Colorado State University
Knowledge to Go Places

Rocky Mountain Regional
Hazardous Substance Research Center

Fate and Transport of Metals and Sediment in Surface Water

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Colorado State University

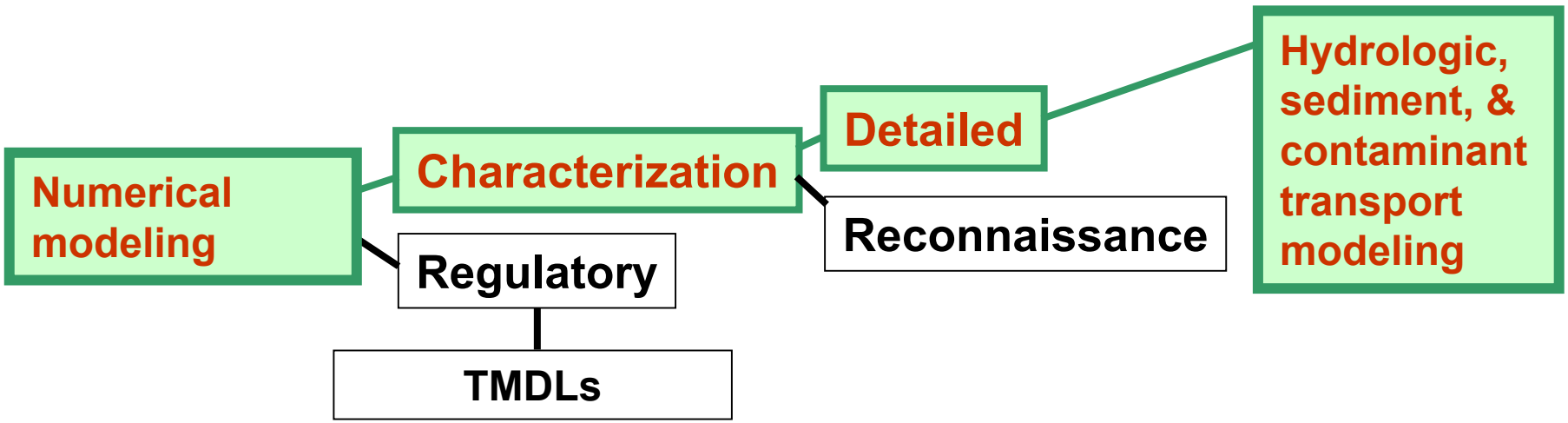
Billings Symposium / ASMR Annual Meeting

