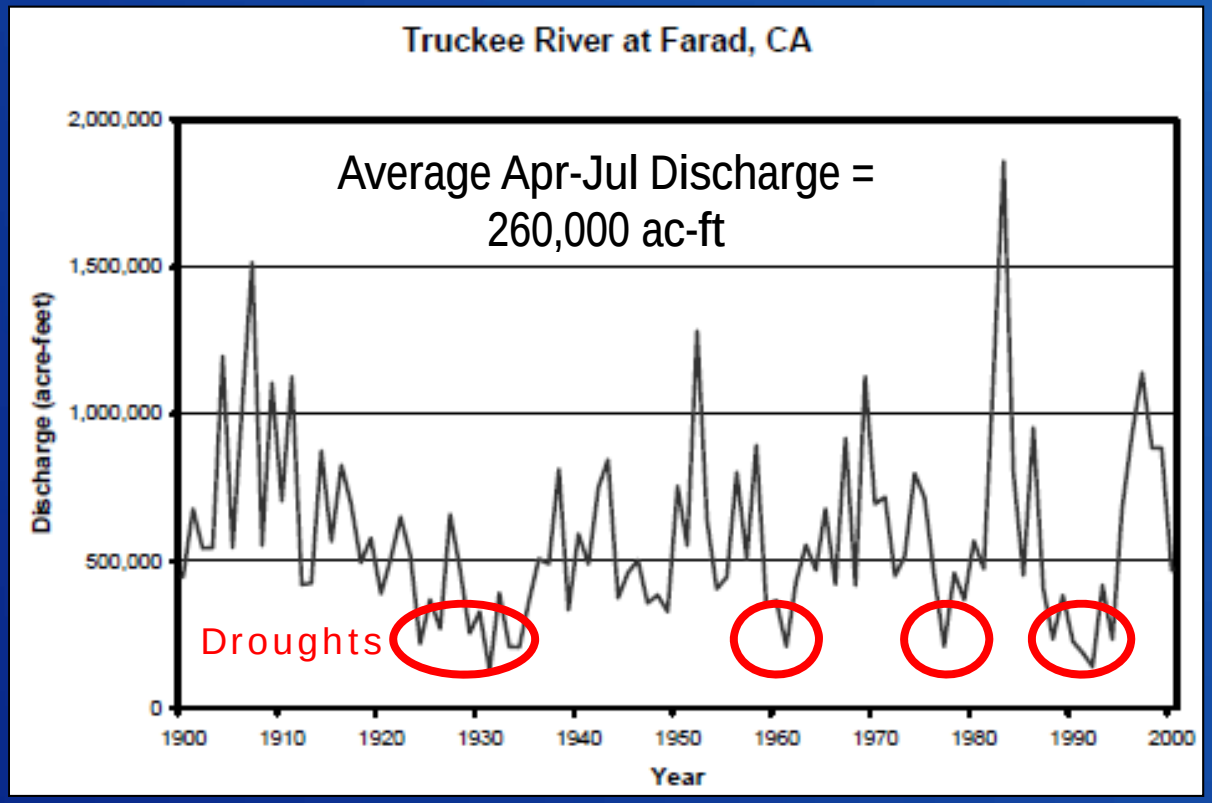
- **6 'accretion' and 'depletion' locations along Truckee River below Farad Gage**



RECLAMATION

Current Supply Assessment

- **Current supply is what our society has become accustomed to and what we have planned for**



RECLAMATION

Future Supply Assessment

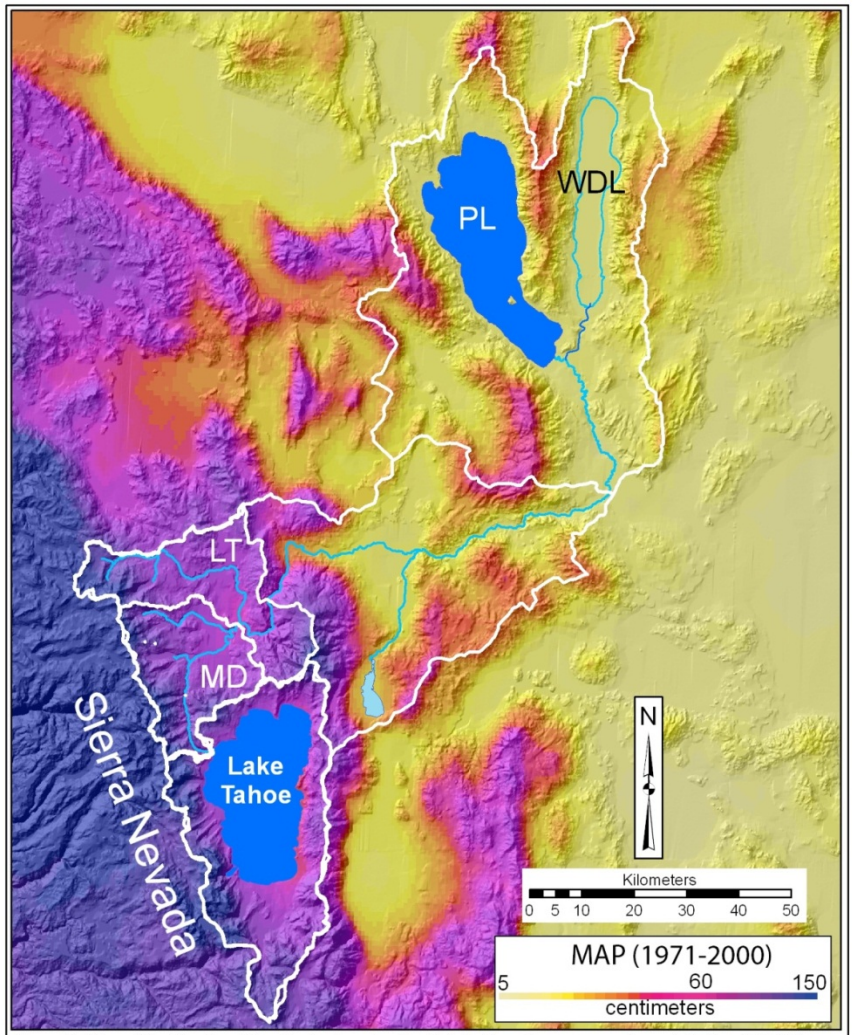


Figure 1. Map of the Truckee River basin showing the distribution of mean annual precipitation (MAP) in relation to the different modeling domains. The modeling domains of Lake Tahoe, Martis-Donner (MD), and Little Truckee (LT) are where most of the preciptation falls in this basin. Evaporation from Pyramid Lake (PL) and Winnemucca Dry Lake (WDL) is responsible for most of the water loss.

Future supply based on three basin-scale PRMS models of the Upper Truckee watershed: Lake Tahoe, Little Truckee and Martis-Donner Basins.

These models encompass the Truckee River watershed from Lake Tahoe down to the Farad Gage – this region accounts for the vast majority flow to the Truckee River.

