Demonstration Program
Urban Flooding and Channel Restoration
in Arid and Semi-Arid Regions (UFDP)

# Program Overview and Direction

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# Points of Contact

- Joan Pope, ERDC
- Jack Davis, CHL Technical Directors Office
- Ed Sing, SPD, Executive Committee
- John Warwick, Desert Research Institute
- Meg Jonas, ERDC-CHL, Program Manager
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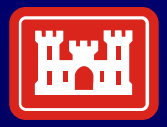

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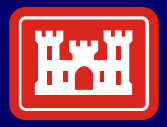
# Program Overview

- FY05 funding of $2M ($1.6M after S&S)
- Collaboration between Corps and Desert Research Institute ($1.1M+ to DRI).
- Urban flood and channel restoration demonstration program
- Congressional add ($2M) in FY03 by Sen. Reid (NV) FY04 funding of $1M ($650k after S&S). Envisioned as 5-year program with $2-3 million funding per year
- Regional program adapted for arid and semi-arid regions
- Products must be useful to the field
- Teaming of ERDC, HEC, DRI, SPD, and local interests (SNWA, CCRFCD, Reno, NVDEP, et al)

# Program Focus on Arid Regions

- Rapidly developing population centers
- Unique watershed management issues
- Opportunity to meet the special needs of this region
- Expertise of Desert Research Institute
- National mission and expertise of Corps
- Expertise and interest of local stakeholders
- International application for arid regions expertise
- Broad applications for urban channel restoration
- High potential ROI benefits



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# Urban Flood Damage Reduction

- Supercritical Flood Channels
- Stabilization Measures
- Multi-dimensional Sediment Transport Modeling
- Hydrologic Prediction
- Stability Analyses
- Evaluation of Impacts
- Vegetative Resistance
- Vegetation Stability

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# Channel Restoration

- Low-Flow Design
- In-stream Features
- Losses at Bends
- Vegetation Impacts
- Stabilization Measures
- Riparian Restoration

- Stability Analyses
- Habitat Assessment
- Floodplain Restoration
- Water Quality
- Sediment Transport
- Impacts/Benefits Analysis

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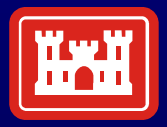
# Criteria for Work Units

- Demonstration. Take new or nearly completed R&D technologies and demonstrate them in the field. (Not reimbursable work, and not basic research either.)
- High value to field and stakeholders. Priorities identified by SPD and local interests. Field needs are the driving factor. Front-burner issues.
- Quick results (ideally as part of a longer-term strategy)
- High benefit-cost ratio
- Wide application
- Productivity
- Collaboration
- Focus on Corps study sites

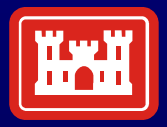
# Funded work units

- Analytical tools for stream restoration design – Truckee River (sediment modeling)
- Sediment transport processes in arid regions
- Improved design guidance for grade control and bank stabilization in arid regions (Las Vegas Wash)
- Extension of design guidance for supercritical flow channels (Las Vegas)
- Characterization of resistance for southwestern vegetative complexes
- Delineation of arid and semi-arid regions of US
- Technology transfer (including web site)



# Funded work units - continued

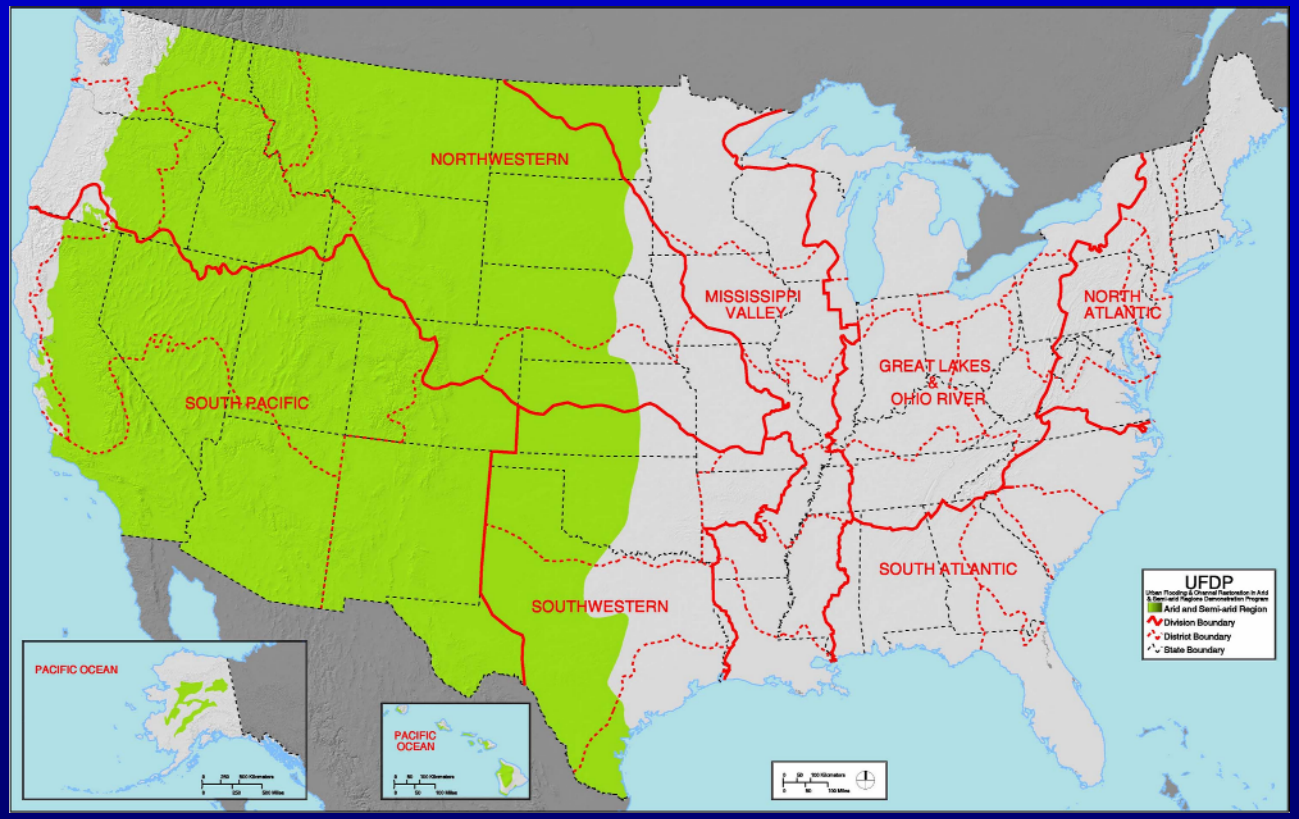
- QPF – use of high-resolution data to improve estimates
- Spatial variations in alluvial fan materials and runoff characteristics
- Improved infiltration estimates for alluvial fan materials
- Temperature impacts on infiltration (will be incorporated into HEC-HMS in FY06 if program is funded)
- Impact of grade controls on nutrient and metals in sediment (Las Vegas Wash)



