Columbia River Basin
Wildlife Monitoring Implementation Strategy
To Support Reporting Basin-wide High Level Indicators

Initial DRAFT

November 11, 2011

Acknowledgements

This initial draft of the Wildlife Monitoring Implementation Strategy was developed through the Wildlife Advisory Committee (WAC) of the Columbia Basin Fish and Wildlife Authority in collaboration with Nancy Leonard, staff of the Northwest Power and Conservation Council. Scott Soults, Kootenai Tribe of Idaho, led the effort as Chair of the WAC during calendar year 2010. Doug Calvin, Warm Springs Tribe, originated the effort as WAC chair during calendar year 2009. WAC participants and contributing authors include: Carl Scheeler and Jenny Barnett (CTUIR); Angela Sondenaa (NPT); Tracy Hames (YN); Jason Kesling and Kyle Heinrick (BPT); Aren Eddingsaas (SBT); Carol Perugini (SPT); Norm Merz (KTI); Lawrence Schwabe (CTGR); Laura Tesler (ODFW); Paul Dahmer and John Pierce (WDFW); Dwight Bergeron (MFWP); Greg Servheen (IDFG); Peter Paquet (NPCC); David Byrnes (BPA); Chase Davis (UCUT); Tom O'Neill (NHI); and Paul Ashley, and John Andrews (CBFWA). Tom Iverson (CBFWA) facilitated the WAC meetings and coordinated writing and edits to the document. This document has not undergone a formal approval process, and has not been approved by any decision making authority.

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CONTEXT FOR DEVELOPING THE COLUMBIA RIVER BASIN WILDLIFE MONITORING IMPLEMENTATION STRATEGY

Columbia River Basin Fish and Wildlife Program[1]

The Columbia is one of the great rivers of North America. Beginning at Columbia Lake, British Columbia, the main branch of the river travels 1,200 miles through ~~fourteen~~ dams before reaching the Pacific Ocean a ~~hundred~~ miles downstream from Portland, Oregon. Fed mostly by melting snow, the Columbia River drains a basin that spans seven U.S. states and a portion of southeastern British Columbia. In all, the Columbia and its tributaries run through climatic conditions and topography as varied as any river in the world—from alpine to desert to rainforest.

Salmon and steelhead runs, along with other native fish and wildlife in the basin, have declined significantly in the last 150 years. Recent years have seen a combined total of little more than a million upriver adult salmon and steelhead passing Bonneville Dam, many of these hatchery fish. Many human activities contributed to this decline, including land and water developments across the region that blocked traditional habitats and dramatically changed natural conditions in rivers where fish evolved.

These developments included the construction of dams throughout the Basin for such purposes as hydroelectric power, flood control, commercial navigation, irrigation, and recreation. Fourteen of the largest multi-purpose dams are on the mainstem Columbia; the mainstem Snake River adds another dozen major projects. Water storage in the Columbia River totals approximately 30 percent of the average annual runoff, which fluctuates from year-to-year depending on the snowpack. With its many major federal and non-federal hydropower dams, the Columbia and its tributaries comprise one of the most intensively developed river basins for hydroelectric power in the world. These river developments support the region's economic prosperity while having substantial adverse effects on the native anadromous and resident fish and wildlife of the basin.

The Northwest Power and Conservation Council (Council), an interstate compact agency of Idaho, Montana, Oregon and Washington, was established under the authority of the Pacific Northwest Electric Power Planning and Conservation Act of 1980 (Act). The Act directs the Council to develop a program to "protect, mitigate, and enhance fish and wildlife, including related spawning grounds and habitat, on the Columbia River and its tributaries … affected by the development, operation, and management of [hydroelectric projects] while assuring the Pacific Northwest an adequate, efficient, economical, and reliable power supply." The Act also directs the Council to ensure widespread public involvement in the formulation of regional power and fish and wildlife policies.

The Program's goals, objectives, scientific foundation and actions are organized in a "framework," an integrated approach to regional fish and wildlife mitigation and recovery. With the framework concept, the Council intends to bring together, as closely as possible, Endangered

1. See http://www.nwcouncil.org/library/2009/2009-09/Default.asp.

Species Act (ESA) requirements, the broader requirements of the Northwest Power Act, and the policies of the states and Indian tribes into a comprehensive Program with a solid scientific foundation. The Program includes a specific set of objectives, describes the strategies to be employed, and establishes a scientific basis. Thus, the Program guides decision-making and provides a reference point for evaluating success. The fundamental elements of the Program framework are:

- The vision, which describes what the Program is trying to accomplish with regard to fish and wildlife, in the context of other desired benefits from the river;
- The biological objectives, which describe the ecological conditions and population characteristics needed to achieve the vision;
- The implementation strategies, procedures, assumptions and guidelines, which guide or describe the actions leading to the desired ecological conditions; and
- The scientific foundation, which ties the Program framework together.

In other words, the vision implies biological objectives that set the strategies. In turn, strategies address biological objectives and fulfill the vision. The scientific foundation links the components of the framework, explaining why the Council believes certain kinds of management actions will result in particular physical habitat or ecological conditions of the basin and why the ecological conditions will affect fish and wildlife populations or communities in a desired way to achieve the vision.

DRAFT Monitoring, Evaluation, Research and Reporting Plan[2]

Since the first Program in 1982, the Council has emphasized an adaptive management approach. The use of adaptive management is important for the success of the Program, given the significant level of uncertainty as to whether any particular protection or mitigation activity will contribute to long-term sustained improvement in fish or wildlife adversely affected by the hydrosystem. This means, among other things, the need for a close and appropriate interaction between science and policy decision-making. Policy-makers must develop clear and conceptually consistent management actions and corresponding questions that focus on the uncertainties inherent in those actions. Scientists must help policymakers by explaining the current level of technical knowledge and the relative confidence level that the scientists have in that information, describing how best to monitor and address the uncertainties and framing the relative risks of the different policy options the science might present. Policy-makers must then manage the uncertainty and risk in making and adapting decisions.

In November 2009, the Council released a Draft Monitoring, Evaluation, Research and Reporting (MERR) Plan to ensure the Council's (Program) goals, objectives, and actions are monitored, evaluated, and reported in a manner that allows assessment and reporting of Program progress. To facilitate Program assessment and reporting, the draft MERR Plan consists of a Strategic Plan, Implementation Framework, as well as implementation strategies for anadromous fish, resident fish, and wildlife.

2. See http://www.nwcouncil.org/fw/merr/Default.asp.

The **Strategic Plan** focuses on the Council's research, monitoring, evaluation (RME) and reporting needs at the policy level. The Strategic Plan sets forth the purpose and expectations for RME and reporting implemented through the Program.

The **Implementation Framework** contains existing, modified and new processes for prioritizing and implementing RME and reporting at the programmatic level. The Implementation Framework describes how the various components of RME can be used to adaptively manage the Program and guides the development of standardized Implementation Strategies for anadromous fish, resident fish, and wildlife.

The three **Implementation Strategies**, Anadromous Fish Implementation Strategy, Resident Fish Implementation Strategy, and Wildlife Implementation Strategy, are being developed as separate appendices to the draft MERR Plan, providing additional guidance in prioritizing and implementing RME and reporting. The Implementation Strategies are being developed with regional partners, and will consider integration of regional products.

The draft MERR Plan provides general guidance on conducting and prioritizing RME and reporting conducted through the Program. To be successful, the draft MERR Plan needs to be incorporated into the implementation process of the Program. To facilitate evaluating how the draft MERR Plan is being considered and incorporated in the implementation process, implementation strategies for RME need to be developed.

The implementation strategies provide a unique opportunity to summarize strategies used in conducting RME and reporting through the Program in a single location. These implementation strategies should be considered as a refinement of existing RME and reporting approaches in the Basin that will evolve over time. Therefore, similar to the process used in developing the Anadromous Salmonid Monitoring Strategy component of the Anadromous Fish Implementation Strategies, managers conducting RME and reporting should coalesce their RME and reporting strategies as feasible. This effort will provide a basinwide context for RME and reporting, which will facilitate communicating the Basin's strategy for implementing the Program as well as providing context for ISRP review of the Program and its projects. Ultimately, these implementation strategies should provide sufficient guidance to ensure that the data sharing and aggregating necessary for evaluating and reporting on the Program occurs, as well as meeting the assessment needs of other processes recognized by the Program, such as assessments for recovery plans and biological opinions.

Implementation strategies should be refined as needed to ensure alignment with the guidance provided in the Program and in the draft MERR Plan. This guidance includes, but is not limited to, the draft Council management questions, Council indicators, the Program's biological objectives, Program's performance standards as they become available, the draft MERR Plan's prioritization scheme, and the draft MERR Plan's research and monitoring approaches. Further, implementation strategies should incorporate, as appropriate, information from ISRP and ISAB reports, RME products collaboratively developed by the region, and other sources of expertise, such as those listed in the 2009 Program measures and in the draft MERR Plan's Appendix 5. Implementation strategies should emphasize a rigorous application of the scientific method, as well as an active adaptive management versus a passive approach to learning when conducting

research or monitoring. Lastly, the development of implementation strategies should include discussions and coordination with action implementation project proponents to ensure adequate levels of actions are implemented to enable effectiveness evaluation.

Implementation strategies should include the following elements:

1. Description of management questions and indicators the strategy aims to address,
2. Objectives and performance standards used to assess progress,
3. Prioritization criteria and rational,
4. Identification of priorities,
5. Standards for data quality, including precision and accuracy,
6. Preferred study designs and statistical analyses,
7. Performance measures and protocols, and
8. Data management, data sharing, and reporting approach.

As informal strategies, the Council does not expect any of the regional partners to formally adopt these strategies.

Wildlife Monitoring Implementation Strategy

In 2009, the fish and wildlife managers directed the Columbia Basin Fish and Wildlife Authority (CBFWA) and staff to support and facilitate coordinated basinwide assessments for the purpose of evaluating the status of the species and implementation of strategies to help determine success of the Fish and Wildlife Program. Due to the overlap in work priorities and planning activities, CBFWA staff and Council staff worked together to coordinate their separate efforts to implement the CBFWA work plan and to develop implementation strategies to address the Council's draft MERR Plan. It was agreed that the CBFWA technical committees would initiate the development of Implementation Strategies described in the draft MERR Plan, with the Council staff joining the effort as it progressed to ensure participation by non-CBFWA entities and relevance to the Program of the final products. This approach was consistent with the goal of the draft MERR Plan to assess the progress of the Program while avoiding duplication of monitoring efforts, in the most cost effective way. The Council will ultimately be responsible for the Implementation Strategies, based on the recommendations by the fish and wildlife managers; however, the CBFWA Members and other co-managers require these strategies to support the Status of the Resource Report and their own decision processes.

The wildlife co-managers have been working on the framework for this initial draft Wildlife Monitoring Implementation Strategy (WMIS) since the fall of 2009, consistent with Programmatic Issue #3 of the Council's Wildlife Category Review funding recommendations[3]. Developing relevant high level indicators for wildlife within the context of the Council's Program has been a challenge and will require continued discussion and coordination into the future among the wildlife managers, BPA, and Council. This WMIS is the first iteration, and will continue to develop and expand over time to include additional HLIs as they are adopted by the Council (i.e., Ecosystem Health).

3 See http://www.nwcouncil.org/fw/budget/2010/decision_wildlife.pdf.

COMPILING WILDLIFE INFORMATION AT THE COLUMBIA RIVER BASIN SCALE

Council Management Questions and High Level Indicators

On October 7, 2009 the Council adopted three High-Level Indicators (HLI) to communicate to Congress on the biological and implementation progress accomplished by the Council's Fish and Wildlife Program.[4]

The Council approved the following three HLIs:

1. Abundance of Fish and Wildlife,
2. Hydrosystem Passage and Survival; and
3. Council Actions.

The Council chose to postpone its decision on the fourth HLI, Ecosystem Health, until it is defined more clearly.

The lists of indicators are not static; rather these lists are intended to evolve over time. The data incorporated by the indicators are obtained from numerous sources throughout the Basin, not just Program-funded data, ~~in order~~ to provide the broadest and most accurate overview of the Basin's fish, wildlife, and habitat characteristics (i.e., Biological Indicators). Hence, the Biological Indicators also reflect the work and progress made by other fish and wildlife entities in the Basin. It is important to recognize that reporting these indicators will not only require coordination with activities that occur outside of the Council's Program, but will also require effort beyond the scope of the existing wildlife projects funded through the Council's Program. The remaining indicators, Implementation Indicators, report on specific actions implemented through the Program.