RECLAMATION

PRMS Watershed Model

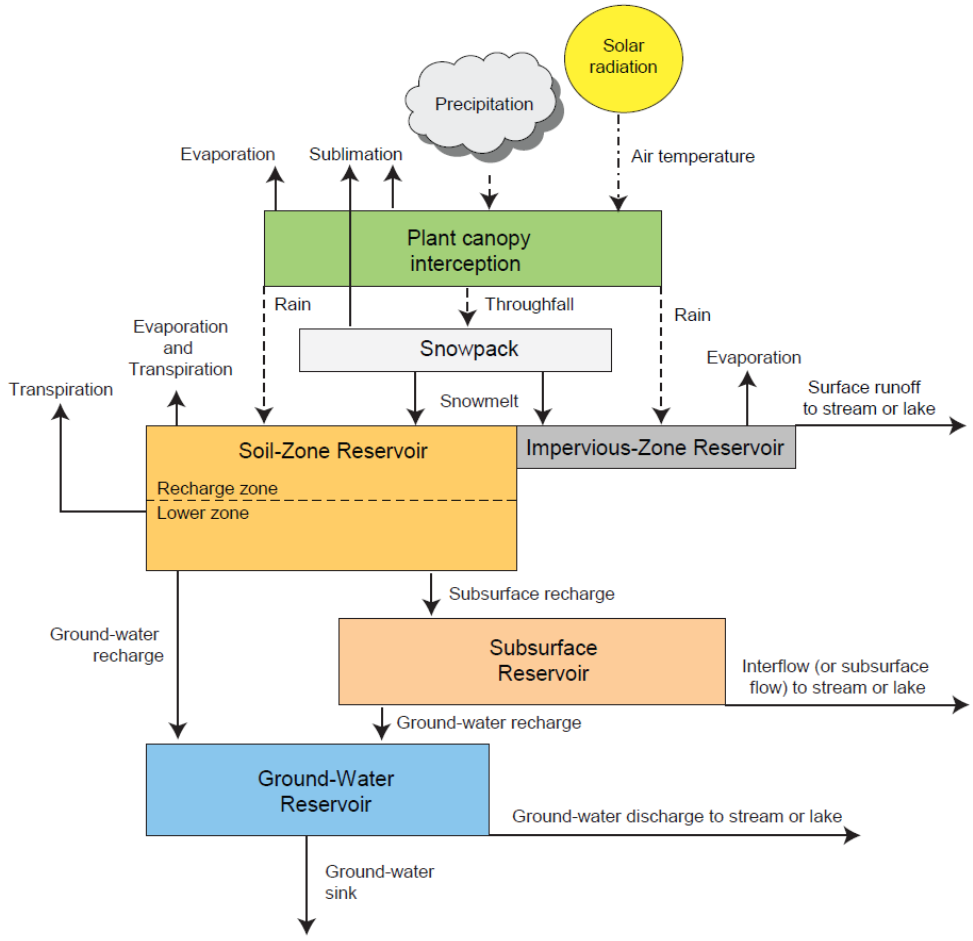


Figure 2. Schematic diagram of a watershed and its climate inputs (precipitation, air temperature, and solar radiation) simulated by PRMS (modified from Leavesley and others, 1983).

From Markstrom et al., 2008

The USGS code Precipitation-Runoff Modeling System (PRMS) simulates the dominant watershed processes affecting streamflow (with the exception of groundwater discharge).

The output of interest is streamflow, which serve as inputs into to the Truckee Basin Planning Model.

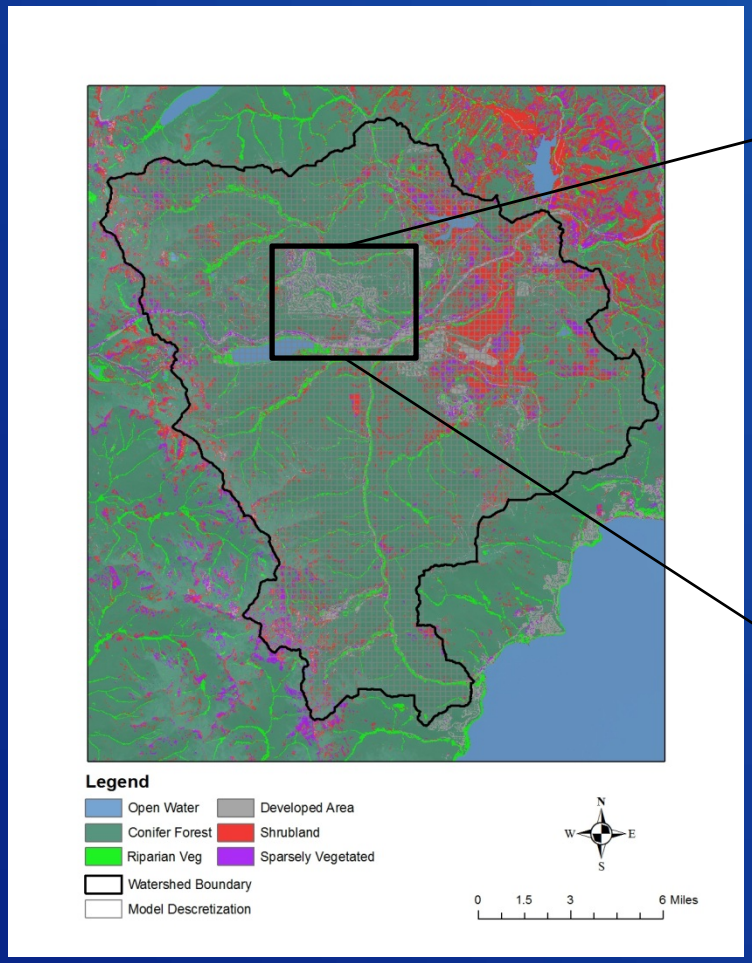
The model is forced with climate according to selected weather stations in the basin.