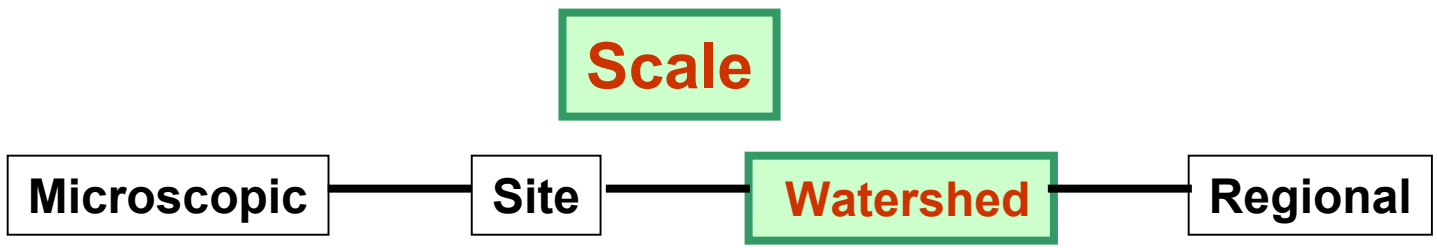
Assessing the Toxicity Potential

of Mine-Waste Piles Workshop

June 1, 2003

FLOW CHART FOR RANKING AND PRIORITIZATION





PROBLEM: Erosion

PROBLEM: … Transport

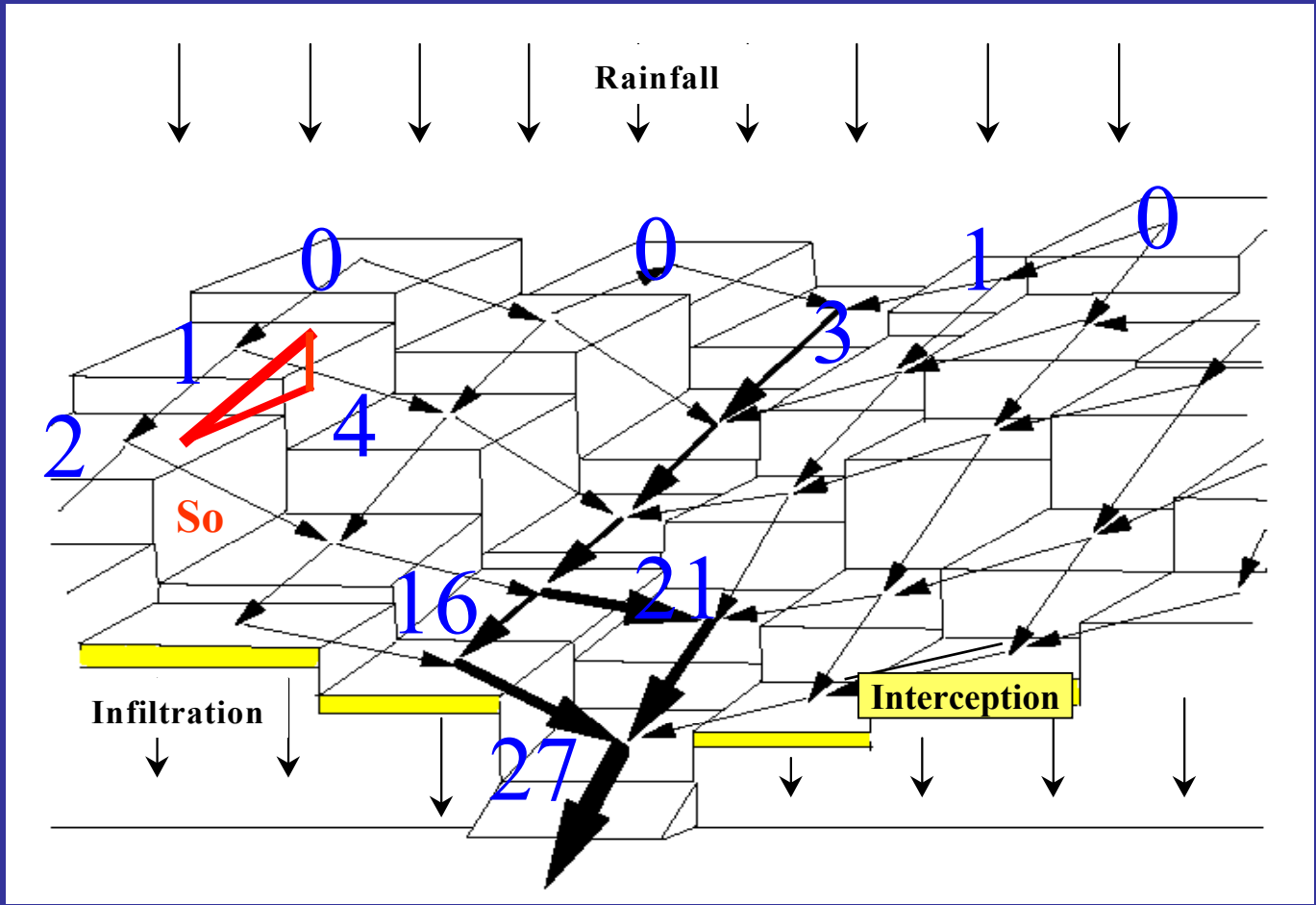
PROBLEM: … and Deposition

Objectives

- Physical characterization of waste piles.

- Numerical modeling of fate and transport of sediment and metals at the watershed scale

CASC2D-SED

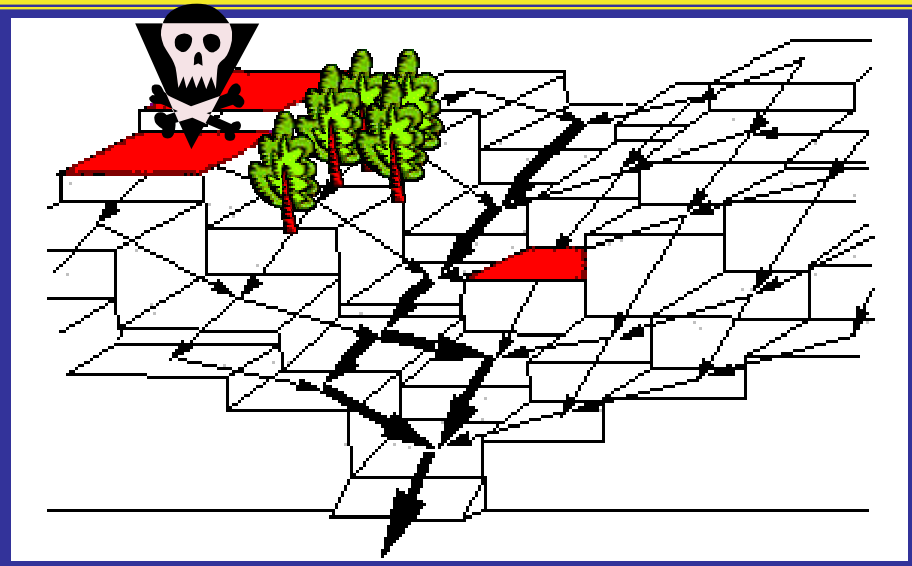


CASC2D- Julien et al. (1995)

