TRRP 2013 Design Process Update

TAMWG Meeting
January 10th, 2013

By: DJ Bandrowski

Douglas City and Lorenz Gulch Channel Rehab Project Sites

Stream Project

Decision Analysis & Design Guidance for Stream Restoration

Peter Wilcock
Geography and Environmental Engineering
National Center for Earth-surface Dynamics
Johns Hopkins University

Jock Conyngham
Environmental Laboratory
Engineer Research and Development Center (ERDC)
US Army Corps of Engineers

Stream Project

Decision Analysis & Design Guidance for Stream Restoration

A collaborative effort,
integrating science, engineering, decision analysis, and practice
to explicitly link appropriate, quantifiable objectives
to design choices
in order to support tradeoff analysis, adaptive management,
& effective learning by doing

Prof. Peter Wilcock (JHU, NCED, ICRRR) Project Director
(*sediment transport, channel dynamics, decision analysis*)

Dr. Dan Baker (JHU, NCED, ICRRR) Project Manager
(*channel design, riparian vegetation, nutrient removal*)

Prof. Patrick Belmont (USU, NCED, ICRRR)
(*watershed analysis, water quality*)

Prof. Phaedra Budy, (USU, ICRRR)
(*fish biology, ecosystem restoration*)

Jock Conyngham (USACE ERDC)
(*fishery restoration*)

Prof. Martin Doyle (UNC)
(*channel design, restoration strategies*)

Dr. Craig Fischenich (USACE ERDC)
(*ecological restoration)*

Dr. Rich Fisher (USACE ERDC)
(*riparian ecosystems)*

Prof. Ben Hobbs (JHU, NCED) Decision Analysis Lead
(*environmental economics, decision analysis*)

Prof. Miki Hondzo (UM, NCED)
(*ecohydraulics*)

Meg Jonas (USACE ERDC)
(*Hydraulics and bank stabilization*)

Prof. Gary Parker (UIUC, NCED)
(*sediment transport, channel dynamics*)

Prof. Fotis Sotiropoulos (UM, NCED)
(*computational fluid dynamics*)

Prof. Jack Schmidt (USU, ICRRR)
(*fluvial geomorphology, channel and watershed history*)

Prof. Joe Wheaton (USU, ICRRR)
(*multi-dimensional modeling, instream habitat*)

Dr. Justin Williams (JHU)
(multi-criteria decision analysis)

Some needs:

- Clearly defined, relevant, quantifiable objectives accounting for watershed, ecosystem, and social context
- Methods designed to achieve objectives, with uncertainty
- Suitable metrics to demonstrate achievement of objectives
- Flexible, transparent method for evaluating tradeoffs