RECLAMATION

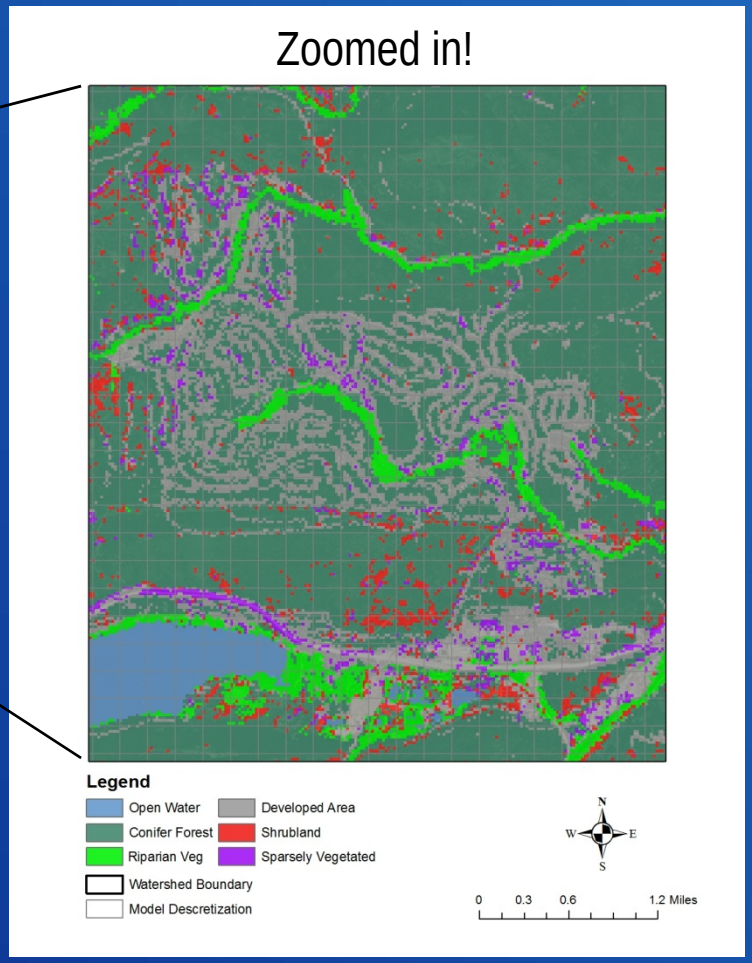
PRMS Model Development

- PRMS models have already been developed by DRI for the Lake Tahoe and Martis-Donner Basins – Little Truckee Basin PRMS model will be developed for this project using the exact same methodology used to develop and calibrate the other two PRMS models.
- These models are developed from extensive datasets describing soils, vegetation, elevation, slope, aspect, etc. and are forced by temperature and precipitation.
- Model calibration consists of matching simulated and historic (observed) streamflows within internal watershed gages.

Cover Type



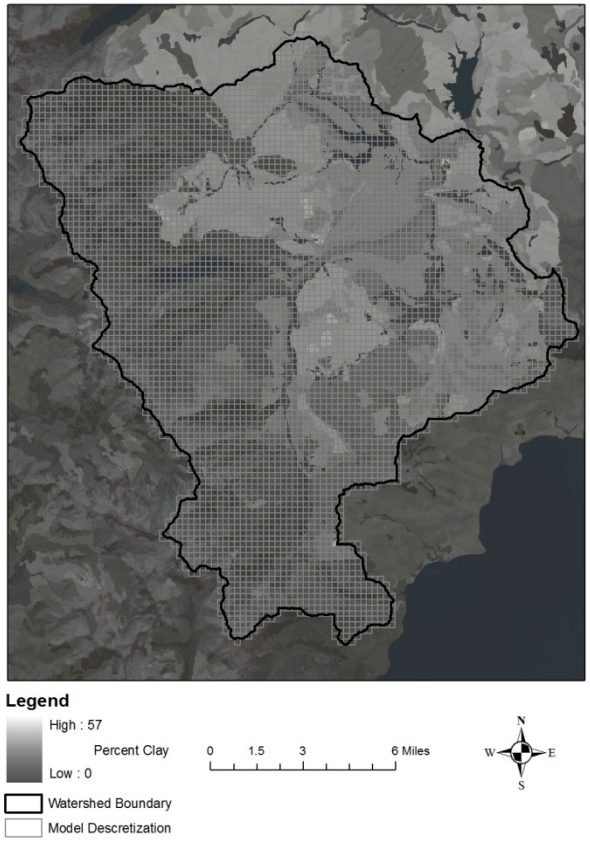
Zoomed in!



