Prioritization Framework
For Management Strategies in the Entiat Subbasin Plan

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Introduction

The purpose of this report is to provide brevity and additional clarification to the Entiat Subbasin Plan for adoption into the Northwest Power & Conservation Council's (NPCC) Fish and Wildlife Program. This report is a summary and an addendum to the Entiat Subbasin Plan and is not intended to be a replacement for that document. For a complete understanding of the subbasin vision, goals, management strategies and objectives and near term opportunities, readers must refer to the Entiat Subbasin Plan.

Entiat subbasin planners have adopted a generalized framework for prioritization of management actions that will benefit fish and wildlife resources in the Entiat subbasin (Figure 1). To keep the process manageable, we suggest a relatively simple analyses weighing biological benefit against the feasibility and cost of each strategy (Figure 2). Projects that are determined to be less feasible are not necessarily assigned a lesser priority, rather are anticipated to be implemented over a longer time interval.

The framework

The first step in prioritizing the suite of recommended strategies would be to assign a qualitative ranking of the biological benefit to each strategy (Table 1). This ranking would be based on how well each strategy addresses the limiting factors and objectives that are described within the Plan.

The second step in prioritizing strategies is to rank the feasibility of the strategies (Tables 1, 2). Criteria used for ranking could range from professional (e.g., biologist, engineers, etc.) and stakeholder (e.g., land owner) judgment to an in-depth feasibility study (which will be needed eventually). It is important to define what "feasibility" means. In Table 5, we suggest some criteria that could be used, including, but not limited to the 1) timing of implementation and 2) acceptance of the various strategies by local stakeholders and government.

Third, strategies should then be ranked based on cost (Table 1). Various methods can be used to determine cost (eventually this would need solid information based on the feasibility study before a project is proposed for funding), but can at first be qualitatively (i.e., order of magnitude) assessed. For example, building a storage reservoir to boost flows would cost more than water conservation measures.

After strategies are ranked on feasibility and cost, they can then be compared to biological benefit (Figure 3). Those projects that show the least cost and are relatively highly ranked on feasibility and have high biological benefit should be assigned the highest prioritization. This is further accomplished by assigning a tier to each category as described in Figure 4.

The highest priority projects would be grouped in the category (or tier) with lowest cost, highest feasibility and greatest biological benefit; the second highest priority would be low cost, high feasibility and moderate biological benefit, etc. (Table 6).

To demonstrate how this framework can be used, we have used the main strategies outlined above from Table 3 and used the proposed process to prioritize the main strategies recommended within the Plan (Tables 4, 5; Figures 3, 4).

It is not the intent of this example to suggest final prioritization, since this remains to be coordinated with all stakeholders (see above).