The indicators provide the Council with information on issues that may require policy decisions and highlight aspects of the Program that should be modified to improve the Program's effectiveness. For example, if an indicator suggests that a specific RME project or group of actions are not making progress towards the stated objectives and performance standard, then the Council may propose to modify or terminate that action or group of actions.

Starting in 2010, the Council will report on the status of the Program's HLIs. The FWIs will be reported through the Columbia River Basin Fish and Wildlife Authority's Status of the Resource report and website. Performance standards used to track progress towards the Program's objectives will also be used to give context to the reported HLIs and FWIs information.

Types of Monitoring

According to the Draft MERR Plan, for purposes of this Implementation Framework monitoring is grouped into three types that are further described and defined in the subsections below:

4. See http://www.nwcouncil.org/fw/program/hli/Default.htm.

1. Compliance and Implementation Monitoring;
2. Status and Trend Monitoring; and,
3. Effectiveness Monitoring.

Compliance and Implementation Monitoring

All actions and projects implemented through the Program must conduct compliance and implementation monitoring. Compliance and implementation monitoring are essential to maintain Program accountability. Per the Pacific Northwest Aquatic Monitoring Partnership, compliance and implementation monitoring are defined as:

> Compliance Monitoring - tracking compliance with established laws, rules, or benchmarks. However, compliance monitoring has also been used in reference to post monitoring of implemented projects to see if they are still functioning as they were designed or intended. Compliance monitoring is also known as post-implementation monitoring.
>
> Implementation Monitoring - monitoring of management actions to determine if they were implemented properly or comply with established standards. This is normally associated with a restoration project where an engineered solution has been constructed, or where a best management practice has been implemented. Implementation monitoring documents the type of action, the location, and whether the action was implemented successfully. It does not require environmental data and is usually a low-cost monitoring activity.

The compliance and implementation data needed for Program performance generally consist of information that project proponents already collect for reporting in Bonneville's PISCES database. The information gathered for these processes will be made available through the appropriate Bonneville database, and will be consulted as needed during the Council's project review process. Compliance and implementation monitoring is not addressed further in this monitoring strategy.

Status and Trend Monitoring

Status monitoring characterizes existing conditions that can be used as a baseline for future comparisons. Trend monitoring measures specified parameters at predetermined time or space intervals ~~in order~~ to assess change in status over time. The regionally accepted definition for status and trend monitoring, per the Pacific Northwest Aquatic Monitoring Partnership is:

> Status and Trend Monitoring - to estimate the status of fish populations and watershed conditions, and to track over time indicators of habitat, water quality, water quantity and other factors that affect watershed health. The spatial scale is large and varies from watershed scale (HUC 6), to ESUs, to the entire Pacific Northwest.

Though the above definition comes from a fish perspective, it can be easily modified to include wildlife populations and their habitats. For the purposes of this WMIS, status and trend

monitoring will estimate the status of wildlife populations and their habitats via vegetation cover type and to track, over time, indicators of quantity of habitat, functional diversity, connectivity, threats, and other factors affecting the habitat suitability for wildlife.

The Council gives higher priority to status and trend monitoring contributing to:

- Assessment of the effectiveness of Program implemented actions.
- Basinwide, or other relevant high level summary, such as population and/or focal habitats and their status and trend data.
- Status and trend assessment for Program priorities.

The Council expects project proponents to collaborate on the collection of status and trend data to enable data sharing and to facilitate determination of status and trend(s) at the appropriate scale, e.g., population, evolutionarily significant unit (ESU) for salmon. For wildlife, this equates to focal species and habitat or vegetation cover type. Keeping in mind that Council and BPA policy is to limit monitoring of habitat projects to a soft cap of 5% of total funding; collecting, managing and sharing data relative to status and trend monitoring for wildlife and their habitats will require a basinwide coordination project to adequately support the Council's HLIs.

Effectiveness Monitoring

Effectiveness monitoring consists of both project scale effectiveness and action effectiveness monitoring. The regionally accepted definitions for these two types of effectiveness monitoring, per the Pacific Northwest Aquatic Monitoring Partnership are:

> Project scale effectiveness monitoring - is conducted by projects implemented at a fine scale, with defined sets of actions intended to protect or enhance specific habitat features or habitat-forming processes. Effectiveness monitoring at the project scale measures environmental parameters to ascertain whether the actions implemented achieved a desired change in habitat conditions. For wildlife, the accepted metric is Habitat Units measured according to the Habitat Evaluation Procedures process or the Combined Habitat Assessment Protocol method.
>
> Action effectiveness monitoring - attempts to establish "cause and effect" or inferential relationships between wildlife, habitat conditions, and/or management actions. It pertains to evaluation of projects and programs meant to enhance habitat conditions with the intent to increase wildlife use. These studies can be complex and technically rigorous, and often require measuring many parameters under a very structured statistical design to detect the variable affecting change.

Project Effectiveness monitoring is critical for adaptively managing the Program at the project and action level. Assessment of project effectiveness will be conducted through the ISRP review of projects. To facilitate this assessment, project proponents should ensure that data are collected for the appropriate metric(s) and approved by the ISRP during an earlier review of the project. If an action or project fails to perform as intended, the Council may recommend modifying or terminating the action or project as necessary.

Action Effectiveness monitoring is critical for assuring that actions implemented through the Program are having the intended biological effects and avoiding unintentional consequences. To achieve this, the Council can recommend implementation of actions with proven effectiveness, such as actions strongly supported by relevant peer reviewed studies, or the Council can support RME work necessary to determine the effectiveness of these actions. The effectiveness of an action type can be evaluated by assessing whether a single action, similar actions implemented across several locations, or a diversity of actions implemented in a specific location are achieving the desired biological result. As resources available for implementing the Program are limited, action effectiveness monitoring should concentrate on actions implemented through the Program and should focus on assessing the highest relevant level of response, such as at the habitat change-level. In addition, when detection of the effectiveness of an action requires a long-term commitment, implementation on a large scale, and/or a high level of sampling intensity, the effectiveness monitoring should maximize the use of a coordinated approach at the appropriate landscape scale.

The Upper Columbia Monitoring and Evaluation Project, BPA Project Number 2008-007-00, is implementing a pilot effort to determine if action effectiveness for wildlife mitigation projects can be efficiently and effectively implemented across a broad landscape. The Upper Columbia Untied Tribes have identified the need to continue to implement wildlife monitoring and evaluation (M&E). Using the Albeni Falls Dam Wildlife Monitoring and Evaluation Plan, the Tribes have pooled 5% of their individual contract resources to initiate a regional perspective to M&E. This approach has been reviewed and endorsed by the ISRP and will be closely linked to past work completed between 2001 and 2006 by the Kalispel Tribe. This approach uses a habitat based approach comparing species guild and vegetation data to determine habitat quality based upon a reference site or desired future condition. Small mammal, breeding bird, amphibian, and vegetation are the four areas of data collection used to build a description of the reference site over a three year period. Once the baseline is completed, permanent sites are selected on each of the managed parcels and data from them is compared against the reference to describe each habitat types' similarity to the reference site. Each permanent sample point is generated randomly and revisited on varying time frames to track changes toward the reference site. Once restoration or passive management is complete and habitat types are showing strong similarity to the reference condition, the active portion of mitigation would be considered completed and the actions a success. Information from this analysis will be stored in a common database and developed to be accessed via a web interface. This information will be used to adaptively manage each project and techniques used to restore, enhance, or manage each area and habitat type. This approach will reduce costs, increase continuity of data collection, data interpretation, data presentation, and data collection methods.

Several other wildlife projects in the Columbia River Basin are implementing innovative monitoring methods and strategies and some of these include:

Ecological Integrity Assessments: Monitoring and Evaluation of Wildlife Areas in Washington:

~~In order to~~ make informed management decisions aimed at maintaining or protecting ecological integrity, credible data on how human activities affect the chemical, physical, and biological

integrity of ecological systems needs to be collected. Indicator-based (ecological endpoints) approaches to assessing and reporting on ecological integrity are now being used by numerous organizations to assist with regulatory decisions to set mitigation performance standards and to set conservation priorities. (excerpt from http://wdfw.wa.gov/publications/01314/)

The Ecological Integrity Assessment (EIA) method aims to measure the current ecological integrity of a site through a standardized and repeatable assessment of current ecological conditions associated with the structure, composition, and ecological processes of a particular ecological system. These conditions are then compared to those associated with sites operating within the bounds of their natural range of variation. Recognizing that EIAs are essential tools for monitoring and evaluating these resources, the WDFW contracted with the Washington Natural Heritage Program to adapt the EIA method (Faber-Langendoen et al. 2009a) as an approach for developing standards and a monitoring protocol for measuring desired ecological conditions on State Wildlife Areas. The draft document presents a framework in which the EIA can be used to achieve those objectives. The document (1) describes the EIA method; (2) provides an overview of how the EIA will be used within the context of a multi-scaled monitoring program; and (3) describes how the EIA approach will be applied to wildlife areas in Washington.

The Kootenai River Floodplain Ecosystem Operational Loss Assessment, Protection, Mitigation, and Rehabilitation project, BPA Project Number 200201100:
The Kootenai River Floodplain Ecosystem Operation Loss Assessment project applies a structured series of biological and ecological evaluations to a post-impoundment large river-floodplain ecosystem as part of a multidisciplinary, adaptive management approach to determine and quantify floodplain ecosystem function losses due to operation of Libby Dam, in the context of other ecological perturbations such as levee construction and floodplain loss. The Kootenai Tribe of Idaho project involves: 1) characterizing past and present hydrological, biological, and ecological conditions involving a large number of abiotic and biotic metrics, analyses and models, 2) constructing a series of abiotic and biotic Indices of Alteration or Integrity (IBIs); and 3) addressing the need to establish a regionally accepted, transferable framework for operational loss methodologies and assessment based on standardized quantitative ecological functions and conditions. Multimetric indices integrate multiple biological attributes (called metrics) to describe and evaluate the condition of a ~~local~~ where data are collected. Metrics are chosen on the basis of whether they reflect specific and predictable responses of organisms to habitat alteration and human activities. The first successful application of the multimetric concept to biological systems (index of biological integrity, or IBI) occurred in freshwater systems (Karr 1981), and the concept has since been adapted for use in upland environments (e.g., Bradford et al. 1998, Karr and Chu 1997). This method measures biotic integrity using a variety of metrics – trophic level, species richness and abundance of taxa. The index of biotic integrity assesses the relative condition of each sample site along a scale of effects. This approach can also be useful in indicating the ecological integrity of an ecosystem. Determining the extent to which ecological systems are experiencing anthropogenic disturbance and change in structure and function is critical for long term conservation of biotic diversity in the face of changing landscapes and land use. The ability to assess status and trends in the condition of ecosystems at specific locations or over broad geographic regions can allow identification of existing problems prior to a crisis. Yet the complex and diverse nature of ecosystems necessitates the use and appropriate validation of

some restricted set of indicators of biological condition (i.e., IBI) to allow efficient monitoring of a broad range of systems.

Habitat and Biodiversity Information System for Columbia River Basin, BPA Project Number 2003-072-00:
This project is based upon the Wildlife Habitat Relationships in Oregon and Washington book (Johnson and O'Neil 2001), which was supported by more than 40 organizations was an outgrowth of the Spotted Owl management issues that occurred in the early to mid-1990s. This book serves as a principal source for standardizing wildlife names, along with relationships with habitat types, structural conditions, and key environmental correlates (i.e. fine feature habitat elements). The collection of data sets that this project uses are called IBIS (Interactive Biodiversity Information System) and are recognized as a regional information system. IBIS has been valued by other organizations as a "Key Informational Source for the Northwest" by National Biological Information Infrastructure, as "Best Available Science" by the Office of Community Development in Washington State, and as "Best Practices" by the Ash Institute-Harvard University. IBIS also includes a spatial component to habitat (mapping) and species range maps based off of the Atlas of Oregon Wildlife (Csuti, O'Neil, Shaughnessy, Gaines, and Hak (2001) and other sources).

Considerations for Wildlife

The Council adopted High-Level Indicators specific to wildlife (Table 1). To communicate the Program's progress to Congress, governors, and the public, the Council approved two lists of indicators; a list of High Level Indicators (HLI) and a list of Fish and Wildlife Program Indicators (FWI), which is related to the Council's working list of management questions. The indicators were selected as a means of conveying a complex message in a simple and useful manner. HLIs summarize the information believed to be of most interest to Congress and Pacific Northwest Governors. FWIs summarize a broader spectrum of information believed to be of interest to Columbia River Basin Fish and Wildlife managers and the public.

