Collaborative Modeling to Support the 2004 Arizona Water Settlements Act

SAND2007-3235C

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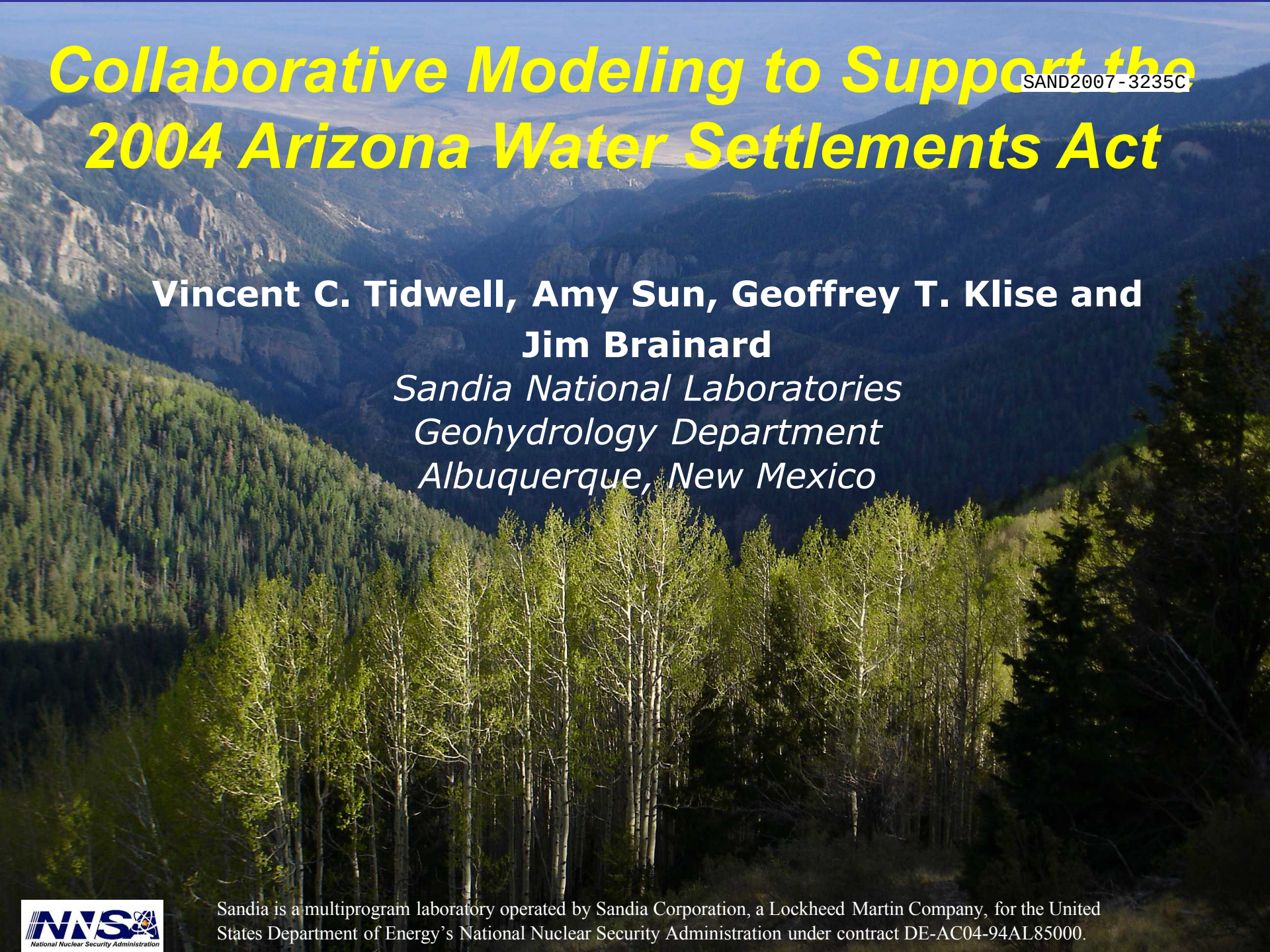

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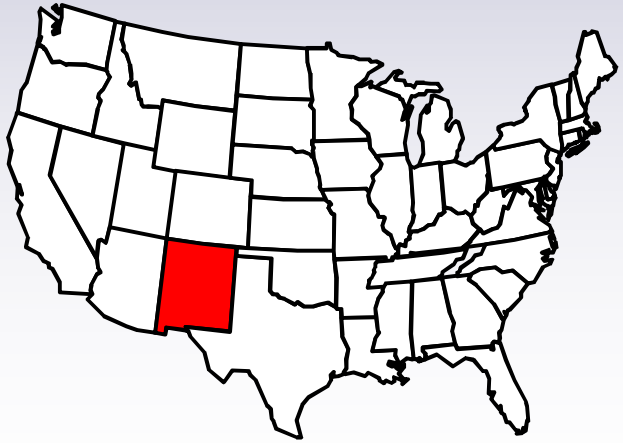
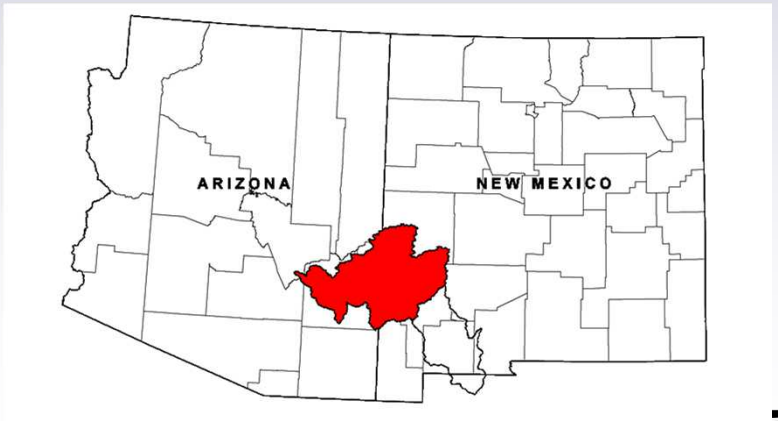
Settlement Background

- 2004 Arizona Water Settlements Act
  - Allows consumption of up to 140,000 acre feet of water in a 10-year period in the New Mexico reach of the Gila/San Francisco Basin (in exchange for Central Arizona Project water)
  - Diversions subject to the Consumptive Use and Forbearance Agreement (CUFA) to ensure downstream senior rights are not harmed
  - $66-$128 Million is available for “water utilization alternatives to meet water supply demands”





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Decision Structure

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Objective

- Our goal is to create an interactive, real-time decision tool to explore:
  - Water availability relative to CUFA and ESA constraints, and
  - Alternative approaches to utilizing water and funding.

- We want to de-mystify the complexity of the settlement language so that stakeholders and decision-makers are better informed.

Create an informed basis for decision making.