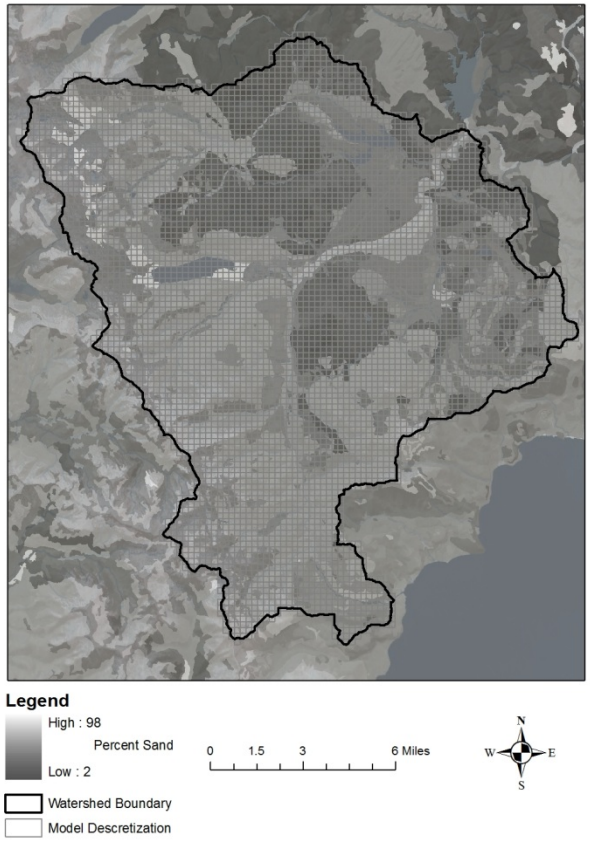
RECLAMATION

Soils Map

Percent Clay



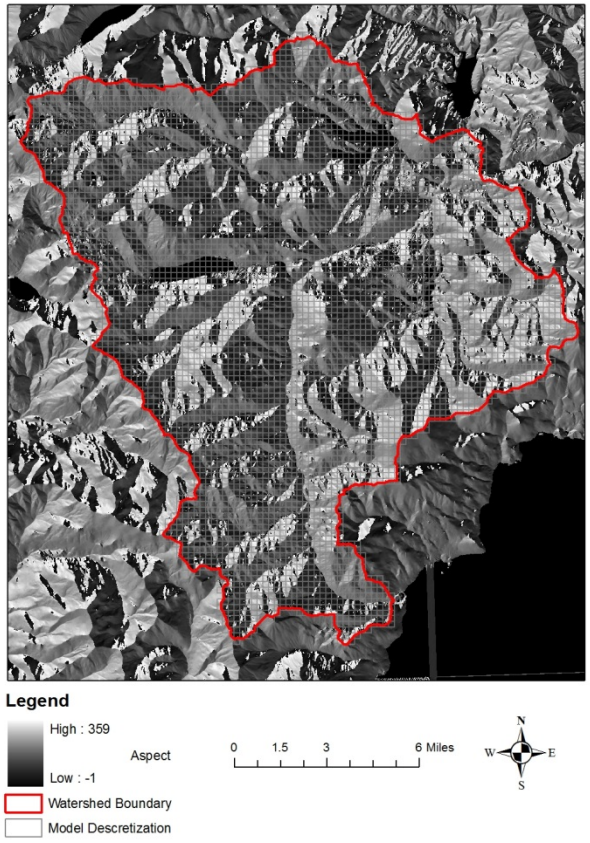
Percent Sand



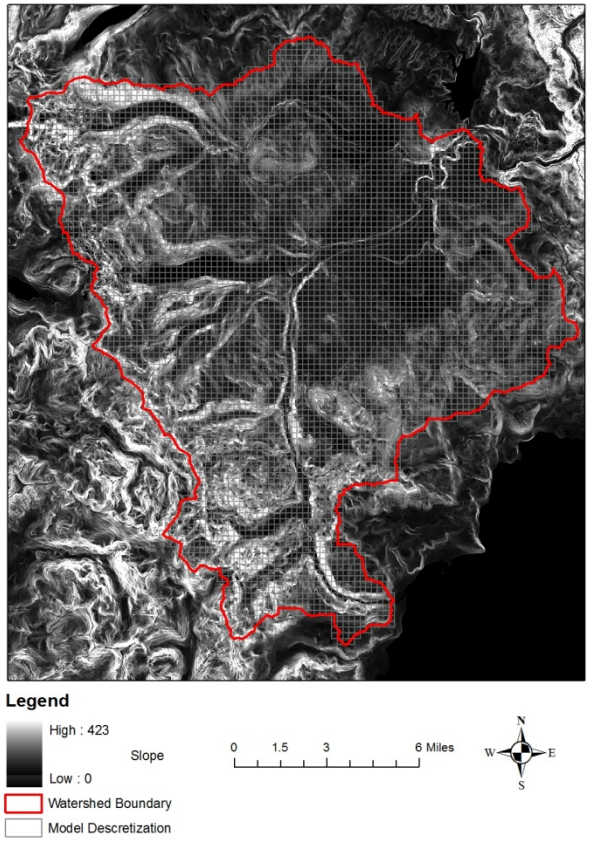
RECLAMATION

Aspect and Slope Map

Aspect



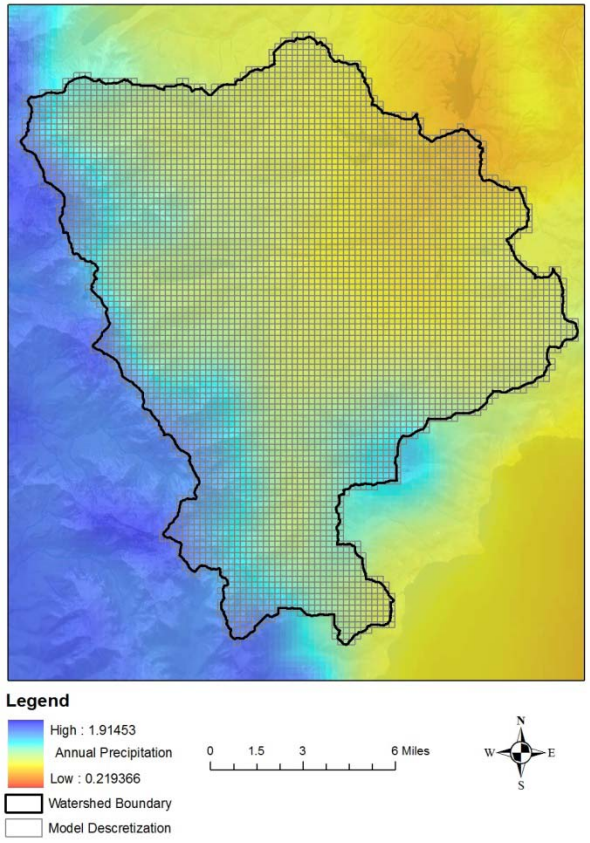
Slope



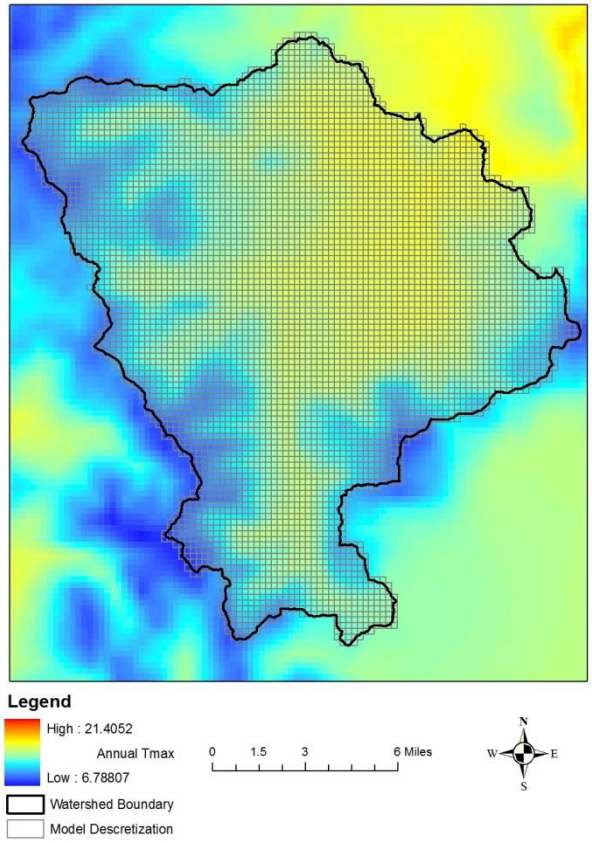
RECLAMATION

Martis-Donner Average Annual PPT, Tmax, Tmin (PRISM Projected: 1980-2011)

