Scientific Evaluation Worksheet

The scientific evaluation process provides a framework for evaluating and documenting the scientific basis for potential Delta restoration actions. Instructions and definitions for completing the worksheet are provided at the end of the worksheet.

Evaluation Team:

Date:

Action:

Step 1: Is the action written in such a way that it can be evaluated?

If yes, list the action, approach, and outcome below and continue.

Action:

Approach:

Outcome(s):

If no, explain why below, reject the action as written and move on to another action. Do not attempt to rewrite the action.

Problem(s) with Action as written:

Step 2: Assess Support for Action-Outcome Relationship Using Outcomes and Stressor Tables

Is the cause-effect relationship inferred in the Action supported by the Conceptual Models or Other Source Information?

If yes, document the specific model sections and/or page numbers, or other source materials that support this conclusion and continue.

Models used:

Other sources:

If no, document the rationale for the finding and stop.

Rationale:

Comments and suggestions for changing Action:

Identify data gaps and information that would be helpful in evaluating the action.

Step 3: Identify Scale of Action *(Large, Medium, Small: see instructions)*

Scale:

Rationale:

Step 4: Describe Relation to Existing Conditions

Would the action result in a change to system dynamics (either within the Delta or as inputs to the Delta) such that the current understanding of how the system works may no longer hold?

<u>If yes</u>, describe the specific boundary conditions that are expected to change and the likely extent of the change. Consider how the changes may affect the ability to evaluate the action using existing models and information.

<u>If no</u>, describe why not and continue.

Step 5: Identify Positive and Negative Outcome(s) to Evaluate

Positive Outcomes to Evaluate

Outcome	Source (name of Conceptual Model or external reference)
Outcome P1 (intended):	
Outcome P2:	
Outcome P"X":	

Negative Outcomes to Evaluate

Outcome	Source (name of Conceptual Model or external reference)
Outcome P1 (intended):	
Outcome P2:	
Outcome P"X":	

Step 6: Score Magnitude, Certainty, and Worth of Potential <u>Positive</u> Ecological Outcome(s)

Outcome P1:

	Criteria Score[1]	**Rationale for Scoring, Document DLO paths/additional information used**
Magnitude		
Certainty		

Worth Score P1:

Outcome P2:

	Criteria Score	**Rationale for Scoring, Document DLO paths/additional information used**
Magnitude		
Certainty		

Worth Score P2:

Outcome P3:

	Criteria Score	**Rationale for Scoring, Document DLO paths/additional information used**
Magnitude		
Certainty		

Worth Score P3:

Comments and/or Assumptions used in scoring:

[1] See Appendix A

Step 7: Score Magnitude, Certainty and Risk of Potential Negative Ecological Outcome(s)

Outcome N1:

	Criteria Score	**Rationale for Scoring, Document DLO paths/additional information used**
Magnitude		
Certainty		

Risk Score N1:

Outcome N2:

	Criteria Score	**Rationale for Scoring, Document DLO paths/additional information used**
Magnitude		
Certainty		

Risk Score N2:

Outcome N3:

	Criteria Score	**Rationale for Scoring, Document DLO paths/additional information used**
Magnitude		
Certainty		

Risk Score N3:

Comments and/or assumptions used in scoring:

Step 8: Identify any Important Gaps in Information and/or Understanding

Data Needs *(indicate specific models, DLO relationships, or other information indicating the need):*

Research Needs *(describe specific research activities that could be employed to increase understanding):*

Step 9: Estimate Overall Degree of Worth and Risk

Combined Worth and Risk Scores

Outcome	Worth Scores	Risk Scores
P1		
P2		
N1		
N2		
Cumulative Score		

Provide rationale for the overall scores:

Step 10: Assess Reversibility and Opportunity for Learning

Reversibility *(yes/easy, no/hard - see instructions):*

Comments:

Opportunity for Learning *(high, low - see instructions):*

Comments *(refer to specific sources of information that support the above determination and identify high priority research questions and testable hypotheses):*

Step 11: Assign the Adaptive Management Category Using the Decision Tree

Adaptive Management Category *(full, pilot project, targeted research, discard):*

Comments:

Instructions

Step 1: Is the action written in such a way that it can be evaluated?

