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 management of ground water and surface water resources.
- Tailor investigation to specific resources and concerns in the Ruby Valley.
- 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 future management scenarios based on local stakeholder concerns.
- Use model to make predictions regarding water availability, view impacts.

Funding

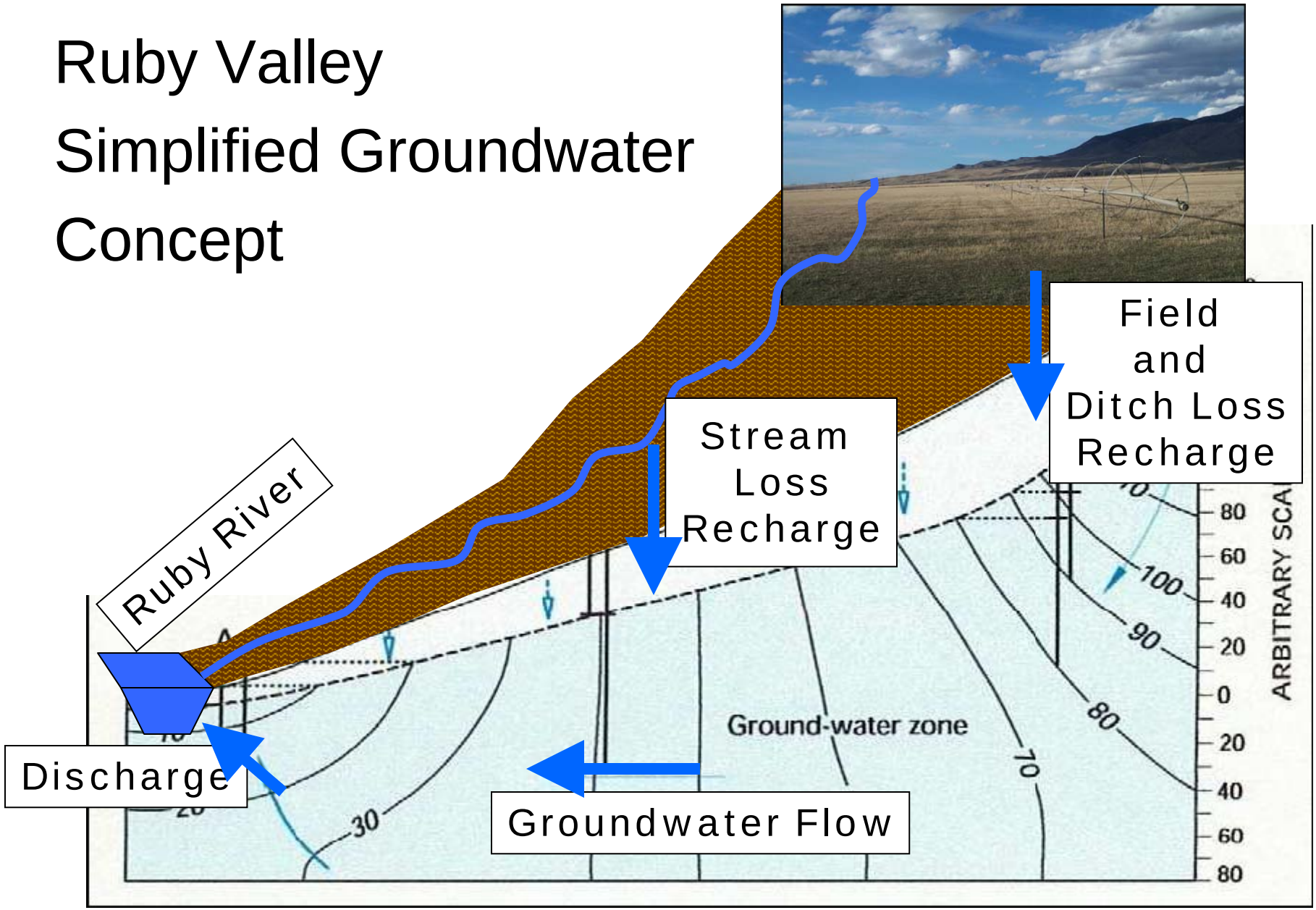
- Data collection and management plan: DNRC RRGL $74,000.
- Modeling: DEQ 319 $73,000.

