Evaluating Ecosystem Restoration

A Case Study

Removal of Matilija Dam

Ventura County, California, USA

Ecosystem Restoration

- Feasibility Study overview
- Habitat Assessment (HEP) Summary

Question:

How to evaluate past and future changes in an ecosystem?

Ecosystem Restoration Goals and Objectives

- Improve Aquatic And Terrestrial Habitat Along Matilija Creek And Ventura River
- Restore Fish Passage
- Restore Natural Processes To Support Beach Sand Replenishment
- Enhance Recreational Opportunities



GENERAL OVERVIEW OF CIVIL WORKS PHASES

- RECONNAISSANCE STUDY
- FEASIBILITY STUDY
- FINAL DESIGN
- PROJECT CONSTRUCTION

FEASIBILITY STUDY

- **FCSA – Feasibility Cost Sharing Agreement**
  - Summer 2001
- **Cost: $4.2 Million**
  - Cost Shared 50/50
    - ➢County 50%
      - In-Kind
      - Cash
- **Six Step Planning Process**

CONCERNS IDENTIFIED from Stakeholder Meetings

- ENDANGERED SPECIES
- STEELHEAD HABITAT IMPAIRED
- SEDIMENTATION
- WETLANDS
- NON-NATIVE VEGETATION
- CULTURAL RESOURCES
- FLOODING
- BEACH NOURISHMENT
- LIABILITY
- WATER QUALITY
- TRAFFIC
- AIR QUALITY
- BANK EROSION
- RECREATION
- SOCIOECONOMIC

FEASIBILITY STUDY Work Groups

- Surveying and Mapping
- Hydrology and Hydraulics, Sediment Transport
- Geotechnical Investigations
- Environmental Resources
  - Cultural Resources
- Coastal Studies
- Civil and Structural Design
- Plan Formulation/Alternative Analysis & Technical Studies
- Public Outreach

FEASIBILITY STUDY Surveying & Mapping

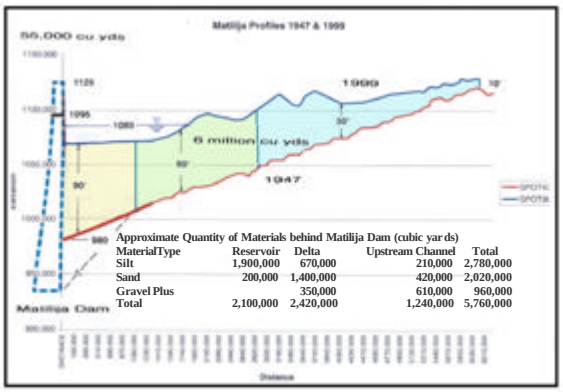
- Watershed Study
- Aerial Photography
- Contour Mapping
- GIS Map

FEASIBILITY STUDY
Hydrology/Hydraulics

- Sediment Sampling
- Hydrologic & Hydraulic Modeling Analysis
- Sediment Transport

FEASIBILITY STUDY
Geotechnical Investigations

- Drilling/Sampling
- Hazardous and Toxic Waste Sampling



Approximate Quantity of Materials behind Matilija Dam (cubic yards)

MaterialType	Reservoir	Delta	Upstream Channel	Total
Silt	1,900,000	670,000	210,000	2,780,000
Sand	200,000	1,400,000	420,000	2,020,000
Gravel Plus		350,000	610,000	960,000
Total	2,100,000	2,420,000	1,240,000	5,760,000

FEASIBILITY STUDY
Plan Formulation:

How to Remove the Dam:

Sediment Management Options:

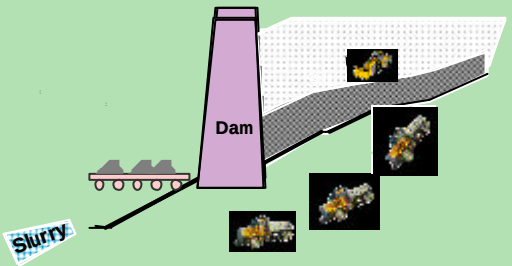
* Mechanical removal
* Natural Transport
* Stabilize on site

FEASIBILITY STUDY
Plan Formulation:

Constraints to Dam Removal & River Restoration:

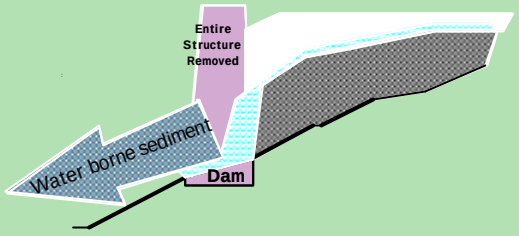
- Floodplain development
- water supply
- other impacts

MECHANICAL SEDIMENT REMOVAL



Move sediment downstream by trucking, slurry, or conveyor

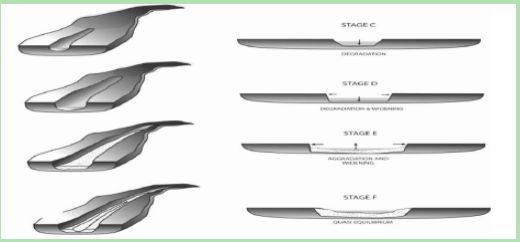
NATURAL TRANSPORT



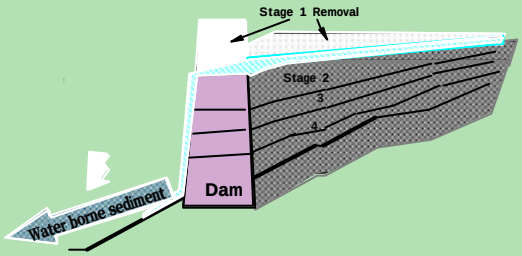
Complete removal of dam, allowing natural transport

Natural erosion of sediments

Modelling/experience is limited

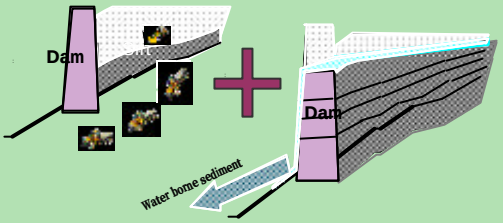


PHASED NATURAL TRANSPORT



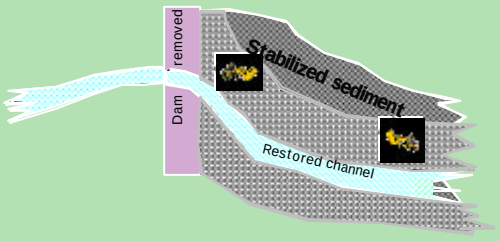
Remove dam in phases and allow sediment to transport naturally, in stages

COMBINATION STRATEGIES



- Move Some Sediment
- Allow for Limited Phased Natural Transport of Sediment

SEDIMENT STABILIZATION ON-SITE



Create "pilot" stream channel
Excavate sediment and stabilize on side of reservoir

Temporary sediment storage

Environmental Studies & Habitat Evaluation

HEP is habitat based evaluation

"Modified" HEP Analysis

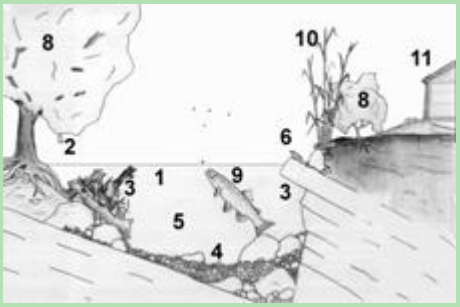
Used to:

- evaluate project benefits
- select optimal project
- justify costs

Habitat: Species diversity

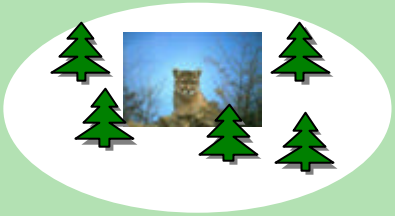
Environmental Studies

Habitat Evaluation Procedure (HEP)

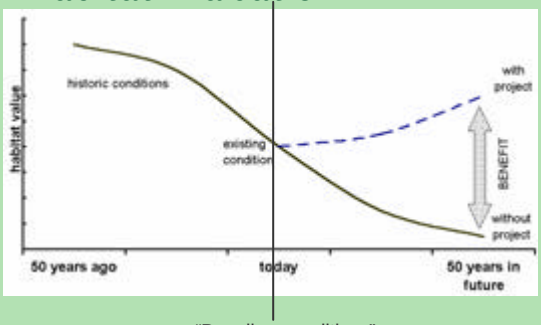


Habitat Unit

- HU = Area * HSI
  = ha * (0.0 < HSI < 1.0)



