

**Northwest Habitat Institute's  
Recommendations for Amendments to the  
NORTHWEST POWER AND CONSERVATION COUNCIL  
2000 COLUMBIA BASIN FISH AND WILDLIFE PROGRAM**

***MARCH 19, 2008***

The Northwest Habitat Institute (NHI) would like to take this opportunity to submit suggested amendments to the Northwest Power and Conservation Council's Fish and Wildlife Program. The Northwest Habitat Institute has been involved with the Council's program for 9 years and with this experience suggests amendments that help clarify a common understanding of fish and wildlife habitat and assist with creating performance standards for the program. Specifically, the Northwest Habitat Institute recommends 1) that a significant regional reference book, *Wildlife-Habitat Relationships in Oregon and Washington* and its *Integrated Habitat and Biodiversity Information System (IBIS)*, and 2) a comprehensive data management strategy recently developed by the Northwest Environmental Data-Network called, *A Strategy for Managing Fish, Wildlife, and Habitat Data - Columbia River Basin Framework* be adopted into the program. Managing our natural resources requires the combination of science and the availability of information. However, for information to be most useful, requires some standardization specifically in definitions and protocols. The *Wildlife-Habitat Relationships* book focuses on the integration of terrestrial, freshwater and marine systems, and since its original publication [Johnson, D. H., T. A. O'Neil. 2001. *Wildlife-Habitat Relationships in Oregon and Washington*. Oregon State University Press. Corvallis, OR. 736 pp.] it now includes fish habitats and their functions. The book had 90 contributing authors include experts in wildlife, botany, fisheries, conservation biology, vegetation mapping, and the ecology of forest, rangeland, and marine environments, among other fields. Over 700 people now have had input into the informational context, approach and digital data sets.

The *Strategy for Managing Fish, Wildlife and Habitat Data* provides a much needed framework and vision of how information should be shared. Currently natural resource information is collected across multiple programs and efforts, using many different methods and is maintained in many different technical systems. The result is that it is difficult, if not impossible sometimes, to assemble the data across geographic, administrative, and political boundaries. This all underscores the need for a regional coordinated data management strategy, which this document provides. The Strategy was developed by a joint committee of the Northwest Environmental Data-Network & Columbia Basin Fish and Wildlife Authority [Roger, P., T. O'Neil, T. Iverson, D. Tetta, S. Toshach, and P. Paquet. 2007. *A Strategy for Managing Fish, Wildlife and Habitat Data – Columbia River Basin Framework*. A report to the Northwest Power and Conservation Planning Council. Northwest Environmental Data-Network & Columbia Basin Fish and Wildlife Authority Joint Committee. Portland, OR 46 pp.].

As we move towards becoming a learning institution, the Council's Fish and Wildlife Program should focus on information management, integration and cooperation, and evaluation and feedback loops so that the information that is relied on for decisions is current. The *Wildlife-Habitat Relationships* book and data sets provide an excellent reference for habitat terms and definitions along with clarifying the fish and wildlife species associations. The *Strategy for Managing Data* outlines a framework for developing a coordinated data system that is integrated and can provide feedback loops back to the system.

We then recommend the *Wildlife-Habitat Relationships in Oregon and Washington* and its *Integrated Habitat and Biodiversity Information System* (IBIS) for the following reasons:

- ❖ The *Wildlife-Habitat Relationships* book was supported by 40 organizations included over 600 peoples input and its purpose is to build a common understanding for management;
- ❖ The Northwest Habitat Institute's IBIS project is a "Core" informational project within the Council's Fish and Wildlife Program [[www.nwhi.org/index/ibis](http://www.nwhi.org/index/ibis)];
- ❖ The book and data sets are also considered by other organizations as a "Key Informational Source for the Northwest" by National Biological Information Infrastructure, and as "Best Available Science" by the Office of Community Development in Washington State,
- ❖ The book and digital data sets have served as a primary source of information and supported for the Council's Subbasin Planning process;
- ❖ IBIS information has been used in all Subbasin Plans submitted to the Council to date;
- ❖ The book clearly defines what wildlife habitat is and contains definitions of habitat terminology that were developed in a multi-agency partnership;
- ❖ IBIS mapping approach helps standardizes the terminology and protocols and a paper describing the approach is in publication for 2008 by the National Academies of Science (paper is an associated file with this document);
- ❖ IBIS habitat classification information is cross-walked to 60 other regional habitat classifications that are currently in use within the Columbia River Basin (a copy of the application is an associated file with this document);
- ❖ Book and IBIS data sets support and depict current biological conditions; and finally
- ❖ Council's Fish & Wildlife Program is habitat base – we need a common understanding for management;

