Details on the Hydrology-based Environmental Flow Regime Method

- HEFR -

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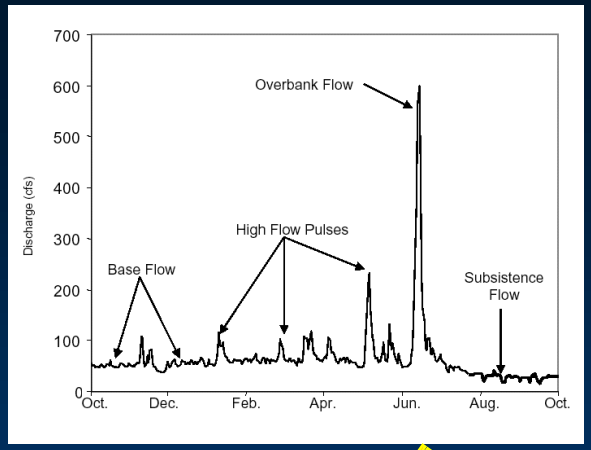
Presentation to Brazos BBEST

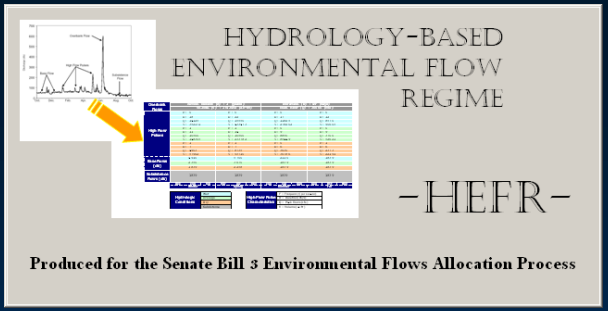
June 13, 2011



Overbank Flows	Qp: 17,800 cfs with Average Frequency 1 per 5 years Regressed Volume is 75,327 to 104,925 (90,126) Regressed Duration is 10 to 54 (23)											
High Flow Pulses	Qp: 6,180 cfs with Average Frequency 1 per 2 years Regressed Volume is 18,502 to 47,434 (32,968) Regressed Duration is 6 to 33 (14)											
	Qp: 1,340 cfs with Average Frequency 1 per year Regressed Volume is #N/A to 21,899 (7,442) Regressed Duration is 3 to 16 (7)											
			Qp: 74 cfs with Average Frequency 1 per 2 seasons Regressed Volume is #N/A to 1,576 (580) Regressed Duration is 1 to				Qp: 205 cfs with Average Frequency 1 per 2 seasons Regressed Volume is #N/A to 12,325 (1,282) Regressed Duration is 1 to			Qp: 1,130 cfs with Average Frequency 1 per 2 seasons Regressed Volume is #N/A to 33,331 (8,856) Regressed Duration is 2 to		
			Qp: 37 cfs with Average Frequency 1 per season Regressed Volume is #N/A to 1,498 (501) Regressed Duration is 1 to									
Base Flows (cfs)	23 (30.9%)			20 (33.0%)			23 (35.4%)			23 (38.0%)		
	12 (58.5%)			16 (54.5%)			14 (56.8%)			12 (61.1%)		
	6.8 (75.4%)			9.6 (76.7%)			8.3 (77.4%)			6.9 (77.3%)		
Subsistence Flows (cfs)	0.7 (99.0%)			0.3 (99.8%)			0.6 (99.3%)			0.7 (98.2%)		
	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	Winter			Spring			Summer			Fall		
Flow Levels	High (75th %ile)											
	Medium (50th %ile)											
	Low (25th %ile)											
	Subsistence											

TEXAS PARKS & WILDLIFE

HEFR Basics



- Uses hydrologic data
- Computations are rapid
- Populates a flow regime matrix

A hydrological tool for an ecological purpose

1. (1) Select Flow Gage
2. (2) Select Period of Record
3. (3) Separate (parse) Hydrograph into Flow Components
4. (4) Generate Statistical Summaries in Excel

This presentation focuses on step (4)

