Least Tern Island Project
Endangered Engineering

Design Team
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The U.S. Army Corps of Engineers
Project Proposal

• Create a method for establishing an ideal Least Tern habitat
• Must be cost effective
• Create little impact to the natural surroundings
• Provide long term sustainability
Habitation Preferences

• 10% to 0% vegetation cover
• Sandy, sloping beaches
• Large island
  • Greater than an acre
Nesting Period

- Critical time period – June to August
- Island flow conditions must be
  - High enough to prevent land bridging
  - Low enough to prevent disturbing the terns
Island Requirements

- Island must be at a height in which vegetation can be scoured off by flooding
- Maintain a constant flow on all sides
  - Keep out predators and recreational vehicles
  - Prevent land bridging
- Island Area should be about 2 to 3 acres
Flow Requirements

• Flood event - 30,000 cfs
  • Scour vegetation from the top of the island

• Average flow - 10,000 cfs
  • Maintain proper scour around the island

• Minimum flow - 2,000 cfs
  • Prevent land bridging
Location Specifications

- Proper flows available
- Stable banks
- Large sediment transport capabilities
- Between Keystone Dam & Muskogee
Previous Attempts

- Army Corp of Engineers- Omaha District
  - Missouri River Project- 1993
    - Repair of previously used habitats
    - 20 sites ranging from 1.3-49 acres
    - Chosen based on final elevations 1-2 feet above water level during flows of 38,500 feet
Missouri River Project

- Island Maintenance
  - Mechanically leveled vegetation
  - Prevented erosion with shoreline arrestor bags
  - Recapped islands with approximately 2 feet of sand
Zink Island
Army Corps Air Boat Inspection

- Jerry Sturdy, Army Corps Biologist, conducted the inspection
- Arkansas River-Jenks Bridge to just past Bixby Bridge
- Observed examples of both good and bad island habitats
Successful Nesting Site
Poor Nesting Site
Proposed Design Top View

Dimensions & quantity of riprap will depend on flow rate.
Proposed Design Side View

Dimensions & quantity of riprap will depend on flow rate.
Design Modeling

- Rudimentary examination of possible design concepts
- Stream Trailer
  - Ground up plastic buttons used to simulate sediment
  - Gravel used to simulate design structure material
  - Two levels of flow available with this model
    - High - ~5 gpm
    - Low - ~2.5 gpm
Design Verification

Low Flow Conditions

High Flow Conditions
Design Completion Requirements

• Height of design structure material
  • Proper deposition occurs
  • Must allow flow to scour vegetation from island at 30,000 cfs

• Spacing of Structures
  • Allows appropriate sediment deposition for anticipated island dimensions

• Material Size
  • Appropriate mass to prevent repositioning due to high flow
Proposed Completion Methods

- Researching common practices
  - Sizing riprap
  - Spacing jetties
  - Minimum velocity to scour vegetation
- 3-D and 2-D computer modeling programs
- 1:20 scale physical model
Gantt Chart

Task ID | Task Name
-------|---------------------
1 | Hydrology Analysis
2 | Location Specification
3 | Calculating Height of Riprap
4 | Obtain information about height recommendations
5 | Calculate Riprap Size
6 | Obtain information about common practices for sizing riprap
7 | Calculate spacing of riprap
8 | Obtain information about common practices used for spacing jettes
9 | Size of Island
10 | Applying HEC HMS
11 | Applying HEC RAS
12 | Explore various construction material
13 | 3-D Computer Modeling Class
14 | Learn how to use the 3-D Model appropriately
15 | Applying 3-D computer model to our design
16 | ARS Hydraulics Lab 1:20 scale Modeling
17 | Construction Specifications
18 | Construction Guidelines
19 | Preparing Presentation
20 | Preparing Final Report
Final Design Requirements

- Location
- Legal & Regulatory Issues
- Construction Specifications
- Cost Estimation