As for language, NHI would suggest to incorporate into the Basinwide Provisions for Habitat Strategies the following statements:

- 1) Adequately fund IBIS and continue to build and update the wildlife-habitat relationships data sets by periodically documenting and updating these data with new information;
- 2) Update wildlife-habitat maps through out the basin at the regional, subbasin, and other specific areas of interest to address changes in habitat condition and abundance every 5-10 years;
- 3) Create tools and services that enhance the usability of data especially in capturing, recording, and reporting information;
- 4) Support coordination especially for capturing, retrieving and accessing fish and wildlife data from resource agencies; and

5) Adopt the *Wildlife-Habitat Relationships in Oregon and Washington* book as a principal source for fish and wildlife habitat definitions.

We also recommend *A Strategy for Managing Fish, Wildlife, and Habitat Data - Columbia River Basin Framework* for the following reasons:

- ❖ The Strategy for Managing Fish, Wildlife, and Habitat Data was developed by an interagency team consisting of federal, state, tribal and non-governmental organizations;
- ❖ Consistent data management practices (not just technology) require policy-level support. The existing systems cannot evolve and incorporate core regional standards without support from relevant policy levels;
- ❖ Coordinating and planning ahead for data sharing is cheaper, faster, and provides higher quality data than acting after the fact. Information management must always be a proactive endeavor. Some flexibility, for example through a “data placeholder” account, is necessary to react to unexpected activities as they arise;
- ❖ Effective information management is an ongoing effort, not an episodic task. A sound data management strategy should be part of core funding considerations during project funding cycles;
- ❖ Most of the regional information sharing needs involve summarized, derived, or other analyzed and synthesized data, rather than the original primary data from which the derived metrics are calculated;
- ❖ Derived data and analyses created during inter-agency technical projects (orphan or homeless data sets) have no long-term owner and are at particularly high risk of being lost over time, if they are not captured and integrated into the regional network;
- ❖ Connecting local data sets to shareable agency or regional databases is an important need for improving data sharing. Developing efficient methods to move data from field collection into regionally accessible nodes and repositories will yield the large benefits. Solutions should focus on improving data management at the local level, not simply transcribing these data into standardized regional formats;
- ❖ Effective regional information sharing will require hybrid solutions. Data management schema may require both distributed and warehouse approaches;
- ❖ Resource managers and scientists need to understand that consistent use of data standards and protocols improves the quality of data, enhances its usability, and clarifies its purpose;
- ❖ Standards and protocols extend the useful life of the data;
- ❖ Data are used from a wide variety of sources to support regional decision making by a wide array of decision makers and stakeholders;
- ❖ Without common understanding and shared standards and protocols, resource managers have “disparate” data sets and fragmented information to answer more and more complex questions at multiple geographic scales (e.g., site, watershed, sub-basin and basin, and regional levels);

- ❖ A strategy is needed to address field data collection and storage along with a design of regional data structures to move information from collection to reporting; and
- ❖ Building of a coordinated strategy will help build a common understanding among the many entities responsible for management of fish, wildlife and their habitats in the Pacific Northwest.

As for language, NHI would suggest to incorporate under the Basinwide Provisions a Data Management category under Strategies (Section III D of the Fish and Wildlife Program) and include Section 4 from *A Strategy for Managing Fish, Wildlife, and Habitat Data - Columbia River Basin Framework* which reads as follows:

## **A Regional Data Management Strategy**

### **1.1 Inter-agency agreements and commitments**

Developing a coordinated data management strategy depends on the adoption of administrative and business practices, agreements, and standardized protocols. To effectively develop these elements, executive coordination and consent are needed. The targeted architecture represents an end-to-end approach to data collection, reporting, management (or handling), discovery and sharing. This approach includes: more consistent use of best practices and standards by content groups (e.g. CSMEP, PNAMP), systematic attention to data quality throughout data management, use of regional-scale tools to making published data discoverable through metadata, migration towards distributed database management technologies (e.g. within NED), and the development and use of data sharing agreements and practices to make data available