United States Department of Agriculture

Natural Resources Conservation Service

Part 654
National Engineering Handbook

Stream Restoration Design

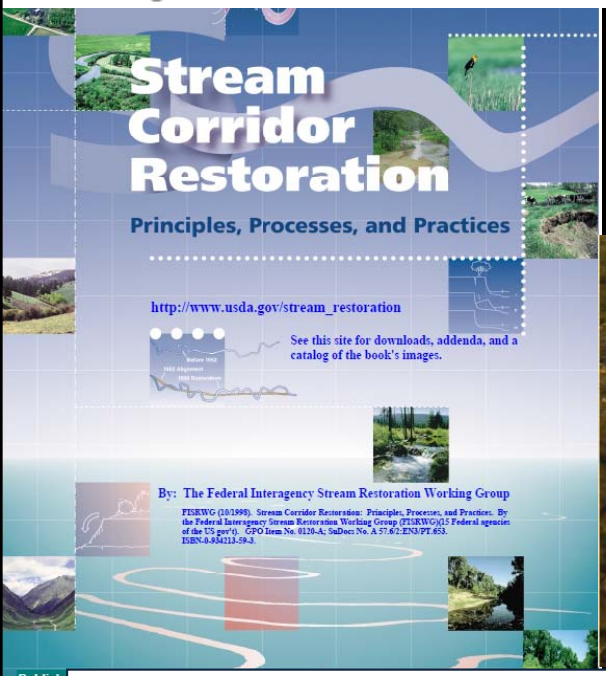
Issued August 2007

River RAT
RESTORATION ANALYSIS TOOL

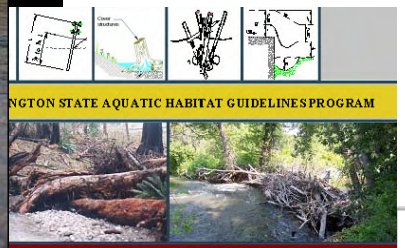
Back to My Projects

Project Title: Shalushiyequst R

ECOLOGICALLY-BASED STREAM RESTORATION IN NEW YORK'S COASTAL WATERSHEDS



There is no shortage of professional guidance



Stream Habitat Restoration Guidelines 2004

Functional Objectives for Stream Restoration

by J. Craig Fischenich[1]

September 2006

Metric Development for Environmental Benefits Analysis

by S. Kyle McKay[1], Bruce A. Pruitt[2], Mark Harberg[3], Alan P. Covich[4], Melissa A. Kenney[5], and J. Craig Fischenich[1]