Reporting high level indicators for wildlife, at the scale of the Columbia River Basin, is a daunting challenge. The impact of the BPA funded wildlife mitigation projects, while significant, may not be detectable within the environmental noise of such a large landscape. Individual wildlife populations are generally highly migratory, and trends in population size is not an appropriate indicator of Program success as species ranges are far greater than the individual project areas, and in many cases far greater the Columbia River Basin. Habitat quantity and quality is the currency for implementation of the BPA funded wildlife mitigation program and should be taken into account when developing HLIs for areas within the Program influence.

For two years the wildlife managers have been discussing possible means for addressing wildlife high level indicators for the Program. The wildlife managers explored several existing landscape scale frameworks that rely on habitat as the metric for population health. Habitat is determined by seeing vegetation groups and environmental correlates (i.e. fine feature components) thru the eyes and lives of wildlife. That is, we can delineate flora at a finer scale than we can the fauna associated with it. Thus, the wildlife managers settled on two data sources to report HLIs, one

based on the National Vegetation Classification System (NVCS) and the other on the region's wildlife habitat types as determined by Johnson and O'Neil (2001). The first criterion for an appropriate framework was that the approach provided the ability to roll data up or down and was flexible enough to work with both vegetation classes and habitat types. The system had to be equally applicable across the Columbia River Basin and supported by quantitative metrics (independent variables) to support statistical analyses and measurable responses; both data sources allow this. The system also needed to have sufficient data layers and data available to support long term implementation. If multiple classification schemes are chosen, they must be able to crosswalk by the user into a common scheme, currently called the Pacific Northwest Habitat Classification System (PHaCS). The PHaCS currently crosswalks 60 fish and wildlife classifications that are used within the Columbia River Basin to wildlife habitat types, structural conditions and key environmental correlates.

Currently the individual wildlife projects funded through the Council's Program do not collect data to support landscape scale status and trend data consistent with this framework. The Northwest Habitat Institute project, Interactive Biodiversity Information System, currently performs part of this function for the Program but has not been adequately funded to support reporting of the Council's HLIs as envisioned here.

In an effort to update the Council's list of indicators, specific comments/edits to the list of wildlife high level indicators are provided in italics in Table 1 based on the wildlife co-managers discussions.

Table 1. – Northwest Power and Conservation Council's (Council) High Level Indicators Table approved by Council October 7, 2009 edited to reflect management questions and indicators relevant to wildlife (http://www.nwcouncil.org/fw/program/hli/2009_10.htm). Wildlife manager comments have been added in italics and strike-through.

Approved by Council October 7, 2009 Council Meeting			**Additional information on the indicators**
Draft Fish and Wildlife Program Management Questions	**High Level Indicator**	**Fish and Wildlife Program Indicator**	**Potential Performance Measures Indicators**
	(Council Report to Congress)	(Recommended for SOTR)	(suggestions for HLI reported to Congress marked as "(Congress)")
Biological Indicators			
Are Columbia River Basin fish and wildlife abundant, diverse, productive, spatially distributed, and sustainable?	**Abundance of Fish and Wildlife**	Wildlife species abundance and diversity in the Columbia River Basin	Abundance over time of wildlife critical species that have a strong association with salmon *(need to ID species)*
			Functional critical wildlife species diversity over time
			State agencies bird species diversity and breeding pair counts
		ESA listed or non-listed status and trend of fish and wildlife in the Columbia River basin	List *wildlife species listing* status as reported by ~~NOAA &~~ USFWS, States, and Tribes ~~for fish and wildlife~~
			ESA listed Wildlife population is increasing, decreasing, or stable in abundance
Implementation Indicators			
Are the fish and wildlife losses associated with the development and operation of the Columbia River Basin's hydrosystem being mitigated as described by the Council's Fish and Wildlife Program? (added Nov 2010)	**To be developed**	Define indicator for wildlife losses	TBD
Are Council program actions coordinated within the program and with other programs?	**Council Actions**	Wildlife habitat units acquired relative to loss by dam.	Annual Total minimum estimated and credited Habitat Unit (HU) acquired summed across all key species and dams (Congress)

Approved by Council October 7, 2009 Council Meeting			**Additional information on the indicators**
Draft Fish and Wildlife Program Management Questions	**High Level Indicator** (Council Report to Congress)	**Fish and Wildlife Program Indicator** (Recommended for SOTR)	**Potential Performance Measures Indicators** (suggestions for HLI reported to Congress marked as "(Congress)")
			Cumulative HU to-date summed across all key species and dams (Congress)
			Annual and cumulative number of acres per habitat type protected on purchased and leased land for salmon, steelhead, resident fish and wildlife (Congress)
		Amount of land receiving actions aimed at improving habitat for fish and wildlife	Annual and cumulative number of ~~miles improved for salmon, steelhead, resident fish and wildlife~~ *acres per wildlife habitat type improved or protected by management* ~~by one or many of these~~ actions *(e.g.,* increasing ~~instream~~ habitat complexity, removing *invasive* vegetation, planting vegetation, fencing, ~~spawning gravel,~~ as well as realigning, connecting, and/or creating ~~a channel~~ *habitat).*
			~~Annual and cumulative number of acres per habitat type improved for salmon, steelhead, resident fish and wildlife by removing vegetation, planting vegetation, erosion and sedimentation control, control burn, enhance floodplain/remove modify, breach dike, as well as realigning, connecting, and/or creating a channel.~~

Since the primary monitoring and reporting tool currently used for BPA funded wildlife mitigation projects is the Habitat Evaluation Procedures (HEP) method, the co-managers investigated how well HEP data would fit within the NVCS framework. The co-managers agree that early HEP efforts and results were inconsistent; however, current sampling methods, protocols, and data collected by the Regional HEP Team (BPA Project 2006-006-00) are consistent and rigorous when compared to earlier HEP efforts. The wildlife managers agree that habitat suitability index (HSI) models are not the preferred method for some monitoring and analysis of floral and faunal communities, and the long employed, scientifically based, vegetation survey methods should form the foundation for the Basin monitoring efforts. This approach is not only used by the Regional Habitat Team by also adopted by CHAP or Combined Habitat Assessment Protocols, and UMEP project. Using both the national vegetation and regional habitat type classifications would provide the best fit for a basinwide framework to support the draft MERR Plan. The managers also found that the functional point of the NVCS framework was at the Group level, and appearing equivalent to some of the ecological systems identified in the region. Data can roll up to a higher level (i.e. wildlife habitat type) or parsed to a lower level (i.e. plant association(s), see Figure 1). But for high level indicators, the vegetation group and wildlife habitat type levels appear to be right and are the most useful in terms of mapping. This framework is also consistent with priority habitats from Subbasin Plans (Appendix B).

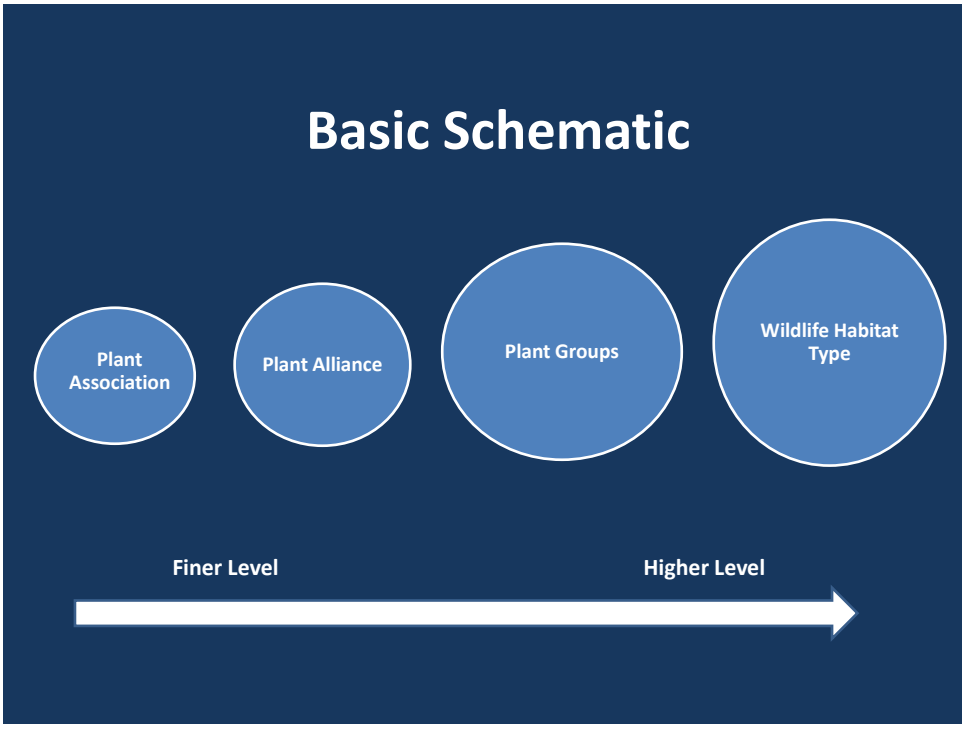

Figure 1. Schematic of vegetation rolling up to report high-level indicators for groups and habitat types

Existing Plans: Legal and Scientific Guidance

The high-level elements proposed here are meant to serve a wide-ranging scope of needs, as identified by various Council's reviews, workshops, regional authorities and reports; including: the Pacific Northwest Electric Power and Planning and Conservation Act[5], the ISRP Retrospective Report(s)[6], the Fish & Wildlife Basin-level Wildlife Objectives[7], the NOAA Fisheries FCRPS Biological Opinion Reasonable and Prudent Alternatives[8], and data management in support of the Fish and Wildlife Program. The Pacific Northwest Electric Power and Planning and Conservation Act address the inclusion of fish and wildlife agencies and tribes into the planning for the region. Specifically, it calls for: 1) coordination of fish and wildlife management and research and development [*839b(h)(2)(c)*], and 2) base and support programs with the best available scientific knowledge [*839b(h)(6)(a)*]. The Act also calls for the development and implementation of a fish and wildlife program and to take into account at each relevant stage of decision-making processes the program adopted by the Council [*839b(h)(d)(i)* and *839b(h)(11)(a)(ii)*]. The Council has developed and adopted a plan called, Columbia River Basin Fish and Wildlife Program: 2009 Amendments (Program).

In the Program there are several statements that directly support the reporting of habitat information as proposed, specifically: (A) an *underpinnings of the program is that it is habitat based* – focal habitats have been identified and selected via the subbasin planning process (Appendix B), (B) *achieving a vision for multi-species during a time of multi-objectives requires coordination of information and actions, which calls for an appropriate structure to be in place from which to plan and coordinate* – the current basinwide program in place to acquire and report the high-level information for wildlife habitat is the Northwest Habitat Institute's IBIS project[9] because its data tie to the basin, province and subbasin scales. (C) *making information readily available is a specific strategy of the program plan* – it states " Dissemination of data via the Internet: The Council will initiate a process for establishing an Internet-based system for the efficient dissemination of data for the Columbia Basin. This system will be based on a network of data sets, such as Streamnet, Northwest Habitat Institute, Fish Passage Center…. the function of each data site, or module will be clearly articulated and defined.", (D) *implementing subbasin plans is a principal portion of the program plan* – subbasin planning brings together multiple agencies, objectives, plans and ideas with the hope of developing a collective vision that incorporates joint biological objectives and strategies. Currently, IBIS makes information available to subbasin planners in part because the data sets have been collaboratively developed, peer reviewed, and have defined terminology. IBIS also served as regional technical support for the subbasin planning process, with 59 subbasins incorporating its information into their plans. The foremost purpose for developing IBIS is to build a common understanding of fish and wildlife resources for better management.

In the ISRP Retrospective Report (footnote 5), there are several places that support the continued development of IBIS and its associated modules. Specifically, under Wildlife Monitoring and

5. See http://www.nwcouncil.org/library/poweract/default.htm.
6. See http://www.nwcouncil.org/library/isrp/isrp2005-14.htm.
7. See http://www.nwcouncil.org/library/2009/2009-09/Default.asp.
8. See http://www.salmonrecovery.gov/BiologicalOpinions.aspx.
9. See project description in Taurus at http://www.cbfish.org/Project.mvc/Display/2003-072-00.

