Flood Risk Management

MEI

Flood Risk Analysis Issues

- *Technical definition of "no net decrease in level of flood protection"*
  - *Water-surface elevations*
  - *Potential damages*
  - *Mitigation measures*
- *Timing of sediment impacts vs. extreme floods*
  - *Joint probability*
  - *Worst-case*

EXISTING CONDITIONS

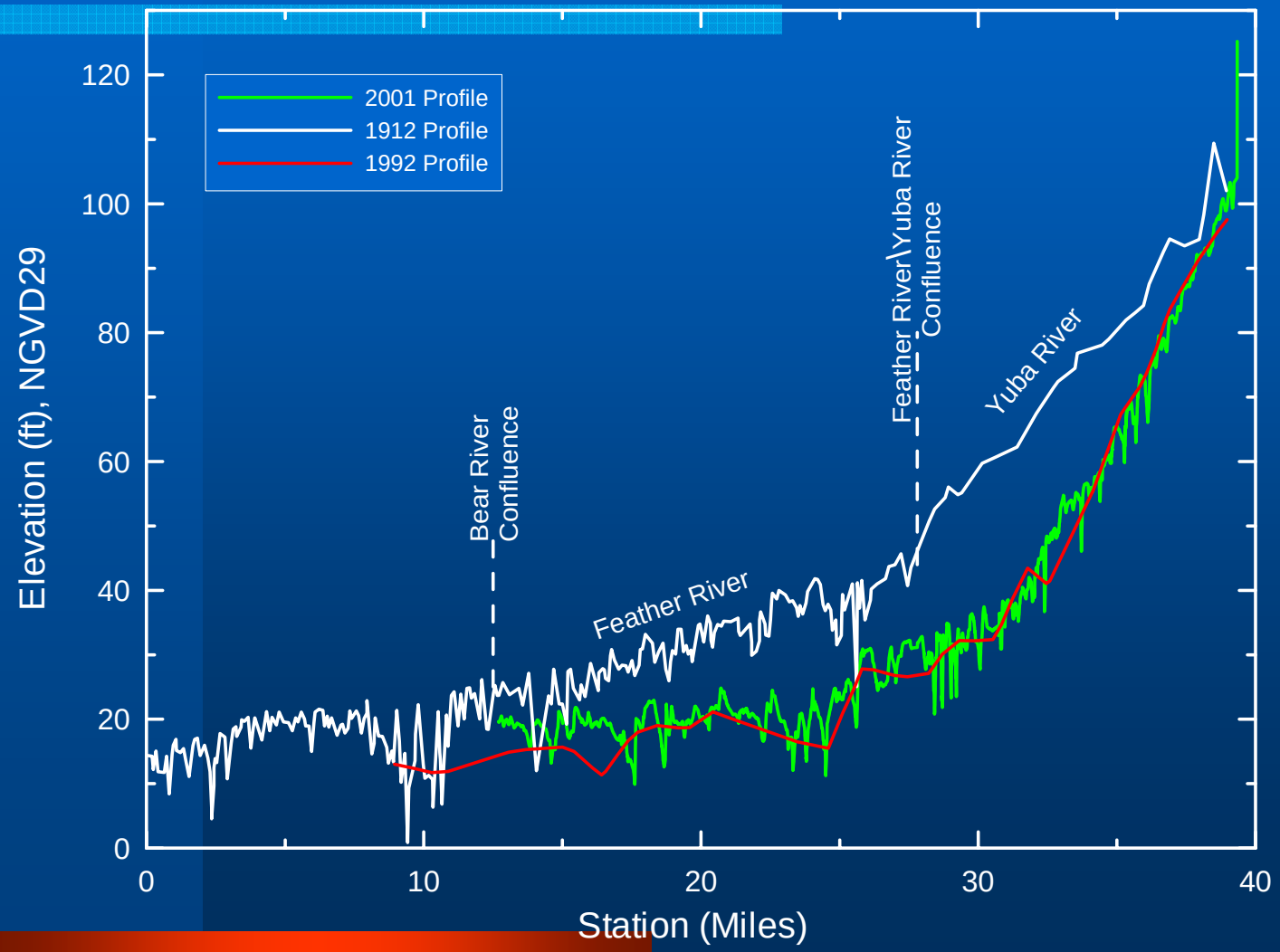
- Channel Morphology
- Sedimentology
- Flood Hydrology

Historic Conditions

- *Historic Geomorphic Data*
  - *Bed Profiles - Yuba & Feather*
  - *Cross Sections - Yuba & Feather*

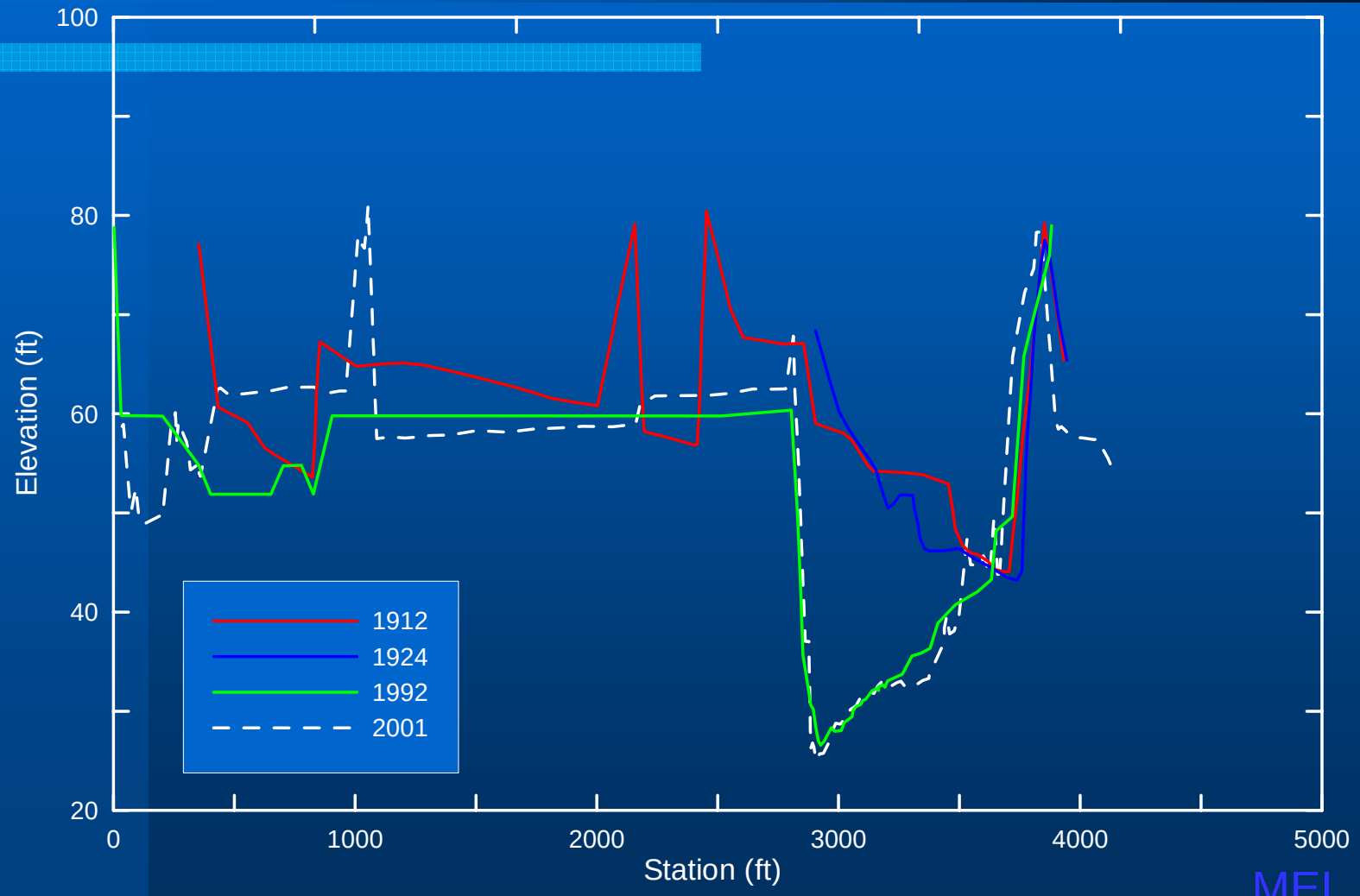
- *Time Frames*
  - *1904, 1908, 1914, 1938, 1992, 2002*

