

Sediment and Water Quality Measurements

Rich Jepsen

Sandia National Labs



Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.



Sandia National Laboratories

Sandia's Water Power Research

SNL Water Power Research Program

MHK Technology
with NREL, ORNL,
and PNNL

*System Design & Modeling:
Develop tools to assist the
industry in the design,
development, and optimization
of MHK devices*

*Advanced Materials and
Manufacturing*

*Instrumentation, Testing and
Evaluation*

MHK Environmental
with PNNL, ORNL,
and ANL

*Evaluating the
effects of MHK
technologies on the
surrounding
environment and
resources*

*Support project
planning and
permitting*

**Conventional
Hydro** with
PNNL, ORNL,
and ANL

*Hydropower
Optimization:
Seasonal Analysis*

*Grid Services and
Integration Modeling*

Reference Model
with PNNL, ORNL,
and NREL

*Develop baseline
cost of energy
(COE)*

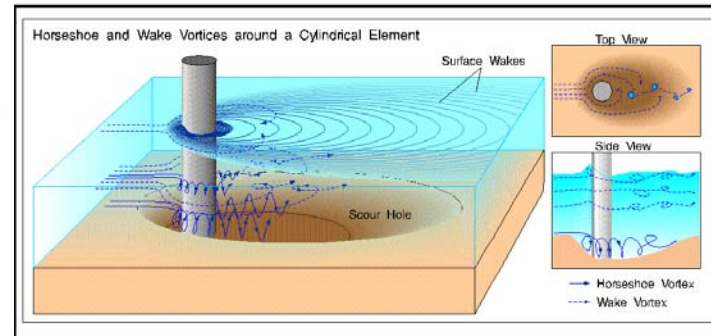
*Identify and evaluate
key cost reduction
pathways.*



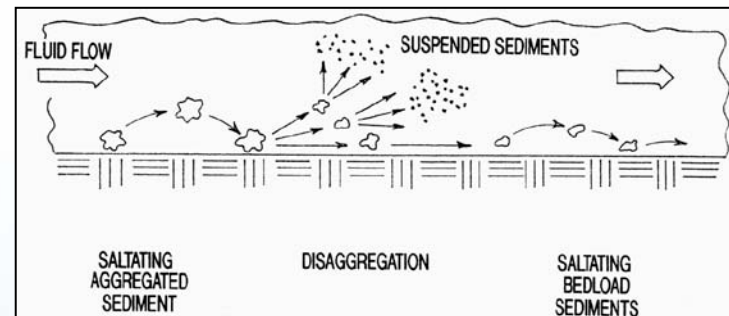
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Focus on Sediment & Water Quality Measurements

