

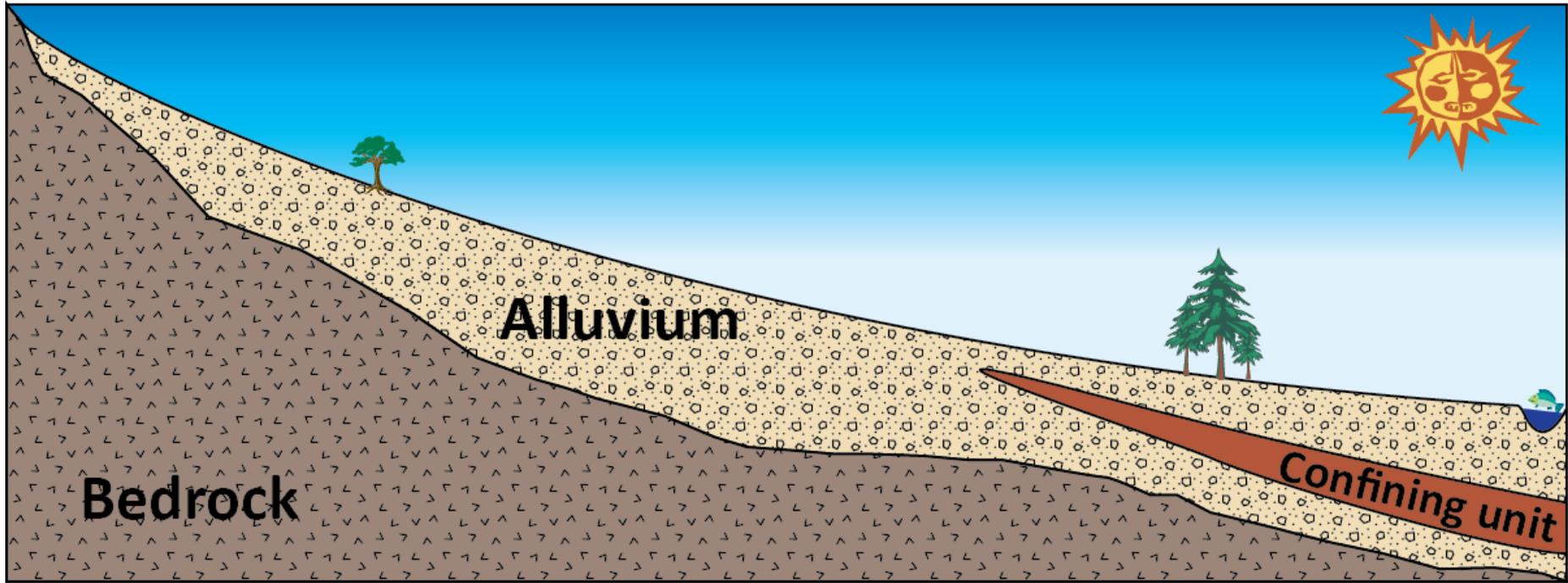
The Wood River Valley Aquifer System Groundwater-flow Model: Progress to date



Jim Bartolino
U.S. Geological Survey
Idaho Water Science Center
January 29, 2014
Hailey, Idaho

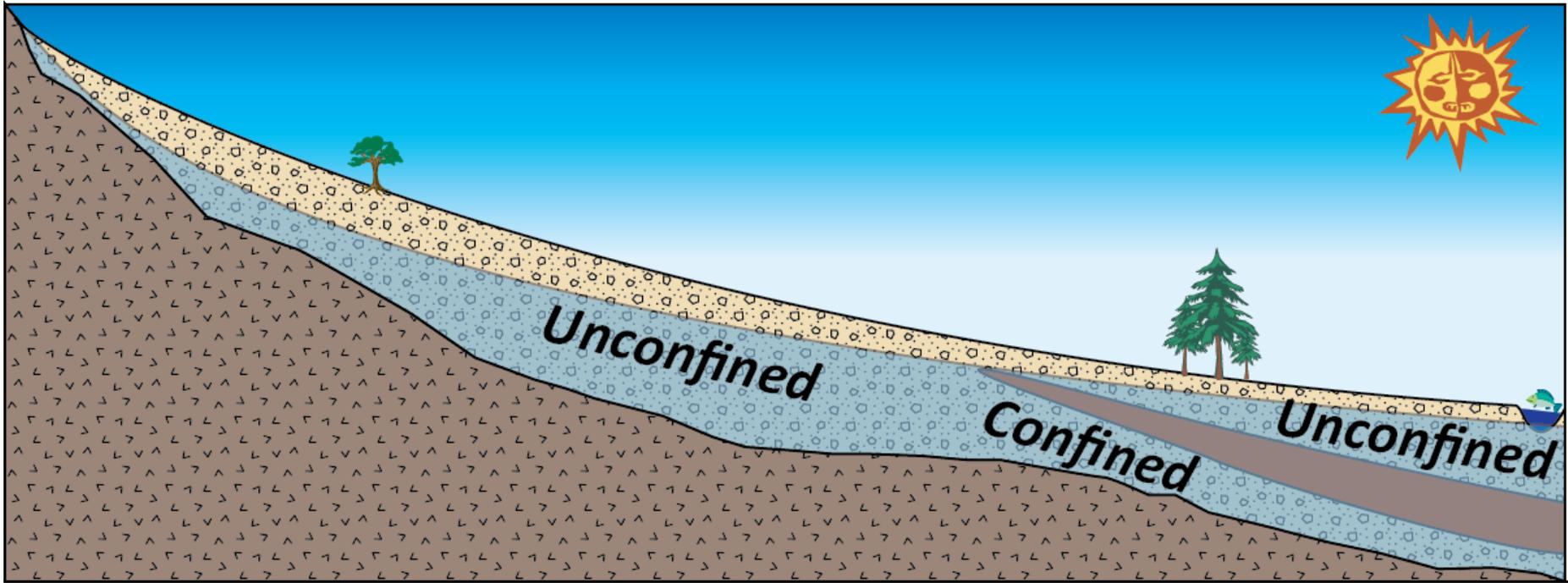
View to east from upper
Townsend Gulch,
05Oct2013