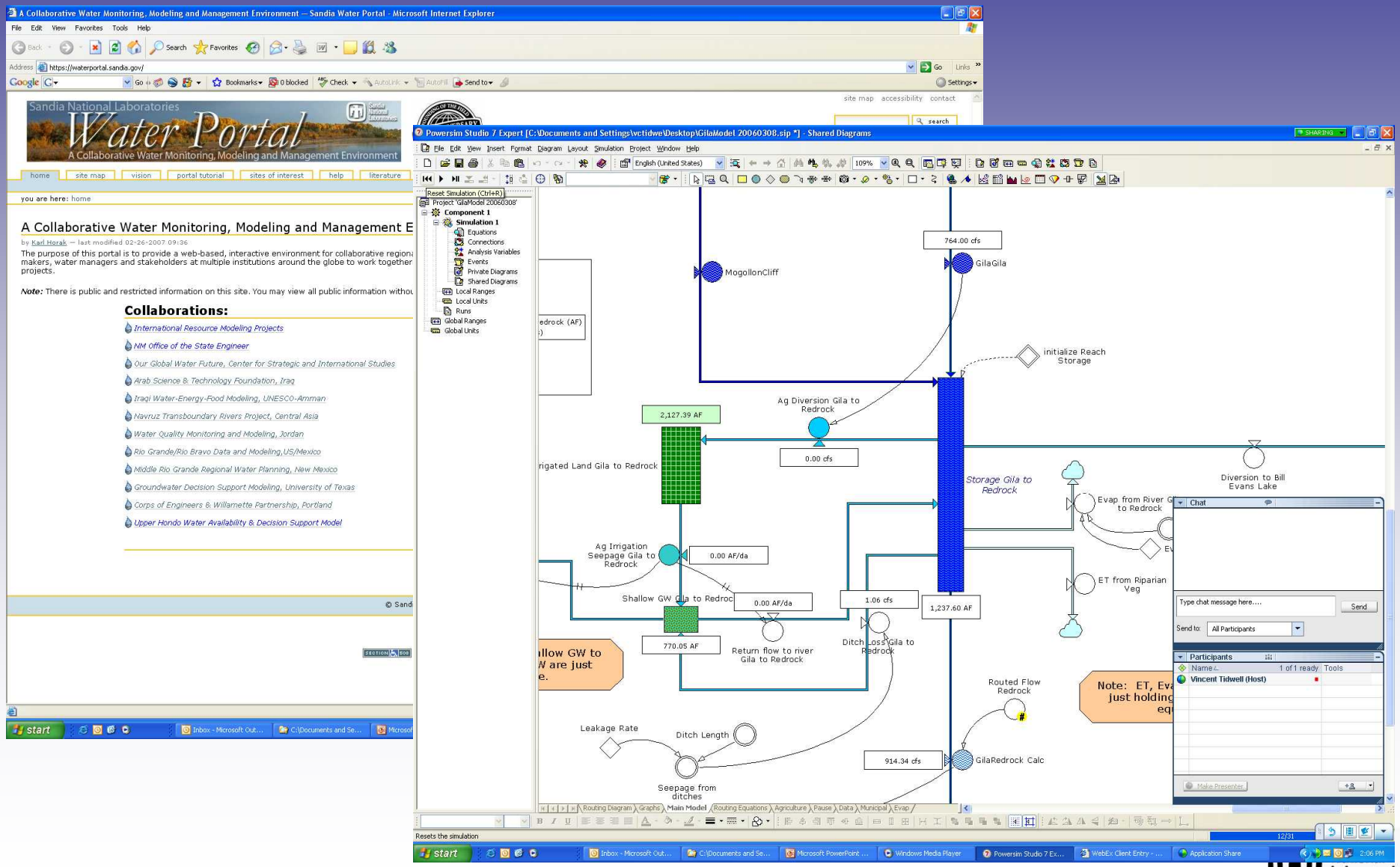
Collaborative Modeling Team

- Implemented an open and transparent model development process.
- Team began meeting in October 2005.
- Team has 2 hour meetings every other week and quarterly face to face meetings.
- Model development process:
  - Team develops causal structure of model,
  - Team identifies data,
  - Sandia develops model,
  - Team reviews model and output.

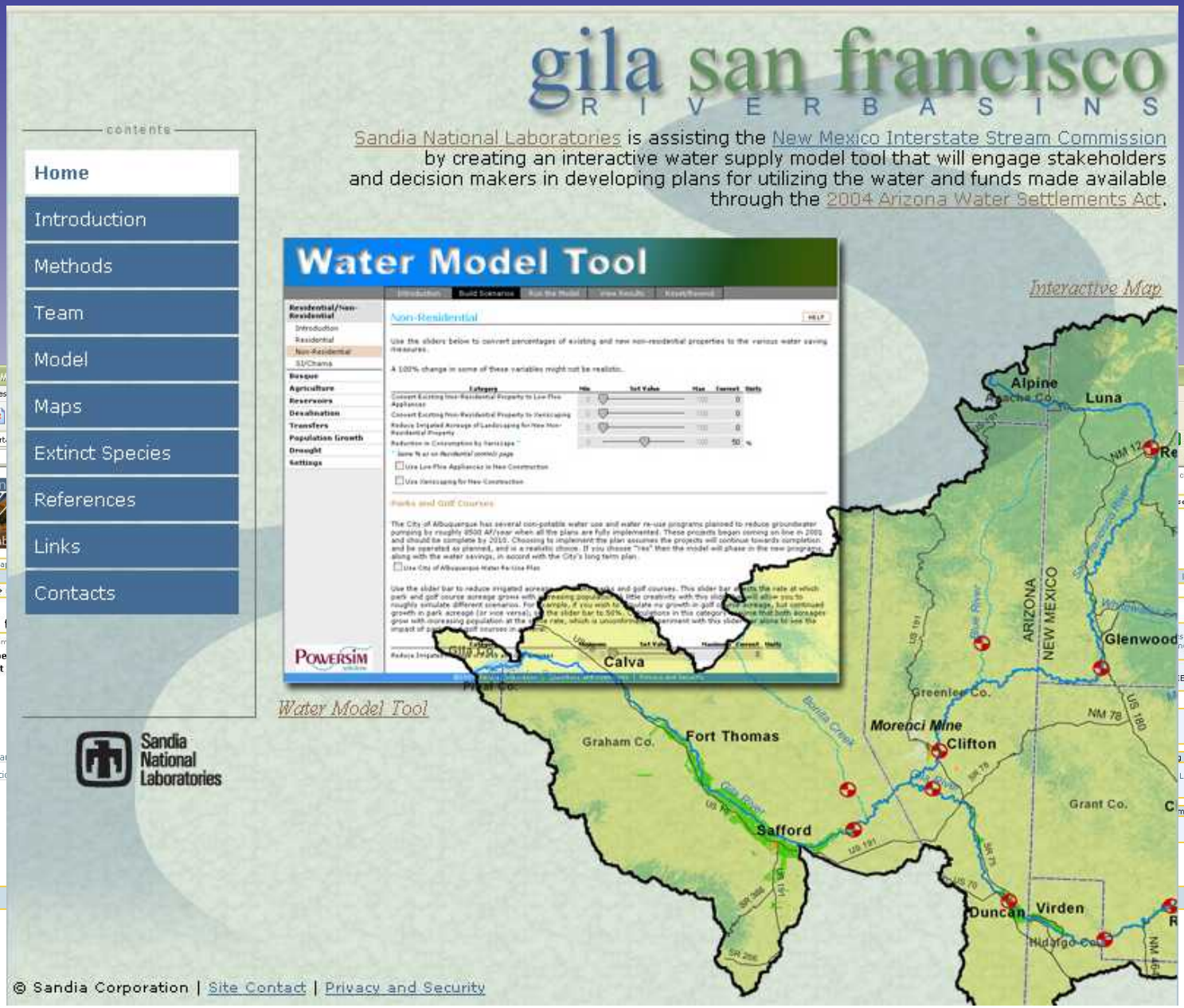
Team Composition

- Bureau of Reclamation
- New Mexico Interstate Stream Commission
- US Fish and Wildlife Service
- Municipalities of Silver City and Deming
- Soil and Water Commission representatives from Grant, Catron, and Luna Counties
- The Nature Conservancy
- Gila Conservation Coalition
- Concerned citizens
- Sandia National Laboratories