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



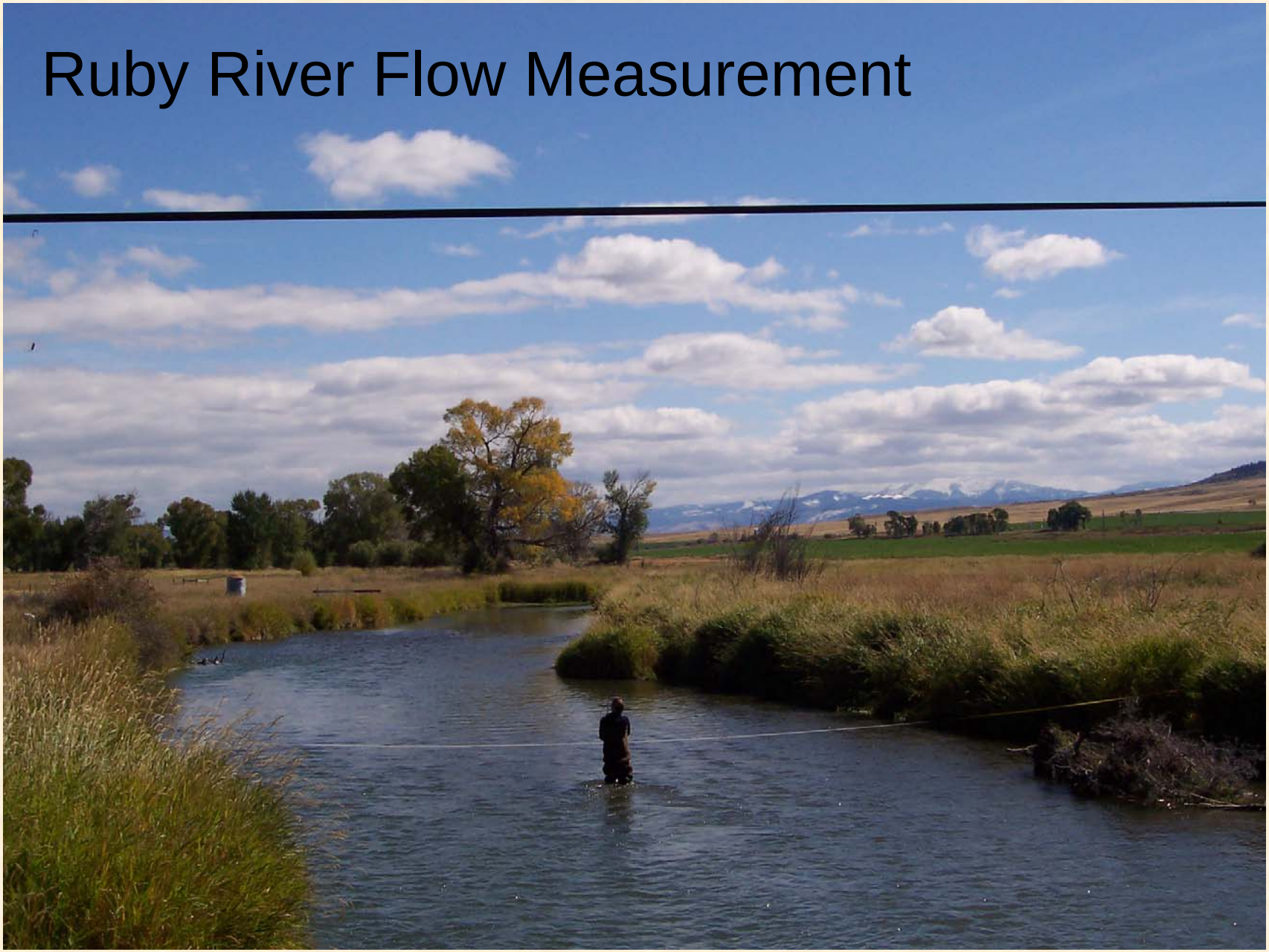
Water Resource Inventory

(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

