

An aerial photograph of a volcanic landscape. In the background, a dark, jagged lava flow stretches across the horizon under a clear blue sky. The middle ground shows a valley with a river winding through it, surrounded by green vegetation and rocky terrain. The foreground is dominated by a large, light-colored, sandy or silty area, possibly a dry riverbed or a volcanic deposit.

The Problematic Nature of Curtailment

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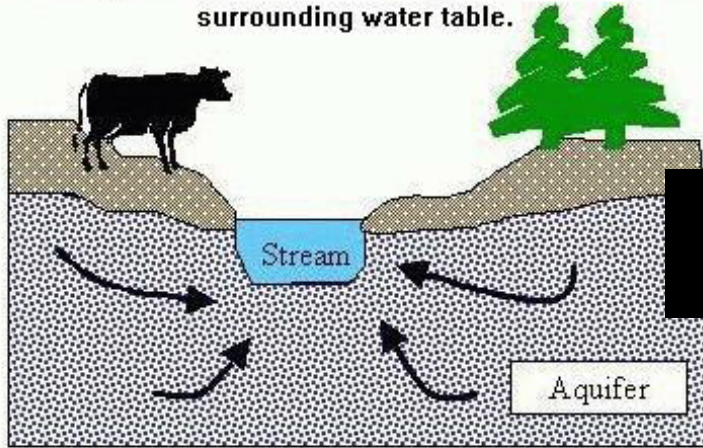
Idaho Water Resources Research Institute

Hydrologically, What Makes Conjunctive Management so Difficult?

- *“A problem Well Stated is a Problem Half Solved”* Charles Kettering (engineer)
- Objective: Describe hydrologic complications that impede conjunctive management and curtailment
- Eastern Snake River Plain as example

Hydraulically Connected Surface and Ground Water

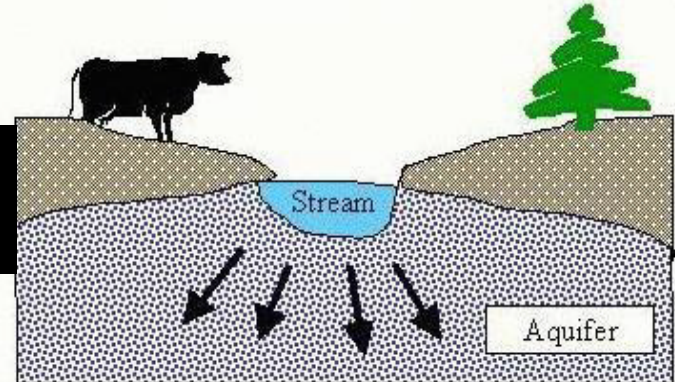
Streams gain water when the stream stage is below the surrounding water table.



Gaining Stream

YES

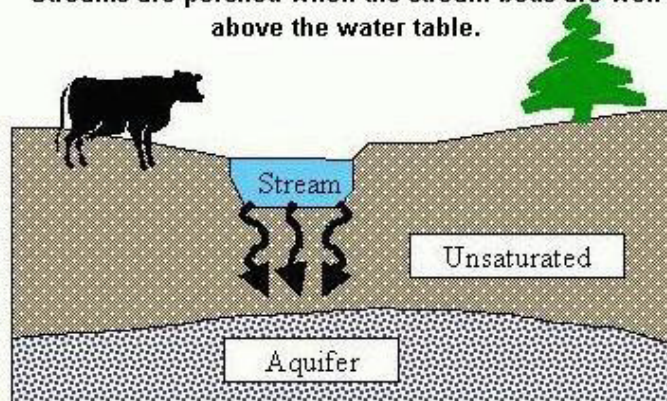
Streams lose water to the aquifer when stream stage is higher than the water table.



Losing Stream

NO

Streams are perched when the stream beds are well above the water table.

