

## **SECTION 35 – Table of Contents**

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## 35 Upper Columbia Research, Monitoring and Evaluation Plan

In light of the various ongoing efforts to develop a regional monitoring plan, subbasin planners the Intermountain Province (IMP) have chosen to develop a monitoring plan based on existing monitoring methods described in the scientific literature. The IMP approach to the Research, Monitoring and Evaluation (RM&E) is as follows:

- Research is handled separately from the M&E design. A wish list of research needs is identified based on the biological objectives, strategies and critical uncertainties identified in the subbasin management plans and subbasin assessments. Many of the subbasin work teams developed preliminary research needs lists. Although there is an extensive “wish list” of research questions in the IMP, the limitations of available funding made it important to prioritize the research questions into two categories: “need to know” and “would like to know.”
- For the M&E component, subbasin planners in the IMP developed a framework to link specific objectives and strategies identified in the IMP subbasin management plans to a suite of M&E protocols and existing programs (an M&E “tool box”). To do this a subcommittee of the OC identified a broad list of existing M&E protocols and existing M&E programs, which represent: peer reviewed, scientifically validated approaches to M&E; are appropriate to range of geographic scales; and, include the range of the Independent Science Review Panel’s (ISRP) three tiers of RM&E. Specific M&E objectives and strategies from each of the subbasin management plans, and from the province level, were then linked in Table 35.1 to:
  - The type of generic approach to addressing limiting factors that is addressed by the strategy or objective (same list used to categorize the inventory of projects)
  - The type of M&E protocol that would be most appropriate
  - Which ISRP M&E tier level of RM&E would be appropriate
  - Which of the “tool box” tools would be used.

The complete tool box bibliography is found in Appendix I. More detailed information on the process for developing the RM&E plan is found in Section 2.

Table 35.1. Upper Columbia Subbasin research, monitoring, and evaluation plan

AQUATIC					
Strategy & Objective	Strategy Type <sup>1</sup>	Monitoring Type <sup>2</sup>	Tier <sup>3</sup>	Scale <sup>4</sup>	Tool Box Tool <sup>5</sup>
<b>Columbia Basin Goal 1A: Subbasin Objective 1A1:</b> Assess resident fish losses resulting from the hydrosystem. (Continue to evaluate hydropower impacts to native and focal species.)	1, 2, 3, 4, 5, 9, 10?	?	2	1, 2, 3	1, 3, 4, 6, 8, 11, 12, 14, 17, 22, 26, 28, 36, 37
<b>Subbasin Objective 1A1 Strategy a:</b> Develop and implement plans to reduce hydropower impacts to native and focal species	1, 2, 3, 4, 5, 9, 10	Population, Habitat Surveys	1, 3	1, 2, 3	1, 3, 4, 5, 6, 8, 12, 17, 18, 22, 36, 37
<b>Subbasin Objective 1A1 Strategy c:</b> Monitor entrainment.	2, 10	?	1, 3	1, 2	17, 22
<b>Subbasin Objective 1A3:</b> Assess nutrient availability and feasibility of enrichment programs for Lake Roosevelt and tributaries.	1, 5, 6, 10	Water Quality Surveys	3	1, 2, 3	4, 5, 6, 9, 10, 16, 17, 22, 36, 37
<b>Province Level Objective 1B:</b> Assess chemical, biological, and physical factors influencing aquatic productivity. (To allow managers to maintain functional ecosystems for resident fish through protection and restoration of in-stream and riparian habitats) Includes, but is not limited to, in-stream connectivity, habitat condition, stream/reservoir temperature, streambed embeddedness, riparian habitat condition, width to depth ratios and flows.	1, 2, 3, 4, 5, 6, 9, 10	Holistic ecosystem monitoring (i.e. All)	1, 2, 3	1, 2, 3, 4	1, 3, 4, 5, 6, 9, 10, 11, 12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 36, 37
<b>Subbasin Objective 1B1:</b> Assess connectivity.	1, 2, 3, 4, 5, 6, 9, 10	Mapping, Surveys, Genetics	1, 2, 3	1, 2, 3	1, 4, 5, 6, 9, 10 . . .
<b>Subbasin Objective 1B2:</b> Assess habitats.	1, 3, 4, 5, 6, 10	Population, Habitat Surveys	1, 2, 3	1, 2, 3	1, 4, 5, 6, 9, 10 . . .
<b>Subbasin Objective 1B3:</b> Assess Stream/Reservoir Temperature.	1, 3, 5, 6, 10	Water Quality Surveys	1, 2, 3	1, 2, 3	1, 4, 5, 6, 9, 10 . . .
<b>Subbasin Objective 1B4 Strategy a:</b> Evaluate heavy metal/organic/inorganic contamination as a limiting factor on native, culturally, and economically important species.	1, 2, 5	Water Quality, Population & Toxicity Surveys	1, 2, 3	1, 2, 3	5, 9, 10
<b>Subbasin Objective 1B5:</b> Assess streambed embeddedness.	1, 5	Mapping, Habitat Surveys	1, 2, 3	1, 2, 3	1, 4, 5, 6, 9, 10 . . .
<b>Subbasin Objective 1B6:</b> Assess riparian habitats.	1, 6, 10	Mapping, Habitat Surveys	1, 2, 3	1, 2, 3	1, 4, 5, 6, 9, 10 . . .
<b>Subbasin Objective 1B7:</b> Assess width to depth ratios.	1, 3, 4, 5, 6, 10	Mapping, Habitat Surveys	1, 2, 3	1, 2, 3	1, 4, 5, 6, 9, 10 . . .