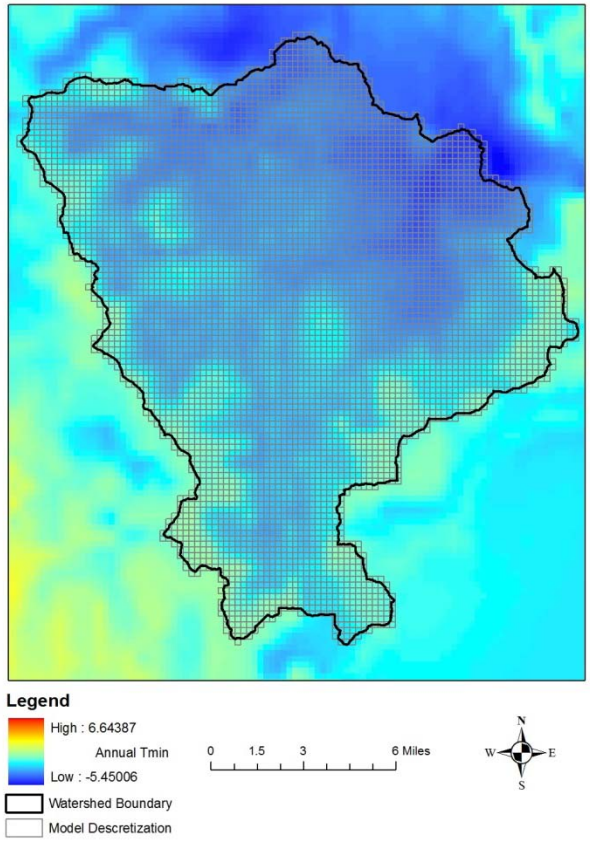
Precipitation



Tmax

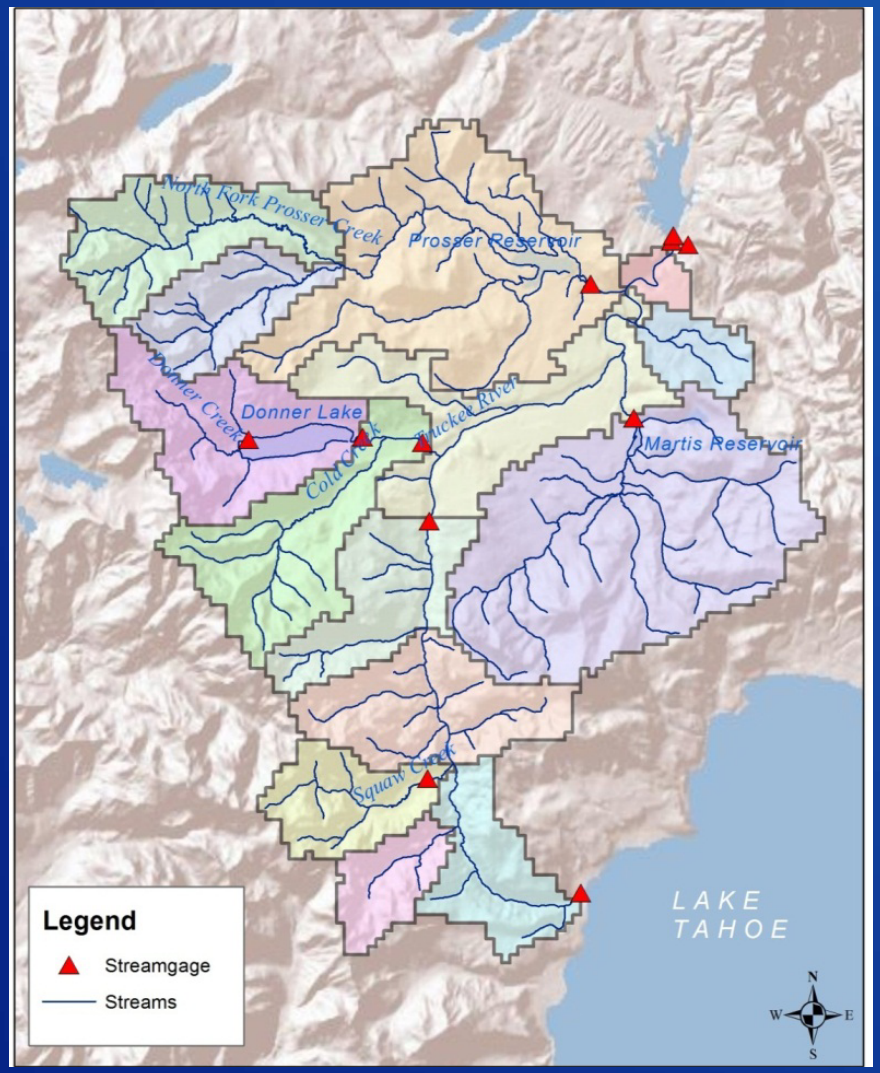


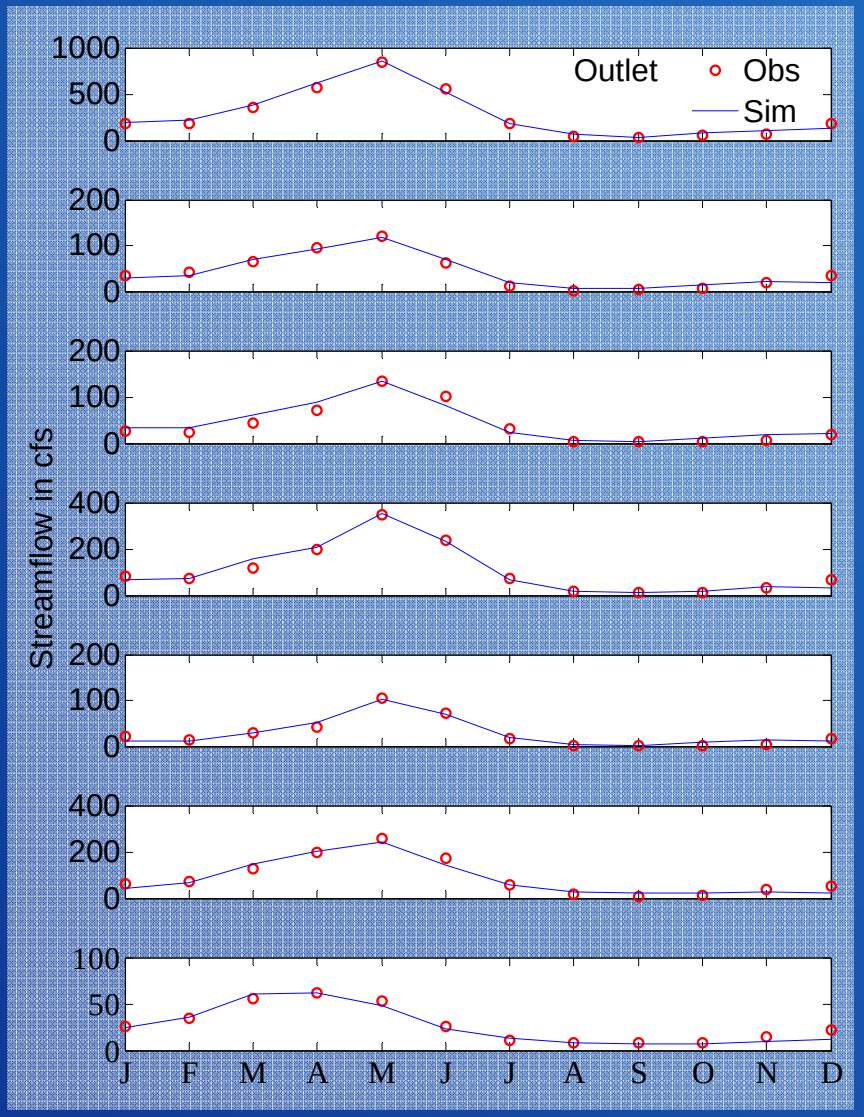
Tmin



RECLAMATION

Model Calibration



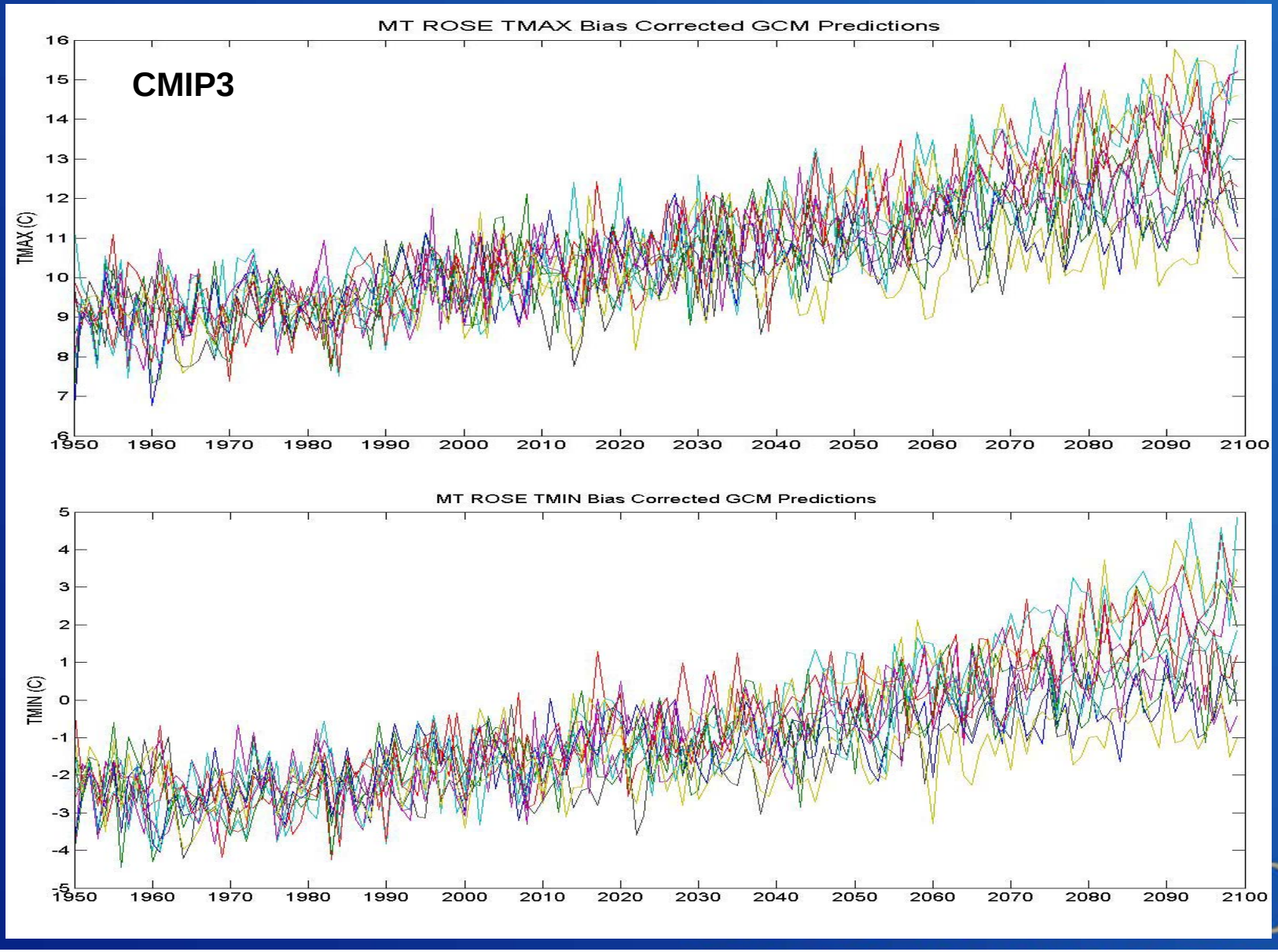


RECLAMATION

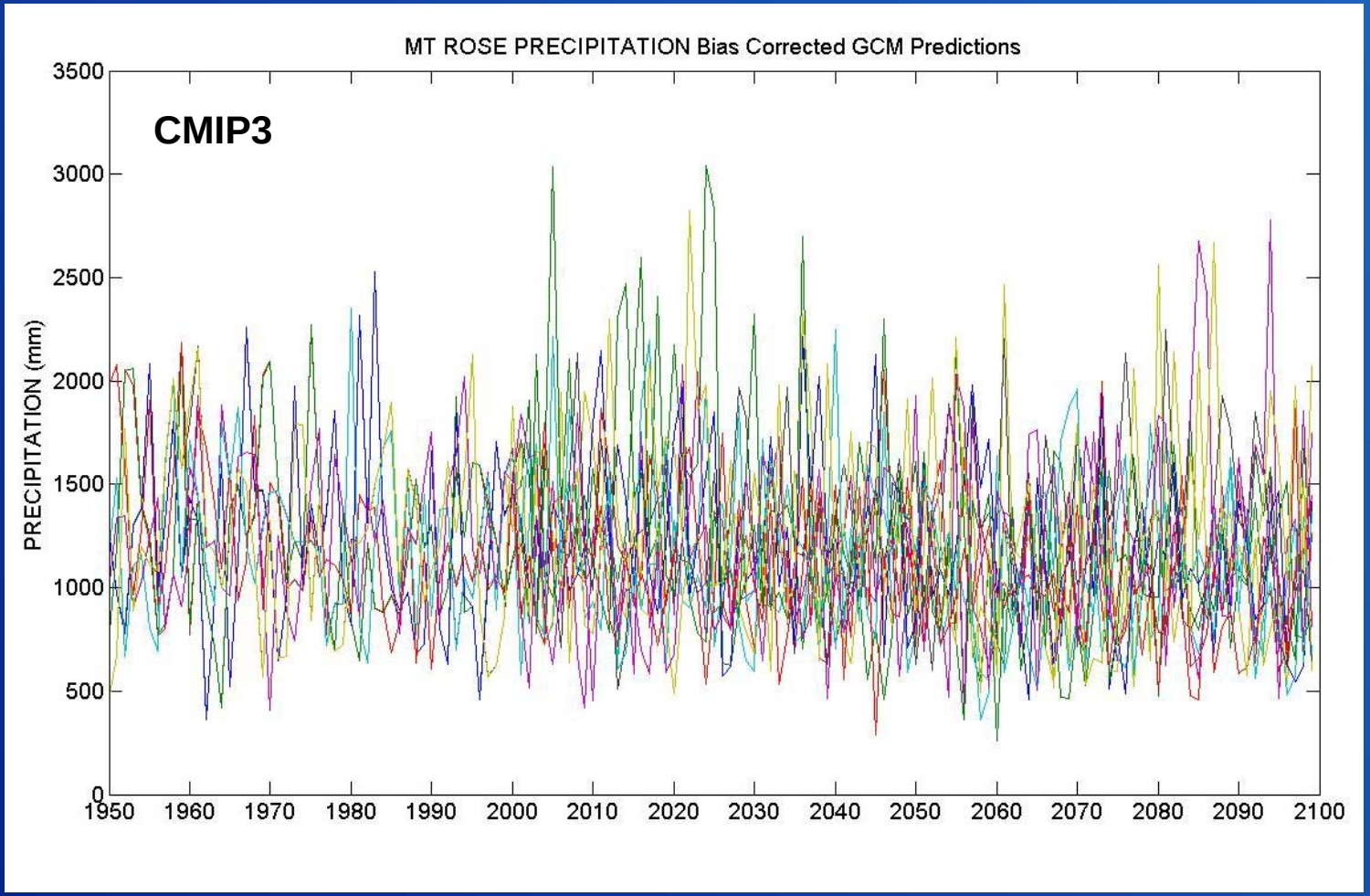
Climate Projections

- Future climate and its variability based on Global Circulation Model (GCM) projections.
- Specifically, Coupled Model Intercomparison Project Phase 3 (CMIP3) or Phase 5 (CMIP5) will be used.
- Both suites are bias-corrected and spatially-disaggregated (BCSD) by the BOR to a 12 km grid as part of the West-Wide Climate Risk Assessment.

