Regional Mitigation Planning –

Dry Lake Solar Energy Zone Pilot Project

Phase I Kickoff Workshop

August 29-30, 2012

Presentations

Introductory Session –
Shannon Stewart, BLM

The Mitigation Framework in the Solar PEIS incorporated comments from stakeholders. The pilot project will start to implement and test the idea. As a pilot, BLM doesn't have all of the answers and is planning to work through the questions with the stakeholders.

The Final Solar PEIS was published on July 27th. The goal over the next several months is to adopt a mitigation plan for solar development in the Dry Lake SEZ, and to apply the lessons learned to mitigation planning for other SEZs.

Landscape-scale planning is the focus - there are 285,000 acres in the SEZs where development will be prioritized. Mitigation planning is intended to incentivize development within the 17 SEZs.

The BLM's Solar Program is designed around a mitigation hierarchy – the first step is avoidance of impacts through siting (i.e, identifying sensitive lands to be excluded from solar development). The next step is minimization which is achieved through implementing design features (that is, required measures or best management practices to address impacts). Minimization also includes compliance with existing laws (e.g., ESA). The third step is mitigation of unavoidable impacts – BLM is working with stakeholders on where and how mitigation will be used. Mitigation planning is intended to simplify the mitigation process at the project-specific level.

A conversation among stakeholders is needed, agreement about what should be mitigated, and development of a strategy. This may look very different from zone to zone where there will be different kinds of impacts and different costs. The make-up of the mitigation plans will be unique for each zone.

Many people have an interest in this pilot mitigation planning project and BLM wants to hear from all interested parties.

Session 1 – Why Undertake a New Approach to Mitigation?

1. How does BLM currently plan for and manage mitigation for renewable energy rights-of-way? *(Presenter - Greg Helseth/BLM)*

2. Redefining mitigation – conservation community view – panel discussion followed by facilitated group discussion *(Presenters - Laura Crane/The Nature Conservancy, John Hiatt/Red Rock Audubon Society [Summary of Dr. Hiatt's presentation to be provided])*

3. Redefining mitigation - solar industry view - panel discussion followed by facilitated group discussion *(Presenters – Andrew Wang/Solar Reserve LLC, Clay Jensen/Bright Source Energy)*

4. Redefining mitigation - other multiple-use perspectives – panel discussion followed by facilitated group discussion *(Presenters – Stephen Fosberg/BLM; Steve Belinda/Theodore Roosevelt Conservation Partnership) (Summaries of these presentations to be provided by the authors)*

Nevada Bureau of Land Management
Why undertake a new approach to mitigation
August 29-30, 2012
Tuscany Suites and Casino, Las Vegas, NV

How does BLM currently plan for and manage mitigation for renewable energy rights-of-way

- Avoid the Impact
- Minimize the effect to the Impact
- Mitigate for the Impact

Questions

Contact information

- **Greg Helseth**

  BLM Renewable Energy Program Manger Southern Nevada

  ghelseth@blm.gov

  702-515-5173

The Nature Conservancy

Protecting nature. Preserving life.™

Overview

1. Why integrate mitigation and landscape-scale planning.

2. What is landscape-scale planning.

3. What is the mitigation hierarchy.

4. How to integrate mitigation with landscape-scale considerations.

Why Integrate Mitigation & Landscape-scale Planning

1. Best approach for achieving multiple goals

2. Improved permitting and reduced uncertainty

3. Improved conservation results

Mojave Desert Conservation Value

Project Area

Mojave Desert

Conservation Value

Ecologically Core

Land with low levels of anthropogenic disturbance which support conservation targets and whose protection is critical for the long-term conservation of the ecoregion's biological diversity

Ecologically Intact

Land with low levels of anthropogenic disturbance or which supports conservation targets and which requires a level of protection that will enable it to continue to support ecological processes and provide connectivity

Moderately Degraded

Land fragmented by roads, off-road-vehicle trails or in close proximity to urban, agricultural and other developments

Highly Converted

Land in urban and agricultural areas that is fragmented and most impacted by human uses

Boundaries

State

County

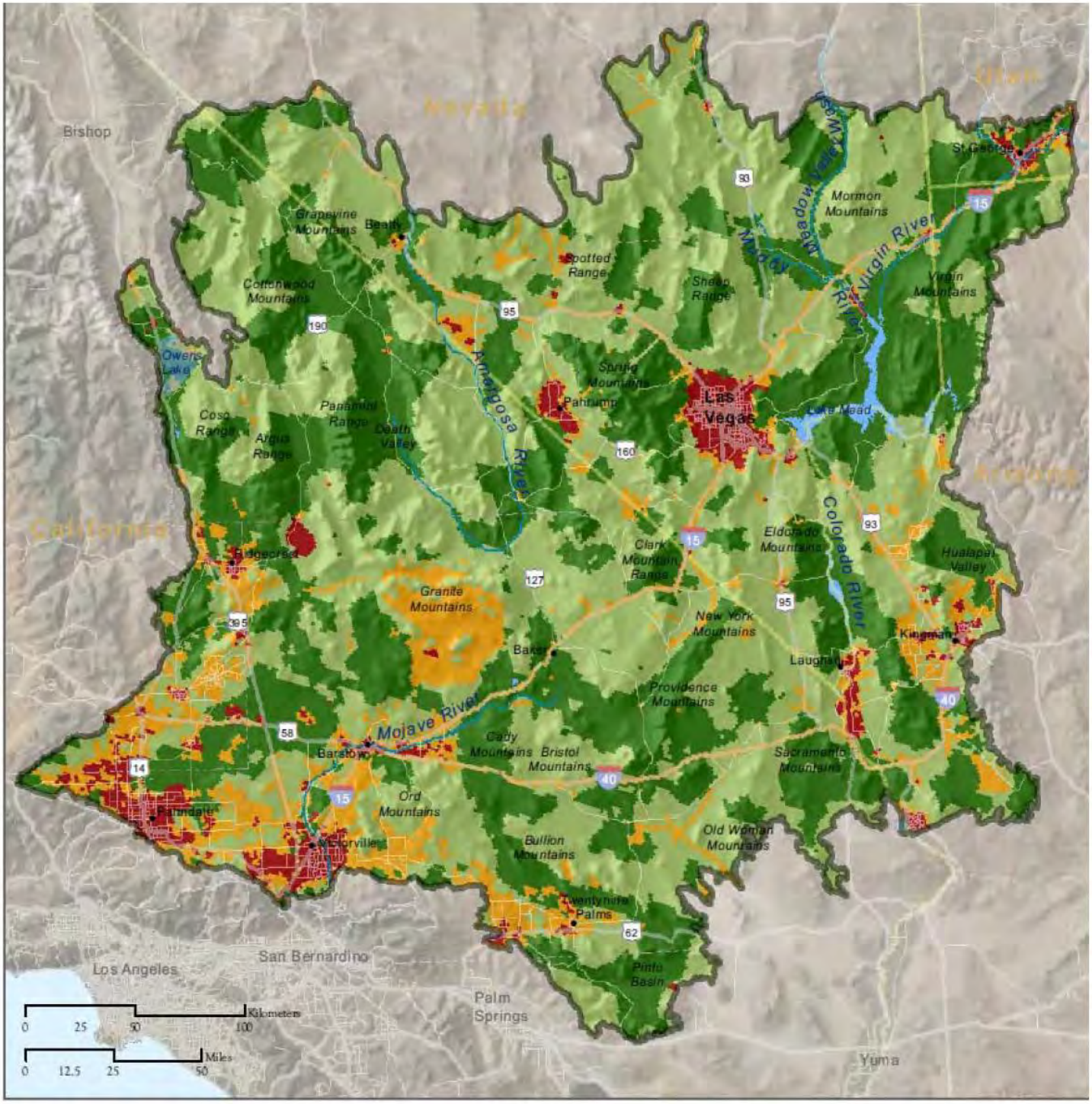
Transportation

Major Road

Other Road

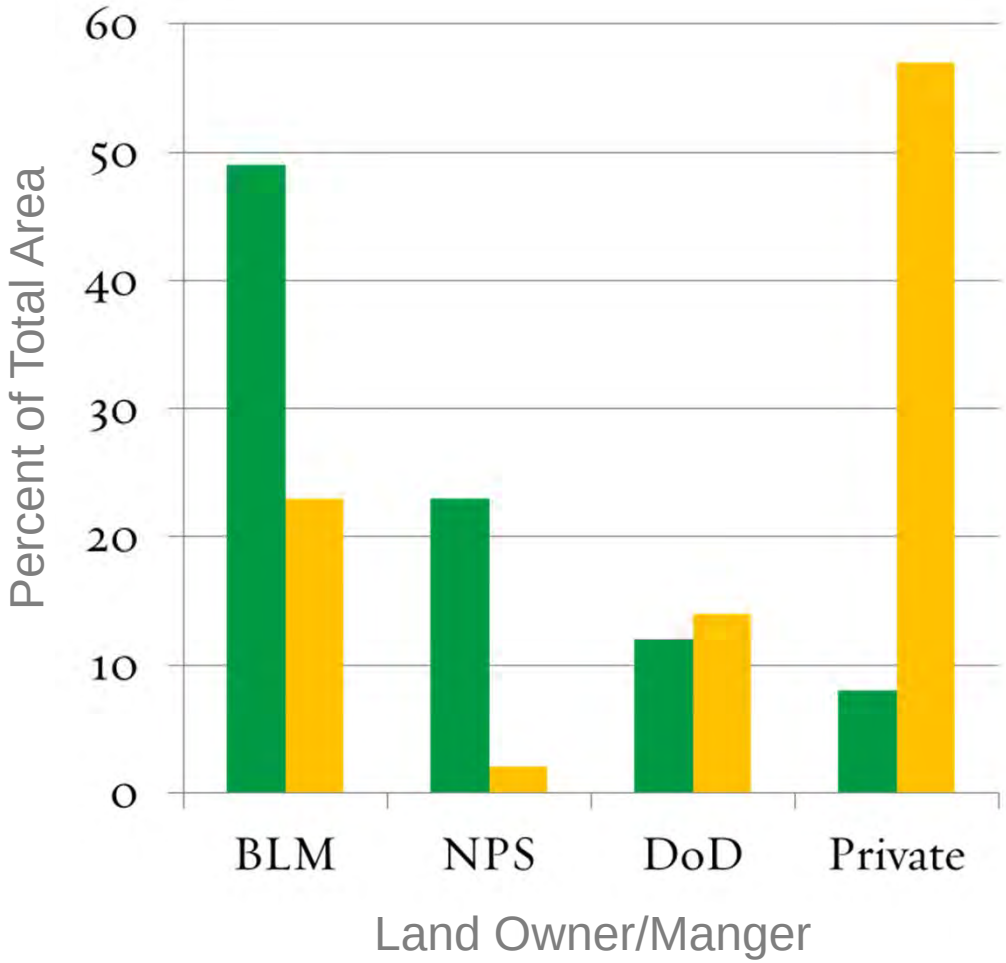
Hydrology

Major River



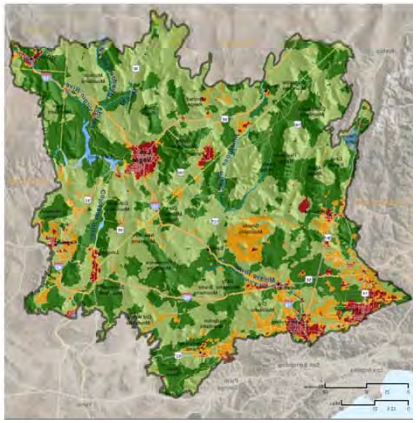
Produced by The Nature Conservancy
California South Coast & Deserts Program
Map Date: July 1, 2010
See Table A.1 for sources

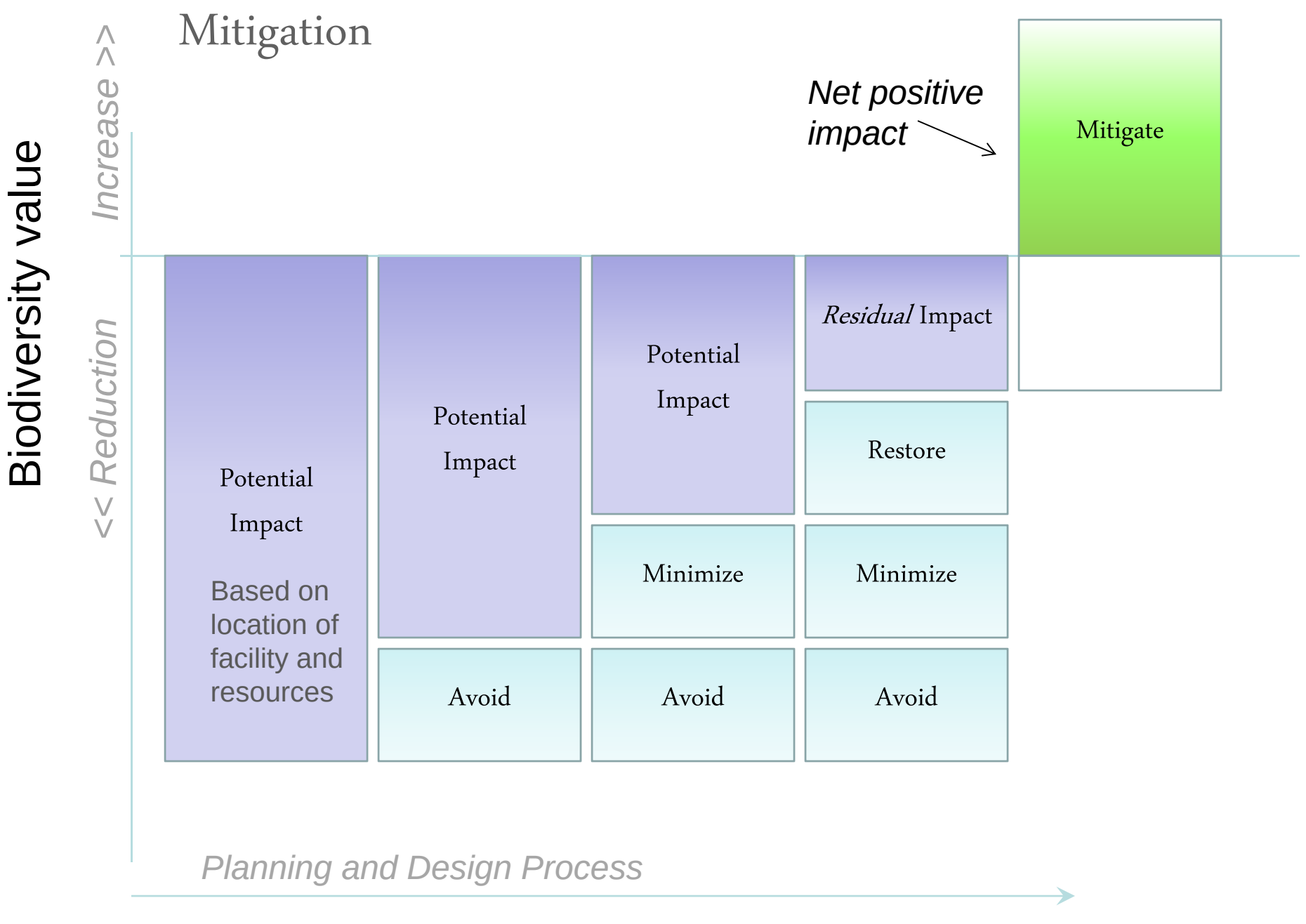
Mojave Desert Conservation Values by Ownership/Management



Ecologically Core & Intact Lands (High Conservation Value)