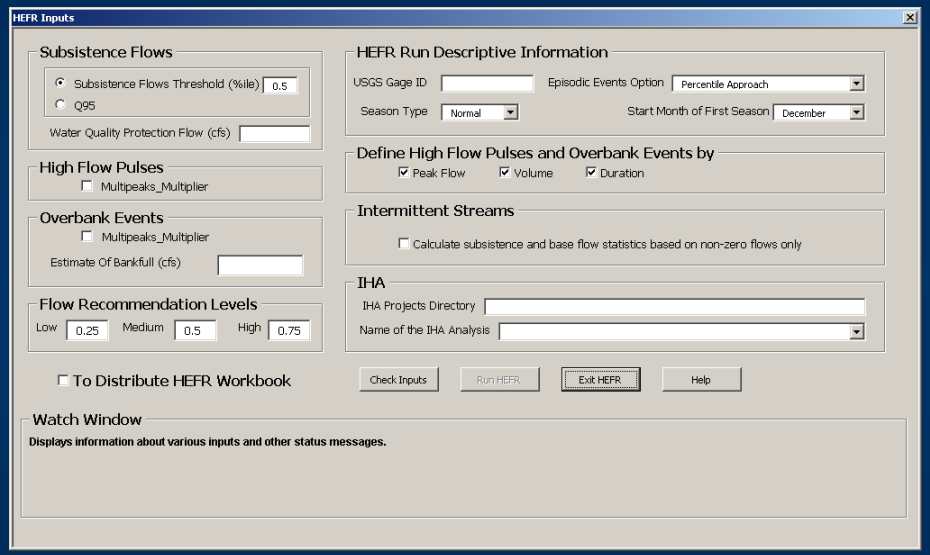
(4) Generate Statistical Summaries in Excel