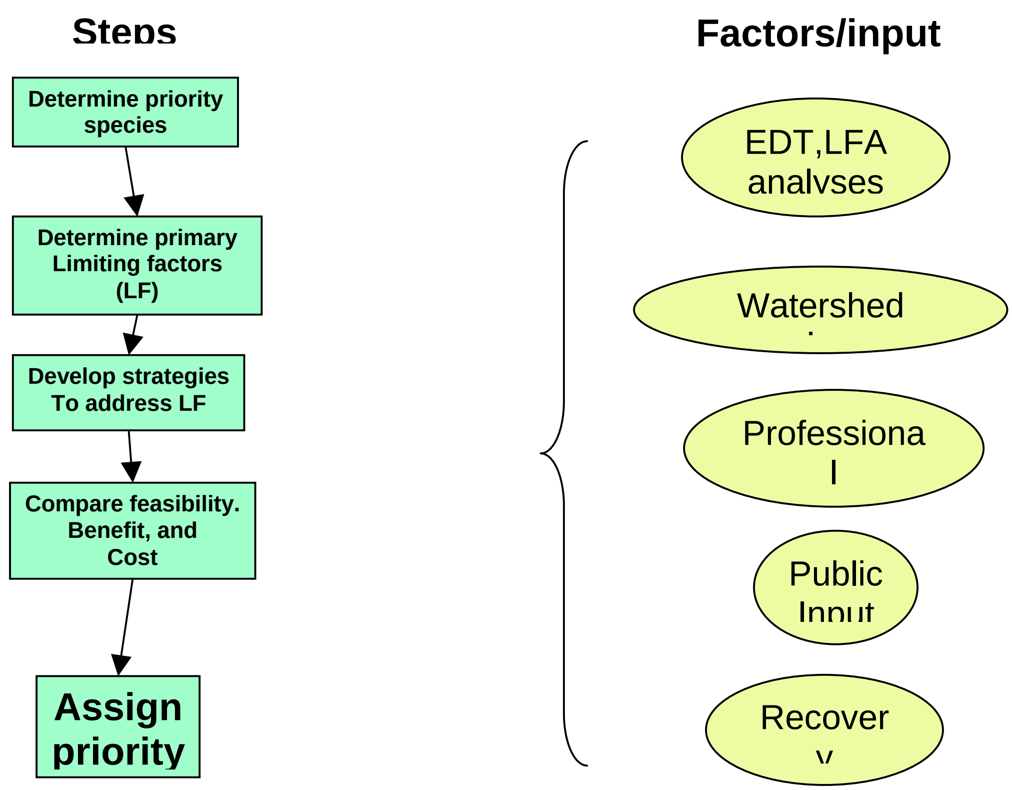

Figure 1. Simplified diagram of factors influencing strategy development and prioritization for the Wenatchee Subbasin Plan.