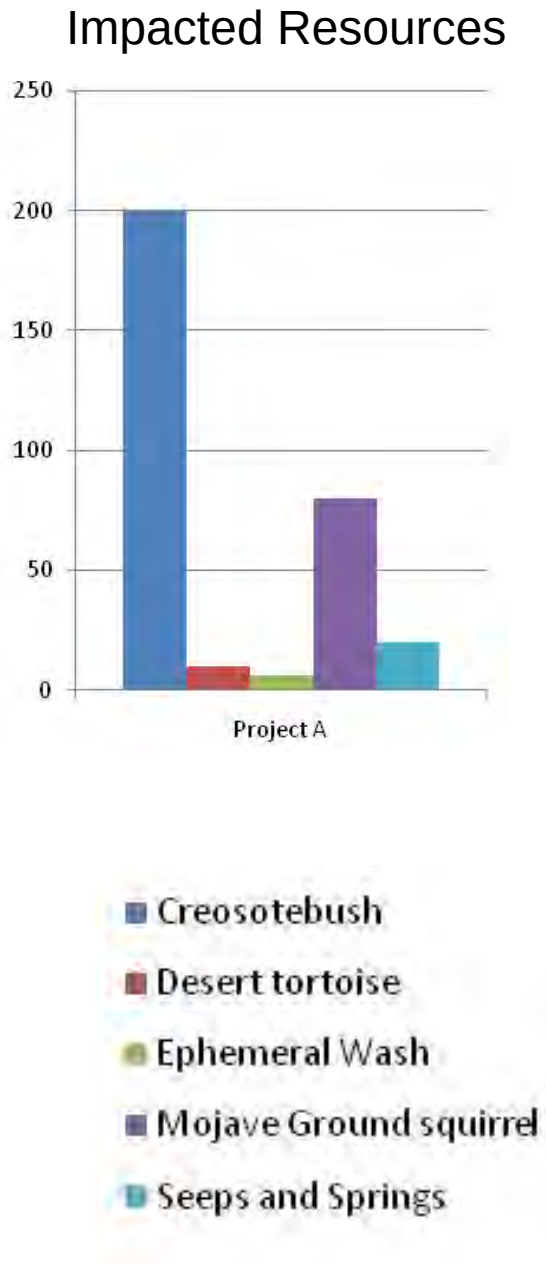
Moderately Degraded & Highly Converted Lands (Lower Conservation Value)




Biodiversity value
Increase >>
<< Reduction
Mitigation
Net positive impact
Mitigate
Potential Impact
Based on location of facility and resources
Avoid
Potential Impact
Minimize
Avoid
Potential Impact
Restore
Minimize
Avoid
Residual Impact
Planning and Design Process

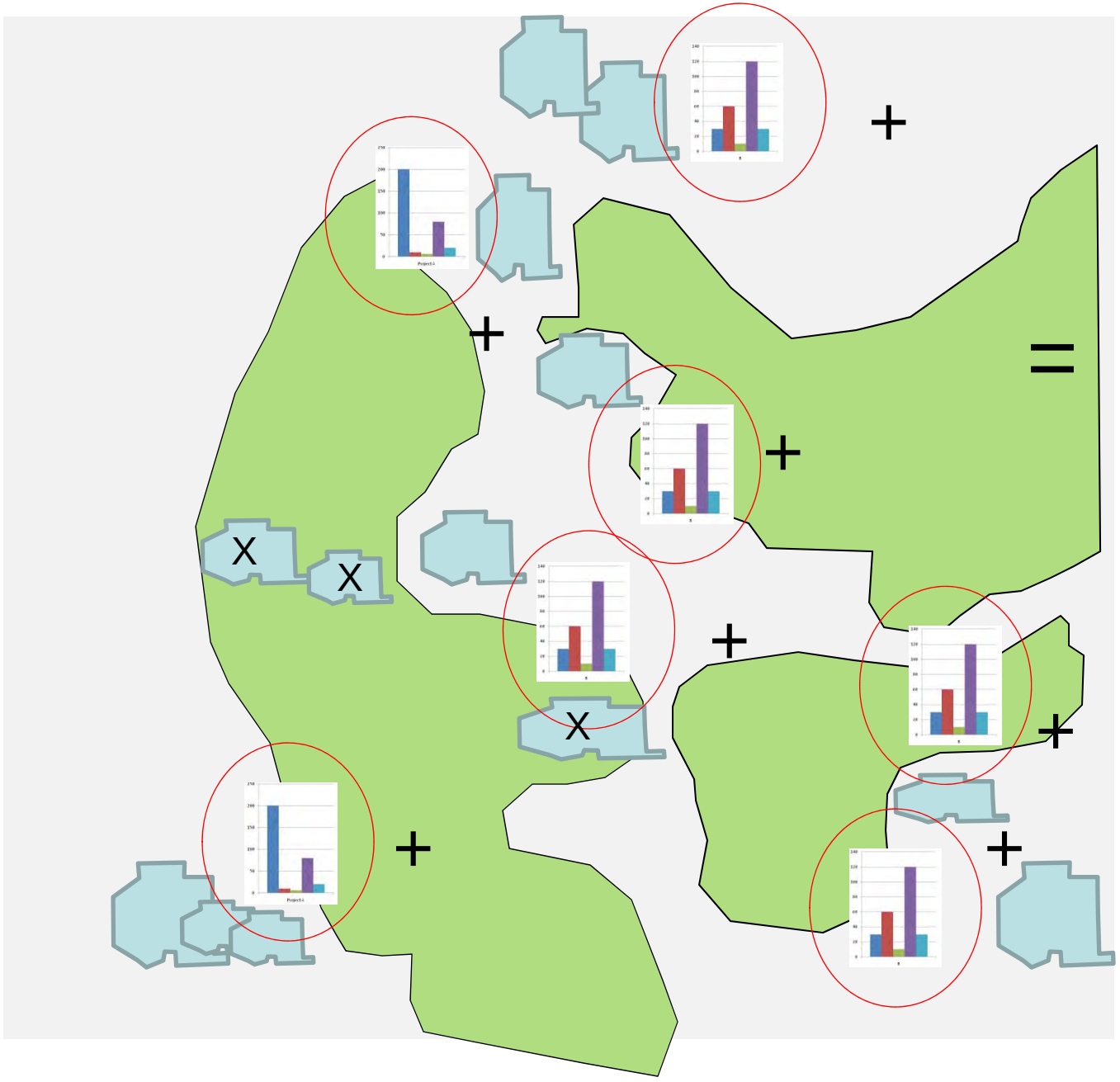

Public domain photo, USGS


Fence springs
Close roads
Solar project
Acquire habitat on private land

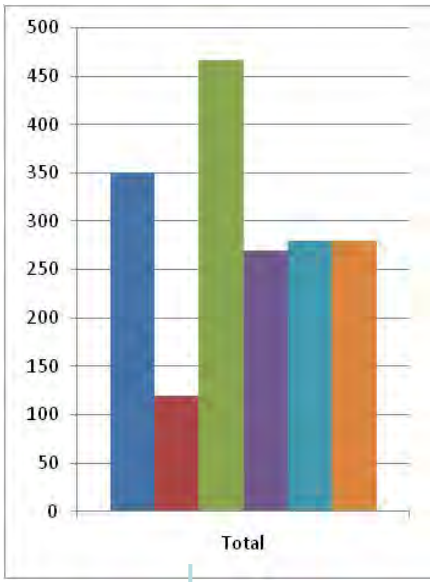

Impacted Resources
250
200
150
100
50
0
Project A
Creosotebush
Desert tortoise
Ephemeral Wash
Mojave Ground squirrel
Seeps and Springs

- One project at a time

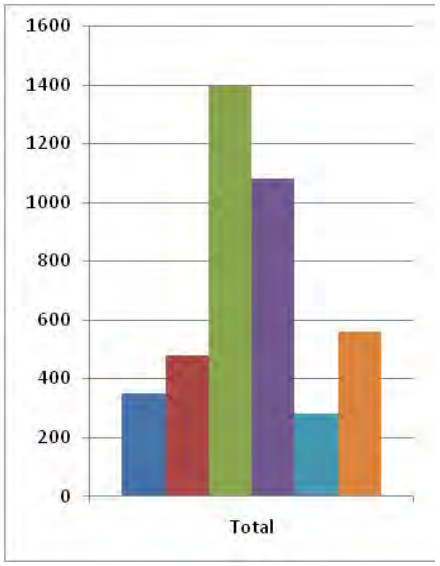
- Smaller, isolated actions

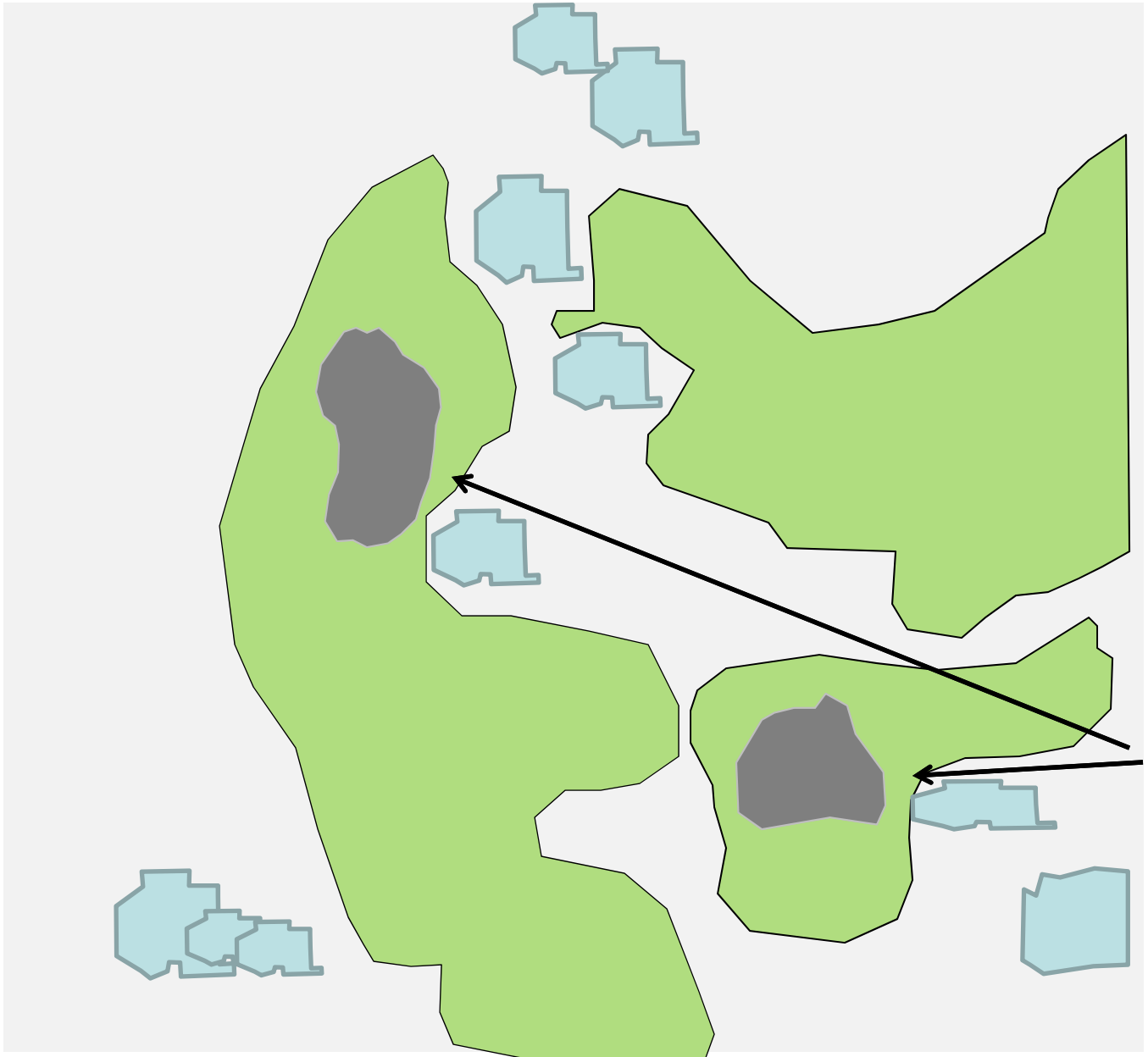


Collective Impacts



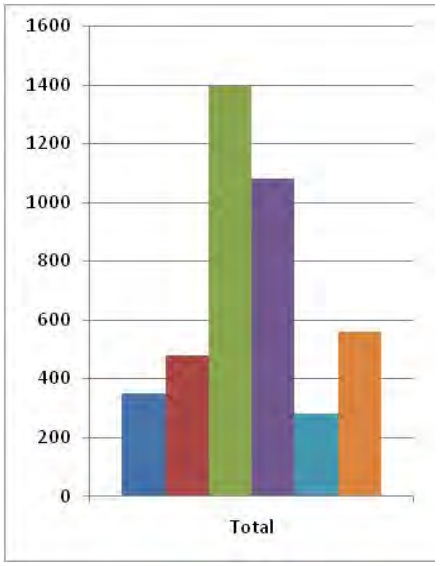
Collective Mitigation





Solar applications
Conservation Priorities
Regional Mitigation Sites

Collective Mitigation



How to Integrate Mitigation & Landscape-scale Planning

1. Ecological baseline
2. Methodology to assess impacts
3. Methodology to translate impacts into dollars
4. Structure for mitigation investments
5. Prioritization of mitigation investments
6. Monitoring & adaptive management

Aligning Mitigation with Landscape-Scale Planning

Who?

- BLM, federal, state & local agencies, Tribes, stakeholders.

What?

- Regional objectives

Where?

- Regional conservation plan

Determining Priorities

1. Surrounding land uses preserve or enhance mitigation benefits
2. Areas with heterogeneity in biota, climate factors, or physical gradients
3. Areas that provide movement corridors
4. Areas featuring desert aquatic and riparian habitats
5. Areas featuring distinct or unique assemblages of species or communities
6. Sites featuring high quality habitat
7. Areas that contribute to the permanence of conservation protections

Additional Recommendations

- Mitigation investments should be additive.
- Low-priority mitigation actions should be identified and avoided
- BLM should explicitly state that proximity to impacts should not be primary factor for prioritization

Groundwater Mitigation

- Desert water resources deserve particular attention
- Same mitigation principles apply
- Exception to the principle of proximity.

Additional Resources

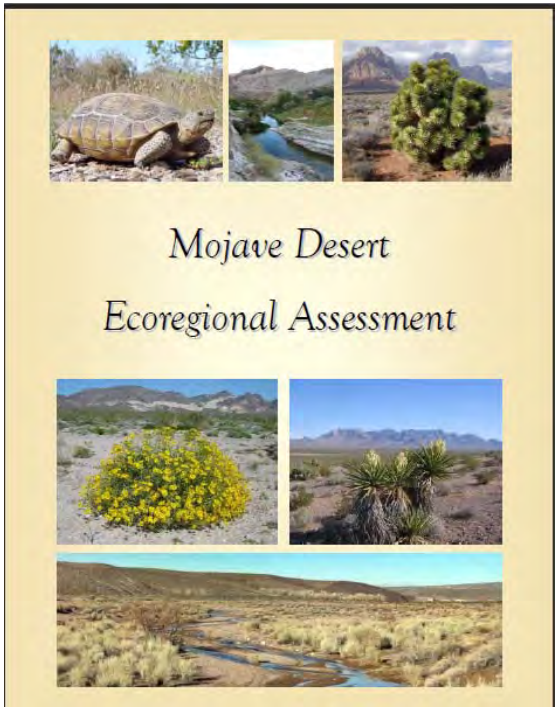
OPEN ACCESS Freely available online

PLoS one

An Approach to Enhance the Conservation-Compatibility of Solar Energy Development

D. Richard Cameron*, Brian S. Cohen, Scott A. Morrison

The Nature Conservancy, San Francisco, California, United States of America



Solar Energy Development in the Western Mojave Desert: Identifying Areas of Least Environmental Conflict for Siting and a Framework for Compensatory Mitigation of Impacts

July 2012

The Nature Conservancy
201 Mission Street, 4th Floor
San Francisco, CA 94105

Questions?