### **1.2 Shared principles**

- Data should be owned and managed “at or near to the source”, when possible. The goal is not to duplicate multiple copies of the data but rather efficiently access, service and maintain these data. This is not to say that data sets can not be housed redundantly in a central warehouse as a means to assist in access, serving and establishing an off-site backup of the data. This does not necessarily eliminate the need for NED or other organizations to compile and host some data (e.g., where a particular data collector has bandwidth issues, complex security issues, or can be put into a regional context), but it does minimize this requirement.
- Data will be accessed via a small number of industry-standard interfaces. For our example there are currently four standards interfaces from the Open GIS Consortium (OGC) are used: the Web Mapping Service (WMS, map-like views of information), the Web Features Service (WFS, retrieve and update geospatial data), Web Coverage Service (WCS, geospatial coverages) and the Web Processing Service (WPS, pre-programmed calculations and/or computation models).

- Data will be exchanged using self-describing technology like eXtensible Markup Language (XML).

Principles Adapted from the FEA Framework report will be used to develop and incorporate these ideas into NED Best Practices documents.

- **Standards:** Develop and adopt a core set of technology standards. The region should adopt open system standards in which the interrelationships of components are fully defined by interface standards available to the public and maintained by group consensus. An open-system architecture is the goal; however, initially only partially open systems will be attained. This principle could lead to use of JAVA and future JAVA-like protocols, which give a high priority to platform independence.
- **Data Collection:** Minimize the burden on data collectors. Data standardization, including a common vocabulary and data definition, will take time to achieve but is critical. A common approach eliminates redundancy and helps ensure data consistency. To ensure success, business units as well as IT personnel should be involved. Each data element should have a trustee accountable for data quality.
- **Functionality:** Take advantage of standardization based on common functions and customers. Agencies should develop or design reusable components or purchase architecture components, recognizing that these items are designed to obtain a particular functionality. Standardization on common functions and customers will help resource managers implement future changes in a timely manner.
- **Information Access:** The region should develop a diversity of public and private access methods for information, including multiple access points, the separation of primary or “raw” from analytical and derived data, and data warehousing/distributed data management system architecture(s). Information access and display must be sufficiently adaptable to a wide range of users and access methods, including formats accessible to those with sensory disabilities.
- **Proven Technologies:** Select and implement proven market technologies to facilitate efficiency across the region. Incorporating proven technologies in a timely manner will help to keep the region up to date and on the forefront of evolving systems. These technologies should also be based on accepted industry data standards and processes to ensure compatibility between systems. Systems should be decoupled to allow maximum flexibility for incorporating new technologies.

### **1.3 A conceptual approach**

With hundreds of entities in the Pacific Northwest involved with various portions of resource management, managing regional and cross jurisdictional data is a daunting task.

Consequently, coordination and collaboration are critical targeted functions of a comprehensive data management strategy that starts by establishing partnerships among Networks (Figure 3). These partnerships can vary in formality, from requiring binding commitments to simple agreements to collaborate, and are critical for successful data management across the region. Formal agreements are preferred because they define the responsibilities for management of the information resource.

Networks are defined as a broad collection of organizations, entities, agencies, or Nodes (referred to collectively as “communities of interest”) that share similar roles in the overall data management schema. For example, Northwest Environmental Data Network (NED) was developed to improve the quality, quantity, and availability of regional data and related information on fish, wildlife & their aquatic and terrestrial habitats from multiple organizations and agencies using a publicly supported approach to information systems management. Natural Resource Information System (NRIS) and National Biological Information Infrastructure (NBII) are also data sharing networks.

Nodes are a collection of applications and projects that are provided by organizations or agencies that have made an agreement to serve as the centralized location for different types of information. Nodes would therefore be required to follow guidelines, standards, and protocols set forth in a shared Framework (described in subsequent sections). Some examples of regional nodes include; StreamNet, Northwest Habitat Institute (NHI), Fish Passage Center (FPC), and Pacific Northwest Aquatic Monitoring Partnership (PNAMP).

Portals refer to an information discovery and sharing application that is designed to facilitate communication and sharing of geographic data and resources to enhance government efficiency and improve citizen services. This tool usually includes 1) a centralized metadata database and search engine to discover and download any type of data (e.g., spatial, tabular, publications); 2) a metadata development template, manual upload service, and automatic harvesting tools; 3) indexes and organizes tabular data, spatial data, and other electronic products such as publications; and 4) provides a current inventory of all data published in the standard format. Additionally, portals can also have: 1) a map viewer to allow viewing and overlay of spatial data; 2) a gazetteer of standard place names; and 3) a web service compliant to allow connection to and use of web-based industry standard services in a distributed environment. An example is the NED portal.

