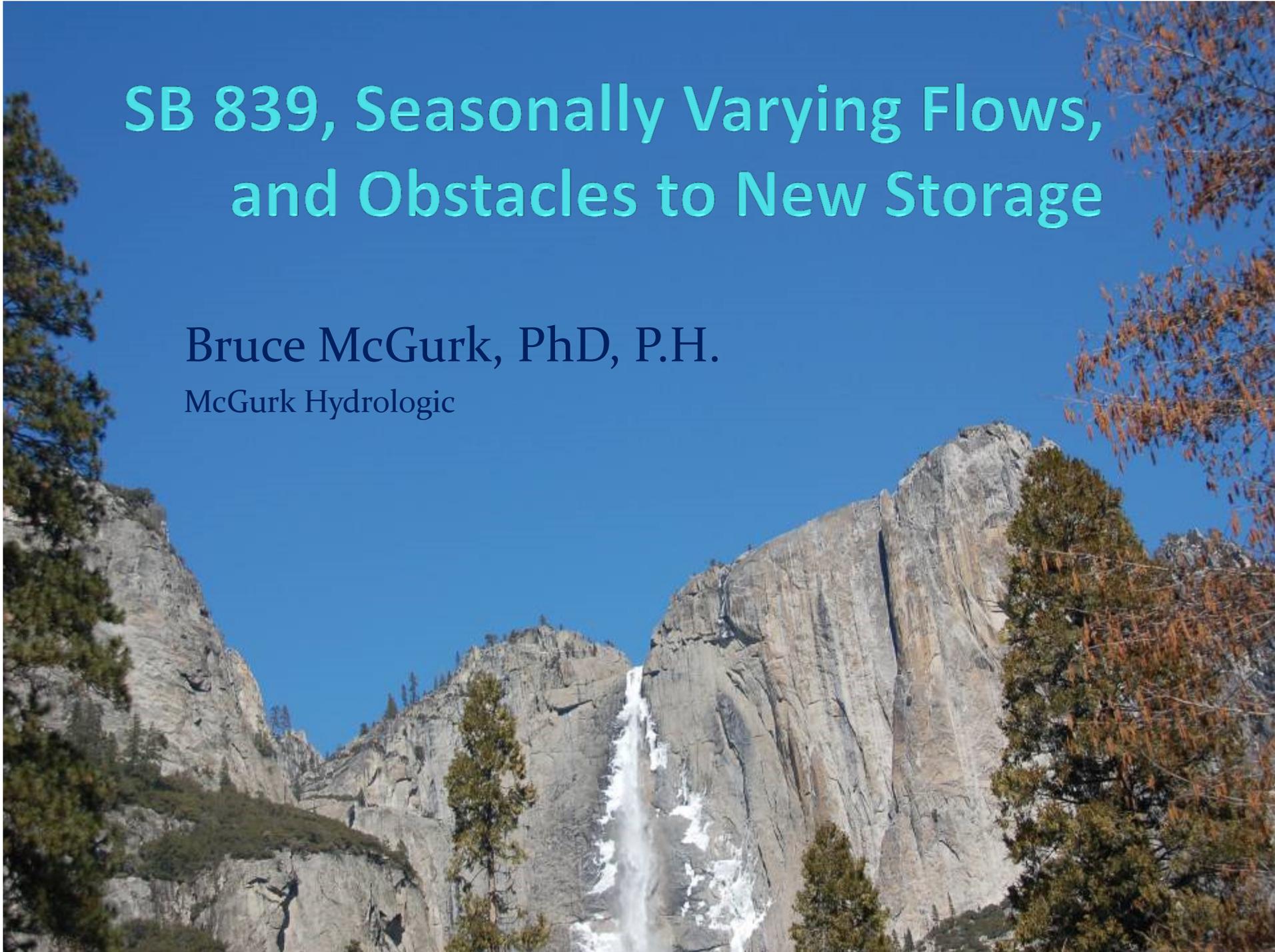


# SB 839, Seasonally Varying Flows, and Obstacles to New Storage

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McGurk Hydrologic



# Experience

- 30 years in mountain and snow hydrology
- FERC re-licensings on Feather, Pit, Mokelumne, Stanislaus, and Yuba-Bear Rivers
- New flow regime be Hetch Hetchy Reservoir, Tuolumne River in Yosemite National Park
- Runoff forecaster and reservoir operator for PG&E
- Operations manager for San Francisco's water supply
- Research hydrologist, US Forest Service
- B.S. in biology, M.S. in resource planning, Ph.D. in hydrology and watershed management

# Release Schedules

- Developed techniques accepted by agencies, irrigation districts, and NGO groups
- Monthly release schedule scaled by water year magnitude, basin size, and downstream ecosystem needs
- Geomorphic functions addressed with ecological pulse flows in early spring
- Storage allowed during periods of flow abundance
- Release schedules benefit cold-water systems by providing increasingly-rare cool and reliable flow