Comparative Thalweg Profiles Feather and Yuba Rivers 1912 to 2001



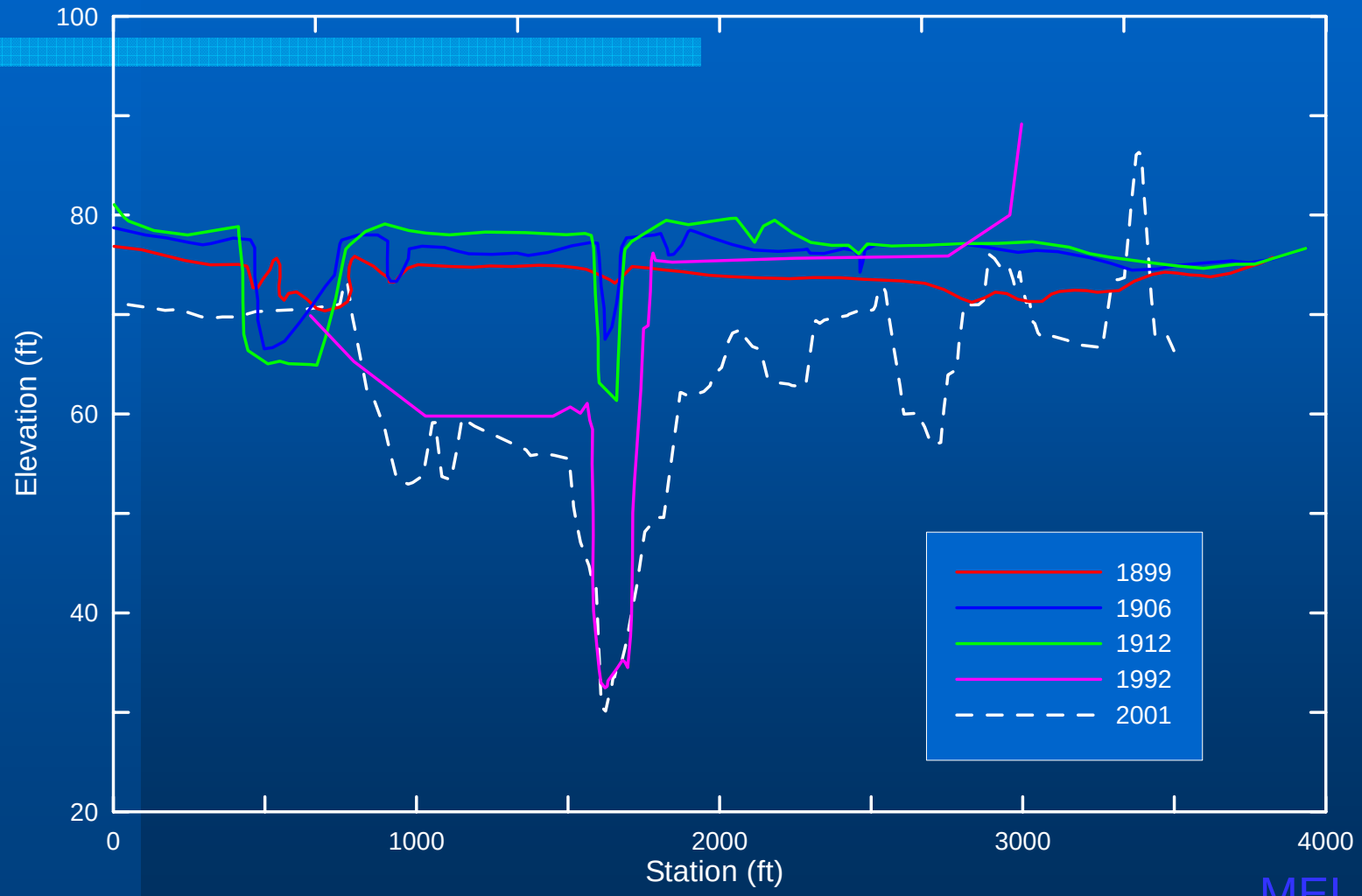
MEI

Feather River - RM 27.3
Just Downstream from the Yuba River



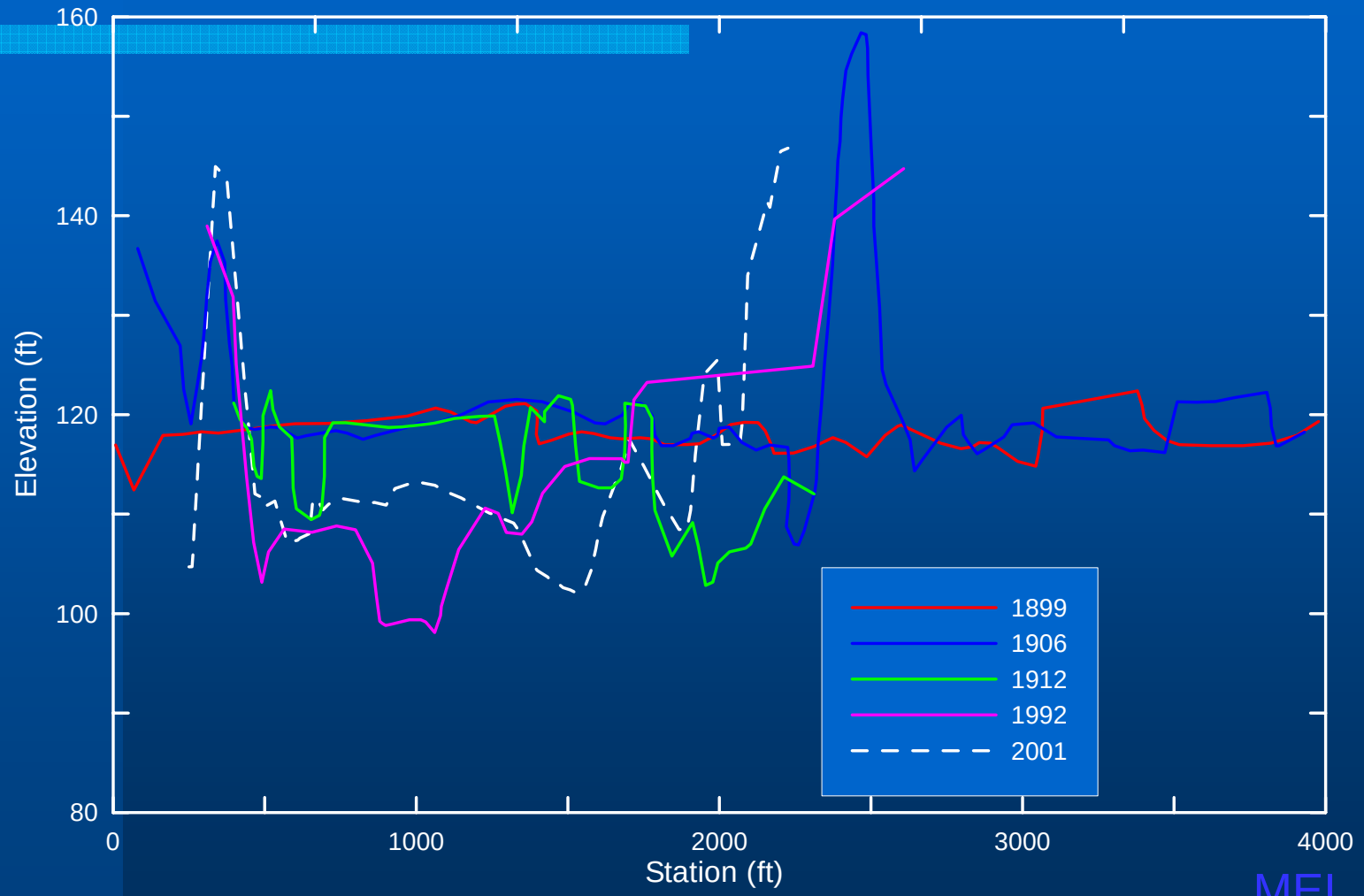
MEI

Yuba River - RM 3
River was relocated here circa 1912 - 1935



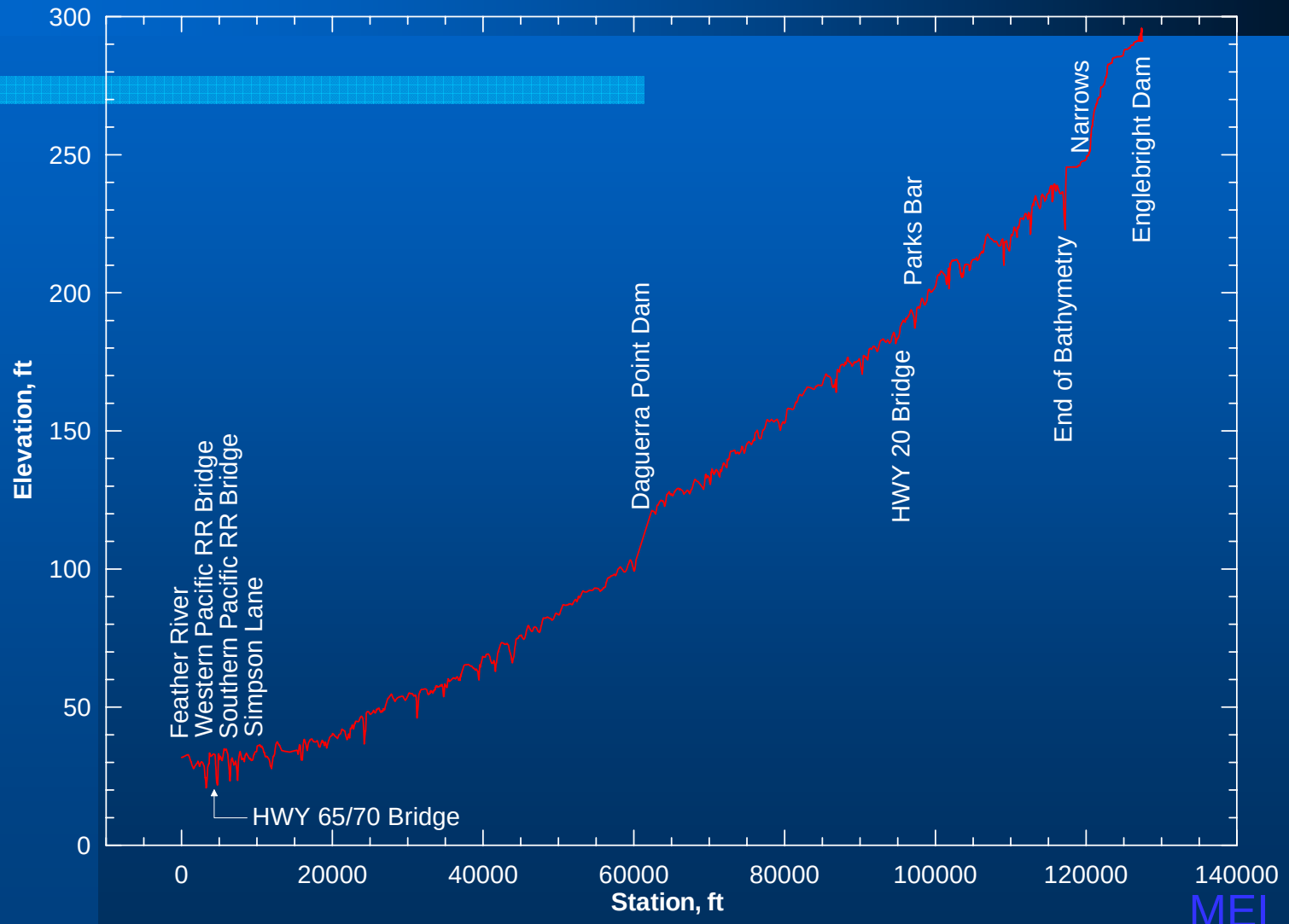