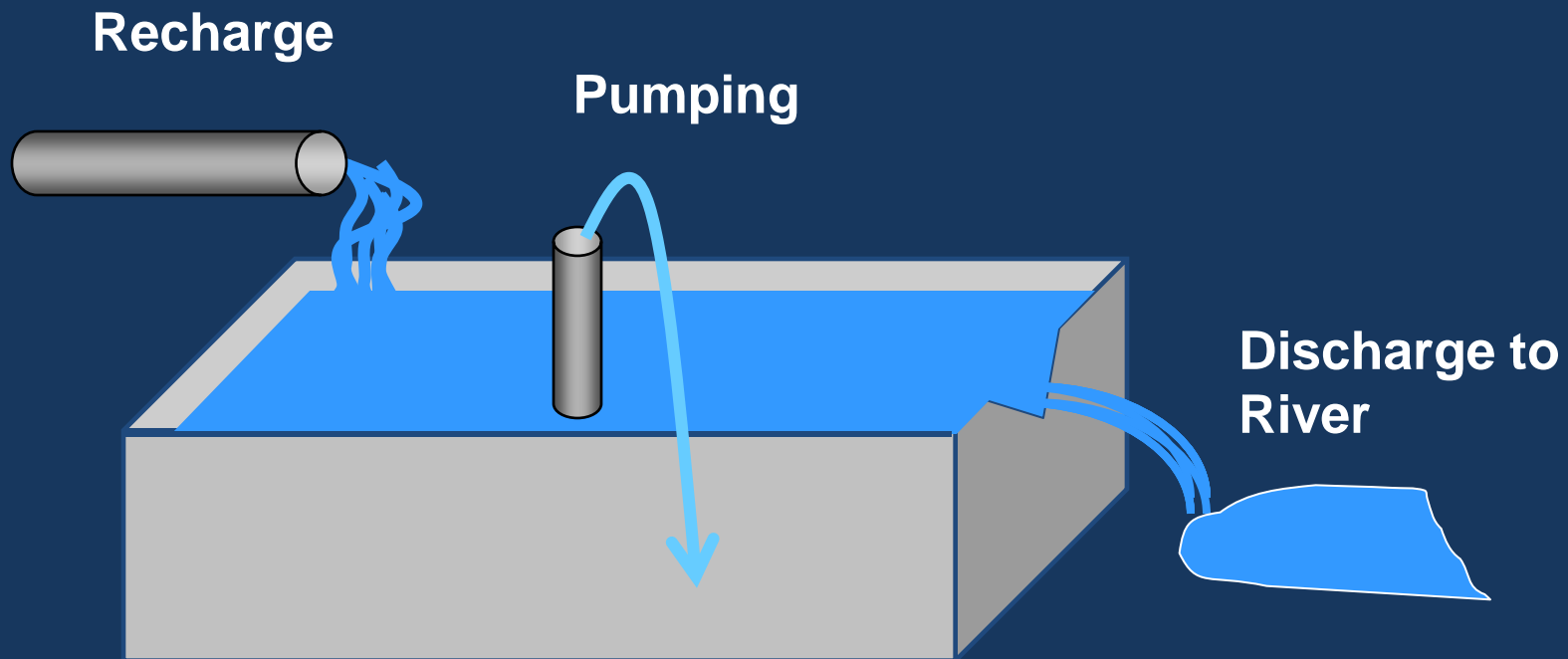


Perched Stream

Seepage Not Impacted by Ground Water Pumping

Illustrations from:
USGS Ground water
and surface water
a single resource

**Complication 1: *A gallon
consumptively used from ground
water is a gallon that will not appear
in streams***



Principle 1: A gallon consumptively used from ground water is a gallon that will not appear in streams