Wood River Valley aquifer system



- ❖ Sand, gravel, clay, & basalt
- ❖ Thickness:
 - About 350 ft in the lower valley
 - Ketchum area: 100 ft
 - Upper valley and large tributaries: 20 - 30 ft
 - Small tributaries: <10 ft

Wood River Valley aquifer system

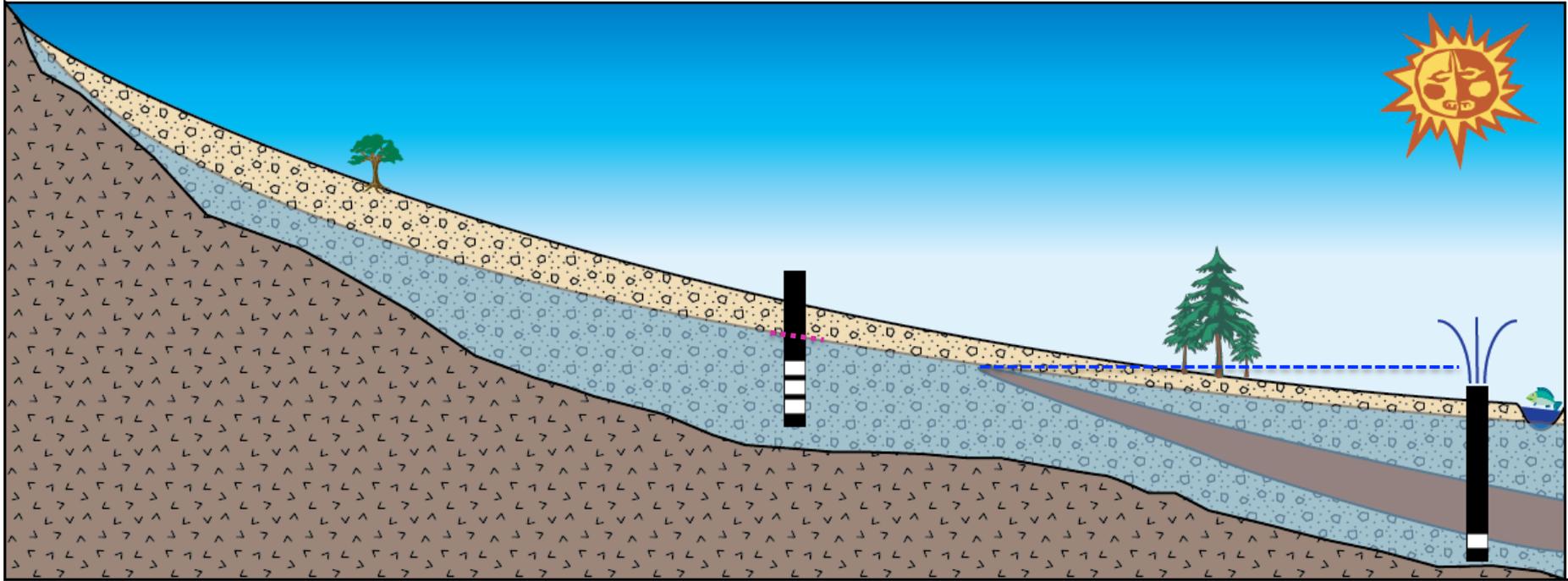


- ❖ Sand, gravel, clay, & basalt
- ❖ Thickness:
 - About 350 ft in the lower valley
 - Ketchum area: 100 ft
 - Upper valley and large tributaries: 20 - 30 ft
 - Small tributaries: <10 ft

- ❖ Water levels:

-
-

Wood River Valley aquifer system

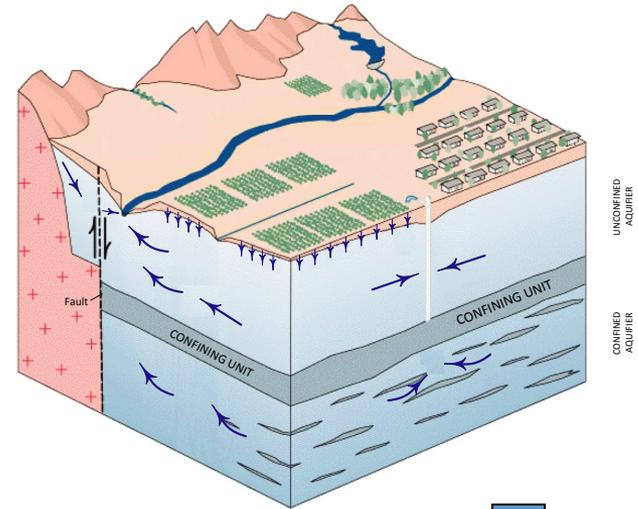


- ❖ Sand, gravel, clay, & basalt
- ❖ Thickness:
 - About 350 ft in the lower valley
 - Ketchum area: 100 ft
 - Upper valley and large tributaries: 20 - 30 ft
 - Small tributaries: <10 ft