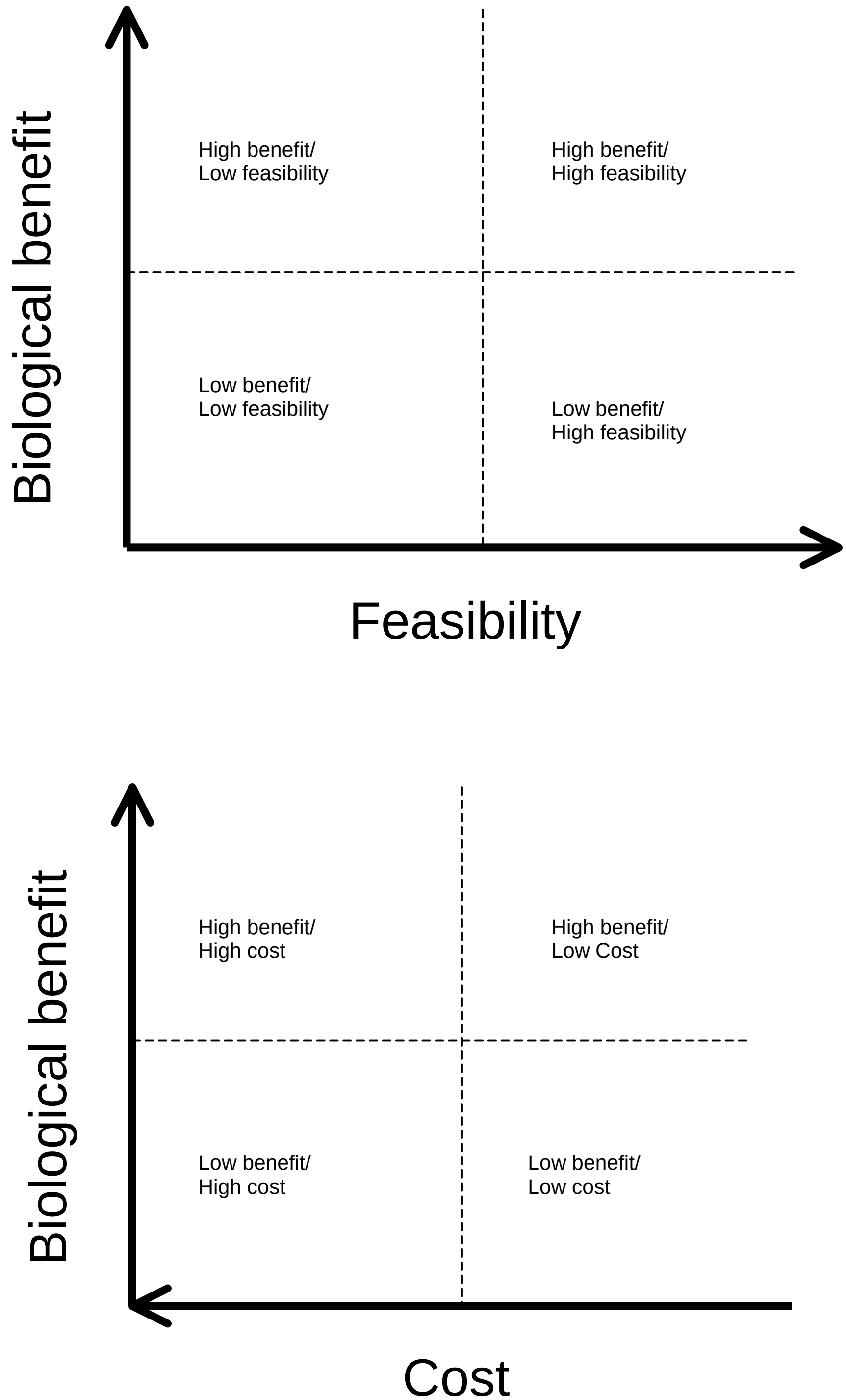

Figure 2. Comparison and ranking of **relative** feasibility and cost of strategies to biological benefit.

Table 1. Example exercise for ranking strategy priorities within the Entiat Subbasin
(Values displayed are for illustrative purposes only.)

		Strategies									
		Reduce or eliminate brook trout	*Moderate summer and winter temperature*	*Identify summer and winter refugia*	*Reduce sediment*	*Determine contaminant levels*	*Reduce impacts of water withdrawal*	*Increase riparian area and function*	*Increase off-channel habitat*	*Increase channel diversity and structure*	*Reduce poaching and harassment*
Variable	**Rank**										
	1										
	1.5										
Biological Benefit	2										
	2.5					x					
	3		x	x	x		x				x
	3.5	x						x	x	x	
	1										
	1.5		x		x		x				
Feasibility	2	x				x		x	x		
	2.5									x	x
	3			x							
	3.5										
	1						x				
	1.5		x		x			x	x	x	
Relative cost	2					x					
	2.5			x							x
	3	x									
	3.5										

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Note: Feasibility values from Table 2. Relative cost values are inverted (i.e., higher the value, the lower the cost).

Table 2. Example of a matrix of criteria for defining feasibility. (Values displayed are for illustrative purposes only.)

Criteria						
Strategy	Strategy #	Time to implement[1]	"Constructability"	Acceptance by local govt.	Acceptance from local stakeholders	Avg. score
Reduce or eliminate brook trout	1	3	2.5	1	1	1.9
Moderate summer and winter temperature	2	1	1	2	2	1.5
Identify summer and winter refugia	3	3	3	3	2	2.8
Reduce sediment	4	1	1.5	1.5	2	1.5
Determine contaminant levels	5	3	2	1.5	1	1.9
Reduce impacts of water withdrawal	6	1	2	1	2	1.5
Increase riparian area and function	7	2	2.5	1	2	1.9
Increase off-channel habitat	8	2	2.5	2	2	2.2
Increase channel diversity and structure	9	2	2.5	3	3	2.6
Reduce poaching and harassment	10	3	2	3	2	2.5

[1]Values for time to implement are 1 = > 10 years; 2 = 5-10 years; 3 = < 5 years