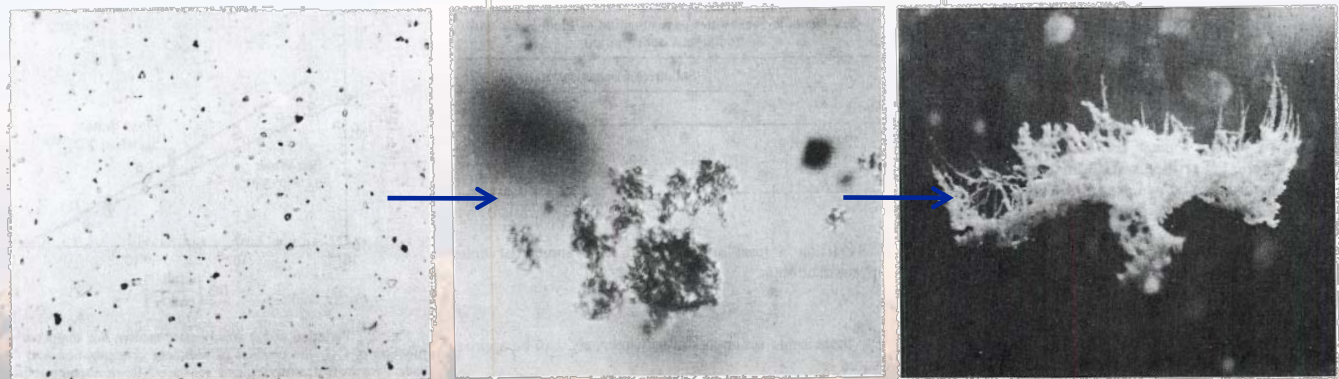
Erosion and Scour



Bedload or Suspension

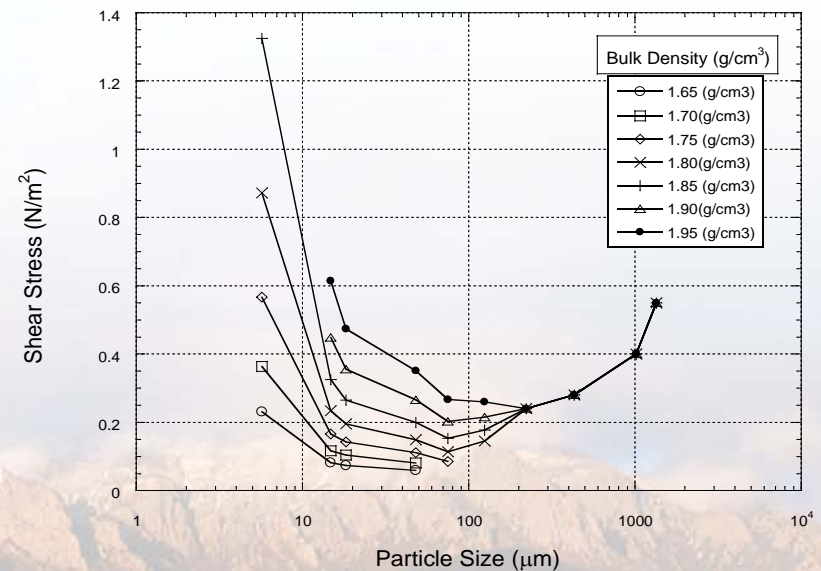
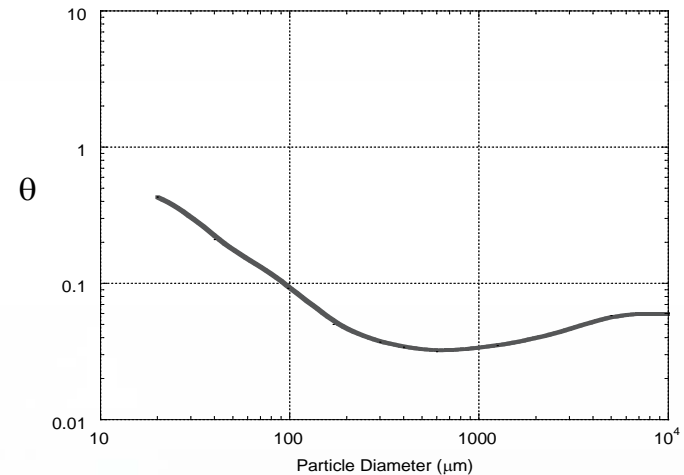


Settling



Erosion and Scour: Cohesive vs. non-Cohesive Sediments

- Non-Cohesive Sediments
(Particle Sizes $> 200 \mu\text{m}$): Use Shields Curve for erosion and scour prediction
- Cohesive Sediments (Particle Sizes $< 200 \mu\text{m}$): Use direct measurement or function of bulk properties for erosion and scour prediction