The action should be clearly written and contain basic components (action, approach, and outcome) as outlined in the Guidelines for Writing and Parsing Actions (*7/16/07*). An action can include multiple outcomes, but should list only one approach.

Step 2: Is the cause and effect relationship between the action, approach, and outcome supported by the conceptual models, or other source material?

Review General Outcomes table to identify conceptual models that include the general type of outcome identified in the action. Use these models and any other relevant source materials to assess if the relationship inferred by the action has been documented. If it is determined that the cause and effect relationship is not supported, document why and provide suggestions for how the actions might be re-cast to better achieve the desired outcome based on information in the conceptual models and other available scientific information. These suggestions can be used by action developers to improve the action for the next round of screening.

Step 3: Identify Scale of Action

Identify the scale of the Action 'scope' based on the following criteria. The purpose of establishing Action scale is to assist with determining the magnitude of effect on the ecosystem. Large, medium and small should be considered relative to the Delta and the temporal dynamics of processes being manipulated.

Large: Broad spatial extent, significant duration and/or frequency, and/or major reversal compared to existing conditions. Landscape scale.

Medium: Moderate spatial extent, moderate duration and/or frequency, and/or moderate change compared to existing conditions. Regional scale.

Small: Small acreage, short duration or only occasionally, and/or small change compared to existing conditions. Local scale.

Step 4: Describe Relation to Existing Conditions

Review the Boundary Conditions paper to assess whether or not the action has the potential to change system dynamics (either within the Delta or as inputs to the Delta) beyond the existing range conditions (i.e. change in inflows to the Delta, modified hydrodynamic conditions, or salinity regimes) such that the current understanding of how the system works may no longer hold? Consider how the changes may affect the ability to evaluate the action using existing models and information.

Step 5: Identify Positive and Negative Outcome(s) to be Evaluated

Using the standardized lists of outcomes and stressors from the Outcomes Table, identify as many positive and negative outcomes as possible (including the intended

outcome). Outcomes should not be evaluated at this step, just simply listed. Outcomes not captured in models but identified based on other available information should be included, with notes describing the information used to identify the outcomes.

Identify positive and negative outcomes focusing only on covered species, but ensuring that all covered species anticipated to be affected are addressed, i.e., if the action is intended to benefit salmon, still look at effects on smelt.

Step 6: Score Magnitude, Certainty and Worth of Potential Positive Ecological Outcome(s)

Using the conceptual models and other relevant source materials, identify and score the expected magnitude and certainty of the identified positive ecological outcomes. Record the magnitude and certainty for each positive outcome. ***Use one table per positive outcome.*** Add additional tables as needed to reflect additional outcomes.

Use the definition, criteria, and conversion tables in Appendix A to guide the scoring determination and to select an estimate of "Worth". Document how scores for magnitude and certainty were arrived at, including citation of specific model sections and page numbers, and/or additional information used in the rationale section.

Step 7: Score Magnitude, Certainty and Risk of Potential Negative Ecological Outcome(s)

Using the conceptual models and other relevant source materials identify and score the expected magnitude and certainty of each negative ecological outcome. Record the magnitude and certainty in the tables below. ***Use one table per outcome***. Add additional tables as needed to reflect additional outcomes.

Use the criteria and conversion tables in Appendix A to guide the scoring determination and to select an estimate of "Risk". Document how scores for magnitude and certainty were arrived at, including citation of specific model sections and page numbers, and/or additional information used in the rationale section.

Step 8: Identify any Important Gaps in Information and/or Understanding

Using the levels of understanding assigned to the DLO relationships used in the evaluation thus far, and/or any additional information from other sources, identify important data or research needs, that could enhance future evaluation of this or similar actions.

Step 9: Estimate Overall Degree of Worth and Risk

Enter scores for Worth and Risk from Steps 5 and 6 above into the table below and estimate the overall Worth and Risk scores for the Action as a whole. Add additional rows to the table as needed to reflect additional positive or negative outcomes.

Overall Worth score should be determined based on consideration of the cumulative positive outcomes (several medium outcomes could justify an overall score of "High" worth).