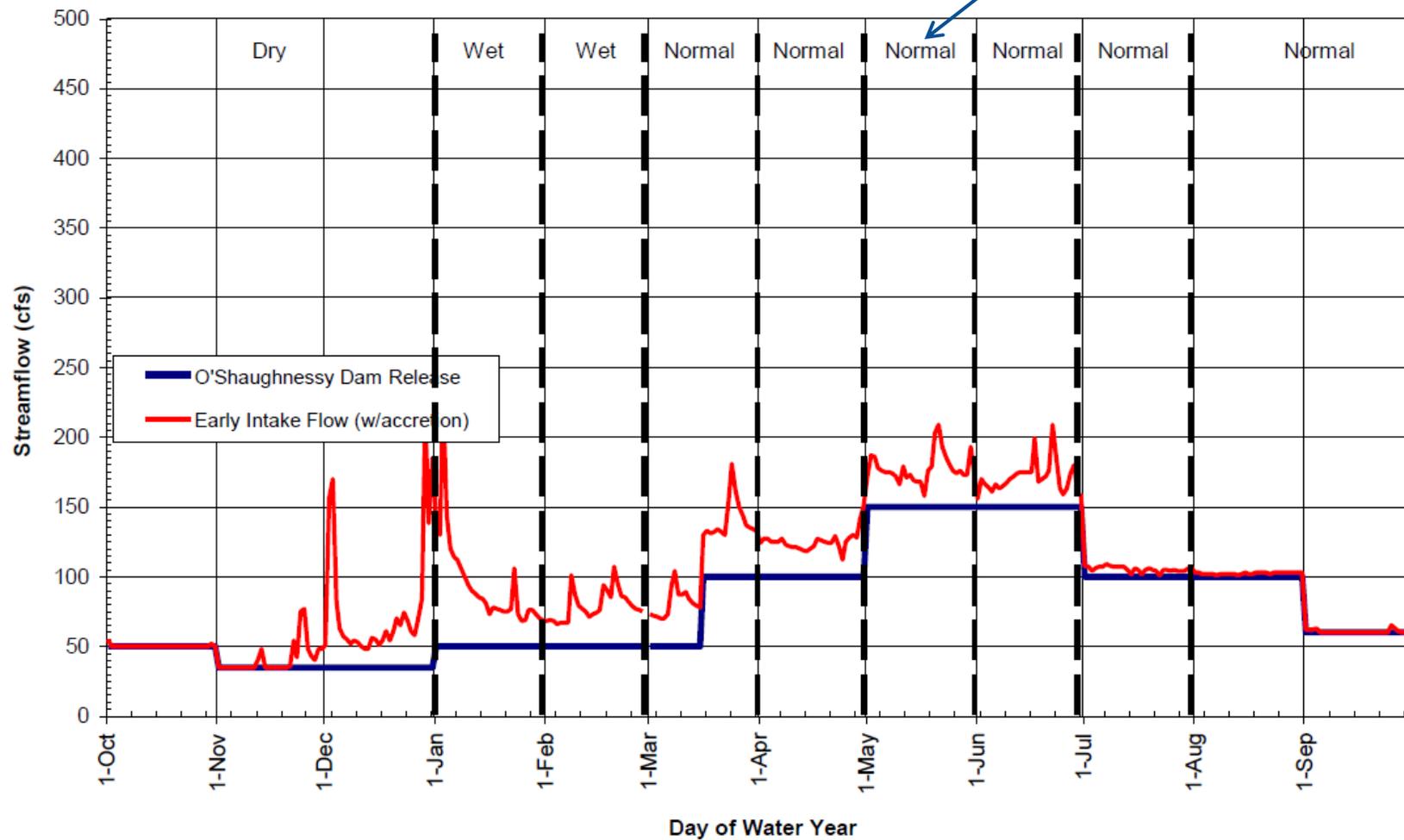
# Release Schedule Example

- WY Type determine by forecasting, updated Jan-Jun
- Reservoir storage is 360,000 Acre-Feet

Period	O'Shaughnessy Dam Baseflow Release Schedules (cfs)				
WY Type:	Ex. Dry	Dry	Normal	Wet	Ex. Wet
Frequency (%):	15%	20%	30%	20%	15%
Jan. 1 - Mar. 15	35	35	35	50	75
Mar. 16 - Apr. 30	140	180	180	200	250
May 1 - June 30	50	90	180	200	300
July 1 - 15	50	60	130	200	300
July 16 - 31	50	60	130	150	175
Aug. 1 - 15	50	50	130	130	130
Aug. 16 - 31	50	50	60	60	75
Oct. 1 - Dec. 31	35	35	35	50	75