MEI

Yuba River - RM 11.3
Just downstream from Daguerre Point Dam



MEI

Existing Yuba River Longitudinal Profile

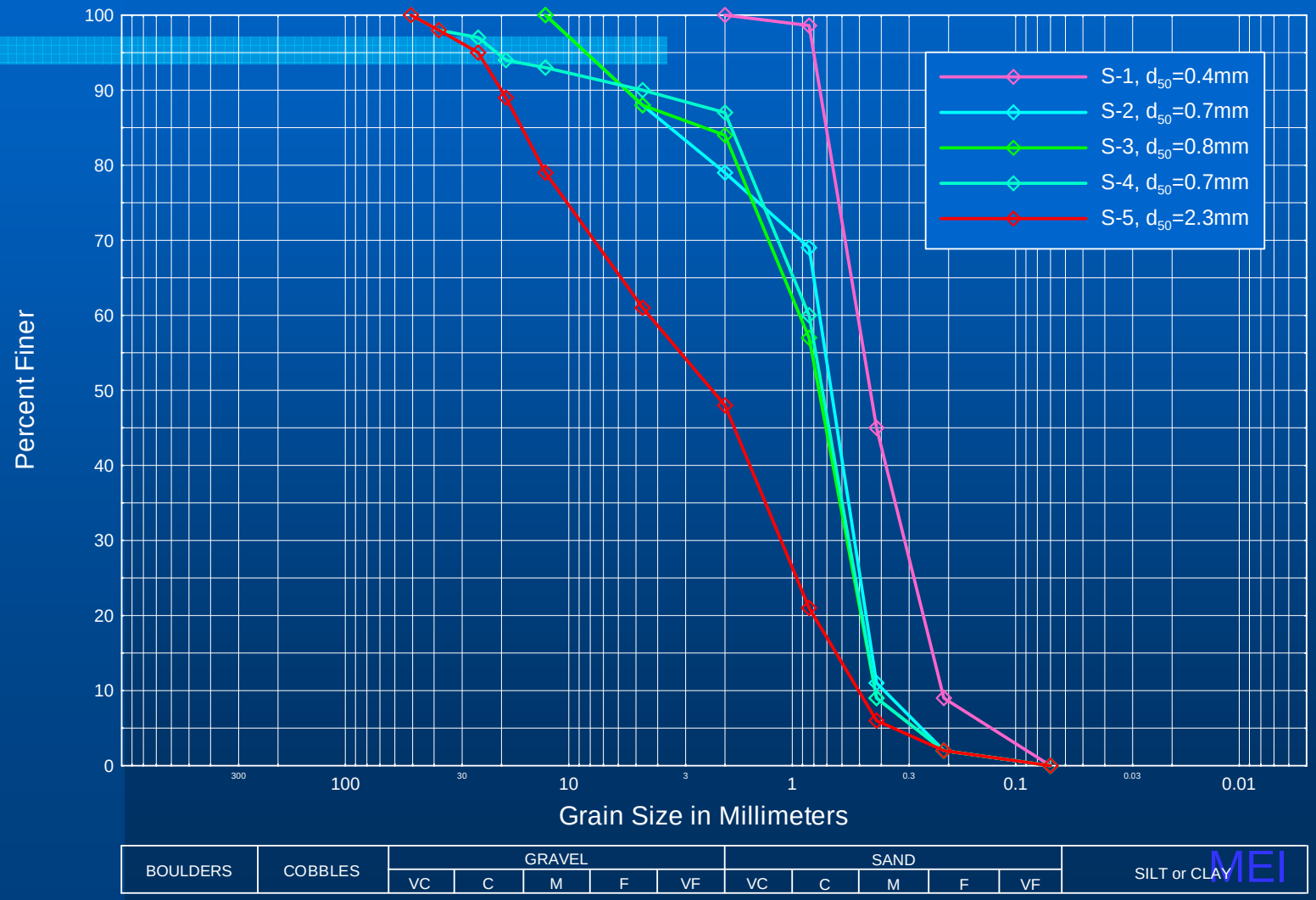


MEI

Bed Material Sediment Data

- *Feather River*
  - *5 bed material samples*
- *Yuba River*
  - *11 Pebble Counts*
  - *7 subsurface samples*