CASC2D-SED – Johnson et al. (2000), Rojas (2002)

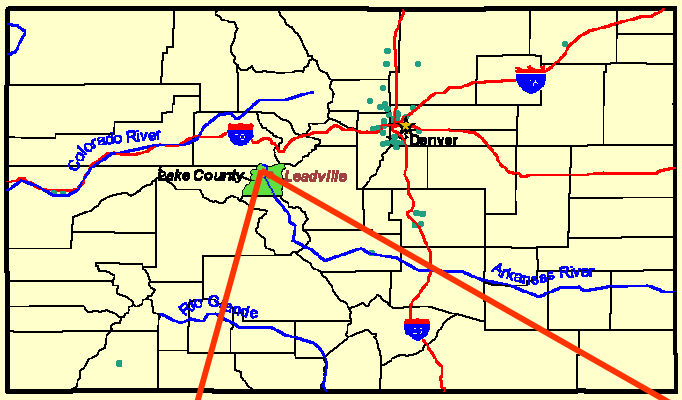
Physical Characterization of Waste Piles

Model accounts for key physical characteristics at the watershed scale:

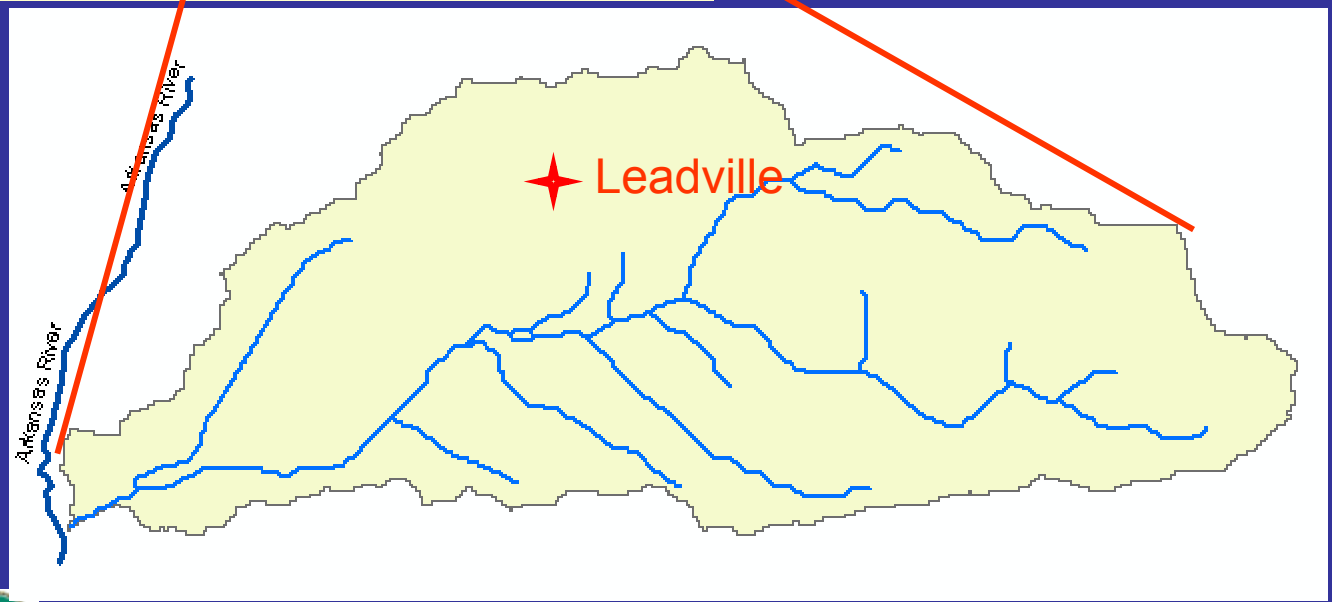


- ☑ Waste pile slope
- ☑ Proximity to a drainage channel ← Elevation grid
- ☑ Degree of erosion ← Soil type grid
- ☑ Presence of vegetation and kill zones ← Land use grid