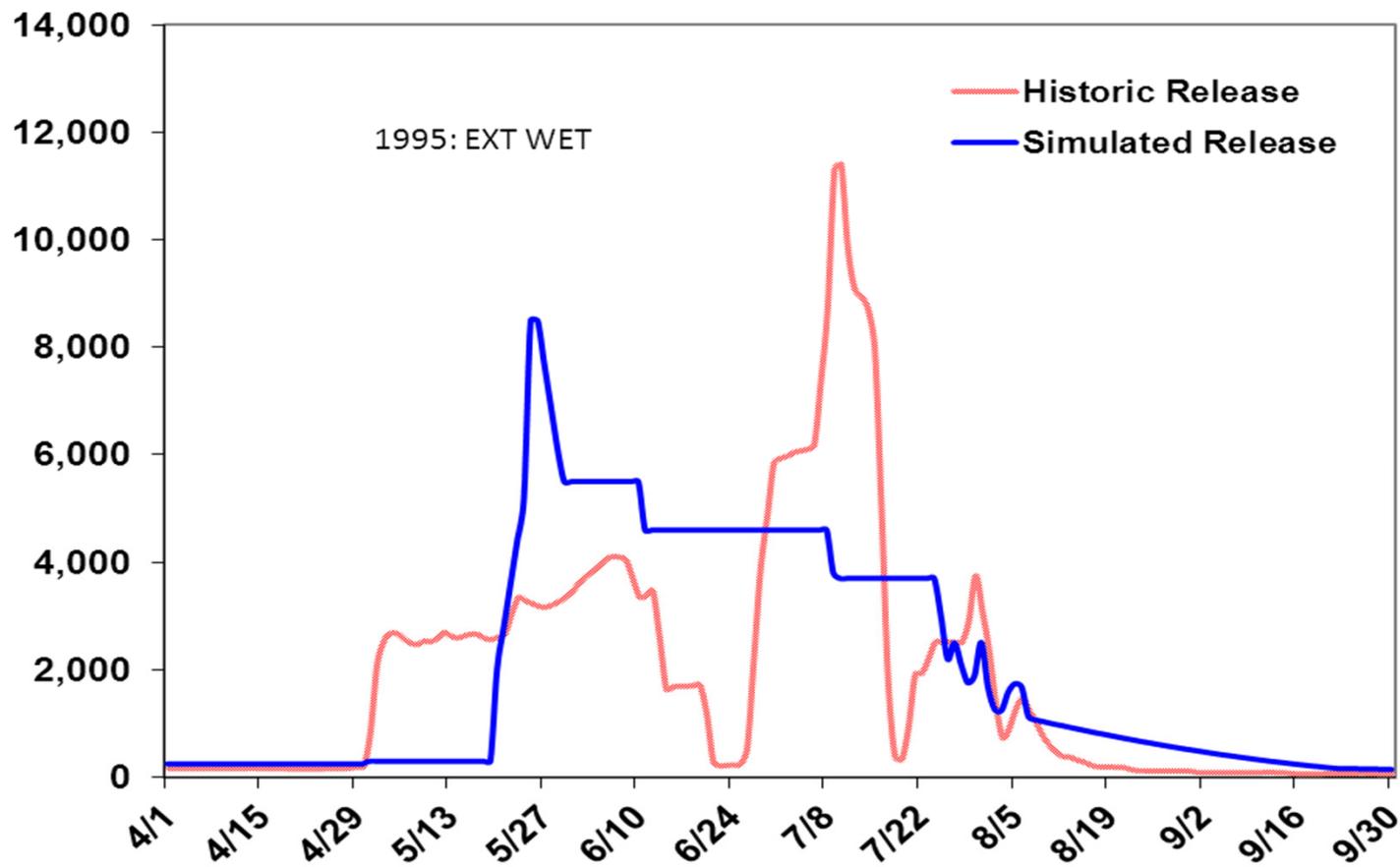
# Release plus Accretion

WY Type Forecast



# Ecological Pulse Flows

- Excess water released on a schedule to clean gravels, connect with the floodplain, and avoid amphibian egg laying



# Senate Bill 839

- “The purpose of.....this 2013 Act is to establish a means for state government to support the development of water resource projects having economic, environmental and community benefits.”
- “Seasonally varying flows.....protect and maintain the biological, ecological, and physical functions of the watershed downstream.....with due regard given to the need for balancing the functions against the need to store water for multiple purposes.”

# SB 839 sets 500 AF Diversion Trigger

- For diversions over 500 AF, stringent requirements mandated for monitoring and release protocols
- 500 AF is 2 cfs or 900 gallons/minute for the 120-day irrigation season. It is a SMALL amount of water for irrigation, and would grow a crop on only 200 acres.
- To divert over 500 AF, a 1,000 AF reservoir would be needed, which is 3 rows of 6 football fields long, 27 ft deep – small by most standards.
- 250 AF would be released to supplement downstream low flow
- With the proposed DAILY flow protocol, two streamgages, diversion gaging, a reservoir depth gage, and expensive release valves/control system would be required
- Construction and operational costs would be greater than benefit from the water, even with grants

# Science Subgroup Report, Feb. 1, 2014

- Concludes a variable flow regime is critical to ecosystem function
- Recommends that only 15% of DAILY inflow (POF) can be stored, remainder must be released each day
- If applicant for publicly-funded projects want more storage or different POF, an “in-depth assessment” must be completed and submitted to the State
- **Combination of the latter two recommendations will make new or modified storage facilities unlikely to occur under SB839**

