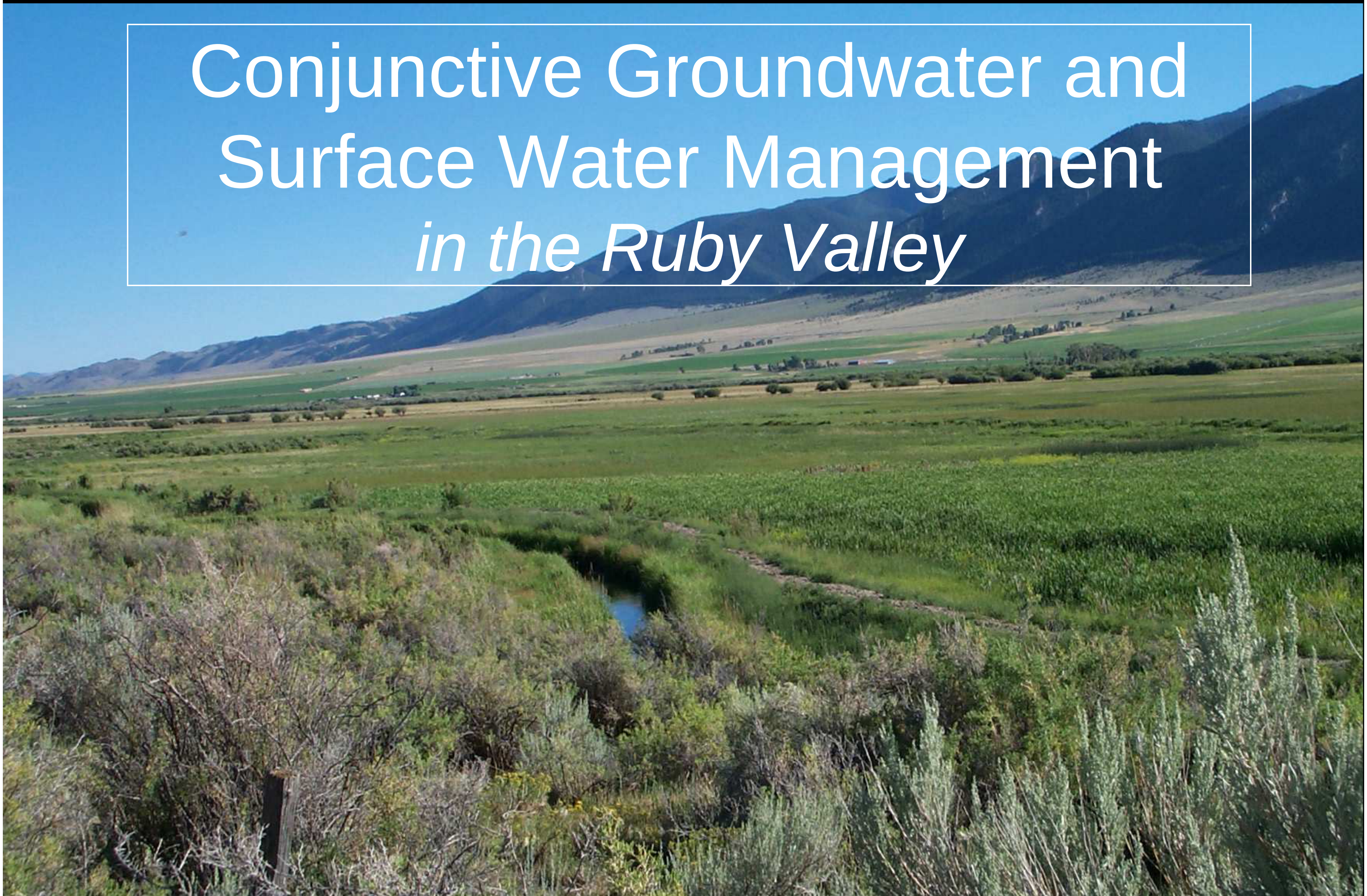
Conjunctive Groundwater and Surface Water Management *in the Ruby Valley*



KirK Engineering & Natural Resources, Inc.

Lower Ruby Valley Groundwater Management Plan
Decision Logic

- RVCD and Ruby Watershed Council sponsored.
- Strategic field data collection pertinent to <u>management</u> of ground water and surface water resources.
- Tailor investigation to specific resources and concerns in the <u>Ruby Valley.</u>
- Stakeholder involvement in planning process.