California Gulch Watershed

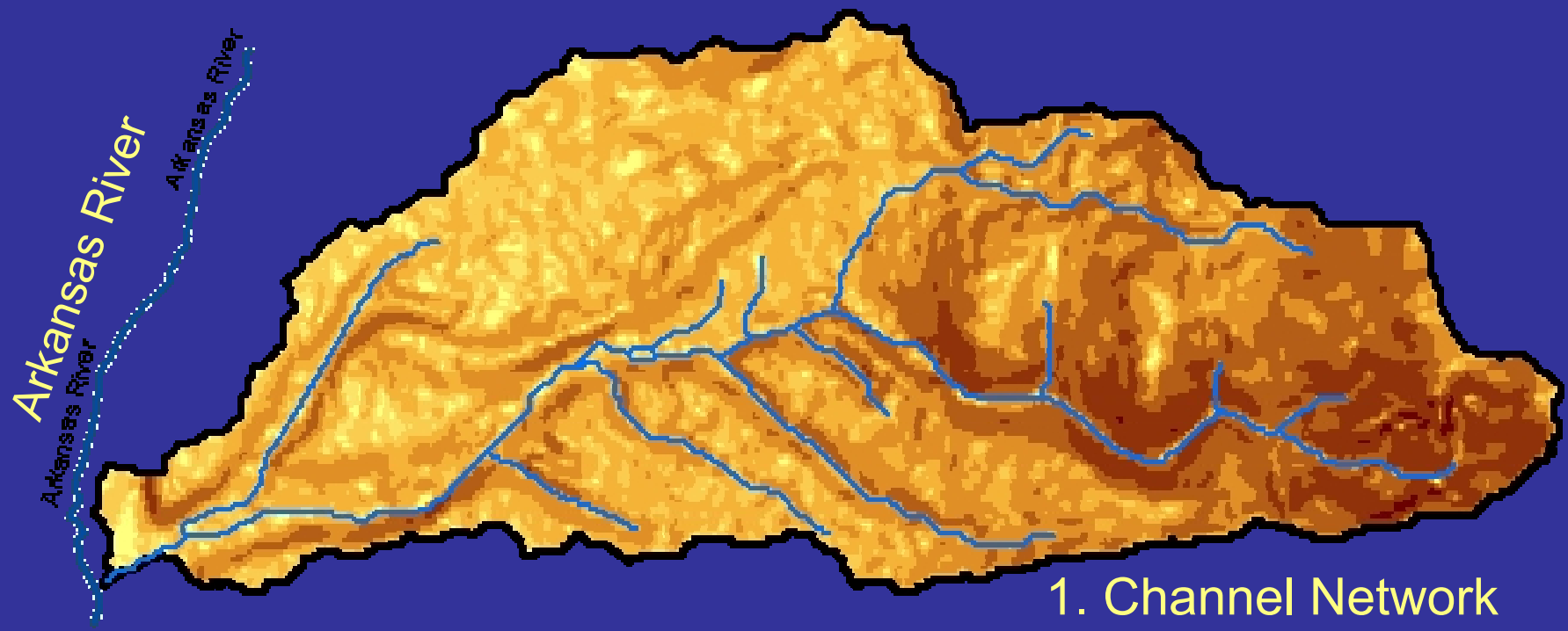


- EPA Superfund Site
- Location: Lake County (CO)
- Area: 30.6 Km^2
- 100-year flood: 2-h: 1.73 in