Overall Risk should be based on the highest single risk score (i.e. if any one of the outcomes has a high risk, then the overall Risk should be "high").

Step 10: Assess Reversibility and Opportunity for Learning

Assess reversibility and opportunity to learn using the criteria below.

Reversibility

Yes/Easy Outcome could likely be reversed as, or more quickly and cheaply than implementing the action.

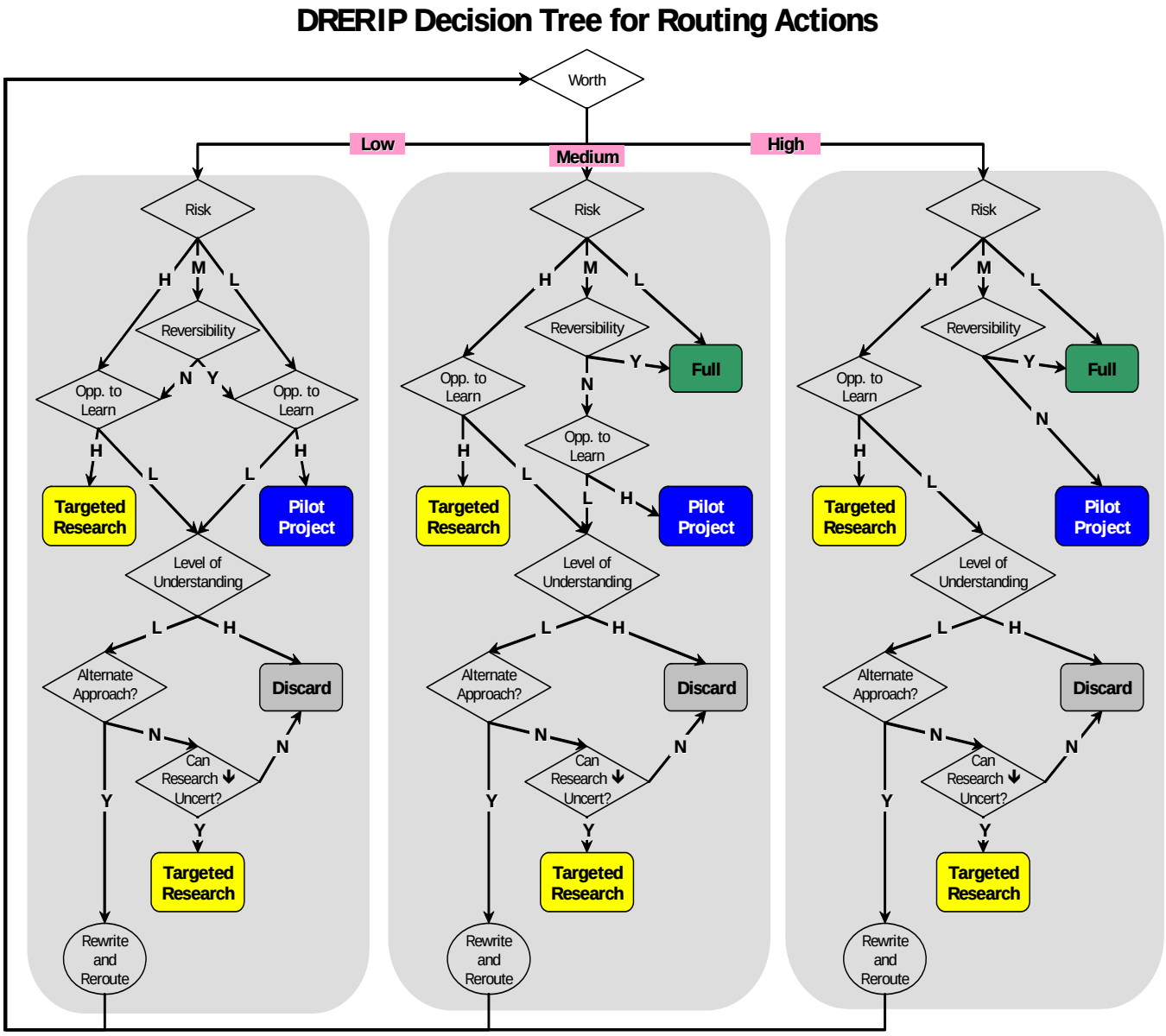
No/Hard Reversing outcomes would require more time or more money than implementing the action; outcomes may not be completely reversible.