HEFR uses Excel to generate summary statistics of each IFC

- Subsistence
- Base Flow
- High Flow Pulses
- Overbank Events

Outputs may include: flow, volume, duration, frequency

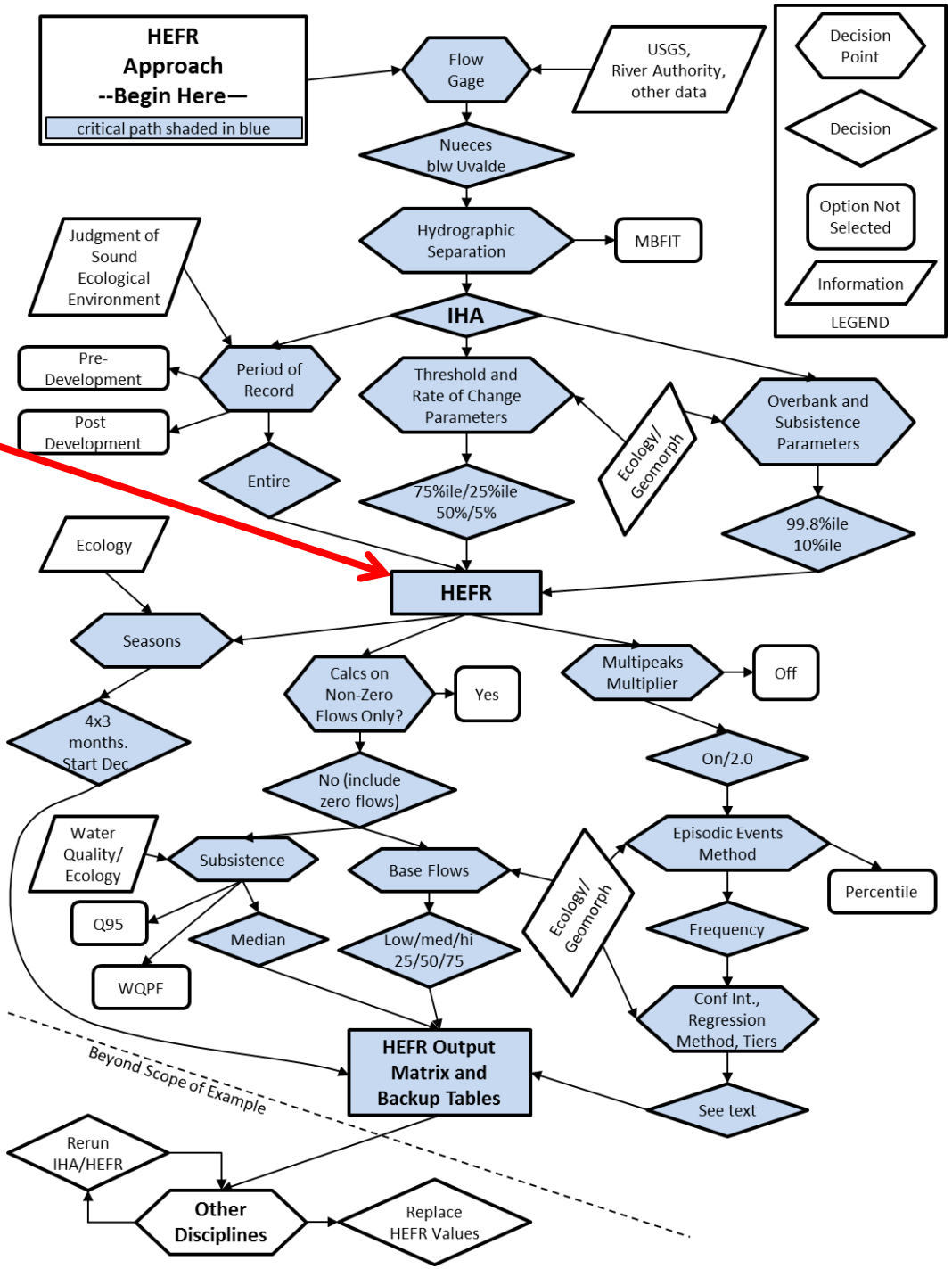
HEFR Input Window



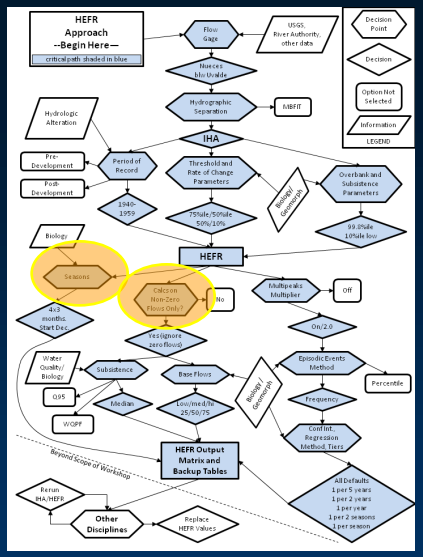
Decision Points

Flow chart from SAC Hydrologic Methods document, 3rd Edition

This presentation starts here



Brief Overview of Decision Points



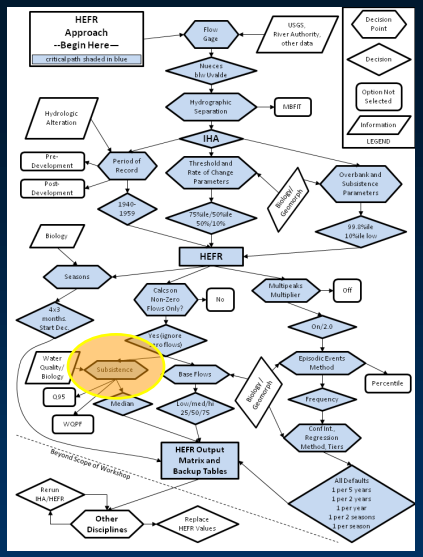
Seasons

- Highly flexible
- Consider flow patterns, spawning, temperature

Non-Zero flows only

- Use to limit flow computations to days with measured flows
- Zero flow frequencies and durations handled separately
- Intermittent sites are challenging, but no BBESTs have used this option

Brief Overview of Decision Points: Subsistence Flows



Selected Ecological Roles

- Protect water quality and critical habitat during very dry times

HEFR can calculate statistics based on historically observed very low flows

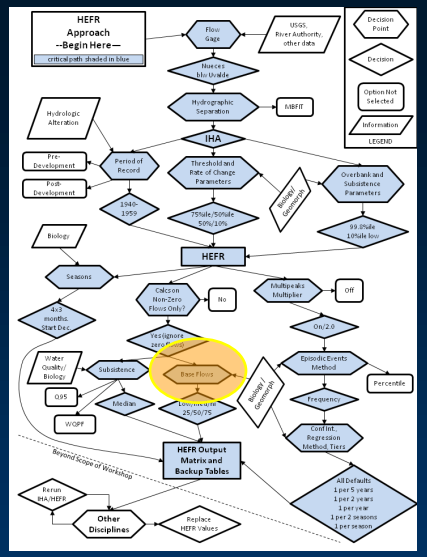
- User-specified percentile of subsistence flow days
- Q95

