

## **Chapter 3 – MANAGEMENT SYSTEMS**

### **3.0 Management Systems Overview**

Pathway agencies are developing a collaborative Adaptive Management System (AMS) that will be used to coordinate monitoring, research, information sharing, and implementation of management strategies for the Lake Tahoe Basin. The term “collaborative adaptive management” reflects two important characteristics of the system. First, adaptive management is to systematically use targeted research and monitoring to reduce uncertainty related to areas of management concern and use of the best available information to support policy decision-making. With adaptive management, policy-relevant knowledge improves through scientific research, monitoring and experience. Second is the system’s ability to support collaboration and coordination among Pathway agencies as they make management decisions. The collaborative AMS will allow the Pathway agencies to pursue a clear and transparent process for making coordinated, information-based decisions that continually improve the effectiveness of management approaches to achieve desired conditions.

As a distinct component of the collaborative AMS, Pathway agencies are developing a Pathway Indicator Reporting System (PIRS). This system will provide meaningful information on the state of the environment and social conditions with respect to the desired conditions established through the Pathway 2007 planning process. It is intended to provide clear and consistent information to the public at large, informed stakeholders and decision makers, and agency staff and the science community.

This section provides more detail on the Collaborative AMS and the PIRS and the path forward for developing and refining them.

### **3.1 Collaborative Adaptive Management**

The collaborative AMS being developed through Pathway 2007 brings together three management concepts: a continual improvement management cycle, adaptive management, and a means for coordinating and collaborating among partners.

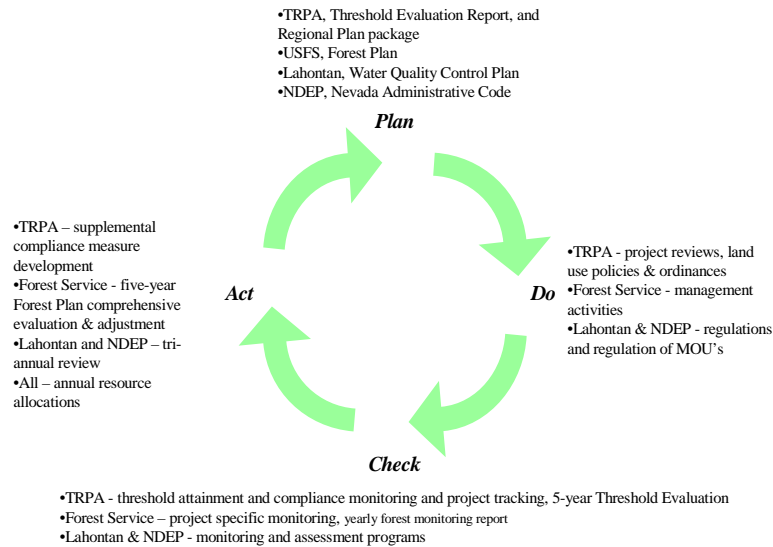
#### **3.1.1 Continual Improvement Management Cycle**

At the core of the collaborative AMS is a classic continual improvement management cycle characterized by the following four steps:

1. Plan — identify and analyze the problem to be addressed.
2. Do — develop and implement solutions.
3. Check — evaluate the results of the implemented solution.
4. Act — adopt and adjust the solution.

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**Figure 3-1 Continual Improvement Management Cycle for the Pathway agencies.**

Figure 3-1 illustrates the continual improvement management cycle for the planning processes of the Pathway agencies. As illustrated in Figure 3.1, the Pathway agencies' current processes for planning and implementation reflect the various elements of the cycle:

- Developing comprehensive agency plans (e.g., TRPA's Regional Plan) in the "Plan" step;
- Undertaking management and regulatory activities in the "Do" step; and
- Monitoring, evaluation, and review activities in the "Check" and "Act" steps.

The role of the collaborative AMS will be to appropriately coordinate these agency cycles to accomplish shared goals.

### 3.1.2 Adaptive Management

Incorporating adaptive management into a traditional plan-do-check-act cycle acknowledges that uncertainty exists about the impact of management actions. Adaptive management introduces an explicit commitment to reducing uncertainty through experimentation and learning. It is, as stated in the Lake Tahoe Watershed Assessment (Murphy & Knopp 2000), "resource management informed by research and monitoring."