Meeting Venue



Information Sharing



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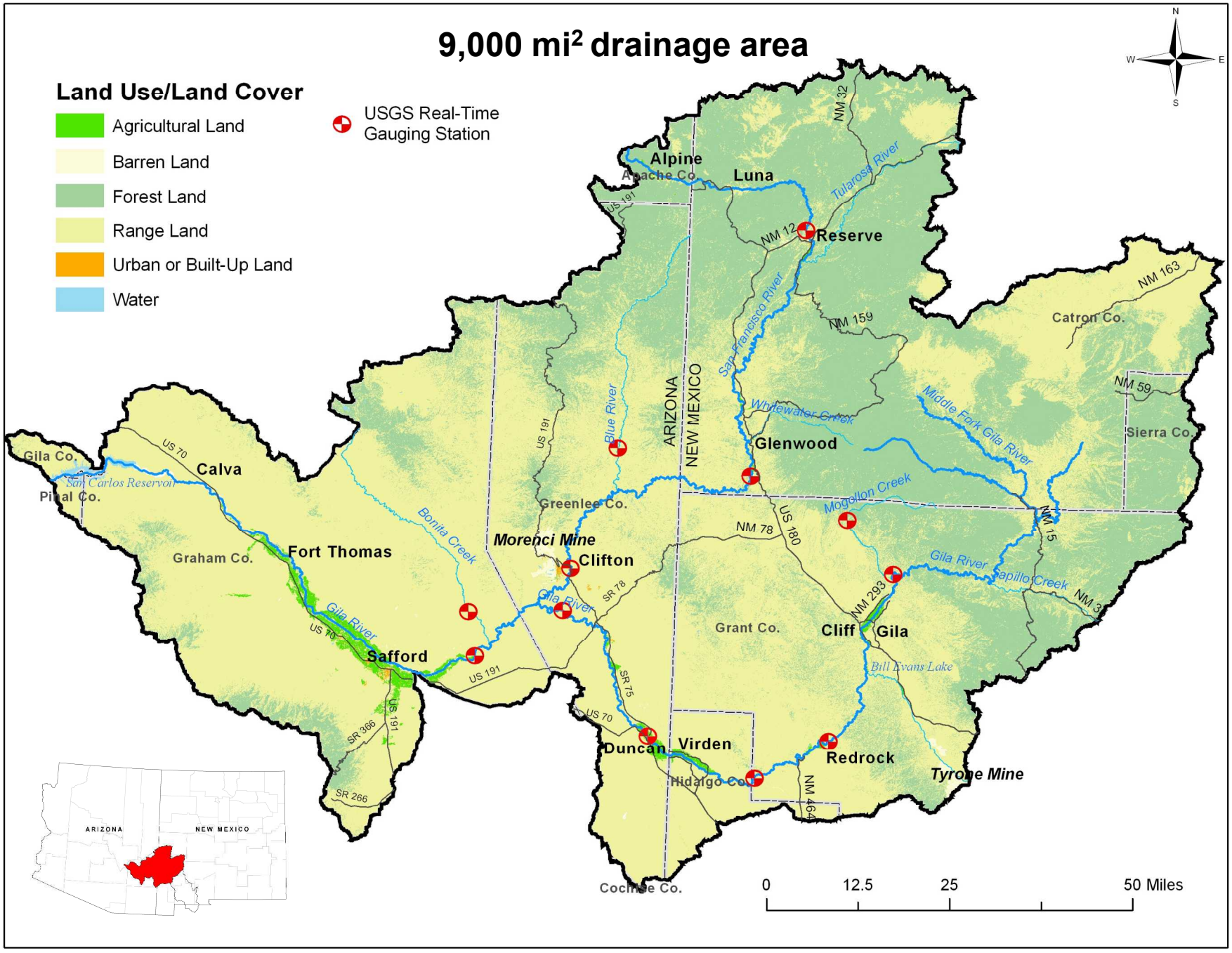
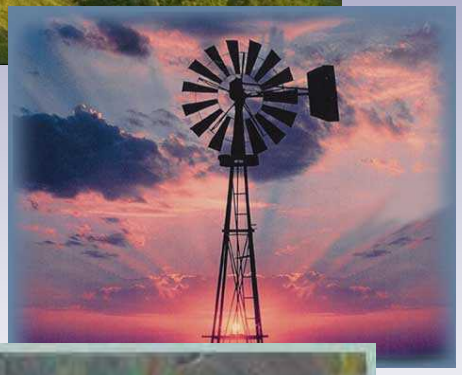

9,000 mi² drainage area
Land Use/Land Cover
Agricultural Land
Barren Land
Forest Land
Range Land
Urban or Built-Up Land
Water
USGS Real-Time Gauging Station
N
W
E
S
Alpine
Apache Co.
Luna
Reserve
NM 32
NM 12
US 191
Tularosa River
San Francisco River
NM 159
NM 163
Catron Co.
NM 59
Sierra Co.
ARIZONA
NEW MEXICO
Blue River
Whitewater Creek
Middle Fork Gila River
Glenwood
Gila Co.
US 70
Calva
San Carlos Reservoir
Pinal Co.
Greenlee Co.
Mogollon Creek
NM 78
US 180
NM 15
Bonita Creek
Morenci Mine
Clifton
Graham Co.
Fort Thomas
Gila River
SR 78
Gila River
Tapillo Creek
NM 293
NM 3
Grant Co.
Cliff
Gila
Bill Evans Lake
US 70
Safford
US 191
SR 75
US 191
SR 366
US 70
Duncan
Virden
Redrock
Tyrone Mine
Hidalgo Co.
NM 464
SR 266
Cochise Co.
0
12.5
25
50 Miles
ARIZONA
NEW MEXICO

Water Use in Basin

- Adjudicated basin.
- Water uses:
  - Irrigated agriculture,
  - Livestock,
  - Mining,
  - Domestic wells,
  - Municipal/mutual domestics.
- Potential for water use outside basin:
  - Silver City,
  - Deming,
  - Lordsburg.