~or~

User can input a recommendation based on other information

- Water Quality Protection Flow (e.g., 7Q2)
- CL, GSA, and Nueces BBESTs using 1 cfs as floor

Brief Overview of Decision Points: Base Flows

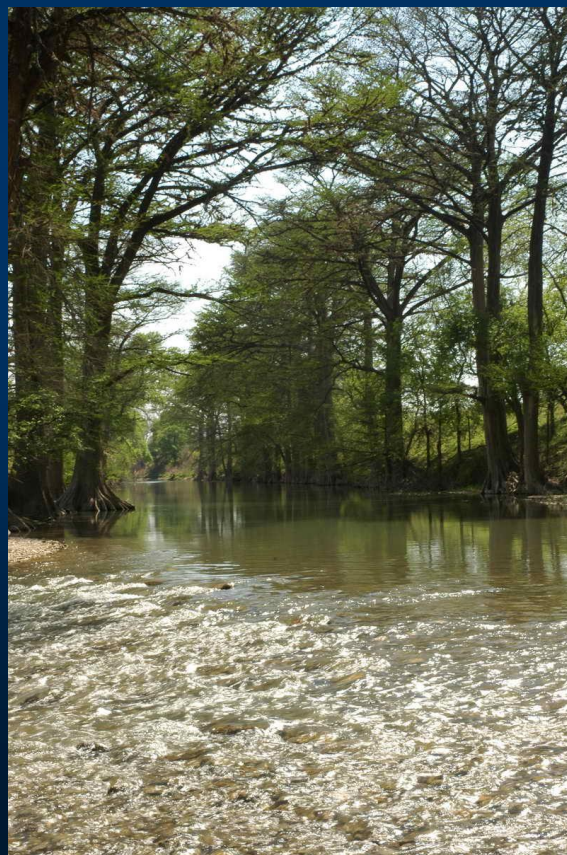


Selected Ecological Roles

- Provide suitable habitat
- Maintain diversity
- Maintain water table for riparian vegetation
- Provide connectivity along channel

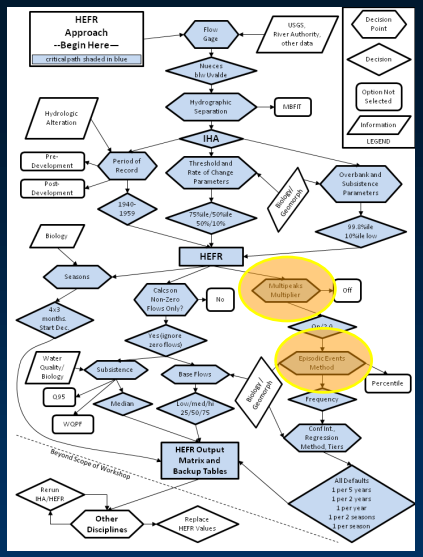
HEFR calculates three user-specified percentiles both seasonally and monthly

Low	Medium	High



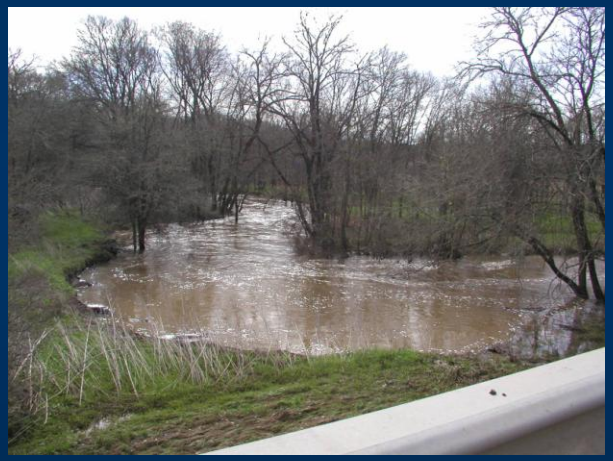
Brief Overview of Decision Points:

High Flow Pulses



Selected Ecological Roles

- Provide spawning cues
- Prevent riparian vegetation from encroaching into channel
- Restore water quality following drought



HEFR has two options

- “Percentile Approach”
  - More prescriptive, seasonal basis only
  - Essentially used in BRA SysOps, not used by BBESTs
- “Frequency Approach”
  - More flexible, can handle multi-year intervals
  - Used by all BBESTs