AQUATIC					
Strategy & Objective	Strategy Type <sup>1</sup>	Monitoring Type <sup>2</sup>	Tier <sup>3</sup>	Scale <sup>4</sup>	Tool Box Tool <sup>5</sup>
<b>Subbasin Objective 1B6 &amp; 1B7 Strategy e:</b> Develop criteria for prioritizing streams and/or stream reaches within the subbasin for habitat improvements, including prioritization of work with identified native red-band rainbow trout habitat, and/or other focal species strongholds.	1, 2, 3, 4, 5, 6, 9	?	1, 2, 3	1, 2, 3	1, 4, 5, 6, 9, 10, 14, 15, 16, 17, 18, 19, 20, 21, 23, 25, 26, 28
<b>Subbasin Objective 1B8:</b> Assess flows.	1, 3, 4, 5, 10	Flow Surveys	1, 2, 3	1, 2, 3	1, 4, 5, 6, 9, 10 . . .
<b>Subbasin Objective 1B1 &amp; 1B8 Strategy e:</b> Develop minimum in-stream flow recommendations for fish bearing streams that meet the biological requirements of salmonid fishes, including focal species.	1, 2, 3, 4, 5, 9, 10	?	1	1, 2, 3	1, 4, 5, 6, 9, 10, 14, 15, 16, 18, 19, 20, 21, 23, 25, 26, 28
<b>Subbasin Objective 1C1 Strategy a:</b> Conduct ESA listed species distribution and habitat suitability surveys (Bull Trout).	1, 2, 4, 5, 6, 9	Mapping, Population/Habitat Surveys, Genetics	2	1, 2, 3, 4	4, 5, 6, 11, 12, 14, 15, 16, 17, 18, 19, 20, 21, 25, 26, 27, 28
<b>Subbasin Objective 2A1 Strategy a:</b> Determine genetic distribution of native focal species (white sturgeon, rainbow/redband trout, Pacific lamprey, burbot, kokanee), identify limiting factors, and develop strategies for addressing limiting factors by 2006.	1, 2, 3, 4, 5, 6, 8, 9, 10	Mapping, Population/Habitat Surveys, Genetics	2, 3	1, 2, 3, 4	1, 4, 5, 6, 7, 8, 12, 14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 25, 26, 27, 28
<b>Subbasin Objective 2A2:</b> Assess population status of wild native fish and subsistence species.	2, 9	Mapping, Population/Habitat Surveys, Genetics	2, 3	1, 2, 3, 4	1, 3, 4, 5, 7, 8, 11, 12, 14, 15, 17, 22, 24, 25, 26, 28
<b>Subbasin Objective 2C1 Strategy a:</b> Evaluate feasibility of anadromous fish re-introduction by 2015, and begin implementation.	1, 2, 3, 4, 5, 6, 8, 9, 10	?	2, 3	1, 2, 3	1, 4, 5, 7, 11, 17, 20, 21, 26, 27, 28