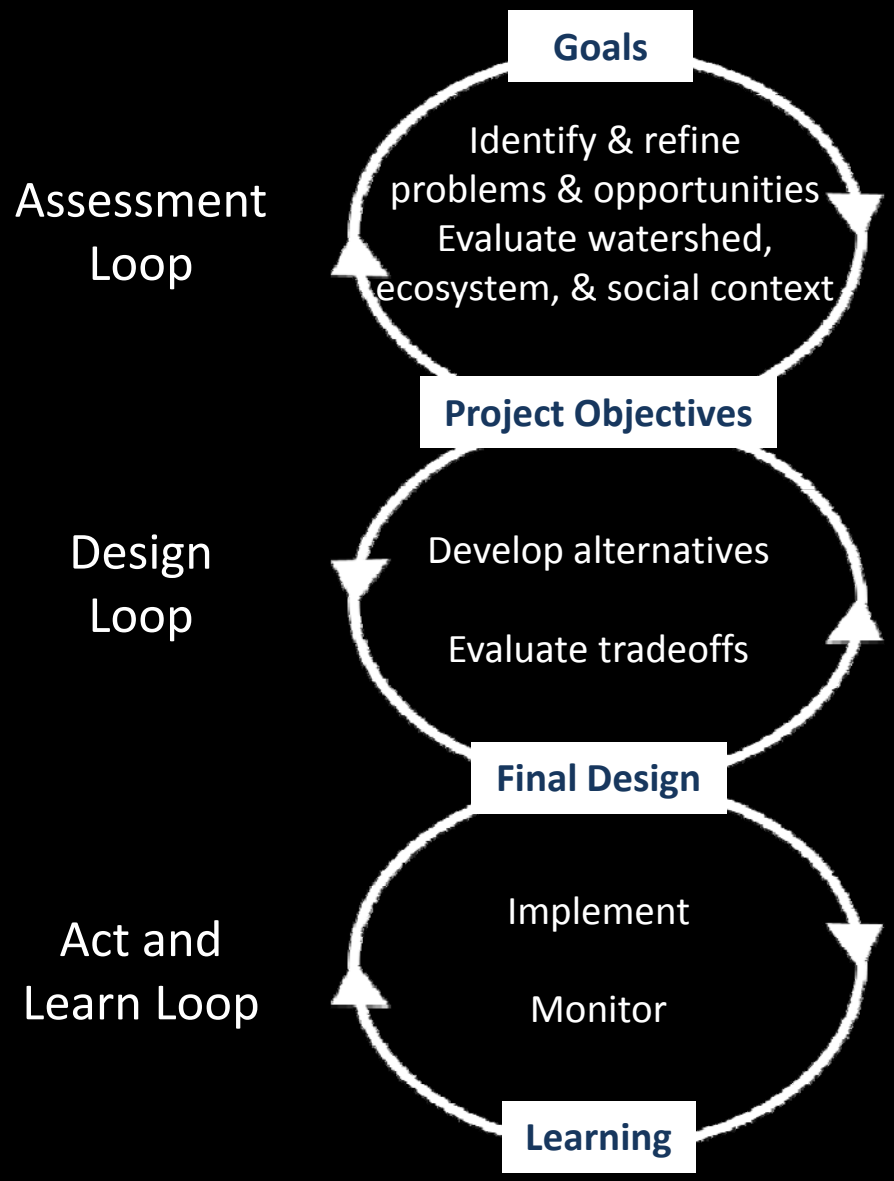
CENTER FOR WATERSHED PROTECTION

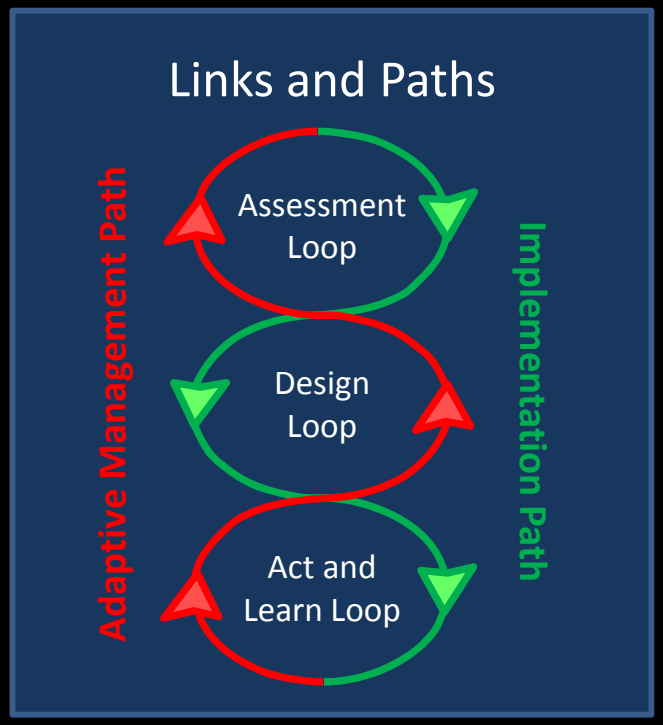
The Stream Project Decision Framework

Organizes stream restoration decision process

Promotes appropriate project objectives, predictive design, and transparent decision analysis

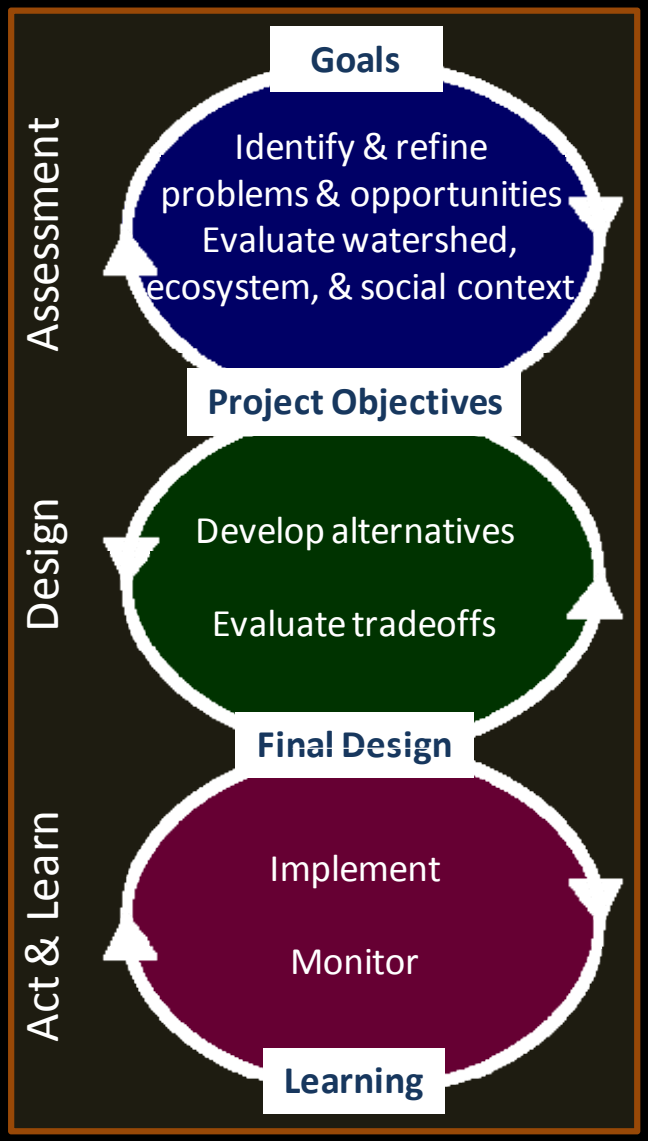
Implemented as series of questions and steps with links to supporting guidance and tools