Environmental Concerns

- Last major free flowing river in New Mexico

- Rich riparian habitat

Environmental Concerns

Federally listed threatened and endangered species

- Southwestern Willow Flycatcher

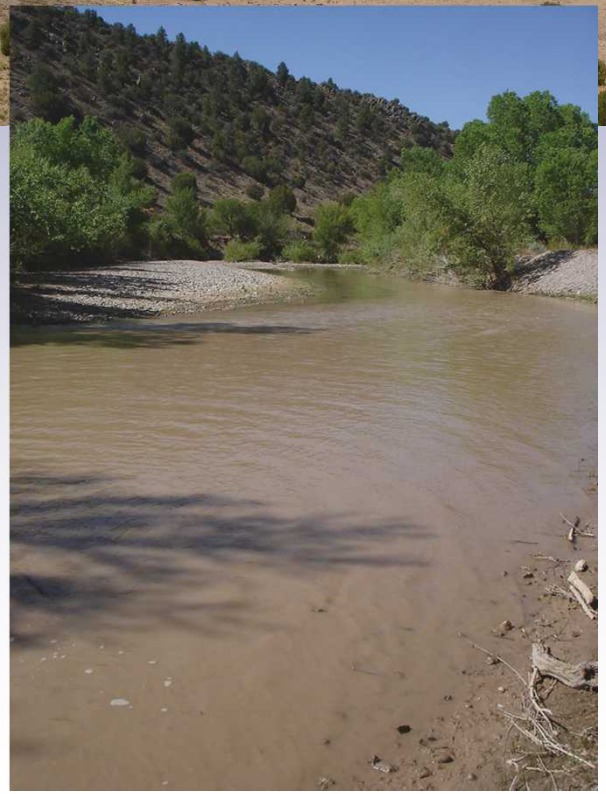
- Gila Trout

- Gila Chub

- Spikedace

- Loach Minnow

- Gila Topminnow



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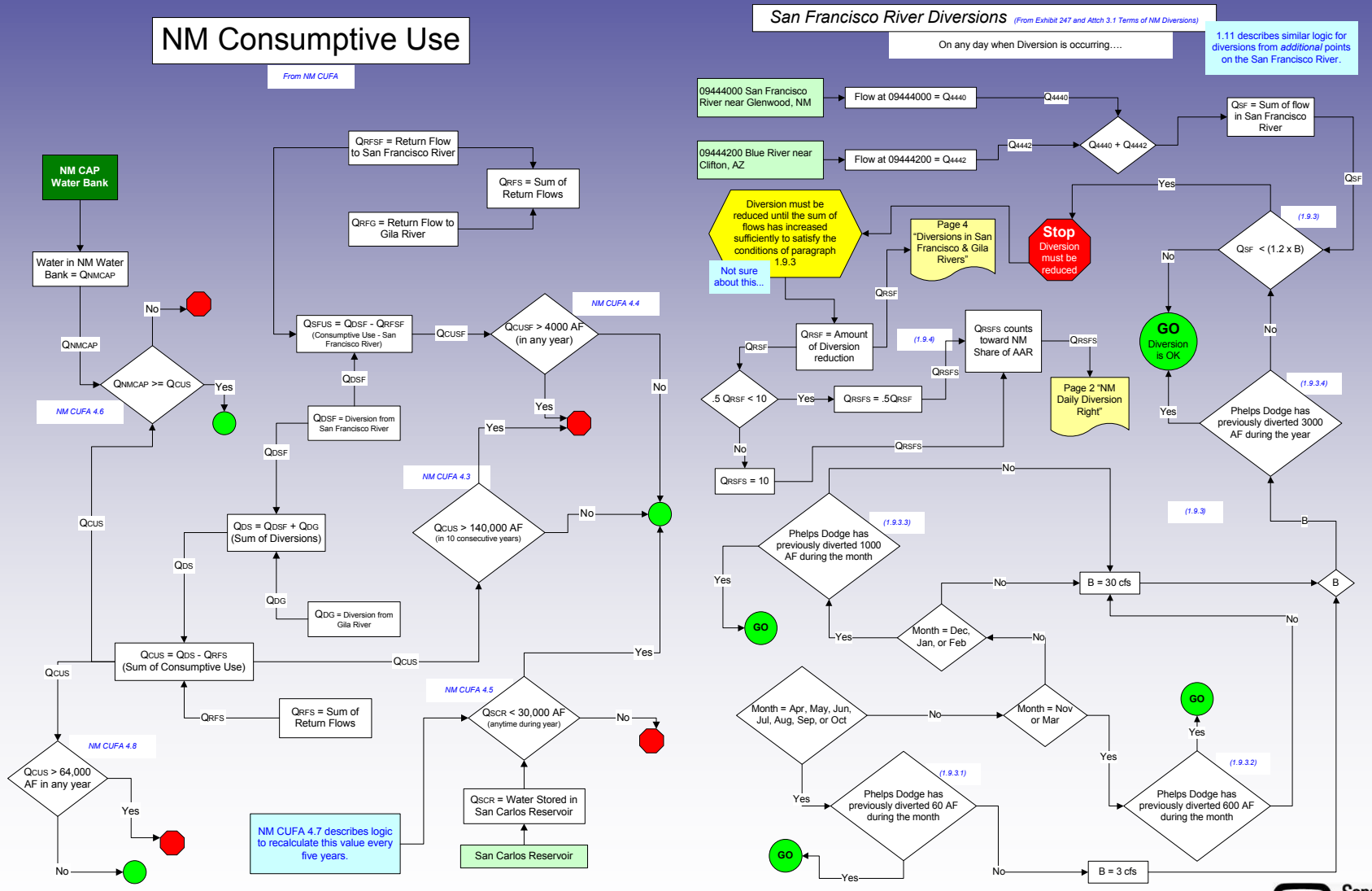
Institutional Controls



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Model Components

- Surface water hydrology
- Ground water hydrology
- Watershed hydrology
- Water demand
  - Residential/commercial
  - Industrial/mining
  - Agricultural/livestock
  - Evaporative/riparian
- Institutional constraints
  - CUFA
  - ESA

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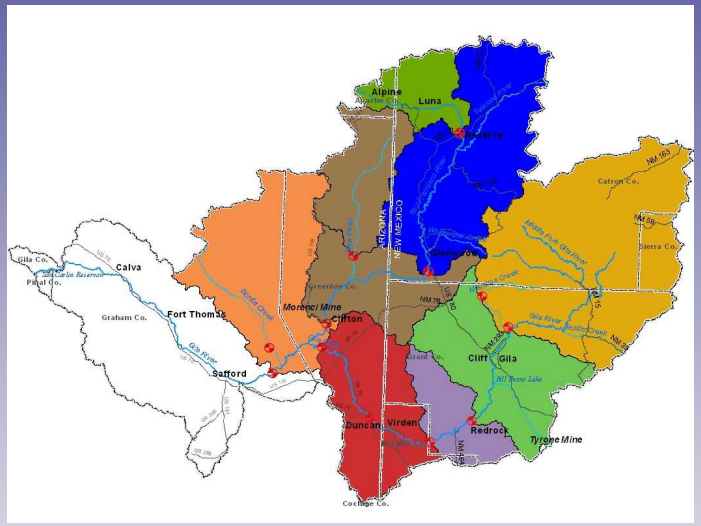
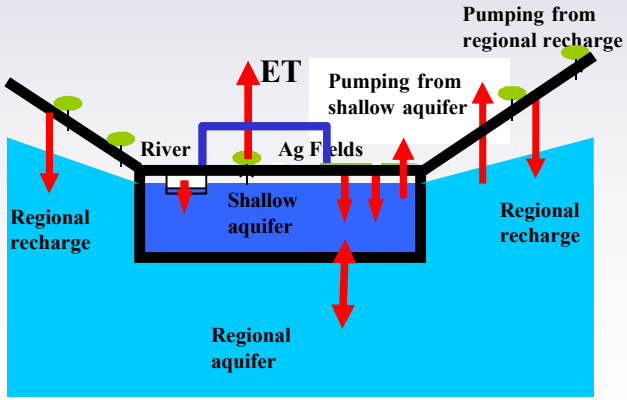
Surface and Ground Water Model

• Basin is broken up into 8 “reaches” defined by stream gauges used in the CUFA



• The ground water component is broken up into a regional and fluvial aquifer per reach



• Daily model with routed flows

• Calculated flows and river stage are “average” over that reach

• Model also can look at flows over sub-reach “critical regions”

• The model can account for:

- Evaporative losses
- Irrigation diversions and returns
- Aquifer interaction
- River leakage or gains