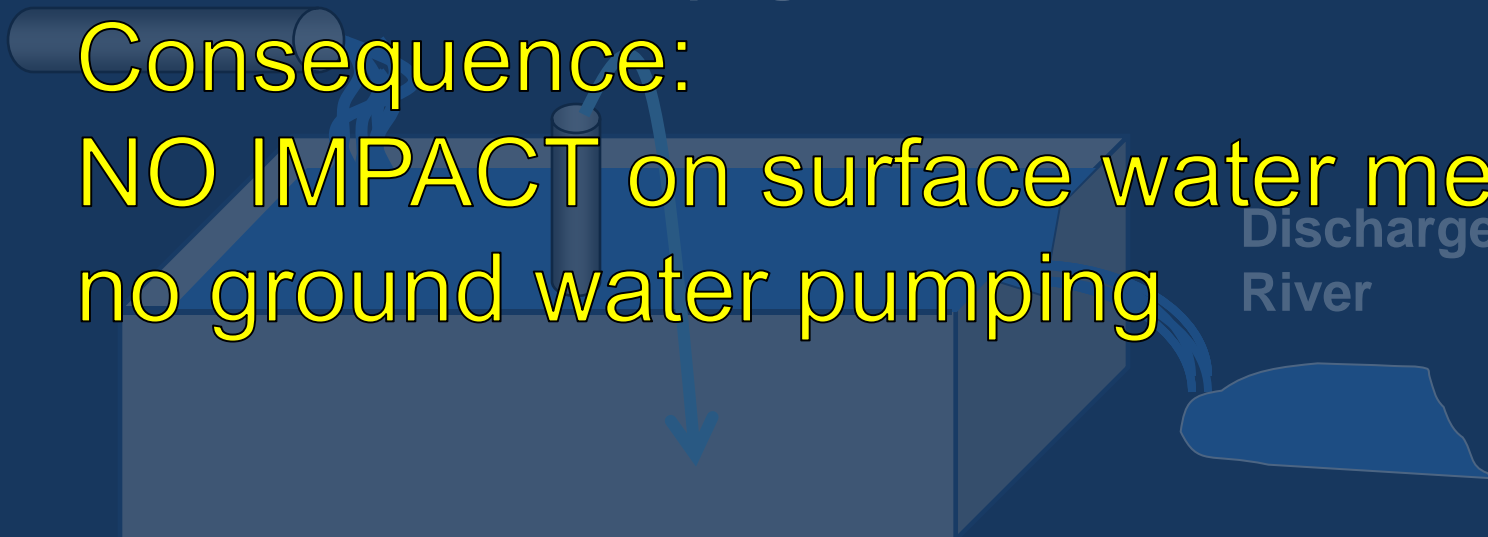
Recharge

Pumping

