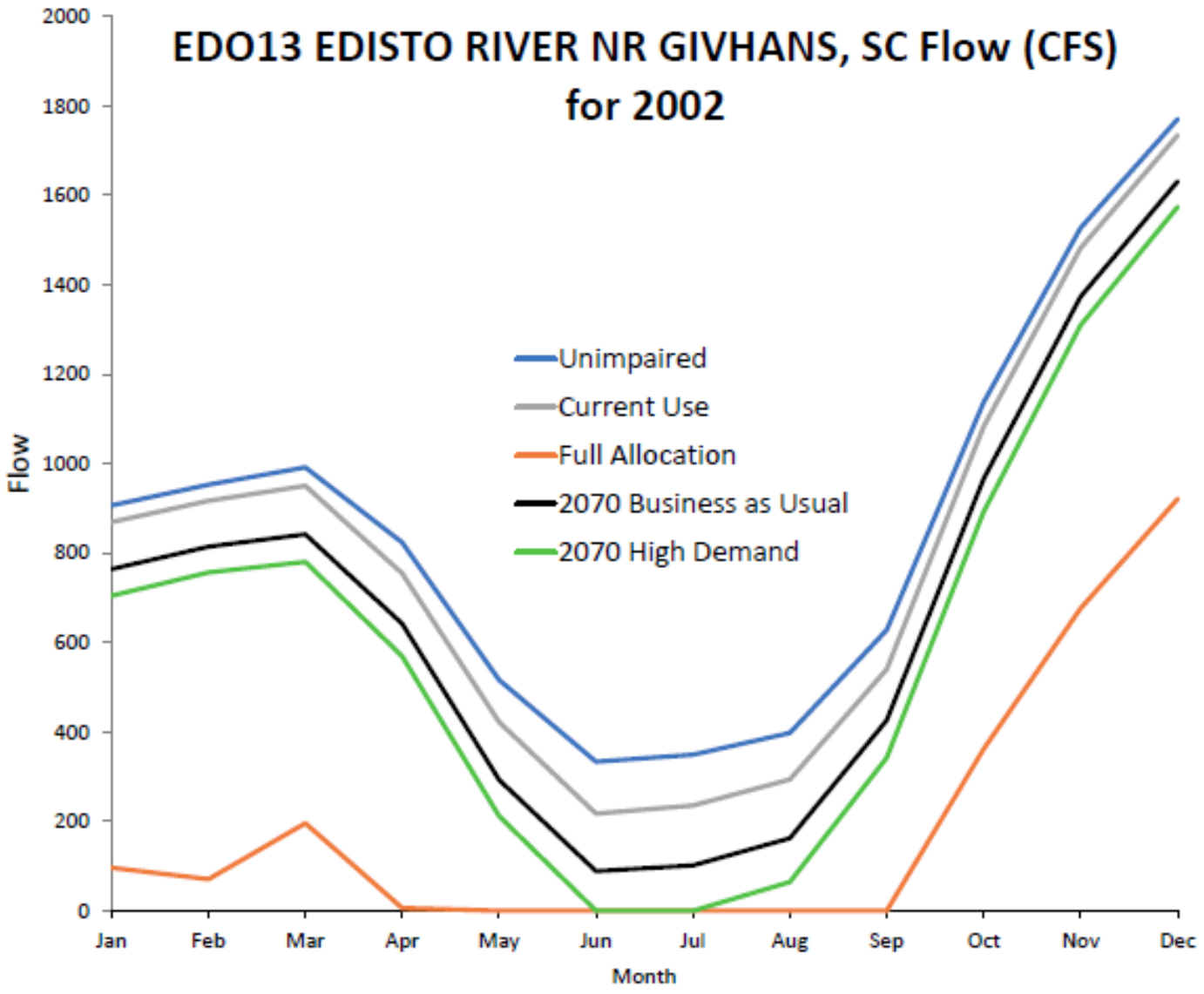
Projected Shortage at Givhans Ferry

Sept 2021



BACKGROUND

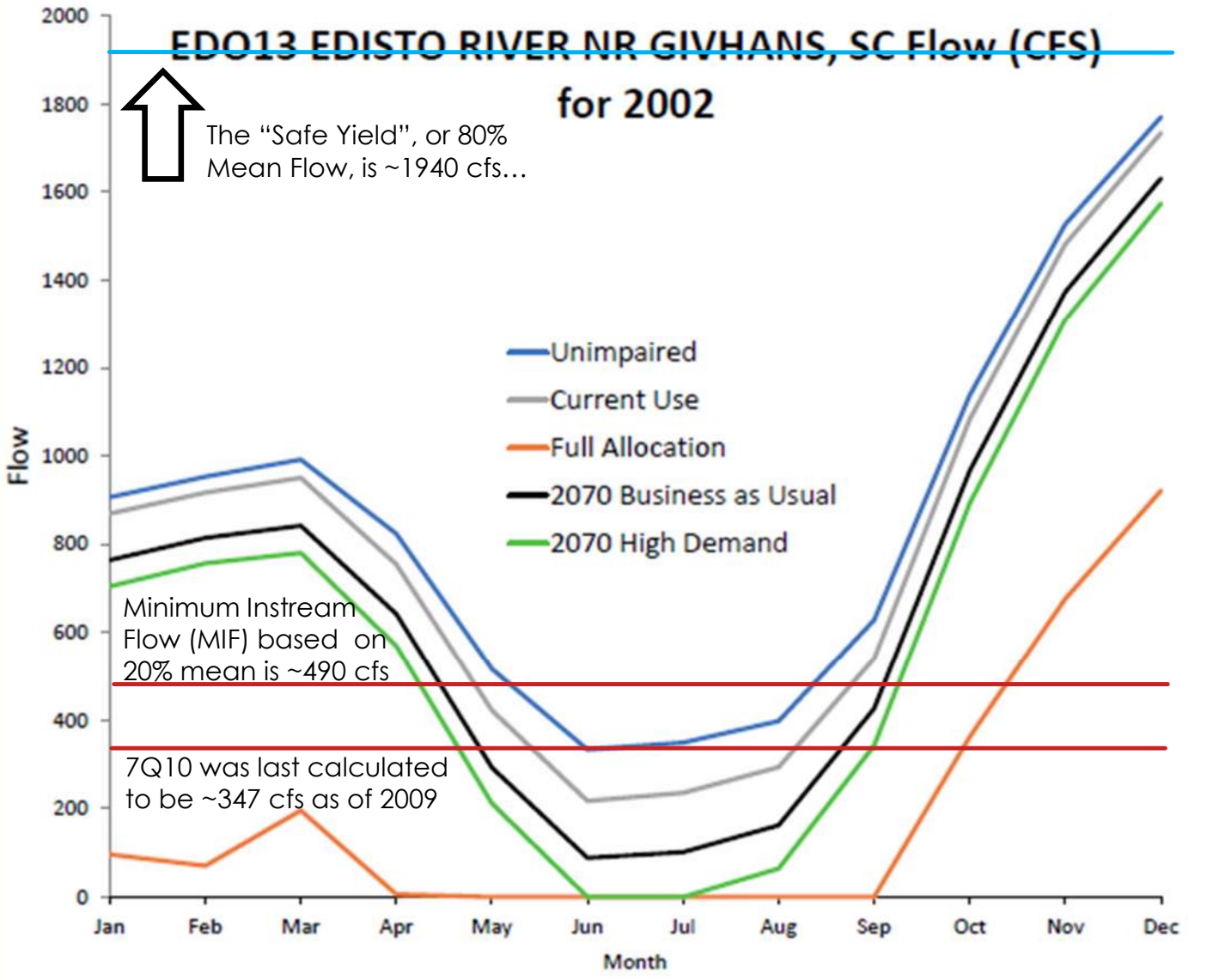
- CWS has been aware of the decreasing flows at Givhans Ferry over the past few decades despite our using less Edisto than we did in the 1990's
- The modeled results confirm this has been the case and is likely to get worse over the coming decades
- This is why it is so important that we develop a river basin plan all of the RBC stakeholders can get behind

OUTLINE

- Is there a reach of interest (or even shortage) at Givhans?
- Should a surface water condition be identified?
- What management strategy or strategies should we consider?