Decision Framework Implemented in 23 steps

Decision Framework



Decision Steps

1	ID interested parties
2	ID problems & opportunities
3	ID regulatory constraints
4	Develop watershed history
5	Are goals feasible?
6	ID financial support
7	Appropriate local objectives
8	Define metrics
9	Level of design effort
10	Develop design actions
11	Adaptive management?
12	Develop alternatives
13	Score alternatives
14	Asses ecological benefit
15	Tradeoffs among alternative
16	Prepare final design
17	Establish permitting plan
18	Implement design
19	Changes during construction
20	Define monitoring program
21	As-built compliance
22	Adaptive adjustments
23	What can we learn?

No.	Project Goals	Objective (Primary Method)	Measurement (metric)
1.	Increase fry and juvenile salmonid rearing habitat	Increase area of shallow/slow habitat with cover in project reach	% change in habitat area-days. Each square meter of habitat gets credit for 1 habitat area-day for each day from January 1 through April 30 (critical rearing period).
2.	Increase or maintain adult salmonid holding habitat	Increase area of deep water in project reach	% change in pool area of 8 feet or greater in depth.
3.	Increase adult salmonid spawning habitat	Increase available riffle spawning habitat in project reach	% change in transition riffles or thalweg crossovers (features where spawning typically occurs)
4.	Increase and enhance wildlife habitat	Increase available habitat (nesting /breeding/rearing) for target species of pond turtle & yellow frogs	% change pond turtle nesting and 1-3 year old habitat area. Increase yellow legged frog breeding and tadpole rearing area
5.	Increase & enhance riparian, wetland, & enhance upland habitats	Promote development of diverse riparian & upland communities; Reduce invasive plant species; Preserve riparian corridor & large trees where possible; etc.	% change in riparian vegetation area (include areas planted and areas designed for natural recruitment).
6.	Increase channel complexity	Increase bars where appropriate; increase channel complexity and bed topography – to create and maintain salmonid habitat	% change in number of flow direction changes at bankfull flows calculated as the total number of flow direction changes induced during bankfull flow
7.	Promote flow processes	Erosion and deposition to create a dynamic channel – to create and maintain salmonid habitat	% change in stream power that quantifies the power available to do geomorphic work in a stream. Unit stream power is the power per unit channel width.
8.	Minimize adverse impacts to existing infrastructure	Protect private and public infrastructure (bridges, infiltration galleries, roads, homes, wells, septic systems)	Relative ranking 1-5 (1 = Least benefit; 5 = maximum benefit)
9.	Minimize uncertainty related to project performance	Consideration toward long term design performance and future evolution of the project reach	Relative ranking 1-5 (1 = Least benefit; 5 = maximum benefit)
10.	Enhance public benefit	Work with federal, state, & local landowners to help develop & define “public benefit” objectives	Relative ranking 1-5 (1 = Least benefit; 5 = maximum benefit)
11.	Cost consideration	Design project to meet goals and objectives with the most efficient use of program dollars	Total cost of the project (reported in millions of dollars)