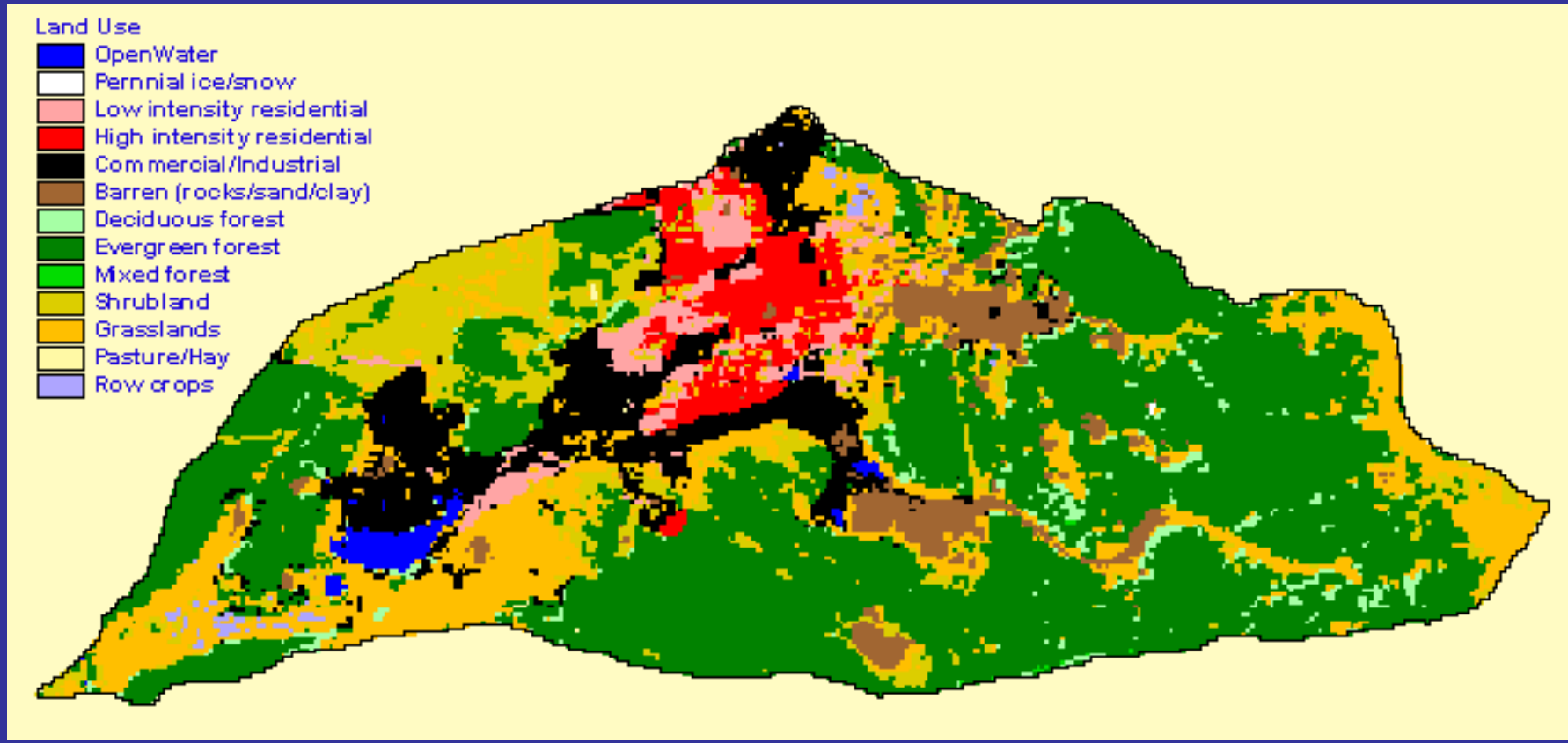
INPUT DATA (DEM)