# Daily Percent of Flow Problems

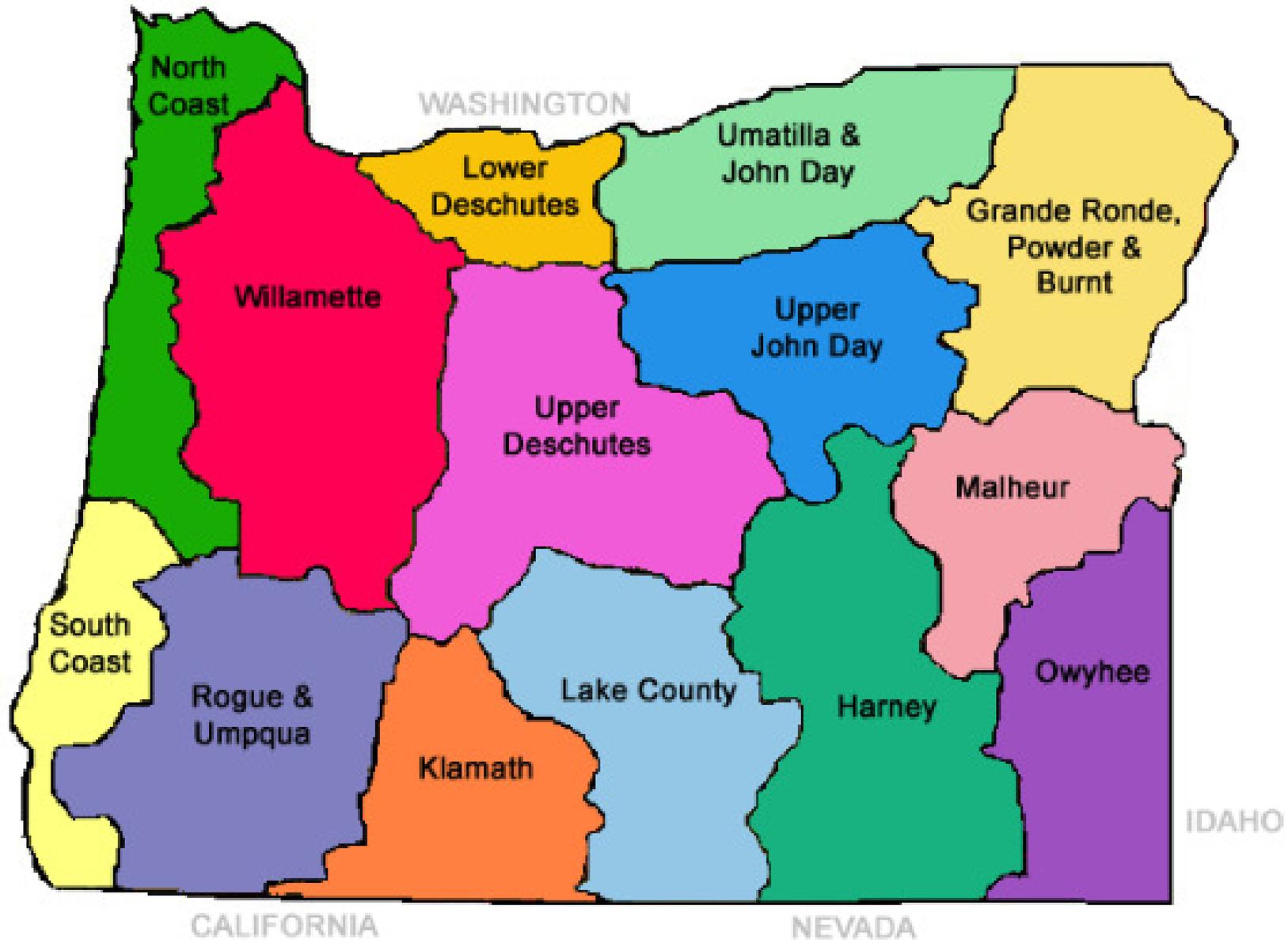
- Too little water can ever be stored
- Small facilities on “flashy” streams would need large and expensive valves or gates
- Each facility would require an upstream & downstream flow gage and for the operator to forecast inflow and make DAILY adjustments
- Remote facilities without line power cannot comply
- Most moderate and large reservoirs have MONTHLY or biweekly release schedules and other provisions that accomplish ecosystem and geomorphic goals



# In-Depth Assessment (IDA)

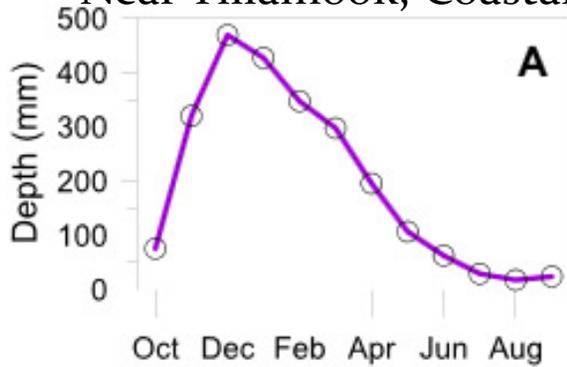
- This detailed process is typically followed nationally for 200,000 AF to 2 million AF reservoirs
- The process takes **3 years and costs \$5 million**
- No small or medium storage project will yield revenue great enough to pay for the IDA
  
- We need more solutions!
- Are all the streams the same?

# Stream Basins in Oregon



# Runoff Regimes in Oregon

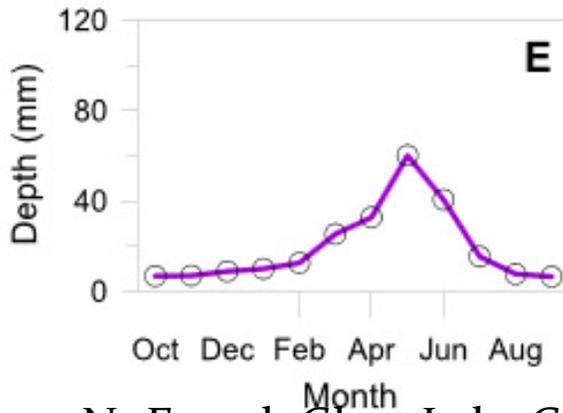
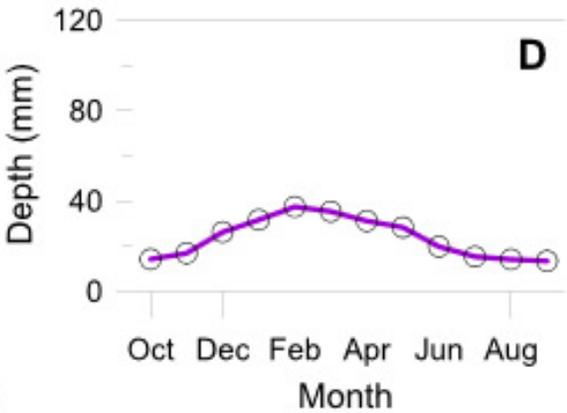
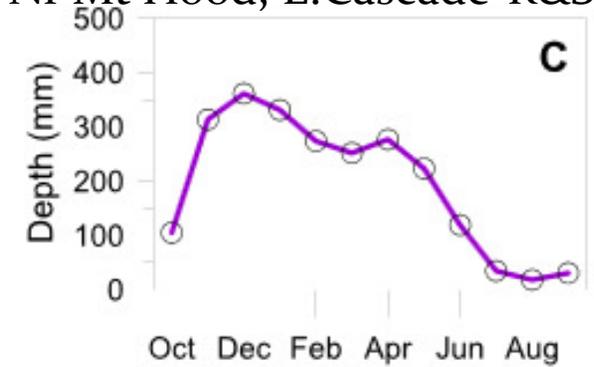
Near Tillamook, Coastal-R