Sediment Bulk Properties

■ **Particle size**

- Sieve analysis
- Laser particle sizer

■ **Density and/or water content**

- Wet/dry weight
- X-ray analysis

■ **Mineralogy**

- XRD analysis

■ **Organic content**

- Acid treatment

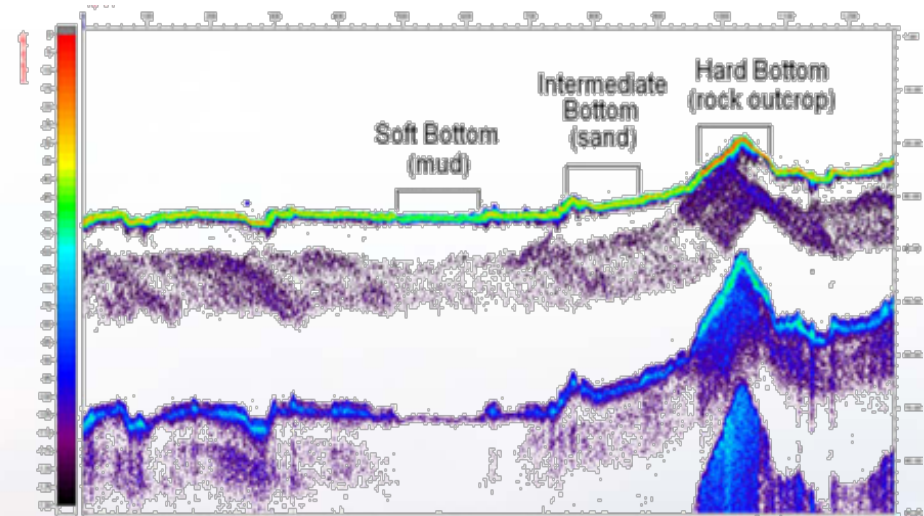
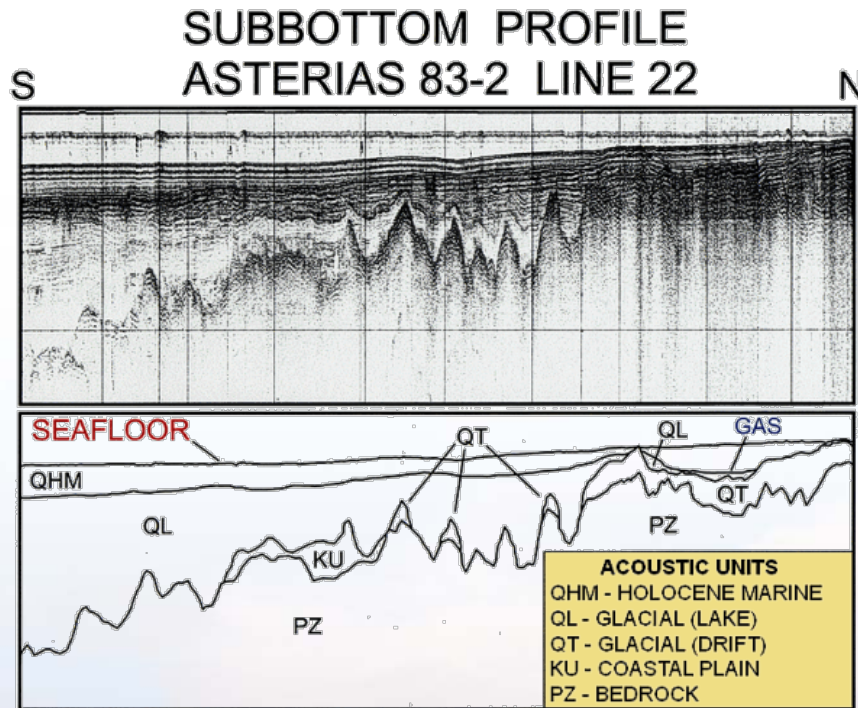
■ **Benthic activity**

■

None of these helps
predict sediment erosion
and transport without
another direct
measurement or analysis