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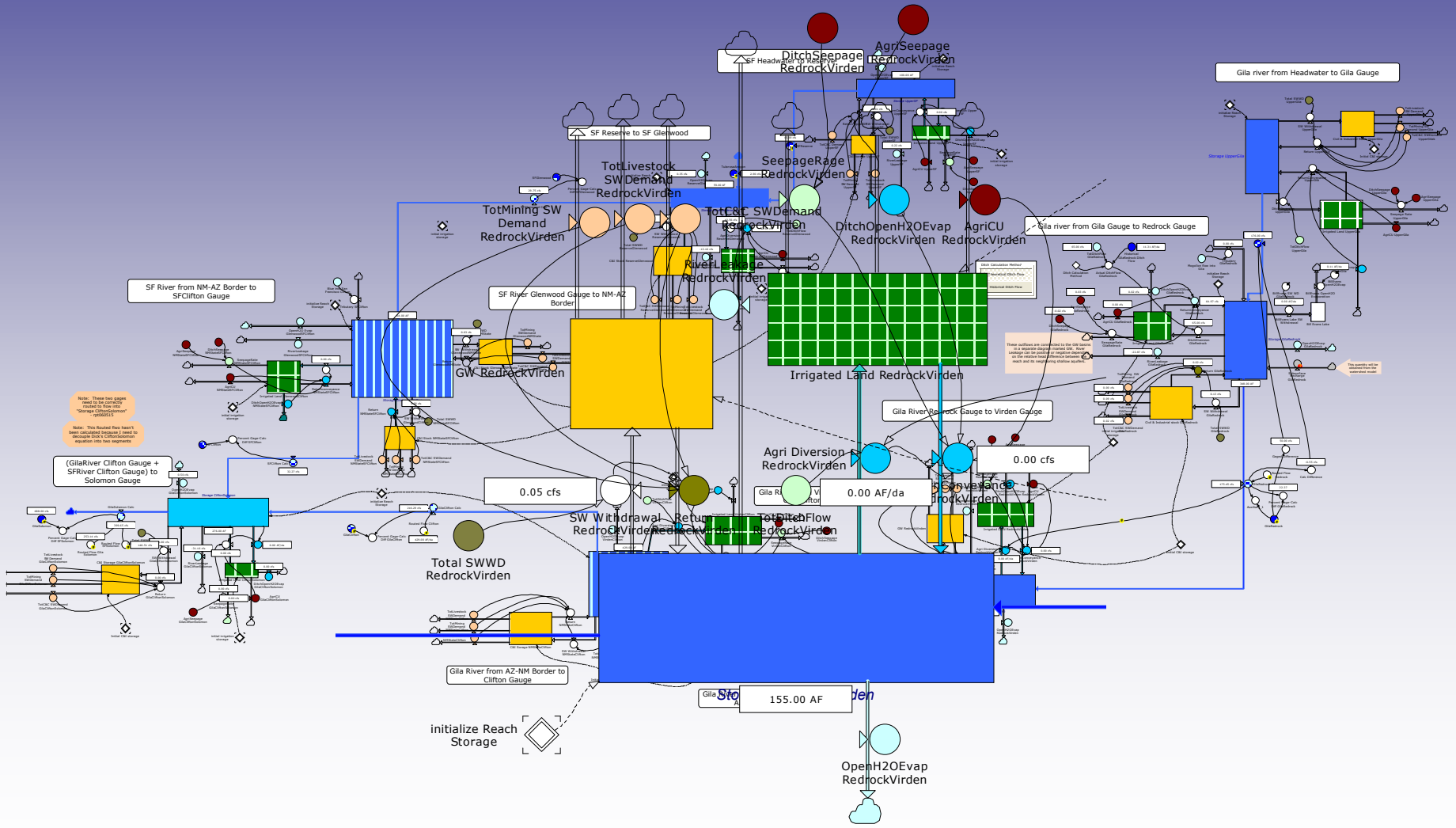
System Dynamics Model



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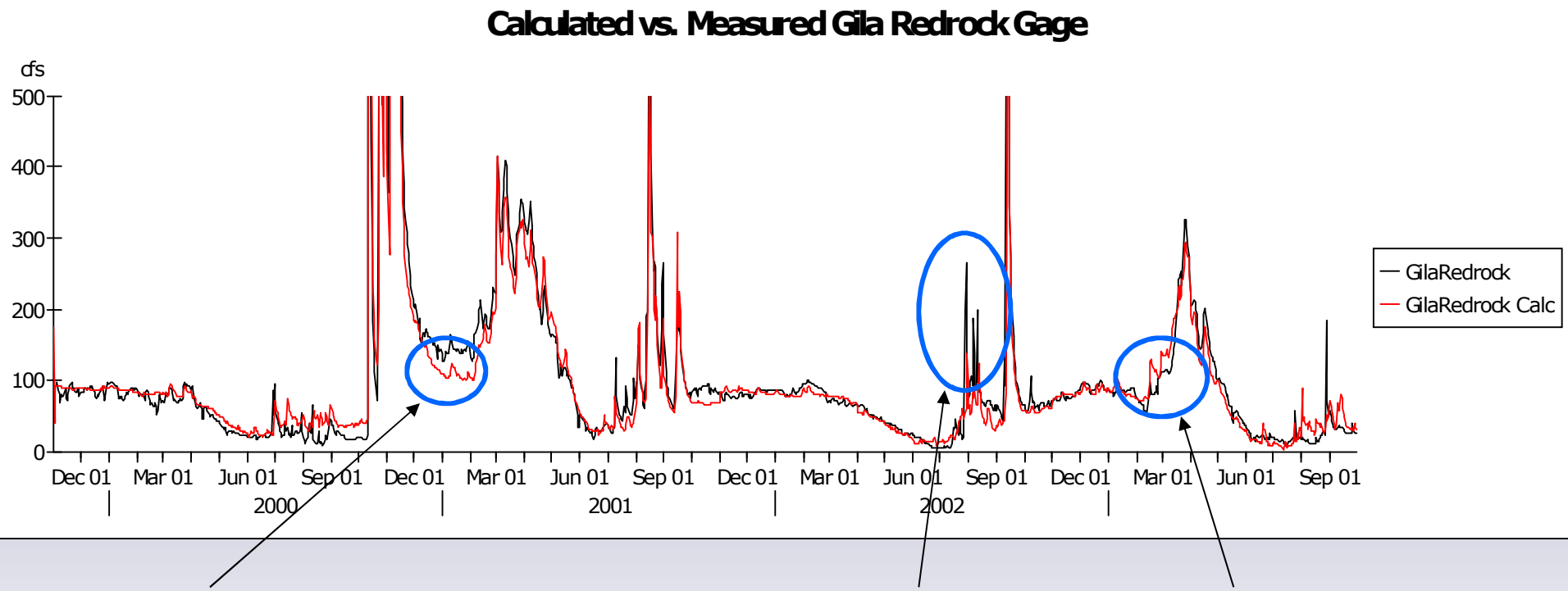
Model Calibration



- Dynamics between fluvial and regional aquifers may be causing this discrepancy

- Tributary contributions from summer monsoon events and snowmelt are missed

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Model Interface

Irrigation Control

Gila River Basin
Modify Agricultural Acreage by Reach

Modify Upper Gila Irrigated Acres

-100 -80 -60 -40 -20 0 20 40 60 80 100
%

0% - Historical Value , 100 % is Max Adjudicated

Modify Gila-Redrock Irrigated Acres

-100 -80 -60 -40 -20 0 20 40 60 80 100
%

0% - Historical Value, 100 % is Max Adjudicated

Modify Redrock-Virden Irrigated Acres

-100 -80 -60 -40 -20 0 20 40 60 80 100
%

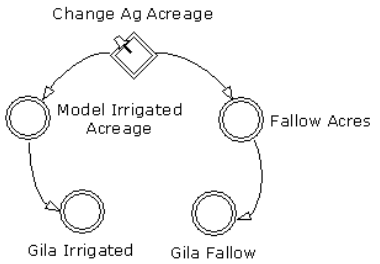
0%- Historical Value, 100 % is Max Adjudicated

Modify Virden-Clifton Irrigated Acres

-100 -80 -60 -40 -20 0 20 40 60 80 100
%

0% - Historical Value, 100 % is Max Adjudicated

Irrigated Acres	Fallow Acres
26 acre	97 acre
1,318 acre	529 acre
155 acre	318 acre
1,944 acre	1,056 acre



Note: A value of -9999 acres indicates there are no recorded rights for irrigable land.