Near Salem, Willamette-R



Nr Mt Hood, E.Cascade-R&S



Nr French Glen, Lake Cnty-S

Nr Warm Spngs, Up.DesChutes-S

Nr LaGrande, Powder Basin

# Some Basins w/o Salmon Habitat

- Southeast zones have no salmon habitat, and other eastern basins have miles of stream that dry up in summer. Every drop of water is really valuable there, and the SB 839 purpose fits well there.



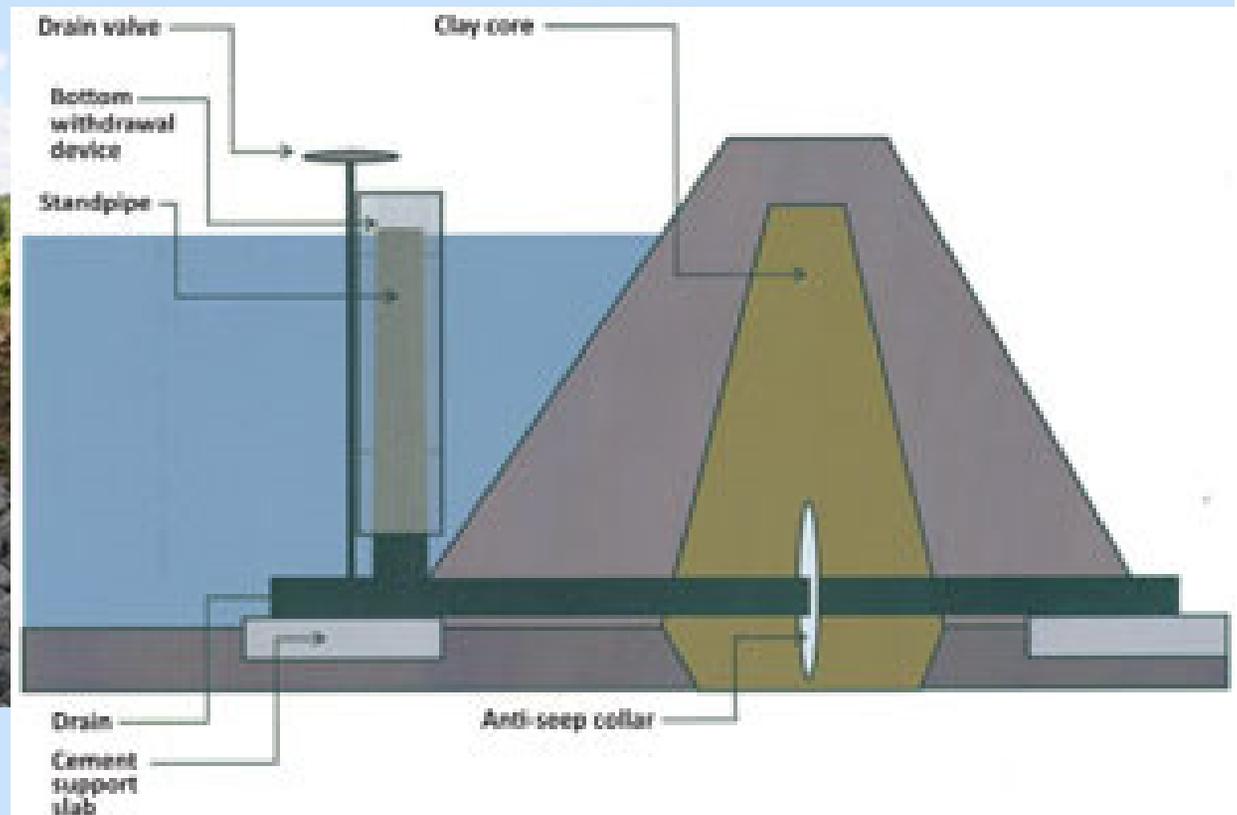
(OR Dept. of State Lands)

# Recommendation #1

- Exempt the non-salmon and ephemeral streams from the POF requirement proposed by the Science Subgroup, but continue the 50% exceedance criteria.
- Establish dam and diversion protocols for the storage on the non-salmon streams, based on watershed size, storage size, and streamflow timing/persistence
  - If storage over 1,000 AF (2,000' x 2,000' x 11' pond), ~monthly release schedule required.
  - If storage over 5,000 AF, ~monthly and pulse flow
  - If under 1,000 AF, fill and spill with small minimum flow

# Smaller Storage Structures

- Typical small structures have few controls – drain, overflow, and minimum flow release valve – automatic, no power, fill and spill