Contact Information: Lcrane@tnc.org

SOLARRESERVE

Dry Lake SEZ Pilot

Andrew Wang
Director of Development
August 29, 2012

SolarReserve Overview

- **Leading solar thermal technology – lowest priced CSP, integrated energy storage**
  - Storage technology leads market – designed for 10 to 15 hours of energy storage for utility customers, 24x7 for mining entities
  - Technology design and performance advancements coupled with supply chain expansion expected to result in substantial cost reductions
- **Flagship project in construction – 110 MW Crescent Dunes Project in Tonopah, NV**
  - Project started construction in August 2011 with operations scheduled for late 2013
  - Full construction "wrap" from ACS Cobra covering technology and balance of plant
- **Technology control under 30-year license with United Technologies**
  - Performance guarantees provided by UTC subsidiary Pratt & Whitney Rocketdyne
- **International expansion advancing**
  - Experienced international team advancing global markets
  - Europe, North & South Africa, Middle East, Australia, Latin America
  - International success – 238 MW PV projects under award in South Africa

SOLARRESERVE

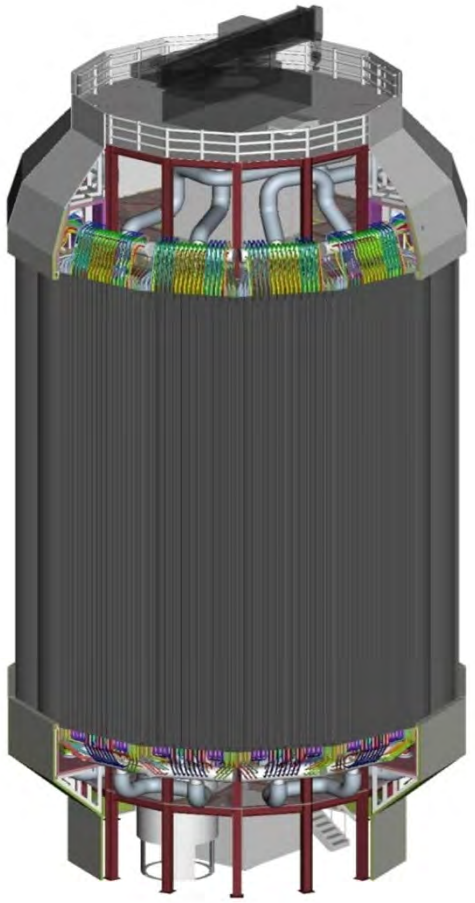
Receiver Derived from Rocket Engine Technology

3,316˚C Rocket Flame

-204˚C Hydrogen Coolant

Technology Leverage

- Engineered to withstand extreme thermal cycles
- Hundreds of regeneratively cooled tubes
- Precision shapes, exotic alloys
- Instantaneous, severe temperature gradients



650ºC Tube Surface Temperature

288ºC Cold Salt Temperature

Technology Validated at Solar Two

Receiver Performance

- Exceeded prediction (receiver efficiency 88%)
- Achieved design temperatures, flow rates, and pressures

Storage Performance

- Demonstrated low daily heat loss (98% efficiency)
- Continuous operation of pumps

Collector Performance

- Demonstrated sun-tracking throughout the year

Plant Performance

- Dispatchability
- Demonstrated electric power up to 24 hrs/day
- Power output (10 MW nominal)

US DOE endorsing conclusions

"The 10 megawatt Solar Two power tower pilot plant near Barstow, California, successfully completed operations in April, 1999, having met essentially all of its objectives."

"Over the three-year operating lifetime, daily operation of Solar Two became relatively routine, with various performance records broken on a fairly regular basis."

US Department of Energy – Sunlab Snapshot, March 2000

Crescent Dunes Solar Energy Project

- **Location**: Tonopah, Nevada
- **Technology**: CSP with Thermal Energy Storage (10 hours full load storage)
- **Size**: 110 MW
- **Energy production**: more than 500,000 MW-hours annually (twice the output per MW of other solar technologies)
- **Capacity factor:** 52%
- **Power contract**: NV Energy – 25 years; $135 MWh
- **EPC Contractor:** Cobra Thermosolar Plants, Inc. with full EPC "wrap"
- **Technology Supplier:** SolarReserve under a subcontract to Cobra
- **Investors:**
  - SolarReserve (managing investor)
  - Cobra
  - Santander

SOLARRESERVE

Project Construction Started in August 2011

Tower foundation installation

Start of tower slip form concrete work

Steel reinforcement

Tower at 200 feet

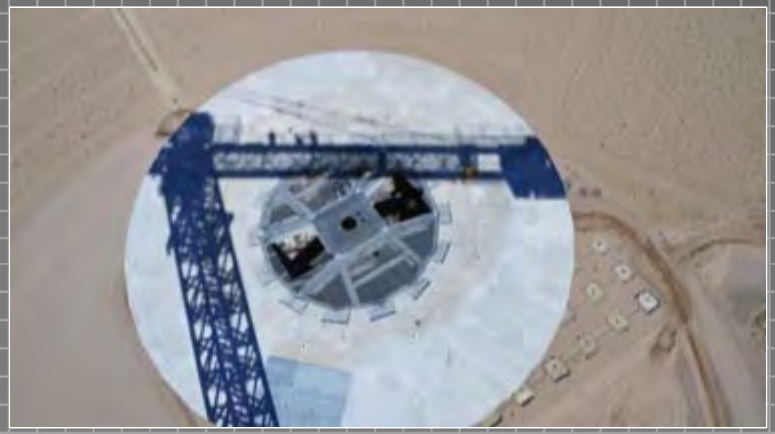
SOLARRESERVE


©SolarReserve
15 . 12 . 2011

Receiver Deck Work

Receiver deck structure

Pouring concrete for receiver deck



Receiver deck completed

Receiver deck with tank foundations below

Construction Progress through August 2012

Pouring control room building foundation

Warehouse maintenance shop foundation

Forming control room building

Unloading the ECV pipe

SOLARRESERVE

Manufacturing – Power Island

Steam Drum

Steam Superheaters

Steam Reheaters

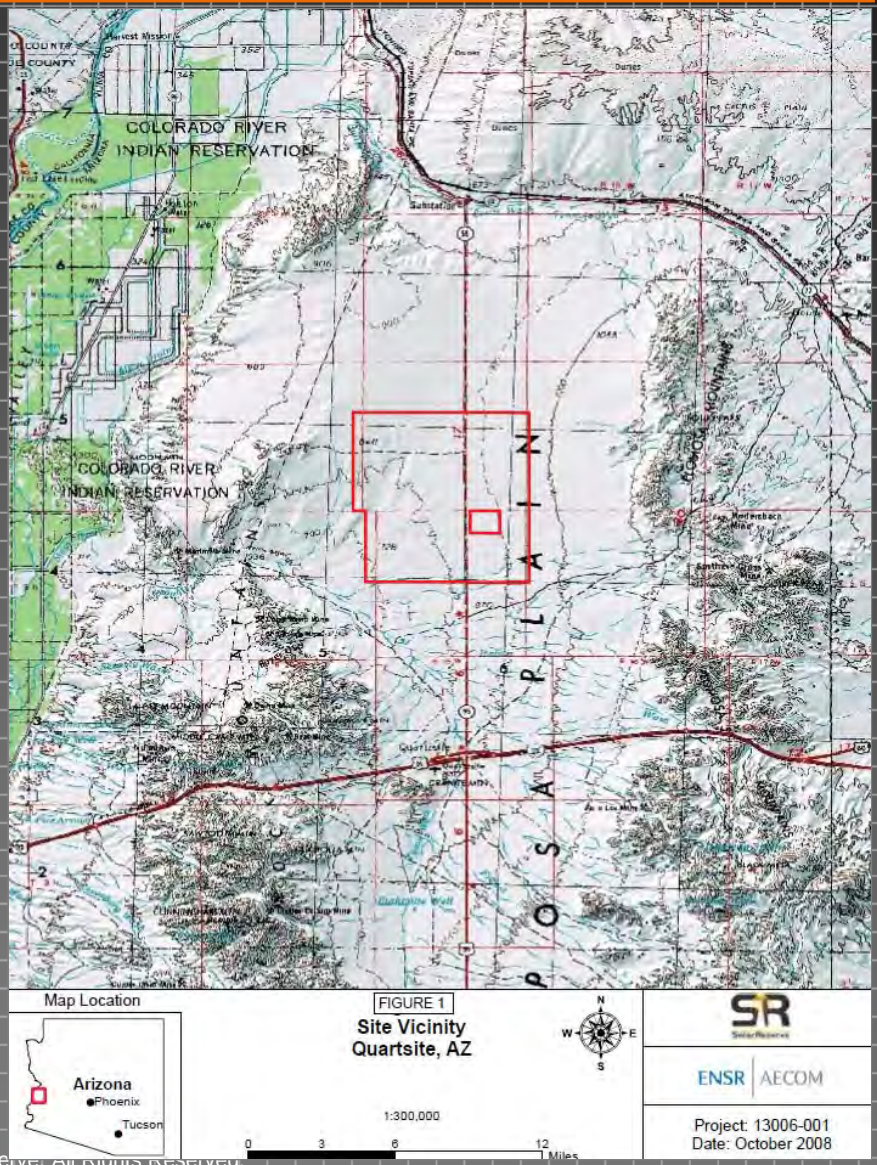
Molten Salt-Feedwater Preheater

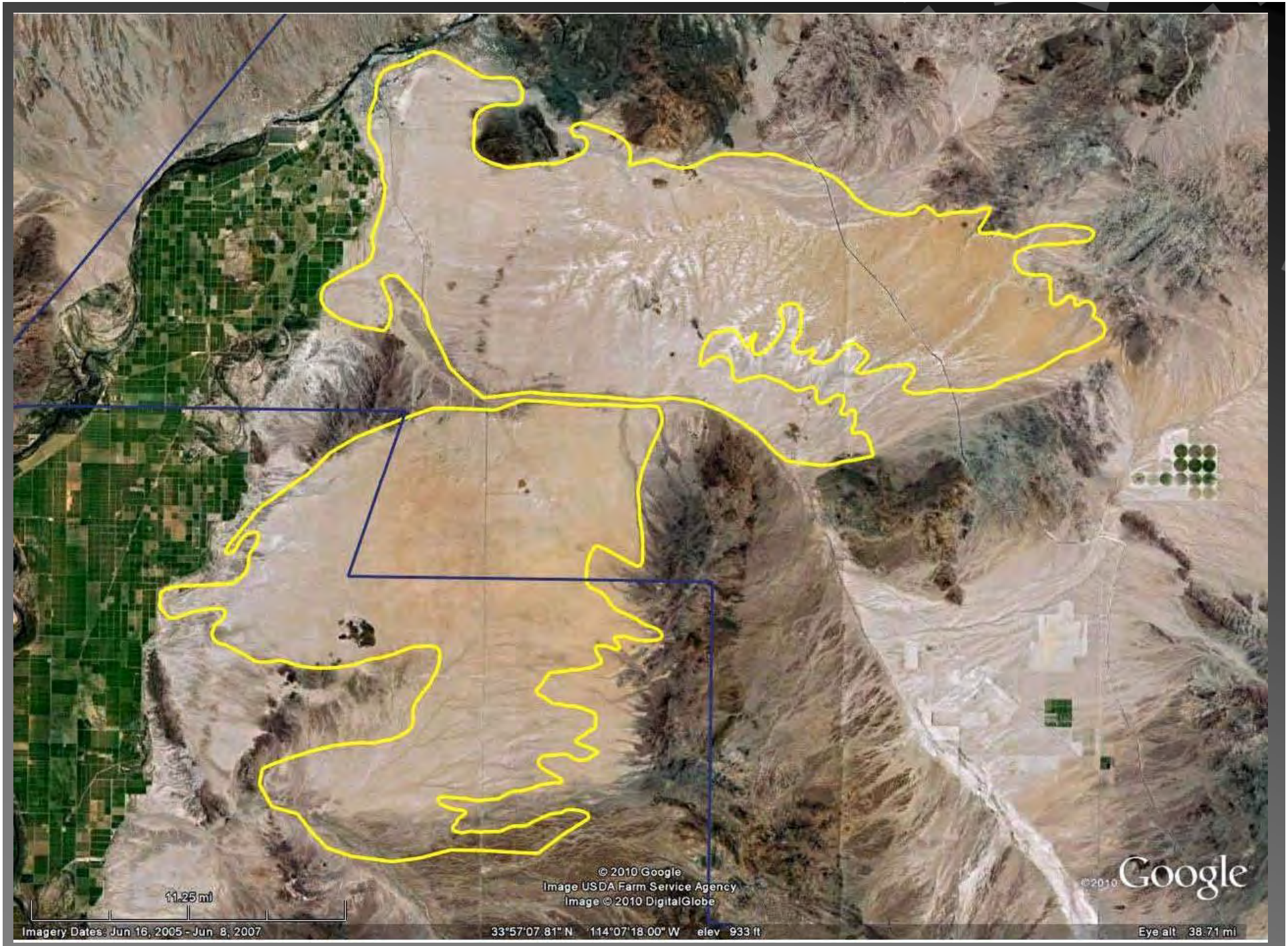
Generator Rotor

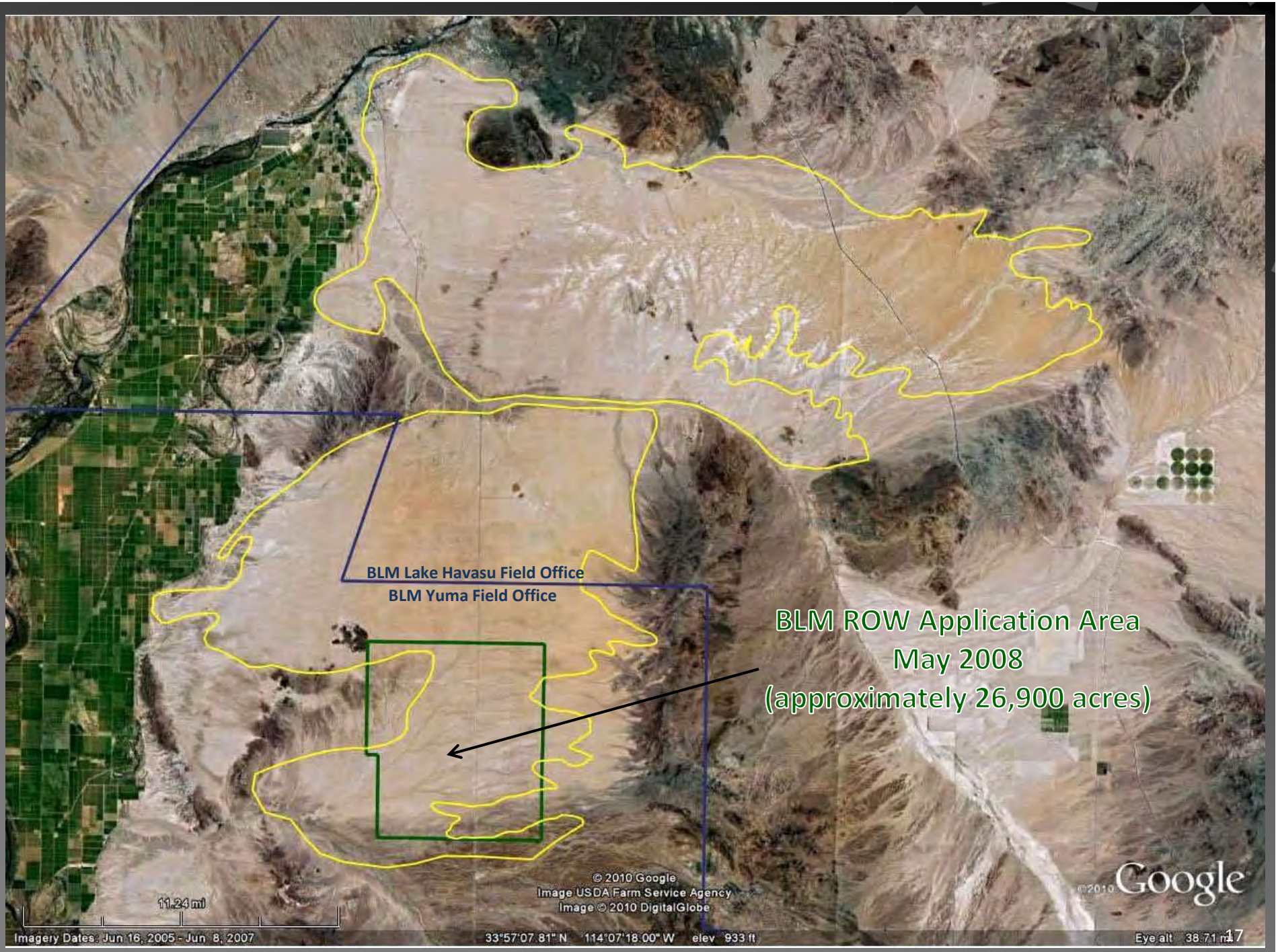
SOLARRESERVE

Quartzsite Solar Energy Project

- 10 miles north of Quartzsite, AZ
- 24,000 acres ROW application
- Actual footprint <1,600 acres
- One 100 MW project, dry cooled
- New switchyard for interconnection on WAPA Bouse-Kofa 161 kV line
- Final EIS underway




© 2010 Google
Image USDA Farm Service Agency
Image © 2010 DigitalGlobe
11.25 mi
Imagery Dates: Jun 16, 2005 - Jun 8, 2007
33°57'07.81" N 114°07'18.00" W elev 933 ft
Eye alt 38.71 mi
©2010 Google