Lower Ruby Valley Groundwater Management Plan
Decision Logic (continued)

- Use field data to develop integrated ground and surface water model.

- Simulate <u>future</u> management scenarios based on local stakeholder concerns.

- Use model to make predictions regarding water availability, view impacts.

Funding

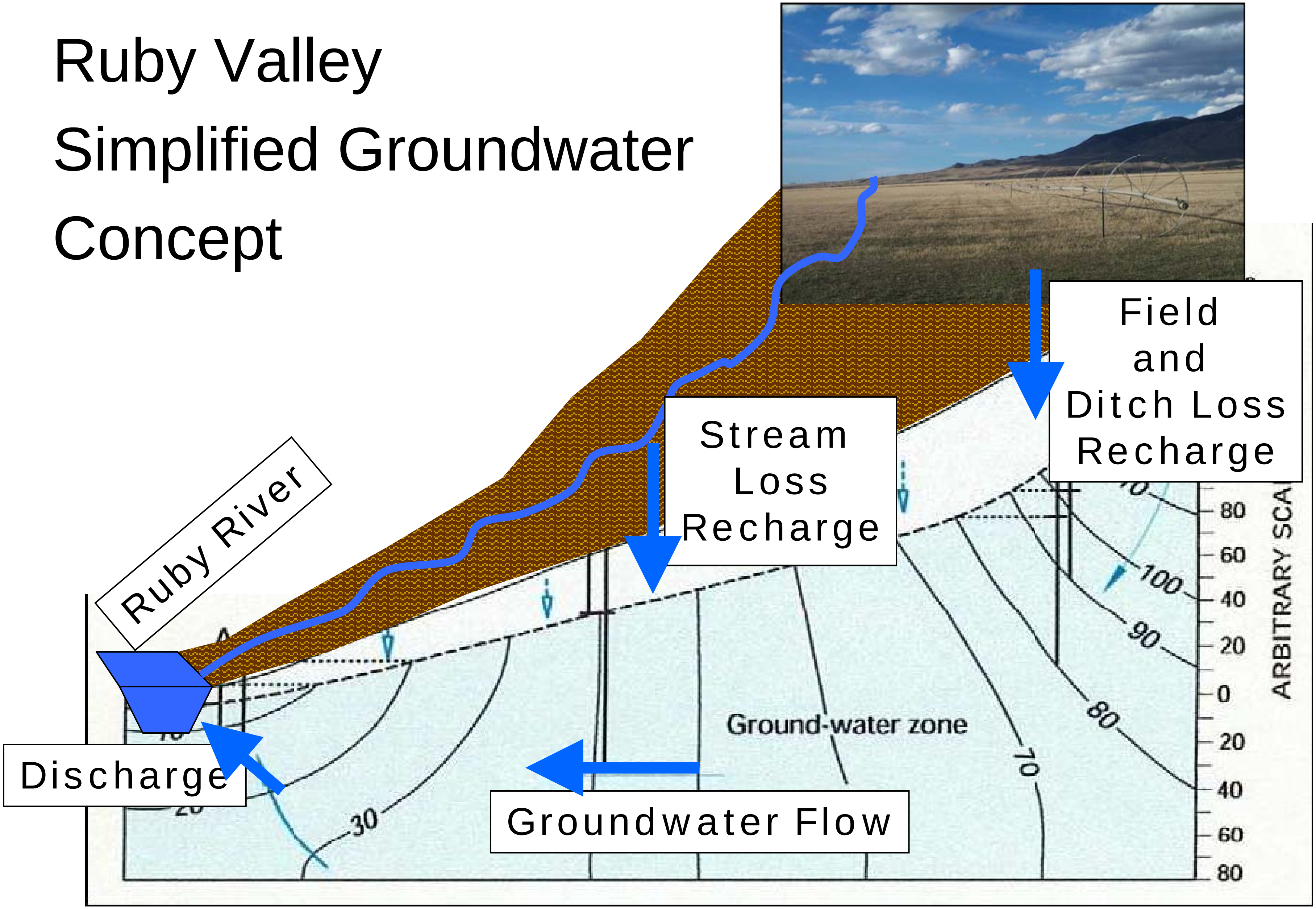
- Data collection and management plan: DNRC RRGL $74,000.
- Modeling: DEQ 319 $73,000.