**AQUATIC – ADDITIONAL RESEARCH, MONITORING, AND EVALUATION NEEDS**

<b>Strategy &amp; Objective</b>	<b>Strategy Type</b>	<b>Monitoring Type</b>	<b>Tier</b>	<b>Scale</b>	<b>Tool Box Tool</b>
Monitor and evaluate artificial reproduction programs and effects on resident fish and lower trophic levels.	1, 2, 3, 4, 5, 9, 10	Holistic ecosystem monitoring (i.e. All)	1, 2, 3	1, 2, 3, 4	1, 3, 4, 5, 6, 9, 10, 11, 12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 36, 37
Monitor and evaluate nonnative effects on native fish populations (competition, predation, and introgression effects).	1, 2, 3, 4, 5, 9, 10	Population/Habitat Surveys	1, 2, 3	1, 2, 3, 4	1, 3, 4, 5, 6, 9, 10, 11, 12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 36, 37
Assess and monitor native and nonnative resident fish stock composition, distribution, and relative abundance within the Subbasin.	1, 2, 3, 4, 5, 9, 10	Population/Habitat Surveys	1, 2, 3	1, 2, 3	1, 2, 3, 4, 5, 6, 9, 10, 11, 12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 36, 37
Assess need for conservation aquaculture facilities.	1, 2, 5, 9	Population Surveys	2	1, 2, 3	1, 4, 5, 6, 10, 12, 14, 15, 16, 17, 19, 21, 22, 23, 24, 26, 27, 28, 36, 37
Conduct baseline assessments for fish	1, 2, 3, 4, 5, 6, 9	All	1, 2	1, 2, 3, 4	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 26, 28, 36, 37, 41, 42,
Assess effects of TDG levels on natural populations and net pen fish for Lake Roosevelt above GCD.	9, 10	TMDL, Water Quality/Fish Surveys	3	1, 2, 3	16, 17, 22, 28, 36, 37, 38
Assess TDG at fixed sites.	1, 5, 10	Water Quality Surveys	1, 3	1, 2, 3	16, 17, 22, 28, 36, 37, 38, 39, 40, 44

**AQUATIC – ADDITIONAL RESEARCH, MONITORING, AND EVALUATION NEEDS**

<b>Strategy &amp; Objective</b>	<b>Strategy Type</b>	<b>Monitoring Type</b>	<b>Tier</b>	<b>Scale</b>	<b>Tool Box Tool</b>
Monitor and enhance lake and stream fisheries.	1, 2, 3, 4, 5, 6, 9	Population/Habitat Surveys	1, 2	1, 2, 3	1-16, 18-28, 36, 37, 39, 40, 41, 42, 43, 44
Monitor and evaluate fish populations for downstream migration/reproductive rates including adfluvial redband trout, mountain whitefish, Chinook, and kokanee (list is not all inclusive).	1, 2, 3, 4, 5, 6, 9, 10	Population/Habitat/Genetic and Water Quality Surveys	2, 3	1, 2, 3	1-16, 18-28, 36, 37, 39, 40, 41
Assess feasibility of developing and utilizing multilevel (adjustable depth) net pens.	9, 10	Population Surveys	3	1, 2, 3	22, 36, 37, 38, 39, 40, 41, 43, 44
Assess watersheds for habitat condition, and implement and monitor watershed improvements as identified in assessment, to address habitat and water quality conditions for native and nonnative resident fish.	1-7, 9, 10	Population/Habitat and Water Quality Surveys	1, 2, 3	1, 2, 3	1, 2, 4, 6, 7, 8, 9, 10, 12, 14, 15, 16, 18, 19, 20, 21, 23, 24, 25, 26, 28, 37, 38, 39, 40, 41, 42, 43, 44
Complete bathymetry for Lake Roosevelt (including Spokane Arm).	1, 5, 10	Habitat/Water Quality	2, 3	1	1, 2,
Assess substrate composition and utilization by fish for streams/reservoirs in the Subbasin.	1, 5, 11	Habitat Survey	2, 3	1, 2	1, 2, 6, 8, 9, 10, 12, 14, 15, 20, 21, 25, 26, 28, 37, 42

**<sup>1</sup>Strategy types:**

- 1) Habitat Assessments
- 2) Population Assessments
- 3) In-stream Diversion
- 4) In-stream Passage
- 5) In-stream Habitat
- 6) Riparian Habitat
- 7) Upland Habitat
- 8) Education/Coordination
- 9) Population Management
- 10) Reservoir Operations

**<sup>2</sup>Monitoring Protocol e.g., type of monitoring protocol [note: the specific reference to detailed monitoring protocol is identified in the "tool box"]:**

- TMDL
- Survey
- Survey and mapping

- HEP
- P/A and trend surveys
- All habitat

<sup>3</sup>**ISRP Tier Level:**

- 1) Tier 1: trend or routine monitoring
- 2) Tier 2: statistical (status) monitoring
- 3) Tier 3: experimental research (effectiveness) monitoring

<sup>4</sup>**Scale of Monitoring and Evaluation:**

- 1) Project
- 2) Subbasin
- 3) Province
- 4) Columbia Basin

<sup>5</sup>**Tool Box Tool**

The Tool Box is found in Appendix I.