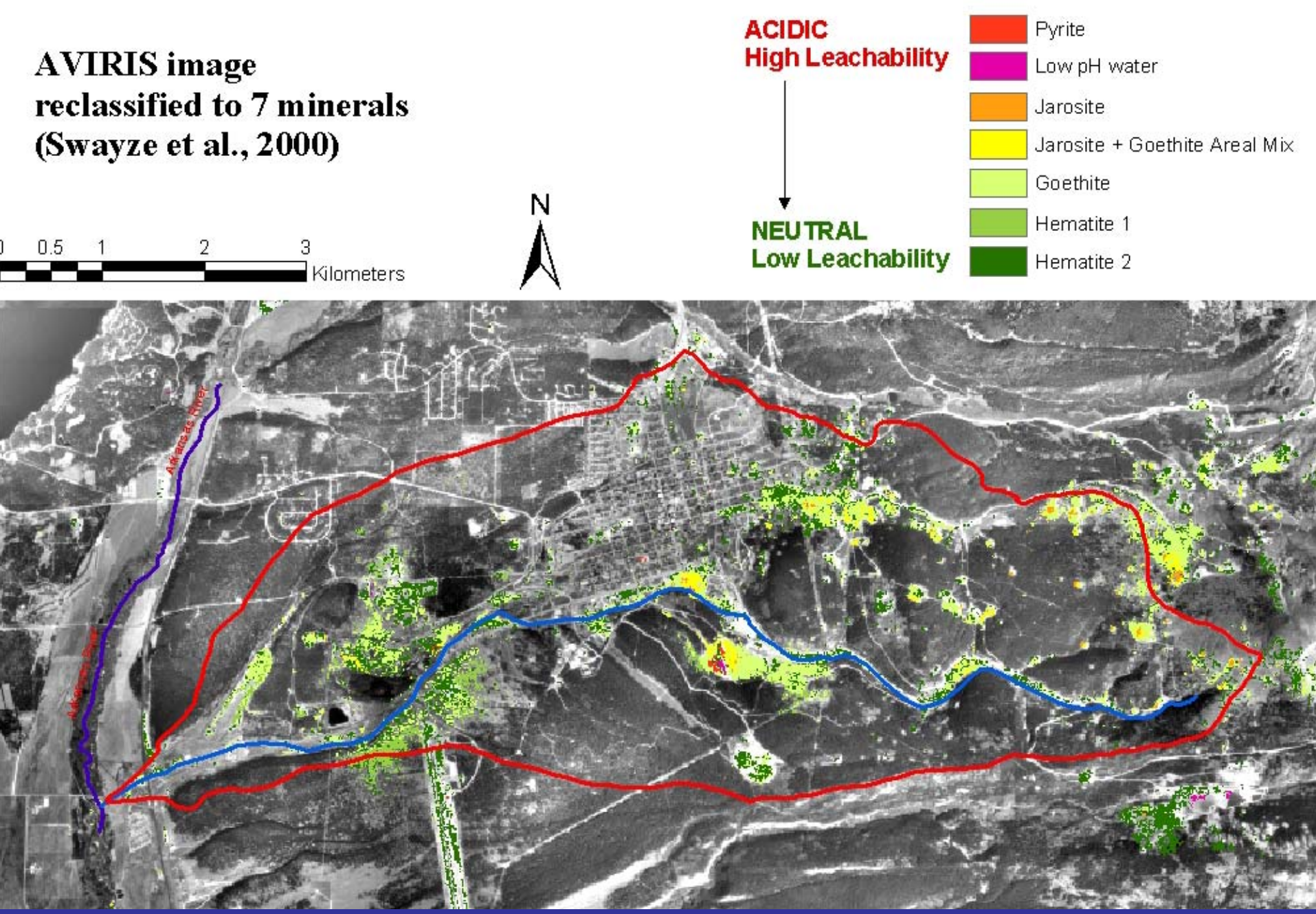
Digital Elevation Model