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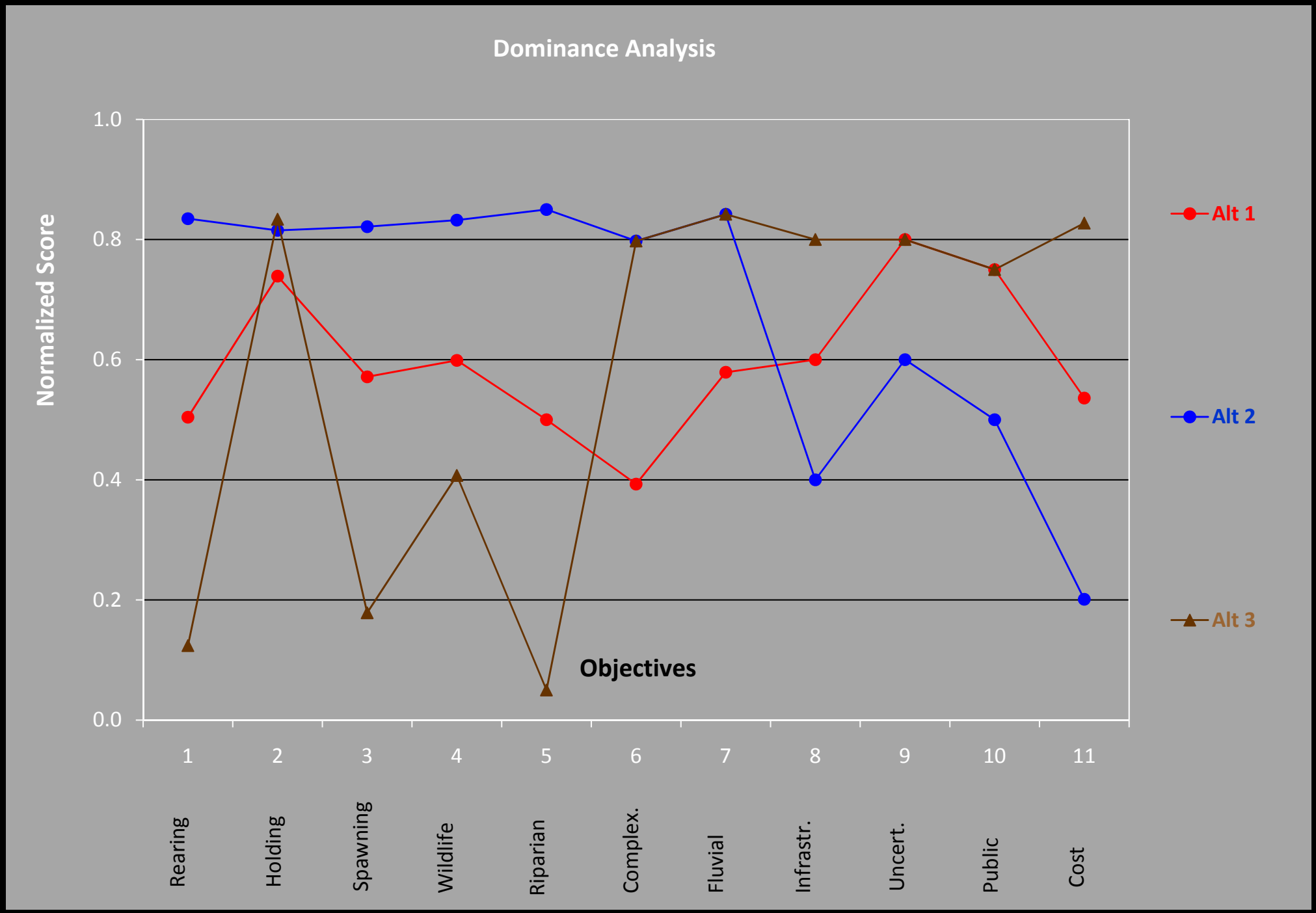
Site: Douglas City