Evaluation (p.35), they voiced a concern "that monitoring and evaluation of wildlife projects and programs should not rest solely on a HEP-based analysis." This concern was also reiterated under the Wildlife Section (p.72&73). They also recommend that the fish and wildlife elements be fully integrated in continuing the development of Subbasin Plans by emphasizing "coordination, subbasin-scale planning that integrates habitat, wildlife, fish goals, and that incorporates explicit consideration of ecological relationships, including linkages amongst multiple populations of fish, wildlife and their habitat" (p.75&76, also in Technical Guide for Subbasin Planners, Council Document 2001-20). Additionally, the ISRP recommended that data of all projects be made available via the regional database projects (p.31), which IBIS is. Finally, the ISRP also supports the need for habitat mapping when it states, "develop a sound census monitoring procedure for trend, based on remote sensing, photography and data layers in GIS. The ISRP's Programmatic report on Wildlife Issues[10] stated that remote sensing can be used to track changes in canopy cover, forest composition, and other potentially useful measures of landscape change (p. 19).

HU Reporting

The rationale to continue to report Habitat Units is supported by the Fish and Wildlife Program Basin-level Wildlife Objectives. Specifically, the Council's basin-level objectives are to mitigate wildlife losses based on the premise that development and operation of the hydrosystem resulted in wildlife losses through construction and inundation losses, direct operational losses or through secondary losses. The program has included measures and implemented projects to obtain and protect habitat units in mitigation for these calculated construction/inundation losses. Operational and secondary losses have not been estimated or addressed. The program includes a commitment to mitigate for these losses. Specific wildlife objectives that require tracking HUs are:

- Basin-Level Wildlife Objective 1 - Quantify wildlife losses caused by the construction, inundation, and operation of the hydropower projects.
- Basin-Level Wildlife Objective 2 - Develop and implement habitat acquisition and enhancement projects to fully mitigate for identified losses.
- Basin-Level Wildlife Objective 3 - Coordinate mitigation activities throughout the basin and with fish mitigation and restoration efforts, specifically by coordinating habitat restoration and acquisition with aquatic habitats to promote connectivity of terrestrial and aquatic areas.
- Basin-Level Wildlife Objective 4 - Maintain existing and created habitat values.
- Basin-Level Wildlife Objective 5 - Monitor and evaluate habitat and species responses to mitigation actions.

Population and Habitat Reporting

In 2009, Wildlife Habitat Relationships in Oregon and Washington book was adopted as part of the Council's Amendment process to the Fish and Wildlife Program.[11] Regarding acquiring

10. See http://www.nwcouncil.org/fw/budget/2010/isrpprogrammatic.pdf.
11. See http://www.nwhi.org/index/publications#Wildlife Habitat Relationships in Oregon and Washington.

wildlife population data, the WMIS will initially rely on Citizen Science involvement and federal, state, and tribal data sets to fill in wildlife information. Examples of a couple of programs that rely on Citizen Science are the USFWS Breeding Bird Surveys[12], Audubon's Christmas Bird Count[13] and Partners-In-Flight[14] efforts.

COMPLETION OF WILDLIFE MONITORING IMPLEMENTATION STRATEGY

Framework: Basinwide Strategies

Introduction:

To report High-Level Indicators requires developing a consistent set of habitat data for both fish and wildlife. The need is obvious: without a consistent set of habitat elements and definitions to consider and use, organizations develop their own. In so doing, comparisons of findings becomes difficult, and hinders the development of a unified ecological picture. Currently there are well over 60 different habitat classifications in use within the Columbia River Basin. Examples of wide-ranging and inconsistent classification systems currently in use were highlighted during a recently survey of the natural resource agencies and organizations within the Columbia River Basin. More than 65 people were contacted and more than 30 currently used habitat classifications were recorded. Some of these are: Potential Natural Vegetation of the Conterminous United States (Kuchler 1964), Fisheries and Oregon Estuarine Habitat Classification System (Bottom 1979), Classification of wetlands and deepwater habitats of the United States (Cowardin et al. 1979), Forest Habitat Types of Northern Idaho (Cooper et al. 1991), A Hierarchical Approach to Classifying Stream Habitat Features (Hawkins et al. 1992), Washington Gap (Cassidy et al. 1997), Montana Gap (Redmond et al. 1998), Idaho and Western Wyoming Gap (Homer 1998), Oregon and Washington Wildlife Habitats (O'Neil and Johnson 2001), Oregon Gap (Kiilsgaard et al. 1999), Oceans, Canada: Sensitive Habitat Inventory Mapping (Mason and Knight. 2001), USGS's National Land Cover Database (2001), ODFW Aquatic Inventories Project (Moore et al. 2002), NatureServe's A Working Classification of U.S. Terrestrial Systems (Comer et al. 2003), USGS's National Vegetation Classification System (2008) and the U.S. Forest Service has several including: Field guide for Forested Plant Associations of the Wenatchee National Forest (Lillybridge et al. 1995), A Structural Classification for Inland Northwest Forest Vegetation (O'Hara et al. 1996), Pacific Northwest Ecoclass Codes for Seral and Potential Natural Communities (Hall 1998), and Classification and Management of Aquatic, Riparian, and Wetland Sites on the National Forests of Eastern Washington: Series Description (Kovalchik and Clausnitzer 2004).

Given this wide variety of classification systems, the need exists to incorporate a consistent and transferable language in data management for wildlife habitat. The principal stated purpose in the peer-reviewed text, Wildlife-Habitat Relationships in Oregon & Washington (Johnson and O'Neil 2001), is that wildlife-habitat information should be compiled in such a way that management decisions are built on a common understanding. This is accomplished by focusing

12. See https://migbirdapps.fws.gov/mbdc/databases/db_selection.html.
13. See http://birds.audubon.org/christmas-bird-count.
14. See http://www.partnersinflight.org/.

on habitat, while creating a consistent language in regards to its terms and assessment for wildlife and fish. The wildlife managers agreed that Wildlife-Habitat Types according to Johnson and O'Neil classification should be reported along with broadest vegetation classification that is being used, which is the National Vegetation Classification System (USGS 2008).

Purpose- One of the best methods to gauge human and natural influences on our environment is to evaluate landscapes and the populations that reside within them to determine the amount of change. We live in a dynamic world where the only constant seems to be change. Knowing the rate, amount and location of change can provide valuable information to planning and monitoring programs and resource management. That is, periodically checking in and obtaining this information will lend context to a principal objective of the Council's Fish and Wildlife Program, which is to answer the question: How effective are our actions?

Scale: Understanding scale is an important concept because various environment components within a landscape require multi-scale approaches. For instance, regarding habitat types, habitats that cover large expanses like shrub-steppe can be mapped at a coarse scale while fine feature habitats such as riparian habitat require an intermediate to fine scale for detection of change (Figure 2).

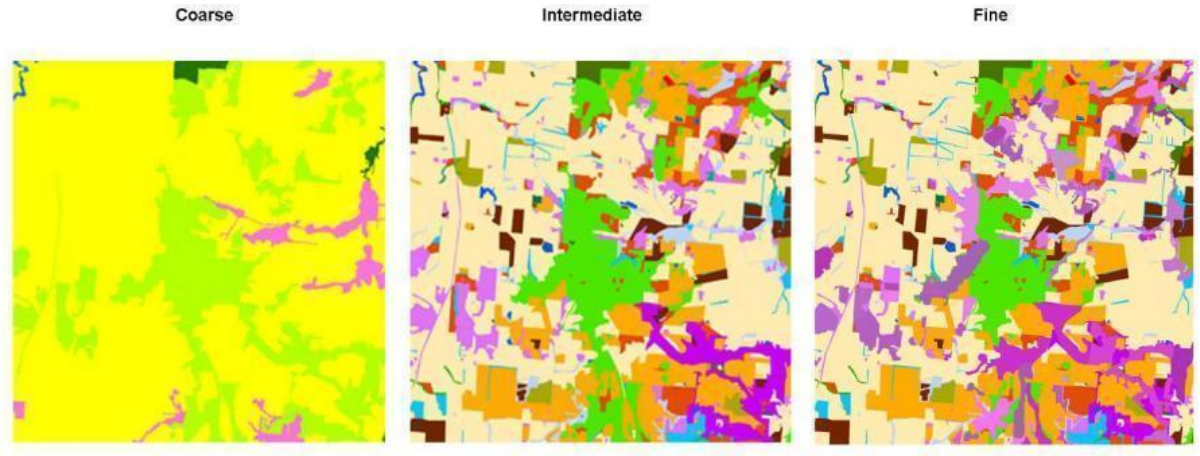

Figure 2. Example of mapping at various hierarchical scales that combines both a wildlife habitat classification scheme and relational databases.

Each HLI has a relative importance based on the scale on which it is measured and reported.

By combining the use of aerial image interpretation and extensive ocular surveys of forested oak and riparian stands, it is possible to map the quantity and distribution of these high-level indicators on a continual basis. The National Agriculture Imagery Program (NAIP) program run by the Farm Service Agency routinely captures high resolution imagery every few years.

Satellite remote sensing has been the traditional source of subbasin wide habitat and vegetation maps for several decades ~~now~~. The reduced costs associated with large scale remote sensing efforts have been the main driver for this. However, many of the focal habitats ~~that are being~~ identified for use as high-level indicators (such as riparian forests, or particular species compositions like oak woodlands) are not well defined using 30 meter pixels. Recent advances in GIS technologies allows for the capture of small spatial areas, (~2 acre MMU) using NAIP imagery and targeted field visits. Once a subbasin has undergone initial mapping, subsequent dates of NAIP imagery can be used to detect where changes have occurred and field visits can then be targeted to identify these changes. Other areas that do not experience change in a given cycle can be revisited with an ocular survey on a much more extended frequency, for instance every 5 y.

When these high-level indicators are mapped, and then the map itself is maintained in an ongoing basis, a wealth of information becomes available. The datasets become 'living', if you will, growing and reducing as needed to reflect real world conditions. As the datasets grow, they will be able to become 'time-aware', that is containing the knowledge of not only that change occurred, but when that change occurred. This will help in understanding the intricate processes that control our upland and aquatic regimes. The ability to monitor these indicators will also help coordination between projects and to provide protections for our valuable natural resources. Especially important is how the information can be dovetailed to support not only upland wildlife projects, but also to relieve the burden of upland riparian data collection for fish related projects, an area not necessarily within fishery biologists' expertise.

Figure 3 below depicts an area where a conservation easement was purchased by BPA in conjunction with the McKenzie River Trust on the Green Island property just north of the confluence of the McKenzie and Willamette Rivers in the Willamette Valley, Oregon. As the photos show, considerable change in the course of the river has been observed. This is a small sample of the numerous possible changes that can over a short time period (only five years between aerial photo surveys). In fact, the changes depicted in the photos actually occurred in only one or two years. Thus it is important not only to capture the locations and characteristics of riparian forest and other high-level indicators, but to also capture and characterize changes to these systems that are the true drivers to ecological integrity and degradation.

Figure 3. Change detection of riparian forests and hydrology changes using aerial imagery and field visits at Green Island.

In 2010, the NPCC chartered the Wildlife Crediting Forum to provide advice on the quantifying and accounting system (informally known as the Ledger) for the wildlife habitat mitigation credits associated with the construction and inundation impacts of the Federal Columbia River Power System (FCRPS) within the Columbia River Basin[15]. The database that currently houses the Ledger is called PISCES (BPA project accounting and management program/software[16]). The Forum consisted of wildlife co-managers representing the 14 tribes and 3 state fish and game departments (Oregon, Washington, Idaho) impacted by the FCRPS; and representatives of the U.S. Fish and Wildlife Service (USFWS), BPA, and BPA Customers. The State of Montana is not a Forum participant, as wildlife mitigation issues relating to FCRPS have been settled by prior agreement between BPA and that state. CBFWA and NPCC staff acted as advisors to the

15. See http://www.nwcouncil.org/fw/wcf/2011_09Report.pdf.
16. See http://efw.bpa.gov/contractors/usingpisces.aspx.

Forum. A private consulting firm was engaged to facilitate Forum processes and to provide for augmented technical analysis of the Ledger.