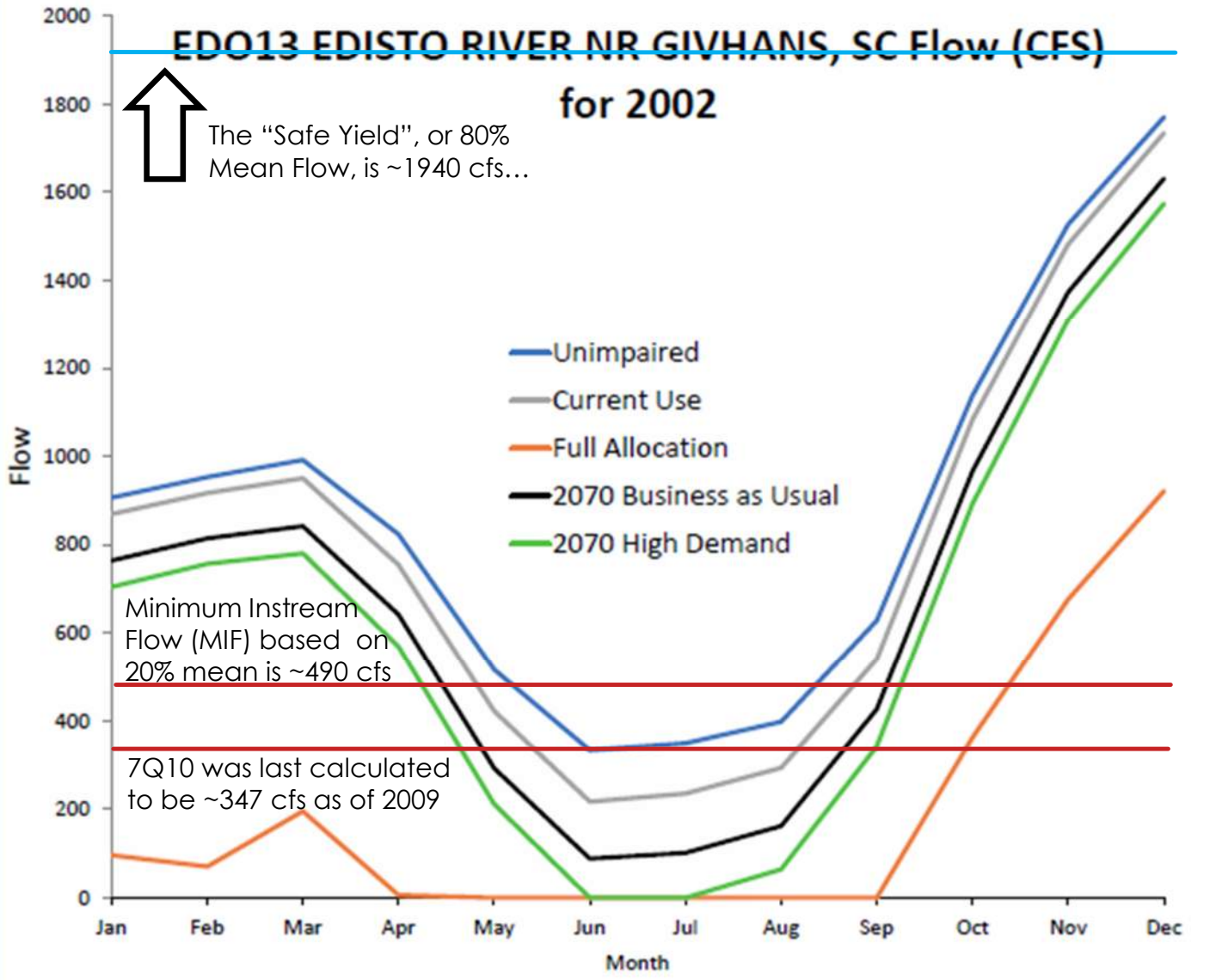
IS THERE A PROJECTED SHORTAGE

- The "unimpaired" scenario shows flows under MIF even with no withdrawal
- The "current use" scenario shows flows have already been low during drought
- Obviously increased withdrawals will lead to even lower flows