# Funded work units - continued

- Truckee River restoration: collaborative effort using habitat mapping (DRI), hydrodynamic modeling (ERDC), and EFM (HEC)
- Truckee River restoration: geomorphic evaluation, hydrologic modeling, and water quality analyses
- 2D sediment transport modeling of Las Vegas Wash – evaluation of channel modifications on downstream flows and sediment transport
- Development of sediment transport function for Las Vegas Wash (bed load and suspended sediment)
- Infiltration - intercode comparison of GSSHA and HEC-HMS (Arizona); development of infiltration algorithm for sloping ground

# Arid and semi-arid region delineation for United States

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# Truckee River restoration
# McCarran Ranch

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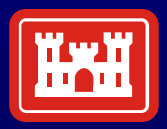
# Truckee River Channel Restoration

Reconnaissance Level Channel Stability Analysis
Using ERDC SAM Computer Programs

RESTORATION GOALS:

- Restore meandering plan form to the channel
- Modify channel geometry to encourage over bank flooding for a one – two year return flow



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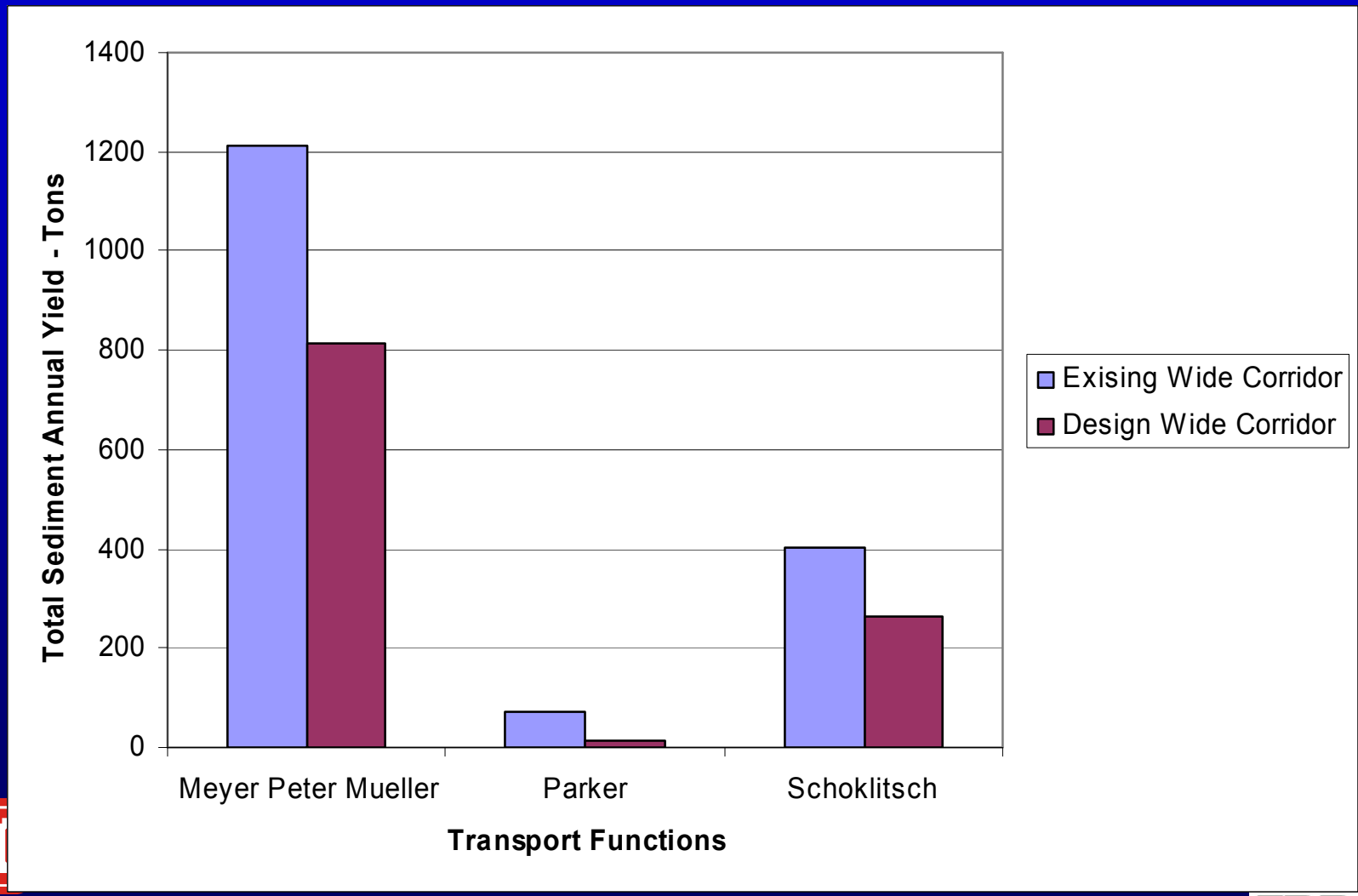
# Sediment Annual Yield – Wide Channel Corridor