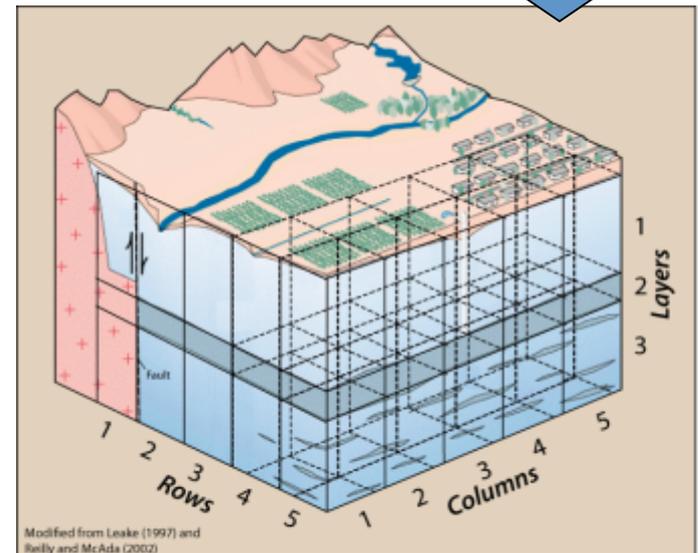
- ❖ Water levels:
 - Unconfined: 0 - 100 ft
 - Confined: Often above land surface
- ❖ Well-connected to streams
- ❖ In some areas wells are completed in bedrock

Groundwater-flow models

- ❖ A model is a simplified representation of the appearance or operation of a real system
- ❖ Groundwater-flow models:
 - Attempt to simulate the processes of a real aquifer system
 - The geology of the aquifer system is represented as a series of blocks
 - Describe flow between cells by solving a series of equations