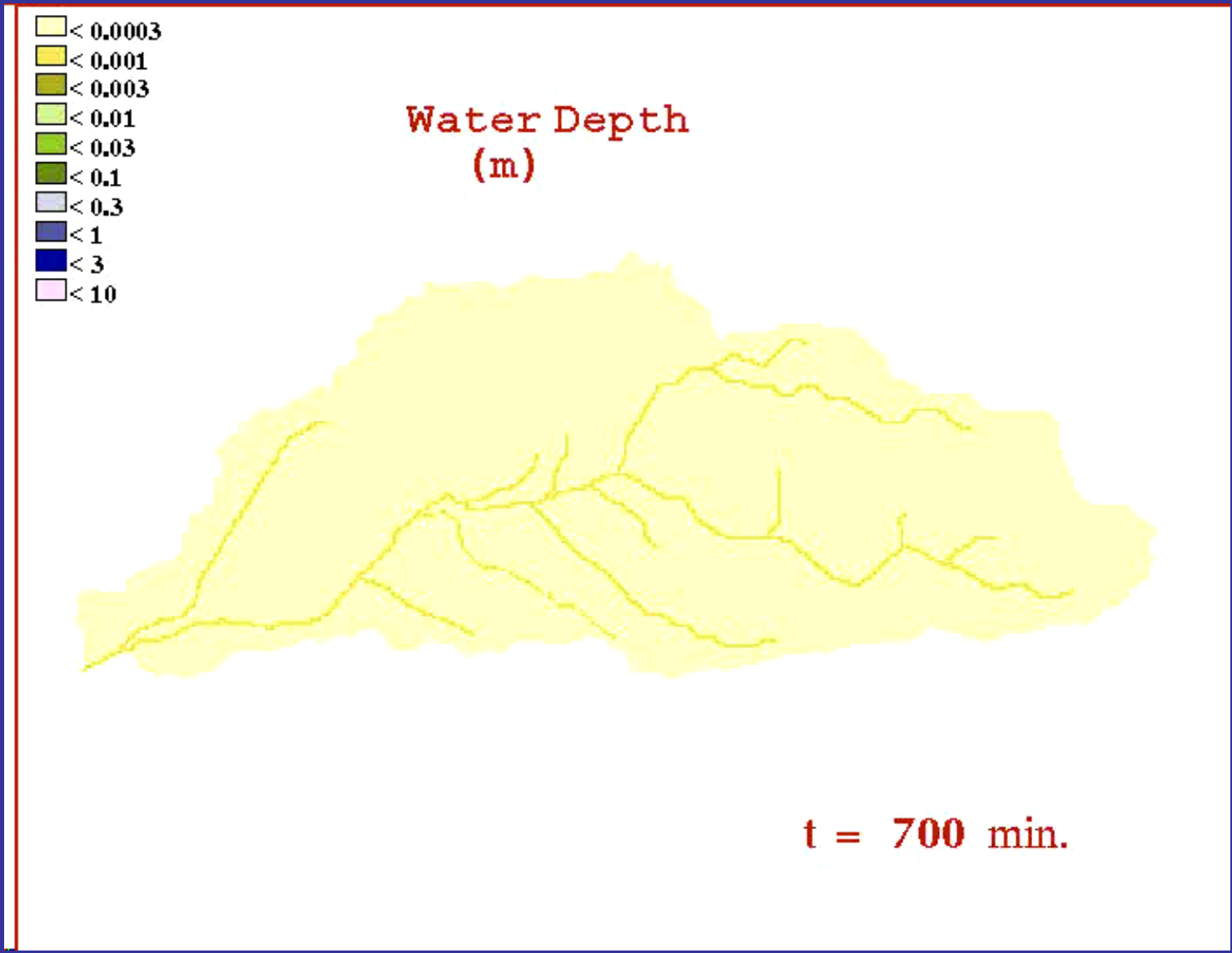
1. Channel Network
2. Terrain Slopes

INPUT DATA (land use)