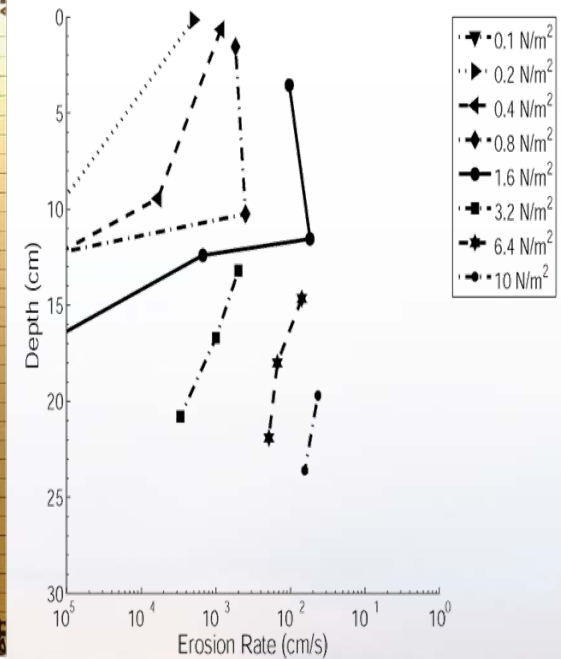
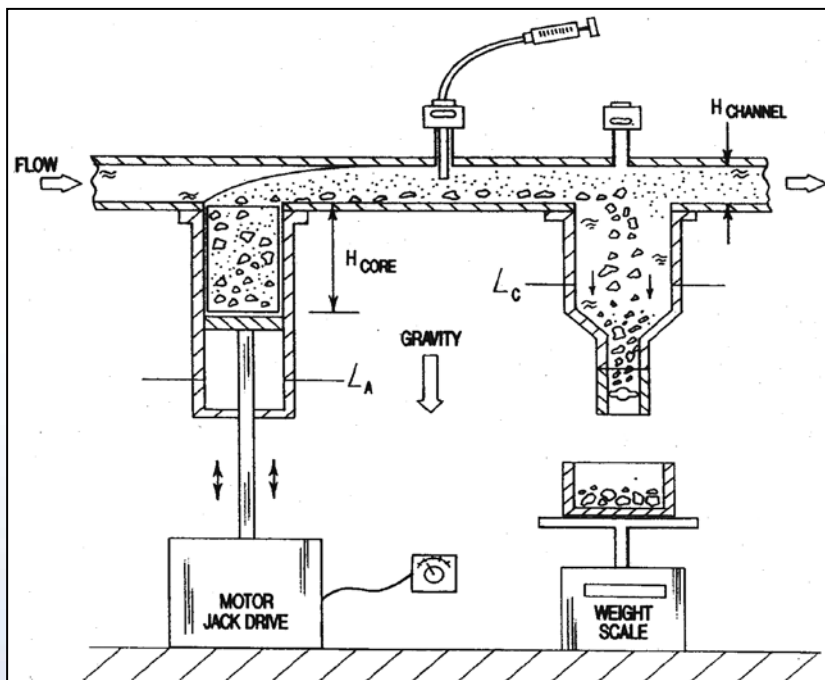


Sediment Bulk Properties: Side Scan Sonar or Hydroacoustic



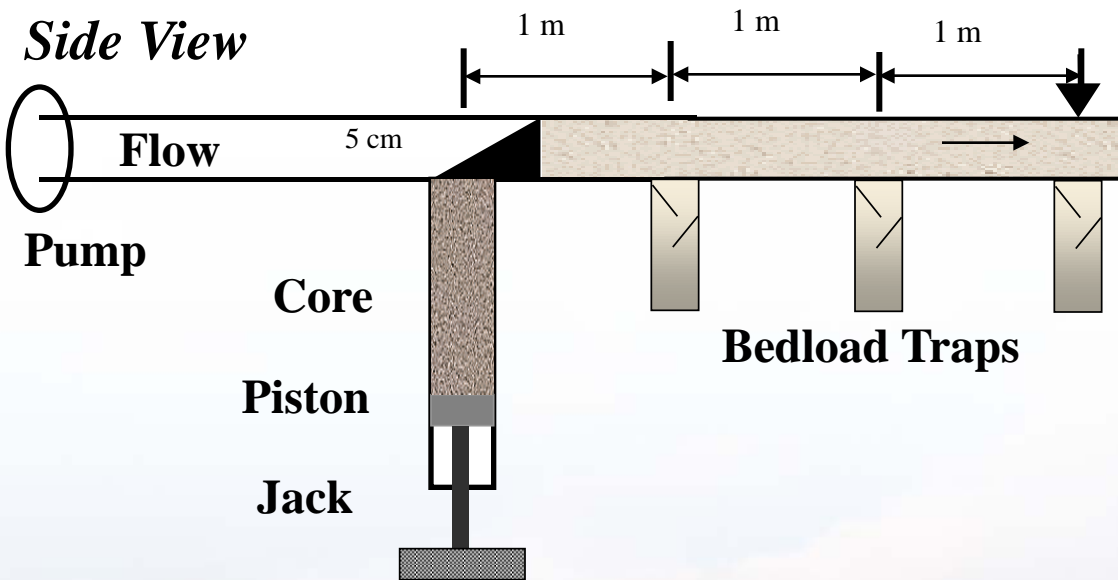
(ORNL owned system)