Relative numbering: 1=low, 3=high

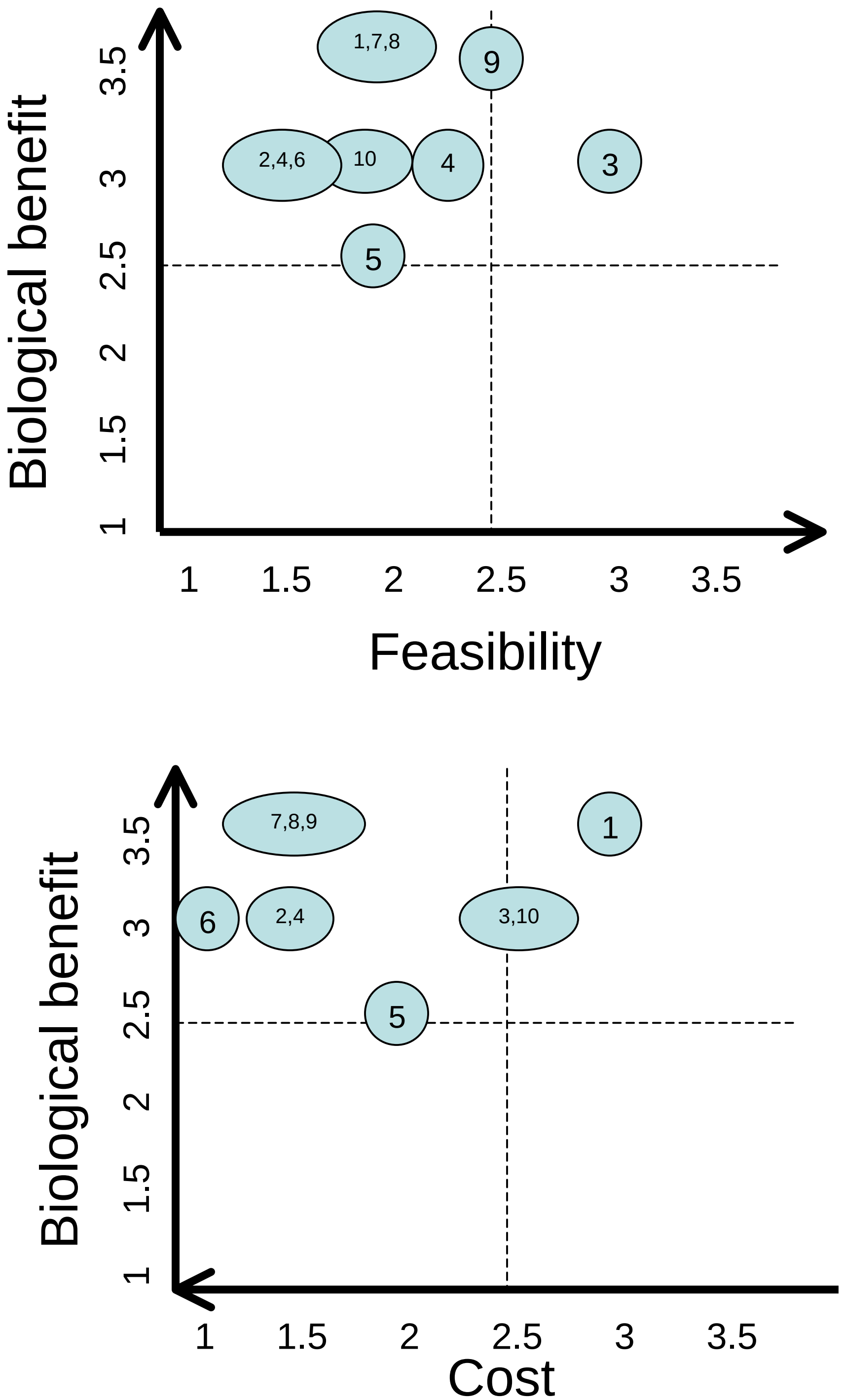

Figure 3. Relative comparison between biological benefit and feasibility and cost. See Table 2 for definition of the numbers. (Values displayed are for illustrative purposes only.)