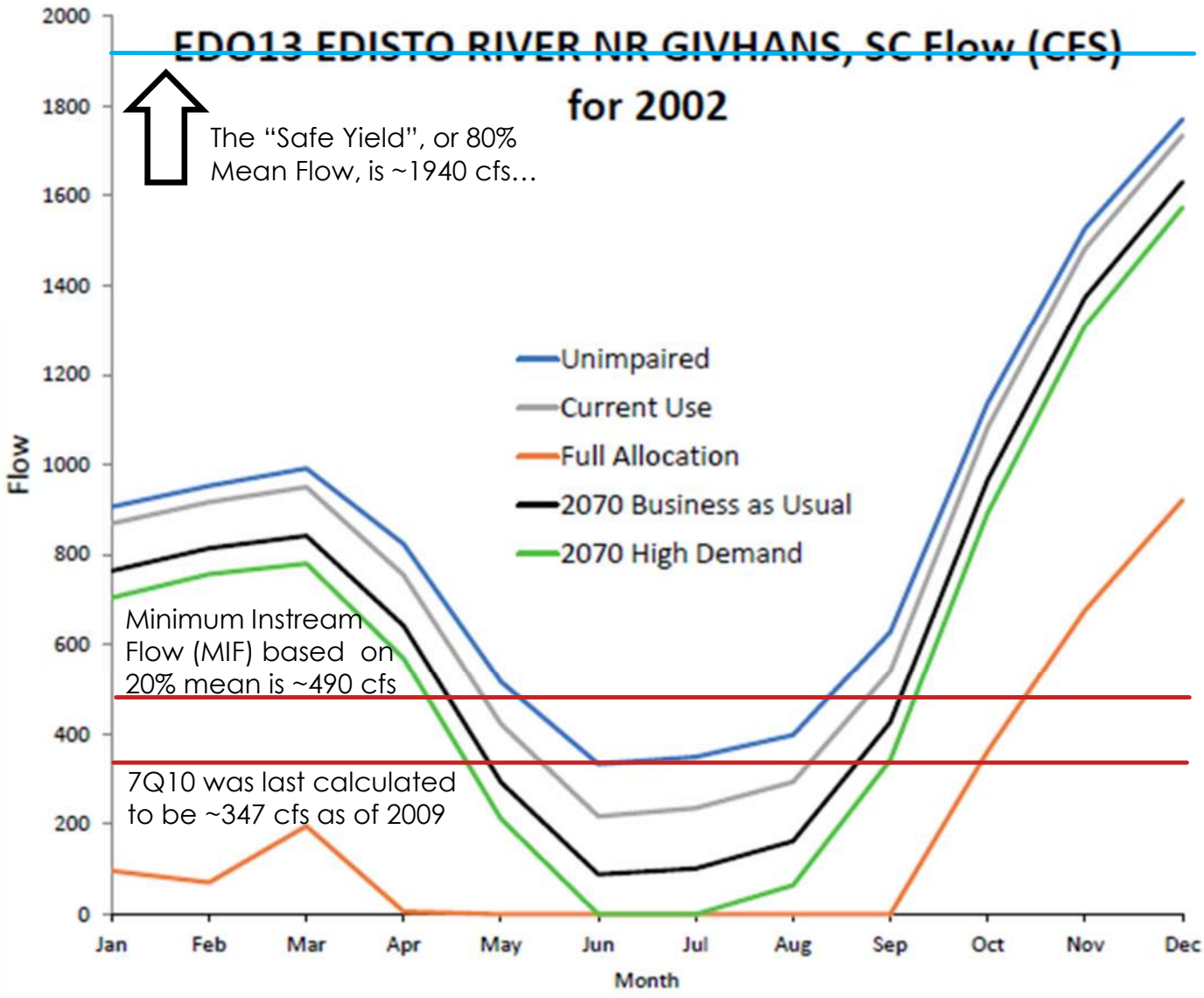
IS THERE A PROJECTED SHORTAGE

- Much lower flows are likely to result even in the "business-as-usual" scenario
- The river is projected to reach zero flow by 2070 in both the "high demand" and "full-allocation" scenarios



IS THERE A PROJECTED SHORTAGE

- The results of all of the scenarios point to the fact the resource has likely been fully allocated even if you don't include the recent registrations



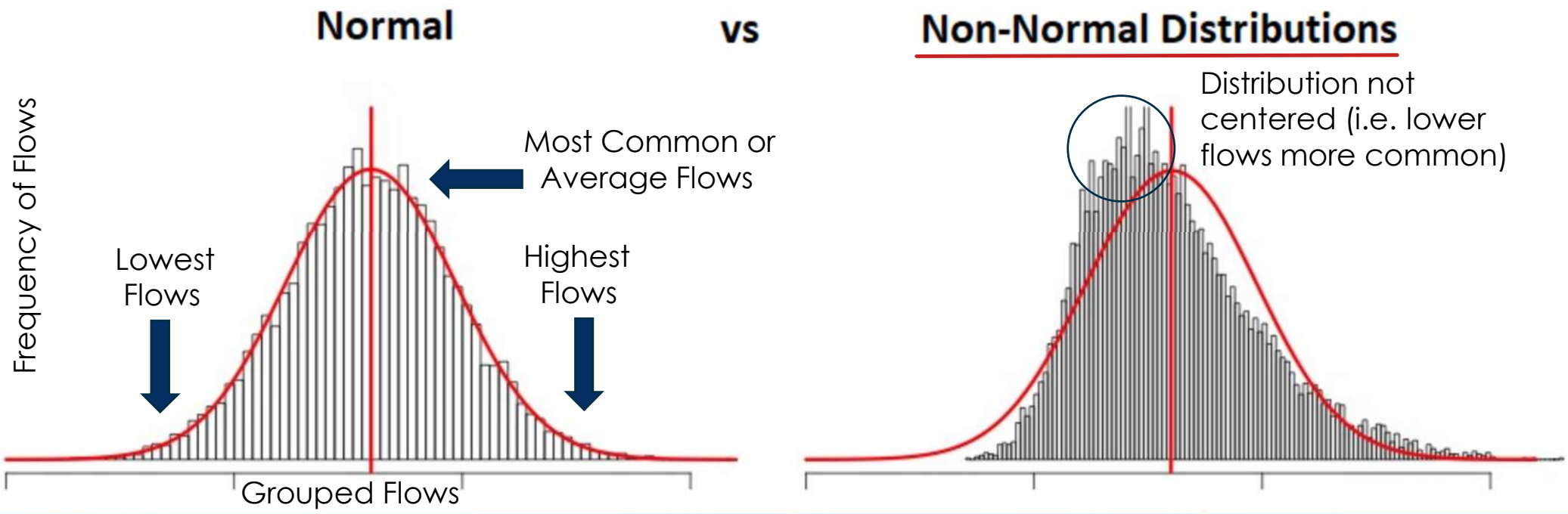
SHOULD ANY SURFACE WATER CONDITION BE IDENTIFIED