			Score performance of each alternative for all objecti												Set performance measure range		
			Alt 1.			Alt 2.			Alt 3.			Existing Cond					
	Local Objective	Metric for each objective	(-)	Mean	(+)	(-)	Mean	(+)	(-)	Mean	(+)	(-)	Mean	(+)	Min	Max	Opt
1	Fry rearing habitat	Change in habitat area-days (%)	12	**61**	12	20	**101**	20	3	**15**	3	0	**0**	0	0	121	121
2	Adult holding habitat	Change in pool area > 8ft depth	64	**320**	64	71	**353**	71	72	**361**	72	0	**0**	0	0	433	433
3	Spawning habitat	Change in transition riffles (%)	3	**16**	3	5	**23**	5	1	**5**	1	0	**0**	0	0	28	28
4	Wildlife habitat	Change in area turtle/frog habitat	20	**100**	20	28	**139**	28	14	**68**	14	0	**0**	0	0	167	167
5	Riparian habitat	Change in vegetation area (%)	2	**10**	2	3	**17**	3	1	**1**	1	0	**0**	0	0	20	20
6	Channel complexity	Change in flow directions at	7	**33**	7	17	**67**	17	17	**67**	17	0	**0**	0	0	84	84
7	Fluvial processes	Change in channel stream power	2	**11**	2	3	**16**	3	3	**16**	3	0	**0**	0	0	19	19
8	Mitigate infrastructure	Rank 1-5 [5 most benefit]	1	**3**	1	1	**2**	1	1	**4**	1	0	**0**	0	0	5	5
9	Mitigate uncertainity	Rank 1-5 [5 most benefit]	1	**4**	1	1	**3**	1	1	**4**	1	0	**0**	0	0	5	5
10	Public Benefit	Rank 1-5 [5 most benefit]	1	**3**	1	1	**2**	1	1	**3**	1	0	**0**	0	0	4	4
11	Cost consideration	Total implementation cost	0.45	**1.8**	0.45	0.78	**3.1**	0.78	0.17	**0.67**	0.17	0	**0**	0	0	3.88	0


Dominance Analysis
Normalized Score
1.0
0.8
0.6
0.4
0.2
0.0
Objectives
1
2
3
4
5
6
7
8
9
10
11
Rearing
Holding
Spawning
Wildlife
Riparian
Complex.
Fluvial
Infrastr.
Uncert.
Public
Cost
Alt 1
Alt 2
Alt 3