The conceptual approach includes three overlapping communities or networks; note some groups can operate in several communities (Figure 4).

Each community is described below:

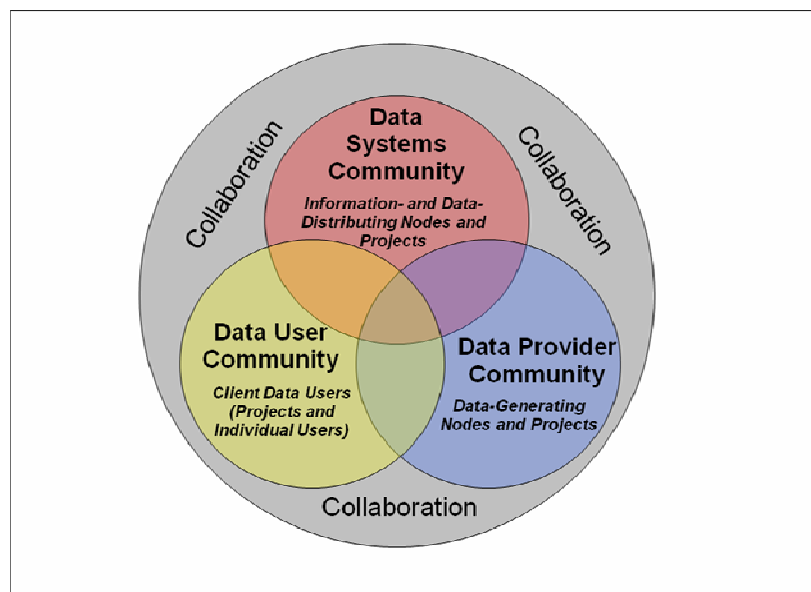
- 1) A Data Provider Community, comprised of projects that generate primary data and Data-Generating Nodes (such as a Monitoring Node), that facilitate providing access to raw data via the Internet;
- 2) A Data Systems Community, comprised of Data- and Information-Distribution Nodes, Portals and projects. Groups working within this community provide data, information (derived data, analyses, and reports), as well as information tools and services; and

- 3) A Data User Community, comprised of Client Data Users (which are sometimes Nodes, but often projects or individual entities).

Nodes within the communities use the Internet to facilitate collaboration via information exchange. Each Node follows appropriate (i.e. Network-specific) components, standards and protocols consistent with the framework. A broad conceptual example within the Pacific Northwest of how several Protocols interact and collaborate, including data creation, flow and coordination is illustrated in Figure 5.

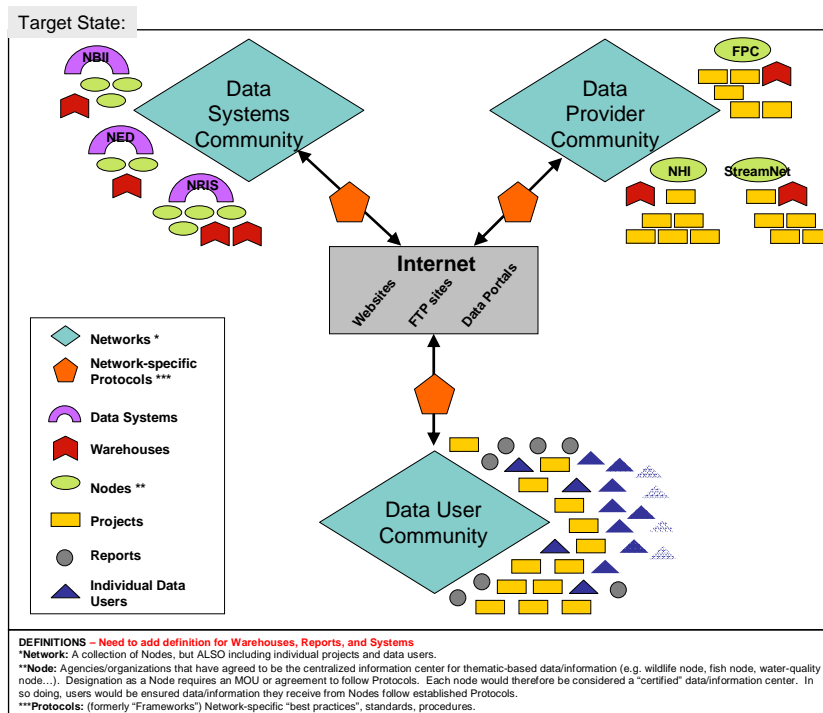
Nodes currently funded by the Fish and Wildlife Program include Fish Passage Center, StreamNet, Northwest Habitat Institute (IBIS), Data Access in Real Time, and the NED Portal. These nodes would become more connected via the Internet and to other substantial data sharing nodes funded through additional projects, State, Federal and Tribal agencies, and others.