Erosion and Transport Flumes: ASSET Flume (Addjustable Shear Stress Erosion and Transport)



Ex-situ Measurement

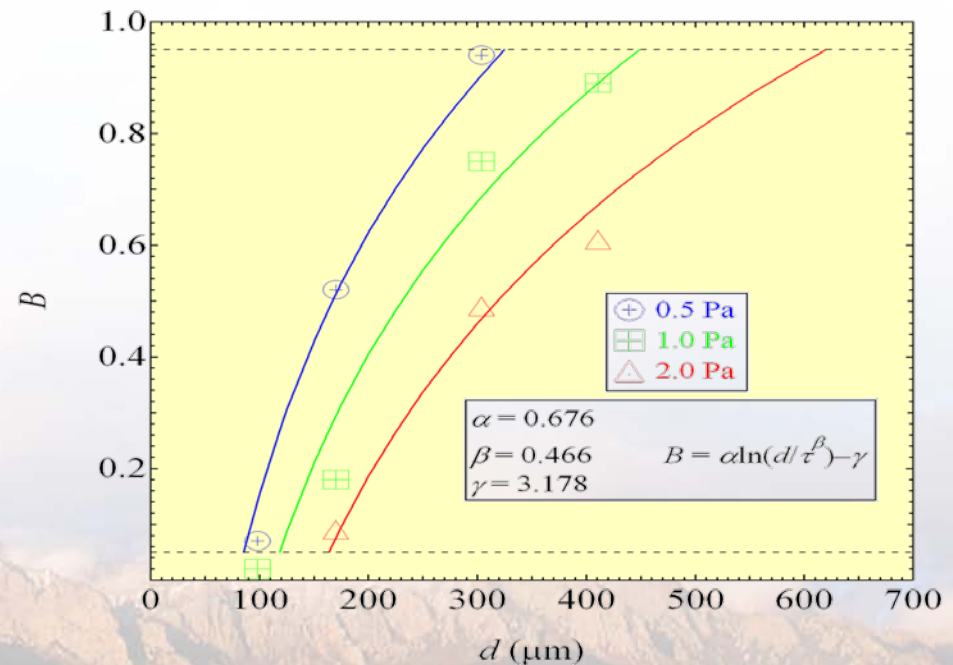
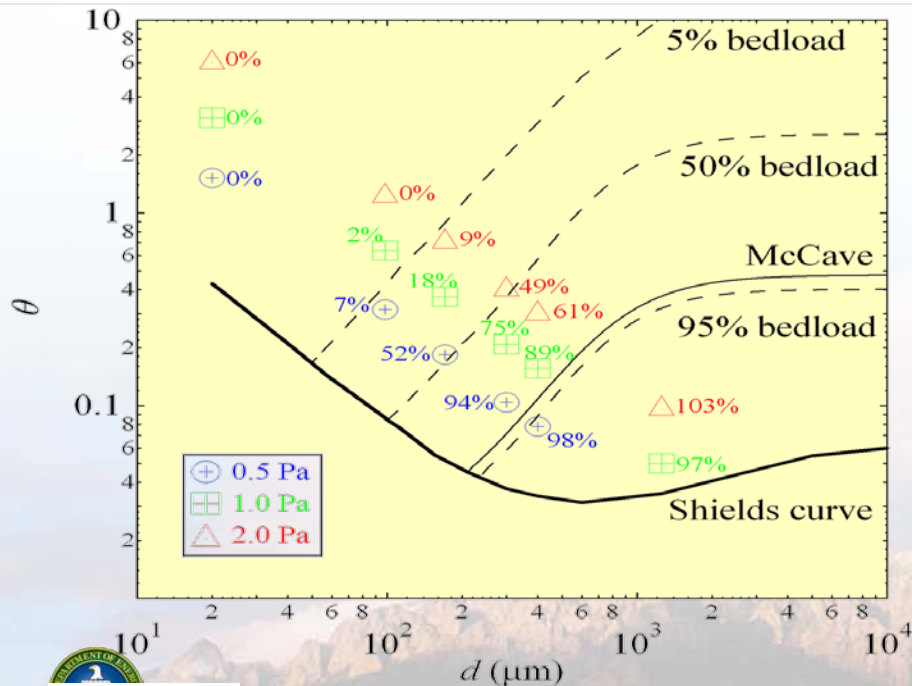
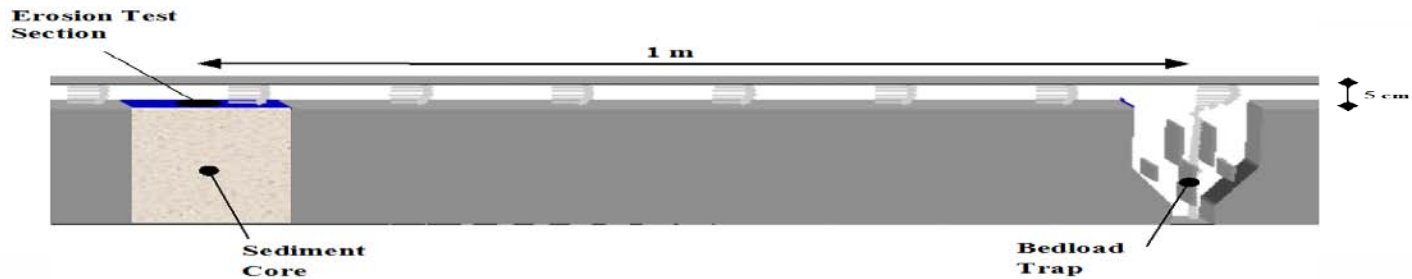
Erosion and Transport Flumes: ASSET Flume