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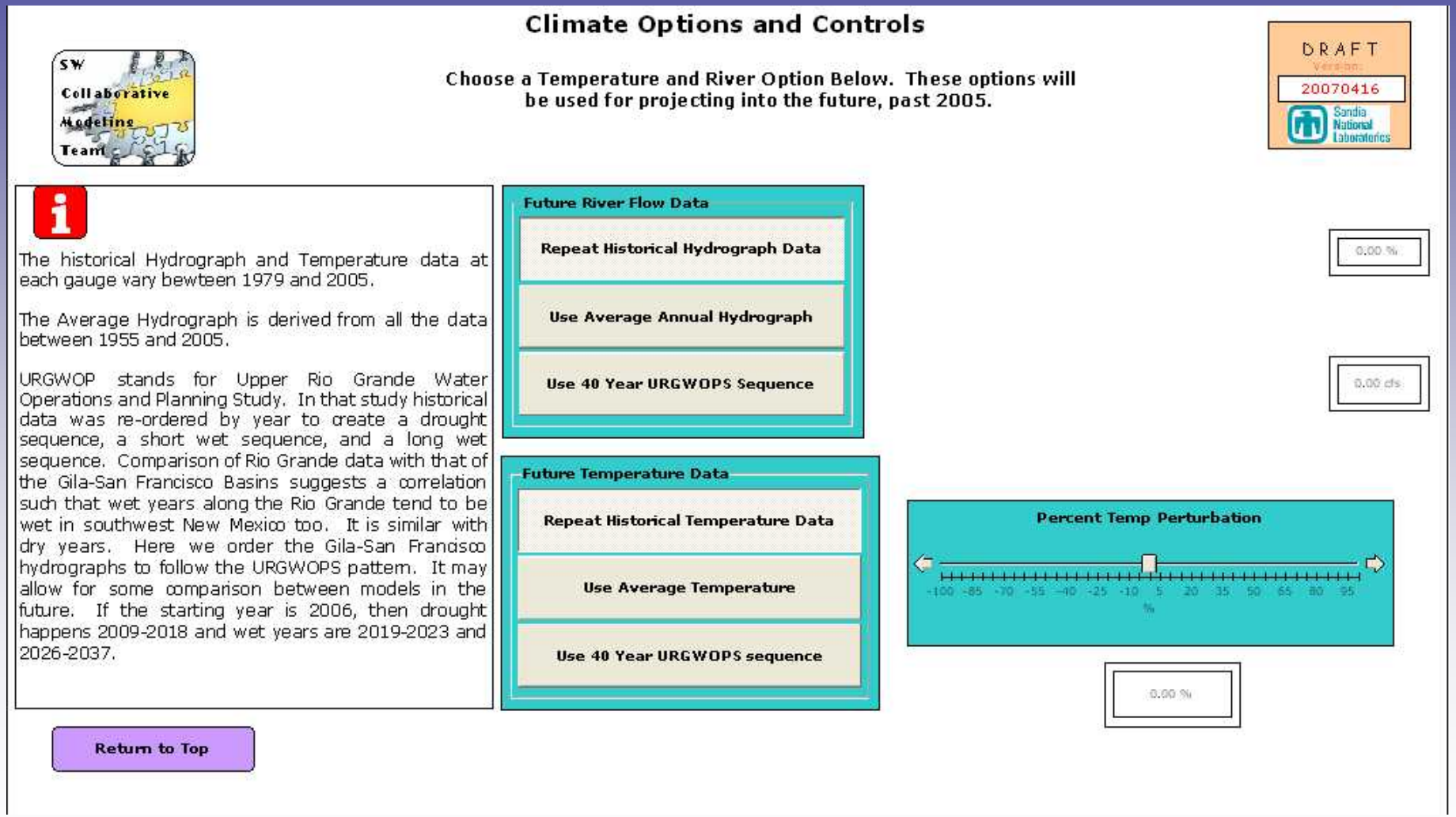
Climate Control



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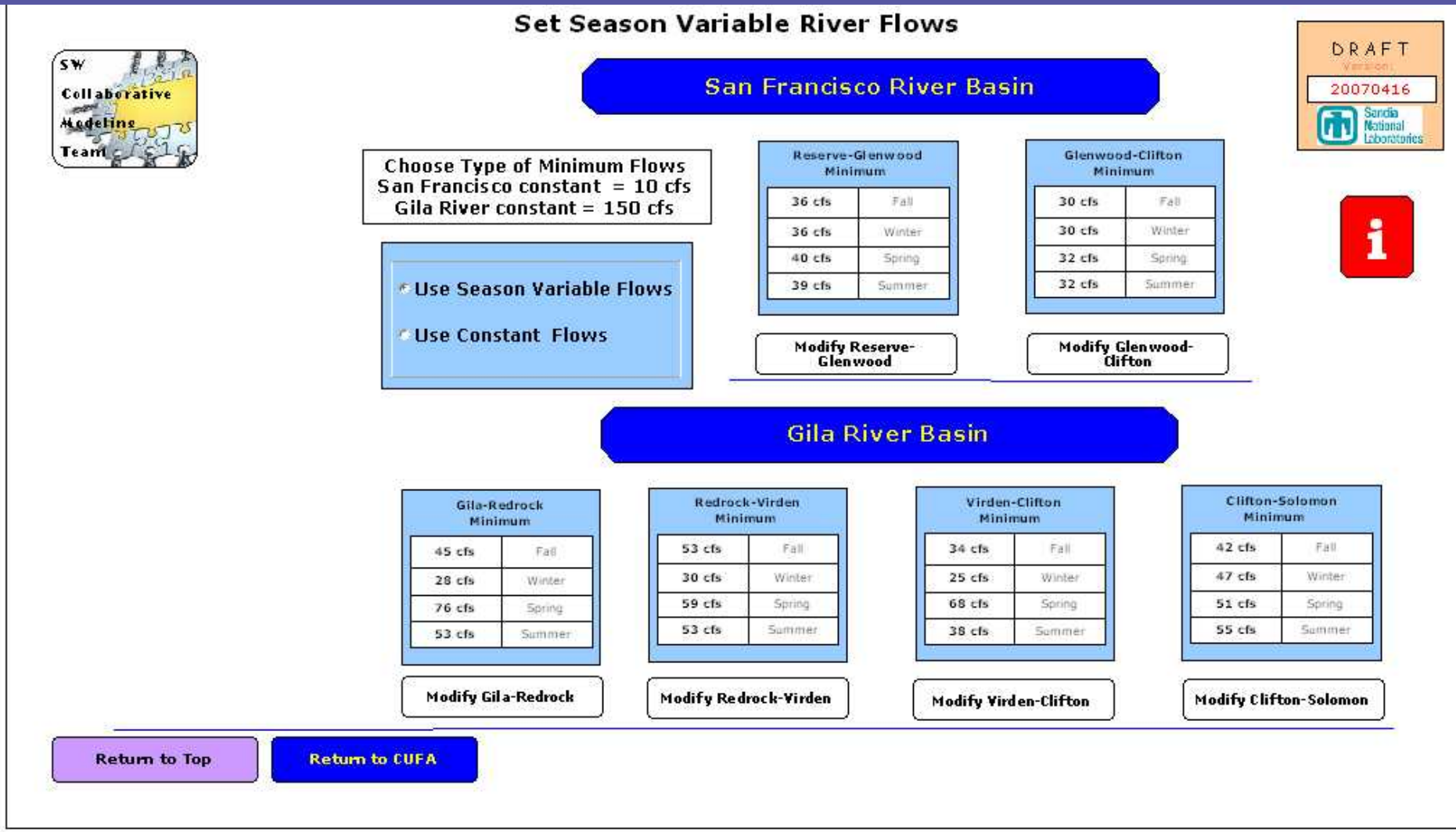
Target Flow Control