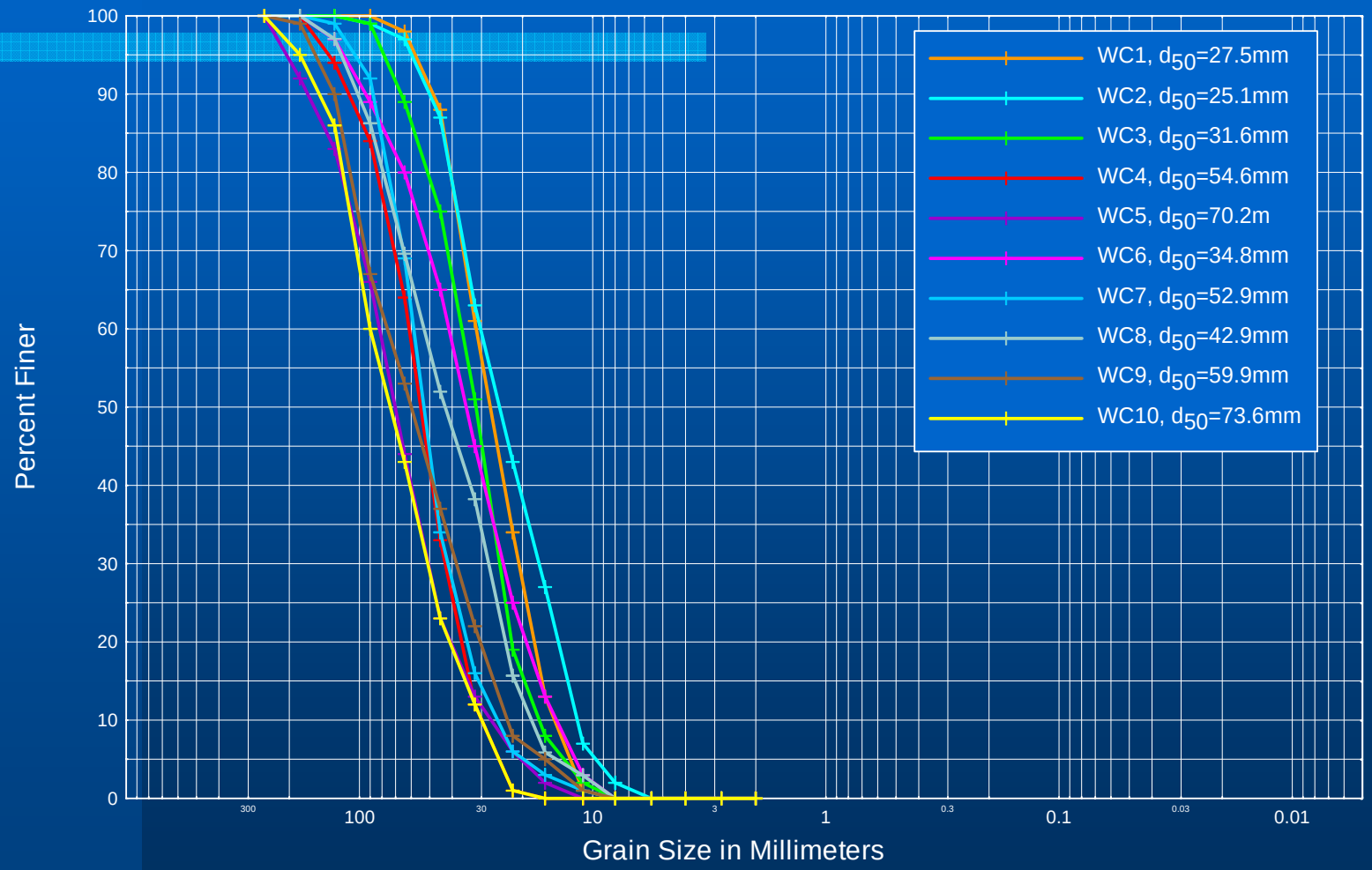
Feather River Sieve Gradations



MEI

GSA
CM
IN

Yuba River Surface Gradations

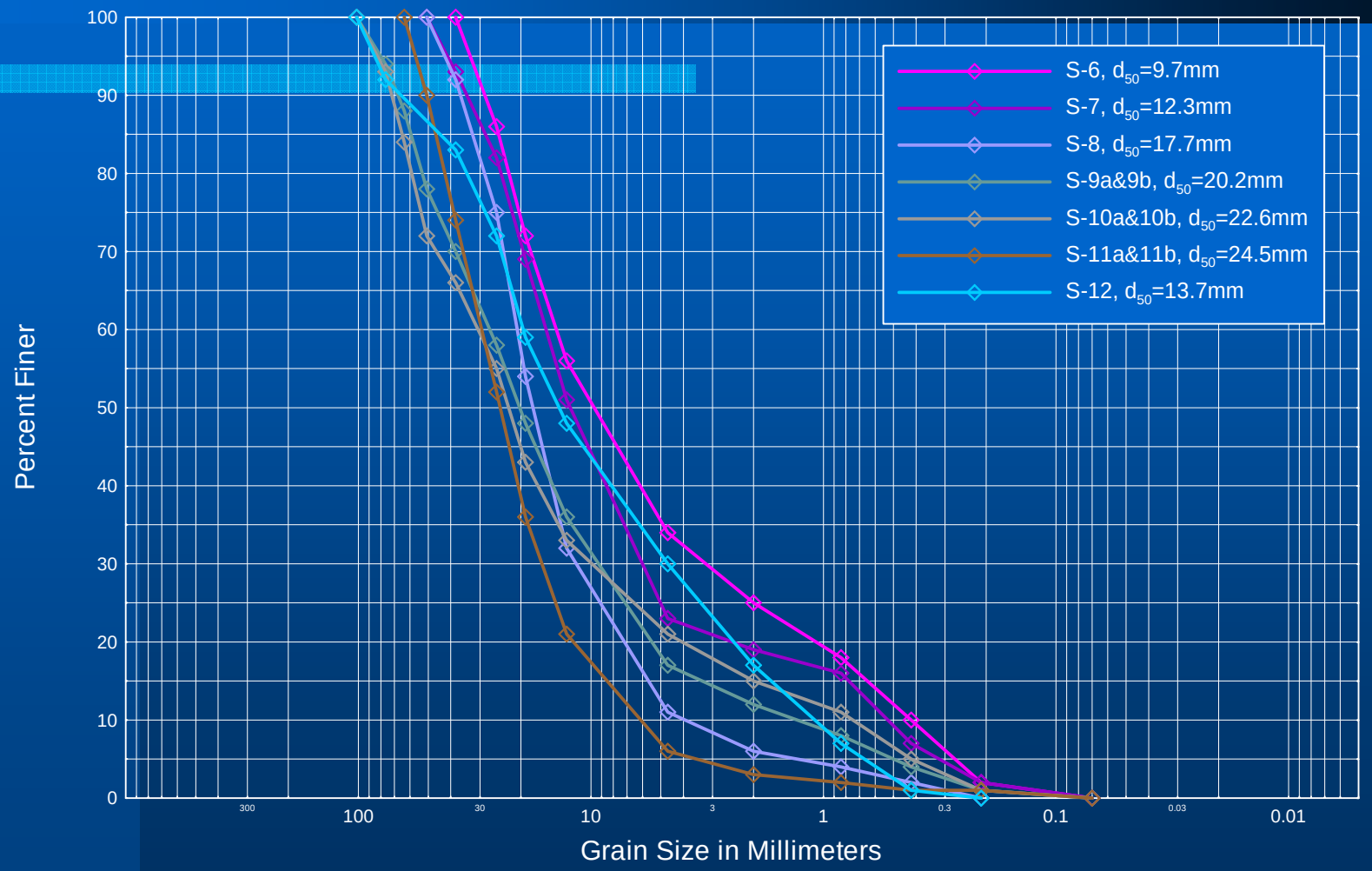


BOULDERS	COBBLES	GRAVEL					SAND					SILT or CLAY
		VC	C	M	F	VF	VC	C	M	F	VF	

MEI

GSA

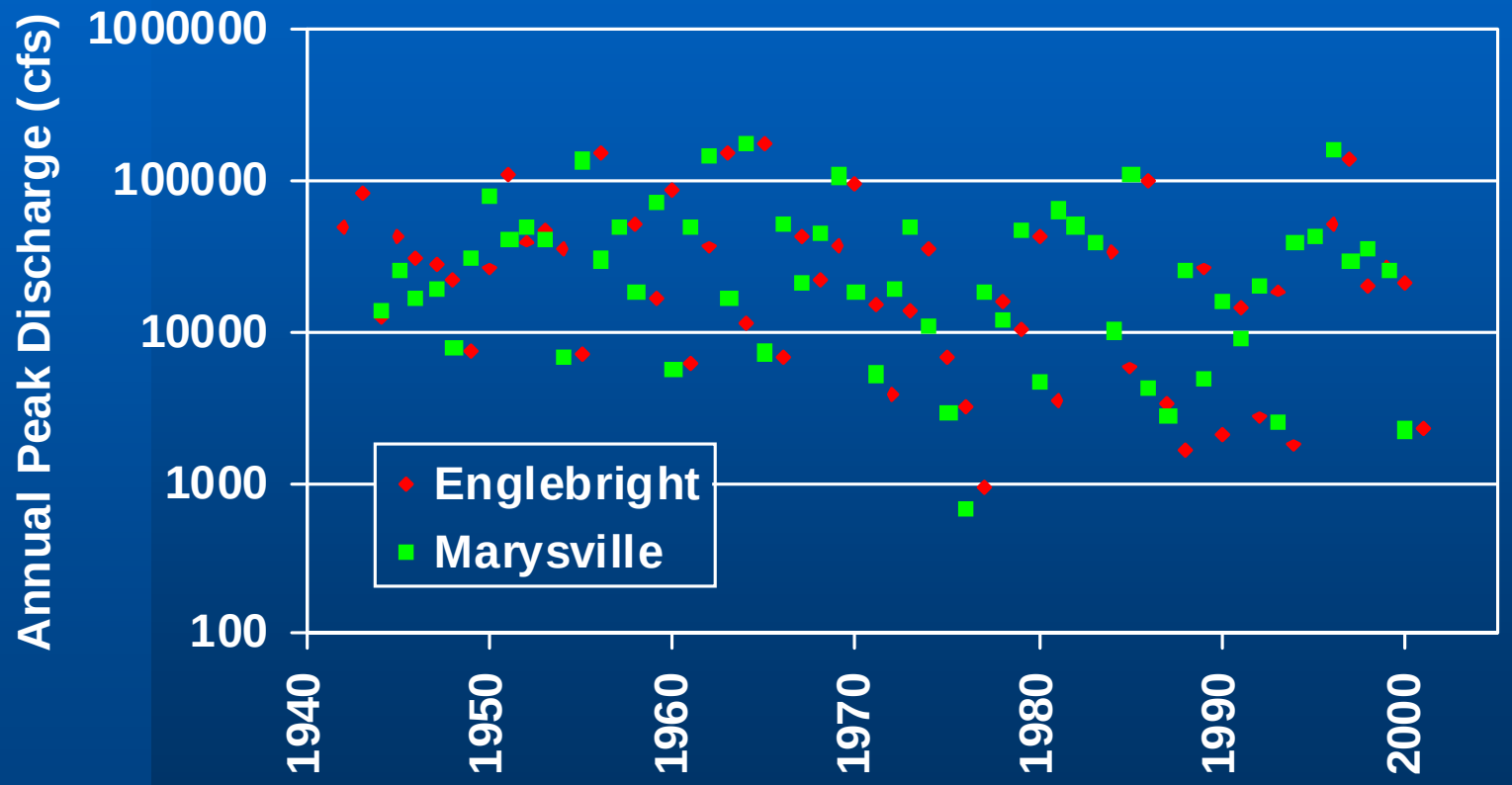
Yuba River Subsurface Gradations



BOULDERS	COBBLES	GRAVEL					SAND					SILT or CLAY
		VC	C	M	F	VF	VC	C	M	F	VF	

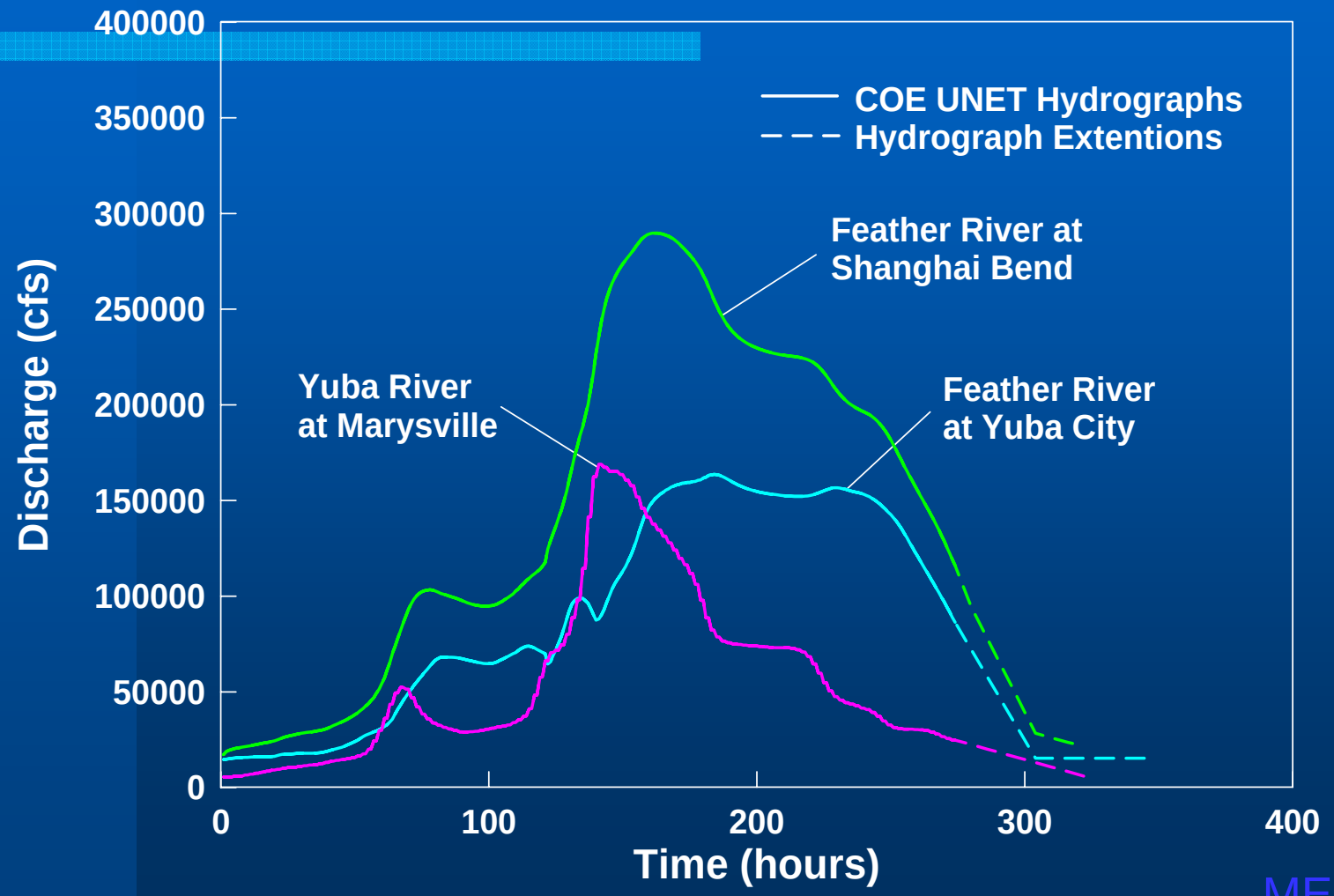
MEI

Yuba River
Annual Peak Discharge



MEI

Feather and Yuba River 100-yr Flood Hydrographs



MEI

Maximum Flood Peak Objective
Existing Flood Control Operations

Location	Objective Flow (cfs)	Exceedence Frequency (Return Period)*
Feather River above Yuba City	180,000	204
Yuba River at Marysville	180,000	183
Feather River at Shanghai Bend	300,000	139

*Based on log-probability interpolation between the values of existing conditions peak discharges resulting from MBK Engineers' operational studies of the Yuba and Feather River systems.