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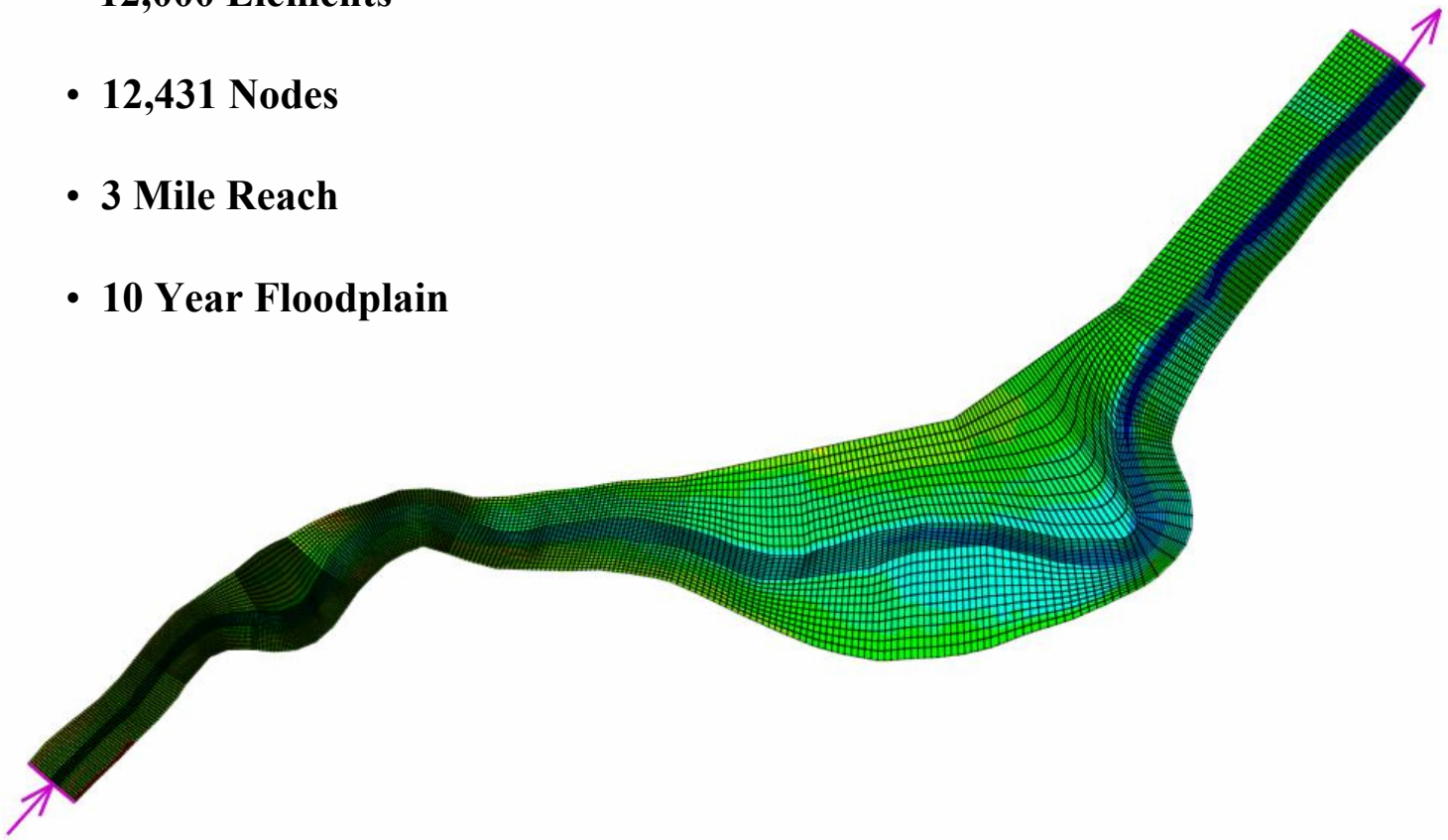
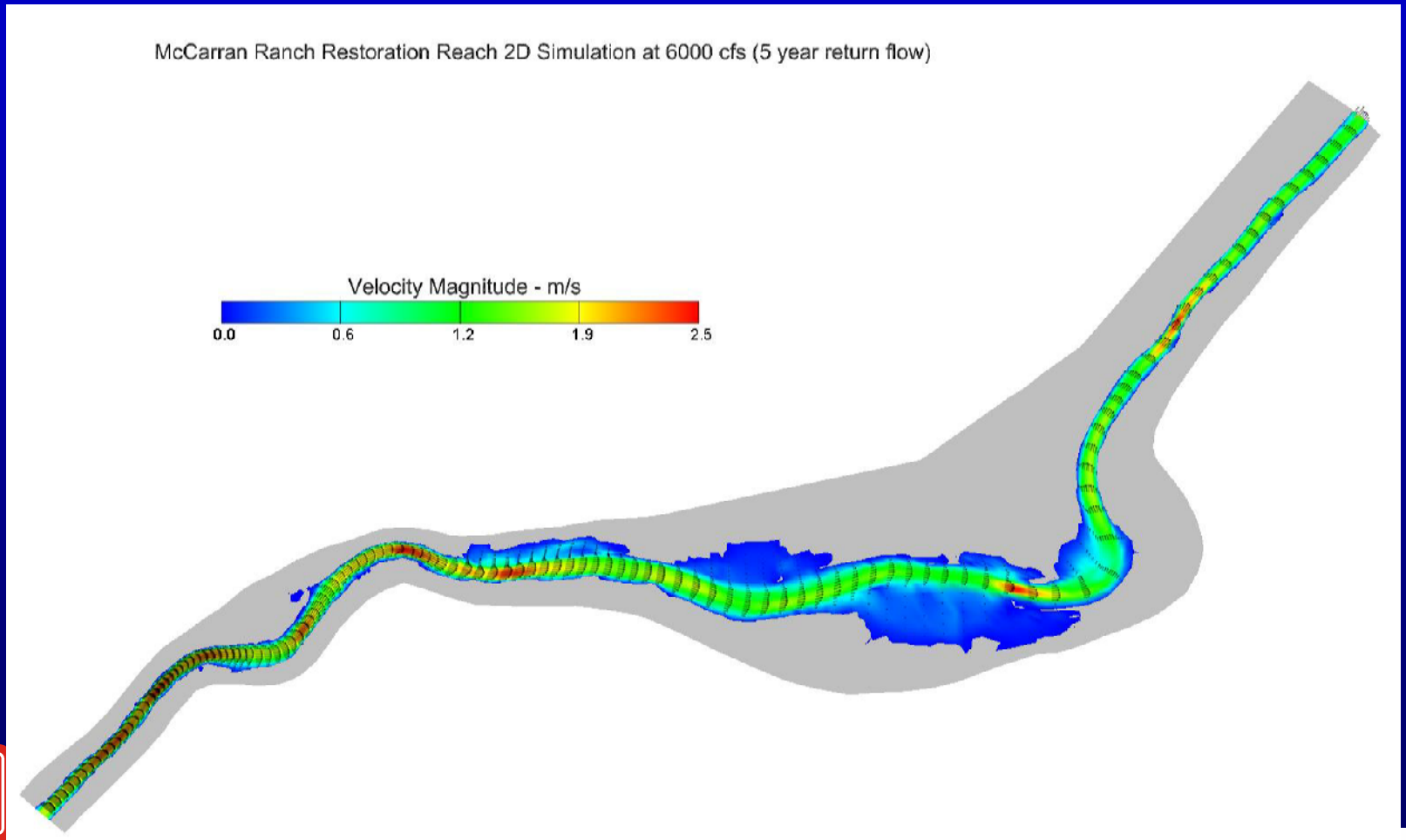
# 2D Model Finite Element Mesh of Truckee River Restoration Reach