Habitat Evaluation



"Baseline conditions"

Study Area

- Watershed basis
- river corridor from headwaters to ocean

Study Reaches

- River divided into segments
- hydrologic functions
- ecologic function
- Habitat Units = HSI x acres of habitat

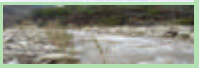
HEP Parameters

Total Habitat Value =

+ Riparian Habitat

+ Steelhead Habitat

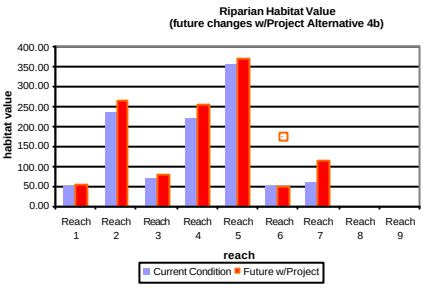
+ Natural Processes



HEP Parameters: Riparian Habitat

- Riparian Habitat Value =
- ([2(%Native Veg. Cover + Giant Reed Cover)]
- +Listed Species
- + Adjacent Land Use Character) / 6

HEP Parameters: Riparian Habitat



Increase in Riparian Habitat values are a result of non-native plant eradication (Arundo donax)

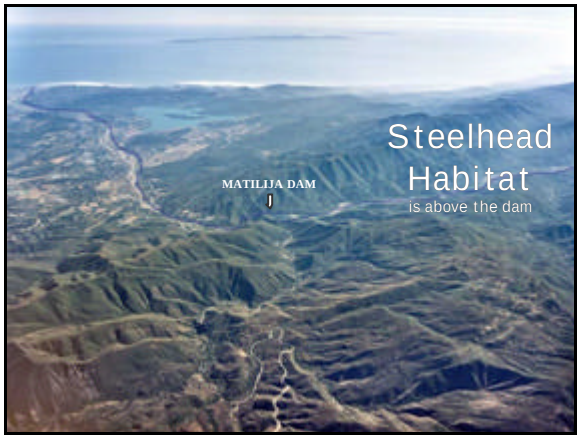
HEP Parameters: Steelhead Habitat

Steelhead Habitat Value =
{(Habitat Value Score*)
x [(Fish Passage)
x (other steelhead factors)]1/2}1/2

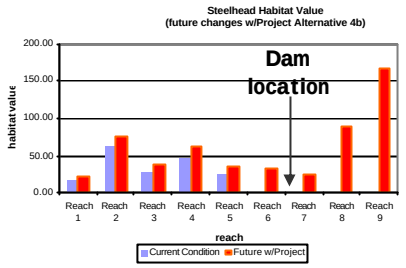
***Habitat Value Score Definitions**
1 Very Poor; **2** Poor;
3 Fair; **4** Good; **5** Excellent;
(as compared to historical condition)

Steelhead Habitat

Fish Passage:
Dam blocks access to 50% of historic habitat

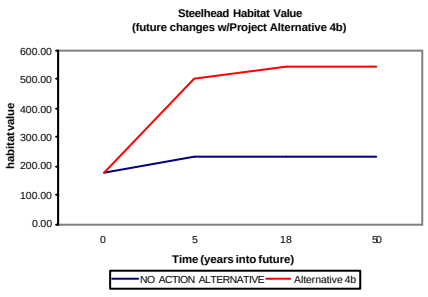


HEP Parameters: Steelhead Habitat Values



Steelhead habitat value increases in all reaches with dam removal

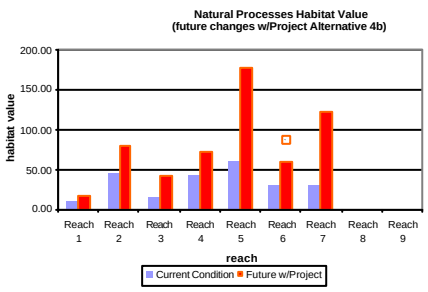
HEP Parameters: Steelhead Habitat Values