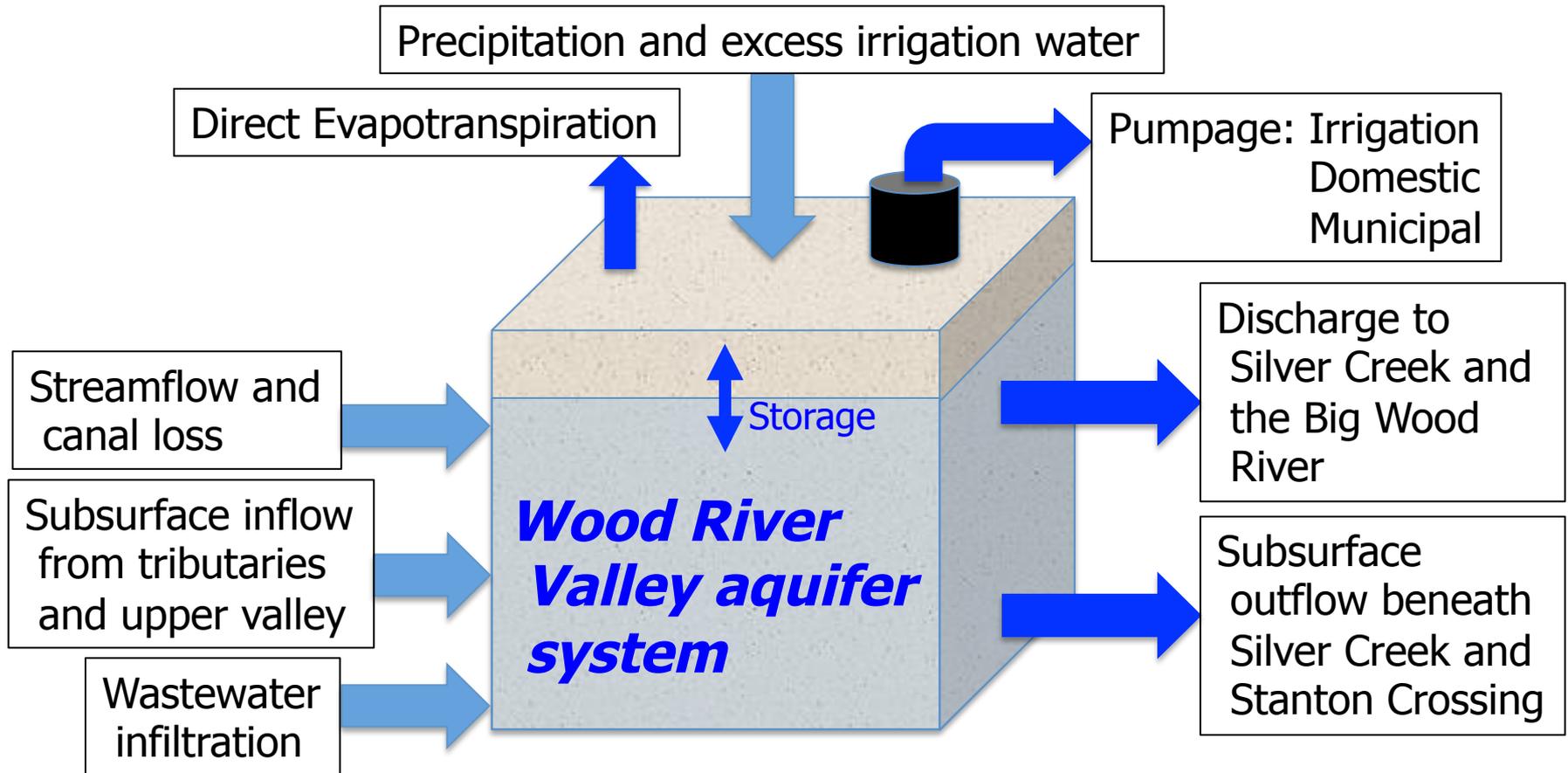


Model discretization



Modified from Leake (1997) and
Rilly and McAda (2002)

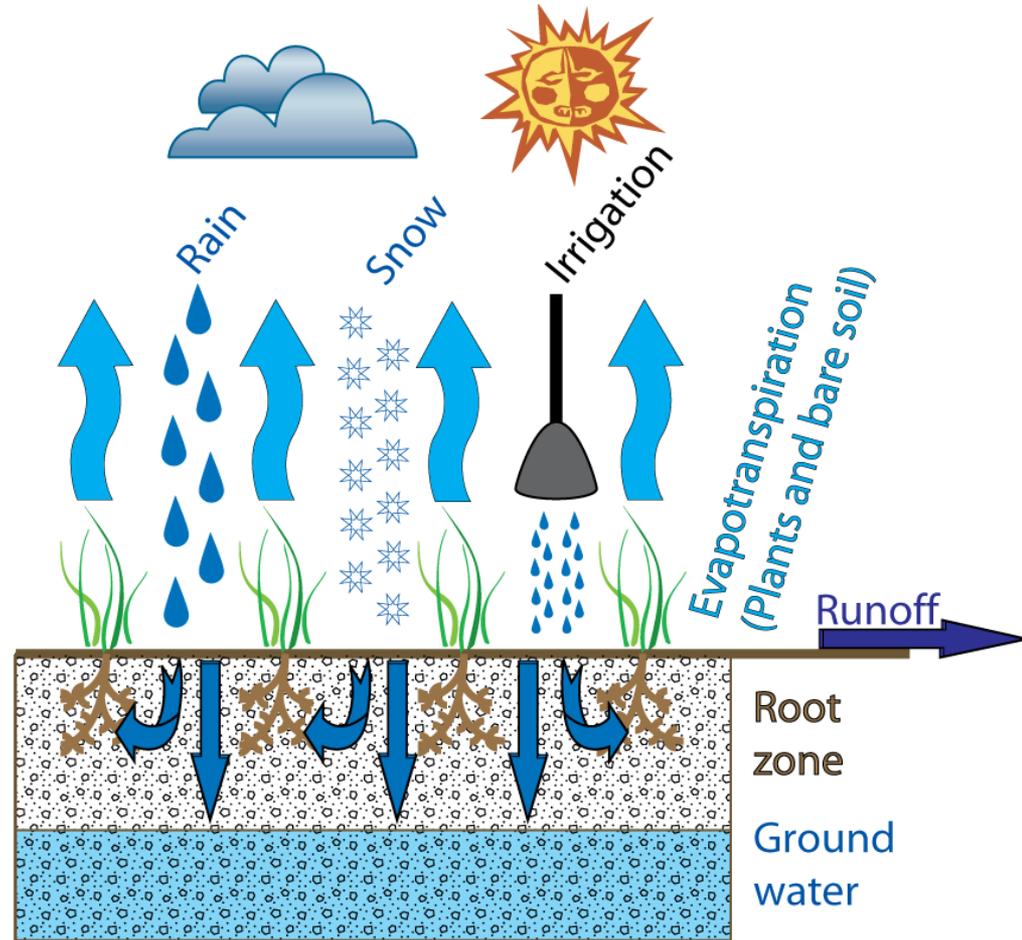
Water budget for the flow model



- ❖ An accounting of water moving into and out of the system for a given time period

Recharge: Irrigated and Nonirrigated Lands

- ❖ Four components:
 - + **Surface-water Irrigation**
 - IDWR database
 - + **Groundwater Irrigation**
 - IDWR database
 - + **Precipitation**
 - 3 zones based on weather stations
 - **Evapotranspiration**
 - METRIC: satellite imagery (Univ. of Idaho)
-
- = Recharge**