MEI

Levee Capacity Design Flows
Original and Improved

Location	Design Discharge (cfs)	
	Original Design	Improved Capacity
Feather River at Yuba City	210,000	210,000
Yuba River at Marysville	120,000 to 180,000	225,000
Feather River below the Yuba River	300,000	325,000
Feather River below the Bear River	320,000	320,000

MEI

Authorized Improved Levee Capacities and Approx Exceedence Frequencies

	Design Discharge (cfs)	Exceedence Frequency (Return Period)*
Feather River at Yuba City	210,000	241
Yuba River at Marysville	225,000	188
Feather River below the Yuba River	325,000	158

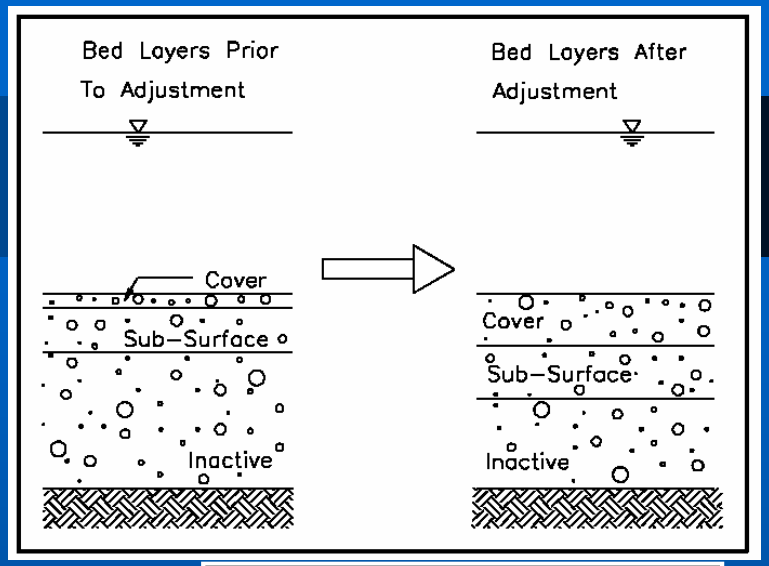
*Based on log-probability interpolation between the values of existing conditions peak discharges resulting from MBK Engineers' operational studies of the Yuba and Feather River systems.