In a recent analysis of the first annual Status of the Resource report, in which a population abundance indicator was provided (where available) for every focal population identified within the Council's Subbasin Plans, it was determined that BPA (the Fish and Wildlife Program) directly funds less than 22% of the data required to create the report (Figure 2), and cost shares on another 25% of the data. Other tribal, state, federal, utilities, and NGOs, not affiliated with the Fish and Wildlife Program provide over 50% of the data necessary for regional fish and wildlife management decision making.

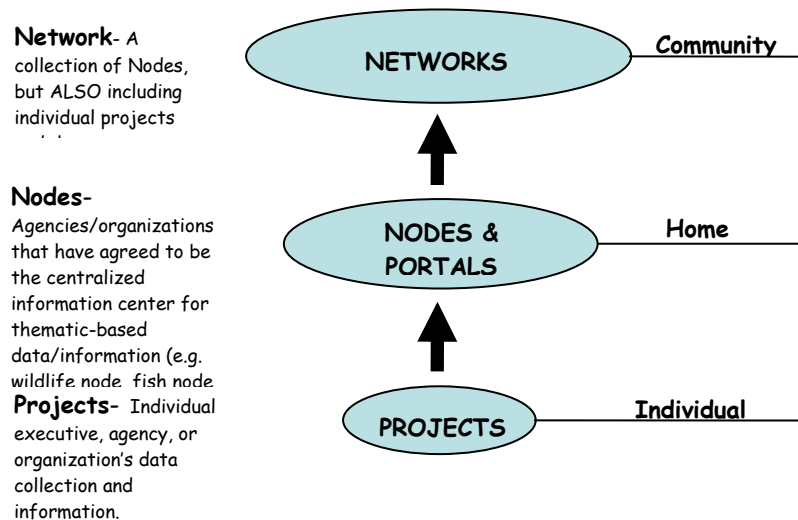


**Figure 3.** Example of Types of Networks: Data Systems, Data Providers, and Data Users.





**Figure 4.** Example of Networks as communities of interest accessible through the Internet.



**Figure 5.** Pathway for individual projects to reach data sharing networks.

### **1.3.1 Building from FEA Framework**

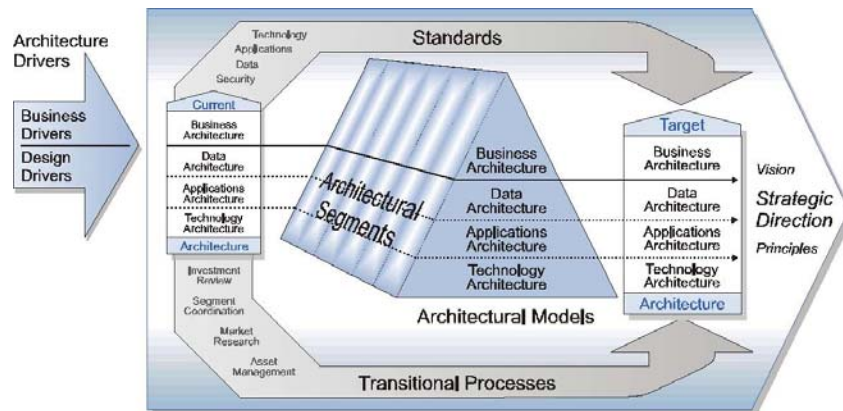
The FEA framework is a conceptual model to define and document a coordinated structure for cross-cutting businesses and design developments by government and with partners. The framework can be applied where a structure is needed among multiple State and Federal agencies.

The FEA Framework can guide the Fish and Wildlife Program, the Council, BPA and partners in building a shared development for common data management processes, interoperability, and information sharing. This is appropriate, as the FEA Framework is recommended for use whenever Federal business areas and substantial Federal investments are involved with international, State, or local governments. This shared framework allows individual organizations to work their architecture issues within the broader context of the FEA to reap benefits of resource sharing and interoperability.