Lower Ruby Valley ~ agricultural setting
Project area is entire lower valley.

Ruby Reservoir ~ 37,600 acre feet

Consistent surface water availability.

Ruby Valley Simplified Groundwater Concept



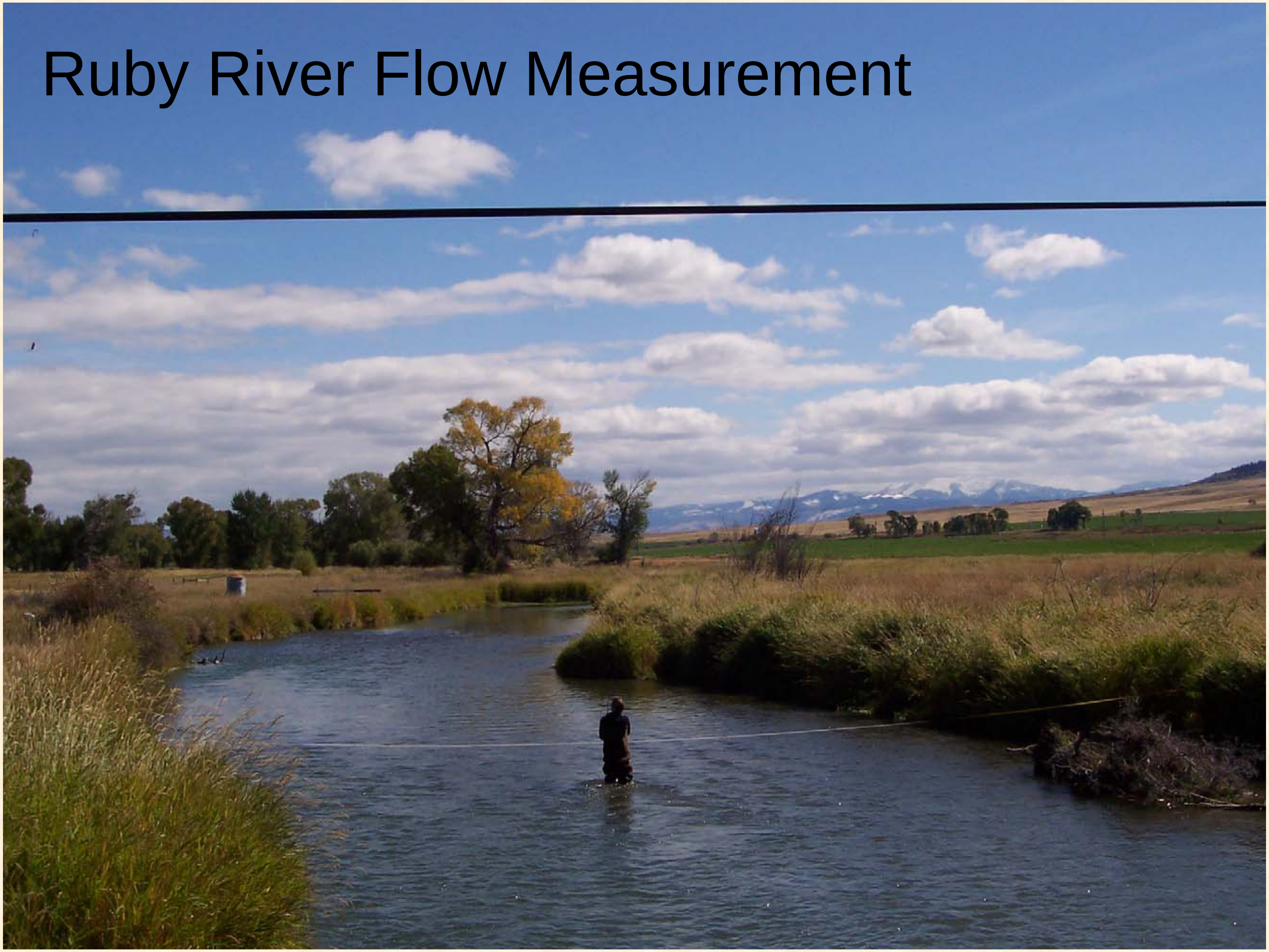
Water Resource Inventory

(collected over 18 months)

- 500+ water level measurements in wells.
- Streamflow of ditches, creeks, springs, and Ruby River.
- Ground water chemistry ~ to differentiate and characterize aquifers.