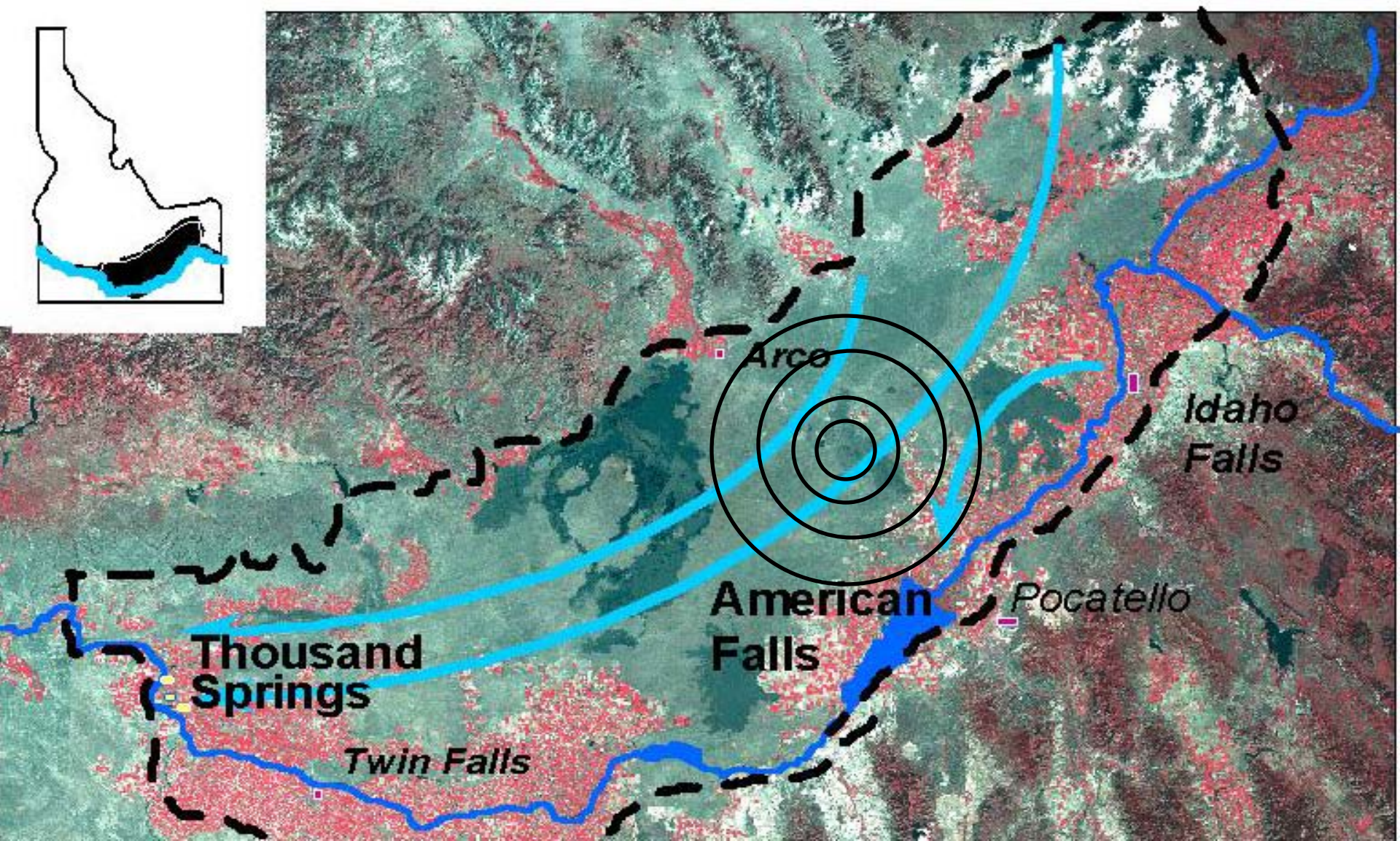
Consequence:

NO IMPACT on surface water means
no ground water pumping

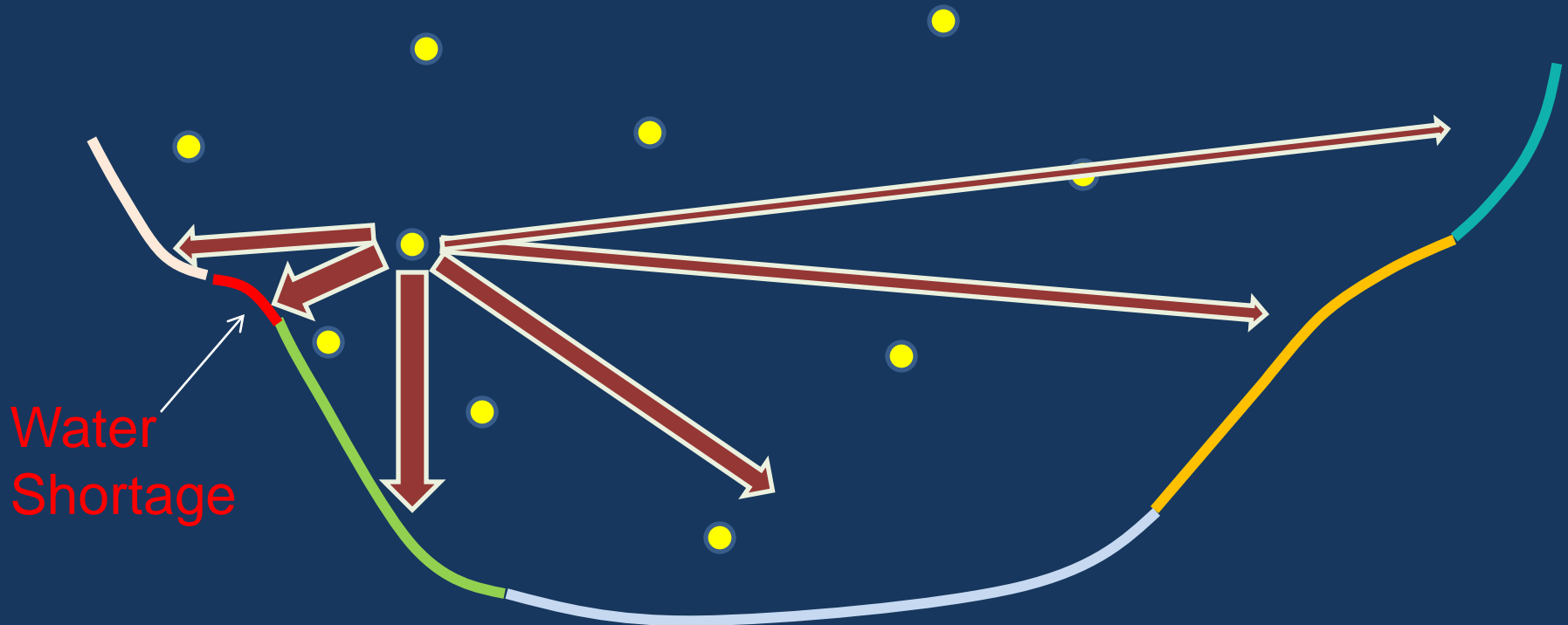
Discharge to
River



Complication #2: *Impacts do not follow flow lines*



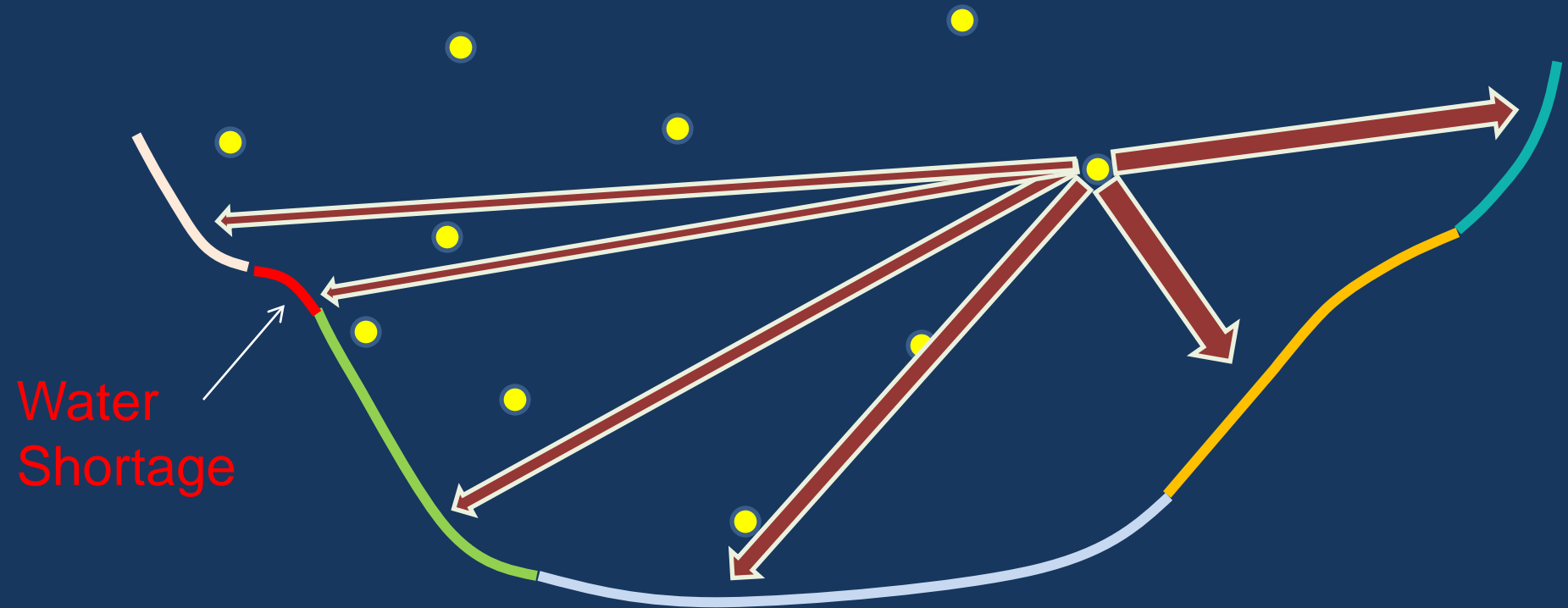
Curtailment Effects



Water
Shortage