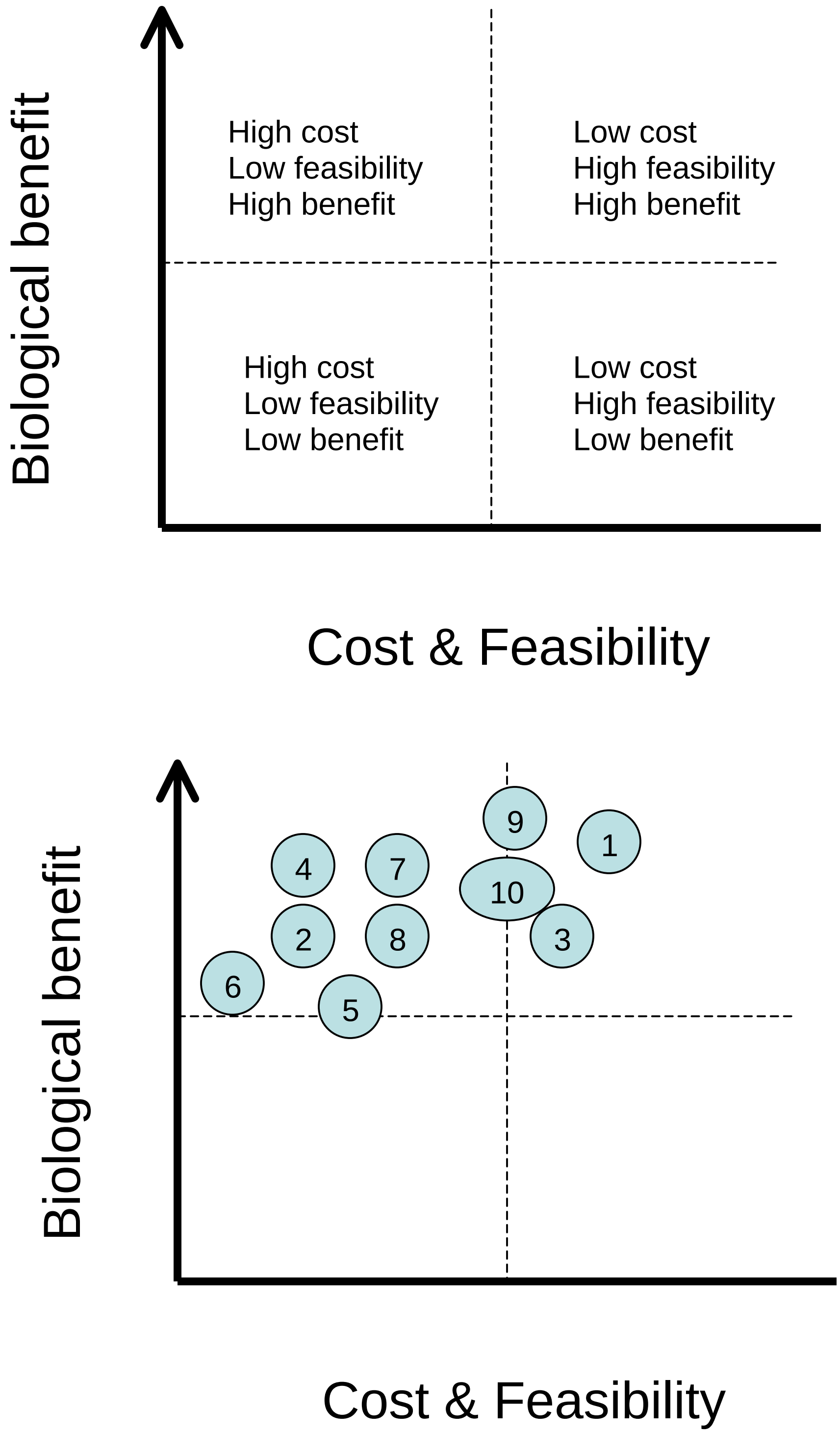

Figure 4. Relative cost and feasibility compared to biological benefit.