# Storages over 5,000 AF – Pulse Flow

- Cone Valve Discharging 2,000 cfs

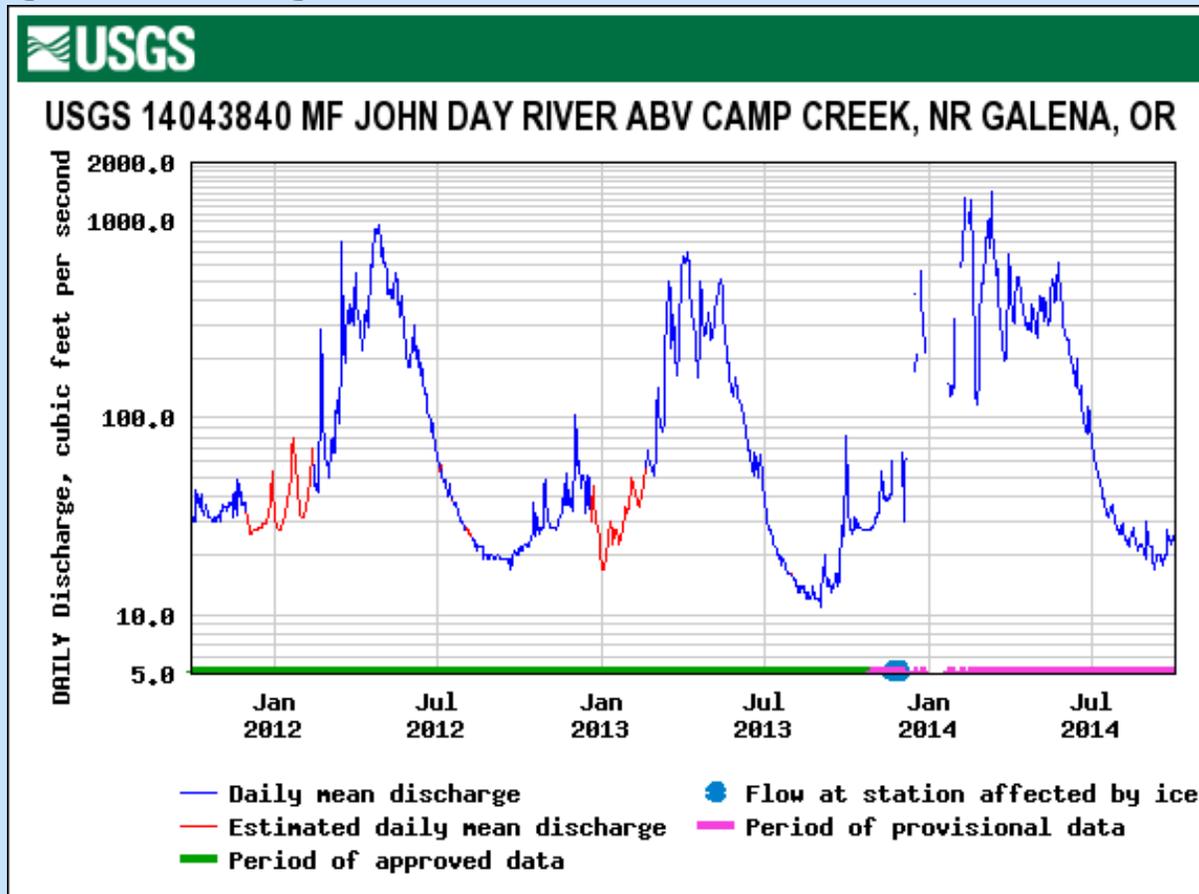


## Recommendation #2

- Group the snowmelt streams into a second category, and exempt them from the proposed POF protocol.
- As with non-salmon streams, size of proposed storage and upstream basin should govern release requirement complexity and volume.
- Using a streamlined IDA, establish monthly minimum release that mimics pattern of historic monthly, but allows storage for projects between 5,000 AF and 50,000 AF.
- Develop a simple “requirements checklist” for projects between 1,000 and 5,000 AF.

# Snowmelt Stream Example

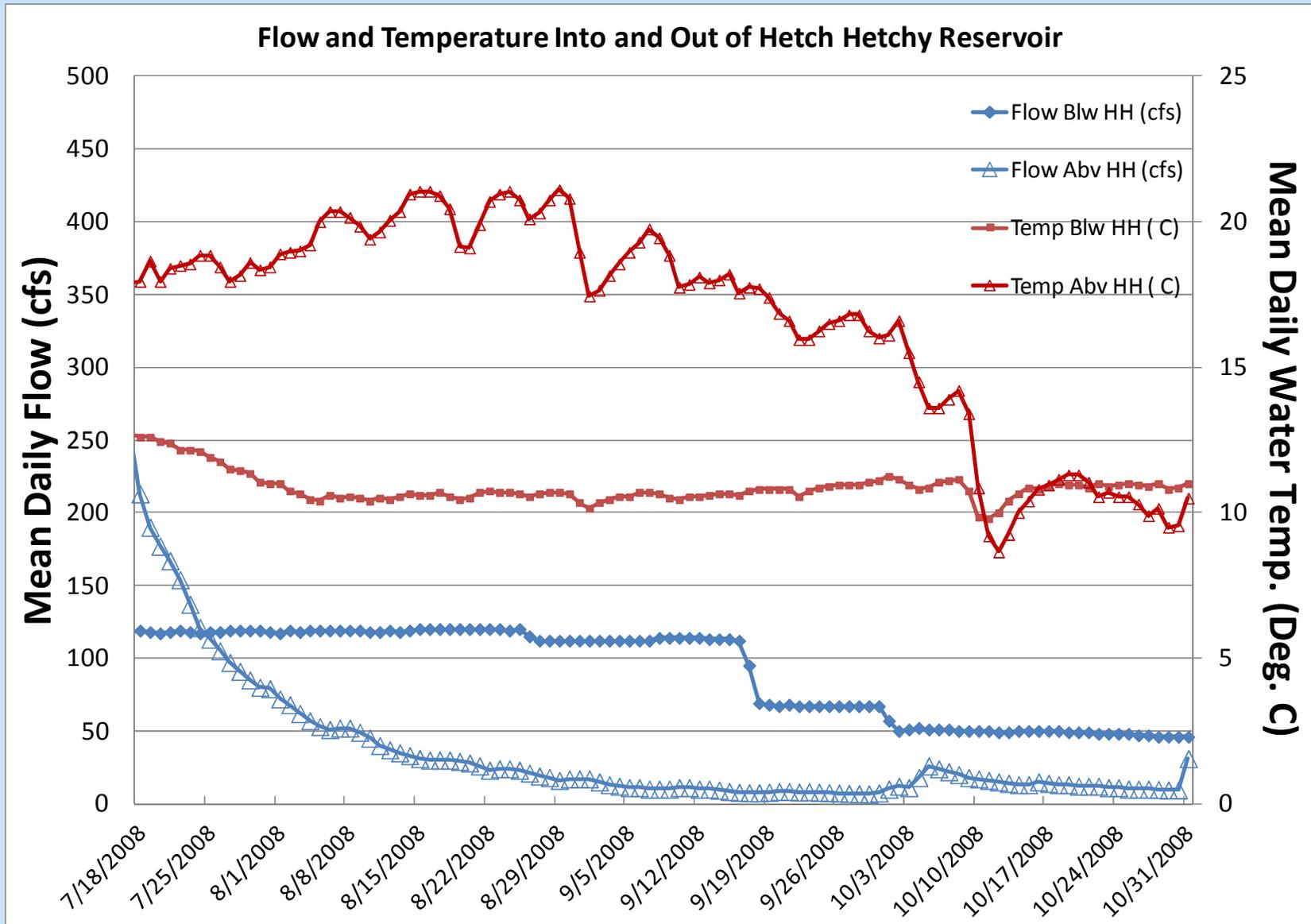
- Upper Fork John Day, salmon stream, 267 sq miles, 3,400 ft elevation, 86,000 AF/yr, Nov-Apr/Winter
- Storage could be 5,000-15,000 AF, would fill and spill, apply monthly release schedule and overflow section