Water Level Measurement

Ruby River Flow Measurement



Leonard Slough Flow Measurement

What about prediction?

Foreseeable future scenario

Growth → Land use change → Reduced irrigated acreage; Increased irrigation efficiency; New wells; Fish ponds

Reduced irrigated acreage → Water savings; Decreased groundwater recharge

Increased irrigation efficiency → Decreased groundwater recharge

New wells; Fish ponds → Increased groundwater demand

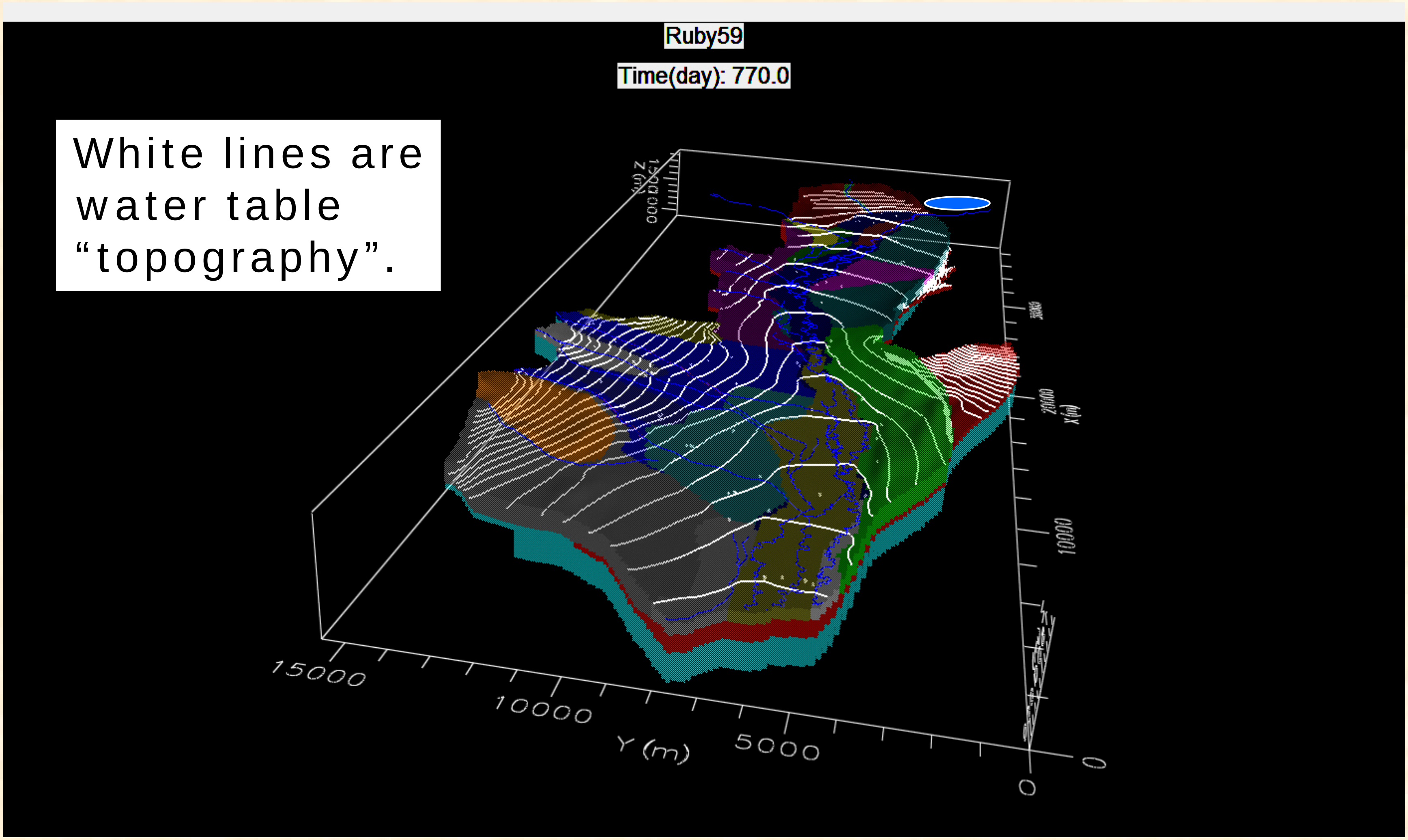
Water savings; Decreased groundwater recharge; Increased groundwater demand →

<u>Changes in</u>

- River Flow
- Water table
- Springs
- Wetlands

Impacts

Ruby Groundwater Model



White lines are water table “topography”.

