Draft Framework for Developing a Monitoring and Adaptive Management Plan for the BLM's Solar Energy Program
April 19, 2012

BACKGROUND

Comments to both the Draft Solar PEIS and Supplement to the Draft Solar PEIS indicate substantial public interest in a robust, long-term, scientifically-sound monitoring and adaptive management plan for BLM's Solar Energy Program. Commenters with an interest in monitoring strategies expressed a preference for public engagement, transparency and data availability.

In 2011, the BLM released the Assessment, Inventory and Monitoring (AIM) Strategy for condition and trend monitoring of BLM-managed resources and lands. The BLM supports the use of the AIM Strategy as the basis for a long-term solar monitoring and adaptive management plan (Solar LTMP). AIM provides a replicable, consistent framework for collecting monitoring data across solar program areas and for adaptively managing siting and permitting of solar energy projects and Solar Energy Zones (SEZs). Further, an AIM-based Solar LTMP will take advantage of and augment other AIM efforts underway including Rapid Ecoregional Assessments, the national landscape monitoring framework, greater sage grouse analysis, and an array of local, management-driven monitoring efforts. The information derived from these coordinated, multi-program efforts will provide an unprecedented understanding of the condition and trend of BLM-managed lands and support informed decision-making across jurisdictional boundaries.

At present, data collected using survey-level protocols inform permit decisions for solar projects on BLM-managed lands. Because the intent of such data collection is to ascertain site-specific impacts, the data often do not encompass areas or control sites outside of project boundaries or across varied landscapes. Further, such project-level data are not generally collected continuously over temporal scales. Project-level decisions, including right-of-way grant stipulations, mitigation requirements, grant phasing, and construction compliance monitoring, would benefit from more broadly and consistently collected ecological, socioeconomic, and other non-biological (e.g., visual, noise, cultural) information. The BLM intends to capture this needed information through the deployment of the Solar LTMP across both Solar PEIS program lands and appropriate control sites.

INTRODUCTION TO THE AIM STRATEGY

In 2011, BLM released the AIM Strategy for national use in monitoring the condition and trend of BLM-managed resources and lands (BLM 2011). As shown in Figure 1, the AIM Strategy is an iterative process that generates a body of consistent and compatible data collected across diverse landscapes to provide unbiased information for sound land management decisions.

The AIM Strategy is based on sampling at two primary scales, **intensive** and **extensive**, which, when used together, increase the value of the monitoring effort. Intensive monitoring provides relatively high-density sampling within a focal management area, e.g. a solar zone or project area, to inform specific management objectives. Extensive monitoring provides a low-intensity sampling grid across a broad ecologically-defined geographic area, e.g. the Sonoran Desert, for regional baseline, condition, and trend reporting. Sampling at either scale provides valuable information for management of the solar program across jurisdictional boundaries.

Methods to gather data at the intensive and extensive scales include field collection and remote sensing techniques. AIM field collection techniques are consistent and compatible across landscapes and provide statistically valid estimates of condition and trend. Remote sensing techniques maintain their utility at multiple scales and provide spatial pattern, distribution and abundance information. Field data provide critical ground-truthing information for focusing remote imagery.

The AIM Strategy hinges on the development of **conceptual models** that describe the relationship between ecosystem processes, conservation elements, and stressors. Developing conceptual models for the solar program will require the BLM and its partners and stakeholders to describe in detail the processes that are essential to sustain the relevant ecosystems and the stressors that influence those processes. A robust appropriate model drives the selection of **core and supplemental indicators** for monitoring that are relevant to the studied ecosystem.