- 12,000 Elements
- 12,431 Nodes
- 3 Mile Reach
- 10 Year Floodplain



# 2D Simulation of Existing Over bank Flooding Threshold

## Velocity Magnitude

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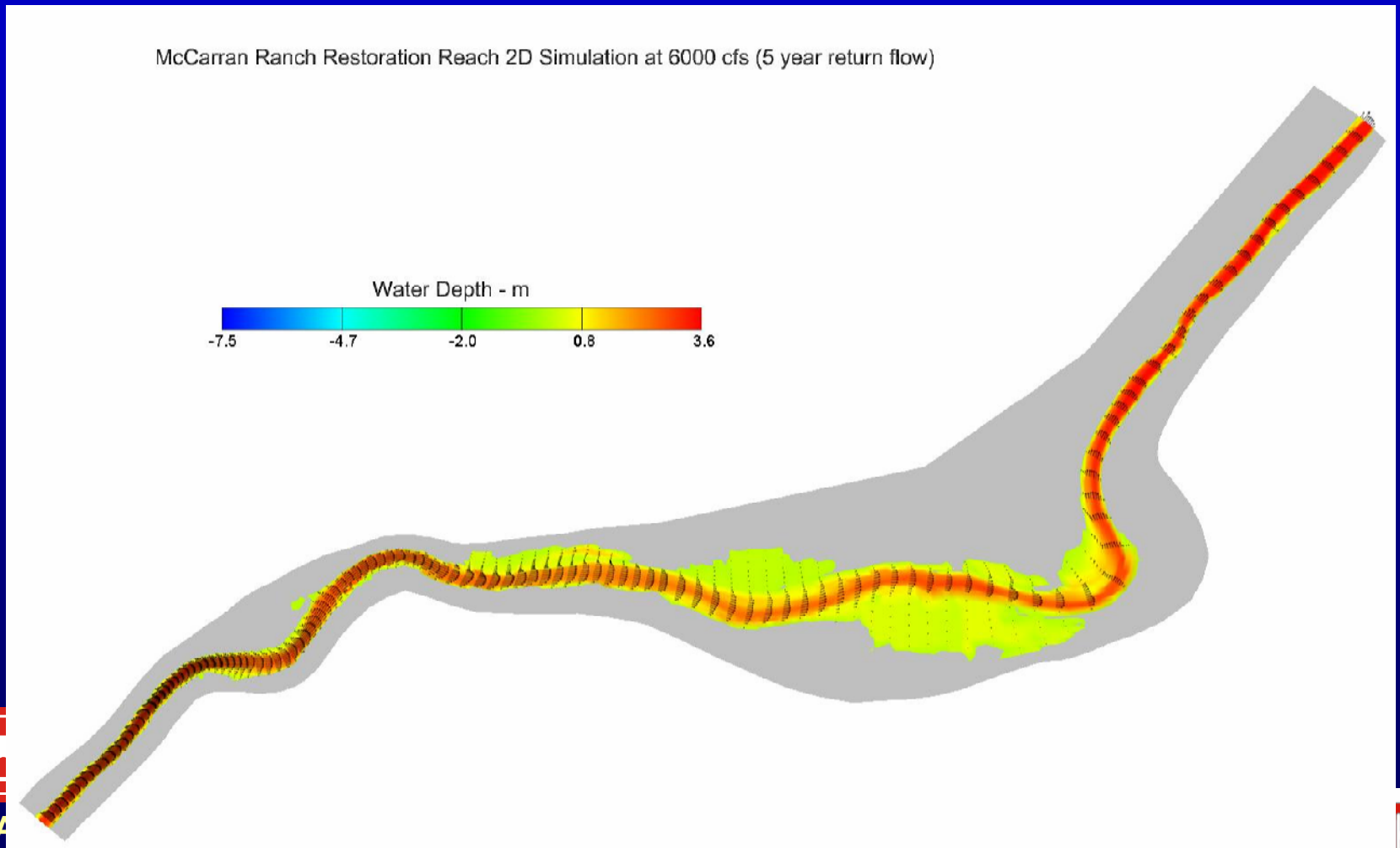
# 2D Simulation of Existing Over bank Flooding Threshold

## Water Depth

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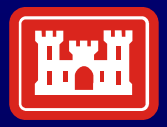
# Truckee River Channel Restoration

Goal is to merge 2D hydraulic modeling (ERDC-CHL) with habitat mapping (performed by DRI).