BLM Lake Havasu Field Office
BLM Yuma Field Office
BLM ROW Application Area
May 2008
(approximately 26,900 acres)
© 2010 Google
Image USDA Farm Service Agency
Image © 2010 DigitalGlobe
11.24 mi
Imagery Dates: Jun 16, 2005 - Jun 8, 2007
33°57'07.81" N 114°07'18.00" W elev 933 ft
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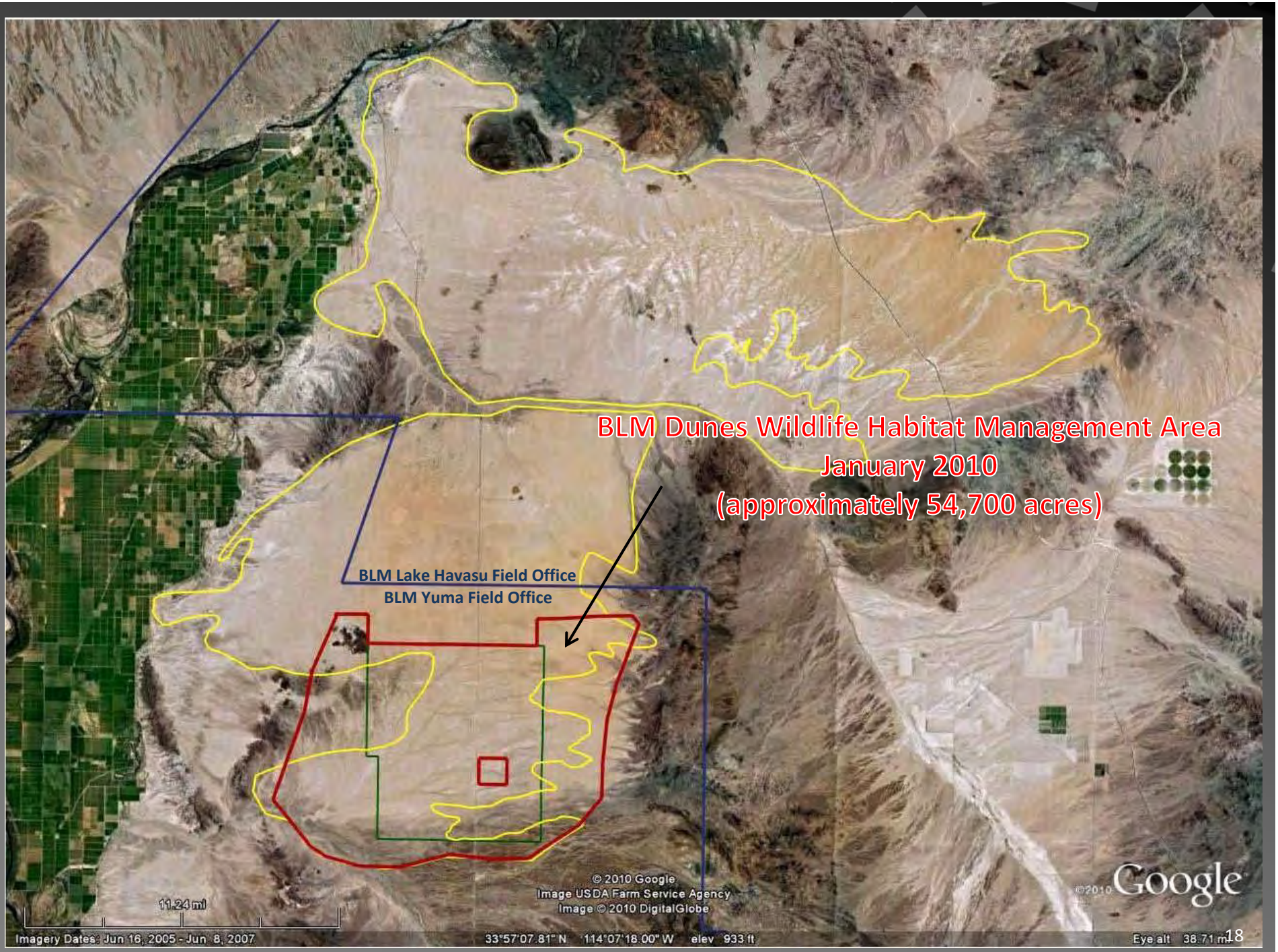
BLM Dunes Wildlife Habitat Management Area
January 2010
(approximately 54,700 acres)
BLM Lake Havasu Field Office
BLM Yuma Field Office
© 2010 Google
Image USDA Farm Service Agency
Image © 2010 DigitalGlobe
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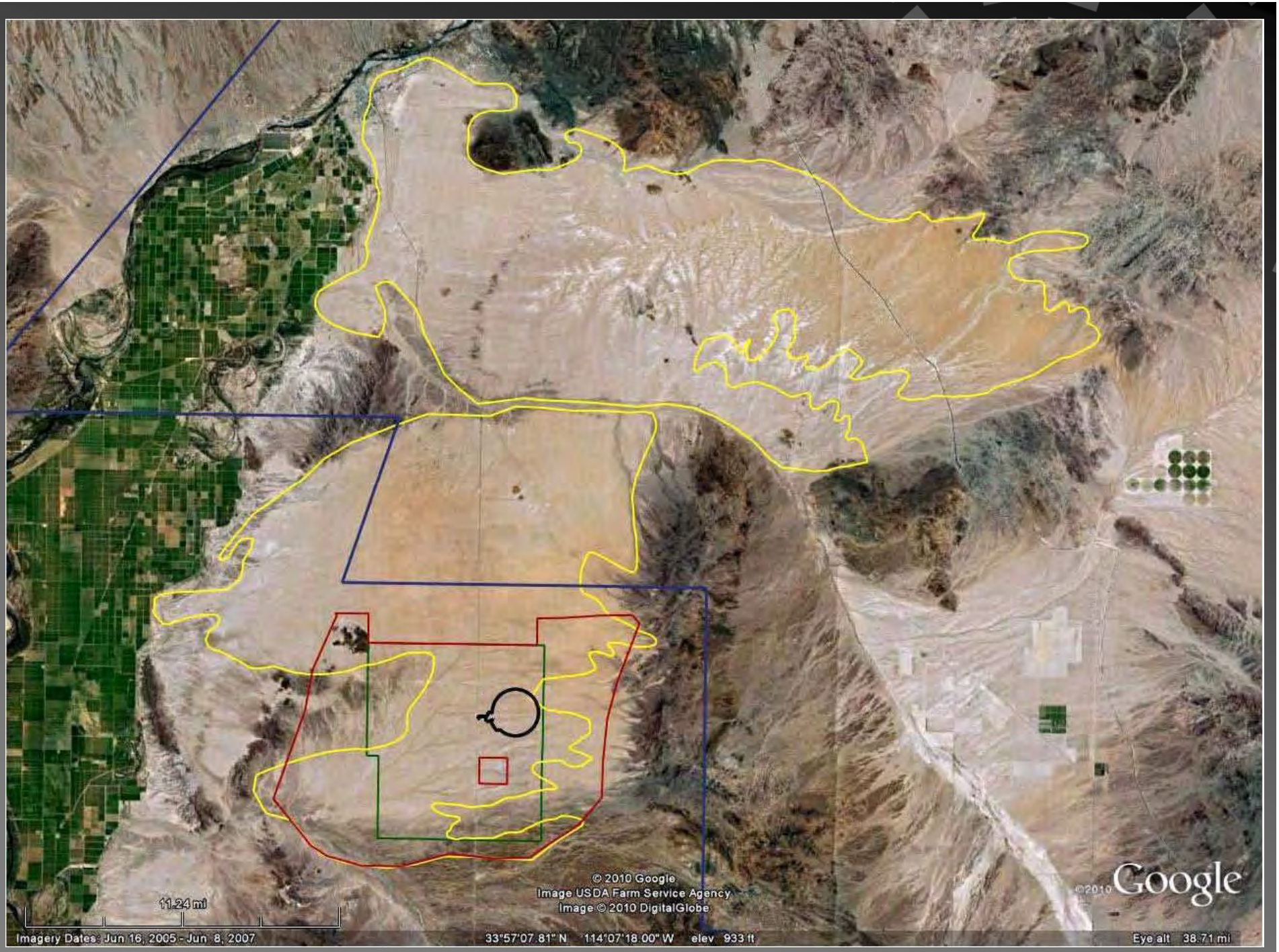
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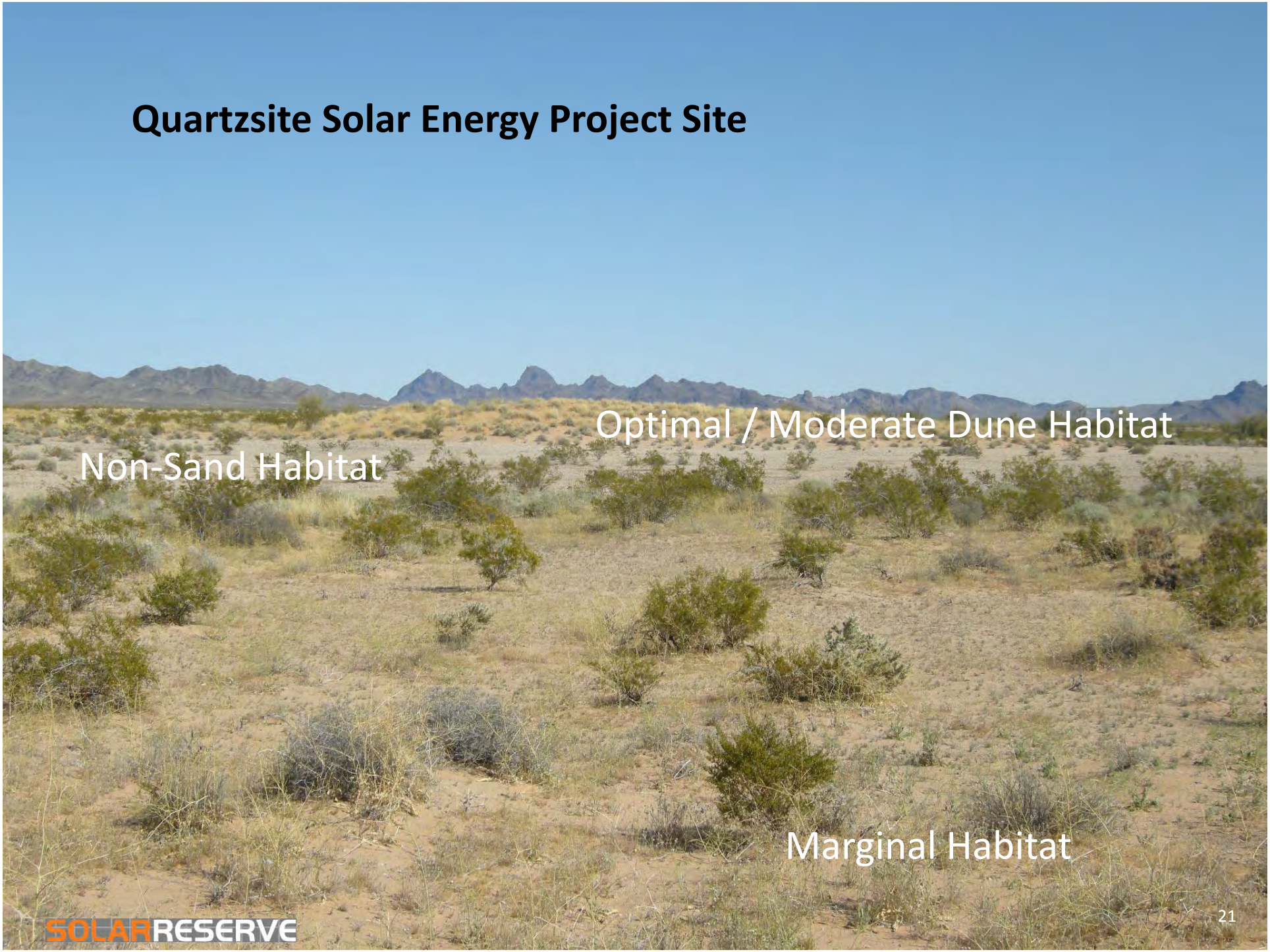
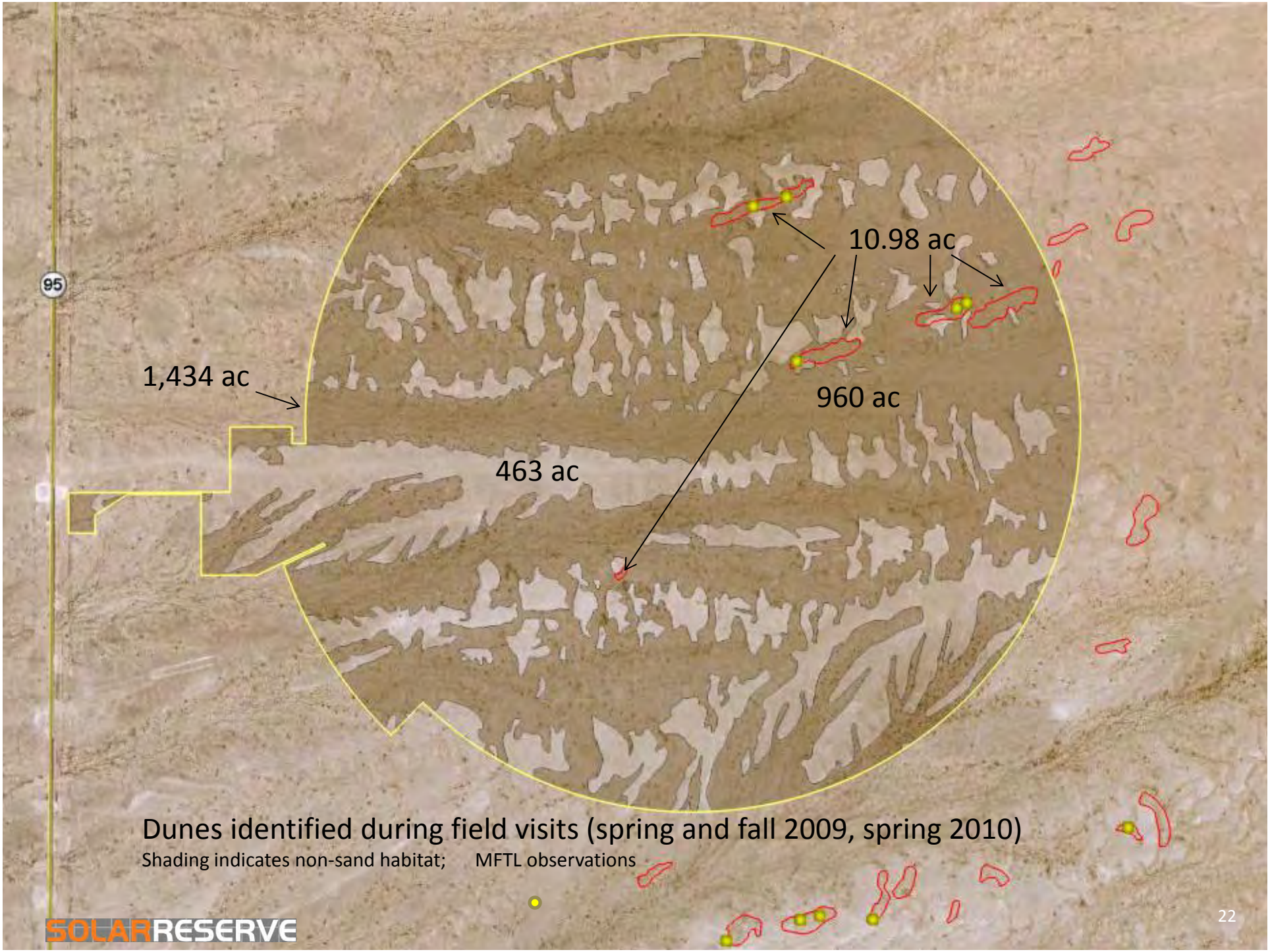
Quartzsite Solar Energy Project Site





Dunes identified during field visits (spring and fall 2009, spring 2010)

Shading indicates non-sand habitat; MFTL observations

Mojave Fringe-Toed Lizard Study

- Dr. Cecil Schwalbe
  USGS / University of Arizona
- Study Objectives
  - Determine occupancy on dunes vs sand sheets
  - Determine density on dunes vs sand sheets
  - Determine home ranges on dunes vs sand sheets
  - Determine activity patterns on dunes vs sand sheets
  - Investigate demography
  - Provide base of knowledge for BLM to make informed land management decisions

Contact

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Redefining Mitigation: Solar Industry View

Presented by Clay Jensen
August 29, 2012

BrightSource
Limitless

BrightSource's SustainOne Approach



Designed to minimize impact on ecosystems and positively address all aspects of:

- Site selection
- Low-impact design
- Water usage
- Air quality
- Species protection

Sustain One

RESPECT. PROTECT. PRESERVE.