Water savings

Decreased groundwater recharge

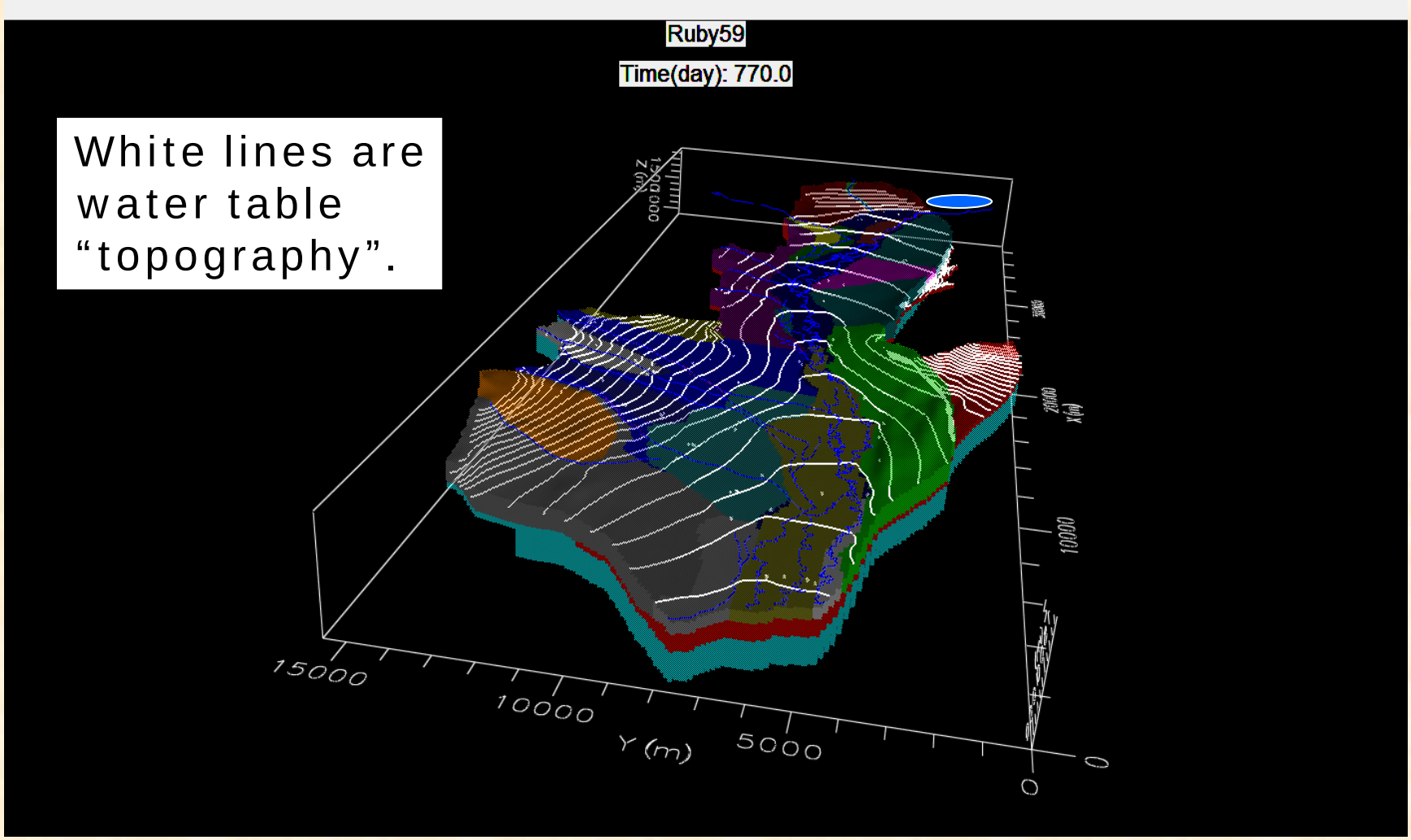
Increased groundwater demand

Changes in

- River Flow
- Water table