Model Features

- Aquifer flow.
- Creeks and Ruby River.
- Runoff from mountains.
- Ditches.
- Irrigated fields.
- Ground water – surface water exchange.
- Wells.

- Seasonal operation to capture irrigation season, runoff, stream flow.

Run calibrated model with different water use, look at effect years into future.

1. Irrigation efficiency / ditch lining improvement.

2. Nine new large wells.

3. “Fish” pond proliferation.

4. Large scale residential subdivision.

Evaluate change in river flow.

Scenario #1: *Canal Lining with Flood Changed to Pivot*.

Before

Inflows:

Recharge (irrigation field loss)	64,000	acft
Ditch loss	54,000	acft

After

Inflows:

Recharge (irrigation field loss)	29,000	acft
Ditch loss	28,000	acft

61,000 acft total water savings.

Annual Water Budget

Scenario #1: *Canal Lining with Flood Changed to Pivot*.

Before

Inflows:

Recharge (irrigation field loss)	64,000	acft
Ditch loss	54,000	acft

Outflows:

ET	32,000	acft
Net stream gain	92,000	acft

After

61,000 acft water savings

Inflows:

Recharge (irrigation field loss)	29,000	acft
Ditch loss	28,000	acft

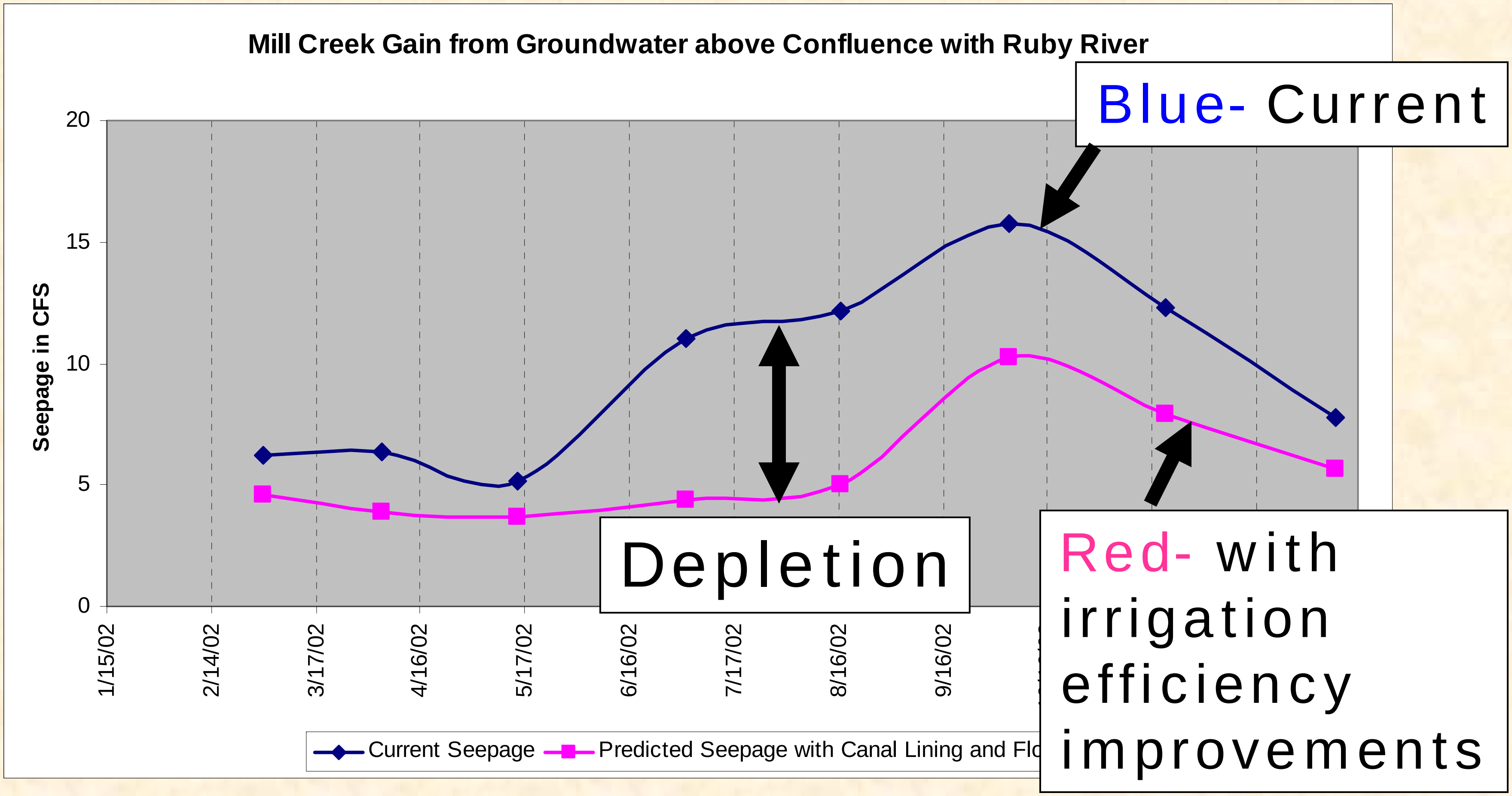
Outflows:

ET	23,000	acft
Net stream gain	41,000	acft

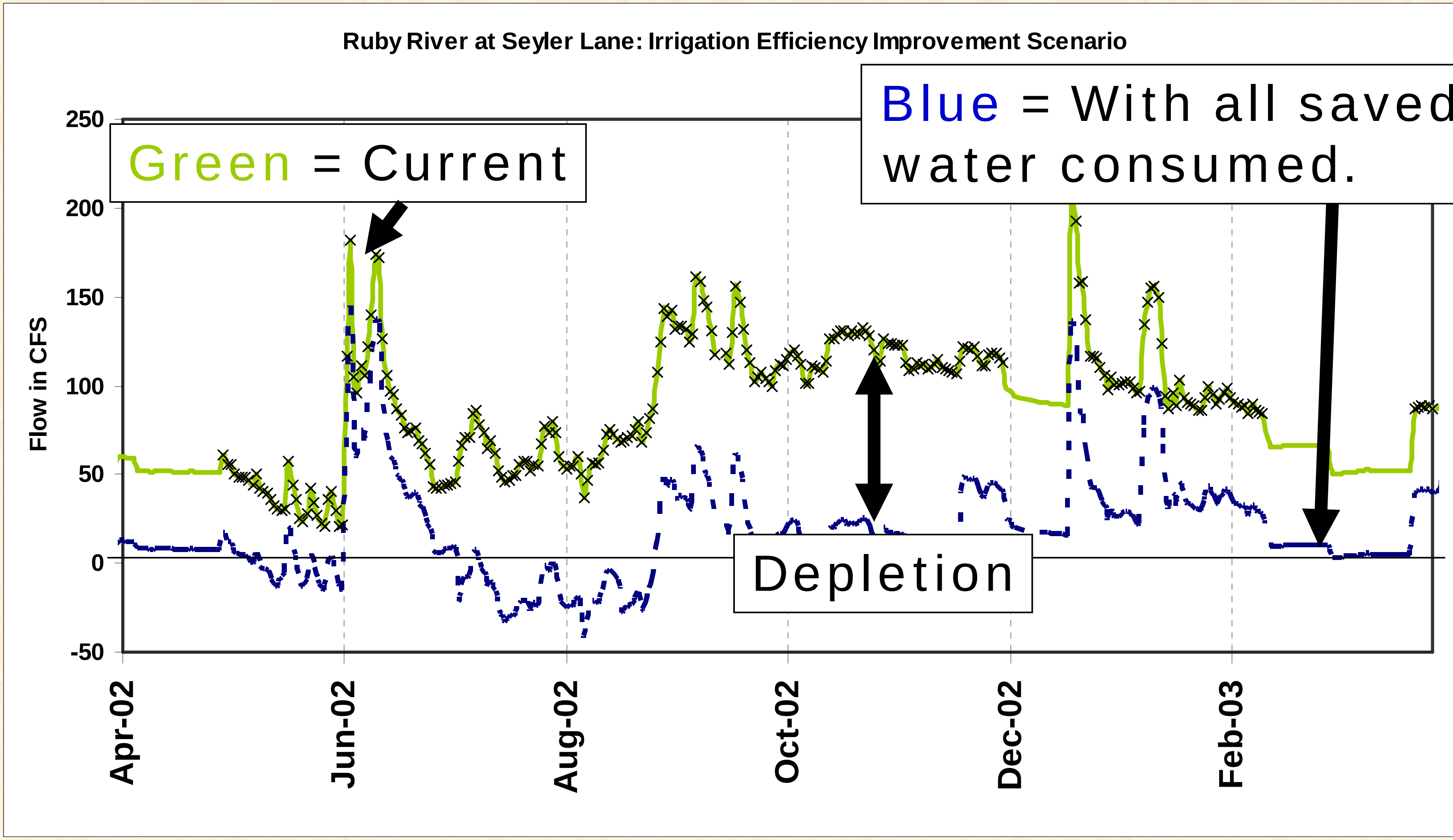
51,000 acft reduction in stream flow gain