Site Selection

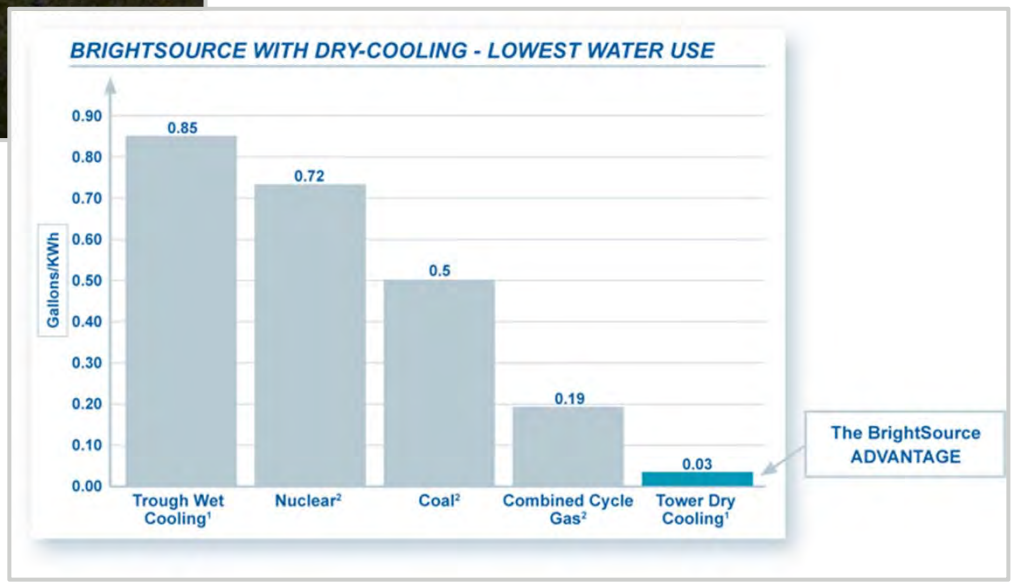
- Dedicated to maximizing land efficiency, minimizing footprint
  - Focusing on areas of high insolation, or solar radiation
  - Near roads and existing transmission lines where human activity is already evident
- Adaptable, environmentally-friendly design
  - Does not require level ground, extensive grading or wide-open space

Designed for the Environment

- Highly land efficient; 1/3 less land per MWh
- Provides for heliostat placement and flexible plant design to work within natural land contours
- Avoids impacts and costs of extensive land grading and concrete pads

Key design parameters:

- Water Use: dry-cooling, conservation and closed-loop recycling
  - Uses air instead of water to condense steam
  - Uses over 90% less water than CSP using traditional wet-cooling



Low Impact Technology

- Provides for heliostat placement and flexible plant design to work within natural land contours
- Avoids significant costs and water flow issues associated with extensive land grading & concrete pads

Restoration

- During – and beyond – the life of the project
  - After construction
    - Restoring areas affected during construction
      - De-compacting soil
      - Spreading of topsoil salvaged during construction
      - Restoring disturbed vegetation
- Decommissioning
  - Though decades away, detailed plan already in place
    - Comprehensive site restoration
      - Removal of all structures
      - Re-vegetation of access roads
      - Removal of all fencing
    - Recycling of steel, concrete, etc.

BrightSource Mitigation Objectives

- Follow the Mitigation Hierarchy:
  - Avoid
  - Minimize
  - Provide Compensatory Mitigation
- When compensatory mitigation is required, BrightSource seeks to provide as much value as possible, just as it does with any other aspect of its business.
- This means compensatory mitigation must be:
  - Effective in protecting species and habitat
  - Robust & reliable
  - Enduring

Existing Mitigation Approaches Fall Short

Current piecemeal approaches to mitigation are:

- Expensive and inefficient
- Not as effective as their cost would merit
- Fail to provide the comprehensive approaches needed to protect species, habitat and migration corridors, particularly in the face of climate change
- An unsatisfying, undue burden on business, while leaving species recovery programs unfulfilled

Comprehensive, Regional Mitigation Would Provide Superior Results

- Regional Mitigation Plans
  - Agency driven programs that identify:
    - Regional, multi-species needs &
    - Comprehensive solutions that provide for contiguous habitat and linking corridors
  - Developer input and ability to contribute cost-effective work to implement comprehensive solutions
- Avoids the “Find a Rock” Exercise
  - Improved results for a broad range of species
  - Makes efficient use of resources
  - Consistent across jurisdictions


brightsourceenergy.com

Session 2 – What does the New Approach to Mitigation Entail?

1. Proposed Solar Regional Mitigation Planning Framework (RMPF): Final Solar PEIS Appendix A.2.5 - presentation followed by facilitated group discussion *(Presenters – Joe Vieira and Shannon Stewart/BLM)*

2. Solar Long-Term Monitoring Plan (LTMP): Final Solar PEIS Appendix A.2.4) *(Presenters - Gordon Toevs and Jason Taylor/BLM)*

3. Group discussion: Is the new approach on the right track? How might it be improved upon? How can stakeholders contribute? Are the outcomes appropriate and well-defined? *(Summary of discussion to be provided in Workshop Summary, in preparation)*

BLM
SOLAR ENERGY
REGIONAL MITIGATION
PLANNING FRAMEWORK

Joe Vieira
Shannon Stewart
BLM

August 29,2012

Overview - Discussion

- **BLM Solar Regional Mitigation Planning – *Why?***
- **Mitigation Hierarchy & *Unavoidable Impacts***
- ***Goals*: BLM SEZ Regional Mitigation Framework**
- **Solar PEIS Regional Mitigation Framework *Elements***
- ***Building* and *Testing* the Framework**

Why?

- Respond to public comments on Draft Solar PEIS & Supplement
- Incorporate a robust mitigation framework
- Adopt a mitigation approach
  - Transparent
  - Systematic
  - Equitable
  - Cost-efficient
- Expand mitigation thinking beyond consideration of individual projects
- Opportunity to pre-plan priority development areas

Mitigation Hierarchy – Avoidance & Minimization

- Solar PEIS describes utility-scale solar energy development & potential impacts

- BLM's Solar Energy Program addresses potential impacts via *Mitigation Hierarchy:*

  1. Avoidance – *Exclusions and SEZs*
  2. Minimization – *General & SEZ-specific Design Features*
  3. Mitigation – *Regional Mitigation Plans for SEZs; case-by-case for variance areas*

Mitigation for SEZs

- **BLM will consider measures to *offset* unavoidable impacts**
- **BLM proposes *regional mitigation plans* to help insure viability, over time, of resources impacted by solar development in SEZs**
- **BLM aims for *streamlined* and *standardized* regional mitigation plans for SEZs**
- **BLM envisions increased *permit efficiencies* and *financial predictability* through regional mitigation plans**
- **BLM's desired outcome = impact mitigation + increased clarity and certainty around *mitigation requirements* and costs for projects in SEZs**

Mitigation for SEZs

- **BLM envisions Regional Mitigation Plans for SEZs that:**
  - **Address the resources impacted by development in SEZs**
  - **Enhance state and federal agencies investment in larger scale conservation and mitigation efforts**
  - **Pool financial resources and prioritize mitigation investments**
  - **Foster equitable allocation of costs among developers proposing development in SEZs**
  - **Avoid inadvertently dis-incentivizing use of SEZs**

Mitigation for Variance Areas

- **Variance Areas – lands outside of SEZs that are open to application in accordance with the proposed variance process**
- **Mitigation for projects proposed in variance areas will be handled on a case-by-case basis**
- **Projects proposed in variance areas would not directly benefit from the pre-determined mitigation strategies, efficiencies, or financial predictability of regional mitigation plans for SEZs**
- **The *objectives & priorities* in regional mitigation plans for SEZs however, may serve as a guide for mitigation requirements for projects proposed in variance areas in a given region**

Regional Mitigation Framework Goals

BLM has identified the following goals for a regional mitigation framework:

- ***Mitigation Hierarchy***
  - Prioritize the consideration of avoidance and minimization strategies before assessing whether and to what extent it is appropriate to mitigate impacts;
- ***Integration and Consistency***
  - Address mitigation obligations at multiple levels concurrently (i.e., federal, state, and local) to avoid duplication and/or unintended consequences;
- ***Repeatability***
  - Establish mitigation strategies that are replicable across the Solar Energy Program and adaptable to differences in SEZs, individual projects, and technologies;

Regional Mitigation Framework Goals

- *Evaluation of Land Acquisition*
  - Comprehensively evaluate land acquisition and long-term management strategies for both public and private lands to fully understand impacts on, for example, local jurisdictions and recreational opportunities, as well as regulatory challenges;
- *Restoration*
  - Allow for the restoration of degraded and previously disturbed public and private lands as appropriate to meet conservation objectives;
- *Fiscal Sustainability*
  - Ensure adequate funding over time to achieve mitigation outcomes;

Regional Mitigation Framework Goals

- *Fiduciary Structure*
  - Employ transparent and accountable third-party managed endowments to hold and manage regional mitigation funds and direct mitigation investments;
- *Combined Investments*
  - Focus investments from a number of projects collectively to increase the likelihood of achieving an effective and enduring offset of impacts and to reduce overall cost;
- *Strategic Prioritization*
  - Establish priority mitigation activities and locations based on, and consistent with, existing conservation objectives, resource management plans, and other Federal, state, and/or local goals;

BLM Solar Energy Zones Regional Mitigation Framework Goals

- ***Mitigation Sustainability***
  - Provide solutions that are as enduring and long lasting as the impacts;

- ***Monitoring and Adaptive Management***
  - Implement monitoring and adaptive management to verify that mitigation strategies are adequate relative to the impacts over time.

Solar PEIS Regional Mitigation Framework Elements

- **Transparent and Legally Defensible Stakeholder Engagement Process**

- **Baseline upon Which Unavoidable Impacts Are Assessed**

Solar PEIS Regional Mitigation Framework Elements

- **Methodology for Assessing and Quantifying Unavoidable Impacts**

- **Methodology for Determining Mitigation Obligations or Costs for Individual Projects**

Solar PEIS Regional Mitigation Framework Elements

- **A Structure to Hold and Apply Mitigation Investments**
- **Regional Objectives Regarding Where and How Mitigation Investments Will Be Made**
- **Monitoring and Adaptive Management**

Building and Testing the Framework

- BLM proposes to pilot, test, & develop the regional mitigation plan framework.
- As part of a pilot, BLM will work with key stakeholders and cooperating agencies with experience in developing and implementing mitigation plans.
- Through the pilot, the BLM will collect lessons learned and use that information to build a template for developing the next round of regional mitigation plans for all SEZs.
- BLM doesn't have all the answers in August, 2012 but welcomes and values hearing from a variety stakeholders to build a framework that works

Monitoring and Adaptive Management Plan for Solar Energy

Stakeholder Workshop
August 29, 2012

Gordon Toevs and Jason Taylor

BLM

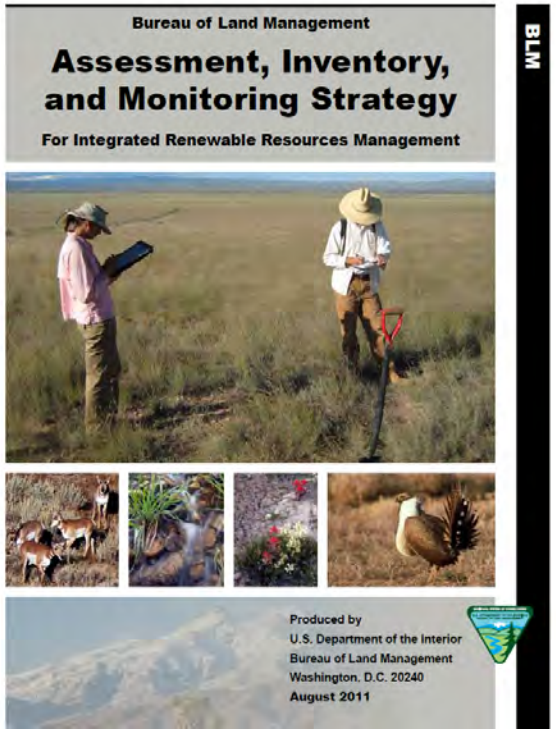
Solar Long Term Monitoring and Adaptive Management

Outline

- AIM Strategy Foundations
  - Frame the Issue
  - Conceptual Models
  - Core Indicators
  - Sample Design
  - Remote Imagery
- Integrated Monitoring Approach
- Solar Monitoring and Mitigation
- Next Steps

BLM Monitoring Strategy

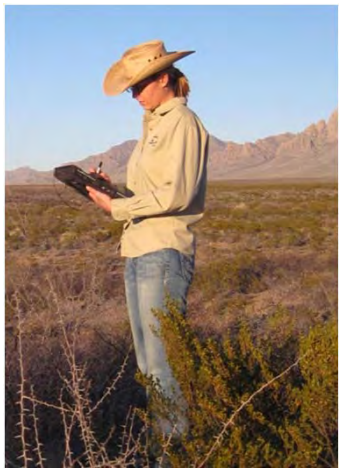
- Adopted by Agency in 2011, Peer Reviewed
- Initial Focus on Terrestrial and Aquatic Ecosystems
- Quantitative Information for Management Decisions
- Ecosystem Processes
- Multi-scale
- Interagency
- Site Based Data
- Remote Sensed Data
- Data Management

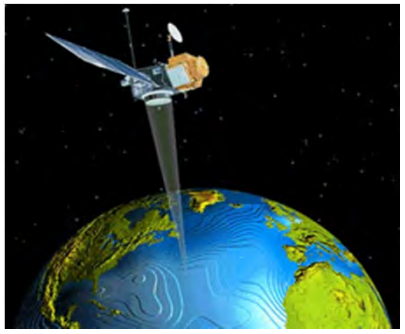


Monitoring Foundations

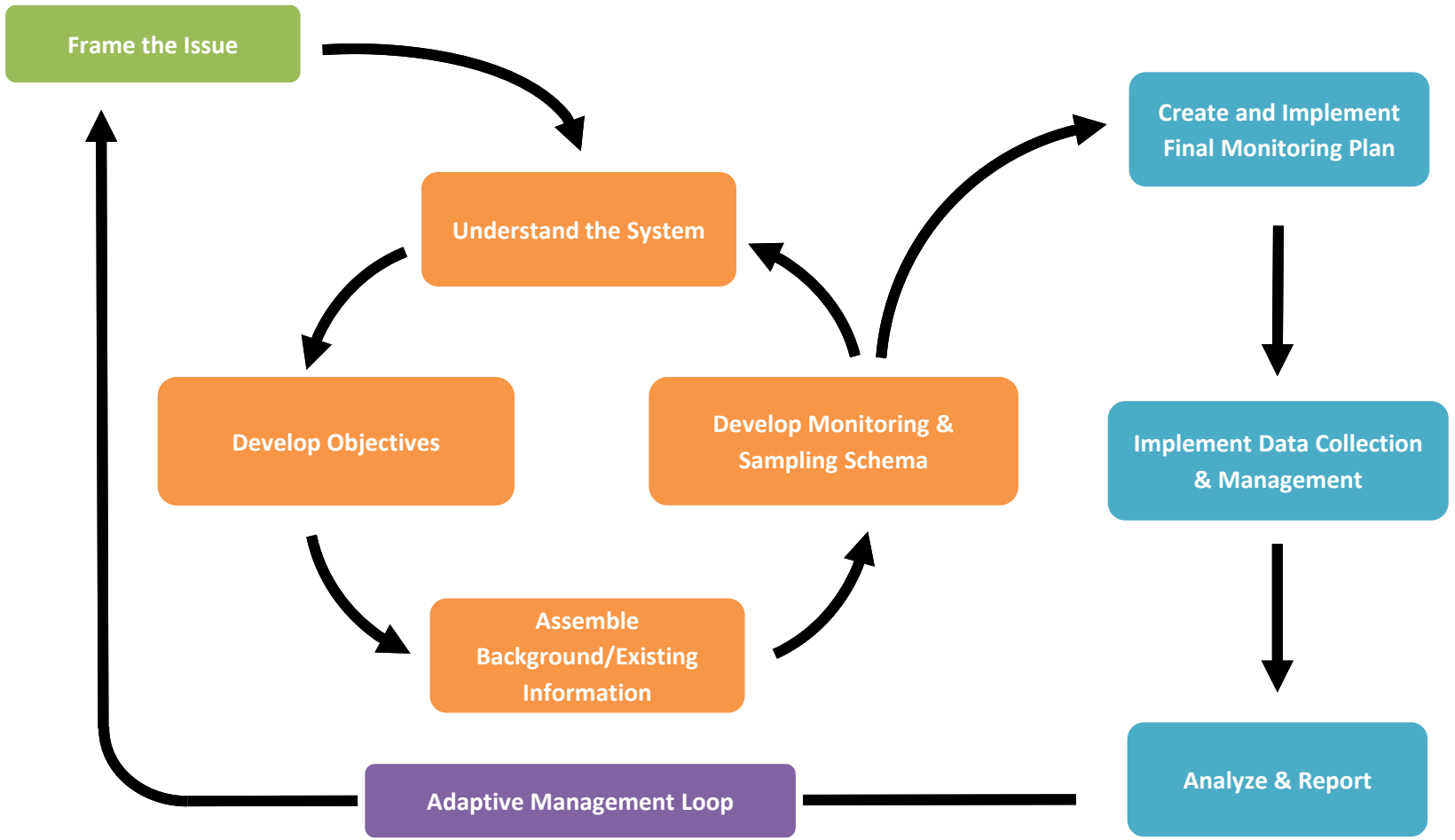
- Consistent, Repeatable, and Statistically Valid
  - **Core indicators**
  - **Consistent collection methods**
  - **Sampling design**
- Scalable Information

