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Why?

- #1 point source pollutant of surface water
- Urbanization
- 90%+ total sediment
- $16 billion annually
- $1.1 billion in DFW area
Outline

- Importance
- Hypothesis
- Locations
- Methods – Field, Lab
- Results
- Comparison
- Conclusions
Hypothesis Statement

Submerged Jet Test

Field Erosion Pins
Why? #2

Erosion pins = TIME

Submerged jet test = TIME

= $
Location 1

3 – 41 square kilometers
Location 1

Average Monthly Rainfall
Study Period Rainfall

Rainfall (mm)

Month

January
February
March
April
May
June
July
August
September
October
November
December
Location 2

5 – 239 square kilometers
Average Precipitation Kaufman County, Texas
Source: NOAA, North Central Texas Climatology

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<th>Month</th>
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Location 2

- **Average Monthly Precipitation**
- **2007 Monthly Precipitation**
Methods - Field

Erosion Pins
Methods - Field

![Graph showing water level changes with dates and elevations.]

**Graph Details:**
- **Water Level (m)**: The y-axis represents the water level in meters.
- **Discharge (cms)**: The y-axis on the right represents discharge in cubic meters per second (cms).
- **Date Axis**: The x-axis represents dates from 2/27/2008 to 3/18/2008.
- **Key Points**:
  - **Lower Bank**: Lower water level on 3/18/2008.
  - **Wetting Duration**: Time period from wetting to drying.
  - **Drying Duration**: Time period from drying to wetting.

The graph illustrates the variation in water level and discharge over a specified period, with key events marked for analysis.
Methods - Field Erodibility

\[ K_{\text{field}} = E_p \times D_w \times \tau_a \]

- \( K_{\text{field}} \) = field erodibility coefficient (cm/hr/Pa)
- \( E_p \) = measured pin erosion (cm)
- \( D_w \) = wetting duration (hr)
- \( \tau_a \) = Applied shear stress (Pa)

Capello, 2008
Methods - Lab

$$y = 0.0068x$$

$$R^2 = 0.7758$$

0.000
0.002
0.004
0.006
0.008
0.0 0.2 0.4 0.6 0.8 1.0

$$V(t)^{-0.931}$$

$$D/t \text{ (cm/s)}$$

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Water delivery hoses from sink faucet and recirculating pumps

Recirculating pumps

Primary Head Tank

Secondary, adjustable head, jet tubes

Submerged Jet Test samples

Scissor jacks for adjusting sample height

original surface

$$h = \text{height}$$

$$d = \text{diameter nozzle}$$

$$D_s = \text{maximum scour}$$

$$U_o = \text{velocity at nozzle}$$
Methods - Submerged Jet Erodibility

\[ K_{Jet} = 0.003e^{385J_i} \]

\( K_{Jet} \) = submerged jet erodibility (cm³/N-s)

\( J_i \) = jet index

Hanson, 1991
Methods - Lab

Before

After

Calculate K
Results 1 - Stream Bank Properties

**Lower Bank**
Bulk density: 1.34-2.58 g/cm³
Percent clay: 0.61-5.41

**Upper Bank**
Bulk density: 1.32-2.64 g/cm³
Percent clay: 1.9-5.16
Upper Bank
Bulk Density 1.27 - 1.57g/cm³
Percent Clay 1.82 - 17.32

Lower Bank
Bulk Density 1.32 - 1.51g/cm³
Percent Clay 2.34 - 24.44
Results – Erosion vs. Duration

- Cohesive Lower Bank
- Non-Cohesive Lower Bank

Diagram shows the relationship between cumulative erosion (mm) and cumulative wetting duration (hours).
Results – Erosion vs. Duration

Cumulative Erosion (mm) vs. Cumulative Wetting Duration (Hours)

- **Cohesive Upper Bank**
- **Non-Cohesive Upper Bank**

572 mm
Non-cohesive vs. Cohesive
Results – Field vs. Jet

Non-cohesive
Results – Field vs. Jet

Cohesive

Field Measured Erosion (mm)
Submerged Jet Calculated Erosion (mm)

Lower Bank
Upper Bank

572 mm
Conclusions

• Submerged jet test viable for cohesive and non-cohesive bank material

• Cohesive 18% error LB and -35% UB
  – +/- 1 cm

• Non-cohesive 12% error LB and -40% UB
  – +/- 1.5 cm
Jet Erosion vs. Field Erosion

Average error = 1.5 cm
QUESTIONS?