From the preceding exercise, the strategies are then ranked within a tier (Table 3).

Table 3. Suggested prioritization of strategies based on Table 4, and Figures 3 and 4. (Values displayed are for illustrative purposes only.)

Strategy	**Number (from graphs)**	**Tier**
Reduce or eliminate brook trout	1	**1**
Identify summer and winter refugia	3	**1**
Increase channel diversity and structure	9	**1**
Reduce poaching and harassment	10	**1**
Moderate summer and winter temperature	2	**2**
Reduce sediment	4	**2**
Reduce impacts of water withdrawal	6	**2**
Increase riparian area and function	7	**2**
Increase off-channel habitat	8	**2**
Determine contaminant levels	5	**3**

Based on this exercise, strategies 1, 3, 9 and 10 would be given the highest priority, followed by 2, 4, 6, 7, 8, and lastly 5.

Artificial Production and Supplementation:

Researchers have been describing relationships between genetic ancestry, ecological fitness, and relative survival rates of hatchery and wild salmonid populations. A working hypothesis emerged from this body of research suggesting that conventional hatchery rearing protocols diminished the fitness and survival of fish reared in a hatchery and released into natural production areas. Further, researchers hypothesized that hatchery-reared fish that interbred with wild fish in natural production areas contributed to reduced average population fitness in the wild population, thereby contributing to lower survival rates and reduced population productivity. Nearly 20 years of research has failed to conclusively answer the question of hatchery rearing effects on wild populations, but the issue has substantially altered perceptions of preferred hatchery rearing regimes and prudent uses of hatchery-reared fish.

Based on the demographic and genetic considerations described above, fishery co-managers and scientists in the Columbia Basin developed a concept of artificial propagation that was designed to provide wild and naturally-spawning populations with the very significant survival benefits of hatchery rearing, but in a manner that would also conserve or, at least, recognize the genetic benefits of maintaining the “wild” traits in those populations. The term, “supplementation,” was applied to this new concept to describe the intention of supplementing wild population abundance and productivity through the use of innovative artificial propagation methods.

Supplementation is envisioned as a means to enhance and sustain the productivity of wild and naturally-spawning populations at levels exceeding the cumulative mortality burden imposed on those populations by habitat degradation and by natural cycles in environmental conditions. A supplementation hatchery is properly operated as an adjunct to the natural production system in a watershed. By fully integrating the hatchery with a naturally-producing population, high survival rates for the component of the population in the hatchery can raise the average productivity of the total population (hatchery component + naturally-producing component) to a level that compensates for the high mortalities imposed by human development activities.

The use of supplementation is appropriate where wild population productivity does not meet conservation and rebuilding goals prescribed by the fishery managers. These goals generally include maintaining the numerical abundance and spatial diversity of natural spawners as well as supporting some level of harvest. Supplementation also may be the preferred method for implementing mitigation actions required of human activities known to cause specific unavoidable mortalities to wild and natural salmonid populations, such as hydroelectric dam operations.

It is also important to recognize what supplementation cannot do. The use of supplementation will not, by itself, create a sustainable, naturally-producing population of salmonids in a watershed where the indigenous wild population has been diminished or extirpated. Habitat quality is the sole determinant of natural population productivity and sustainability. The use of supplementation can only “subsidize” population productivity to levels that compensate for poor habitat quality. If supplementation ceases without changing the underlying habitat conditions that required its use in the first place, the remaining, unsupplemented, naturally-producing population will be expected to resume the decline that was apparent before the application of supplementation. Only adequate habitat quality can ensure the long-term viability of unsupplemented, naturally-producing populations.

Within the Entiat subbasin, fishery co-managers hold open the potential and will continue to evaluate the application of providing supplementation programs for focal species as appropriate. Co-planners expect to work closely with the Entiat Planning Unit and other stakeholders within the ongoing salmon recovery forum in the development of the role of artificial production within the Entiat subbasin generally, and more specifically the appropriate application of supplementation techniques.