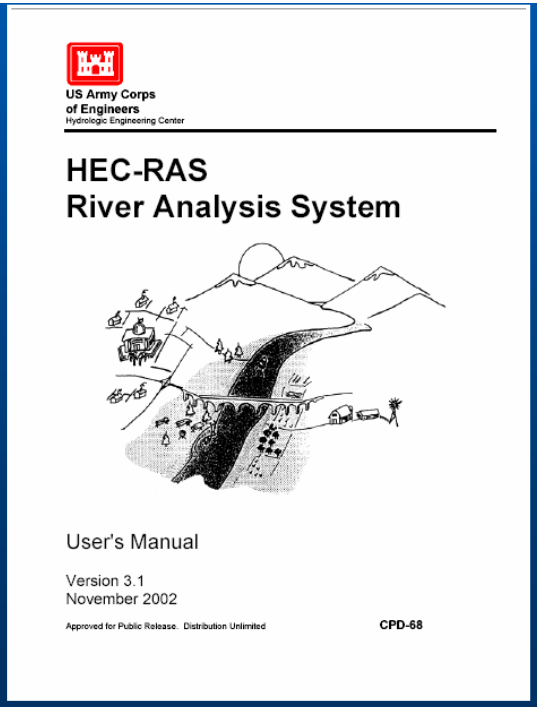
MEI

Models

- *Sediment routing*
  - *HEC-6T*
  - *Two models (Yuba, Feather)*

- *Flood impacts*
  - *HEC-RAS with imported*
  - *HEC-6 cross sections*

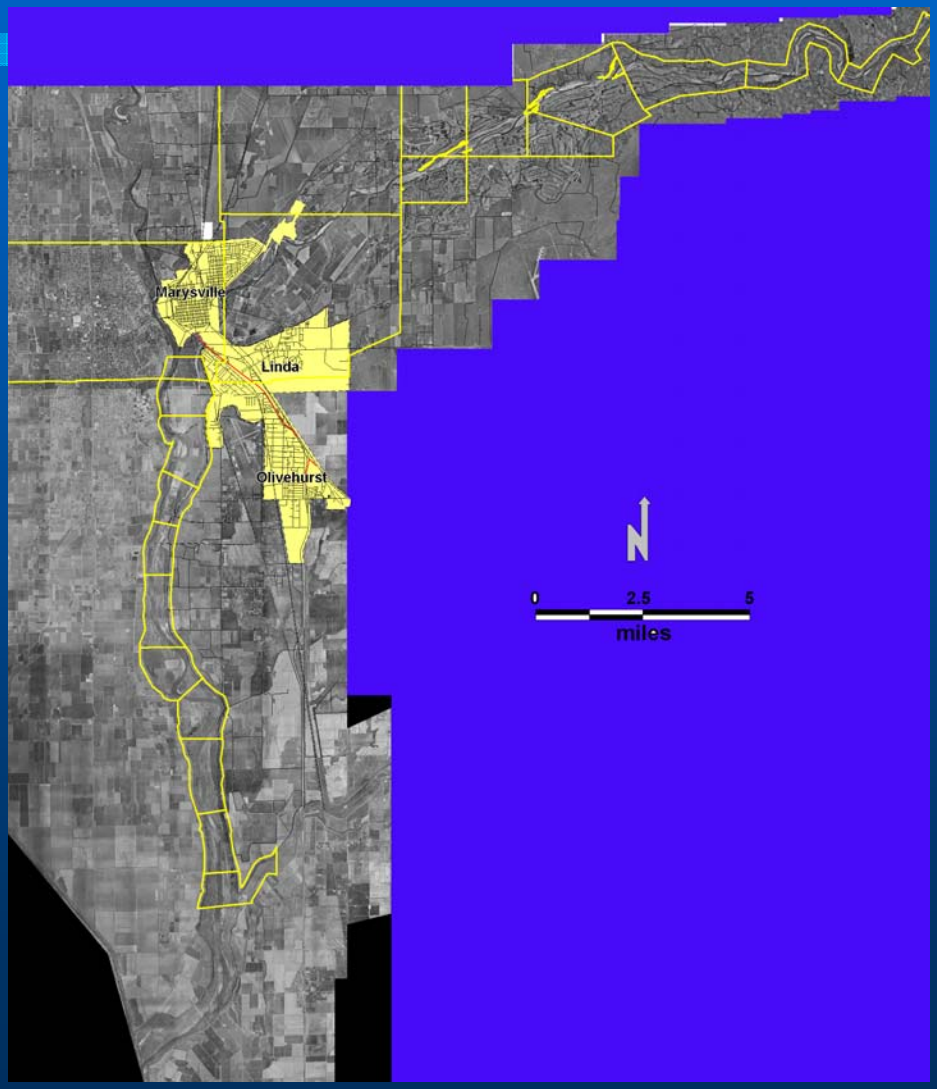




MEI

Topography and Bathymetry

- *Sources*
  - *COE and YCWA*
- *Types of Data*
  - *DTM, Contour Mapping, Orthophotography*
- *Data Coverage*
  - *Mouth of Bear River to Downstream end of Narrows Downstream*
  - *USGS Cross Sections*