The BLM has published guidance on **core indicators** and methods specific to terrestrial resources (BLM 2011b). Specific core indicators were selected from a conceptual model based on land health. For example, core indicators for vegetation include percent cover, height, and composition. The intent of the AIM Strategy is to monitor core indicators across all BLM-managed lands and provide consistency across jurisdictional boundaries through coordination with other federal agencies, e.g. NRCS. While AIM is a national effort, the Strategy accommodates local needs through incorporation of **supplemental indicators** specific to the particular landscape, habitat or zone. For example, supplemental indicators for SEZs might include air quality, viewshed quality or ground water availability.[1]

Data collected through the AIM Strategy at the right scale and with appropriate precision should bolster existing data sources and populate a BLM-specific data set to be shared publicly. Over time, study of such data will provide a layered image and understanding of BLM-managed lands. Data analysis and synthesis will also feed into adaptive management processes and support the development of local and national policies to codify effective management methods.

The AIM Strategy represents to BLM a robust, responsive method to build a monitoring and adaptive management plan for the BLM's Solar Energy Program.

An AIM Strategy implementation framework for the Solar LTMP is described below.

This framework references a solar long-term monitoring and adaptive management program inter-disciplinary team. The BLM intends to build an inter-disciplinary team (IDT) to ensure the successful implementation of monitoring and adaptive management activities across the Solar Energy Program. The IDT would ideally include leadership and oversight from within BLM's Solar Energy Program with technical assistance from BLM's National Monitoring Program. IDT members would include practitioners and experts from the BLM's National Operations Center, renewable energy policy and program leaders from the relevant State Office, and resource specialists from the relevant field office(s). Stakeholders from the local and state government, the development community, environmental organizations, Tribes, and the larger community where SEZs are sited would be engaged both formally and informally throughout the process.

[1] Core indicators will help determine the forage availability for the Desert Tortoise while supplemental indicators could determine the impact of dust on forage.

The IDT will engage in a pilot of the Solar LTMP in one or more of the SEZs (described below). Results of the pilot will aid in adaptively managing the Solar LTMP framework to allow for replication of a sound process across the remainder of the SEZs and program areas.