Annual Water Budget

Predicted Flow in Mill Creek



Predicted Flow in Ruby River



Scenario #1: *Canal Lining with Flood Changed to Pivot*.

Additional Consideration: subirrigation (plant evapotranspiration)

Inflows:

Recharge (irrigation field loss)	64,000	acft
Ditch loss	54,000	acft

Outflows:

ET	32,000	acft
Net stream gain	92,000	acft

Inflows:

Recharge (irrigation field loss)	29,000	acft
Ditch loss	28,000	acft

Outflows:

ET	23,000	acft
Net stream gain	41,000	acft

9,000 acft reduction in subirrigation.

Annual Water Budget

Subirrigation example – Ruby Floodplain

Recharge from irrigation has raised the water table, creating wetlands and off-channel riparian areas.

Subirrigation example – Sheridan Fan.

Scenario #2: *Nine **Large** Pumping Wells*

Before

Inflows:

Recharge (irrigation field loss)	64,000	acft
Ditch loss	54,000	acft

Outflows:

ET	32,000	acft
Net stream gain	92,000	acft
Groundwater pumping	2,000	acft

After

Inflows:

Recharge (irrigation field loss)	64,000	acft
Ditch loss		

Small decrease in subirrigation.

Outflows:

ET	30,000	acft
Net stream gain	80,000	acft
Groundwater pumping	16,000	acft

Increase in pumping 14,000 acft.
Decrease in stream flow 12,000 acft.

Annual Water Bu

Scenario #3: *70 New Fish Ponds*

Before

Inflows:

Recharge (irrigation field loss)	64,400	acft
Ditch loss	53,500	acft

Outflows:

ET	32,200	acft
Net stream gain	92,000	acft
Groundwater pumping	1,500	acft

After

Inflows:

Recharge (irrigation field loss)	64,400	acft
Ditch loss	53,500	acft

Decrease in stream flow 500 acft.

O

E	[illegible]	[illegible]
Net stream gain	91,500	acft
Groundwater pumping	1,500	acft
Pond evaporation	700	acft

Pond evaporation 700 acft.

Annual Water Budget

Scenario #4: Subdivision ~ *850 lots with ¾ acre lawn and garden*

Before

Inflows:

Recharge (irrigation field loss)	64,400	acft
Ditch loss	53,500	acft

Outflows:

ET	32,200	acft
Net stream gain	92,000	acft
Groundwater pumping	1,500	acft

After

Inflows:

Recharge (irrigation field loss)	64,400	acft
Ditch loss	53,600	acft

Outflows:

ET	[illegible]	
Net stream gain	90,300	acft
Groundwater pumping	3,200	acft

Decrease in stream flow 1,700 acft.

Increased pumping 1,700 acft.

Annual Water Budget

If goals are to:

Protect surface water flows, water right holders, and aquatic resources.

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Protect surface water flows, water right holders, and aquatic resources.

Need to consider:

- Land use change will drive water use change.
- Irrigation important to aquifer recharge and late summer river flows.
- New ground water use will impact surface flows.

Success of the Ruby project owes to:

- Stakeholder involvement.
- Streamlined investigation tailored to local water issues.
- Ground water – surface water modeling versus traditional ground water centered investigation.
- Evaluating management implications.
  - Land use effects of water resources.
  - Ground water use effects on river flows.

Ruby model is a work in progress:

Possible future uses:

- Snowpack – runoff timing effects on water availability.
- Evaluation of water right mitigation.
- Implications of management on water quality and stream temperature.