This goal of greater openness and sharing between today's natural resource data repositories is shared in the data provider, data user, and data systems communities. The present data networks and nodes have each developed using internally consistent principles and frameworks. However, the individual frameworks have focused on meeting internal agency or program needs and communication across diverse nodes and datasets was not a major consideration in the designs. Consequently, today we are faced with data systems that have difficulty communicating with each other.

We propose to be guided by the FEA as the organizing framework for moving toward more collaborative regional data efforts (Figure 6). This framework was developed specifically "to promote shared development for common . . . processes, interoperability, and sharing of information among" diverse information systems. Other reasons for organizing efforts with a FEA Framework include:

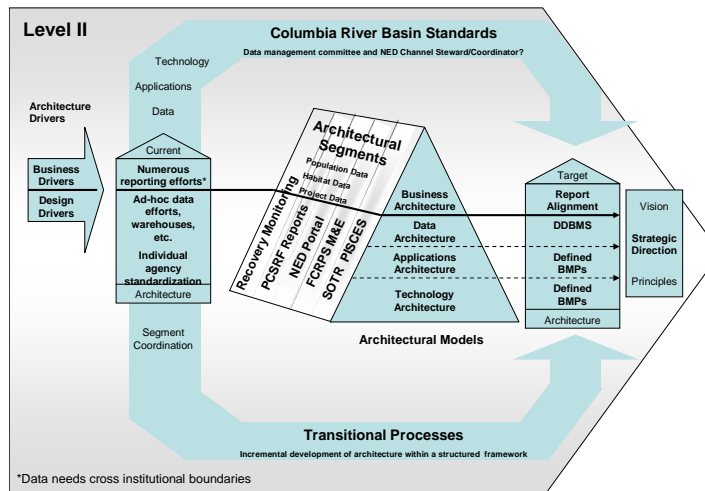
- The approach is robust and flexible. It was created by some of the leading systems architects in the world. It is unlikely we can do better, locally.
- It can be adapted to individual needs and is nonrestrictive.
- It is, or will be, already being used by federal resource managers as they review and modify their own information management programs.
- The conceptual approach is extensible to state, tribal, and NGO data management efforts.
- It provides a common language to address common problems.
- It integrates both business models and technical models for information management.
- We would not be recreating the wheel - Pacific Northwest natural resource data coordination problems are similar to the problems faced by federal agencies and addressed in the CIOC report (1999).



**Figure 6.** Federal Enterprise Architecture Framework.

This strategy is an end-to-end approach to data collection, reporting, management (or handling), discovery and sharing and includes: 1) more consistent use of best practices and standards by content groups, (e.g. within CSMEP and PNAMP for collection of aquatic data), 2) for systematic attention to data quality throughout data management, 3) regional scale tools for making published data discoverable through metadata, 4) migration to distributed database management technologies, and 5) the development and use of data sharing agreements and practices to make data available that has either been unavailable at all or unavailable in a timely manner.

The FEA framework can be readily applied to the Columbia River Basin scale (Level II, Figure 7). Primary data needs support the Northwest Power Act, the Endangered Species Act as it applies to the Federal Columbia River Power System and recovery planning for other anthropogenic influences on fish and wildlife management (like hatchery runs, water releases, and fishing harvest) . These data consist primarily of population, habitat and project information.



**Figure 7.** FEA framework applied at the Columbia River Basin scale.

The strategy recognizes the value of data being collected by others (states, tribes, etc.) that help to support Fish and Wildlife Program implementation and effectiveness efforts including actions required under the various FCRPS Biological Opinions.

The desired state of regional network data/information for populations, habitats, and human actions is a network of data networks that would provide decision makers, researchers and the public with access to comprehensive data/information they trust. Standardized regional data collection, quality assurance and storage protocols would be implemented and used by all data gathering and processing entities and priority legacy data would be brought into conformance with standard storage schemas.

Data gathered within any basin by any project on any topic (such as juvenile Spring Chinook out migration), could be included in queries, summary statistics or trend analyses encompassing other basins or projects in a timely and meaningful way. Processed data (information), in the form of interpretive reports would be indexed and easily accessible through search engine functionality. All data and information would be geo-referenced with common parameters to allow spatial analysis and presentation. Metadata and data dictionaries would be complete, concise, available via the web, and inclusive of the regional information spectrum. Most of the forgoing depends on a clear understanding of data content and the adoption and use of data standards/protocols for network participants.