- Springs
- Wetlands

Impacts

Ruby Groundwater Model



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

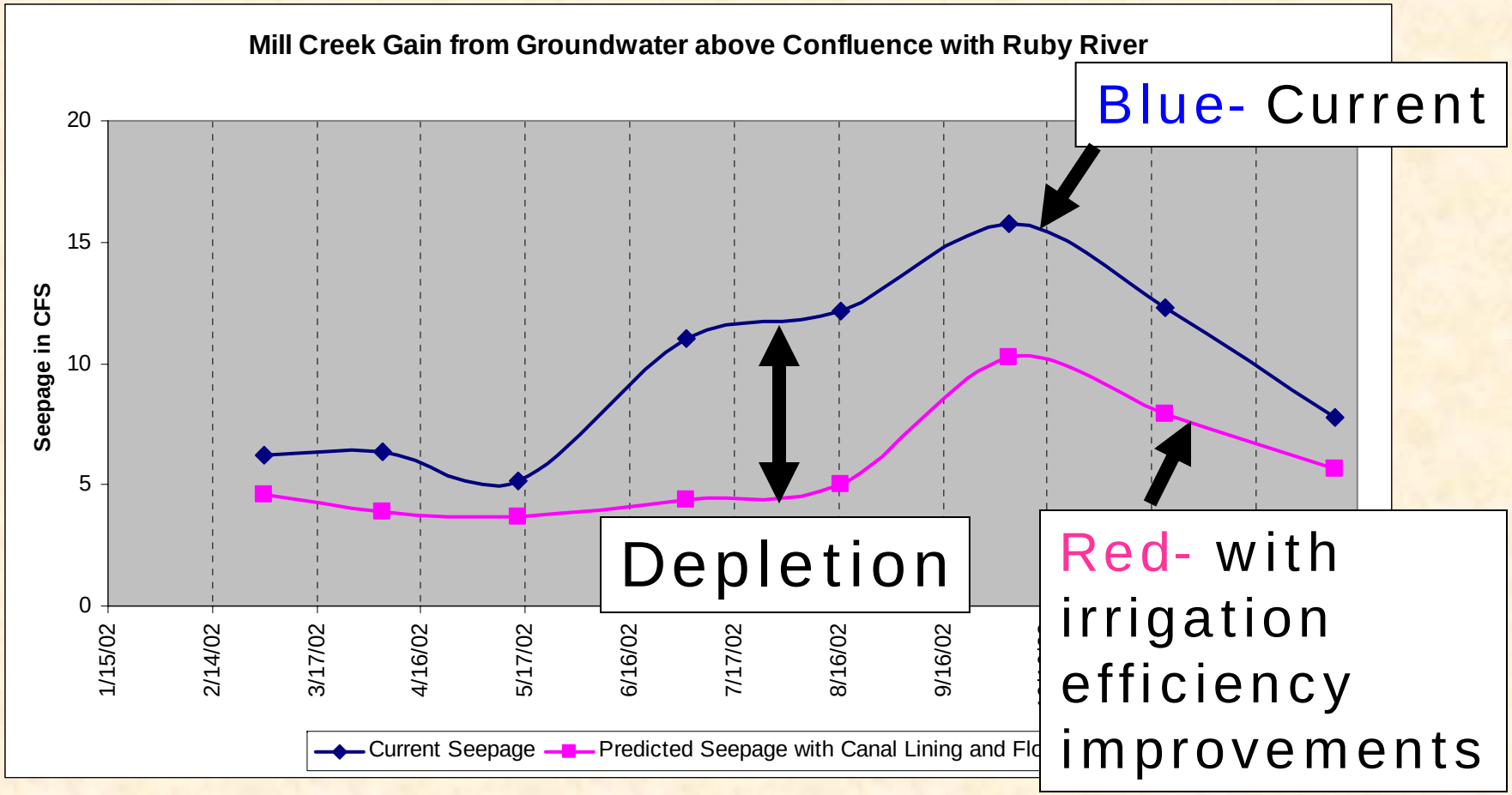
Outflows:

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

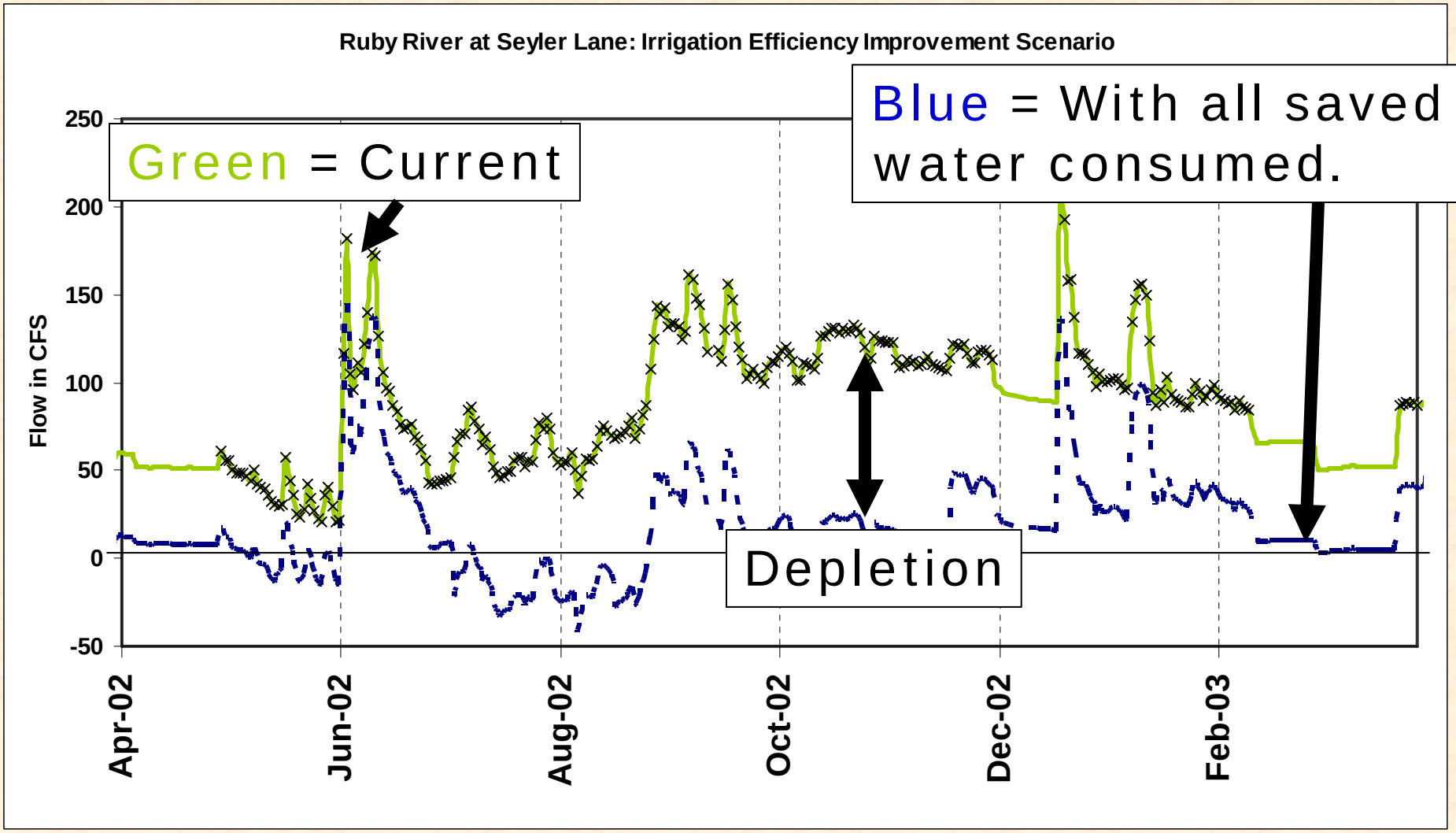
51,000 acft reduction in stream flow gain

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

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Net stream gain	91,500	acft
Groundwater pumping	1,500	acft
Pond evaporation	700	acft

Decrease in stream flow 500 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

Decrease in stream flow 1,700 acft.

Net stream gain	90,300	acft
Groundwater pumping	3,200	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.