The Forum and several subcommittees met to address Program issues. Much of the Forum's early deliberations focused on the difficulty of coming to collective agreement on all issues posed by the Council's Fish and Wildlife Program. Crediting issues were found to differ depending on geographic area, specific hydropower projects, and the entities involved in specific crediting decisions. The methodologies involved in crediting decisions have also changed and evolved over time, been interpreted and applied in differing ways, and in some cases crediting has been resolved through individual project agreements. Reflecting on these factors, the Forum felt that the many technical and recordkeeping issues with the ledger, overlaid with unresolved policy issues, would make full resolution at the Forum level difficult, and decided that "agreements" were more likely to be an effective means of resolution. At the same time, the Forum indicated that the technical analysis of the ledger should continue ~~in order~~ to help resolve or make clear as many outstanding issues as possible. The Forum dedicated considerable effort over several months and while not every issue or dispute was resolved, and while significant anomalies remain, the commonalities developed by the Forum provide a solid basis for bringing this portion of the Program to a successful conclusion. Major areas of accomplishment include:

- Establishment of a ledger depicting the current status of Bonneville-funded wildlife mitigation activities;
- Development of Standard Operating Procedures for future applications of HEP;
- Development protocols for determining the amount of credit Bonneville should receive for management actions that occur on Federal lands;
- Development of protocols for determining the amount of credit that Bonneville should receive for fish mitigation projects that benefit wildlife; and,
- Acceptance of the Fish and Wildlife Program loss assessments as the agreed upon measure of wildlife losses.

However, several policy-related issues remain unresolved including:

- Agreement on the application of the crediting ratio established in the Fish and Wildlife Program;
- Agreement on how to deal with wildlife species benefiting from open water habitats resulting from reservoirs associated with dam construction; and,
- Agreement on how to account for mitigation that occurred prior to the 1980 Northwest Power Act.

While these issues remain unresolved, the report provides important background information on them which can form the basis for negotiations focused on agreements and for future Council policy deliberations associated with future Fish and Wildlife Program amendment processes. Also, the Basin partners now have the ability to map Wildlife Management Areas, with links to the hydro-projects being mitigated for, and relative size of protection area for the BPA wildlife mitigation program (Figure 4). The HU data for each wildlife management area is available on the CBFWA website[17].

17. See http://sotr.cbfwa.org/HLI_SummaryWildlife.cfm?mnu=HLI.

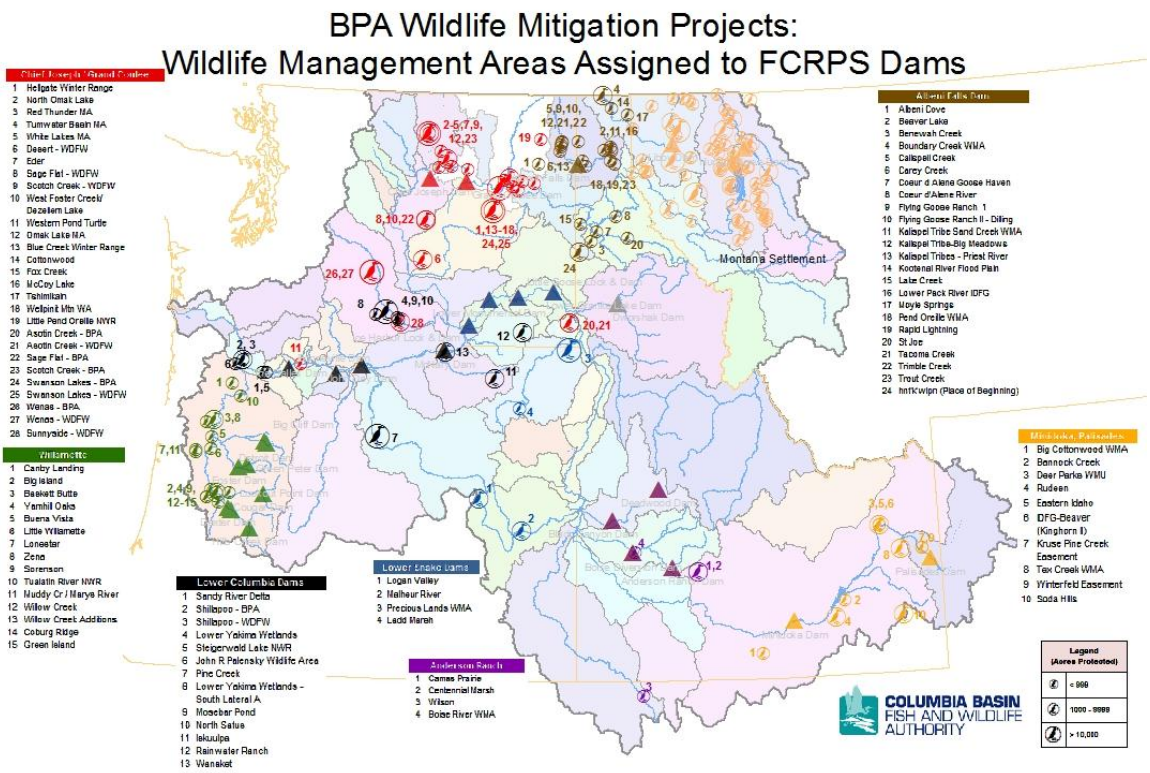

Figure 4. Projects and Facilities Mitigated by BPA under the Fish and Wildlife Program (July 2011).

The Reporting Framework:

The co-managers developed a working draft for a reporting framework (Table 1) based on three categories of HLIs. This table demonstrates that further work is required to fully develop a reporting mechanism for the Council's needs. The Council identified the following three categories of HLIs:

1) Habitat and Vegetation Types – several metrics would be reported for each cover type that represents status and trend in quality and quantity of the cover type, which can infer benefits to focal species or guilds. While this data is collected by individual wildlife projects within the Program, compilation and reporting will be required at a scale larger than any individual project. Reporting this information would require a designated project to perform the summary, analysis and reporting necessary to provide useful and timely indicators for Council reports.

2) Focal Species – several national/state level data sets could be used to represent relative status of wildlife species in this area. This level of data would be retrieved from national or state databases, and not from the individual projects; however, most of the data is initiated at the project level. Reporting this information would require a designated project to perform the summary, analysis and reporting necessary to provide useful and timely indicators for Council reports.

3) Habitat Units – the BPA HU ledger would continue to be reported as a measure of mitigation actions implemented specific to the Fish and Wildlife Program. The recent completion of the Wildlife Crediting Forum has provided a clean slate for reporting HUs at the project scale, a project may be needed to provide the high level summary of this information similar to the CBFWA Status of the Resource Report and website.

In developing the Wildlife Monitoring Implementation Strategy (WMIS), wildlife managers considered the following concepts:

- Scale integration: data collected can be used at multiple scales of interest for decisions
- Integration across separate monitoring programs: information gathered serves multiple functions and thus reduces costs
- Integration of policy and technical domains: precision of data fits time frames and acceptable risks for decisions
- Species integration: collection of data for multiple species in an efficient manner
- Adequate sample size: sample sizes are statistically adequate to discern differences among populations, across spatial distributions, and across temporal scales relative to varying human-induced and natural environmental stressors

Table 1. Working Draft Wildlife High Level Indicator Reporting Framework.

Category	Element (or Class?)	Purpose	Scale	Metric/Indicator	Report Interval	Report by	Take away	Source?
Vegetation Cover and Wildlife Habitat Type								
	Shrub-steppe Ponderosa Pine Riparian Wetlands Grassland Other Focal Habitats?	Status and Trend of habitat type	Basinwide/Province/ Subbasin	Total acres	5 years	Map and Table	Total Acres of this habitat type in CRB	Who maintains basin level habitat maps? How often are they updated?
		Protection Actions	Basinwide/Province/ Subbasin	Recent Acres purchased/protected (per habitat?)	5 years	Table	Acres of this habitat type purchased/protected in last 5 years (fee title/easement/etc.)	BPA, TPL, USCOE, USFWS, State lands, NGOs, others. What have we done lately (last 5 years)?
		Protection Status	Basinwide/Province/ Subbasin	Total Acres protected	5 years	Table	Total Acres in "protection" status of this habitat type	BPA, TPL, others. Total known protected.
		Biodiversity	Basinwide/Province	Functional diversity	5 years	Map and Table	Change in total functional diversity of this habitat type Metric indicators for operational losses (wetland acres quality, IBI scores, hydrologic data) UCUT reference sites	This would require analysis, by who?
		Primary Threats (Stressors)	Province/Subbasin	Define by cover type. General examples follow in the next rows.	Annual	Map and Table	Annual trends?	Specific threats will vary by cover type.
		Primary Threats	Province/Subbasin	E.g., annual acres burned by wildlife (unintentional) and/or for wildlife purposes (prescribed)	Annual	Map and Table	Annual trends of fire threat	Who maintains this data? Relevant for Shrub-steppe, maybe not for wetlands.
		Primary Threats	Province/Subbasin	E.g., conversion of cover type, development for residential or commercial use	Annual	Map and Table	Annual trends	Is this available somewhere?
		Primary Threats	Subbasin	E.g., Acres of invasive species	Annual	Map and Table	Annual trends of invasive species within this habitat type	NRCS, MSU, Other?
		Primary Threats	Basinwide/Province/ Subbasin	E.g., Change in acres and patterns in land use	5 years	Map and Table	Impact on habitat type by development and changes in land use	Land ownership and land use. Are they the same?
		Primary Threats	Subbasin	E.g., Grazing	3 years	Map and Table		
		Connectivity of Existing Habitats	Province	Contiguous acres of this habitat type	5 years	Map and Table	Description of appropriate corridors, islands, contiguous protected acres, etc.	Who would develop and maintain these calculations? TNC, Yukon to Yellowstone (Y2Y)
		Restoration Actions	Subbasin	Acres of invasive species treated	Annual	Map and Table	Annual efforts to control invasive species	PISCES (what are metrics required by PISCES?)
		Restoration Actions	Subbasin	Acres of native plantings	Annual	Table	Annual efforts to restore native vegetation	PISCES
Focal Species								
	Breeding [redacted] veys	Status and Trends	Habitat Class?		Annual	Graph	Trend of breeding bird populations	national resource?
	Christmas bird counts	Status and Trends	Habitat Class?		Annual	Graph	Trend of bird populations based on an annual snapshot	national resource?
	Bird point counts	Status and Trends	Habitat Class?		Annual	Graph	Diversity?	national resource?
	Harvest records	Status and Trends	Habitat Class?		Annual	Graph	General trends in harvestable wildlife	
	Species by KEF, harvest records, ecosystem services	Status and Trends	Habitat Class?			Table		
	ESA Listings	Status and Trends	Habitat Class?		Annual	Table		
Habitat Units								
	BPA HU ledger	Mitigation Strategy Evaluation	Basinwide	Habitat Units	Annual	Map and Table	Progress towards completing the F&W Program ledger	PISCES

Assumptions:

These HLIs would be maintained on an annual basis, although many of them would only be updated every 5 years and on different schedules.

Much of the data for BPA funded actions could be collected through PISCES, but alternate data bases would be required to support maintaining and reporting these HLIs.

Coordination with other Programs (various land trusts, etc.) would be required to get informaiton in common formats for reporting.

It will be important to emphasize that these are HLIs for Programmatic reporting, project level reporting will still occur and be the responsibility of the projects.

If we agree on these programmatic HLIs, project level reporting could be adjusted to prioritize this information into PISCES.

The co-managers generated a short list of examples of the types of data available to support the HLIs identified in the reporting framework. This list will be more fully developed by the projects assigned to develop the actual reports, and by the co-managers through future coordination meetings to support continued development of the WMIS. Most of ~~this~~ data, while reported at the project scale, will need to be compiled and reported at a scale larger than any individual project.

1) Habitat Units, native plantings, invasive species

a. Currently reported for BPA funded wildlife mitigation projects through Taurus.

www.cbfish.org.

2) Acres of Fire

a. USFS regional maps/data of historic acres burned (with table of dates, acres, geographic area). Website contains 423,000 ~~historical~~ fire records for fires that occurred from 1980 through 2002. http://capita.wustl.edu/fsan/FedFireHist.htm

b. USDA. 1997. Gen. Tech. Rep. PNW-GTR-405. Quigley, Thomas M.; Arbelbide, Sylvia J.; technical editors. An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins. 4 volumes. USFS, Pacific Northwest Research Station, Portland OR.

3) Invasive species (weeds)

a. NRCS website with weed lists for area. Most NRCS data are by state, ~~whese~~ plants are weedy or invasive, or have the potential to become weedy or invasive, in all or part of their U.S. range. NRCS has assembled this list verbatim from sources around the country to provide a comprehensive look at potential problem plants in the U.S. Most are introduced to the United States. http://plants.usda.gov/java/noxiousDriver#state

b. USDA. 1997. Gen. Tech. Rep. PNW-GTR-405. Quigley, Thomas M.; Arbelbide, Sylvia J.; technical editors. An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins. 4 volumes. USFS, Pacific Northwest Research Station, Portland OR.