Opportunity for Learning

High Expect to advance our understanding of critical uncertainties as identified in Conceptual Models in a quantifiable manner

Low Impractical or excessive time or resources likely required to achieve such understanding.

Step 11: Assign the Adaptive Management Category Using the Decision Tree



Appendix A:

Definitions, Criteria and Conversion Matrices

The following definitions, criteria, and conversion matrices, are provided to aid the Scientific Evaluation process. Some of the definitions pertain to terms used in the conceptual models, such as understanding and predictability. Other definitions relate directly to completion of the Scientific Evaluation worksheet.

Scientific Evaluation Terms

The terms ***scale, magnitude, and certainty*** are Scientific Evaluation terms used to characterize the cumulate "path" or "chain" found between a Restoration Action being evaluated and each Outcome being considered within Scientific Evaluation. Such a path or chain is not the same as the linkages in the conceptual models that describe the cause-effect relationships between a single driver and a single outcome (see conceptual model terms below).

The terms ***worth, risk, reversibility, and opportunity for learning*** are Scientific Evaluation terms that combine considerations of magnitude and certainty to assess the consequences of an action and recommend whether the action should be considered as targeted research, a pilot study, a full-scale implementation project, or discarded using the Scientific Evaluation decision tree.

> ***Scale*** - Scale addresses temporal and spatial considerations, quantity and/or degree of change contained within the Action.
>
> ***Magnitude*** – Magnitude assesses the size or level of the outcome, either positive or negative, as opposed to the scale of the Action. It can be assigned using consideration of population or habitat effects, and higher scores require consideration of the scale of the Action shown to result in the outcome. Magnitude scores are assigned by expert assessment, documented in the Scientific Evaluation worksheet, of the DLO pathway linking the action and the outcome, and/or any additional information available to the Scientific Evaluation team, the use of which must be documented in the Scientific Evaluation worksheet.
>
> ***Certainty*** - Certainty describes the likelihood that a given Restoration Action will achieve a certain Outcome. Certainty considers both the predictability and understanding of linkages in the DLO pathway from the action to the outcome. Generally, high importance-low predictability linkages drive the scoring; it is important to ensure that certainty is not unduly weighted by a comparatively low-importance, albeit low-predictability linkage.
>
> ***Worth*** - Combines the ***magnitude*** and ***certainty*** of positive outcomes to convey the cumulative "value" of a Restoration Action toward achieving an Outcome.

Risk - Combines the ***magnitude*** and ***certainty*** of negative outcomes to convey the cumulative "potential" for a Restoration Action to result in an adverse, or negative Outcome.

Reversibility - The ease and predictability with which the outcome(s) of a Restoration Action or a group of Restoration Actions can be undone and/or reversed. For example, if the Action changes the ecosystem structure, can the original form be re-established? Have such outcomes been un-done in the past? A change to a flow regime is relatively easy to reverse; successful introduction of a new species is relatively difficult to reverse.

Opportunity for learning - Opportunity for learning is the likelihood that a Restoration Action or a group of Restoration Actions will increase the level of understanding with regard to the species, process, condition, region or system that is in question or of concern, assuming that appropriate monitoring and evaluation is conducted.

Conceptual Model Terms

The terms ***importance, predictability, and understanding*** are used in the conceptual models to characterize individual linkages (depicted as arrows in the models) between a driver and an outcome. The terms pertain to specific processes or mechanisms within a given model (e.g. how important is the supply of organic matter to mercury methylation?). The graphical forms of the conceptual models apply line color, thickness, and style to represent these three terms.

Importance - The degree to which a linkage controls the outcome *relative to* other drivers and linkages affecting that same outcome. Models are designed to encompass all identifiable drivers, linkages and outcomes but this concept recognizes that some are more important than others in determining how the system works. If a driver is potentially more important under particular environmental conditions, the graphic should display the maximum level of importance of this driver with the narrative describing the range of spatial and temporal conditions associated with this driver.