  Project ⟷ Region ⟷ Area
- Integration of Remote Sensing
  - **Amount, location, and spatial pattern**
  - **Multiple platforms**
- Data Management
  - **Electronic capture**
  - **Enterprise solution**





AIM-Monitoring Process Model



Framework

Process Model

- Frame the Issue
- Understand the System
- Develop Objectives
- Assemble Background/Existing Information
- Develop Monitoring & Sampling Schema
- Create and Finalize Monitoring Plan
- Implement Data Collection & Management
- Analyze & Report
- Adaptive Management

Implementation Steps

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

- 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

- 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 for a specific amount of change, timeframe, and level of confidence

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

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

- 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

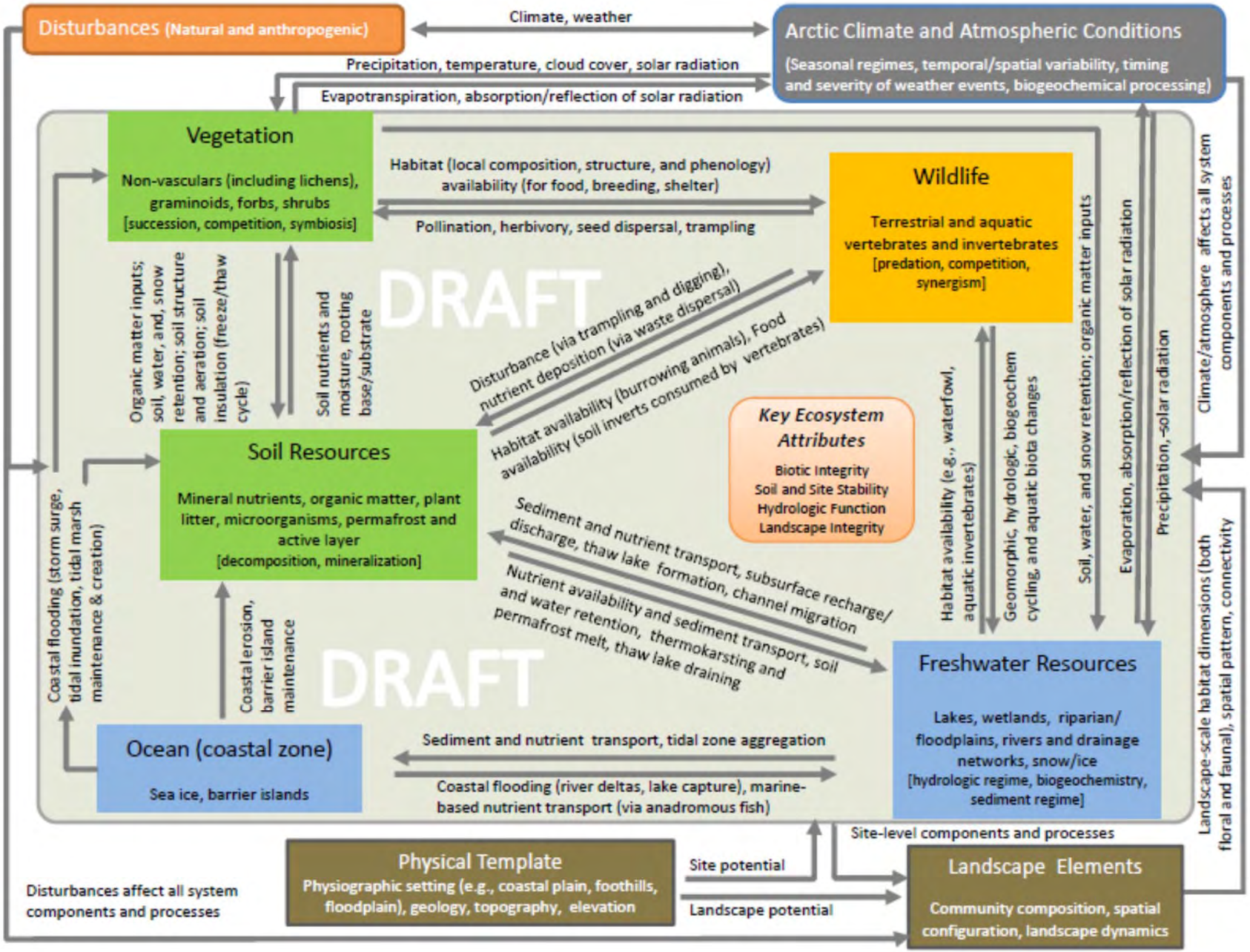
- Implement monitoring plan and collect data
- Perform QA/QC and data stewardship
- Upload data to national monitoring database
- Review, approve, and replicate to production database

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

- Adapt or Continue

BLM

Solar Long Term Monitoring and Adaptive Management


Disturbances (Natural and anthropogenic)
Climate, weather
Arctic Climate and Atmospheric Conditions
(Seasonal regimes, temporal/spatial variability, timing and severity of weather events, biogeochemical processing)
Precipitation, temperature, cloud cover, solar radiation
Evapotranspiration, absorption/reflection of solar radiation
Vegetation
Non-vasculars (including lichens), graminoids, forbs, shrubs [succession, competition, symbiosis]
Habitat (local composition, structure, and phenology) availability (for food, breeding, shelter)
Pollination, herbivory, seed dispersal, trampling
Wildlife
Terrestrial and aquatic vertebrates and invertebrates [predation, competition, synergism]
DRAFT
Organic matter inputs; soil, water, and, snow retention; soil structure and aeration; soil insulation (freeze/thaw cycle)
Soil nutrients and moisture, rooting base/substrate
Disturbance (via trampling and digging), nutrient deposition (via waste dispersal)
Habitat availability (burrowing animals), Food availability (soil inverts consumed by vertebrates)
Key Ecosystem Attributes
Biotic Integrity
Soil and Site Stability
Hydrologic Function
Landscape Integrity
Soil Resources
Mineral nutrients, organic matter, plant litter, microorganisms, permafrost and active layer [decomposition, mineralization]
Habitat availability (e.g., waterfowl, aquatic invertebrates)
Geomorphic, hydrologic, biogeochem cycling, and aquatic biota changes
Soil, water, and snow retention; organic matter inputs
Evaporation, absorption/reflection of solar radiation
Precipitation, -solar radiation
Climate/atmosphere affects all system components and processes
Sediment and nutrient transport, subsurface recharge/ discharge, thaw lake formation, channel migration
Nutrient availability and sediment transport, soil and water retention, thermokarsting and permafrost melt, thaw lake draining
Coastal flooding (storm surge, tidal inundation, tidal marsh maintenance & creation)
Coastal erosion, barrier island maintenance
DRAFT
Freshwater Resources
Lakes, wetlands, riparian/ floodplains, rivers and drainage networks, snow/ice [hydrologic regime, biogeochemistry, sediment regime]
Ocean (coastal zone)
Sea ice, barrier islands
Sediment and nutrient transport, tidal zone aggregation
Coastal flooding (river deltas, lake capture), marine-based nutrient transport (via anadromous fish)
Landscape-scale habitat dimensions (both floral and faunal), spatial pattern, connectivity
Site-level components and processes
Physical Template
Physiographic setting (e.g., coastal plain, foothills, floodplain), geology, topography, elevation
Site potential
Landscape potential
Landscape Elements
Community composition, spatial configuration, landscape dynamics
Disturbances affect all system components and processes

Climate, weather

Arctic Climate and Atmospheric Conditions

(Seasonal regimes, temporal/spatial variability, timing and severity of weather events, biogeochemical processing)

Precipitation, temperature, cloud cover, solar radiation

Evapotransphiration, absorption/reflection of solar radiation

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availability (for food, breeding, shelter)

Pollination, herbivory, seed dispersal, trampli

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availability (soil inverts consumed by

Key Ecosystem Attributes

Biotic Integrity
Soil and Site Stability
Hydrologic Function
Landscape Integrity

Organic ma
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Habitat availability (e.g., waterfowl, aquatic invertebrates)

Geomorphic, hydrologic, biogeochem
cycling, and aquatic biota changes

Soil, water, and snow retention; organic matter inputs

Evaporation, absorption/reflection of solar radiation

Precipitation, -solar radiation

Climate/atmosphere affects all system components and processes

Sediment and nutrient transport, subsurface recharge/ discharge, thaw lake formation, channel migration

Nutrient availability and sediment transport, soil and water retention, thermokarsting and permafrost melt, thaw lake draining

Coastal flooding (storm surge, tidal inundation, tidal marsh maintenance & creation)

Coastal erosion barrier island maintenance

Freshwater Resources

Lakes, wetlands, riparian/ floodplains, rivers and drainage networks, snow/ice [hydrologic regime, biogeochemistry, sediment regime]

Ocean (coastal zone)

Sea ice, barrier islands

Sediment and nutrient transport, tidal zone aggregation

Coastal flooding (river deltas, lake capture), marine-based nutrient transport (via anadromous fish)

Site-level components and processes

Landscape-scale habitat dimensions (both floral and faunal), spatial pattern, connectivity

Physical Template

Physiographic setting (e.g., coastal plain, foothills, floodplain), geology, topography, elevation

Site potential

Landscape potential

Landscape Elements

Community composition, spatial configuration, landscape dynamics

Disturbances affect all system components and processes

DRAFT

DRAFT

BLM

Solar Long Term Monitoring and Adaptive Management

Indicators and Objectives

- Terrestrial Indicators
  - **1. Bare ground** (Direct measure)
  - **2. Vegetation composition** (Indicator measure)
  - **3. Non-native invasive species**
  - **4. Plant species of management concern**
  - **5. Vegetation height**
  - **6. Proportion of soil in large inter-canopy gaps**
  - **7. Soil aggregate stability**
- Aquatic Indicators
- Resource Specific Indicators
  - **Add as necessary**

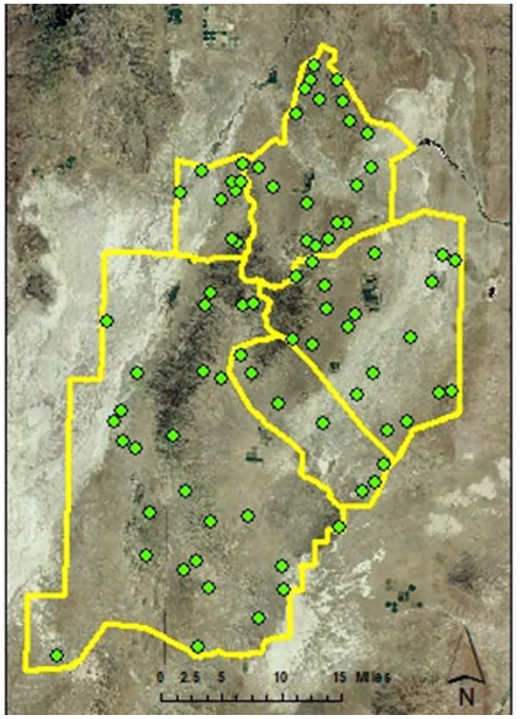
Adopt Consistent Methods

- Line-Point Intercept
- Height
- Canopy Gap
- Species Search
- Soil Aggregate Stability
- Additional as Needed

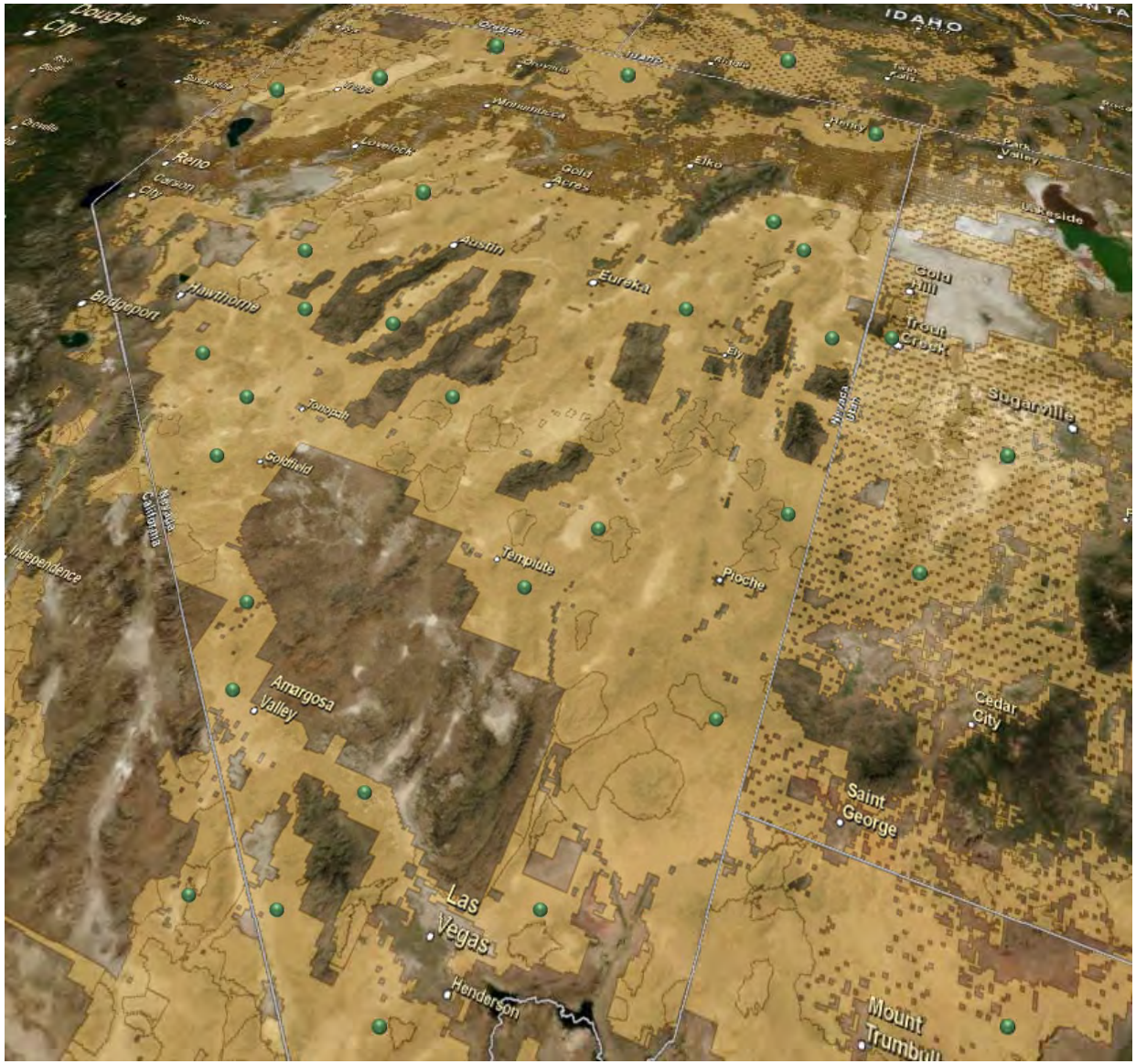
- Data Dense
  - **Many indicators can be derived from measurements**