4) North American Breeding Bird Survey (h/www.mbr-pwrc.usgs.gov/bbs/)

a. Summary information on population change by region and time period
b. Trend and regional trend estimates
c. Route analysis
d. Community dynamics

5) Threatened and Endangered Species (http://ecos.fws.gov/tess_public/pub/listedAnimals.jsp)

Guidelines for Study Design and Data Quality Standards

Obtaining Focal Wildlife Habitat/Vegetation Cover Types:

Protocols have been submitted to the Monitoring Methods (MM.org) to address the approach for determining wildlife habitat and vegetation cover inventory that may occur at multiple scales. Protocols are identified as landscape level Habitat Mapping using Landsat TM Imagery and Mapping High-Level Indicator Habitats**.** Though these methods are suggested based on previous work completed in the basin, future inventories may have a variation on the approaches given that multiple objectives will be desired. According to the guidelines for developing protocols in the Monitoring Methods application, there are allowances for ~~adaptation as one does have the ability~~ to publish a revised method.

Additionally, mapping change is done by comparing one time period to another. The preferred approach is to develop detail baseline conditions of each habitat/vegetation type(s) and hydrology condition if associated, then use future maps at the same scale for quick comparisons. Typically, habitat or vegetation types are classed in both periods so simple comparison(s) can be made. Working with various scale comparisons requires clearly identifying and discussing mapping unit sizes and other nuances that affect a direct comparison. Metadata developed should clearly identify how each map was developed along with listing constraints and potential uses (Rentmeester 2010).

As for reporting other ancillary data to meet HLI needs. These data will be retrieved from known sources who's primary information is to collect these kinds of data. For example, a known data source for fires in the region is National Interagency Fire Center in Boise, Idaho (http://www.nifc.gov/fireInfo/fireInfo_maps.html).

Obtaining Focal Species Information:

These data for the most part will first be obtained from known and reliable data collection or repository sites. For example, one source to obtain bird trend information would be from the North American Breeding Bird Survey (http://www.mbr-pwrc.usgs.gov/bbs/). In some instances, however, volunteers and/or citizen science projects may be acquiring this data as more resource agencies work to incorporate public involvement into their programs. It would be desirable if the sampling design could follow the principal approach outlined by the Master Sampling Tool that the Pacific Northwest Aquatic Monitoring Program has been promoting, except modifying it for wildlife. That is PNAMP defines a master sample as essentially a list of sites needed for a complete census of an area of interest and a list of attributes assigned to each site. A master sample can be created using the Generalized Randomized-Tessellation Stratified (GRTS) technique, which creates the list of sites but also retains randomization and spatial balance if the full list of sites is subset for sampling. Because conducting a complete census is often cost prohibitive, a master sample for an area of interest can be used to select a randomized, spatially balanced set of representative sampling locations (http://pnamp.org/project/3263).

aining Habitat Units Information:

Under the Northwest Electric Power and Conservation Act, BPA has a duty to protect, mitigate, and enhance fish and wildlife and their habitats affected by the development and operation of the Federal Columbia River Power System. BPA entered into Memorandum of Agreements (MOAs) with state, federal, and tribal wildlife management entities, with jurisdiction throughout the Columbia Basin Region, to protect and/or enhance habitat as mitigation/compensation for wildlife losses due to the construction of hydro facilities and subsequent inundation when the dams were put into operation. Habitat Evaluation Procedures (HEP) were developed by the USFWS[18,19] and for this mitigation program are used to evaluate and document habitat losses and habitat gains. Habitat units (HUs), the output of HEP analysis, are the form of currency used to document both the losses from hydro projects (dams) and the gains from habitat protection/enhancement measures (mitigation projects). Habitat unit (HU) determination/crediting is required for all BPA terrestrial habitat mitigation projects throughout the Basin. BPA applies the HUs it earns against the HUs lost as reflected in habitat loss assessments wildlife managers developed to estimate and document the impact of the construction of FCRPS dams throughout the Columbia Basin Region.

The Regional HEP Team (RHT) is an unbiased evaluation team that conducts HEP evaluations (BPA Project 2006-006-00). The RHT provides consistent application of HEP models and unbiased survey results (HU credits)[20]. In addition, RHT staff identifies and rectifies (when possible) inconsistencies in past HEP evaluation results. From 1999 through 2006, the RHT conducted HEP surveys on thousands of acres throughout the Columbia Basin Region for WDFW, ODFW, IDFG, USFW, Kootenai Tribe of Idaho, Kalispel Tribe, Coeur D' Alene Tribe, Warm Springs Tribe, Burns Piaute Tribe, Umatilla Tribe, Spokane Tribe, Colville Tribe, and Yakama Tribe. The RHT works directly with project proponents, BPA COTRs, and natural resource agencies such as the Northwest Habitat Institute (NHI) to conduct surveys and develop new, innovative approaches to assess habitat. To that end, another approach has been employed within the Willamette Valley called Combined Habitat Assessment Protocols (CHAP) to determine HUs where in 2010 the RHT assisted NHI in those evaluations.

The RHT's top priority is to complete baseline surveys on new mitigation acquisition sites and/or leases. Follow-up surveys are accomplished as time/funding permit. Until recently, determining Regional follow-up survey needs was cumbersome at best; however, with the advent of the PISCES data base developed by Bonneville Power Administration (BPA), it is now relatively easy to identify mitigation projects that require follow-up/baseline surveys. These surveys follow the Habitat Measurement Techniques Manual (2010), which can be found in the Monitoring Methods Protocol application (MM.org), HEP species booklet models, and HEP Sampling Design and Measurement Protocols (Ashley 2006, Footnote 16). General protocols

18. USFWS. 1980. Habitat as a Basis for Environmental Assessment, Ecological Services Manual (ESM) 101. Division of Ecological Services, U. S. Fish and Wildlife Service, Washington, DC: Department of the Interior.
19. USFWS. 1980a. Habitat Evaluation Procedures (HEP), Ecological Services Manual (ESM) 102. Division of Ecological Services, U.S. Fish and Wildlife Service, Washington, DC: Department of the Interior.
20. Ashley, P. R. 2006. Habitat evaluation procedures standard measurement protocols and techniques (Draft). Columbia Basin Fish and Wildlife Authority. Portland, OR.

include a brief description of pre HEP survey pilot studies; transect establishment guidelines and photo documentation parameters while specific habitat variable measurement techniques, including diagrams, provide detailed mensuration instructions. Finally, line transects used in field inventories are GPS ~~to establish locations~~ for future comparisons, and GIS data can also be incorporated when available.

A primary outgrowth of these regional habitat inventories using the Habitat Measurement Techniques is the establishment of status and trend information for a site. Although other parts of the HEP process are not robust enough to be used solely for monitoring and evaluation. In addition, HEP cannot provide wildlife species response data. Therefore, continuation of the NHI's IBIS work that also supports subbasin planning is necessary to have the capacity to address HLIs identified by the Council.

DATA MANAGEMENT, SHARING, AND REPORTING

The staying power of regional monitoring is a well planned data management, data sharing and data reporting structure. Unfortunately, data management and data sharing structure is an often overlooked component of monitoring and evaluation and the adaptive management process. To date, only one holistic draft document has been produced in 2007, *A Strategy for Managing Fish, Wildlife and Habitat Data in the Columbia River Basin*, but it has never been adopted by Council nor finalized. The PNAMP project is now calling for a data management and sharing roadmap for fish and it is unclear if wildlife would even be included (http://pnamp.org/project/3135). Currently, no overall guiding document exists but there are "Best Practice" reports and peer reviewed papers (O'Neil et al. 2007) to help build a basic understanding. As for data reporting, BPA has begun to take steps via contract language to institute the ISRP's recommendation that an "adoption of a policy requiring that the reporting requirements for projects funded by the program include requirements for delivery of primary data, and their associated metadata, in a standard machine readable format, within a specified period of time. Compliance with this policy should be a condition for continued funding" (ISRP 2000).

Evaluation cannot occur without an explicit effort to accumulate the appropriate information to support analysis and decision making. Reporting of high level indicators for wildlife in the Columbia River Basin (CRB) will require a long term data series, accumulated and synthesized at the CRB scale. Data management for wildlife information occurs at multiple scales and in processes that stretch well beyond the CRB. Acquiring the complex and often disparate data will require a dedicated project to perform this specific activity.

The monitoring and evaluation currently funded within the individual agency and tribe wildlife projects is not sufficient to support reporting of Vegetation Cover/Habitat Type and Focal Species HLIs. The projects collect and report information to support reporting status and trends of mitigation implementation (HUs), and the Program funds the Regional HEP Team to specifically ensure those efforts are consistent and compatible across the Basin. However, the BPA funded wildlife mitigation projects are postage stamps on the larger canvas of the Columbia River Basin. The individual project data for habitat and focal species do not add up (roll up) to provide a picture, or indicator, of overall health within the Basin. Even if they did, the current

level of funding for monitoring within those projects would not support the additional effort to perform roll-up analyses.

The wildlife managers involved in development of the WMIS have agreed that a dedicated project for producing wildlife HLIs for the Program is required if the Council intends to report them at the Basin scale on a routine basis. The wildlife managers developed a conceptual work plan which could be used to guide a project to meet this need (Appendix C), consistent with the framework presented in Table 1. The project should have a proven history of engaging and manipulating regional databases for habitat and focal species, and have the capacity to perform the roll-up analyses necessary for producing the Council's HLIs. It is recommended that this project be closely coordinated with the wildlife managers in order to ensure adequate interpretation and presentation of the results of any such analyses.

The wildlife HLI project should be closely coordinated with the Status of the Resources Project to provide access to the wildlife indicators generated on an annual and five-year basis. While the Council will report on the status of the Program's HLIs, according to the Draft MERR Plan the FWIs (fish and wildlife indicators) will be reported through the Columbia River Basin Fish and Wildlife Authority's Status of the Resource report and website. Performance standards used to track progress towards the Program's objectives will also be used to give context to the reported HLIs and FWIs information. PISCES and TAURUS will be used to report performance standards in the form of implementation metrics and HUs.

Finally, coordination among the wildlife managers will also be required to continue development and implementation of the WMIS. This is the first iteration of the WMIS, and further refinement will be required as the effort to report HLIs progresses. An ongoing process/forum/project will be needed to facilitate coordination between the Federal and the region's State wildlife agencies and the appropriate Native American tribes to support development of common methodologies and business practices that provide continuity and uniformity of input, information, and recommendations that support efficient and cost effective development and implementation of the Fish and Wildlife Program.

References:

Bradford, D.F., S.E. Franson, A.C. Neale, D.T. Heggman, G.R. Miller, and G.E. Canterbury. 1998. Bird species assemblages as indicators of biological integrity in Great Basin rangeland. Environ. Manage. Assess.

Bottom, D., B. Kreag, F. Ratti, C. Roye, and R. Starr. 1979. Habitat classification and inventory methods for the management of Oregon estuaries. Oregon Department of Fish and Wildlife, Portland, OR.

Cassidy, K. M., M. R. Smith, C. E. Grue, K. M. Dvornich, J. E. Cassady, K. R. McAllister, and R. E. Johnson. 1997. Gap Analysis of Washington State: An evaluation of the protection of biodiversity. Volume 5 in Washington State Gap Analysis - Final Report (K. M. Cassidy, C. E. Grue, M. R. Smith, and K. M. Dvornich, eds.). Washington Cooperative Fish and Wildlife Research Unit, University of Washington, Seattle, 192 pp.

Comer, P., D. Faber-Langendoen, R. Evans, S. Gawler, C. Josse, G. Kittel, S. Menard, M. Pyne, M. Reid, K. Schulz, K. Snow, and J. Teague. 2003. Ecological Systems of the United States: A Working Classification of U.S. Terrestrial Systems. NatureServe, Arlington, Virginia.

Cooper, S.V., K.E. Neiman, and D.W. Roberts. 1991. Forest Habitat Types of Northern Idaho: A Second Approximation. General Technical Report INT-236

Cowardin, L.M., V. Carter, F.C. Golet and E.T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. FWS/OBS-79/31, USFWS, Washington, D.C.

Hall, F.C. 1998. Pacific Northwest ecoclass codes for seral and potential natural communities. Portland, OR: USDA For. Serv. Gen. Tech. Rep. PNW-GTR-418, 290 pp.

Hawkins,C.P., J.L. Kershner, P.A. Bisson, M. D. Bryant, L.M. Decker, S.V. Gregory, D.A. McCullough, C. K. Overton, G.H. Reeves, R.J. Steedman and M.K. Young. A Hierarchical Approach to Classifying Stream Habitat Features. 1992. Fisheries 18(6):3-12.