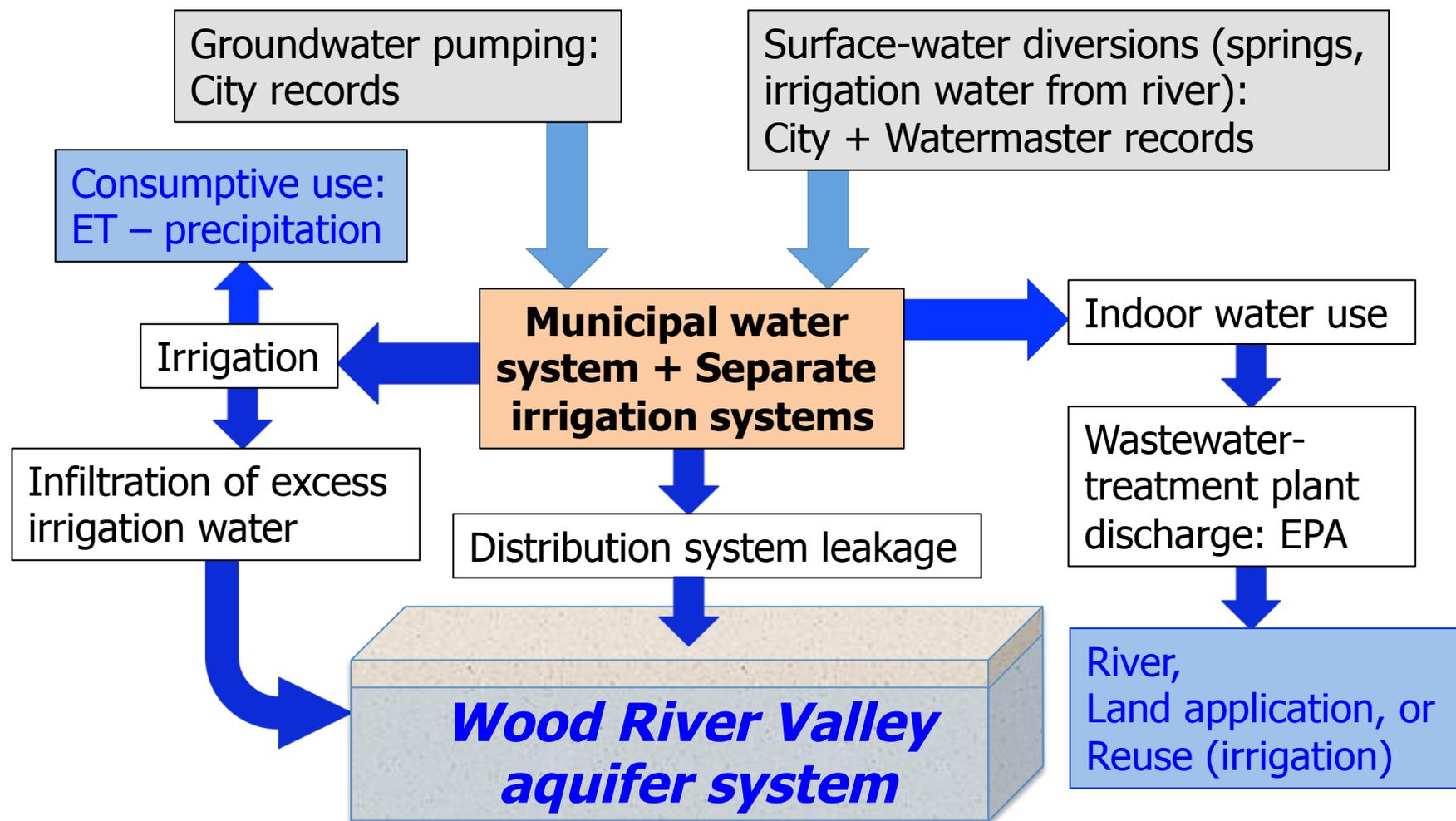


Recharge: Tributary underflow

- ❖ Subsurface flow into the aquifer system cannot be measured directly and requires estimates of hydrologic properties
- ❖ Subsurface flow can be estimated using:
 - Cross-sectional area of the aquifer
 - Slope of the water table
 - Permeability of the aquifer
- ❖ Estimates can be constrained within a given range