The EFM model developed by HEC will be used to link the hydraulic parameters to the habitat data.



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# Truckee River
# Ecosystem Function Modeling (HEC)
## *Baetis predicted habitat*


River section at McCarran Ranch

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## Habitat Predictors

Substrate

> 0.5cm

Water column Velocity

> 70 cm/s

Water Depth

> 60 cm

# Supercritical flood channels: extension of design guidance


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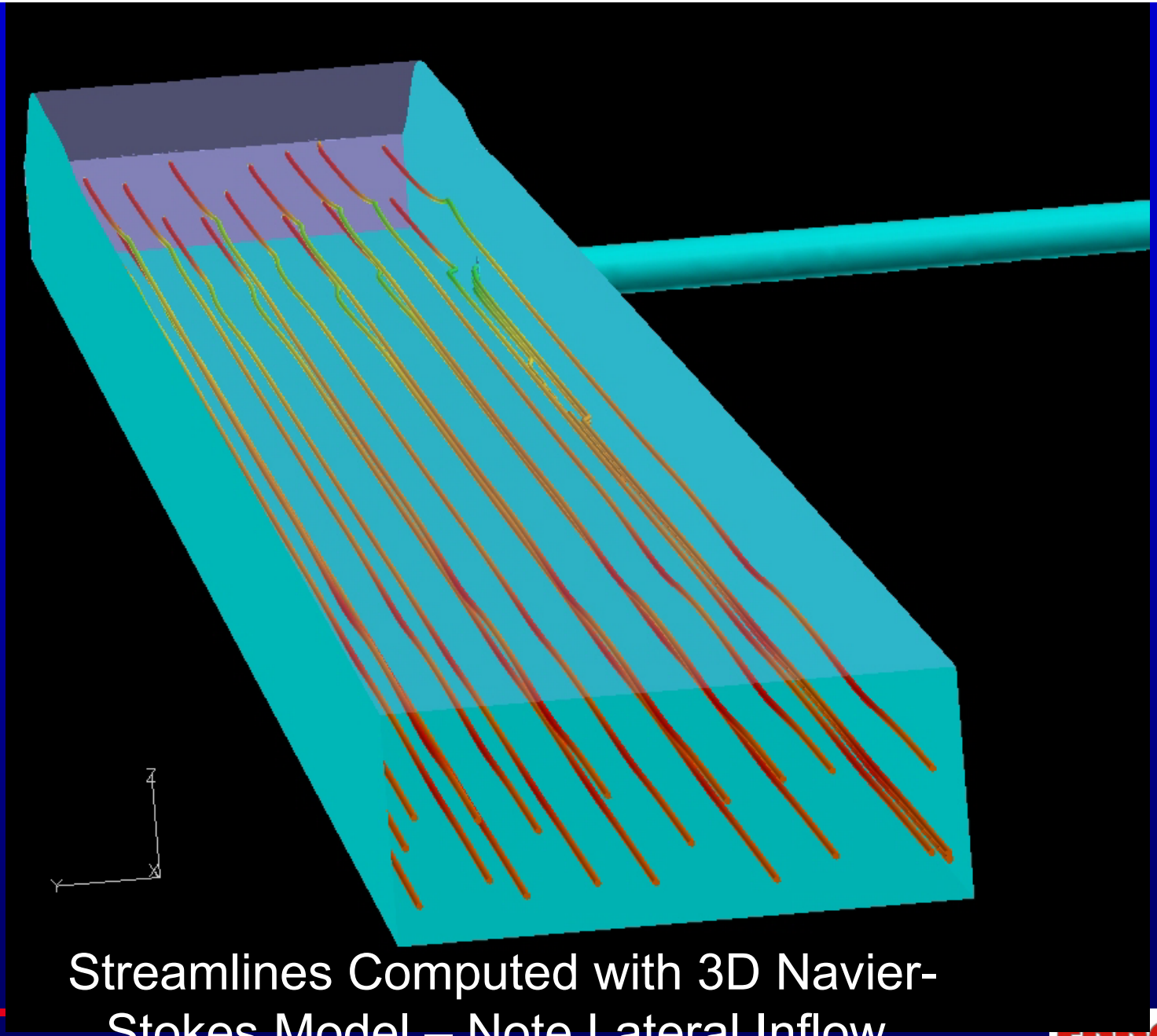