# Snowmelt Stream, cont.

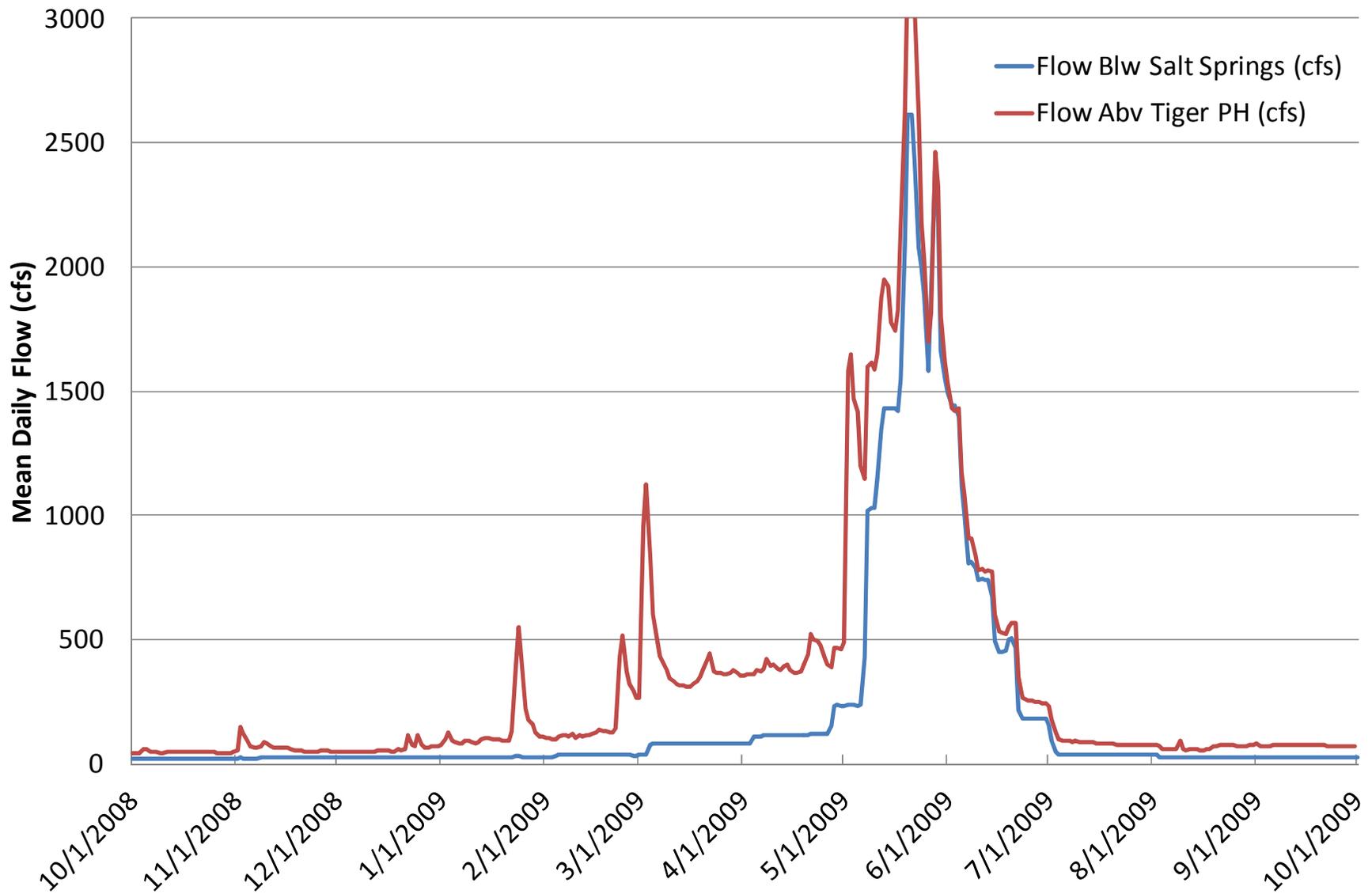
- SB 839 purpose is to promote development of storage that can provide environmental benefits
- This site has flows as low as 11 cfs in summer, and are likely warmer than is optimal for most fish
- A full 5,000 AF dam could supplement current low flows at critical times, i.e., add 5 cfs for 3-months
- The release would likely be cooler than the inflow
- It would also allow for diversion to beneficial uses