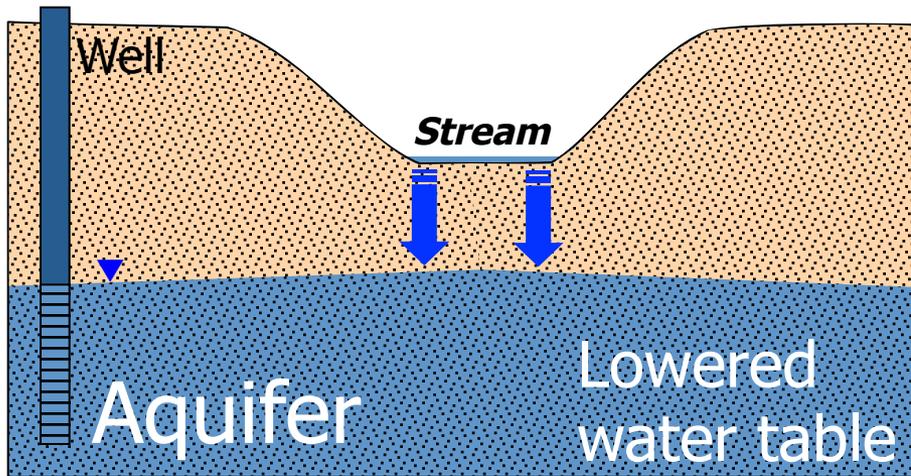
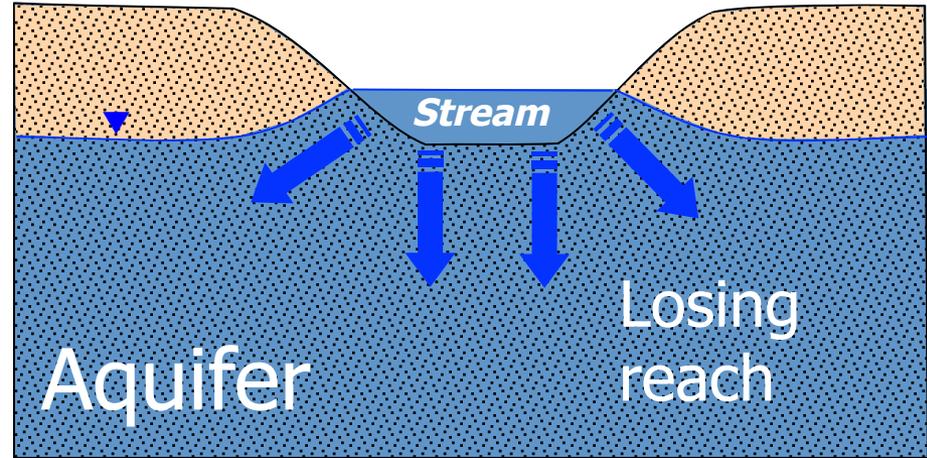
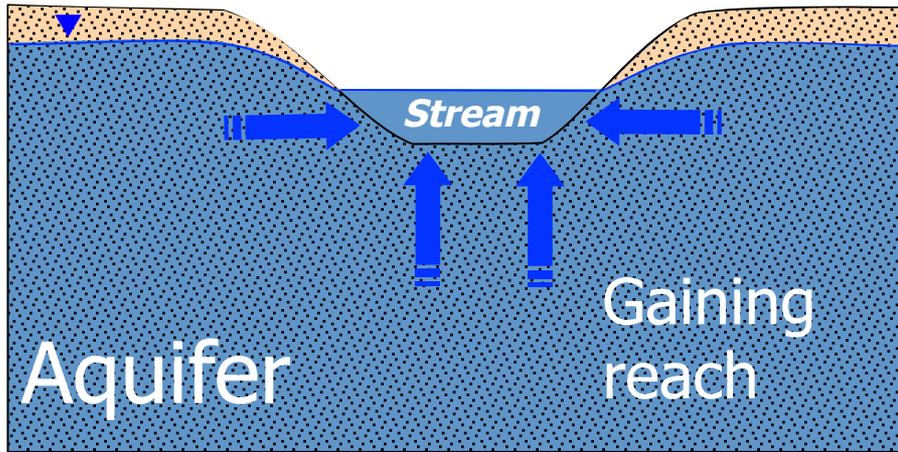


Recharge: Municipal-water systems



$$\text{Diversion} - \text{Wastewater} - \text{ET} = \text{Infiltration}$$

Gaining and losing stream reaches

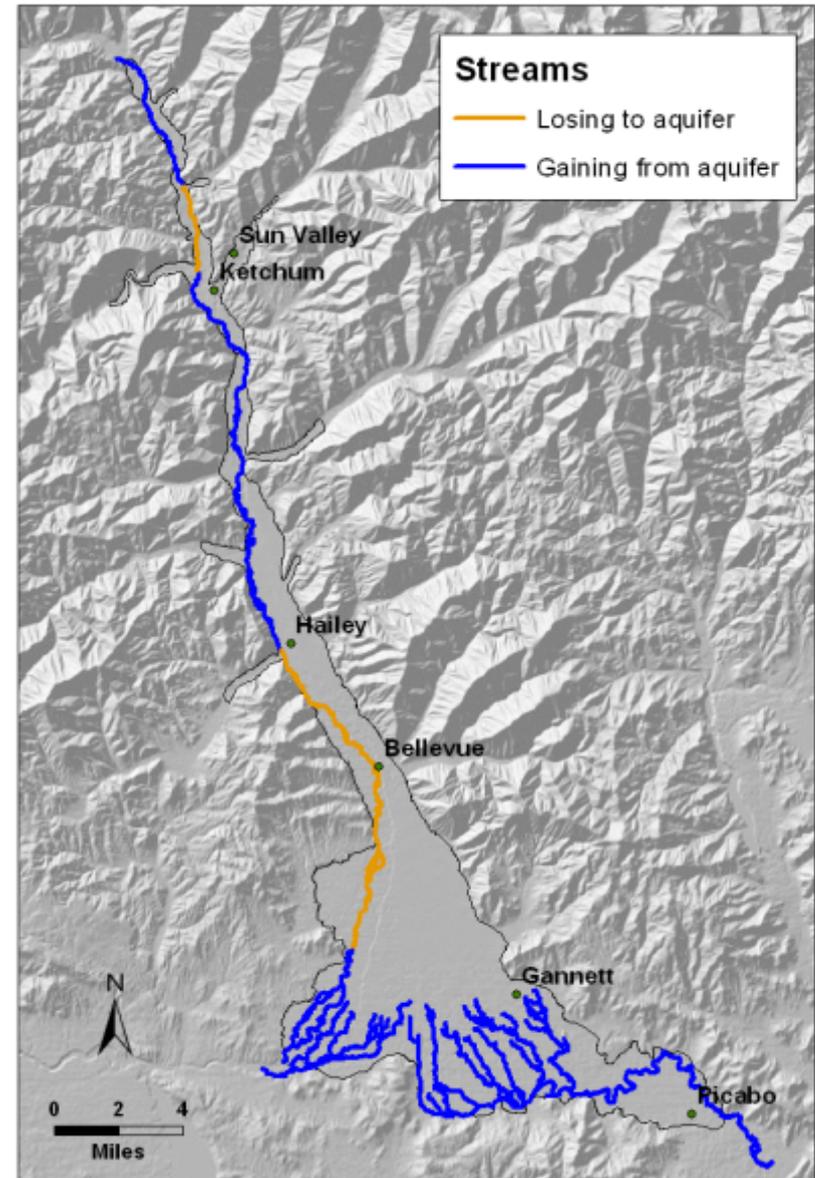


- **Streamflow gain** = groundwater discharge
- **Streamflow loss** = groundwater recharge