Mt. Rose Station (Tmax and Tmin, 112 GCM)

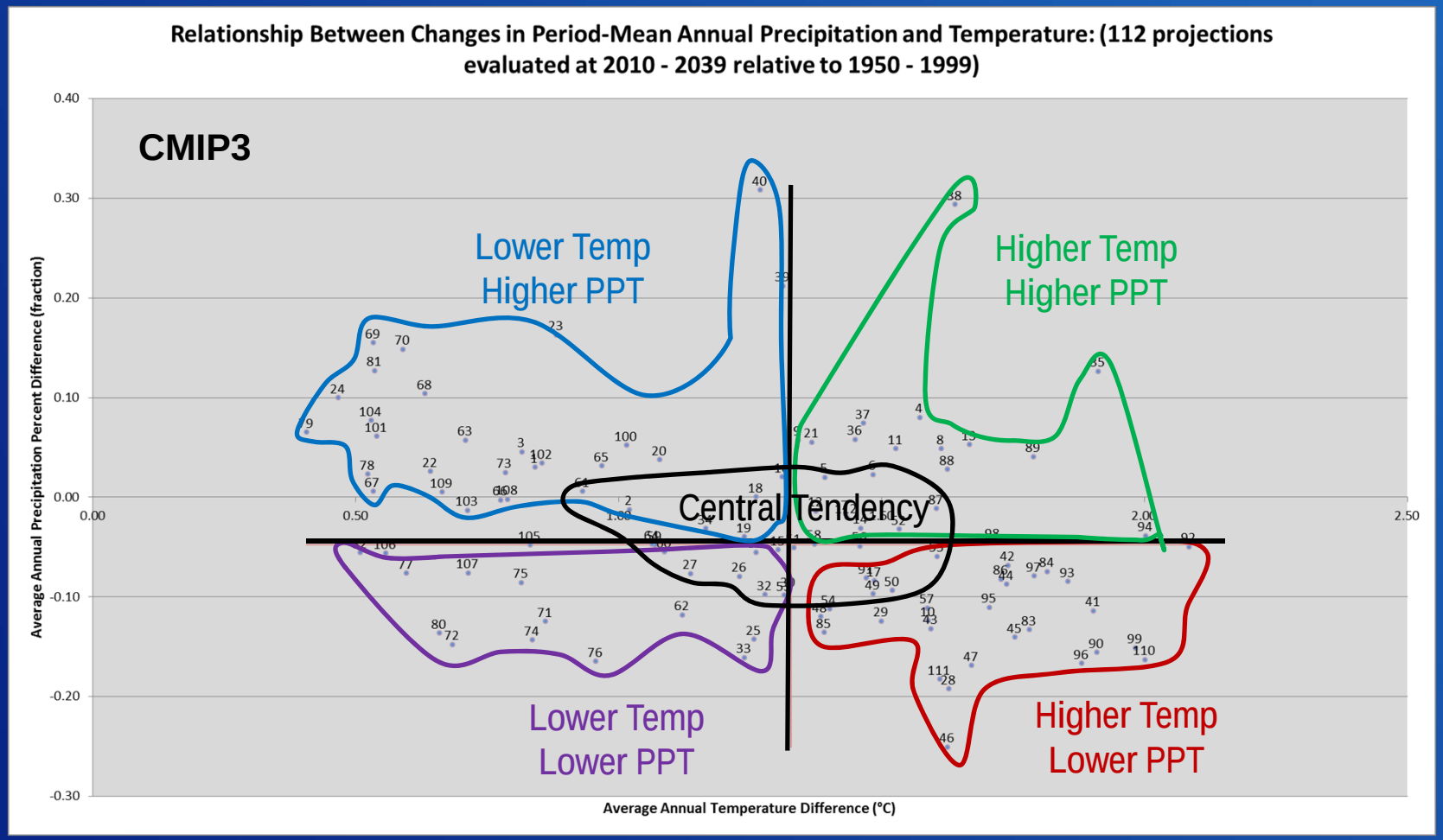


Mt. Rose Station (PPT, 112 GCM)