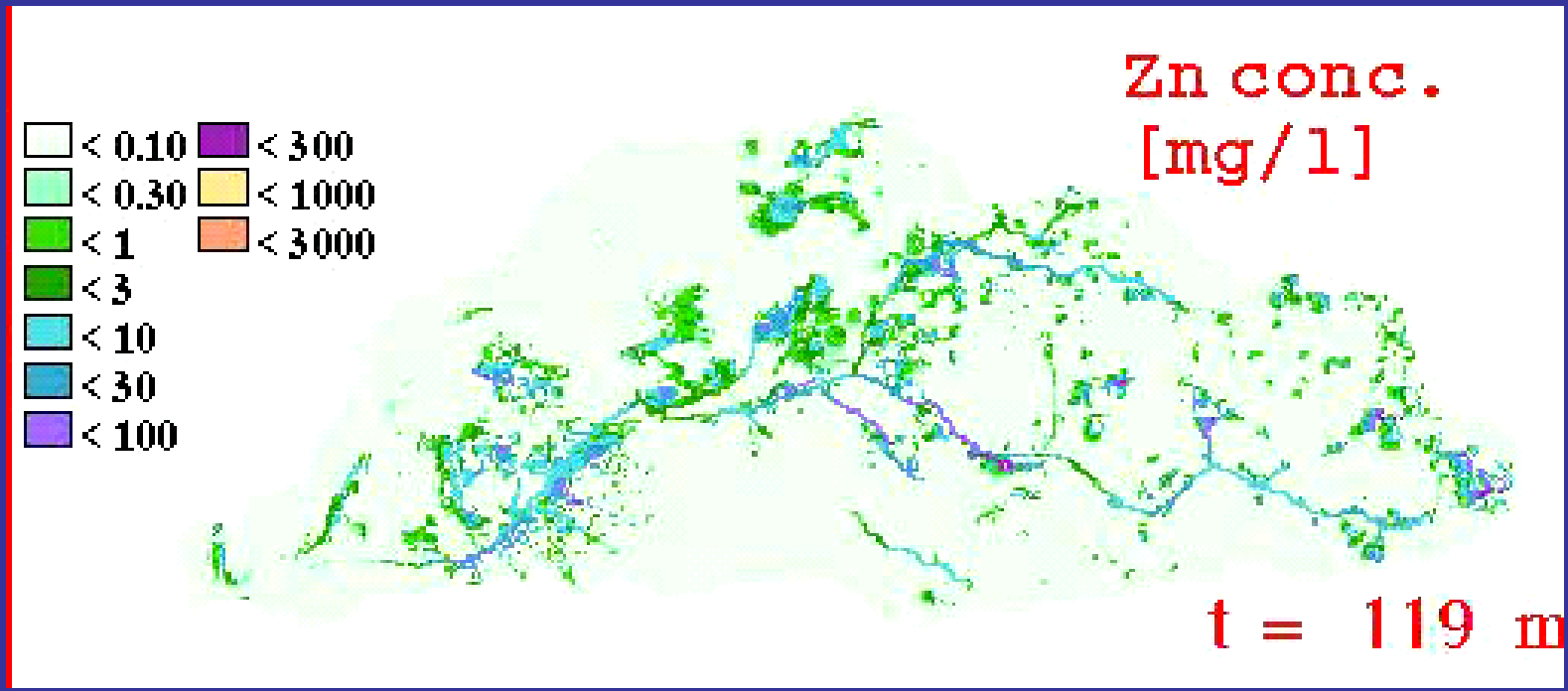



AVIRIS image
reclassified to 7 minerals
(Swayze et al., 2000)
ACIDIC
High Leachability
NEUTRAL
Low Leachability
Pyrite
Low pH water
Jarosite
Jarosite + Goethite Areal Mix
Goethite
Hematite 1
Hematite 2
N
0 0.5 1 2 3
Kilometers

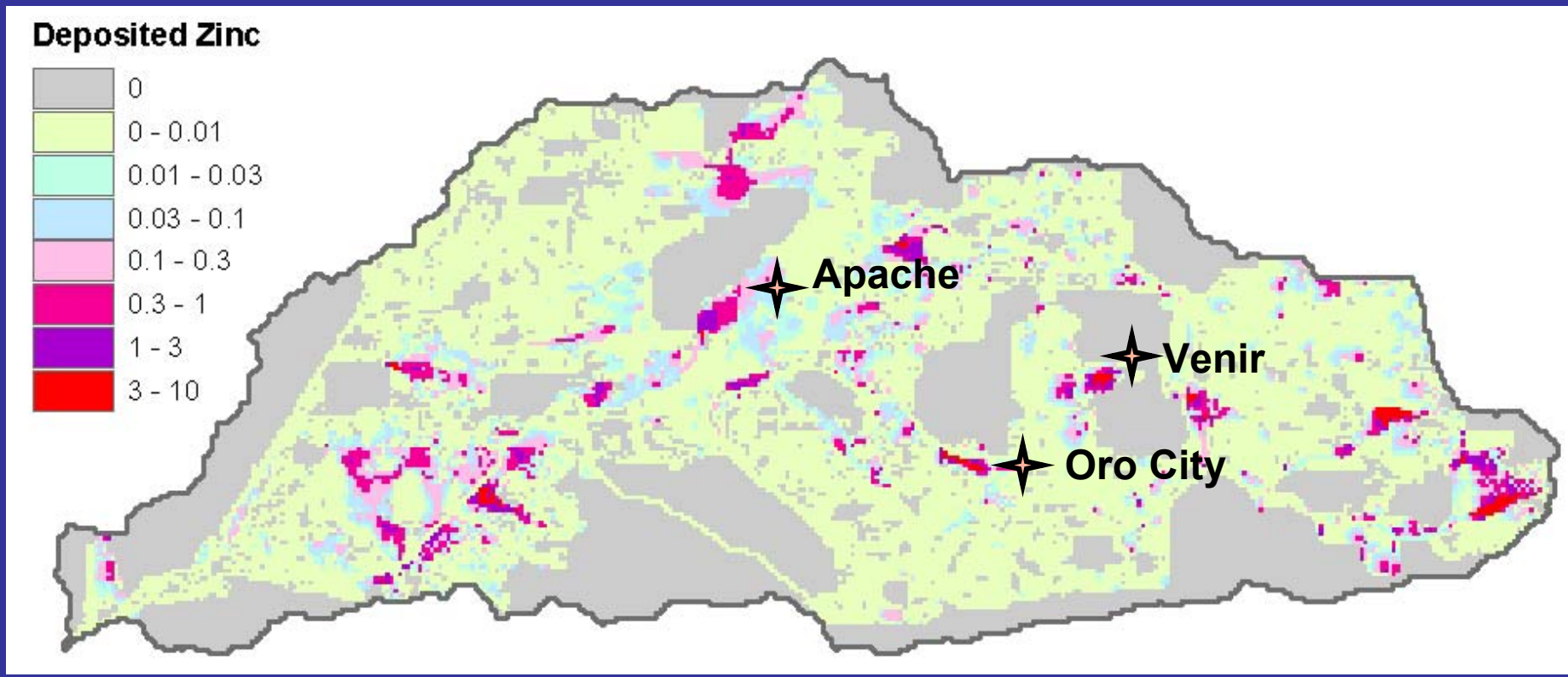
GEOVISUALIZATION: rainfall-runoff



Metals Transport



Metals Deposition



Conclusions

1. Physical characterization of piles

2. Numerical modeling of fate and transport of sediment and metals at the watershed scale

3. Ultimate Goal: Analyze different remediation scenarios to establish clean-up priorities