Only one fourth of curtailed pumping
benefits reach with water shortage

Curtailment Less Effective At Farther Wells

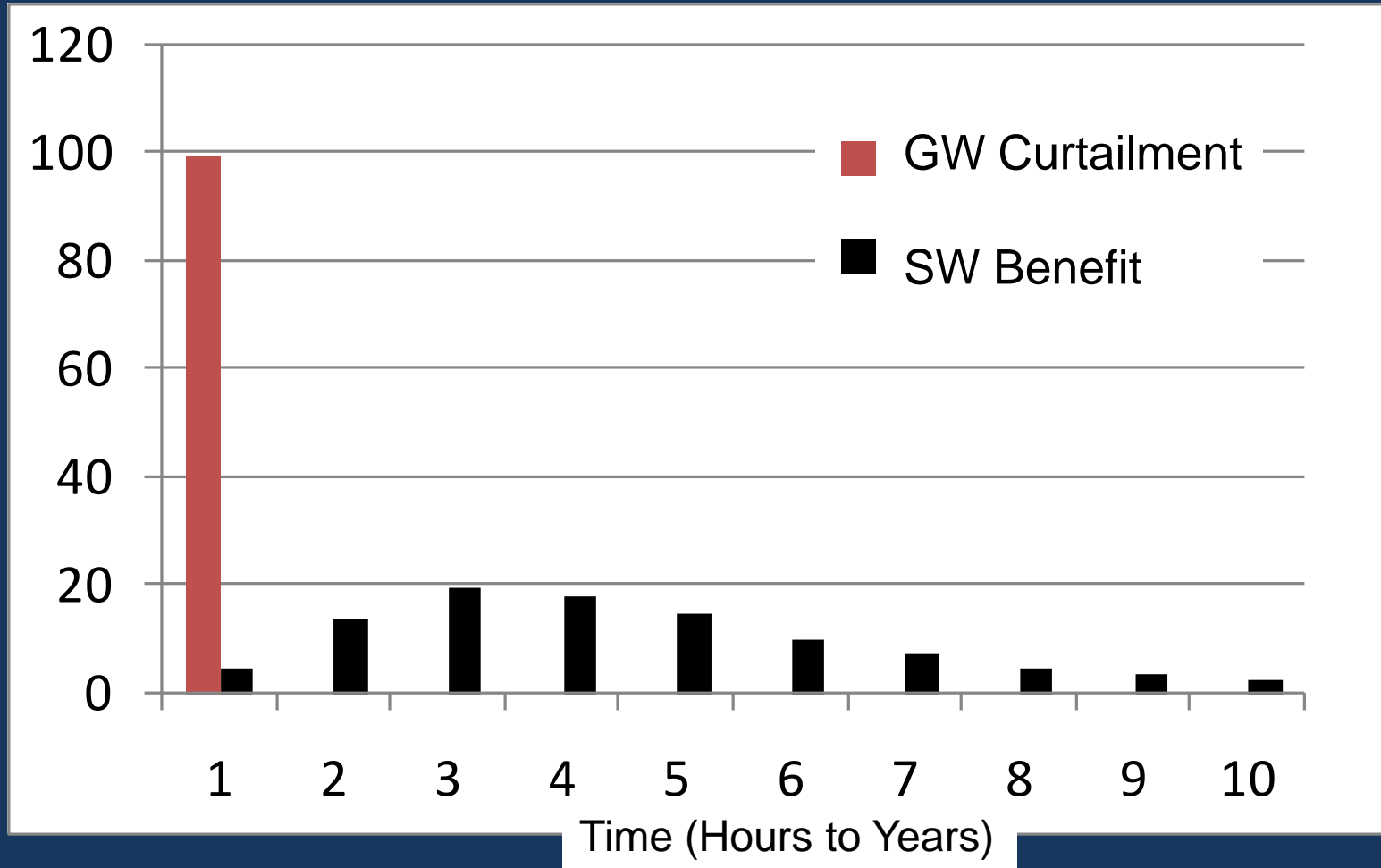


Only 1/10 of curtailed pumping
benefits reach with water shortage

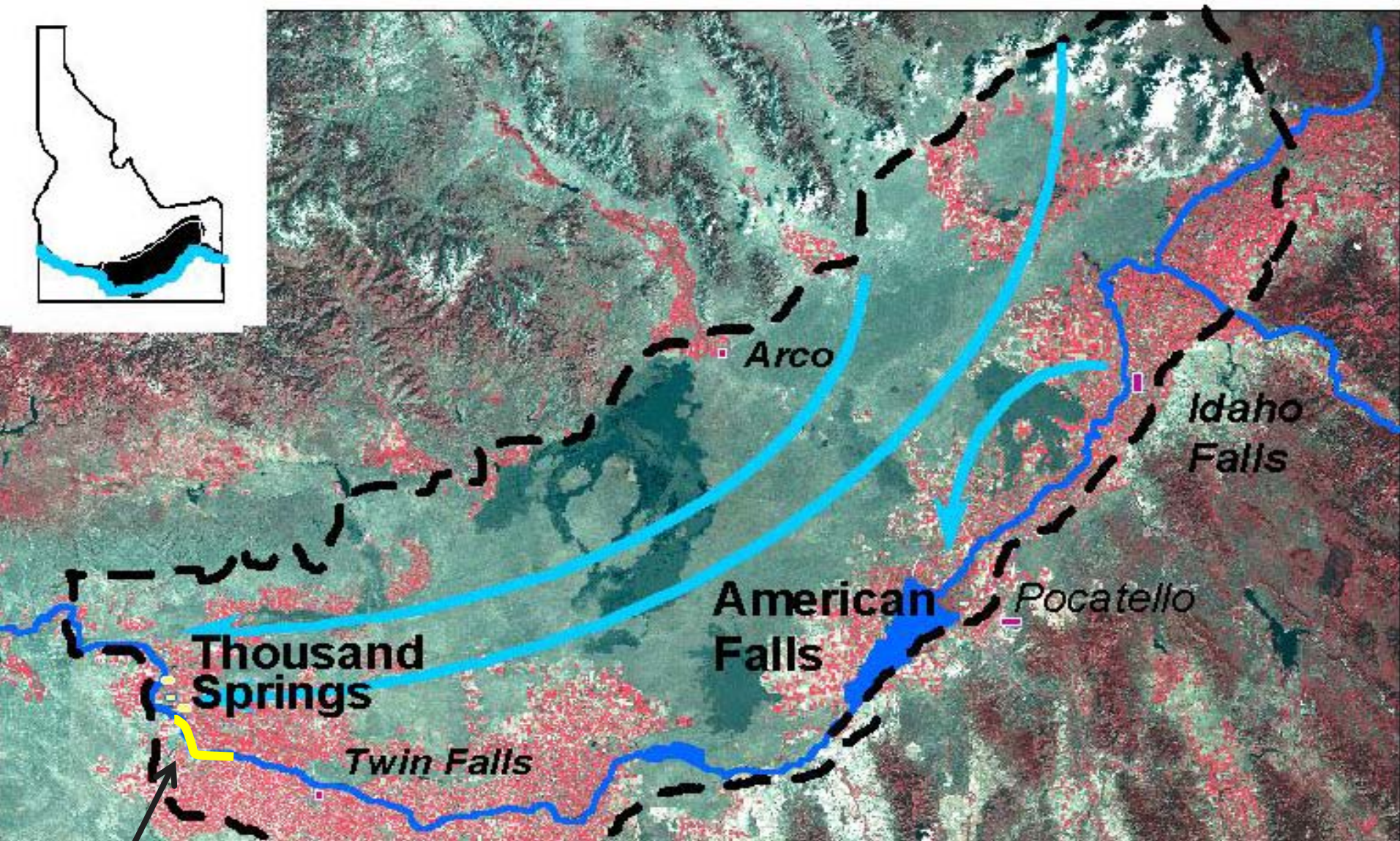
Consequences of Complication #2

- Every GW pumper impacts all connected surface water to a small degree (administratively awkward)
- Curtail 10 cfs to create 1 cfs of benefit? (Curtailment inefficiency)
- Some de minimis level of impact?