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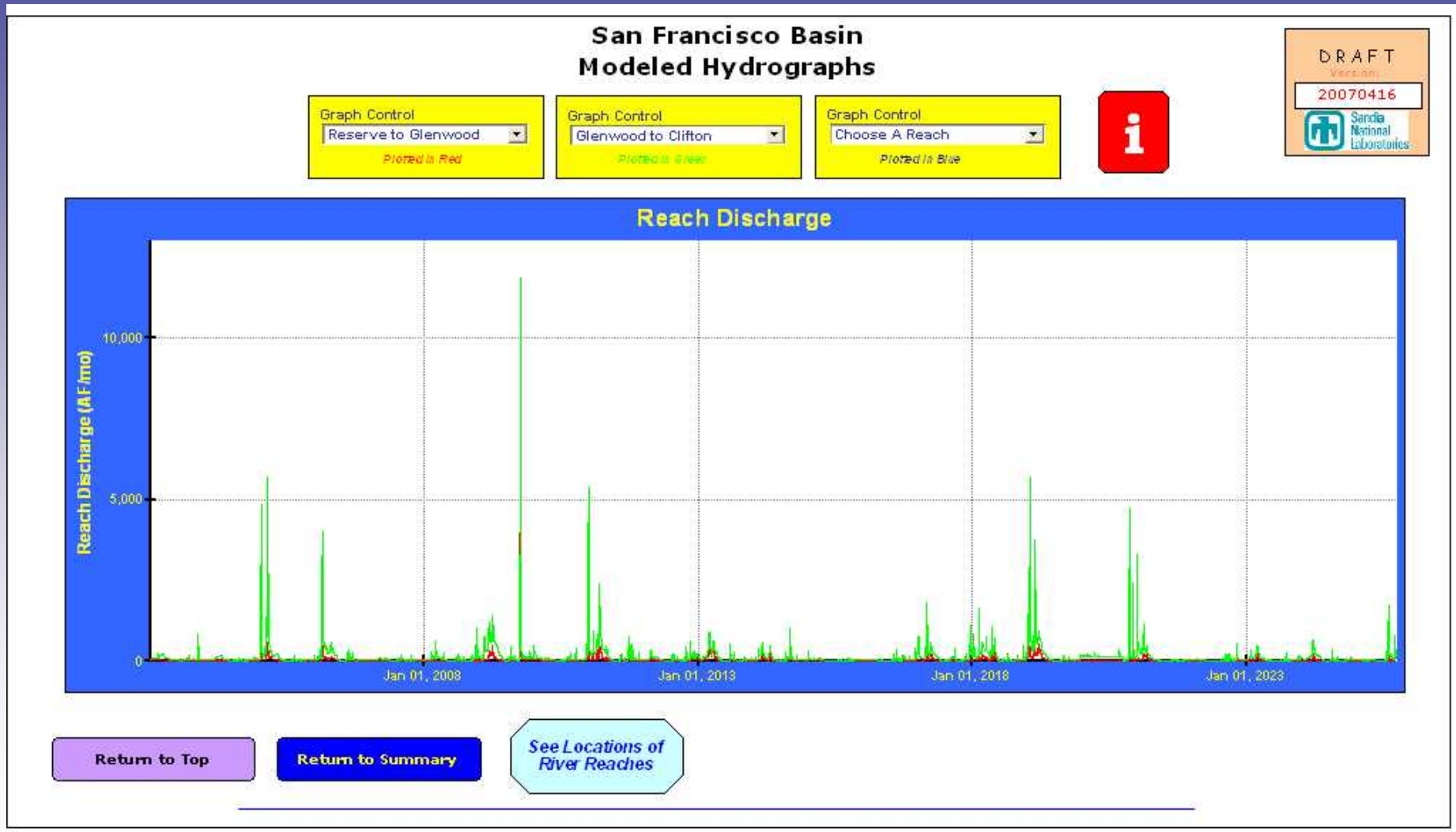
Hydrograph Output



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CUFA Output

Controls
Pause Controls
Diversions
Test Summary
San Francisco
Detailed Diversion
Minimum Flows
Water Bank
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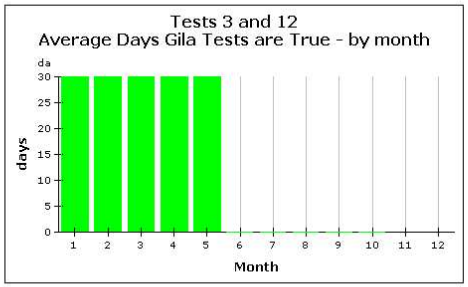

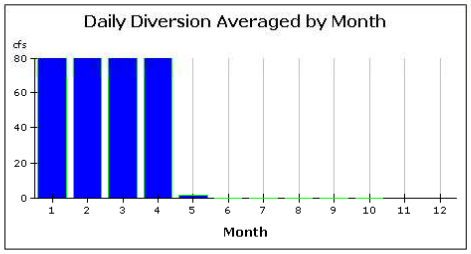

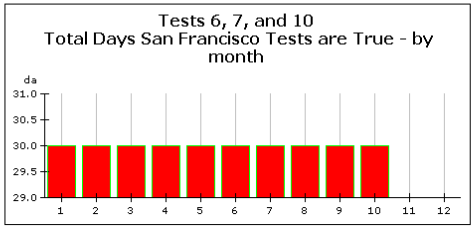

20 | 10 | 2005 — Tests — Tests - ON or OFF — Days: 292

When Tests are controlling flow

Test	Test	# False	% True
Test 1	San Carlos >= 30K AF	3	99 %
Test 2	Sum of Flows > DDB	170	42 %
Test 3	GilaVirden > 120% Call for DV	78	73 %
Test 4	Sum of Diversions < DD Right	0	100 %
Test 5	Allowable Diversion < 350 cfs	69	76 %
Test 6	SFClifton >=Potential flow needed	0	100 %
Test 7	SumSF gauges>120%(3 or 30cfs)	0	100 %
Test 8	CU < 140K in 10 yr	0	100 %
Test 9	CU < 64K in 1 yr	0	100 %
Test 10	San Fran CU < 4K in 1 yr	0	100 %
Test 11	Bank is > 0	0	100 %
Test 12	Gila Gila >= Potential Flow needed	142	51 %