Develop Statistical Sample Design

1. Unbiased
2. Probability-Based
3. Stratified
4. Before-After-Control-Impact
5. Scalable



Sample Design

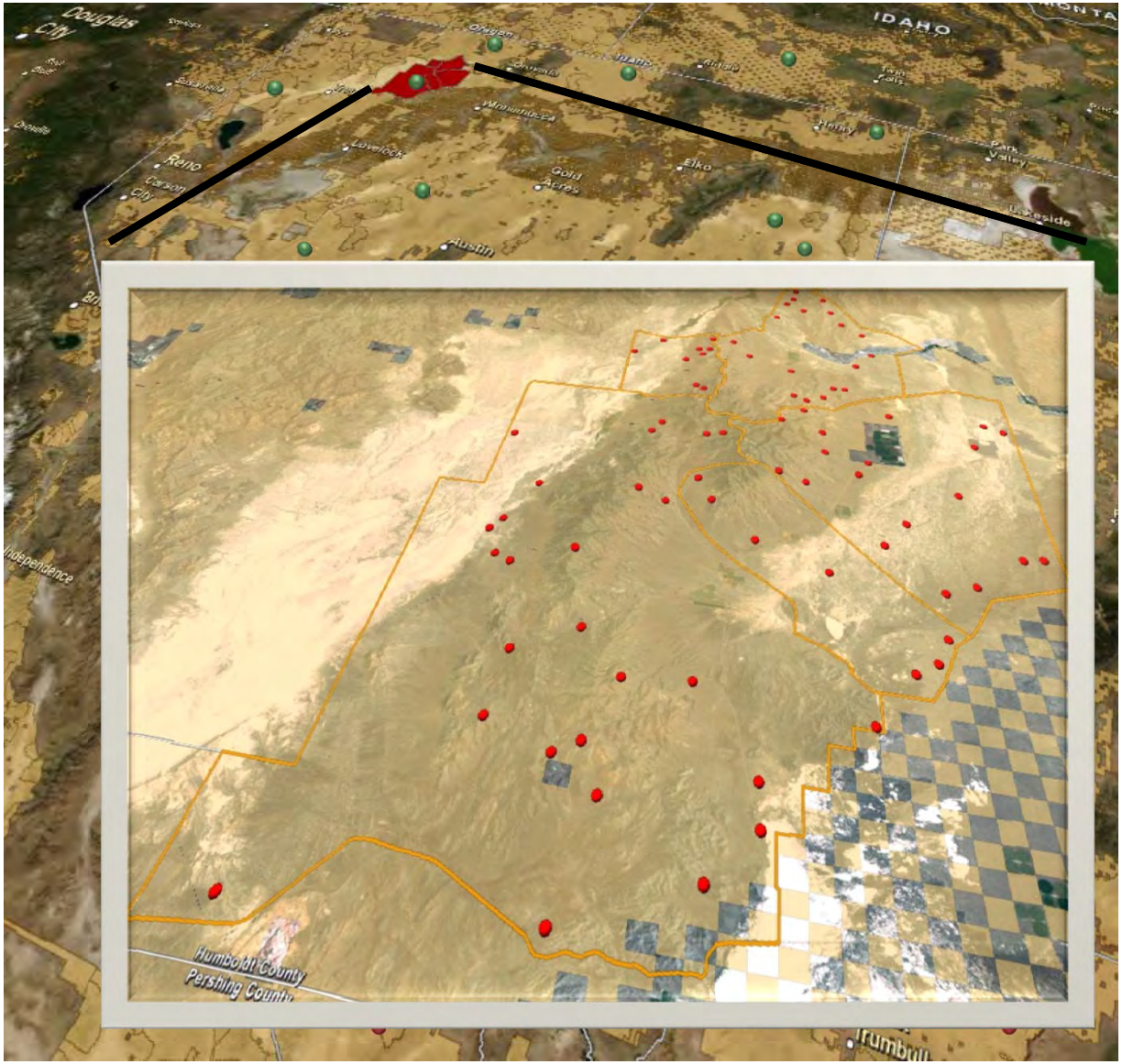


Extensive Sampling*

- Low density network of sampling locations across all BLM-managed lands
- Low-density sites inform regional and national questions
- High-density sites inform local questions

*Hypothetical points for illustration only

Sample Design



Extensive Sampling*

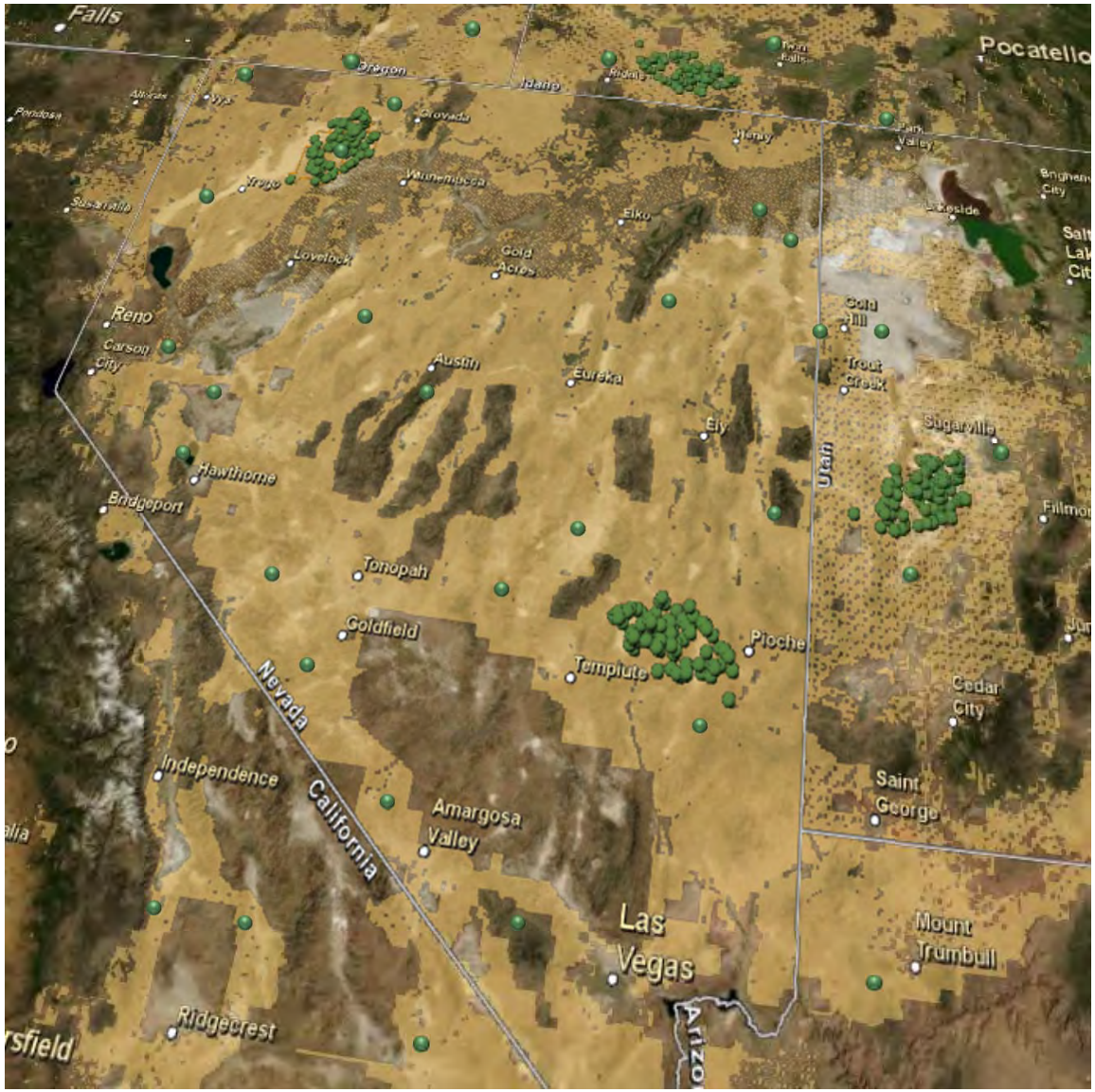
- Low density network of sampling locations

Intensive Sampling

- Higher-density sampling
- Designed to meet local management needs
- Can make-use of extensive samples
- Insufficient coverage to use alone for national/ regional needs
  - *Can be folded into extensive network to improve estimates*
  - *Requires sample weight*

*Hypothetical points for illustration only

Sample Design



Extensive Sampling*

- Low density network of sampling locations

Intensive Sampling*

- Higher-density sampling for local management needs

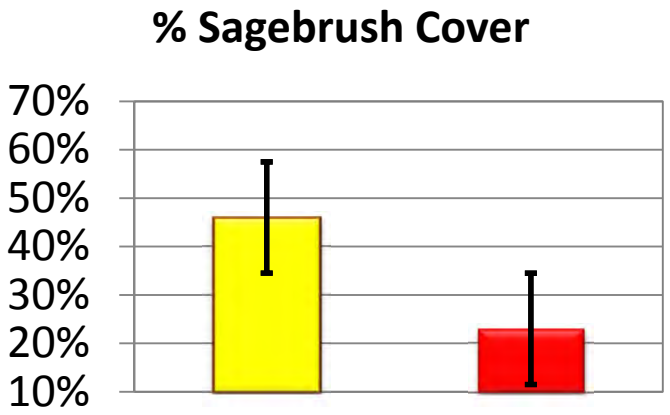
Integrated Sampling

- Intensive data combined with extensive network
- Increases precision of extensive sampling resource estimates
- Comparability of resource values across scales and jurisdictions

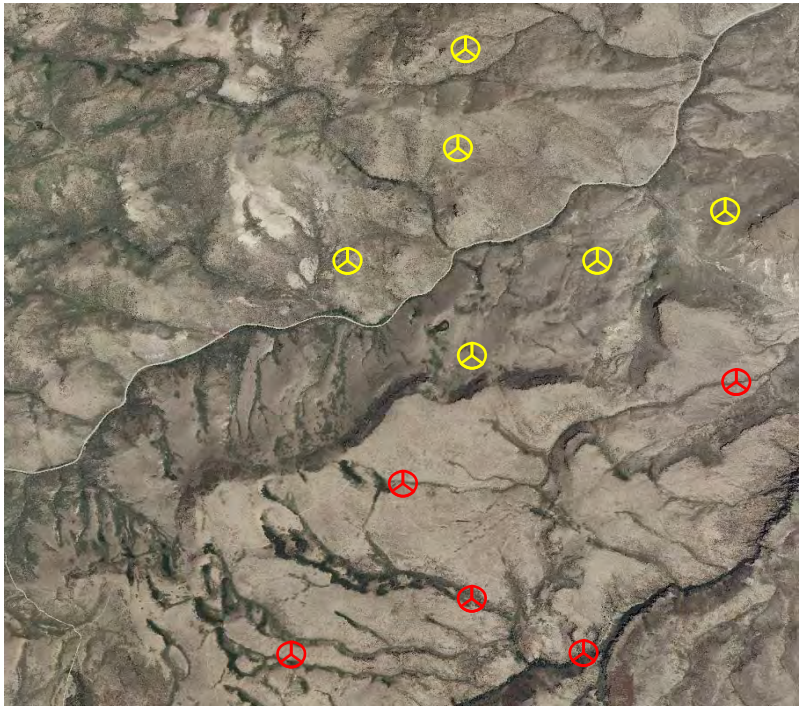
*Hypothetical points for illustration only

Statistically Valid Estimates

- Condition Estimate for a Resource of Interest
  - Analyze plot level estimates
  - Known confidence bounds



- Compare Conditions
  - Between zones
  - Between impact areas
  - Trends

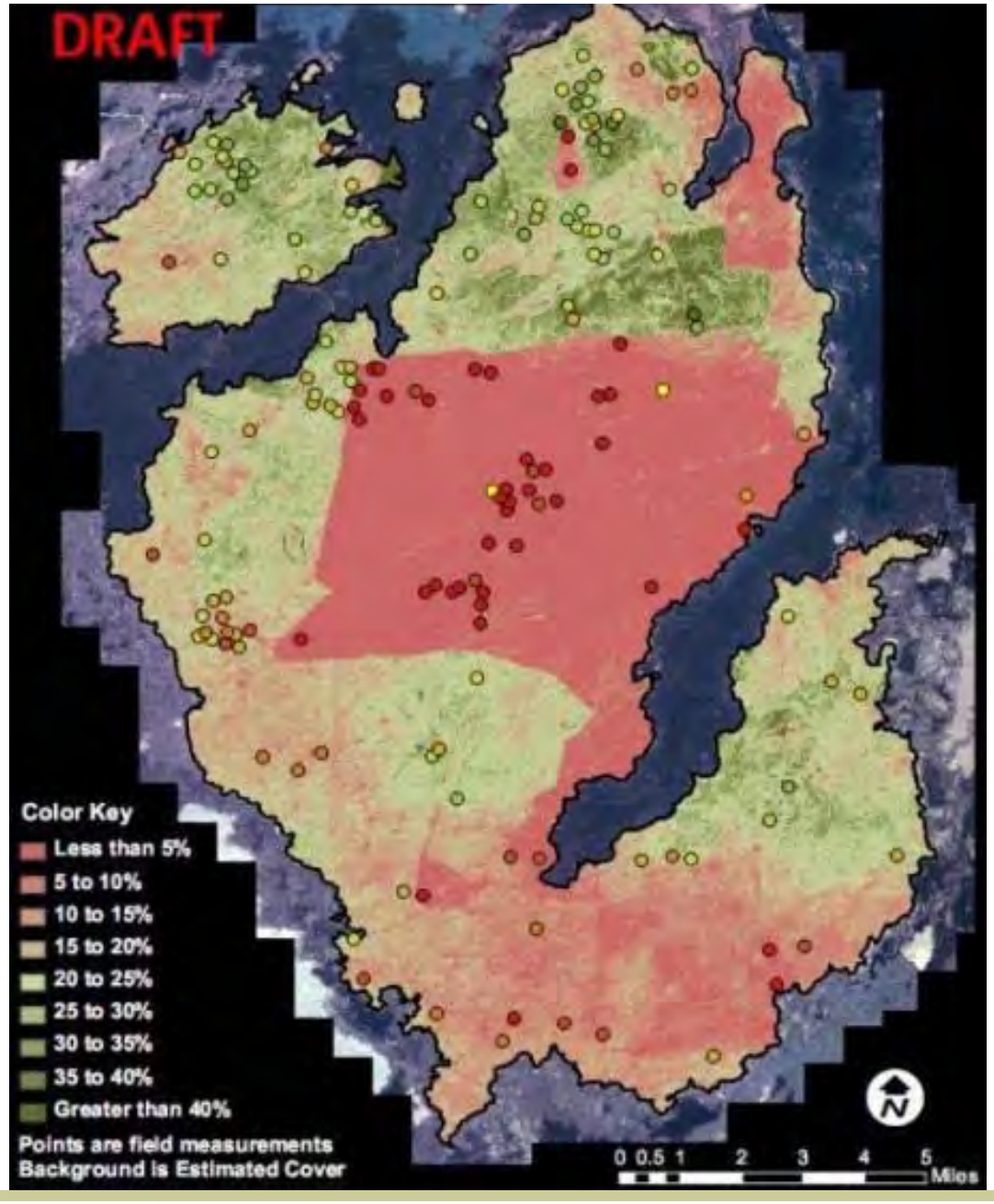


- Spatial Pattern
  - Unknown

Field and Remote Sensing Data

- Field Collected Data
  - Statistically defensible resource estimates
  - Increase precision in priority areas
- Remote Collected Data
  - Location, amount, and pattern of resources
- Together
  - Field can “train” RS to improve landcover maps
  - Remote can aid sample design development
    - Stratification
    - Selection probabilities
  - Exploring was to reduce monitoring costs

Continuous Landcover Maps



Integrated Monitoring










Solar LTMP and Mitigation

- Adaptable Monitoring Plan
  - Based on core plus locally significant resources
  - Minimizes costs and maximizes benefits
    - Data informs multiple scales and multiple questions
    - Fewer conflicts/ fewer indicators (SEZ vs. avoidance)
- Monitors Avoidance, Minimization, and Offsite
- Historical Approach For Mitigation
  - Qualitative information to inform decisions
  - Project-by-project
- LTMP Approach For Mitigation
  - Quantitative information to inform decisions
  - Cumulative impact analysis
  - Repeatable, documented process
  - Effectiveness monitoring and adaptive management

Offsite Mitigation

- Conservation Element — Creosote Plant Community
  - Regional conservation element
- Indicator — Abundance
  - Land cover maps (remote imagery)
- Casual Factor — Disturbance (Solar)
  - Resource conceptual Model
- Objective — Maintain/ Restore
  - Biological opinion/ RMP/ other
- Currency — Ecological Site
  - Landscape Monitoring Framework
- Management Action — Improve/ Protect
  - Greatest benefit/ Least cost analysis
- Monitor — Adaptive Management
  - Before/ After/ Control/ Impact

Next Steps

- Regional Conceptual Models
- Resource Specific Models
- Objectives and Thresholds
  - Outputs and Outcomes
- Long Term Funding
- Partners
- Capacity

BLM

Solar Long Term Monitoring and Adaptive Management

Session 3 - Develop an Action Plan for Preparing a Regional Mitigation Plan for the Dry Lake Solar Energy Zone

1. Overview of the Dry Lake SEZ: Affected environment/resource values, summary of impacts - presentation followed by facilitated group discussion *(Presenters –Heidi Hartmann and Ben O'Connor/Argonne)*

2. Preliminary Framework and Action Plan: seven elements, how each element might be completed, who might be involved, preliminary list of 'lessons-learned' questions to be evaluated. Explain the group activity to follow. *(Presenter - Mike Dwyer, BLM)*

3. Break-out group discussions: feedback on the straw-man action plan (suggestions regarding the what, how, who; deliverables; 'lessons-learned' questions); how do you see your organization