Complication #3: *Effects are delayed and dampened*

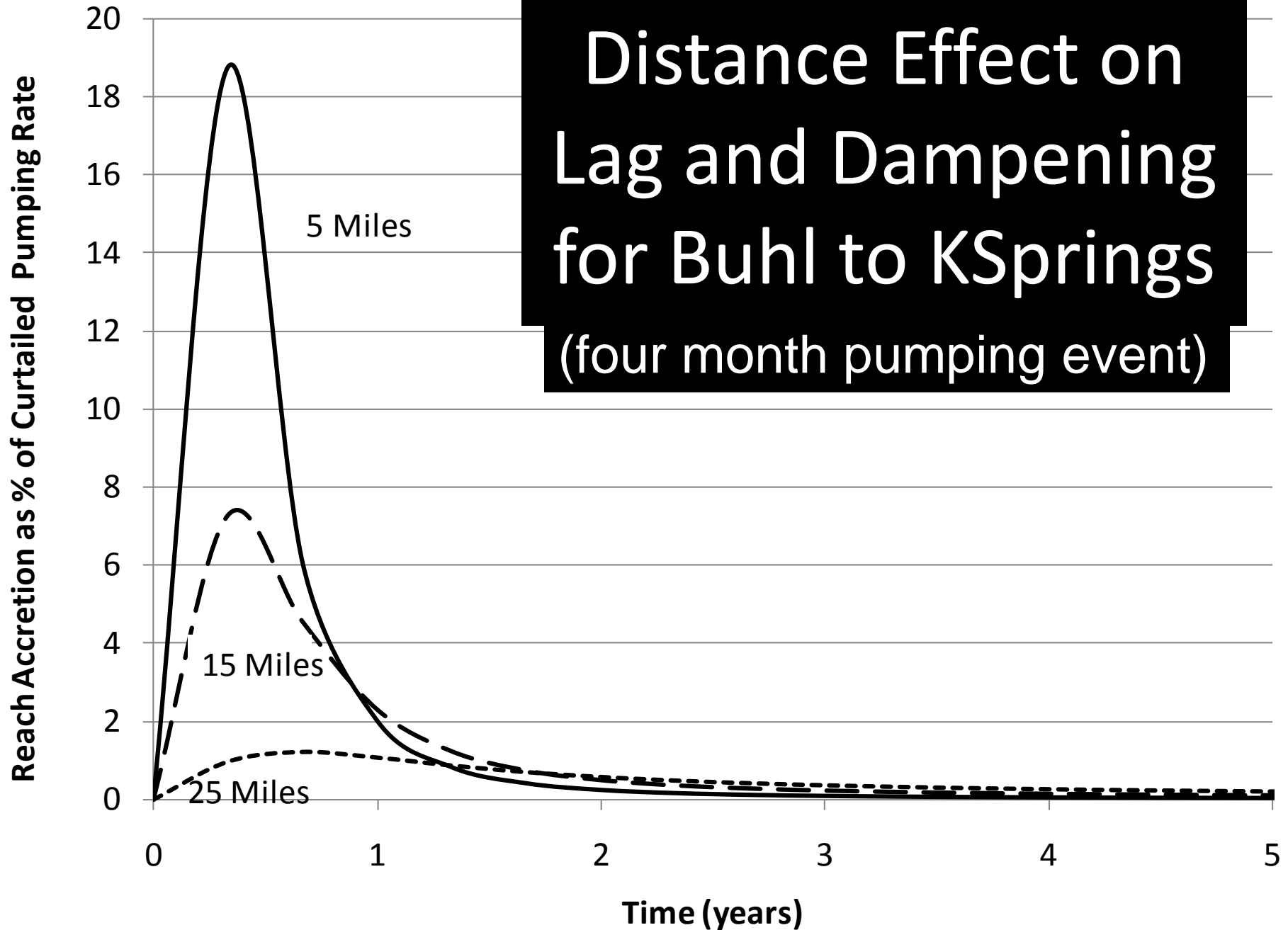


Lag and dampening increase with increased distance



Buhl to Thousand Springs Reach

Distance Effect on Lag and Dampening for Buhl to KSprings (four month pumping event)



Consequences of Complication #3

- Rate curtailment \geq rate of benefit
- Today's problems result from yesterday's (and last year's) actions
- Can't go back in time to change what we did yesterday
- Preemptive Curtailment
 - If effects are sometime in the future, do we know there will be a water shortage at that time?

Other Complications

- “Trust me I’m a hydrologic modeler”
- Uncertainty and evolving knowledge

“A Problem Well Stated is a Problem Half Solved”

Charles Kettering (engineer)

- Alternative problem statements
 - Curtailment is so inefficient that it is ineffective in providing relief to injured surface water users and useful only as a punishment
 - Prior appropriation is hydrologically incompatible with conjunctive management
 - ??????

More information?

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