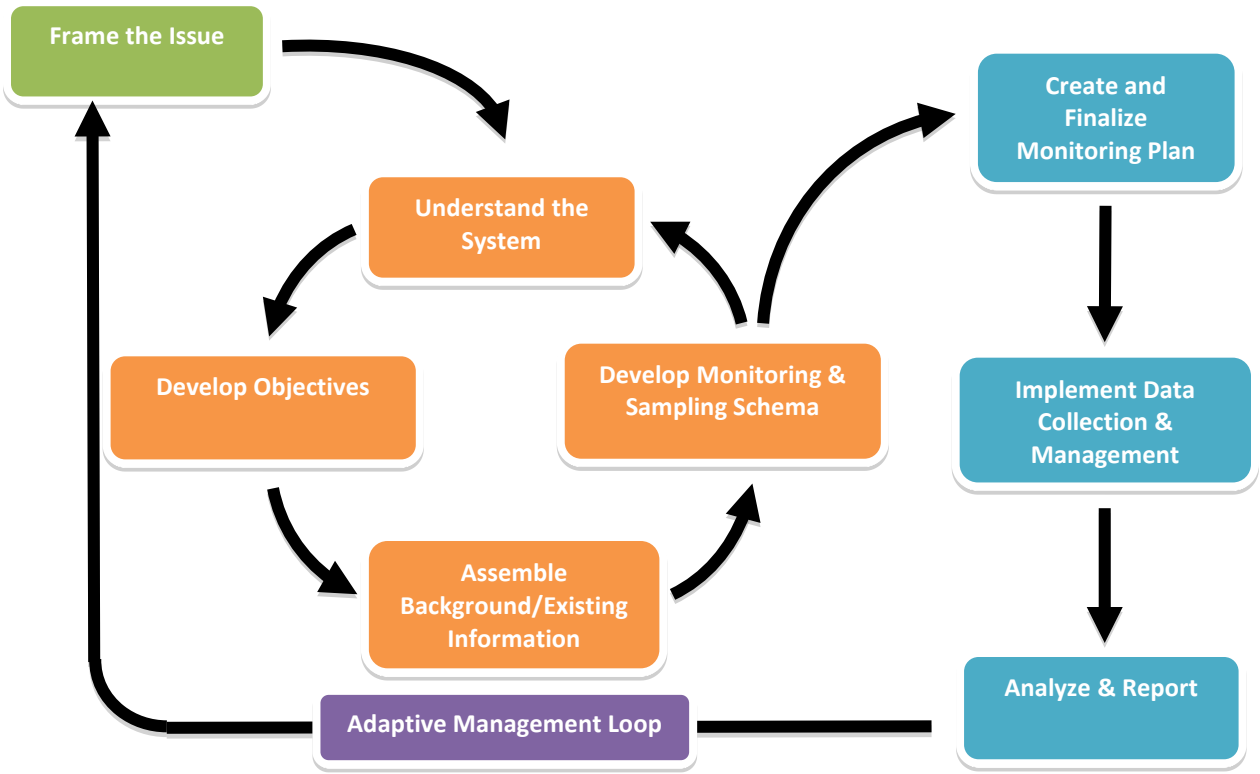

Figure 1. Often depicted as a linear sequence of steps, developing and using a robust monitoring program is an iterative process involving multiple steps and several nested loops.

Frame the Issue

- Identify management question(s)
- Define study areas and determine scale of effort (national, regional, local)
- Review regulatory requirements (FLPMA, RMPs, Standards, etc.)

The IDT frames the issue by identifying one or more specific management questions and geographies of interest to guide the solar monitoring process. Interpretation of the Federal Land Policy and Management Act (FLMPA), specific regulatory standards and directions, land use plans, and any documented stakeholder input aid in focusing refinement of management questions. The IDT also reviews existing biological opinions and monitoring requirements. Across all SEZs, the IDT determines a suite of baseline requirements informed by national level management questions. At the SEZ-specific scale, field or district level resource specialists on the IDT will identify additional local-scale, resource specific management questions. Stakeholders may also contribute information in identifying past and future concerns relevant to siting clustered utility-scale solar projects.

Understand the System

- Review existing literature and models
- List key ecological components, interactions, and processes essential for system sustainability
- List drivers related system functioning
- Review relevant local/traditional knowledge
- Review AIM conceptual model
- Create regionally specific conceptual model; adapt/add detail related to listed processes, drivers, and needs to the AIM model

To understand the system and develop objectives, the IDT reviews existing literature and conceptual ecological models. More specifically, the IDT identifies key ecological components, interactions, processes and drivers, and local and traditional knowledge related to system sustainability for each SEZ. These key factors are the basis for a hypothetical understanding of ecological sustainability and are formalized in a project-specific conceptual model. Existing, peer-reviewed models can used; if an existing model does not exist, ecological components, interactions, processes and drivers should be used to create a new model. The detail of this project model should be appropriate for the scale of the management questions. For consistency, models should be shared across SEZs as appropriate.

Develop Objectives

- List regulatory requirements and program needs, including Land Health Fundamentals and Standards
- Consider key ecological elements (defined by the conceptual model), management questions, and regulatory requirements to ensure core indicators and methods fulfill needs
    - Add SMART supplemental indicators as necessary
- Develop SMART monitoring objectives related to core and supplemental indicators

To develop monitoring objectives, the IDT inventories management questions, regulatory requirements and program needs, including Land Health Fundamentals and Standards, as well as key ecological elements as defined in the conceptual model. Considering both management questions and ecological concepts, the IDT then determines if the data collected using the AIM core indicators and methods meet all local and program monitoring needs. In the event that the core indicators are not comprehensive enough, the IDT identifies and describes supplemental indicators as necessary.

All monitoring indicators and objectives identified must be specific, measurable, achievable, relevant, and time sensitive (SMART) and derived from the conceptual model. Indicators can serve as a common currency across other monitoring efforts to determine effectiveness of mitigation measures. Objectives must also be SMART by indicating the desired amount of change (specific), level of confidence for the measured change (measurable), funding and capacity requirements (achievable), relationship to the management question (relevant), and time frame during which the measurement occurs to effectively inform management (time sensitive). The monitoring objectives may be based on ecological sustainability or management questions.