Name:_____

Trinity River Restoration Program (TRRP) **Stakeholder Priority Ranking Worksheet for 2013 Design Process** (Ranking Info: 0= no Importance; 10 = very important)			
No.	**Goals**	**Objective (Primary Method)**	**Ranking (0–10)**
1.	**Increase fry and juvenile salmonid rearing habitat**	Increase area of shallow/slow habitat with cover in project reach	
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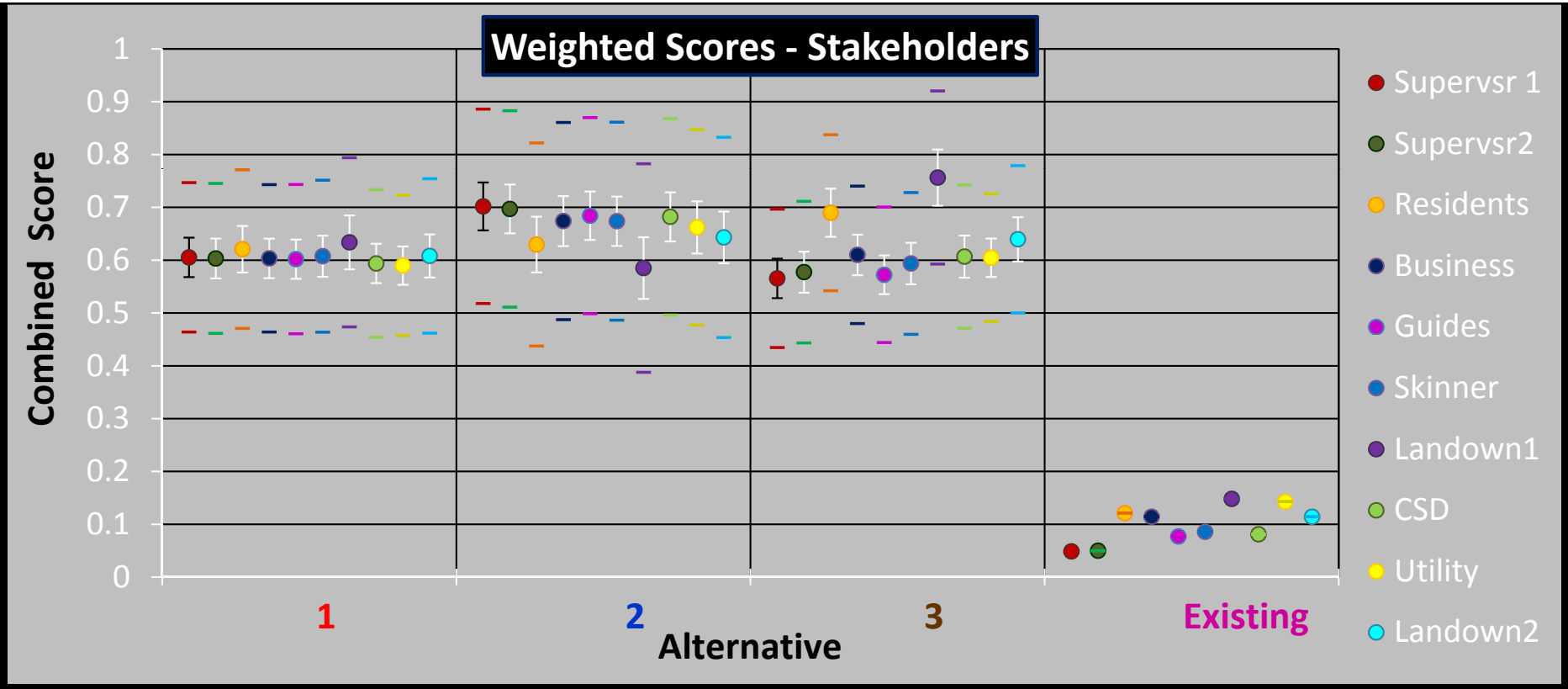
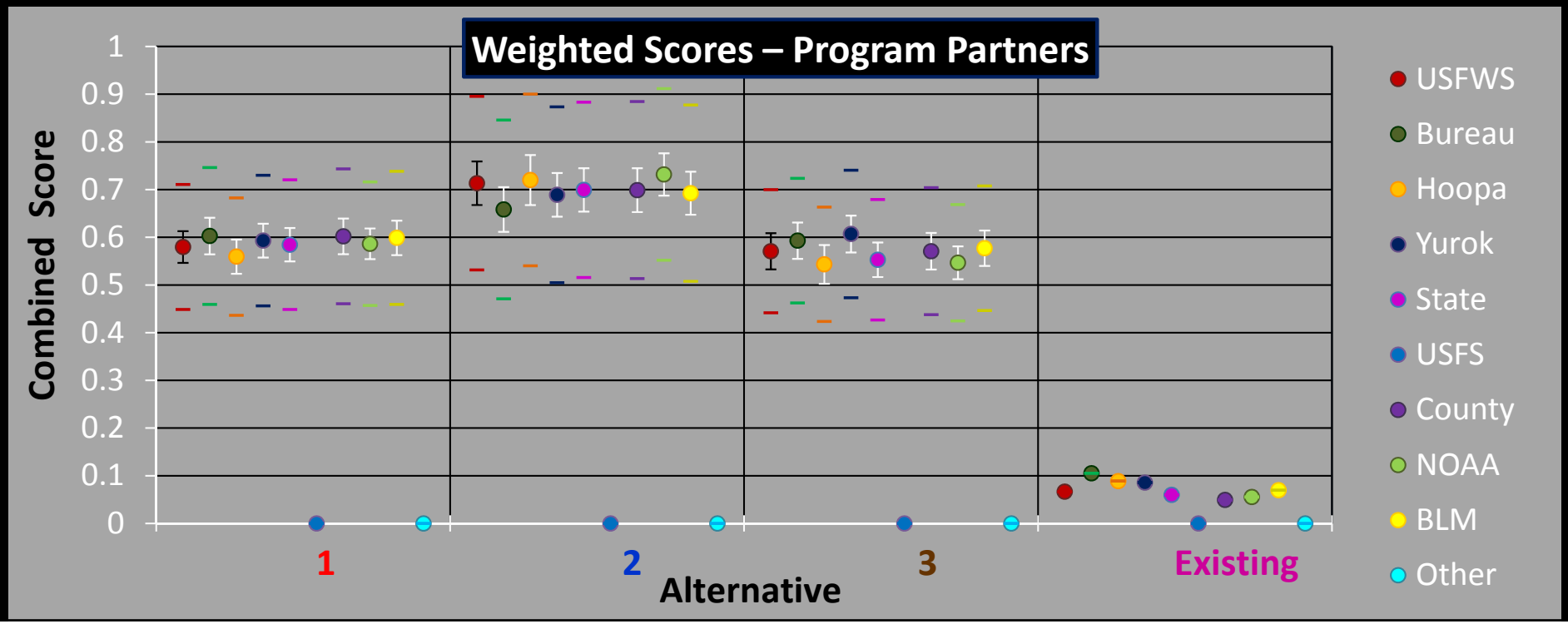
10.	**Enhance public benefit**	Work with federal, state, & local landowners to help develop & define "public benefit" objectives	
11.	**Cost consideration**	Design project to meet goals and objectives with the most efficient use of program dollars	