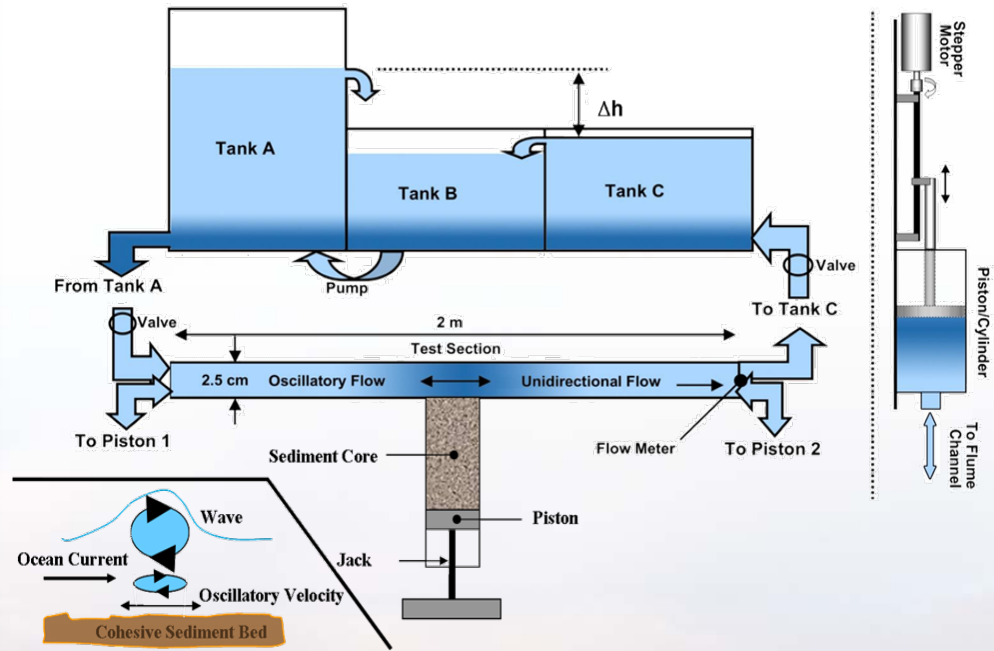
Measures erosion rate and transport mode as a function of shear stress and depth within the sediment bed