Assemble Background and Existing Information

- Review and assemble existing research to support supplemental indicators and methods
- Identify related, existing, and legacy monitoring efforts
- Identify and assemble existing reference/base data (e.g., to support sample stratification)

In this step, the IDT reviews and assembles background and other information (such as local input from stakeholders) to integrate pre-existing work efforts, knowledge and/or science, reduce potential redundancy, and identify base layers available for mapping needs. The IDT performs a literature review to justify the selection of supplemental indicators and determine appropriate peer reviewed methods for data collection. The IDT also evaluates past and existing monitoring activities at multiple scales and related data within the BLM, cooperating agencies, Tribes, academic institutions and relevant NGOs to determine quality and relevance to derive supplemental indicator status and function. The IDT assembles existing reference data (e.g., vegetation maps, ecological site potential, topography, and administrative areas) to support project design and implementation.

Develop Monitoring and Sampling Schema

- Refine study area
- Identify potential data collection approaches for selected indicators
  - Field and/or remote sensing based
- Choose sample design, stratification and intensity
- Generate unbiased sample points

The IDT finalizes the study area to include the SEZ, adjacent variance areas and other surrounding lands if they are determined to be within the selected monitoring scale (i.e. watershed, landscape, eco-region). The IDT develops and optimizes the data collection and sample design necessary to meet the monitoring objectives and thus inform the management questions at the desired level of precision. In doing so, the IDT considers the spatial distribution, stratification, sampling weights, and temporal interval of sampling visits. All of the information gathered provides the input for the AIM sample design calculator to generate unbiased sample points across the study area (SEZ and adjacent areas) that are consistent and compatible with AIM based sampling at multiple scales within the BLM.

Create and Finalize Monitoring Plan

- Define and document protocol decision rules for replacing sample points, locating and laying-out plots, and collecting/recording data
- Optimize data collection (field and/or remote sensing)
- Finalize/ approve monitoring plan
- Develop/ approve monitoring implementation plan

The IDT coordinates decision rules for replacing sample points, locating and laying-out plots and collecting/recording data across all 17 proposed SEZs for consistency and compatibility and to ensure the success and utility of the Solar LTMP. The core indicators will be implemented as described in AIM Technical Note 440 (found on the solar PEIS website: http://solareis.anl.gov/) and collected to the AIM National data standard; supplemental indicators will use peer-reviewed, accepted methods. To maximize the efficiency of data collection and to address site access issues, remotely-sensed data will be integrated with field visits. The final Solar LTMP will receive technical approvals from a BLM national monitoring specialist, State monitoring lead, and the National solar program monitoring coordinator. To develop a monitoring implementation plan, the IDT will consider the devised plan and determine the cost for the Solar LTMP over the life of the Solar PEIS or utility of the SEZ, including time for decommissioning and site stabilization or restoration. A final plan will also catalogue necessary staff resources to deploy the monitoring program and the necessity of a third party contract to enact the Solar LTMP.

Implement Data Collection and Management

- Implement monitoring plan and collect data
- Perform Quality Assessment/Quality Control (QA/QC) and data stewardship
- Upload data to national monitoring database
- Review, approve, and replicate to production database

To implement the Solar LTMP and ensure consistency throughout the Solar LTMP, all IDT staff or contractors will be required to complete annual training and calibration activities. All data will be collected using the Database for Inventory, Monitoring and Assessment (DIMA) on a tablet PC or similar device. All field collection tools must meet the minimum standards established in the AIM data implementation framework. Field collected data will undergo initial QA/ QC steps in the office managing the solar zone and will then be loaded into the corporate data base (in development) for additional QA/ QC validation. Monitors will upload data to the National publication database. The data quality plan will include stewardship requirements at the Field, State and National Offices. Field user-support and maintenance of the National data base will be needed, and may require additional capacity.