Misc Geometry

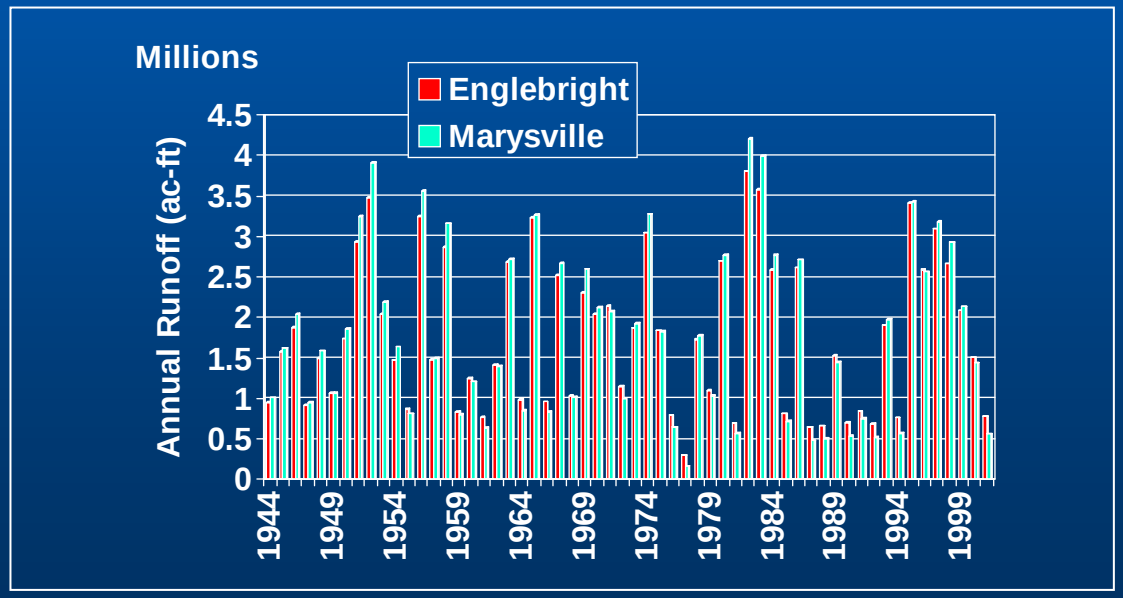
- *Bridge Geometry*
  - *HEC-RAS only*

- *Daguerre Point Dam*

MEI

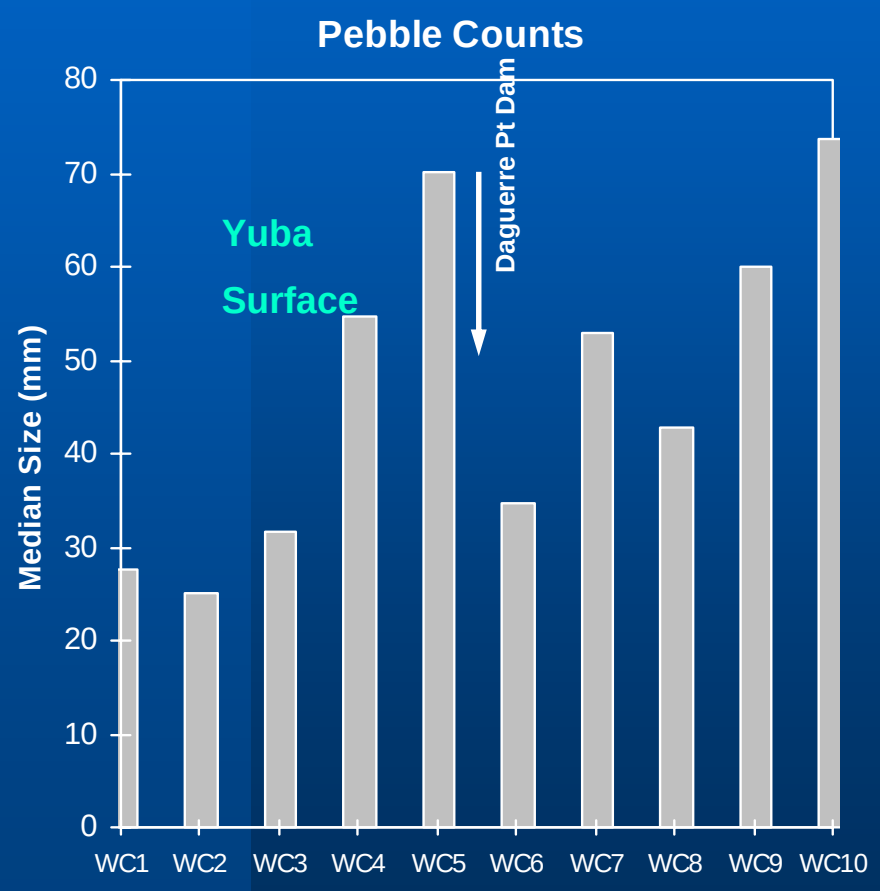
Hydrology

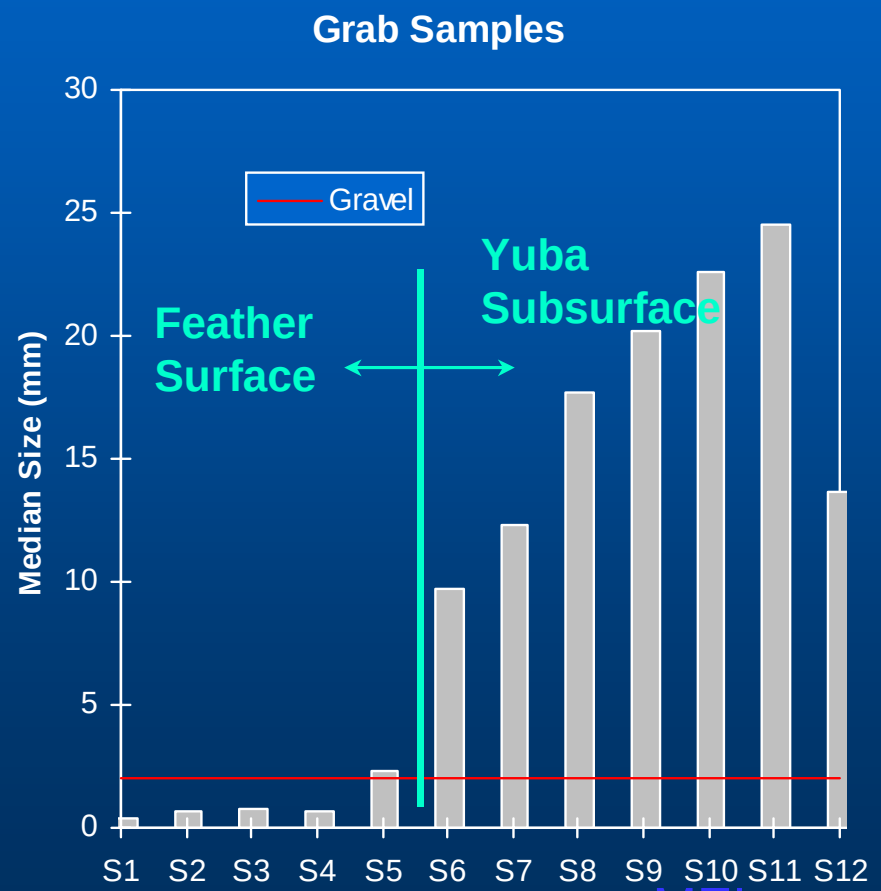
- *Long-term simulations*
  - *Period of record*
  - *Flow sequence(s)*
- *Flood impacts*
  - *100-year event*



MEI

Bed Material Sediment Data





MEI

Sediment Supply

- *Upstream boundary condition*
  - *Englebright Dam*
  - *Existing $Q_{supply} \approx 0$*
- *Tributaries*
- *Lateral loading*
  - *dredge fields*

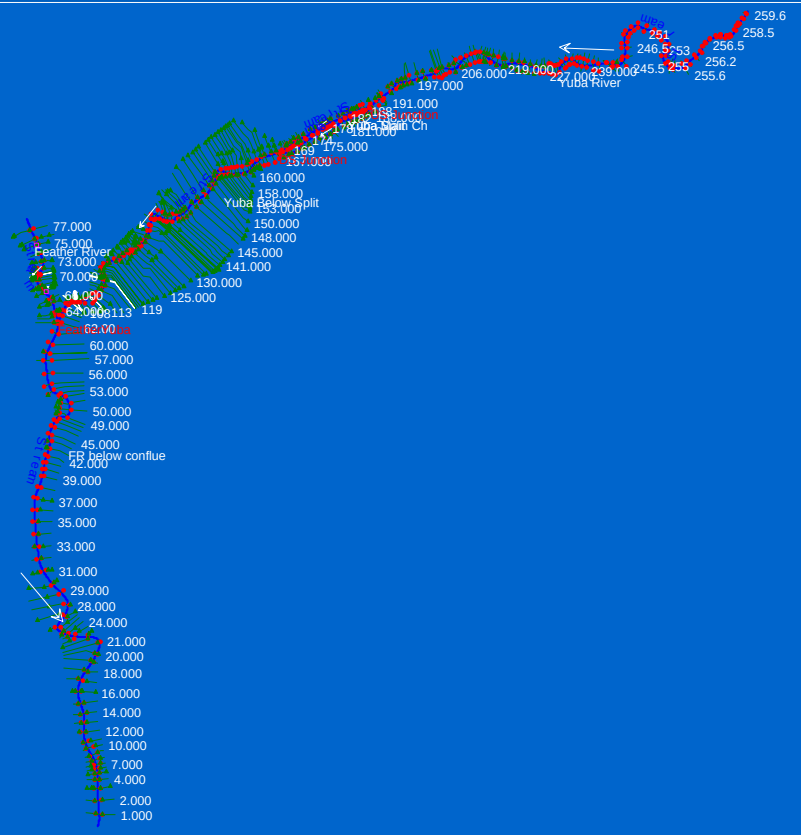
MEI

Model Validation

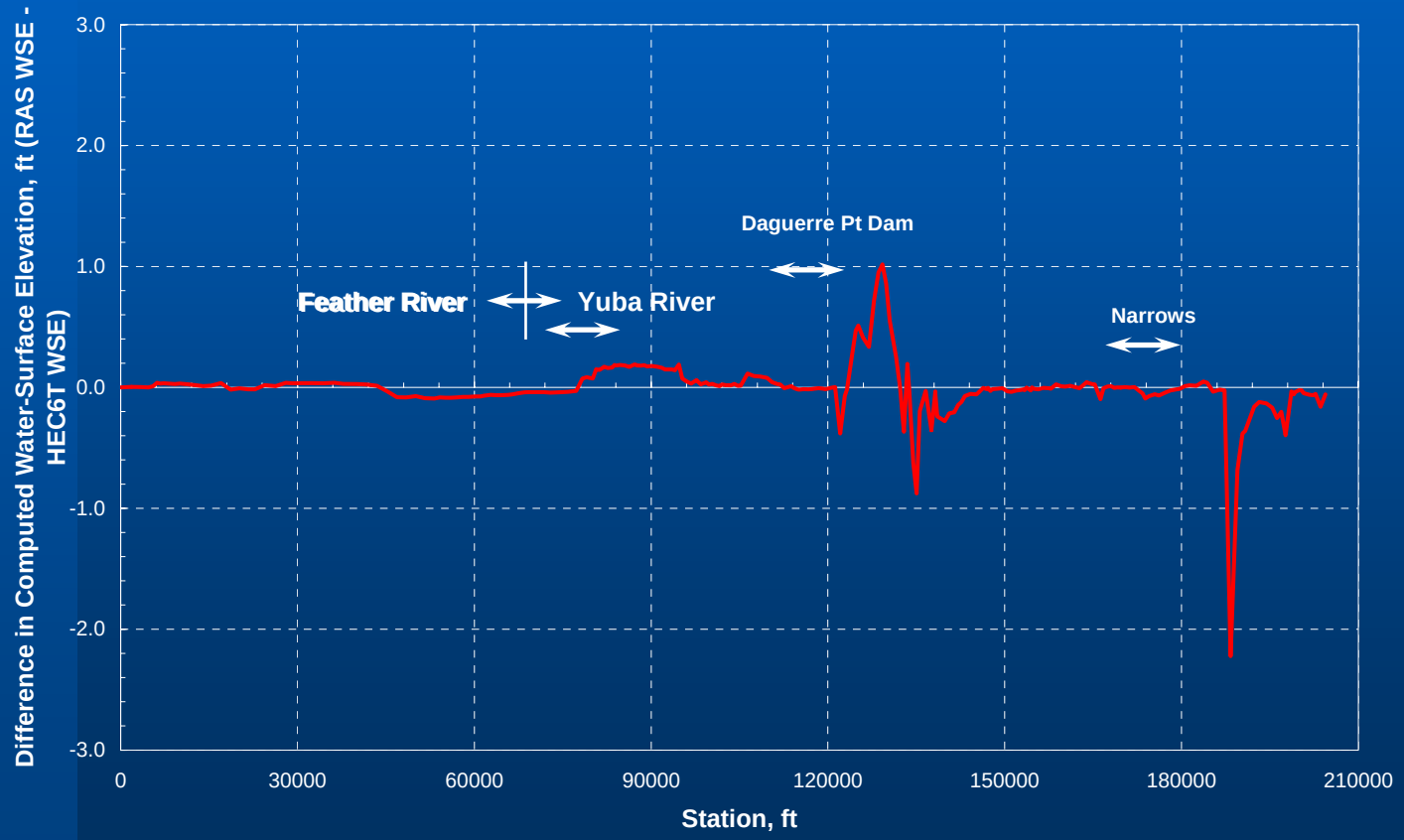
- *Hydraulics/Water-surface profiles*
  - *High-water marks*
  - *Gage rating curves*