Recharge/Discharge: Surface water

❖ Seepage measurements

- Identify gaining and losing reaches and quantity
- Aug 2012, Oct 2012, Mar 2013 at 50 sites
- Big Wood River
 - 3 gaining, 2 losing
- Silver Creek
 - Mostly gaining
- Some seasonal variability



Discharge: Irrigation wells

- ❖ The southern portion of the model contains three layers
 - Unconfined aquifer
 - Confining unit
 - Confined aquifer
- ❖ Assigning pumping to the proper layer is important
- ❖ IDWR database of drillers' logs:
 - Incomplete prior to 1987
 - Well construction is constrained by local geology
- ❖ Where well construction is unknown, assume the well is constructed similarly to its nearest neighbor



Discharge: Domestic and subdivision wells

- ❖ Outdoor use is for irrigation
 - Evapotranspiration
 - Recharge
- ❖ Indoor use is non-consumptive:
 - Treated and returned to the aquifer
- ❖ To determine *net* pumping we only need to quantify evapotranspiration (consumptive use) with METRIC



Total Pumping =

Consumptive + Nonconsumptive

Net Pumping =

Consumptive use/Evapotranspiration

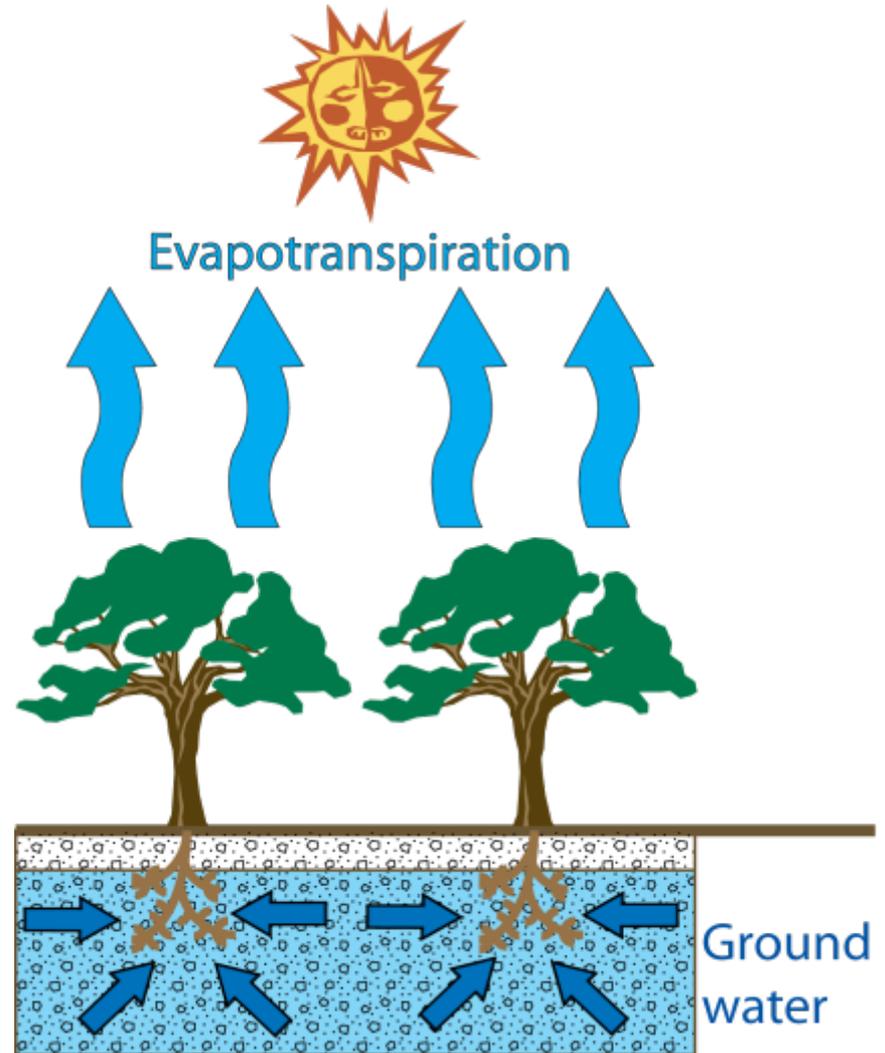
Discharge: Direct Evapotranspiration

❖ Phreatophytes: Plants whose root systems directly tap ground water

- Cottonwood, willow, tamarisk, other riparian vegetation

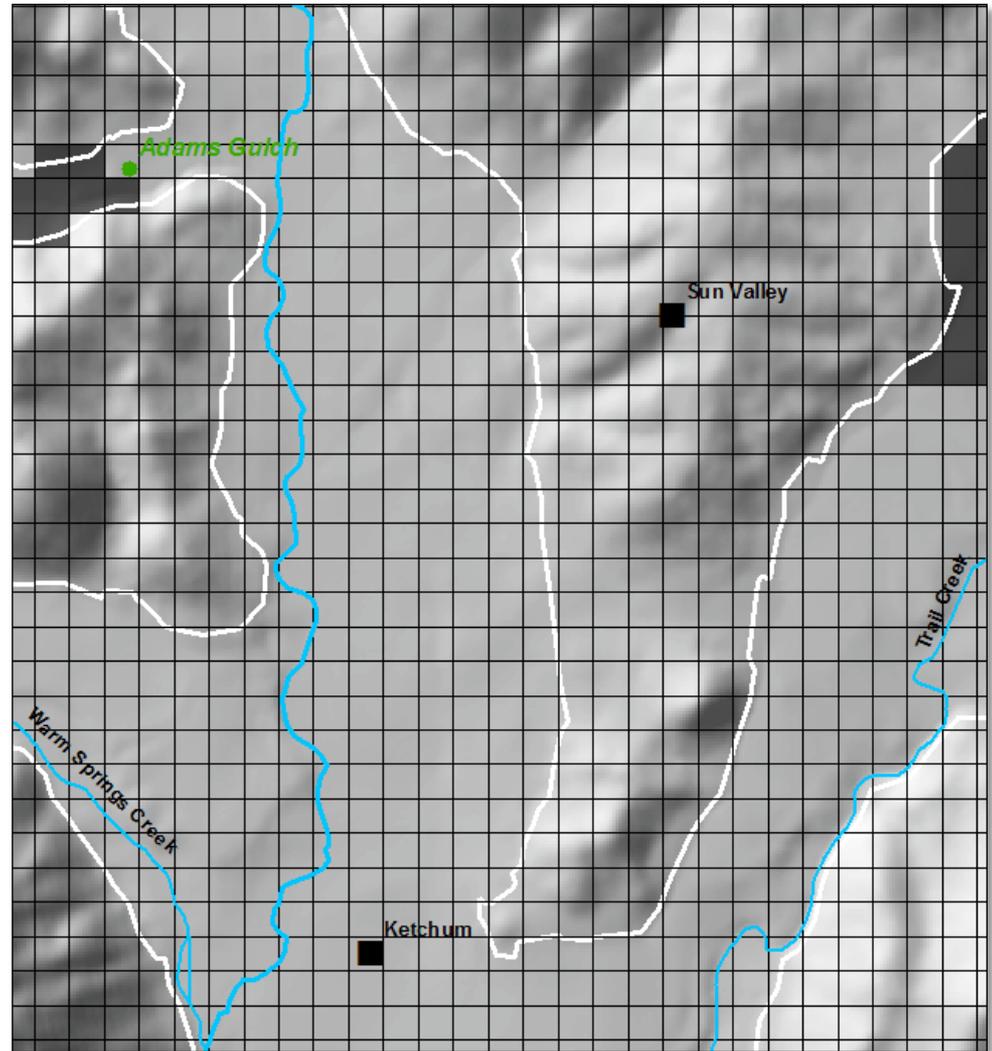
❖ Evapotranspiration

➤ METRIC



Groundwater-flow model characteristics

- ❖ MODFLOW-USG
 - Plus various packages
- ❖ 1995-2010 simulation
- ❖ 300 ft × 300 ft cells
- ❖ 3 layers:
 - Unconfined system
 - Confining unit
 - Confined system
- ❖ Will be calibrated with PEST software
- ❖ Completed by Oct 2015

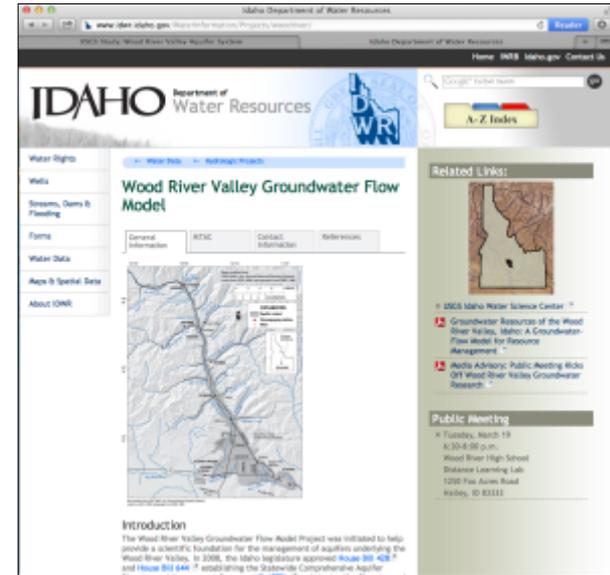


Thanks...



- ❖ Modeling Technical Advisory Committee (MTAC)
- ❖ USGS cooperators
- ❖ Citizens of the Wood River Valley

More information:



❖ U.S. Geological Survey:

- USGS Wood River Valley Aquifer System Web site: id.water.usgs.gov

❖ Idaho Department of Water Resources:

- Wood River Valley Groundwater Flow Model Project Web site: idwr.idaho.gov