Analysis and Reporting

- Analyze/evaluate data against monitoring objectives and/or land health standards
- Communicate results as appropriate
- Complete annual reports

Monitoring indicator values will be interpreted against monitoring objectives, ecological potential, Land Health Standards, and management thresholds. Raw data and data products will be available to the public in a timely manner. Consistent with other sensitive data, the exact point location will be buffered for publicly-available data to protect the integrity of the sample site. A critical element of the Solar LTMP will be the production of an annual report summarizing the condition and trend of the area. The annual reports will be used to determine management and mitigation effectiveness. Analysis of condition and trend reports will adaptively feed back into the monitoring planning process for relevant SEZs and the

solar program more generally. Management changes with SEZs may result from such analysis (see adaptive management below). This report will be made available to the public.

Adaptive Management Loop

- Analyze monitoring results in annual reports against resource objectives and conceptual model
- Adapt activities, models and monitoring plan as necessary
- Incorporate lessons learned into future activities and management actions

The BLM will use information derived from the Solar LTMP to adaptively manage projects, the Solar Energy Program, Solar LTMP conceptual models and the Solar LTMP more generally. For example, Solar LTMP reports will aid BLM in efforts to (1) review project-level construction compliance activity and adjust future project compliance decisions; (2) amend BLM's Solar Energy Program by adopting new or revised SEZ-specific design features or SEZ boundaries, include new or revised programmatic design features, or assign new or revised exclusions (changes to the BLM's Solar Energy Program will be subject to appropriate environmental analysis and land use planning and the related requirements for public involvement); (3) modify Solar LTMP conceptual models to include or exclude stressors, increase specificity of resource stressor interactions, or add or remove supplemental monitoring indicators; and (4) adapt the Solar LTMP to increase or decrease frequency of sample collection and/or accommodate precision and accuracy requirements, or add or remove supplemental monitoring indicators. Adaptive management and feedback of Solar LTMP results would be beneficial at multiple administrative levels within the BLM. Information from the Solar LTMP might also be used to adaptively manage resources adjacent to SEZs or within the wider SEZ region particularly through ensuring participation on the IDT from other Department of the Interior agency staff and coordination with Department monitoring programs.

Building and Testing a Solar LTMP

The IDT will engage in a pilot of the Solar LTMP in one or more of the proposed SEZs. Results of the pilot will aid in adaptively managing the Solar LTMP framework to allow for replication of a sound process across the remainder of the SEZs and other program lands.

A potential pilot process is outlined below.

1. BLM-Washington Office, California, and National Operations Center staff adapt existing state-based monitoring protocols and research efforts to include AIM Strategy process language and principles.
2. Recruit a Solar LTMP project manager.
3. Expand leadership team to form an IDT composed of BLM and other Department of the Interior staff with solar policy knowledge and resource expertise in the pilot eco-region; include team-members from local and state agencies and other partners with local knowledge where possible.
4. Hold in-person three-day kickoff meeting with IDT to:
    a. Identify roles
    b. Determine schedule

    c. Understand budget limitations and possibilities and set LTMP budget, including potential partnering opportunities
    d. Set goals and deliverables
    e. Identify resources and stressors in selected pilot area
    f. Determine management questions
    g. Assign development of conceptual models and set deadlines for completion
    h. Begin discussion before-after-control-impact Solar LTMP design
    i. Determine availability of baseline data (if known)
    j. Identify data gaps
    k. Propose data report process and analytical frameworks
    l. Establish stakeholder engagement process and schedule
5. Thereafter, meet weekly by web-ex to review conceptual models, identify supplemental indicators and determine final Solar LTMP.
6. Release statement-of-work for third party monitoring contract, provide application time and select contractor.
7. Begin baseline monitoring on control and impact sites.