Brief Overview of Decision Points:

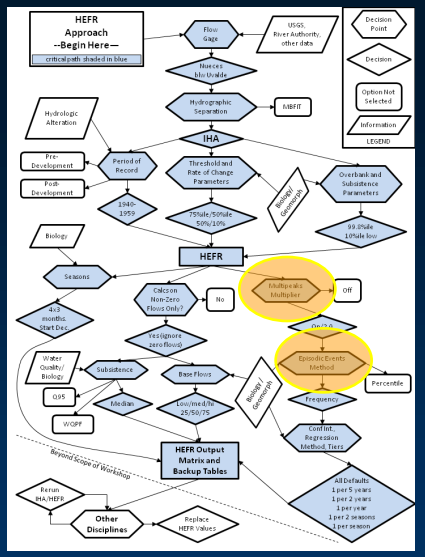
Overbank Events

Selected Ecological Roles

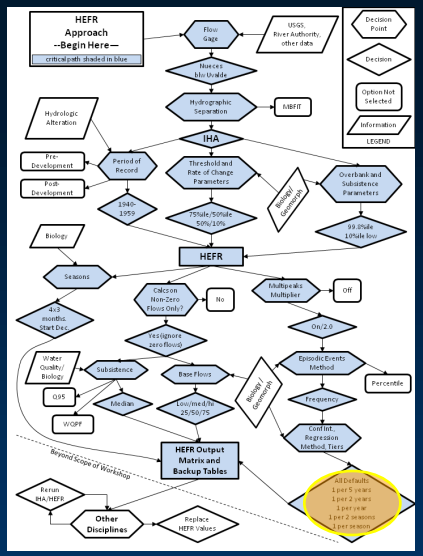
- Shape physical habitats
- Provide migration and spawning cues
- Facilitate exchange of nutrients, sediments, woody debris

HEFR has two options

- "Percentile Approach"
  - Median of historical overbank flows
  - Not used by BBESTs
- "Frequency Approach"
  - Same as High Flow Pulses
  - Used by all BBESTs



More Details on Frequency Approach



Simply identifies the magnitude of historical events at various return intervals

Analyst selects which events to recommend

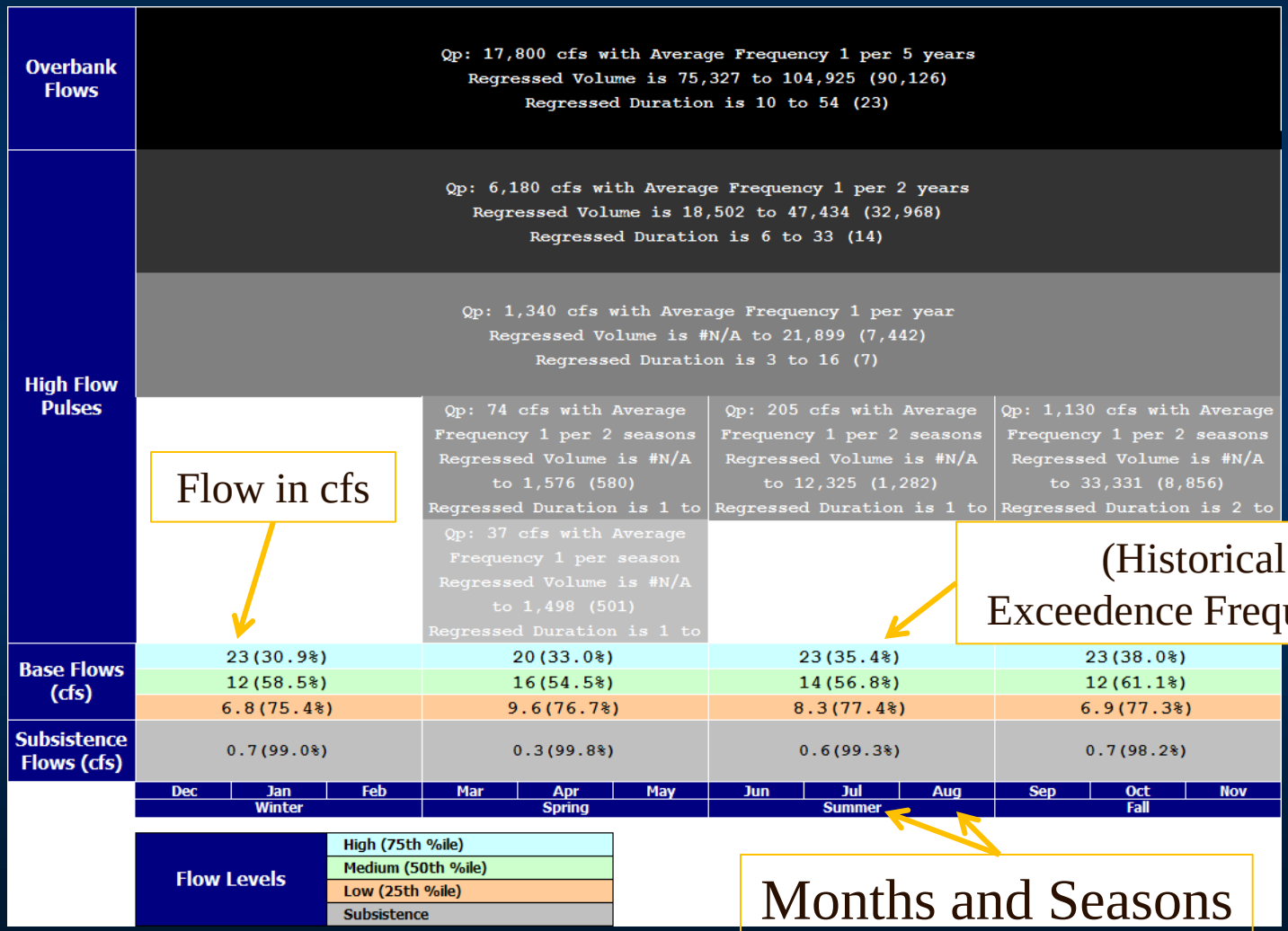
- For example, “one per two years” event