TERRESTRIAL					
Strategy & Objective	Strategy Type <sup>1</sup>	Monitoring Type <sup>2</sup>	Tier <sup>3</sup>	Scale <sup>4</sup>	Tool Box-tool <sup>5</sup>
<b>Basin Level Goal 1A:</b> Fully mitigate for construction and inundation losses					
<b>Objective 1A11:</b> M&E on wildlife lands to determine benefits of enhancements.					
<b>Strategy a:</b> Monitor habitat enhancement activities.	1,6,7	HEP		1	
<b>Strategy b:</b> Monitor wildlife population response to habitat enhancement activities.	2			1	52, 53, 54, 55, 56, 57, 58, 59
<b>Basin Level Goal 1B:</b> Quantify the <b>operational effects</b> of federal hydrosystem projects on terrestrial resources, develop mitigation plan in coordination with other resource mitigation and resource planning efforts, and implement projects to mitigate the impacts, including maintenance and monitoring.					
<b>Province Level Objective 1B:</b> Quantitatively assess and mitigate <b>operational impacts</b> of the Chief Joseph, Grand Coulee Dam, and Albeni Falls projects per the requirements of the Northwest Power Act and the current Wildlife Mitigation Program. Complete assessment of operational impacts by <b>2008</b> ; develop mitigation plan by <b>2010</b> ; implement initial mitigation by <b>2015</b> ; incorporate formal methods for review and update of effects assessment and mitigation plan on a three-year cycle, to respond to changes in operation and to effectiveness of mitigation actions.					
<b>Upper Columbia Subbasin Objective 1B:</b> Quantitatively assess operational impacts of the Grand Coulee Project on terrestrial resources by year 2008.					
<b>Objective 1B1:</b> Quantitatively assess operational impacts of the Grand Coulee Project on terrestrial resources by year 2008.					
<b>Strategy a:</b> Have an impartial third party contractor conduct the assessment, including but not limited to: fluctuation zone, loss of nutrients in watershed from loss of salmon, recreational effects to terrestrial resources, BPA transmission lines, connectivity, and erosion, etc.	1, 2, 6, 7			2, 3	
<b>Objective 2A1:</b> Maintain bald eagle at or above present levels (2004) in the Upper Columbia Subbasin.					
<b>Strategy b:</b> Identify and map current or potential winter perching and foraging habitat.	1	IBIS, GAP		2, 3	



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<b>Strategy c:</b> Continue or increase monitoring of nesting and wintering bald eagles.	2			2, 3	59
<b>SO 2A2: Strategy a:</b> Determine limiting factors on sharp-tailed grouse populations within the IMP and associated subbasins by 2006.	1, 2, 6, 7	HEP		2, 3, 4	
<b>SO 2A2: Strategy c:</b> Assess current versus historical habitat availability and quality and if needed implement habitat restoration/conversion to address concerns.	1, 6, 7	HEP, IBIS, GIS		2,3,4	
<b>SO 2A2: Strategy d:</b> Assess and, if deemed needed, limit/restrict nonnative invasive species interaction/competition and habitat degradation.	1, 6, 7	HEP		1,2,3,4	
<b>SO 2A3: Strategy a:</b> Identify specific factors limiting/affecting blue-grouse populations in the Upper Columbia Subbasin and adjacent subbasins/provinces by year 2010.	1, 2	HEP		2,3	
<b>SO 2A3: Strategy d:</b> Assess current versus historical habitat availability and quality and if needed implement habitat restoration/conversion to address concerns.	1, 7	HEP, IBIS, GIS		2, 3	
<b>SO 2A3: Strategy e:</b> Assess, and if deemed, needed limit/restrict nonnative invasive species interaction/competition and habitat degradation.	1, 6, 7	HEP		1,2,3,4	
<b>SO 2A4: Strategy a:</b> Determine limiting factors for golden eagles by 2006.	1, 2			2, 3	
<b>Objective 2B1:</b> Identify, maintain, restore, and enhance priority habitats (wetlands, riparian areas, upland forests, steppe and shrub-steppe, cliffs and rock outcrops, caves, grasslands, and other priority habitats) within the Upper Columbia Subbasin, including their structural attributes, ecological functions, and distribution and connectivity across the landscape to optimize conditions required to increase overall wildlife productivity of desired species assemblages. Strategies may include land acquisition, conservation easements, management contracts, and/or partnerships with other landowners.					

<sup>1</sup>**Strategy types:**

- 1) Habitat Assessments
- 2) Population Assessments
- 3) In-stream Diversion
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- 5) In-stream Habitat
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