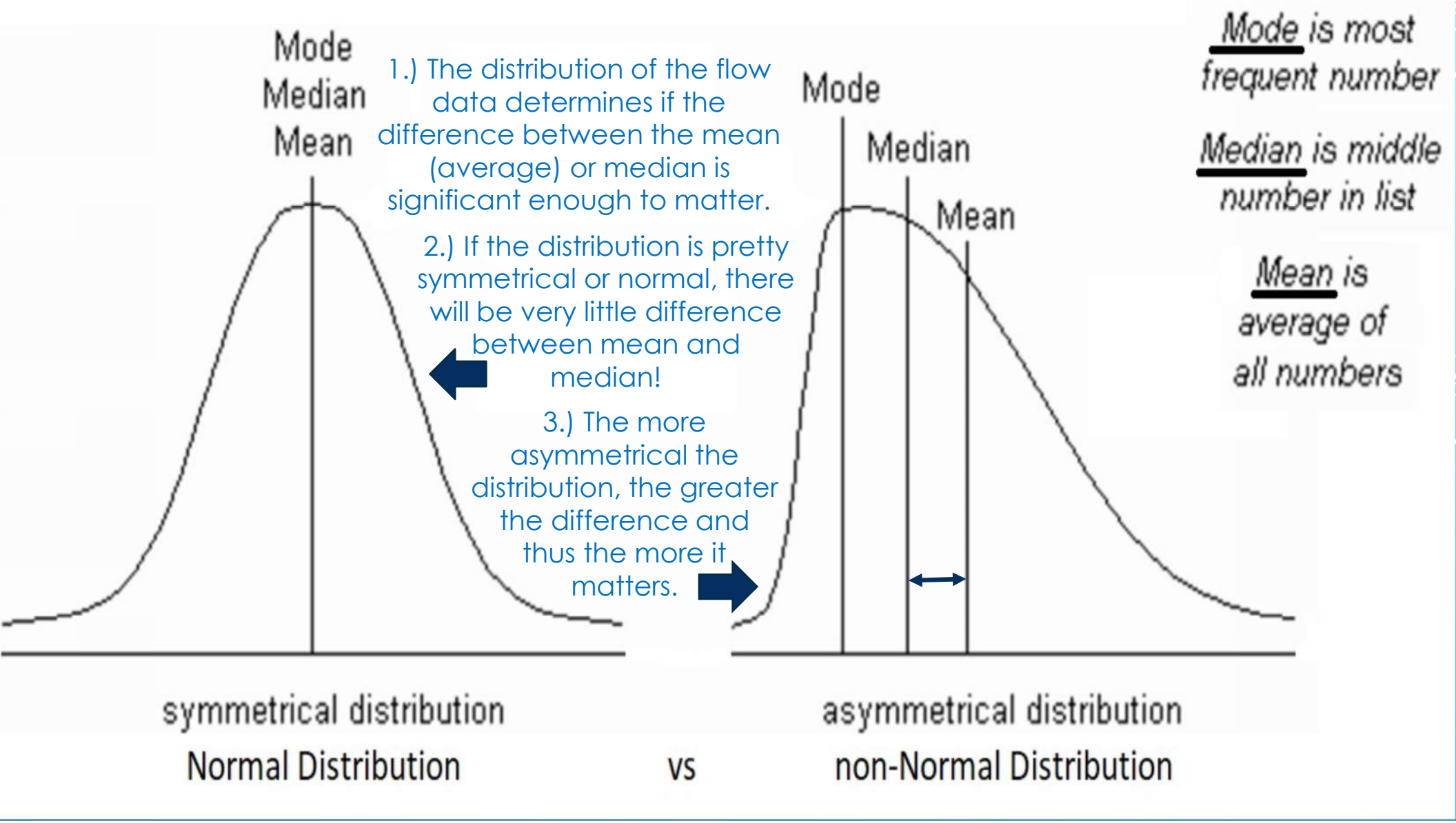
- Yes, because in the absence of a "surface water condition", a "surface water shortage" isn't recognized until there is no streamflow left
- A surface water condition is needed to:
  - ensure the river basin plan acknowledges when the water resources are strained long before the river runs dry
  - trigger action before the last user runs out of water or the river runs dry
- Even during drought, the last withdrawer:
  - should have some portion of their allocation
  - shouldn't be put in the position of having to decide if they can leave any water for the environment