Erosion and Transport Flumes: ASSET Flume



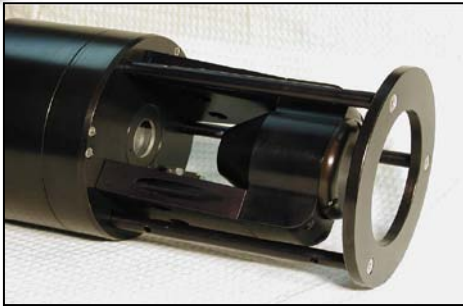
SEAWOLF (Sediment Erosion Actuated by Wave Oscillations and Linear Flow)



Ex-situ Measurement



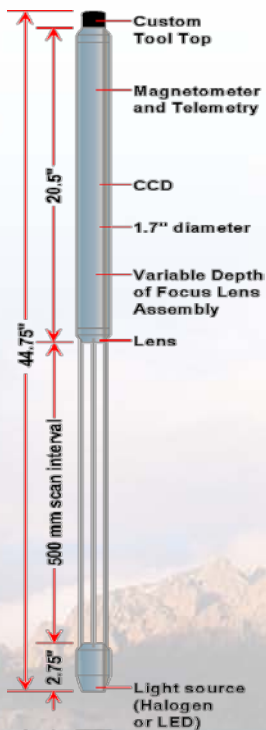
Sediment Suspensions



LISST (Laser In-Situ Scattering and Transmissometry): In situ particle size and concentration



Scanning Sediment Scope



Grab samples:
Bedload and/or
suspended load

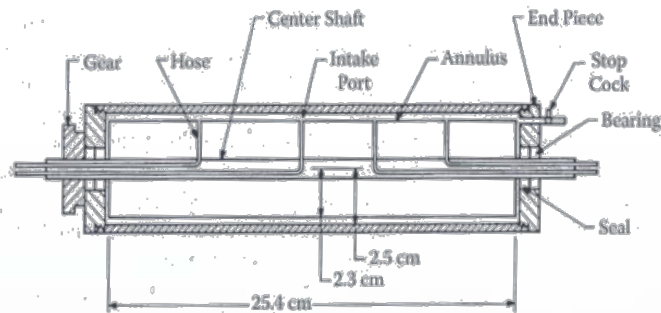


Turbidity: In situ
concentration (no
particle size)

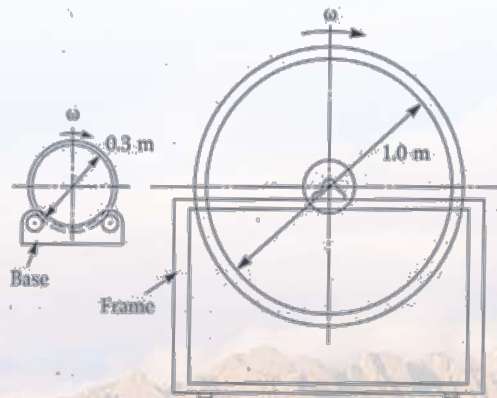


Sediment Settling

Flocculation (Marine Snow)



Couette Flocculator



Disc Flocculator

Settling measurements

- In situ (boroscope)
- Settling tube