HEP Parameters: Natural Processes

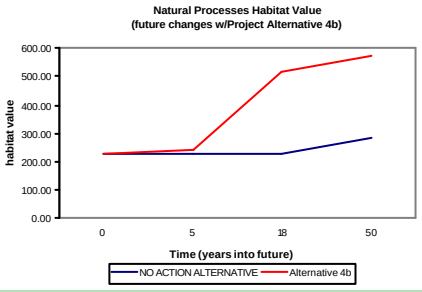
Natural Processes = (Natural Hydrological Regime + Natural Sediment Regime)/2

HEP Parameters: Natural Processes



Natural processes values increase with dam removal

HEP Parameters: Natural Processes

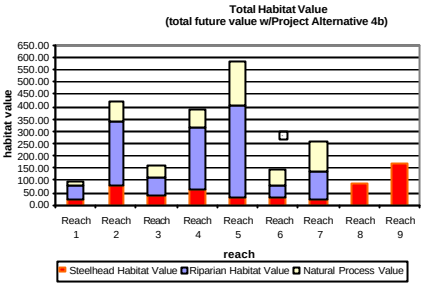


Project Benefits

TABLE 4-6: HEP Comparison of No Action to Recommended Plan (Habitat Units)

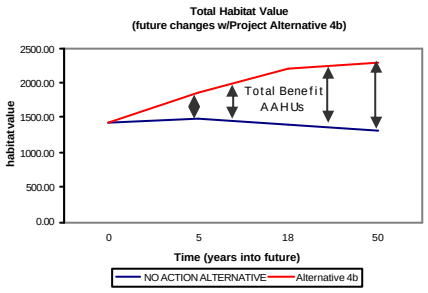
	Steelhead Habitat Component		Riparian Habitat Component		Natural Processes Component		TOTALS	
TARGET YEAR	No Action	With Project	No Action	With Project	No Action	With Project	No Action	With Project
0	177	177	1032	1032	228	228	1437	1437
5	234	501	1029	1125	228	240	1491	1866
20	234	543	944	1145	228	520	1406	2208
50	234	544	782	1183	286	570	1302	2297
AAHUS	231	514	917	1147	245	464	1393	2128
Change in AAHUs	----	283	----	229	----	219		731
% Change	----	122%	----	25%	----	89%		53%

HEP Parameters: Total Habitat Value

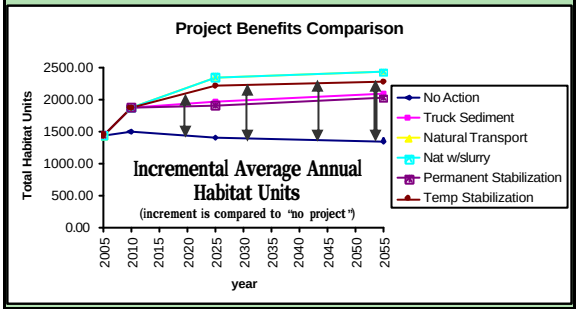


Total habitat value is the sum of all river reaches (=2300 HU)

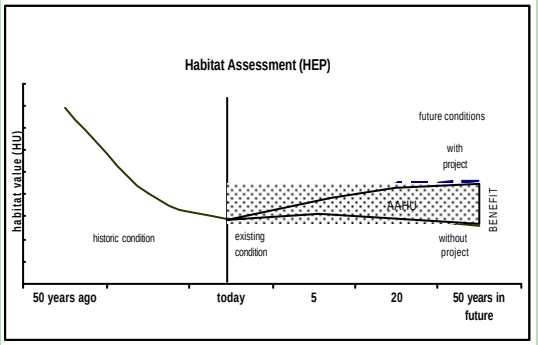
HEP Parameters: Total Habitat Value



Project Selection using HEP



Habitat Evaluation



Cost-benefit Analysis

Cost Effectiveness Analysis			
Alternative	Incremental Avg. Annual Habitat Units (AAHU)	Avg. Annual Cost ($)	cost/benefit $/AAHU
No Action	N/A	0	N/A
perm stabilization	554	6,498,000	11729
truck	609	6,917,000	11358
notch/slurry	678	8,006,000	11808
natural/slurry	678	7,963,000	11745
notch	678	6,900,000	10177
natural transport	678	6,637,000	9789
temp stabilization	731	6,498,000	**8889**

Project Selection

HEP is one parameter in project selection

		Summary of NED/NER Outputs		
NED/NER ($/AAHU)	HEP (AAHU)	Environmental Quality	RED/OSE	Other
National Economic Development/National Environmental Review cost/benefit ratio	**"average annual habitat unit"**	water, air, noise, traffic, T&E species, cultural, sedimentation	Regional Economic Development, Other Social Effects	beach nourishment, construction risk

Project Status – Where are we today?