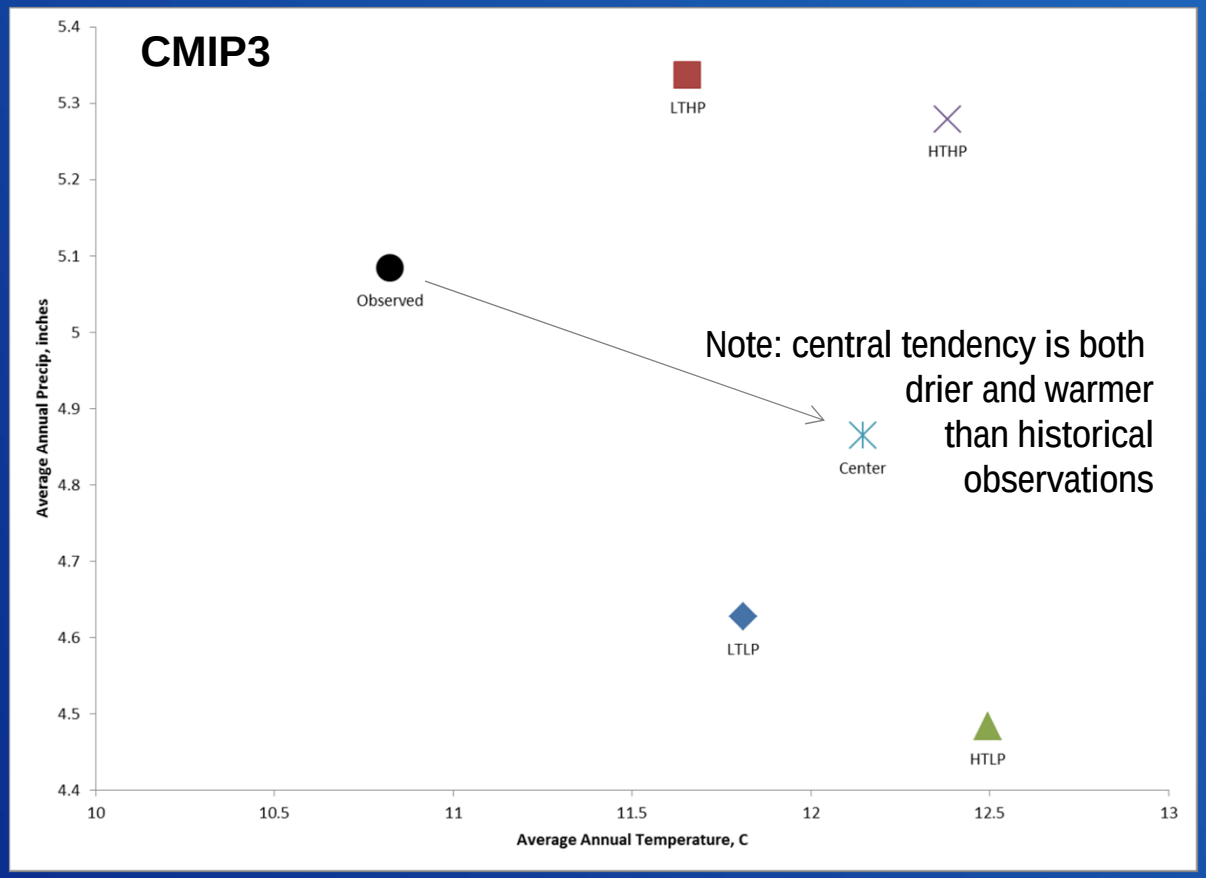


RECLAMATION

Hybrid-Delta Ensemble (HDe)



RECLAMATION



- **A number of projections within each quadrant and central tendency are combined to form ensemble-averaged projections.**
- **These projections are then delta-corrected for ppt and temp which incorporates observed periodicities in the historic record.**

RECLAMATION

Expected Results

- **Simulated future steamflows over 100 year period based on HDe climate projections computed from either CMIP3 or CMIP5 data: four quadrants, one central tendency, and one current for each of the three PRMS watersheds.**

- **Streamflows from each of these scenarios serve as inputs into the Truckee Basin Planning Model.**

RECLAMATION

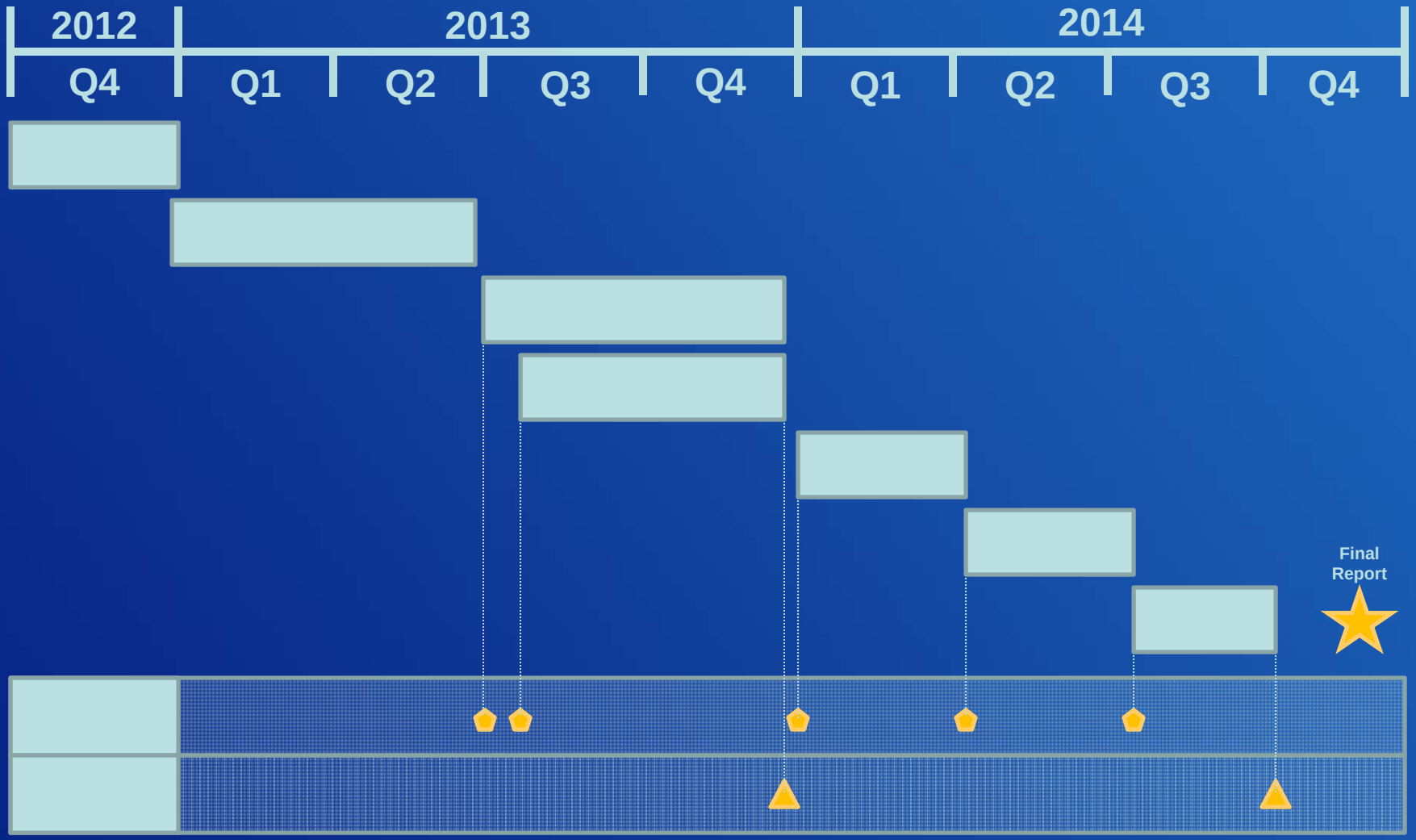
Technical Advisory Group Discussion

RECLAMATION

Ongoing and Future Basin Study Activities

RECLAMATION

Truckee Basin Study Schedule



RECLAMATION

Planned Workshops & Presentations

- **Technical Advisory Group Meetings**
  - **Demand, August 5 at 1:00 PM**
  - **Risk and Reliability Imbalance Metrics, Quarter 1 2014**
  - **Opportunities Identification, Quarter 2 2014**
  - **Strategy Development, Quarter 3 2014**
- **Public Presentations**
  - **Quarter 1 2014**
  - **Quarter 3 2014**

RECLAMATION

Basin Study Information

- Reclamation's Basin Study Program Website
  - http://www.usbr.gov/WaterSMART/bsp/studies.html
- Truckee Basin Study Website
  - http://www.usbr.gov/mp/tbstudy
  - Public information related to Study
  - Public meetings will be archived on the site
- Additional Information, Questions, and/or Comments
  - Arlan Nickel phone: 916-978-5061 or
    Shelley McGinnis phone: 916-978-4349
  - email: bor-mpr-truckeebasinstudy@usbr.gov

RECLAMATION