Homer, C.G. 1998. Idaho/Western Wyoming landcover classification. Remote Sensing/GIS Laboratories, Utah State University, Logan, Utah.

Independent Scientific Review Panel (ISRP). 2000. Review of Databases Funded through the Columbia River Basin Fish and Wildlife Program. Northwest Power and Conservation Council's Report 2000-3. Portland, OR 32pp.

Johnson, D.H., T.A. O'Neil. 2001. *Wildlife-Habitat Relationships in Oregon and Washington.* Oregon State University Press. Corvallis, OR. 736 pp.

Karr, J. R. 1981. Assessment of biotic integrity using fish communities. Fisheries 6:21–27.

Karr, J. R. and E. W. Chu. 1997. Biological monitoring and assessment: Using multimetric indexes effectively. EPA 235-R97-001. University of Washington, Seattle, WA.

Kiilsgaard C.W., J.C. Hak, and B. Csuti. 1999. Oregon Gap Analysis Project Final Report: A geographic approach to planning for biological diversity. Oregon Dept. of Fish and Wildlife and Oregon Natural Heritage Program, Portland, Oregon. 72 pp.

Kovalchik, B.L. and R.R. Clausnitzer. 2004. Classification and management of aquatic, riparian, and wetland sites on the national forests of eastern Washington: series description. Gen. Tech. Rep. PNW-GTR-593. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. Portland, OR. 354 pp.

Kuchler, A.W. 1964. Potential Natural Vegetation of the Conterminous United States, American Geographical Society, Special Publication No. 36

Lillybridge, T.R., B.L. Kovalchik, C.K. Williams, B.G. Smith. 1995. Field guide for forested plant associations of the Wenatchee National Forest. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. Gen. Tech. Rep. PNW-GTR-359. Portland, OR. 335 p.

Mason, B., and R. Knight. 2001. Sensitive Habitat Inventory and Mapping. Editor M. Johannes, In Fisheries and Oceans, Canada: Sensitive Habitat Inventory Mapping (SHIM). Community Mapping Network, Vancouver, British Columbia. 315pp.

Moore, K., K. Jones, and J. Dambacher. 2002. Aquatic Inventories Project (Version 12.1), Natural Production Program. Oregon Department of Fish and Wildlife, Corvallis, OR, 97333.

O'Hara, K.L., P.A. Latham, P. Hessburg, B.G. Smith. 1996. Structural Classification for Inland Northwest Forest Vegetation. Western Journal of Applied Forestry. 11: 97-102.

O'Neil, T.A., and D.H. Johnson. 2001. *Oregon's and Washington's wildlife species and their habitats. in*: Wildlife-Habitat Relationships in Oregon and Washington. Johnson, D.H. and T. A. O'Neil (managing directors). Oregon State University Press. Corvallis, OR. 1-23 pp.

O'Neil, T. A., S. Toshach; and W. Luscombe. 2007. Regional Data Sharing. *In* D. Johnson et al. *The Salmonid Field Protocol Handbook - Data collection methods for status and trends in salmon and trout populations*. American Fisheries Society. P.38-45.

Redmond, R.L., M.M. Hart, J.C. Winne, W.A. Williams, P.C. Thornton, Z. Ma, C.M. Tobalske, M.M. Thornton, K.P. McLaughlin, T.P. Tady, F.B. Fisher, S.W. Running. 1998. The Montana Gap Analysis Project: final report. Unpublished report. Montana Cooperative Wildlife Research Unit, The University of Montana, Missoula. 136 pp.

Rentmeester, S. 2010. Regional Guidance on Metadata for Environmental Data. PNAMP http://pnamp.org/sites/default/files/PNAMP%202010-001_MetadataGuidance.pdf (accessed November 8, 2011).

U.S. Geological Survey. 2001. National Land Cover Database. http://www.mrlc.gov/index.php. Accessed 10/17/2011.

Appendix A. Table of BPA funded wildlife projects, including data management and coordination projects (Project in bold will be reviewed under the Data Management Category Review for 2013-15 BPA funding).

Number	Title	Proponent Orgs	Area	Purpose	Emphasis	2011 Review	Monitoring Type
2003-072-00	**Habitat and Biodiversity Information System for Columbia River Basin**	**Northwest Habitat Institute**	**Basinwide**	**Habitat**	**Data Management**	**Funding**	**Status and Trend**
2006-006-00	**Habitat Evaluation Project**	**Columbia Basin Fish and Wildlife Foundation (CBFWF)**	**Basinwide**	**Habitat**	**RM and E**	**Contextual**	**Status and Trend**
2008-007-00	**Upper Columbia United Tribes (UCUT) Monitoring and Evaluation (M&E) Program**	**Upper Columbia United Tribes (UCUT)**	**Basinwide**	**Habitat**	**RM and E**	**Contextual**	**Action Effectiveness**
1989-062-01	**Wildlife Program Coordination**	**Columbia Basin Fish and Wildlife Foundation (CBFWF)**	**Basinwide**	**Regional Coordination**	**RM and E**	**Funding**	**Coordination**
1989-062-01	**Basin-scale Program Reporting of HLIs and FWIs**	**Columbia Basin Fish and Wildlife Foundation (CBFWF)**	**Basinwide**	**Regional Coordination**	**Data Management**	**Funding**	**Reporting**
Multiple	Ecological Integrity Assessments: M&E of Wildlife Areas in Washington	Washington Department of Fish and Wildlife (WDFW)	Basinwide	Monitoring and Evaluation	RM and E	FYI	Status and Trend
1991-078-00	John R. Palensky Wildlife Area	Oregon Department Of Fish and Wildlife (ODFW)	Lower Columbia/ Willamette	Habitat	Restoration/ Protection	NA	Implementation and Effectiveness
1992-048-00	Hellsgate Big Game Winter Range	Colville Confederated Tribes	Intermountain/Columbia Upper	Habitat	Restoration/ Protection	NA	Implementation and Effectiveness
1992-059-00	Amazon Basin/West Eugene Wetlands	Nature Conservancy	Lower Columbia/ Willamette	Habitat	Restoration/ Protection	NA	Implementation and Effectiveness

1992-061-00	Albeni Falls Wildlife Mitigation Capital Land Acquisitions	Coeur D'Alene Tribe, Idaho Department of Fish and Game (IDFG), Kalispel Tribe, Kootenai Tribe	Intermountain/Pend Oreille	Habitat	Restoration/ Protection	NA	Implementation and Effectiveness
1992-061-02	Albeni Falls Wildlife Mitigation-Kalispel Tribe	Kalispel Tribe	Intermountain/Pend Oreille	Habitat	Restoration/ Protection	NA	Implementation and Effectiveness
1992-061-03	Albeni Falls Wildlife Mitigation-Idaho Department of Fish and Game (IDFG)	Idaho Department of Fish and Game (IDFG)	Intermountain/Pend Oreille	Habitat	Restoration/ Protection	NA	Implementation and Effectiveness
1992-061-05	Albeni Falls Wildlife Mitigation-Kootenai Tribe	Kootenai Tribe	Intermountain/Pend Oreille	Habitat	Restoration/ Protection	NA	Implementation and Effectiveness
1992-061-06	Albeni Falls Wildlife Mitigation-Coeur D'Alene Tribe	Coeur D'Alene Tribe	Intermountain/Pend Oreille	Habitat	Restoration/ Protection	NA	Implementation and Effectiveness
1992-068-00	Willamette Basin Mitigation	Oregon Department Of Fish and Wildlife (ODFW)	Lower Columbia/ Willamette	Habitat	Restoration/ Protection	NA	Implementation and Effectiveness
1992-092-00	Wanaket Wildlife Area	Umatilla Confederated Tribes (CTUIR)	Columbia Plateau/Umatilla	Habitat	Restoration/Protection	NA	Implementation and Effectiveness
1994-044-00	Sagebrush Flat Wildlife Mitigation	Washington Department of Fish and Wildlife (WDFW)	Columbia Cascade/Columbia Upper Middle	Habitat	Restoration/ Protection	NA	Implementation and Effectiveness
1995-057-00	Southern Idaho Wildlife Mitigation	Idaho Department of Fish and Game (IDFG)	Middle Snake/Boise, Upper Snake/Snake Upper	Habitat	Restoration/ Protection	NA	Implementation and Effectiveness
1995-057-01	Southern Idaho Wildlife Mitigation	Idaho Department of Fish and Game (IDFG)	Middle Snake/Boise	Habitat	Restoration/ Protection	NA	Implementation and Effectiveness
1995-057-02	Shoshone-Bannock Wildlife Mitigation Projects	Shoshone-Bannock Tribes	Upper Snake/Snake Upper	Habitat	Restoration/ Protection	NA	Implementation and Effectiveness

1995-057-03	Southern Idaho Wildlife Mitigation--Shoshone-Paiute Tribes	Shoshone-Paiute Tribes	Middle Snake/Owyhee	Habitat	Restoration/ Protection	NA	Implementation and Effectiveness
1995-060-01	Isqúulktpe Watershed Project	Umatilla Confederated Tribes (CTUIR)	Columbia Plateau/Umatilla	Habitat	Restoration/ Protection	NA	Implementation and Effectiveness
1996-080-00	Northeast Oregon Wildlife Project	Nez Perce Tribe	Blue Mountain/ Grande Ronde	Habitat	Restoration/ Protection	NA	Implementation and Effectiveness
1996-094-01	Scotch Creek Wildlife Mitigation	Washington Department of Fish and Wildlife (WDFW)	Columbia Cascade/Okanogan	Habitat	Restoration/ Protection	NA	Implementation and Effectiveness
1998-003-00	Wildlife Mitigation/Operations and Maintenance (O&M) for Spokane Tribe Land Acquisitions	Spokane Tribe	Intermountain/Spokane	Habitat	Restoration/ Protection	NA	Implementation and Effectiveness
1998-022-00	Pine Creek Conservation Area	Confederated Tribes Of Warm Springs	Columbia Plateau/John Day	Habitat	Restoration/ Protection	NA	Implementation and Effectiveness
2000-009-00	Logan Valley Wildlife Mitigation	Burns-Paiute Tribe	Middle Snake/Malheur	Habitat	Restoration/ Protection	NA	Implementation and Effectiveness
2000-016-00	Tualatin River National Wildlife Refuge Additions	US Fish and Wildlife Service (USFWS)	Lower Columbia/ Willamette	Habitat	Restoration/ Protection	NA	Implementation and Effectiveness
2000-021-00	Ladd Marsh Wildlife Mitigation	Oregon Department Of Fish and Wildlife (ODFW)	Blue Mountain/ Grande Ronde	Habitat	Restoration/ Protection	NA	Implementation and Effectiveness
2000-026-00	Rainwater Wildlife Area Operations	Umatilla Confederated Tribes (CTUIR)	Columbia Plateau/Walla Walla	Habitat	Restoration/ Protection	NA	Implementation and Effectiveness
2000-027-00	Malheur River Wildlife Mitigation	Burns-Paiute Tribe	Middle Snake/Malheur	Habitat	Restoration/ Protection	NA	Implementation and Effectiveness
2001-027-00	Western Pond Turtle Recovery	Washington Department of Fish and Wildlife (WDFW)	Columbia Gorge/Columbia Gorge	Habitat	Restoration/ Protection	NA	Implementation and Effectiveness

2002-008-00	Reconnect Kootenai River with Historic Floodplain	Kootenai Tribe	Mountain Columbia/Kootenai	Habitat	Restoration	NA	Implementation and Effectiveness
2002-011-00	Kootenai River Operational Loss Assessment	Kootenai Tribe	Mountain Columbia/Kootenai	Habitat	Restoration/ Protection	NA	Implementation and Effectiveness
2002-014-00	Sunnyside Wildlife Mitigation	Washington Department of Fish and Wildlife (WDFW)	Columbia Plateau/Yakima	Habitat	Restoration/ Protection	NA	Implementation and Effectiveness
2003-012-00	Shillapoo Wildlife Mitigation	Washington Department of Fish and Wildlife (WDFW)	Lower Columbia/Columbia Lower	Habitat	Restoration/ Protection	NA	Implementation and Effectiveness
2006-003-00	Desert Wildlife Mitigation	Washington Department of Fish and Wildlife (WDFW)	Columbia Plateau/Crab	Habitat	Restoration/ Protection	NA	Implementation and Effectiveness
2006-004-00	Wenas Wildlife Mitigation	Washington Department of Fish and Wildlife (WDFW)	Columbia Plateau/Yakima	Habitat	Restoration/ Protection	NA	Implementation and Effectiveness
2006-005-00	Asotin Creek Wildlife Mitigation	Washington Department of Fish and Wildlife (WDFW)	Blue Mountain/ Asotin	Habitat	Restoration/ Protection	NA	Implementation and Effectiveness
2009-017-00	TNC Willamette Wildlife Acquisitions	Nature Conservancy	Lower Columbia/ Willamette	Habitat	Restoration/ Protection	NA	Implementation and Effectiveness

Appendix B. Focal Habitats by Province and Individual Subbasin (NHI 30 June 2011).