Streamlines Computed with 3D Navier-Stokes Model – Note Lateral Inflow

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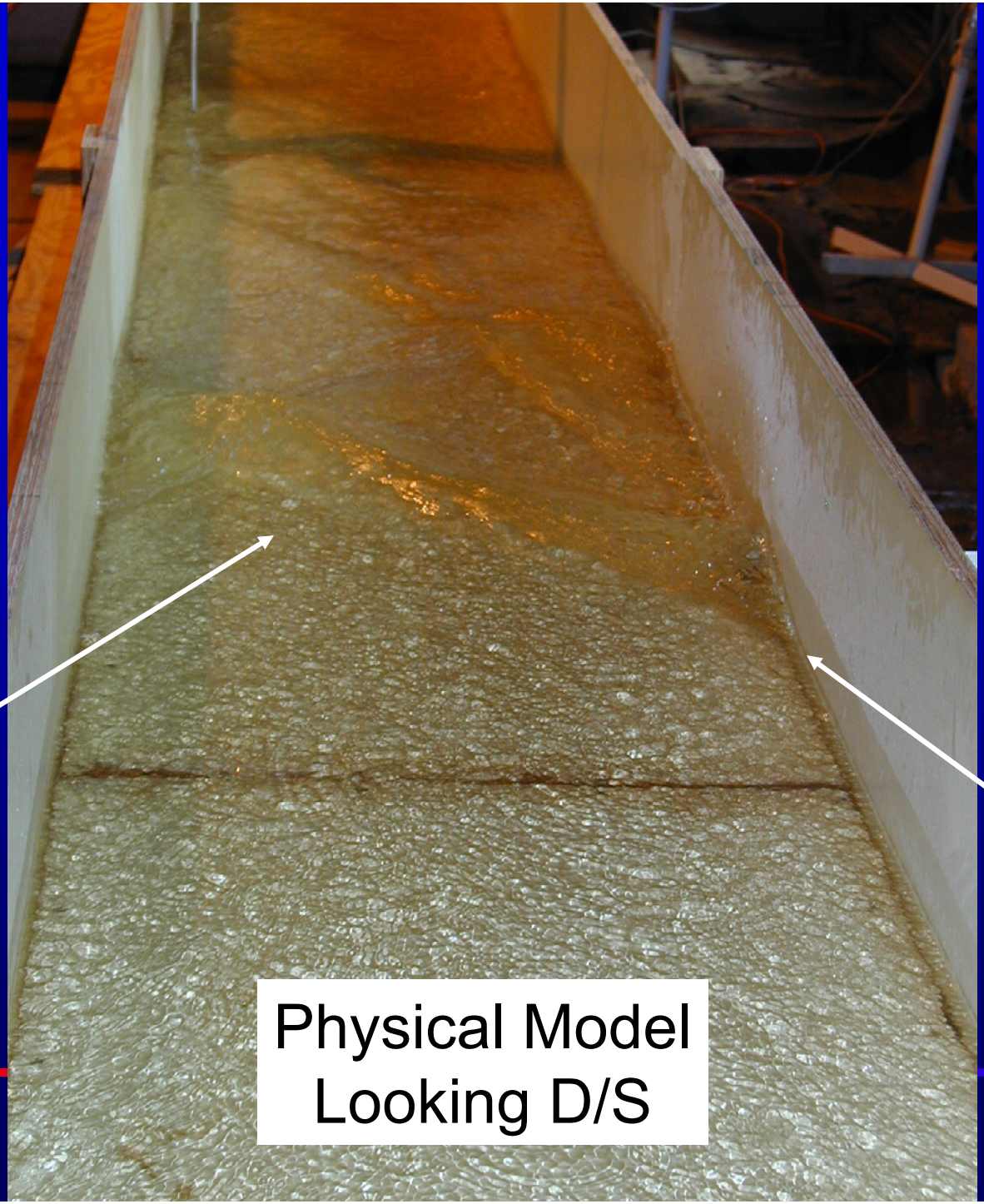


Physical Model Looking D/S

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# Grade control in Las Vegas Wash Improved Design Criteria

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# Grade control in Las Vegas Wash
# Improved Design Criteria