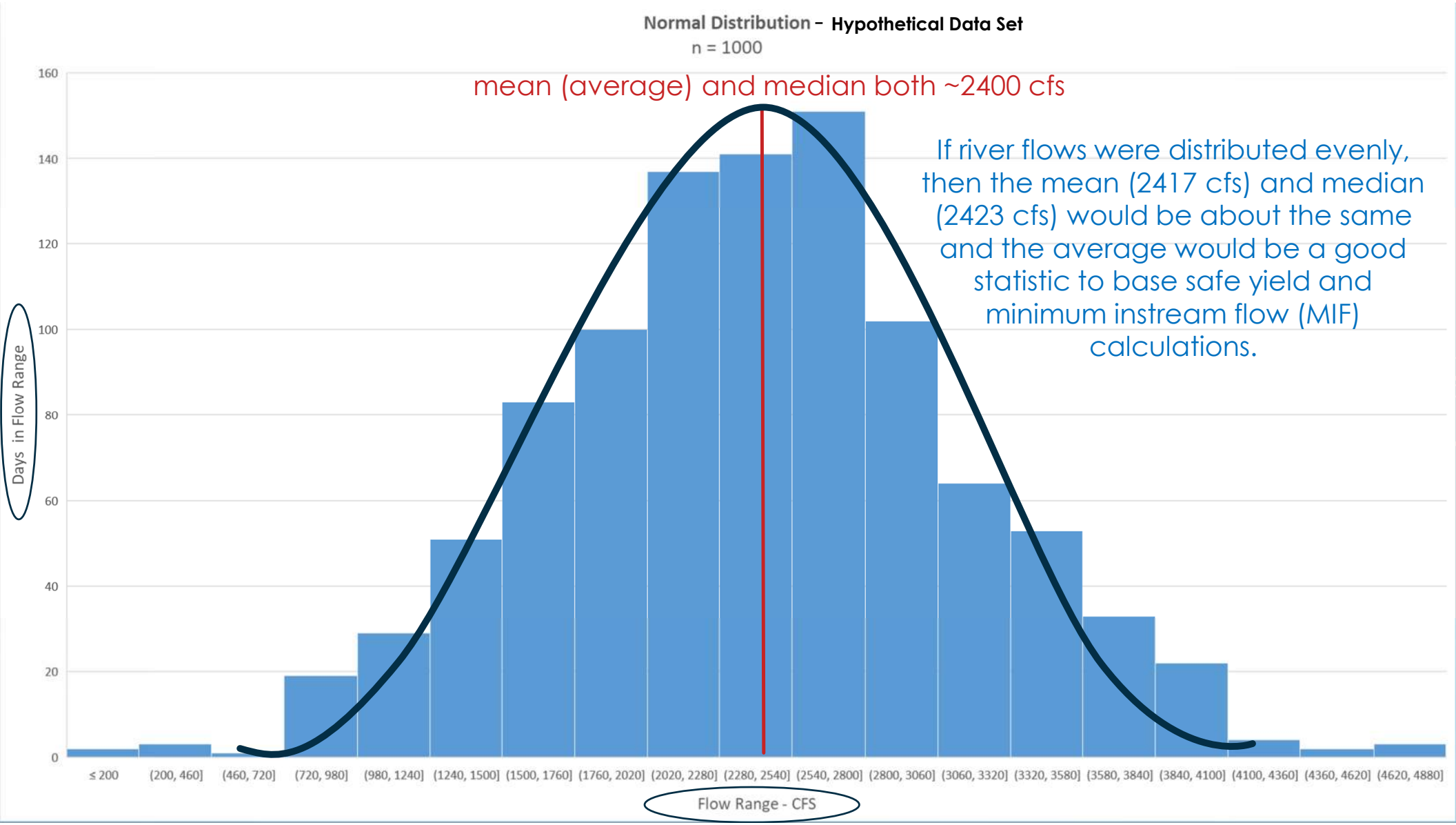
WHAT SHOULD THE SURFACE WATER CONDITION BE BASED ON OR BE IN REFERENCE TO

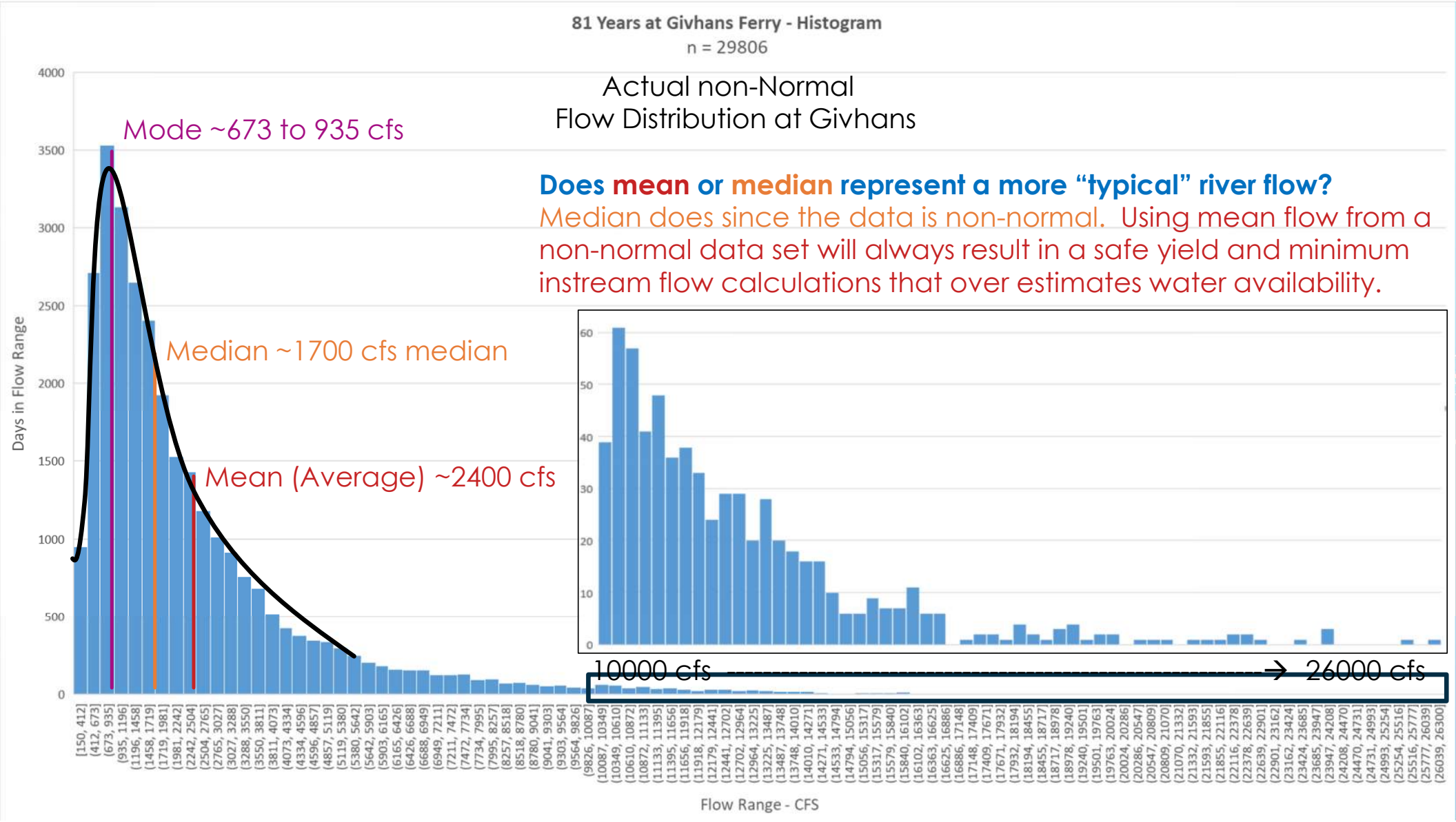
- Water quantity standards have historically referenced mean (average)
- A surface condition is different than a water quantity standard
- But should a surface condition at Givhans be based on mean flow or something else, like median flow?
- Why mean or median matters?