Province	Subbasin	Focal Habitats	Common Focal Habitats
Blue Mountains	Asotin	ponderosa pine, eastside interior grasslands, interior riparian wetlands, and shrub-steppe.	
Blue Mountains	Grande Rhonde	*unspecified	
Blue Mountains	Imnaha	*ponderosa pine, grassland, riparian	**ponderosa pine, grassland, riparian**
Blue Mountains	Snake Hells Canyon	riparian wetland, herbaceous wetland, native grassland, ponderosa pine, and old-growth habitats	
Columbia Cascade	Entiat	shrubbsteppe, ponderosa pine mixed hardwood forest, riparian	
Columbia Cascade	Lake chelan	Shrubsteppe, ponderosa pine, riparian wetland	
Columbia Cascade	Methow	riparian wetlands, shrubsteppe, and Ponderosa pine forest habitats.	**Shrubsteppe, ponderosa pine, riparian wetland**
Columbia Cascade	Okanogan	ponderosa pine, shrubsteppe, riparian wetland	
Columbia Cascade	Upper Middle Columbia	shrubbsteppe, riparian wetlands, herbaceous wetland, agriculture	
Columbia Cascade	Wenatchee	riparian wetland, ponderosa pine, shrub steppe	
Columbia Gorge	Big White salmon	The focal habitats are montane coniferous wetlands, ponderosa pine/Oregon white oak forests and interior riparian wetlands.	

Province	Subbasin	Focal Habitats	Common Focal Habitats
Columbia Gorge	Columbia Gorge	*unspecified	
Columbia Gorge	Fifteen mile	Shrubsteppe, pine-oak woodlands, late successional mixed conifer forest	**Ponderosa pine/Oregon white oak**
Columbia Gorge	Hood	*unspecified	
Columbia Gorge	Klickitat	Ponderosa Pine / Oregon White Oak, Shrub Steppe /Interior Grasslands and Interior Riparian Wetlands	
Columbia Plateau	Crab	shrubsteppe, interior grasslands	
Columbia Plateau	Deschutes	Riparian and herbaceous wetlands, shrubsteppe, interior grasslands, rimrock, logepole pine forest, large juniper woodlandsand cliff habitat, ponderosa pine and oak forests	
Columbia Plateau	John Day	quaking aspen, interior grasslands, herbaceous wetlands, riparian wetland, interior canyon shrublands, juniper and mountain mahogany woodlands, shrub steppe, ponderosa pine and woodland, montane mixed conifer	
Columbia Plateau	Lower middle Columbia	interior riparian wetlands, shrub stepp/interior grasslands, and ponderosa pine/Oregon white oak	**riparian wetland, shrub steppe, grasslands, ponderoa pine**
Columbia Plateau	Lower Snake	ponderosa pine, eastside interior grasslands, interior riparian wetlands, and shrub-steppe	
Columbia Plateau	Palouse	Agriculture, Shrub-steppe, Ponderosa Pine Forest, Grassland, Mixed Conifer Forest, Wetlands	
Columbia Plateau	Tucannon	riparian/riverine, wetlands, ponderosa pine, and interior grasslands	

Province	Subbasin	Focal Habitats	Common Focal Habitats
Columbia Plateau	Umatilla	Mixed conifer, ponderosa pine, quaking aspen, western juniper, shrub steppe, interior grasslands, herbaceous wetlands, riparian wetlands	
Columbia Plateau	Walla Walla	riparian wetland, shrub steppe, grasslands, ponderoa pine	
Columbia Plateau	Yakima	montane coniferous wetland, ponderosa pine/ oak woodland, shrub steppe, interior riparian wetland	
Columbia River Estuary	Lower Columbia	streams, estuary amd lower mainstem, ocean	**streams, estuary amd lower mainstem, ocean**
Inter-mountain	Intermountain	wetlands, riparian areas, upland forests, steppe and shrub-steppe, cliffs and rock outcrops	**wetlands, riparian areas, upland forests, steppe and shrub-steppe, cliffs and rock outcrops**
Inter-mountain	Pend Oreille		
Lower Columbia	Willamette	oak woodland, upland prairie/savanna/rock outcrop, wetland prairieseasonal marsh, perennial pond and their riparian area, riparian areas of rivers and streams, old growth conifer forest	**oak woodland, upland prairie/savanna/rock outcrop, wetland prairieseasonal marsh, perennial pond and their riparian area, riparian areas of rivers and streams, old growth conifer forest**

Province	Subbasin	Focal Habitats	Common Focal Habitats
Middle Snake	Boise, Payette and Weiser	riparian/herbaceous wetland, shrub-steppe, Dry Pine/Fir Forest, Interior Mixed Conifer (Montane Mixed Species) Forest	
Middle Snake	Bruneau	Upland aspen, shrub steppe, dwarf shrub steppe, riparian wetland spring, western juniper, desert playa, montane conifer forest	
Middle Snake	Burnt	*unspecified	
Middle Snake	Malheur	Mixed conifer, western juniper and mt. mahogany woodlands, shrub-steppe, open waters/herbaceous wetland, interior riparian habitat	**shurb steppe, riparian habitat, juniper, mixed conifer, mountain mahogany**
Middle Snake	Middle snake	shrub steppe, riparian wetland, native grasslands	
Middle Snake	Owyhee	wetland riparian, shrub steppe, western juniper and mountain mahogany woodland, aspen, grassland, pine/fir/mixed conifer forest	
Middle Snake	Powder	sagebrush steppe, riparian habitat, mixed conifer	
Mountain Columbia	Bitteroot	RIPARIAN AND WETLAND HABITATS, GRASSLAND AND SAGEBRUSH/SHRUB HABITATS, DRY FOREST AND MESIC FOREST	
Mountain Columbia	Flathead	*riparian/wetland, grassland, coniferous forest	**Riaprian/wetland, Grassland, conifer forest**
Mountain Columbia	Kootenai	*Riaprian/wetland, Grassland, conifer forest	

Province	Subbasin	Focal Habitats	Common Focal Habitats
Mountain Snake	Clearwater	*prairie grassland, ponderosa pine	
Mountain Snake	Salmon	Shrub steppe, riparian wetland, grassland, ponderosa pine woodland, western juniper and mountain mahognay	**Grassland, Ponderosa Pine**
Upper Snake	Upper Snake	shrub steppe, mountain brush, pine/fir, juniper/mahogany, whitebark pine, aspen,open water/ pond, riparian wetland	**Shrub steppe, mountain brush, pine/fir, juniper/mahogany, whitebark pine, aspen,open water/ pond, riparian wetland**

Appendix C. Proposed workplan to generate wildlife HLIs for the Wildlife Monitoring Implementation Strategy.

Goal: Conduct habitat mapping to support subbasin planning and high-level indicators - to develop baseline information at multiple scales to allow informed planning and decision making and to characterize changes across the landscape.

Objective 1: To develop baseline information at multiple scales to allow informed planning and decision making

Task 1 - Identify the relative amounts and locations of vegetation cover, wildlife habitat types, structural conditions, land use types, protected areas, and primary threats on a landscape level for the entire Columbia River Basin.

A. Multiple Scales Mapping of Vegetation Cover and Wildlife Habitat Types: Riparian, Wetlands, Native Grasslands, Shrub-Steppe, Ponderosa Pine and Other Focal Habitats identified in Subbasin Plans**.**

   Purpose: Establish Baseline Status for Vegetation Cover and Wildlife Habitat Types.

   Reporting Time Period: Every 5 Years

B. Multiple Scales Mapping of Structural Conditions and Land Use Types: Tree Size, Number of Canopies, Percent Canopy Cover, Various Land Use Types.

   Purpose: Establish Baseline Status for Structural Conditions and Land Use Types.

   Reporting Time Period Every 5 Years

C. Multiple Scales Mapping of Protection Areas: Capture and record Fish and Wildlife refuges, Tribal Reservations, State Wildlife Management Areas, BLM Wild and Scenic Rivers, Research Natural Areas, etc.

   Purpose: Establish Baseline for Lands with a Protected Status

   Reporting Time Period Every 5 Years

D. Multiple Scales Mapping of Potential Threats or Stressors: Fire, Logging, Location and Controlling of Invasive Species.

   Purpose: Depict Amount and Locations of Primary Threats or Stressors

   Reporting Time Period Every Year

E. Based on Potential Species Occurrence Establish Functional Profiles for Each Ecoprovince and Subbasin: Using Fish and Wildlife Species Range Maps and/or Species List in Subbasin Plans Join With Key Ecological Functions

Purpose: Depict Potential Functional Diversity and Redundancy

Reporting Time Period Every 5 Years

F. Identify & Display Large Sizes of Contiguous Vegetation Cover and Wildlife Habitat Types: Establish Acreage Ranges Based on Subbasin Parameters of: Size, Amount of Anthropogenic Habitat Types, Amount of Human Populations, etc.

Purpose: Depict Amount and Locations of Contiguous Habitats and Potential Sites and Constraints to Connectivity

Reporting Time Period Every 5 Years

Objective 2: To characterize habitat changes across the landscape.

Task 1. To Compare and Track Baseline Conditions over Time.

A. Compare at Multiple Scales the Mapping of Vegetation Cover and Wildlife Habitat Types: Riparian, Wetlands, Native Grasslands, Shrub-Steppe, Ponderosa Pine and Other Focal Habitats identified in Subbasin Plans**.**

Purpose: Establish Amount of Change &Trends Against Baseline Condtions

Reporting Time Period: Every 5 Years

B. Compare at Multiple Scales the Mapping of Structural Conditions and Land Use Types: Tree Size, Number of Canopies, Percent Canopy Cover, Various Land Use Types.

Purpose: Depict Amount of Change & Trends Against Baseline Conditions

Reporting Time Period Every 5 Years

C. Compare at Multiple Scales the Mapping of Protection Areas: Capture and record Fish and Wildlife refuges, Tribal Reservations, State Wildlife Management Areas, BLM Wild and Scenic Rivers, Research Natural Areas, etc.

Purpose: Depict Amount of Change & Trends Against Baseline Conditions

Reporting Time Period Every 5 Years

D. Capture and Record Restoration Actions: Acres enhanced or conservation easements or acreage purchased.

Purpose: Establish Amounts and Locations of Enhancements or Increases in Amount of Vegetation Cover & Wildlife Habitat Type, Structural Conditions, Key Environmental Correlates, and Amount of Invasive Species Treated and/or Controlled

Reporting Time Period Every Year

E. Capture and Record Protection and Enhancement Actions: Acres enhanced or conservation easements or acreage purchased.

Purpose: Establish Enhancements or Increases in Protection Status and Connectivity

Reporting Time Period Every Year

F. Determine Change in Total Functional Biodiversity by Subbasin, Ecoprovince and Basin Using Changes in Wildlife Habitat Types:

Purpose: Depict Increases or Decreases in Total Functional Diversity Across the Basin. Selective Functions of Interest can also be Illustrated.

Reporting Time Period Every Year

G. Establish Trends in Wildlife Populations by Acquiring Threatened and Endangered Species Information, Breeding Bird Surveys, Christmas Bird Counts, Other Bird Point Counts, Harvest Records, Observations, etc .

Purpose: Report Trends in Wildlife Populations

Reporting Time Period Every Year

H. Identify Legal, Economic or Ecological Status Change for Species

Purpose: Report Any Status Changes to Wildlife Species

Reporting Time Period Every Year

I. Capture habitat units from regional habitat team's inventory work done on new or existing habitat acquisitions.

Purpose: Report Any Status Changes in Habitat Units

Reporting Time Period Every Year

Objective 3: To coordinate with State, Federal and Tribal organizations to assist with the collection and verification of baseline information; its status and trends.

Task 1. Establish formal coordination arrangements or agreements with the necessary organizations that have or can acquire wildlife and associated information that will be in support of the goal and objectives of subbasin planning and high-level indicators.