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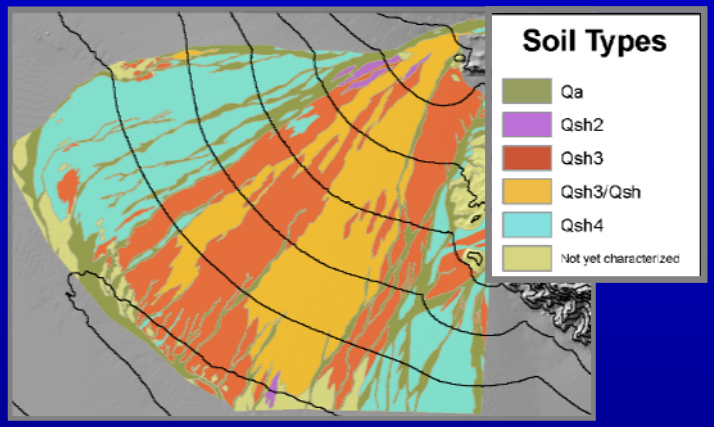
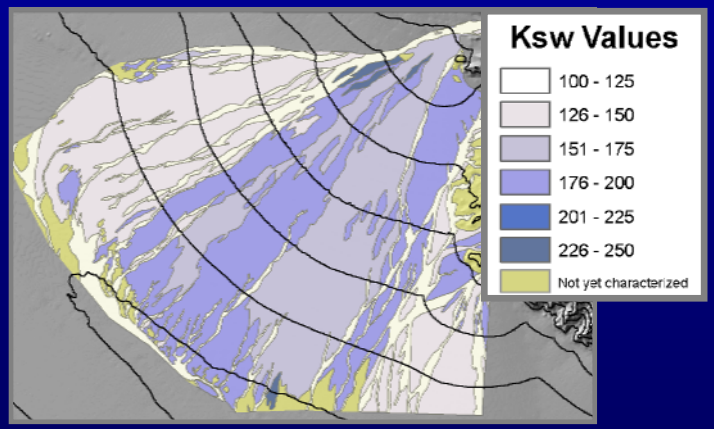
# Assessment and Improvement of Hydraulic Characterization of Alluvial Fans to Support Estimates of Recharge and Initial Abstraction

## Initial Field Results for Basin 126A – Corn Creek Fan

- Upper figure shows geologic units across the fan, with ages increasing from Qa to Qsh4. Lower figure shows the spatial distribution of saturated hydraulic conductivity (Ksw) in units of cm $day^{-1}$.
- Results showed higher hydraulic conductivity for older soils than younger soils, but results were affected by higher variability within age classes because of plant mounds and bar/swale topography.
- Preliminary statistical analyses showed no significant difference in conductivity values for non-vegetated surfaces across fan.
- Vegetated surfaces appear to have significantly higher conductivity (with higher abstraction).

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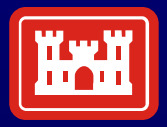
# Collaborative study by ERDC and DRI on the synergistic effect of temperature and soil texture on infiltration

Increasing temperature has two opposing effects on infiltration:

- Decreases water's viscosity, which Increases hydraulic conductivity
- Decreases hydraulic head

The latter effect is more pronounced in fine–textured soils.

These effects an now be predicted quantitatively for inclusion in hydrologic models.



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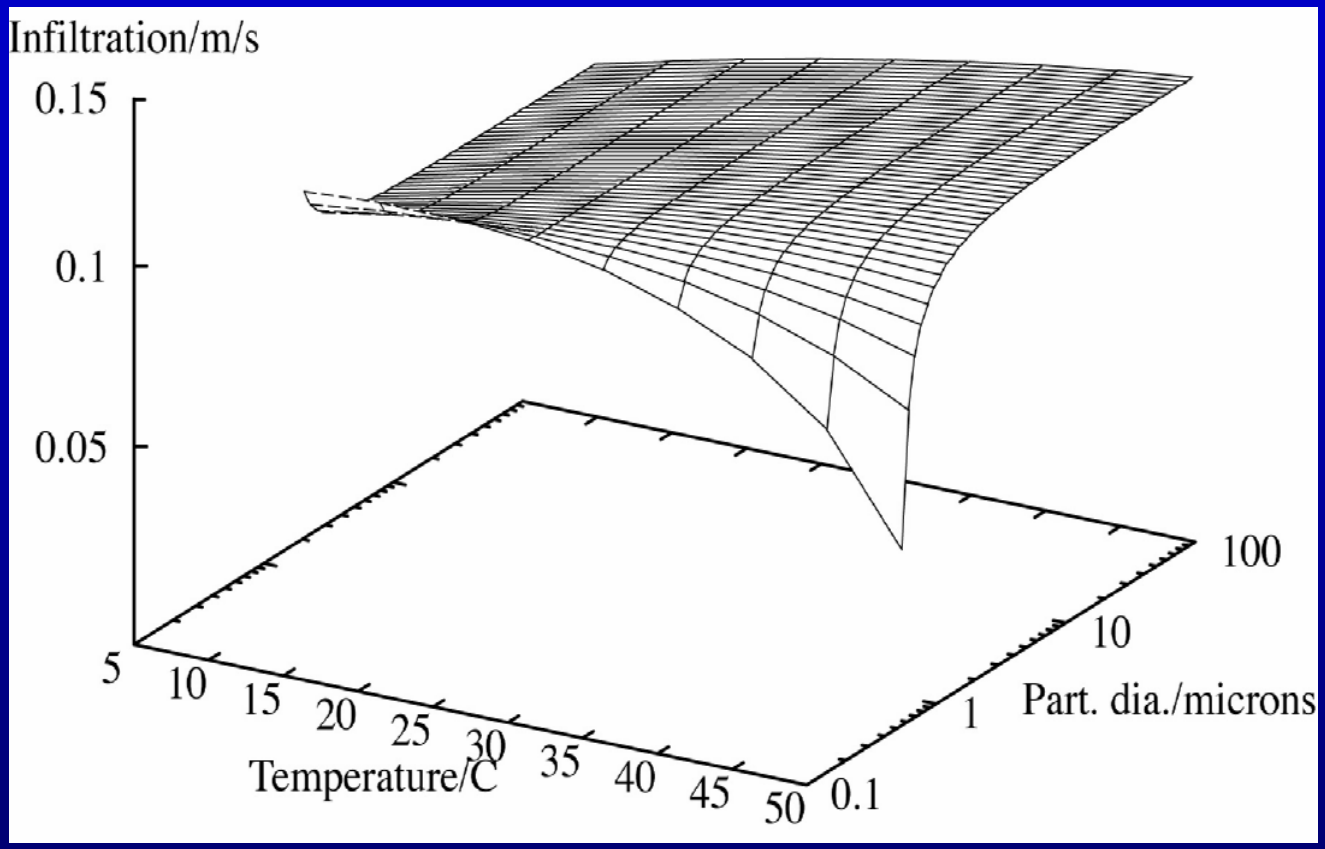
# Temperature–soil particle size–infiltration rate surface for a Yolo loam