### **1.3.2 Coordination and cooperation**

Regional coordination and cooperation requires the development of core standards and practices that promote inter-agency information sharing while maintaining individual agency flexibility. A coordinating strategy based on cooperation will provide a forum for organizing regional programs. That in turn will improve communication, shared resources and data and create solutions that add value to the efforts of cooperating partners.

### **1.3.3 Building a common language**

Because of disparate data sets and habitat classifications, it is preferred to adopt a common data management approach that incorporates a common language built upon core data elements, data standards, and protocols that will enhance information access and transferability. To illustrate the need for a common language some 67 terrestrial and aquatic habitat classification systems that are in use within the CRB were compiled in varying detail, organization, and content. Cross-walks were then established between the various habitat system categories and the Interactive Habitat and Biodiversity Information System (IBIS) because it provides detailed descriptions of three category levels (Habitat Types, Structural Conditions, and Key Environmental Correlates), and applies to terrestrial, aquatic, wetland, and marine environments. The results show many categories could not be cross-walked and many of these categories were not even habitat elements. So our ability to have a clear understanding of at least core data elements is a needed first step towards efficiently and effectively using other data. A connected data

management system with numerous entities in the Pacific Northwest will create a powerful tool for effective management planning and scientific monitoring of our natural resources.

#### 4.3.4 Efficiency

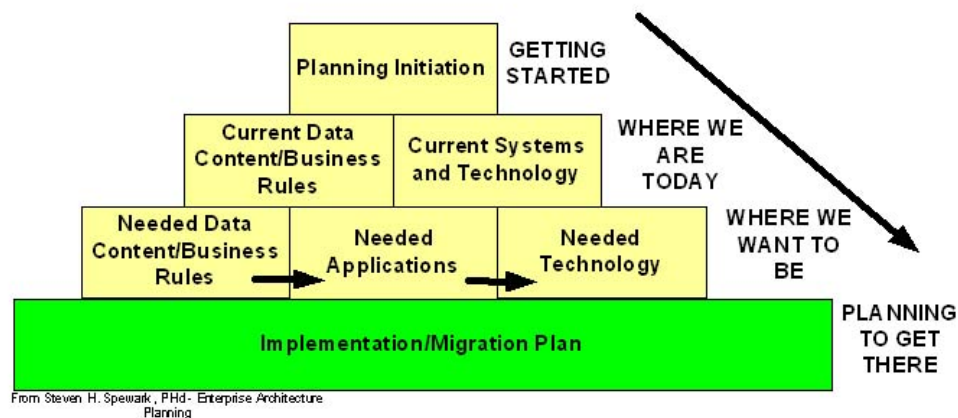
The development of a coordinated regional strategy for managing fish, wildlife, and habitat data will improve efficiency of management and policy based on shared expertise and past viable solutions (e.g. sharing of lessons learned through decades of fish and wildlife management). A coordinated strategy and framework will make it easier to automate tasks and procedures to reduce overall work load. Greater data compatibility will also increase scientific credibility and cost-effectiveness of limited funds.

#### 4.3.5 Shared goals

Sharing common goals means developing a comprehensive data management strategy that ensures efficient use of fish and wildlife information, research, and monitoring data. Similar goals also will provide long-term support to implement the data management strategy. Identifying key components that can improve data-gathering and analysis at various scales will become easier with shared goals and a unified vision for regional data management.

#### 4.3.6 Work within a common process

To coordinate a management strategy, agencies and organizations will use the FEA Framework architecture as a tool to coordinate the expertise, elements, and projects needed to improve information sharing. And to the extent possible, use standard commercial technology along with adapting to “Open Source” concepts and practices to share information. Organizations and agencies will then work through a common process, the “wedding cake” which is a seven-step process to improve regional information sharing based on the FEA Framework (Figure 8).



**Figure 8.** The “Wedding Cake” process is a step-by-step way to systematically identify, design and deploy the FEA Framework.

#### **4.3.7 Share responsibility for implementation**

In order to develop a coordinated data strategy organizations and agencies need to share responsibility for its implementation. Responsibilities includes: Organizations and agencies incorporating Best Practices, sharing technology and applications (pool resources), developing cost-share arrangements, evaluating alternative technologies (e.g. PNWWQX, ISEMP, NED Portal, IDFG, etc.) and where appropriate start with small scale pilot and prototype solutions.