An effective Collaborative AMS ensures that the best available knowledge systematically informs planning and management activities. This is a significant challenge. The Lake Tahoe Watershed Assessment concludes that "the lack of an institutionalized structure to gather, analyze, and disseminate information to support resource management decisions has impeded achievement of ecosystem integrity goals" in the Lake Tahoe Basin. The Sierra Nevada Forest Plan Amendment is clear that "adaptive management is ultimately dependent upon the ability of institutions to integrate new information into management decisions and approaches."

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Reflecting the need to generate, document, and use new information, the key elements of adaptive management are:

- *Explicit documentation of conceptual models* that describe relationships between drivers, pressures and management activities on the system of interest. Numeric models can numerically represent these system dynamics, and should be described in a manner that makes assumptions explicit;
- *Testing assumptions* by systematically implementing actions based on well-researched hypotheses and monitoring actual results;
- *Sustained and focused monitoring* that addresses targeted questions (Boesch, Manley & Melis 2006), as well as monitoring of implementation success and resource conditions;
- *Structured information flow resulting in recommendations* that are delivered in context and utilize terms meaningful to management decision makers. A reporting and recommendation development schedule can help provide timely input into decision making;
- *Adapting management and monitoring approaches* based on analysis of monitoring results and research findings, and changing assumptions and plans to reflect new information; and
- *Learning* through methodical documentation of processes to avoid repeating mistakes and to encourage information sharing.

The degree of adaptive management to be employed will depend upon the level of concern and uncertainty related to specific management decisions. Those management decisions made relating to topics of high concern and low certainty will most benefit from active adaptive management.

### **3.1.3 Collaborative Arrangements**

The Collaborative AMS will enhance coordination among agencies with overlapping management responsibilities and support collaboration in decision-making, information sharing, and other areas. It will allow researchers, agency staff and management to share information and collaboratively “close the loop” when new information suggests the need to adjust management direction. At the same time, a more explicit information flow and decision making process will increase the transparency of the information used to make management decisions. Explicitly incorporating review and input into the system will support factoring stakeholder information into resource management decisions.

When designing collaborative management arrangements, different degrees of formalization, centralization, authority, autonomy and a range of other factors are appropriate under different conditions. The Pathway agencies are exploring how existing and possible future collaborative arrangements may assist them in making coordinated decisions over the next twenty years, while respecting each agency’s legal mandates and governance structure.

## 3.2 Applications of Adaptive Management in the Lake Tahoe Basin

The current work to define a collaborative AMS through Pathway 2007 builds on previous work in the Lake Tahoe Basin, especially the Lake Tahoe Watershed Assessment and the Sierra Nevada Forest Plan Amendment. The Watershed Assessment outlined a set of collaborative arrangements to ensure research and monitoring information would effectively inform policy and project implementation decisions. To date, this system has only been partially implemented through specific applications. The following list summarizes project specific applications of adaptive management in use or development within the Lake Tahoe Basin:

**Conservation Strategy for Tahoe Yellow Cress** – This project established a clear process for directing targeted monitoring and research and developing recommendations for management activities and further targeting subsequent monitoring and research efforts. The calendar of activities and definition of clear reporting structures is key to this program's success.

**The Sediment Source Control Handbook** – This effort outlines a series of steps for testing expectations relating to sediment control project strategies applied at ski resorts and how research and monitoring information feeds back into future implementation decisions.

**TRPA Regional Plan and Threshold Review** – Chapter 32 of the TRPA Code of Ordinances directs TRPA's Threshold Review and review of compliance measures including reporting intervals and establishes the need for a monitoring program.

**Forest Service Environmental Management System (EMS)** – The Forest Service is currently developing an EMS in compliance with national mandates to develop protocols for selected environmental aspects.

## 3.3 Pathway 2007 Adaptive Management System Development

The collaborative AMS will be developed with a solid grounding in current collaborative management approaches in the Lake Tahoe Basin. Three important topics will be examined in-depth and suggestions will be made for improving protocols, lines of communication and decision making structures for each. The experience gained investigating these three topics will then be used to develop a generalized approach for a Collaborative AMS. The Pathway agencies will be able to work with Tahoe Science Consortium researchers to refine this template for additional topics that warrant the application of formal adaptive management.

