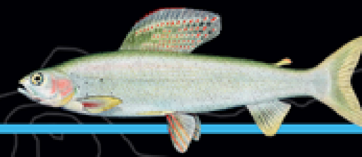
U.S. Department of the Interior
Bureau of Land Management



Principles and Practices
of Integrating Science into Land Management

CASE STUDIES

The case studies in this series showcase examples of integrating science into Bureau of Land Management (BLM) decisions and activities. They highlight how science has helped the bureau successfully manage diverse programs across many geographical areas. These examples are not intended as programmatic guidance or policy direction; the application of science will be unique to each circumstance. Rather, they reflect the critical thinking and systematic, transparent process advocated by the BLM's "Principles and Practices of Integrating Science into Land Management: Guidelines." By using that document's recommended Checklist of actions, they demonstrate key principles and practices of effective science integration at work in a variety of fields and resource areas. Individual case studies differ in how they satisfy Checklist objectives, illustrating that the Checklist is intended to be a flexible tool—one that can be customized to meet the unique aspects and needs of different projects. Comprehensive details about individual studies (including related articles and publications) can be found on the BLM's Science in Practice Portal, through the BLM Library and the Alaska Resources Library & Information Services, and through links in these documents.

CHECKLIST

☐ **1. DEFINE THE MANAGEMENT QUESTION(S)**, including related management objectives. All interested parties must clearly understand the management issue(s) if the five guiding principles and practices are to be successfully applied.

☐ **2. FIND** available science relevant to the management question(s). Be systematic, rigorous, and objective, and use a method that is easy for others to follow and that is well-documented.

☐ **3. EVALUATE** the potential relevance and reliability of the science identified in Step 2.

☐ **4. SUMMARIZE** the science, address any conflicting science, and identify any information gaps.

☐ **5. APPLY** your science-based conclusions to the management question(s) to decide the best course of action for achieving management objectives.

☐ **6. ASSESS** how the application of science affected public support, the sustainability and effectiveness of the decision, confidence in the course of action selected, and further learning about the system and the effects of management actions. Plan any future assessments and/or develop and implement a monitoring plan.

Snapshot of Checklist actions from "Principles and Practices of Integrating Science into Land Management: Guidelines." The numbered actions in the case study below track with this list and show how the BLM implemented the principles and practices for integrating science into the BLM's work. Please refer to the full document for details.

CASE STUDY 5: Using the BLM's Assessment, Inventory, and Monitoring Strategy To Assess the Effectiveness of Placer Mining Reclamation in Streams in Eastern Interior, Alaska

1. DEFINE THE MANAGEMENT QUESTION(S).
BLM regulations require that reclamation result in the rehabilitation of fisheries habitat, as shown by a stable channel form with adequate vegetation to reduce erosion, dissipate stream energy, and promote the recovery of instream habitats (43 CFR 3809.420 and the BLM's Surface Management Handbook, H-3809-1).

Mine reclamation requires the rehabilitation of fisheries habitat, including a revegetated floodplain and a stable channel. This site was last mined in the 1990s and yet remains largely unvegetated, with limited instream habitat recovery.

BLM Alaska developed guidance (Instruction Memorandum AK-2015-004) linking the measurable regulatory performance standard with established metrics for assessing stream functions: hydrology, geomorphology, physiochemistry, and biology. Stream function metrics are based on peer-reviewed literature and have broad application; however, they required validation before BLM Alaska could assess their applicability to Alaskan streams. Consequently, the BLM needed to answer these questions:

- *Are stream function metric measures valid when assessing Alaskan streams?*
- *Are current reclamation efforts in placer-mined streams effectively rehabilitating fisheries habitats?*

2. FIND.

Assessments of reclamation effectiveness, before the efforts described in this case study, were not standardized and when quantitative measures were used, the efforts were highly focused within a particular stream segment. Consequently, the BLM's understanding of regional conditions and the site-to-site variability in conditions among watersheds was limited. By following the BLM's Assessment, Inventory, and Monitoring (AIM) Strategy, the team ensured that high-quality monitoring data were collected to assess the potential for meeting reclamation requirements and for validating the applicability of stream function metrics to Alaskan streams. In addition to collecting field-based monitoring data to assess reclamation effectiveness, staff also conducted peer-reviewed literature searches. They found studies that investigated the environmental response and recovery of streams where placer mining had occurred in Alaska. Using this information, they developed a list of monitoring indicators as well as hypotheses concerning the observed responses and recovery times.

3. EVALUATE.

Determining the natural conditions that potentially existed before mining activity—in order to assess the effectiveness of reclamation efforts—was a significant scientific challenge. No data existed about pre-mining conditions for the large majority of active monitoring claims. (BLM Alaska has since issued guidance for collecting pre-mining data before new mining operations are authorized.) Therefore, the team needed to select and apply a scientific method for defining potential natural conditions. They followed guidance in the AIM Strategy's national aquatic monitoring framework (NAMF) to identify sites that were used to determine the range of potential natural stream conditions (reference condition). The pros and cons of this method are well vetted in the scientific literature, and the team actively acknowledged the limitations of this approach relative to more sophisticated modeling techniques. The team continues to refine the process so that conditions indicating reclamation success may be updated as better information becomes available.