Histograms: Grouping Streamflow Data into Distributions




Mode
Median
Mean
1.) The distribution of the flow data determines if the difference between the mean (average) or median is significant enough to matter.
2.) If the distribution is pretty symmetrical or normal, there will be very little difference between mean and median!
3.) The more asymmetrical the distribution, the greater the difference and thus the more it matters.
Mode
Median
Mean
Mode is most frequent number
Median is middle number in list
Mean is average of all numbers
symmetrical distribution
Normal Distribution
vs
asymmetrical distribution
non-Normal Distribution


Normal Distribution – Hypothetical Data Set
n = 1000
mean (average) and median both ~2400 cfs
If river flows were distributed evenly, then the mean (2417 cfs) and median (2423 cfs) would be about the same and the average would be a good statistic to base safe yield and minimum instream flow (MIF) calculations.
Days in Flow Range
0
20
40
60
80
100
120
140
160
≤ 200
(200, 460]
(460, 720]
(720, 980]
(980, 1240]
(1240, 1500]
(1500, 1760]
(1760, 2020]
(2020, 2280]
(2280, 2540]
(2540, 2800]
(2800, 3060]
(3060, 3320]
(3320, 3580]
(3580, 3840]
(3840, 4100]
(4100, 4360]
(4360, 4620]
(4620, 4880]
Flow Range - CFS


81 Years at Givhans Ferry - Histogram
n = 29806
Actual non-Normal
Flow Distribution at Givhans
Mode ~673 to 935 cfs
Median ~1700 cfs median
Mean (Average) ~2400 cfs
Does mean or median represent a more "typical" river flow?
Median does since the data is non-normal. Using mean flow from a non-normal data set will always result in a safe yield and minimum instream flow calculations that over estimates water availability.
10000 cfs
26000 cfs
Days in Flow Range
Flow Range - CFS

MEAN VS MEDIAN

- Choosing to use median rather than mean (average) doesn't ignore the highest flood flows
- No data is being removed
- Using the median just doesn't let the drastically high flood flows carry as much weight as they do when using mean (average) to determine the most appropriate:
  - Safe Yield
  - MIF
  - Surface Condition
  - Etc.

SURFACE CONDITIONS

- Mean probably isn't the best statistic to determine or reference a surface condition
- Median is one option, but there are also others like:
  - Percentile (used by USGS)
  - 7Q10 (referenced in USGS studies, the Drought Response Act and CWS's contingency plan)
- At what flow should our river basin plan acknowledge a water shortage exists? Zero or something else?
- And what should we do when the river gets that low

MANAGEMENT STRATEGY

- Low flows at Givhans Ferry during drought are the result of a combination of basin-wide conditions:
  - ~~Lack of precipitation~~
  - ~~Increased evapotranspiration~~
  - ~~Reduced inflow due to lower ground water levels~~
  - Increased withdrawals
- Less important than asking which of these is this biggest problem is the question: Which of the above do we have any ability to affect?

MANAGEMENT STRATEGIES

- Generally two Types of management strategies or Best Management Practices (BMPs)
- **Resource stretching** (i.e. low flow toilets, crop irrigation nozzle BMPs, etc.) vs **"what if"** this or that happens…
- Our River Basin Plan needs both types if it is to be meaningful and comprehensive
- But I believe the latter "what if" type of strategy is needed to address low flows during drought
- And it isn't as much a matter of "what if" but "when"

A SURFACE CONDITION AND LOW FLOW MANAGEMENT STRATEGY GO HAND-IN-HAND

- Since a surface condition may be closely tied to a low flow management strategy, it makes sense to develop and agree to them at the same time
- I have some ideas, but I believe the other surface withdrawers need to weigh in and have an equal voice on the details especially as those details may in some cases be site specific
- I propose that we create a subcommittee of at least the surface withdrawers (Water, Agriculture and Power) to work on the details of a proposed surface condition and low flow management strategy

WITHDRAWAL GROUPS SUBCOMMITTEE

- The goal is to create an environment conducive to making progress on answering the question how can the we minimize the impacts of drought
- The subcommittee will present the recommendations to the RBC for further discussion and a possible vote
- This will also set the stage to begin more conversations around the resource stretching management strategies