# Reservoir Temperature and Flow Benefits



# Flow Variability Below Structures

Flow Variability on the No. Fork, Mokelumne River



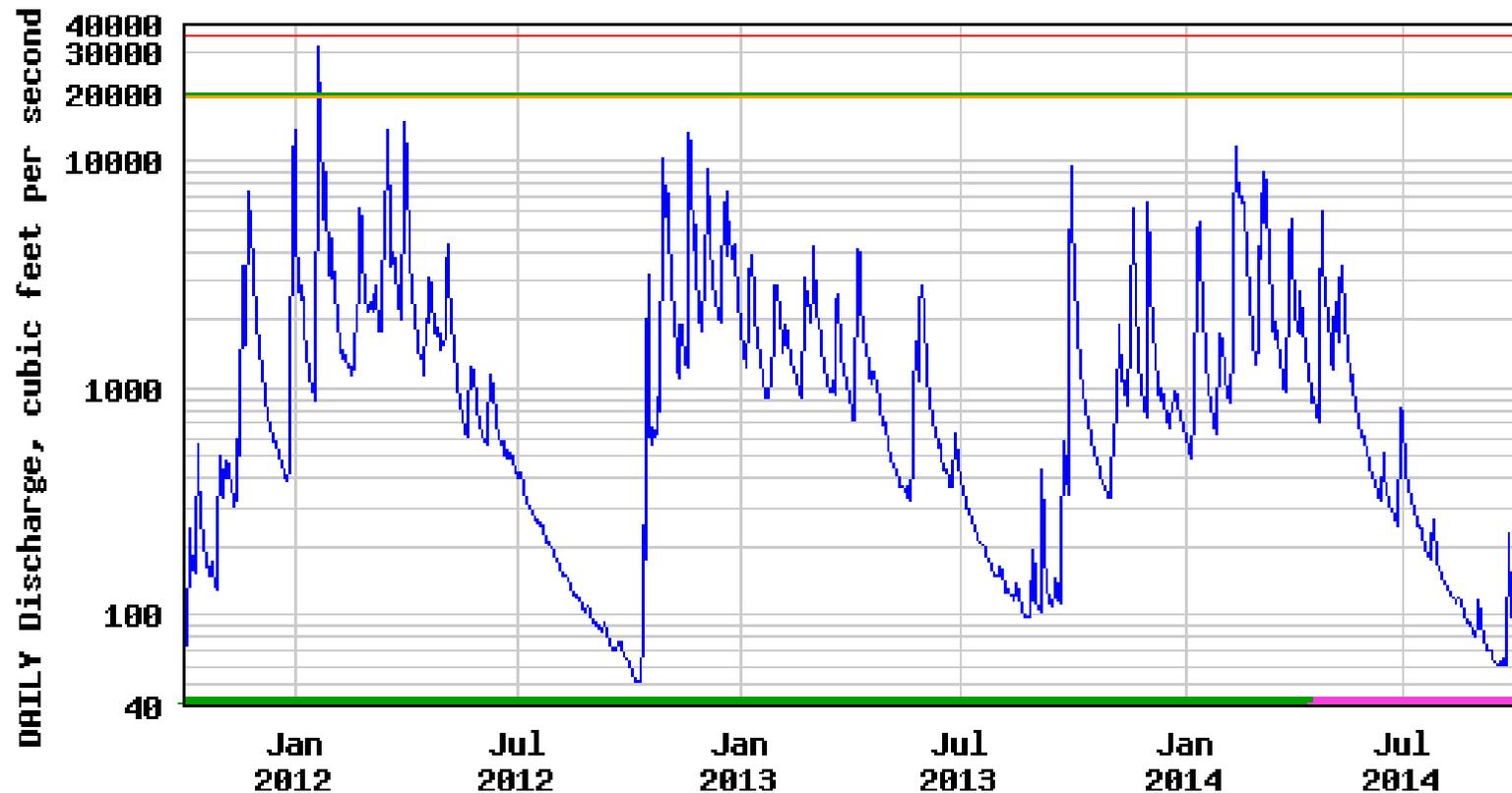
## Recommendation #3

- Group the west-side rain-dominated streams and modify the POF guidelines to recognize that high flow volumes and flashy flows occur there.
- Reservoirs under 5,000 AF will fill and spill in a day for many storms
- Daily POF releases would be very large and very expensive to implement.
- If storage is proposed, flexibility in design and operation is needed.

# West-side Example Daily Flow



USGS 14305500 SILETZ RIVER AT SILETZ, OR



- Daily mean discharge
- 25-year recurrence interval
- Period of approved data
- 2-year recurrence interval
- Period of provisional data
- Discharge at floodstage

# Conclusions

- Requiring DAILY percent of flow release requirements at new or modified reservoirs is impractical
- Even with grants and loans for construction, lifetime operation, monitoring, & reporting costs will be high
- One-size fits all is not practical in OR – it has at least three major hydrologic regimes
- Rules need to be customized by regime for SB 839
- Current proposed POF requirements will counter intent of SB 839, and little new storage will be built



Thank you, and Questions?