- Feasibility and EIS Complete
  - Plan Formulation - consensus plan
  - "short-term sediment stabilization on site"

Project Status – Next steps

- Final Design
  - $6Million, 4 years
- Construction
  - $130 million, 3 years
  - 2009-2011
- Funding
  - 65% Federal - WRDA
  - 35% Non-Federal
    - State of California

Ecosystem Restoration

- Feasibility Study overview
- Habitat Assessment (HEP) Summary

Additional Information

- Overview of civil works process
- Other project alternatives
- mitigation measures

GENERAL OVERVIEW OF CIVIL WORKS PHASES

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IDENTIFIED CONCERNS

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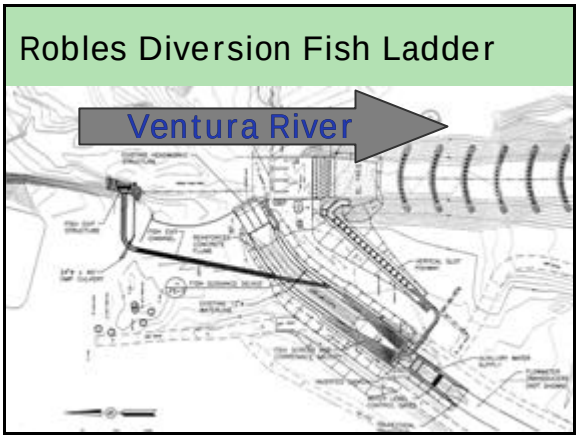
- Plan Formulation/Alternative Analysis & Technical Studies
- Public Outreach

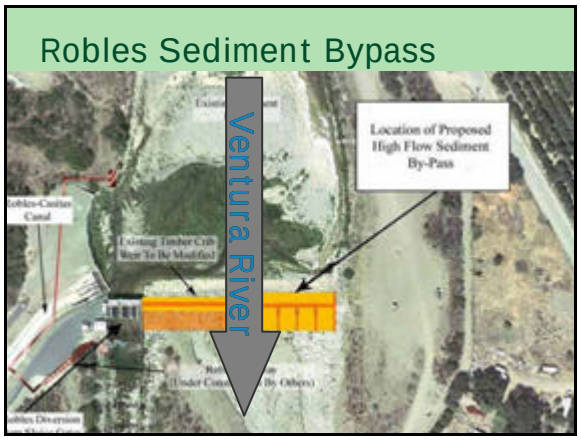
Mitigation Measures

- Flooding
  - Levees & Bridges
- Water Supply
  - Robles High Flow bypass
  - Water supplies/sources
  - Foster park wells
  - Casitas Desiltation basin

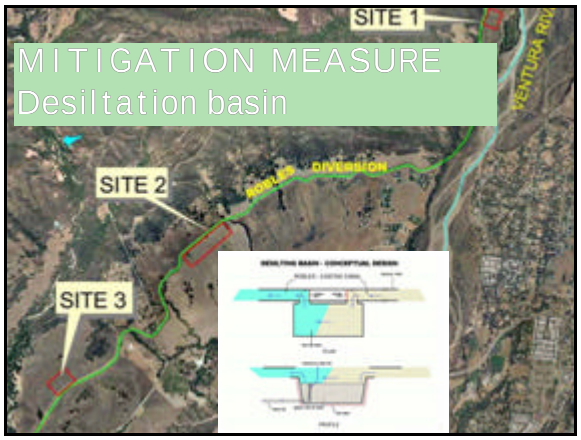
Mitigation Measures: **Levees**


Mitigation Measures
Robles Diversion Dam


Robles Diversion Fish Ladder
Ventura River


Robles Sediment Bypass
Ventura River
Location of Proposed
High Flow Sediment
By-Pass


Mitigation Measures
Robles Diversion Canal


MITIGATION MEASURE
Desiltation basin
SITE 1
SITE 2
SITE 3
VENTURA RIV