Predictability - The degree to which the performance or the nature of the outcome can be predicted from the driver. Predictability seeks to capture the variability in the driver-outcome relationship. Predictability can encompass temporal or spatial variability in conditions of a driver (e.g., suspended sediment concentration or grain size), variability in the processes that link the driver to the outcome (e.g., sediment deposition or erosion rate as influenced by flow velocity), or our level of understanding about the cause-effect relationship (e.g., magnitude of sediment accretion inside vs. outside beds of submerged aquatic vegetation). Any of these forms of variability can lead to difficulty in predicting change in an outcome based on changes in a driver.

Understanding – A description of the known, established, and/or generally agreed upon scientific understanding of the cause-effect relationship between a single driver and a single outcome. Understanding may be limited due to lack of knowledge and information or due to disagreements in the interpretation of existing data and information; or because the basis for assessing the understanding of a linkage or outcome is based on studies done

elsewhere and/or on different organisms, or conflicting results have been reported. Understanding should reflect the degree to which the model that is used to represent the system does, in fact, represent the system.

Scientific Evaluation Scoring Criteria

The following tables should be used to inform ***magnitude and certainty*** scores for Scientific Evaluation. These entail looking holistically at the cumulative value (positive or negative) of an action.

Table 1 - Criteria for Scoring Magnitude of Ecological Outcomes (positive or negative)

4 - High: expected sustained major population level effect, e.g., the outcome addresses a key limiting factor, or contributes substantially to a species population's natural productivity, abundance, spatial distribution and/or diversity (both genetic and life history diversity) or has a landscape scale habitat effect, including habitat quality, spatial configuration and/or dynamics. Requires a large-scale Action.
3 - Medium: expected sustained minor population effect or effect on large area (regional) or multiple patches of habitat. Requires at least a medium-scale Action.
2 - Low: expected sustained effect limited to small fraction of population, addresses productivity and diversity in a minor way, or limited spatial (local) or temporal habitat effects.
1 - Minimal: Conceptual model indicates little effect.

Table 2 - Criteria for Scoring Certainty of Ecological Outcomes (positive or negative)

4 - High: Understanding is high (based on peer-reviewed studies from within system and scientific reasoning supported by most experts within system) and nature of outcome is largely unconstrained by variability (i.e., predictable) in ecosystem dynamics, other external factors, or is expected to confer benefits under conditions or times when model indicates greatest importance.
3 - Medium: Understanding is high but nature of outcome is dependent on other highly variable ecosystem processes or uncertain external factors or understanding is medium (based on peer-reviewed studies from outside the system and corroborated by non peer-reviewed studies within the system) and nature of outcome is largely unconstrained by variability in ecosystem dynamics or other external factors
2 - Low: Understanding is medium and nature of outcome is greatly dependent on highly variable ecosystem processes or other external factors or understanding is low (based on non peer-reviewed research within system or elsewhere) and nature of outcome is largely unconstrained by variability in ecosystem dynamics or other external factors
1 - Minimual: Understanding is lacking (scientific basis unknown or not widely accepted), or understanding is low and nature of outcome is greatly dependent on highly variable ecosystem processes or other external factors

Conversion Matrices

The following two matrices are designed to combine scores for magnitude and certainty to develop overall values for Worth and Risk.

Table 3. Conversion Matrix for Determining Worth from the Criteria Scores for Positive Outcomes.

Is It Worthwhile?

Combining Magnitude and Certainty

		Certainty			
		1	2	3	4
Magnitude	1	***Low***	***Low***	***Med***	***Med***
	2	***Low***	***Med***	***Med***	***High***
	3	***Med***	***Med***	***High***	***High***
	4	***Med***	***High***	***High***	***High***

Table 4. Conversion Matrix for Determining Risk from the Criteria Scores for Negative Outcomes.

Is It Risky?

Combining Magnitude and Certainty

		Certainty (understanding + predictability)			
		1	2	3	4
Magnitude	1	***Med***	***Med***	***Low***	***Low***
	2	***High***	***Med***	***Med***	***Low***
	3	***High***	***High***	***Med***	***Med***
	4	***High***	***High***	***High***	***Med***