CUFA Model
D R A F T
Version:
20060218
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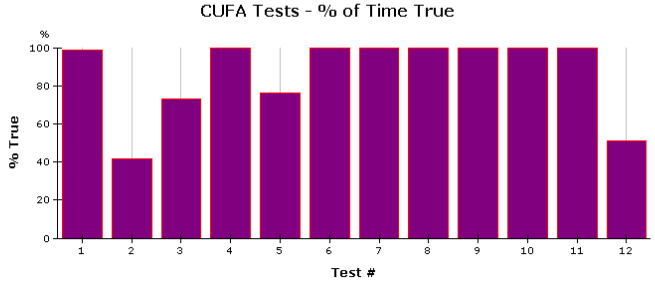
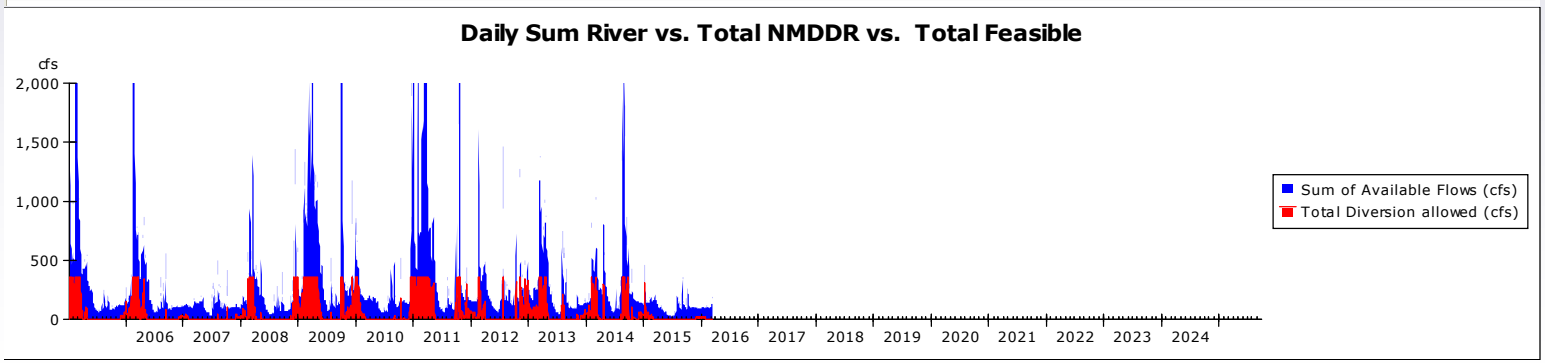
Test Summary

The Critical Tests for Gila River diversion are 3 and12.

Tests 6 and 10 are only critical to San Francisco diversion and use.

The remainder tests apply to sum of both diversions.





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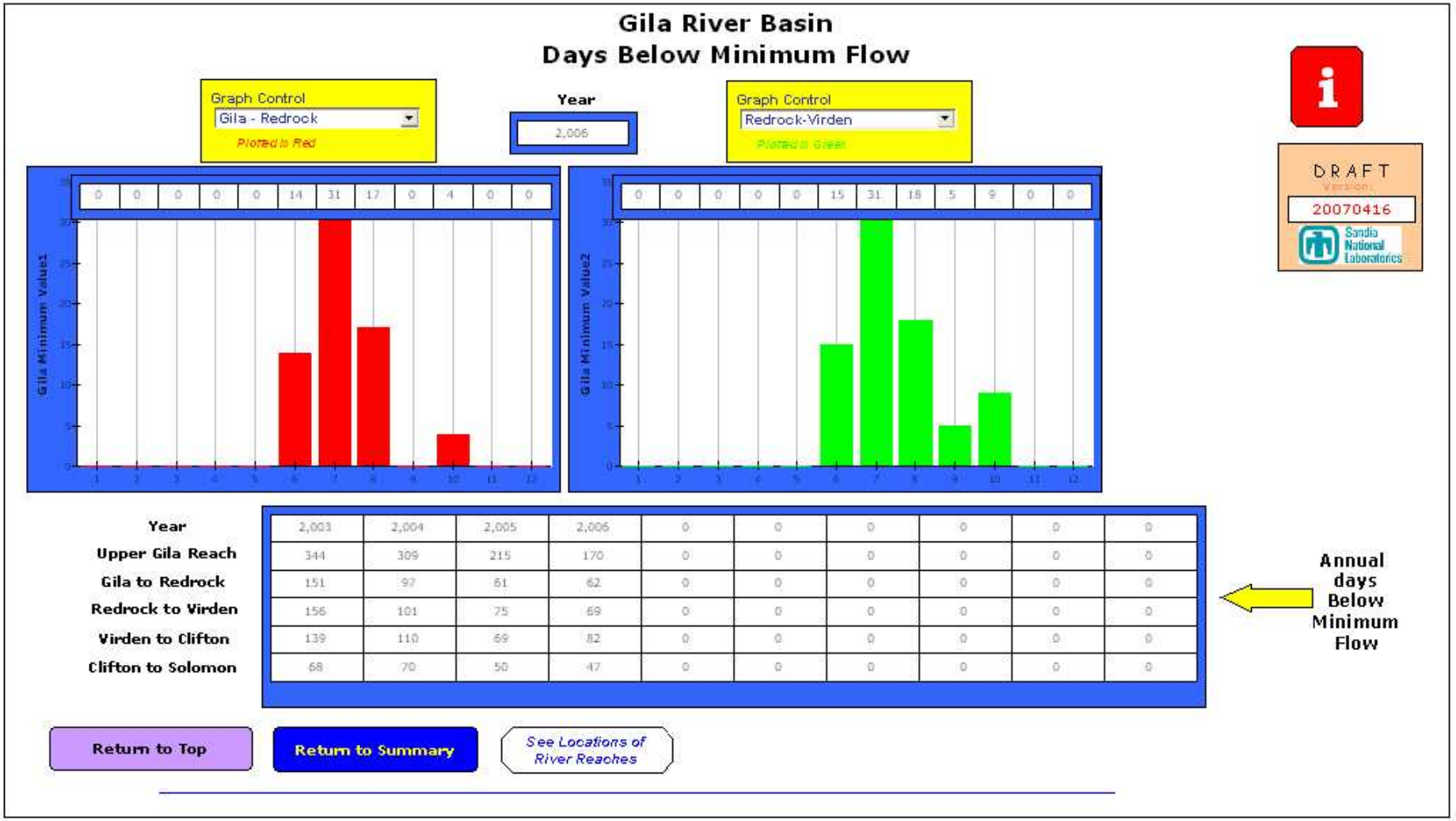
Target Flows Output



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Project Status

- Project is currently on hold

- Numerous entities considering how to continue collaborative modeling effort

Land Letter -- Thursday, March 22, 2007

RIVERS: N.M. governor vetoes Gila River development bill; stakeholders tackle alternatives

April Reese, *Land Letter* Western reporter

New Mexico Gov. Bill Richardson (D) vetoed legislation last week that would have funneled state funds toward controversial development projects on the Gila River. Meanwhile, a stakeholder group of water officials and local interests is studying options for protecting the state's last free-flowing river while meeting future water demands.

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