Regression forms

- To quantify volume and duration characteristics
- Ln/Ln or quadratic
- Confidence level for prediction interval

Illustrative HEFR Output

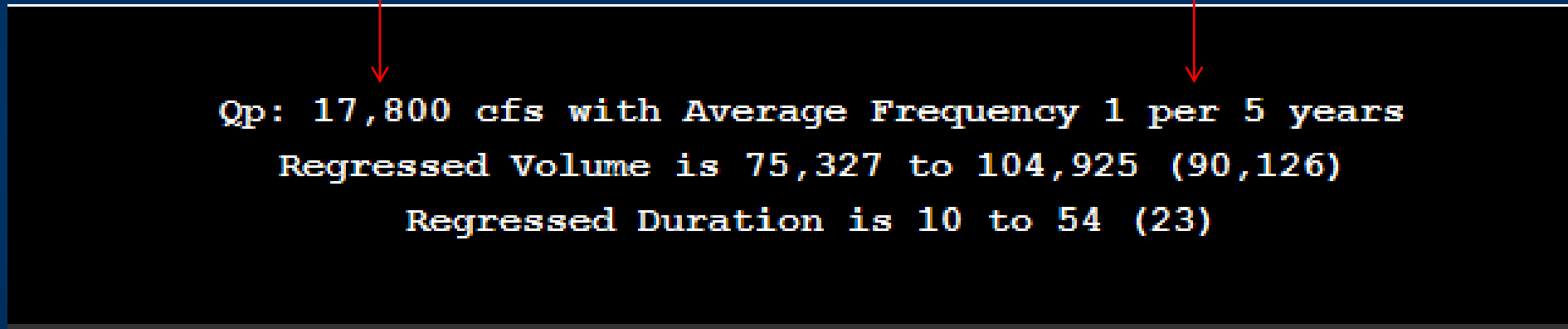
Flow Components



Illustrative HEFR Output

At least one day must exceed 17,800 cfs

Average frequency of such events is once per five years over the period of record



Best-fit Volume is 90,126 ac-ft.
~68% of historical events between 75,327 and 104,925 ac-ft

Best-fit Duration is 23 days.
~68% of historical events between 10 and 54 days

Conclusions

- Flexibility = Decisions Required
- Focus on ecological functions and goals
- HEFR can efficiently populate a flow matrix to generate a first cut
- A HEFR flow matrix consists of summary statistics of historical flows
- A HEFR flow matrix does not replicate all historical flows
- Interpretation/implementation of a flow matrix equally important but not covered today