Supervisor1	Supervisor2	Residents	Sm. Business	Fishing Guides	Jim Skinner	Landowner1	Service Distric	Utility & Wate	Landowner2
10%	10%	6%	11%	10%	9%	4%	8%	14%	9%
10%	10%	12%	11%	10%	9%	15%	11%	7%	9%
10%	10%	12%	9%	10%	9%	4%	8%	11%	9%
10%	10%	0%	6%	10%	9%	0%	8%	4%	3%
10%	8%	0%	6%	8%	9%	0%	8%	4%	6%
7%	10%	9%	9%	8%	9%	11%	11%	11%	9%
10%	8%	12%	11%	8%	9%	7%	11%	11%	11%
10%	10%	12%	6%	10%	9%	15%	11%	7%	11%
10%	10%	12%	9%	8%	11%	15%	5%	14%	11%
10%	10%	12%	11%	10%	11%	15%	11%	4%	11%
5%	5%	12%	11%	8%	9%	15%	8%	14%	11%
100%	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*

US FWS	Bureau Rec	Hoopa Tribe	Yurok Tribe	State of Cal.	USFS	Trinity County	NOAA	BLM	Other
10%	11%	18%	11%	11%		10%	11%	9%	
7%	8%	0%	11%	5%		10%	11%	9%	
7%	8%	0%	6%	10%		10%	11%	9%	
7%	8%	7%	6%	10%		10%	8%	9%	
13%	8%	16%	9%	10%		9%	11%	9%	
13%	8%	16%	11%	10%		10%	11%	9%	
13%	8%	16%	11%	11%		7%	11%	9%	
7%	11%	2%	9%	11%		10%	6%	9%	
10%	11%	13%	9%	8%		10%	8%	9%	
7%	11%	4%	9%	8%		10%	6%	9%	
7%	11%	9%	9%	6%		5%	6%	7%	
100%	*100%*	*100%*	*100%*	*100%*	*0%*	*100%*	*100%*	*100%*	*0%*


Weighted Scores - Stakeholders
Combined Score
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
Existing
Alternative
Supervsr 1
Supervsr2
Residents
Business
Guides
Skinner
Landown1
CSD
Utility
Landown2


Weighted Scores – Program Partners
Combined Score
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
Existing
Alternative
USFWS
Bureau
Hoopa
Yurok
State
USFS
County
NOAA
BLM
Other