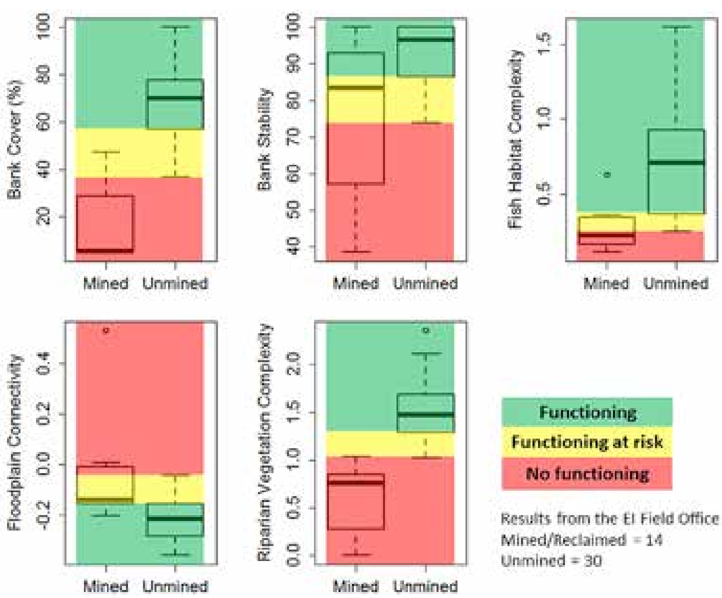
Comparison between unmined (top) and mined/reclaimed (bottom) conditions.

4. SUMMARIZE.

Summary findings for managers included tables and figures illustrating how the monitoring data collected compared to potential natural stream conditions and whether specific standards for stream functions were met. In some stream systems the team combined data they had collected with data collected by others over time;

however, data from these other sources were often disparate in type and quality, ranging from quantitative monitoring information to qualitative assessments and photo points. If conclusions depended on data types or specific indicators, the team used a weight of evidence approach favoring high-quality information to make a final decision about reclamation effectiveness.

The range of potential natural stream conditions was used to validate many of the key metrics adopted by BLM Alaska and established a foundation for developing others specific to streambank riparian community composition and structure. Key gaps remain in the information needed for assessments of reclamation effectiveness that consider the full complement of ecosystem components and indicators required by BLM policy. Of greatest concern are methods for assessing the reclamation of vegetation within the adjacent floodplain and uplands. During this study, the BLM recognized this gap and is working to establish both vegetative metrics and methods for monitoring floodplain riparian and upland vegetation as related to placer mining.



Example results for stream metrics comparing mined (reclaimed) and unmined (potential natural) conditions. Values are binned into functional categories.

5. APPLY.

A central challenge to assessing condition or treatment effectiveness accurately is the ability to discriminate between natural sources of variability and potential effects from human disturbance. In this study the BLM addressed such uncertainty by asking whether unmined (potential natural) sites differed from conditions at reclaimed mined sites. Site metrics were binned into: "functioning," "functioning at risk," and "not functioning" ratings based on the extent of the difference. These ratings were then reviewed by resource specialists who oversaw the design, collection, and analysis of monitoring data, and through forums that communicated monitoring results to field office staff and mining permittees. This framework ensured the collection of relevant, dependable information; created a tool for communicating information to miners; and made the assessment and decisionmaking process transparent, ensuring that scientific principles and practices were used.

6. ASSESS.

Decisions about the sustainability of permitted uses under the BLM's multiple-use mandate are often confounded by inadequate information. Poor data can lead to uncertainty and undermine the strength of the decision. The team sought to avoid such uncertainties by developing and implementing a systematic, transparent, and repeatable process for collecting, analyzing, and interpreting stream reclamation effectiveness data. This process greatly enhanced the team's ability to make efficient and well-informed decisions that were founded in science and could be understood by resource staff and public land users. Using this process, the team was able to integrate monitoring data into its assessment and to identify areas that have and have not met the standards for fisheries habitat rehabilitation following placer mining. This information guided the BLM's development of decision documents and recommended corrective actions that miners could employ to stabilize the reclaimed stream channels and rehabilitate fisheries habitats. Furthermore, the information clearly illustrated that many reclaimed streams have not recovered to a point where attainment of the regulatory requirement to rehabilitate fisheries habitat has been met. These findings, coupled with agency reports and peer-reviewed literature, have contributed to renewed efforts by BLM Alaska to develop reclamation demonstration projects, stream reclamation best management practice guidance, and training for resource staff on stream design and construction. Continued monitoring is expected to further the BLM's understanding of reclamation outcomes as well as timelines necessary for recovery of placer-mined streams. These efforts are designed to improve stream reclamation outcomes and sustainable resource development in Alaska.

MESSAGE FROM THE PROJECT TEAM: This project addressed a fundamental management question that could not be fully answered with existing science and available data. BLM Alaska recognized the limited resources available and teamed up with the National Operations Center to facilitate data collection through the AIM Strategy's NAMF. The Eastern Interior Field Office's success has led to the development of a NAMF implementation plan for Alaska, which lays the foundation for statewide deployment of aquatic AIM and the integration of AIM-based objectives into resource management plans.

Photo showing watershed-scale disturbance within the floodplain (Franklin Creek, Fortymile Wild and Scenic River).

Photo showing lagging recovery timeframes, where full recovery has yet to be realized approximately 20 years after mining ceased (Bachelor Creek, Steese National Conservation Area).

For more information, contact: **Matthew Varner (Fisheries and Riparian Program Lead)** and **Scott Miller (Director, BLM/Utah State University National Aquatic Monitoring Center)**.

Photos by BLM staff unless otherwise noted.

This case study series is sponsored by the BLM's National Science Committee to support science-based decisionmaking throughout the agency.