The effect is most pronounced in fine-textured soils at high temperatures.

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# Bed Load Transport Rate of Desert Gravel Channels



- Desert gravel streams usually have a coarser surface material than sub-surface material, which indicated the existence of an armor layer on bed surface.
- At base flow, sediment transport rate has not reached equilibrium, and limited by the supply from bed surface.
- Surface based sediment transport formulas (e.g. Wilcox and Crowe, 2003; Parker 1990; and Wu et al. (2002) are appropriate to predict bed load transport rate.

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# Riparian Vegetation Resistance Technical Note Content
## status: draft, out for review

- **Arid Riparian Systems**
  - 8 Systems Characterized
  - Vegetation Composition
  - Density
  - Resistance
- **Guidelines**
  - Flood Assessment
  - Restoration
  - Uncertainty
  - Stability






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Urban Flood Demonstration Program: Home - Netscape

File Edit View Go Communicator Help

Back Forward Reload Home Search Netscape Print Security Shop Stop

Bookmarks Location: http://www.ufdp-dev.dri.edu/ufdp_home.htm

Instant Message WebMail Calendar Radio People Yellow Pages Download Customize...

# Urban Flood Demonstration Program

HOME | PEOPLE | PROJECTS | MODELS | DATA | SNWA

UFDP HOME

- Introduction
- Program Goal
- Demo Projects
- Identify Sites / Technologies
- Potential Demo Sites
- Objective
- Team Point-of-Contacts
- USACE-ERDC

## introduction

The Urban Flood Demonstration Program (UFDP) is a collaborative effort between the U.S. Corps of Engineers Engineer Research and Development Center (ERDC) and the Desert Research Institute (DRI) based in Las Vegas, NV—and was initiated through a Congressional appropriation spearheaded by Senator Harry Reid (D-NV).

The UFDP is currently focused on Nevada, as a pilot study area for the entire arid and semi-arid southwestern U.S. Team members will test technology specifically designed and developed for reducing urban flood damage and restoring stream channels, at a number of sites that have been identified as “high priority”. Although these technologies will offer innovative strategies and solutions they must be strongly grounded in scientific concepts and theory, have a high probability of success and be capable of application in a range of arid and semi-arid settings.

**The appropriation:** The UFDP was initiated through an appropriation in PL 108-7, and specifically encouraged the Corps of Engineers to cooperate with the Urban Water Resource Program of the Desert Research Institute. A direct result of the efforts of Senator Harry Reid (D-NV), the UFDP began in FY03 and is funded, in part, by a Congressional allocation from the Corps budget. Alternative funding may be implemented by Congress in the future.

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DRI Desert Research Institute

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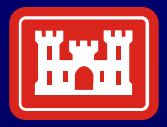
# Website

## http://www.ufdp.dri.edu/



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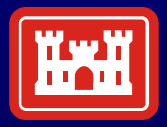
# Funded work units – new starts

- Development of volume-frequency relations (Las Vegas)
- Albuquerque – Rio Grande Bosque Feasibility Study: 2D sediment modeling and ecological studies
- Phoenix – Rio Salado and Rio Salado Oeste: 2D sediment modeling. Ecological evaluation.



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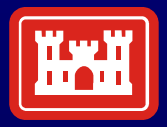
# What's next

- Technical transfer of products (website and other methods)
- Field and local involvement with ongoing work
- Leverage, collaborate, and cooperate to make our limited funds go further
- Continued feedback from districts and local stakeholders (information exchange, identification of issues and priorities, suggestions for future work)
- Goal: consensus on regional needs and priorities, and delivery of products that meet those needs
- Investigate potential for a continuing regional program

# Regional Program

- FY05 submitted language includes reference to considering work in other urban centers in the western United States
- Identify and meet SPD needs and priorities
- Alternatives for program
- Legislative status



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# Further discussion…
# any questions?

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