- *Sediment Transport*
  - *Selection of transport equation*
    - *Yuba – Wilcock-Crowe 2-Phase transport model*
    - *Feather – MPM-Toffaleti*
  - *Bed and suspended load measurements*

HEC-RAS Model Structure



HEC-RAS vs HEC-6T Water-surface Comparison



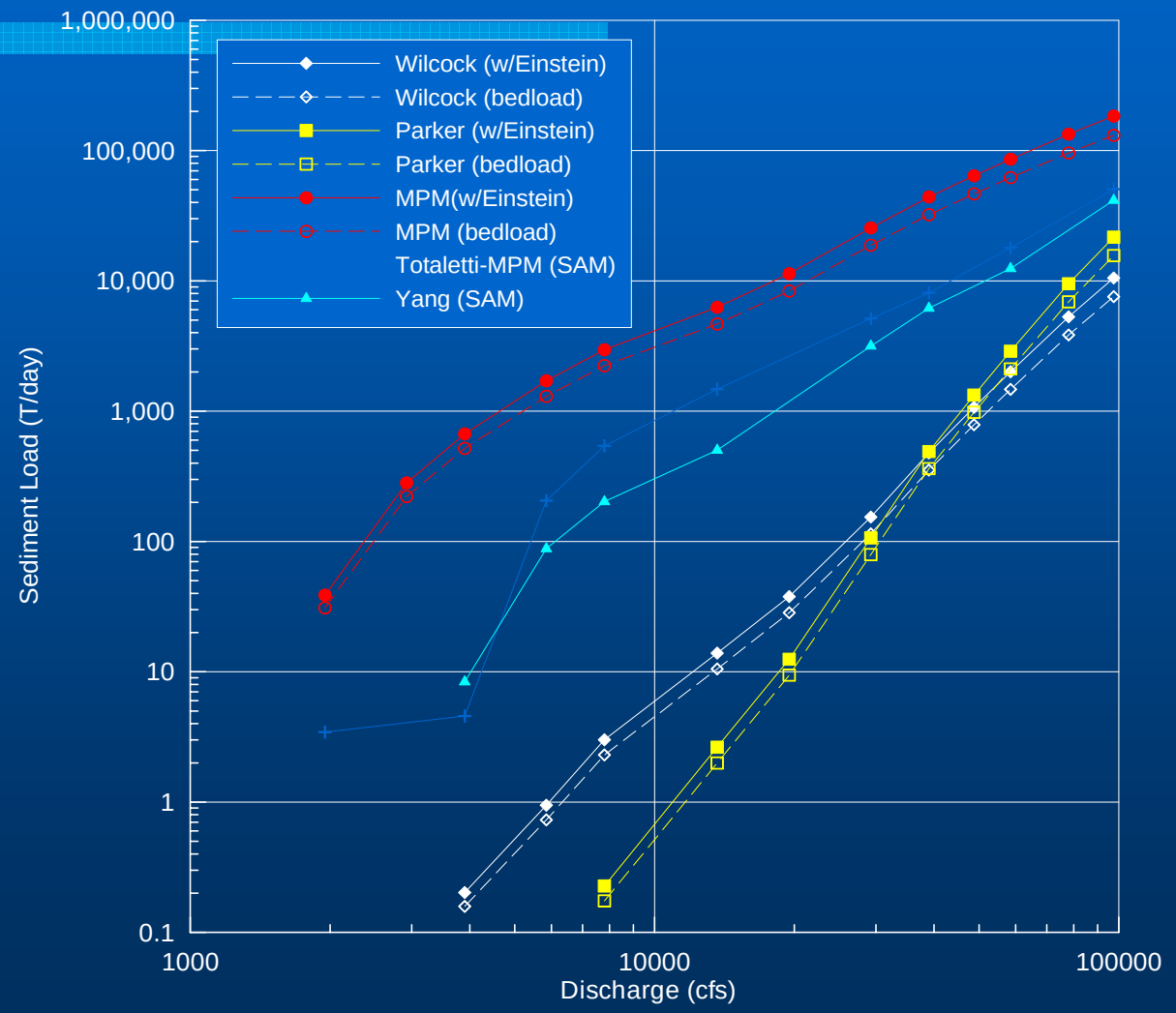
MEI

Other Sediment Routing Issues

Primarily Project Conditions

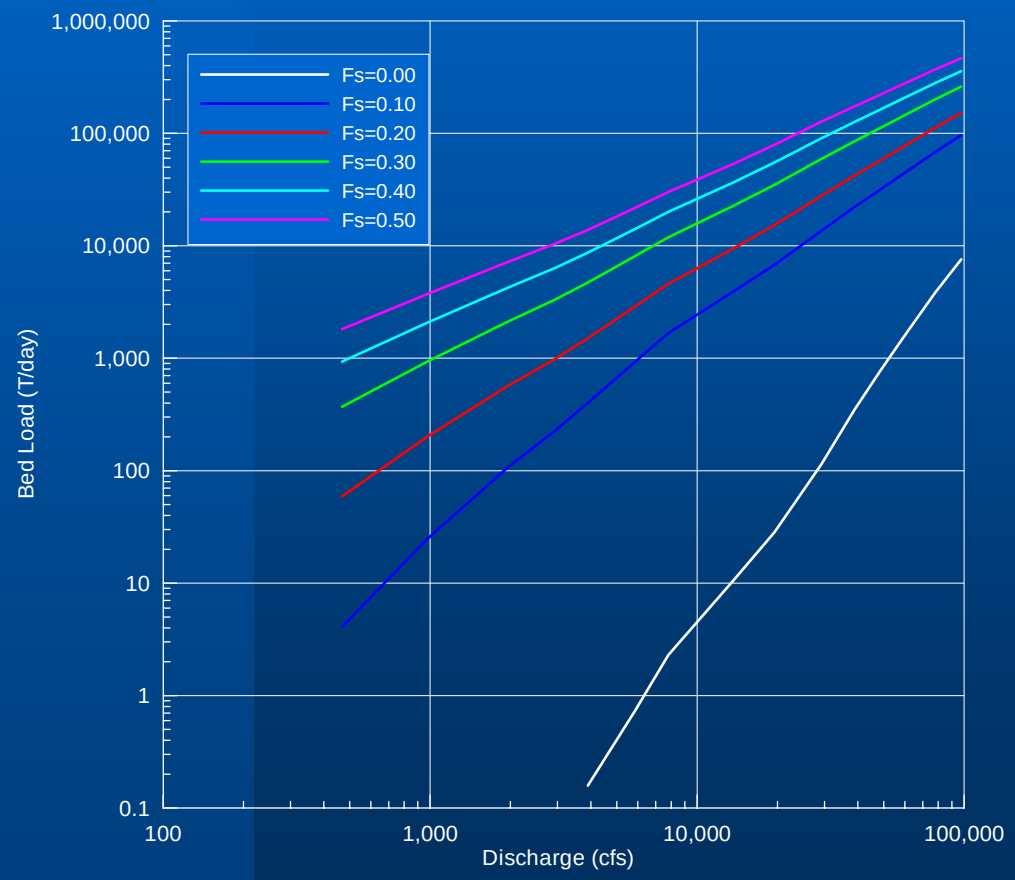
- *Daguerre Point Dam?*
- *Interface with reservoir modeling*
- *1- vs 2-phase sediment transport*

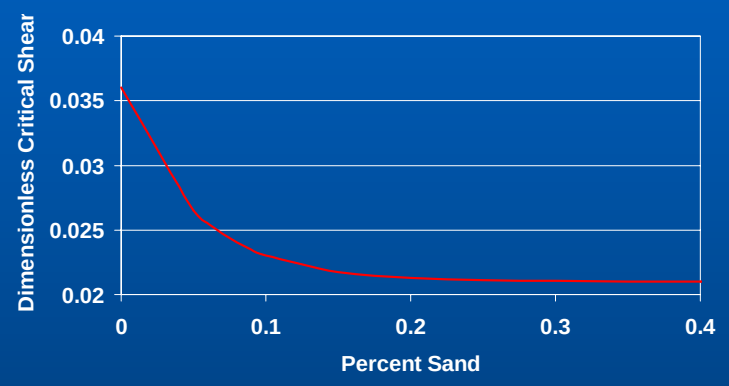
Bed Material Transport Equations



MEI

Wilcock - Crowe
Effect of Sand Fraction





MEI

Other Sediment Routing Issues

Feather-Yuba Confluence

Next Steps

- *Complete Existing Conditions Modeling of Yuba and Feather Rivers*
- *Conduct Modeling of Selected Scenarios*