The three specific topics that will be examined in the process of developing a Collaborative AMS are:

**1) Pathway Indicators and Standards** – The indicators and standards described in this Evaluation report vary in their level of development and degree of scientific understanding. The type 2 and 3 indicators require additional development and/or validation. New information from research may show the need for adjustments to some indicators or standards. A collaborative decision making process that incorporates stakeholder input will be defined to ensure scientific, legal and stakeholder input are considered, and that adjustments are consistent across agencies.

**2) Environmental Improvement Program (EIP) Water Quality Sub-program** – The current EIP Update project is developing a more structured process for developing programmatic goals and employing project effectiveness research and monitoring information into the decision process for selecting future projects. The investigation of a Collaborative AMS will formalize how implementation tracking, effectiveness monitoring and research are systematically reported to a collaborative decision making body.

**3) Lake Clarity Total Maximum Daily (TMDL) Load Allocations** – The Lake Tahoe Clarity TMDL employs a sophisticated set of models to analyze loading of fine sediments, nitrogen and phosphorous to the lake and their impact on lake clarity. Research and monitoring over the coming years will refine the modeling assumptions and improve the accuracy of both the effect of these pollutants on lake clarity and the effectiveness of measures to reduce these pollutants. As a result of this improved understanding the load allocations assigned to specific entities and programs may be adjusted. A collaborative decision-making process will be established to ensure these adjustments occur in a systematic and coordinated manner incorporating input from all stakeholders.

Investigations around these three programs will focus on how implementation, cause and effect, and status and change research and monitoring information will be used in making management decisions. Improving the methods to monitor and report information related to desired conditions is a related area of investigation.

### **3.4 Pathway Indicator Reporting System & Monitoring Strategy**

One goal of the Adaptive Management System project is to develop a strategy to monitor and report Pathway indicators which satisfies the information needs of key audiences including the public at large, engaged stakeholders and decision makers, and agency staff and the science community. The scope of typical restoration programs leads to measurement of a large number of indicators, which can overwhelm the attention of many audiences. Organizing indicators into hierarchies based on spatial scale, programmatic type, resource area or other factors can better communicate results. The Pathway agencies are exploring techniques for reporting the status of environmental and social conditions at different levels of detail for different audiences.

Targeted communication products for key audiences are being investigated to assist in communicating the status of Pathway indicators. The products may take a variety of forms including annual reports, science syntheses, conferences, long-term planning reviews and data-driven websites. A variety of information displays, such as graphical data representations, standardized charts and categorization of data into discrete reporting scales (i.e. good, fair & poor) are under consideration for each of the communication products. These display formats are being used in other restoration programs to clarify communication to important audiences and generate support.

#### **Pathway Indicator Monitoring Strategy**

Sustained monitoring of environmental status related to the desired conditions is mandated for many of the Pathway agencies. Status and change monitoring provides meaningful retrospective information to staff and scientists regarding influences on the environment, including the overall impact of management actions. Further, the public is accustomed to reports of environmental status and expects an annual or periodic update of the status of resources of interest. The Pathway Indicator Monitoring Strategy will focus on defining how available and potential resources can be effectively used to provide the most meaningful information relating to the status of the Pathway Indicators.

### **3.5 Next Steps in Adaptive Management Development**

Through spring 2007 the Pathway 2007 effort will develop detailed designs and an implementation plan for the three topics described in section 3.3 as well as a generalized approach to a Collaborative AMS. A recommended Pathway Indicator Reporting System and Monitoring Strategy will also be described. Each of these components will require detailed review and adjustment by members of the Tahoe Science Consortium's Committee of Scientists as well as a broad set of resource management practitioners.

Following review and adjustment, the agencies will set about developing the specific protocols, collaborative arrangements and monitoring plans outlined in the implementation plans. The Pathway agencies intend to coordinate research, monitoring and reporting needs with the Tahoe Science Consortium. The information system requirements are expected to be addressed through the ongoing development of the Tahoe Integrated Information Management System.

With these systems in place the ongoing commitment of the Pathway leadership will be required to support funding and demand for targeted information to be used in coordinated resource management decisions for the next twenty years.