4. Break-out group presentations: representative from each group present, followed by questions/discussion *(Summary to be provided in Workshop Summary, in preparation)*

5. Group Discussion: Consolidated list of recommend changes to the Framework *(Summary to be provided in Workshop Summary, in preparation)*

6. Group Discussion: What impact issues should BLM address in the Dry Lake SEZ Regional Mitigation Plan *(Session postponed to next Workshop)*

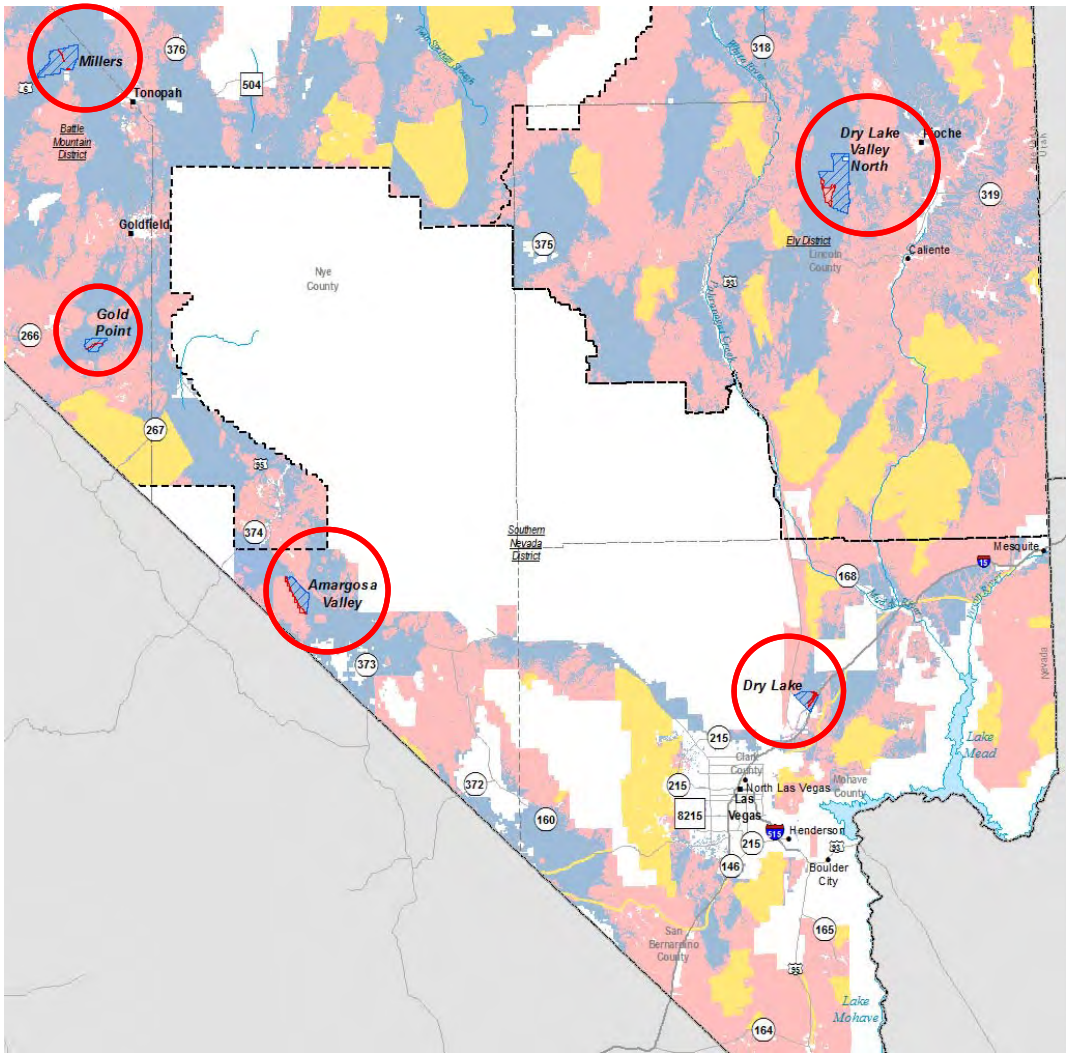
7. Closing and Evaluation: Summary of workshop discussion, next steps. Conduct participant evaluation (Joe Vieira) *(Summary to be provided in Workshop Summary, in preparation)*

Overview of the Dry Lake SEZ – Affected Environment and Summary of Impacts Per the Solar Programmatic Environmental Impact Statement

Presented by:
Heidi Hartmann and Ben O'Connor, Argonne National Laboratory

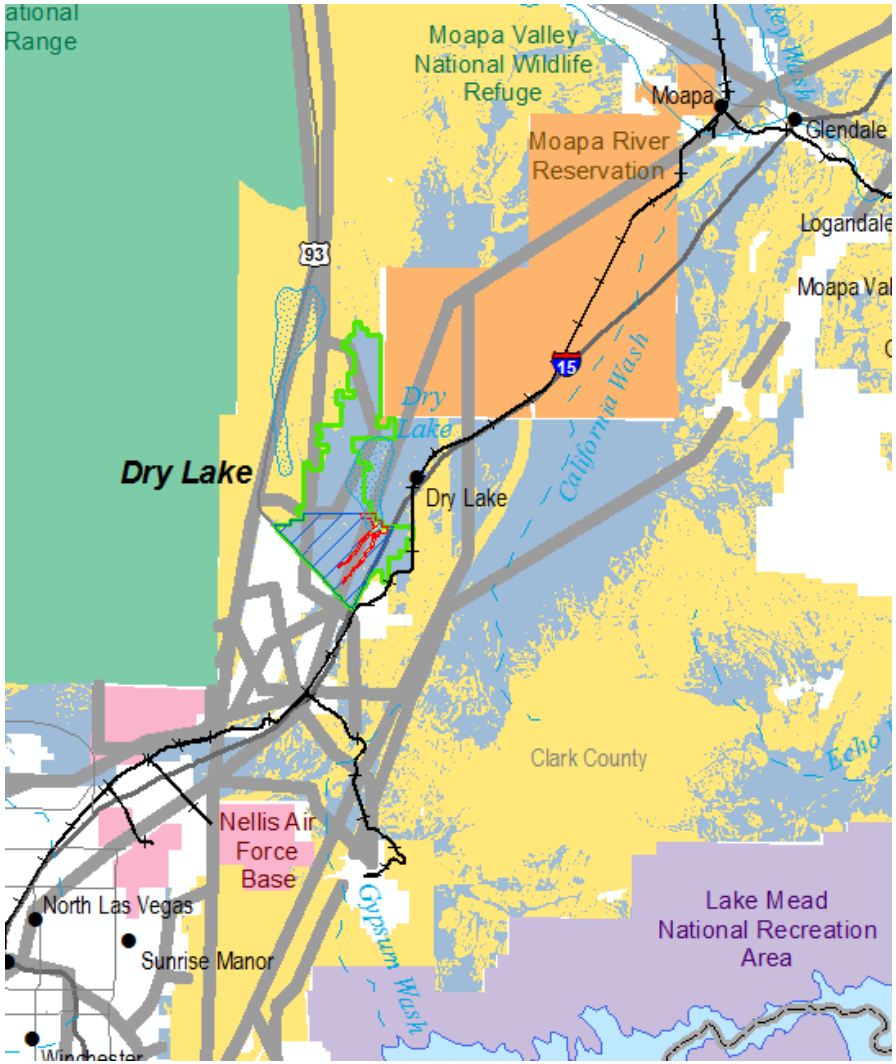
For the Dry Lake Solar Energy Zone Mitigation Project Workshop
August 30, 2012; Las Vegas, NV

Dry Lake SEZ



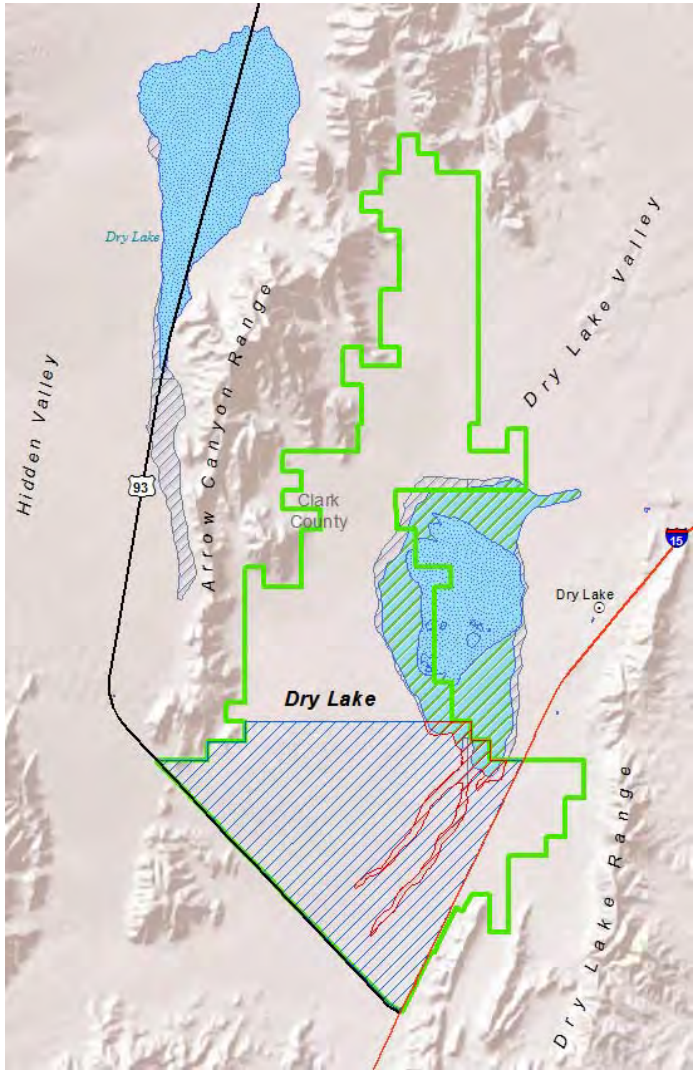
- One of five Nevada proposed SEZs carried forward in the Final Solar PEIS.
- Approximately 15 miles northeast of Las Vegas.
- Draft PEIS: 15,649 acres
- Final PEIS: developable area of 5,717 acres (469 acres of floodplain/ wetland is non-developable)

Dry Lake SEZ



- As of October 2011, there were three active solar applications on BLM-administered lands within or adjacent to the SEZ.
- One recently approved 350-MW application occurs within the Moapa Reservation near the SEZ (K Road Solar Project).
- The SEZ overlaps three locally designated transmission corridors (including a 500-kV line).
- The SEZ is adjacent to major roadways I-15 and U.S. 93.

Dry Lake SEZ



- Supplement to Draft PEIS: Eliminated the northern portion (9,463 acres) of the SEZ to minimize impacts to wildlife (desert tortoise) and military operations.
- An additional 469 acres of floodplain and wetland identified as non-developable.
- The PEIS examined 20 resource areas:

Lands and Realty Recreation Rangeland Resources
Specially Designated Areas and Lands with Wilderness Characteristics
Military and Civilian Aviation Geology Minerals
Water Resources Vegetation Wildlife and Aquatic Biota
Special Status Species Air Quality and Climate Visual Resources
Paleontology Cultural Resources Native American Concerns
Acoustic Environment Socioeconomics Environmental Justice
Transportation

Lands and Realty

- Assuming 80% of the SEZ would be developed, full development of the SEZ would disturb up to 4,574 acres, and allow generation of up to 915 MW of electricity.
- Development could sever existing roads on the SEZ, making it difficult to access public lands within the SEZ that are not developed or those outside of the SEZ.
- Programmatic Design Features (Final PEIS Section A.2.2.1):
  - Early consultation with BLM to identify conflicts
  - Siting should avoid, minimize, and/or mitigate impacts on BLM land use planning designations
- SEZ-Specific Design Features: None

Lands and Realty (cont.)

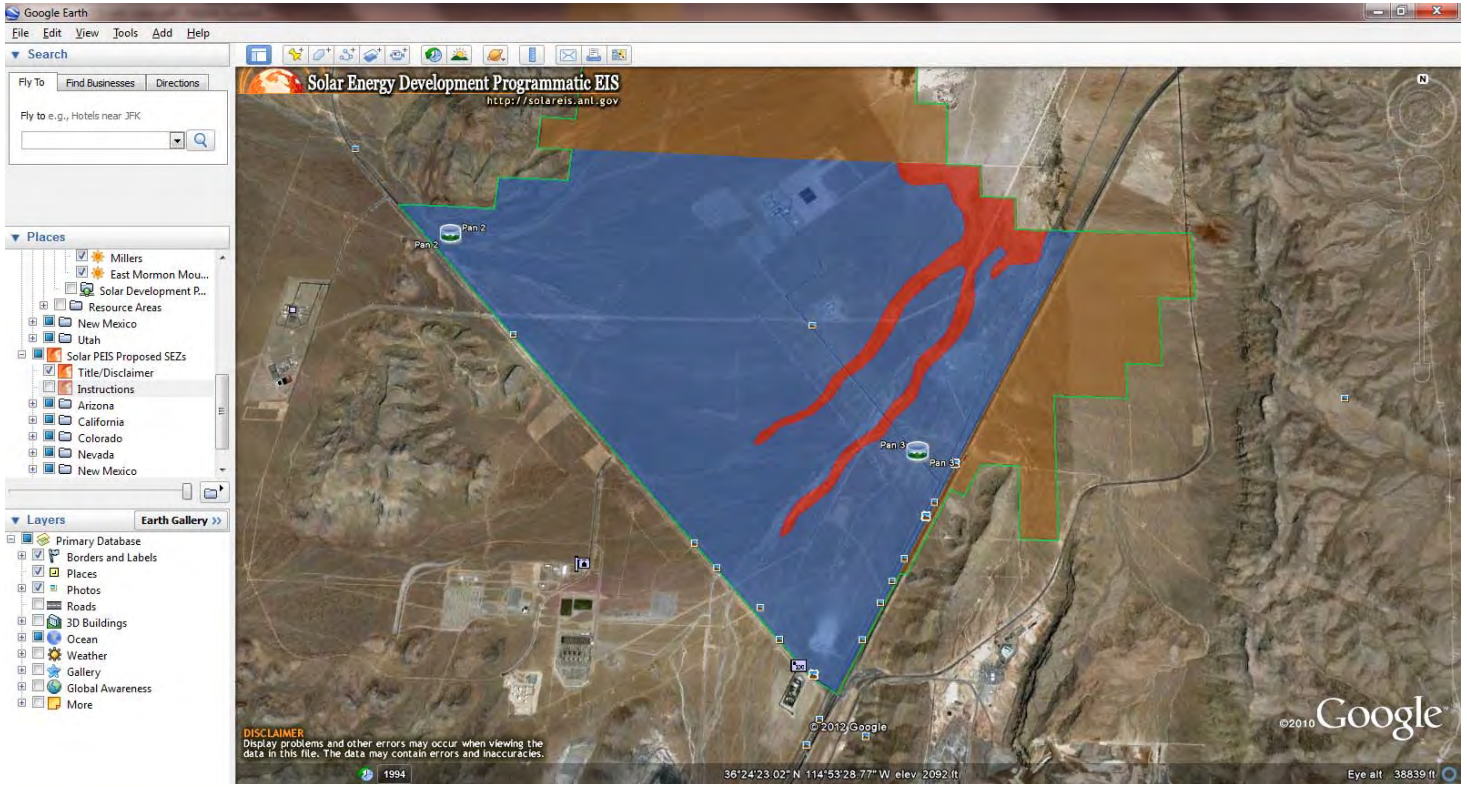


FIGURE 11.3.14.1-3 Approximately 180° Panoramic View of the Proposed Dry Lake SEZ from Southeastern Portion of SEZ Facing Northwest, Arrow Canyon Range at Left, Dry Lake Range at Right

Specially Designated Areas

- There are 9 specially designated areas within 25 miles of Dry Lake SEZ:

  Arrow Canyon WA Muddy Mountains WA Rainbow Gardens ACEC River Mountains ACEC
  Desert National Wildlife Range Moapa Valley NWR Old Spanish Trail Valley of Fire State Park
  Bitter Springs Backcountry Byway

- Impacts to small portions of these areas could occur due to visibility of solar facilities.
- Programmatic Design Features (Final PEIS Section A.2.2.2):
  - Protection of existing values shall be evaluated during the environmental analysis for solar energy projects
  - Solar facilities shall be sited to avoid, minimize, and/or mitigate impacts to values of specially designated areas
- SEZ-specific Design Features:
  - For projects on the SEZ that are within the viewshed of the Old Spanish Trail, a National Trail inventory will be required

Rangeland Resources

Livestock and Grazing

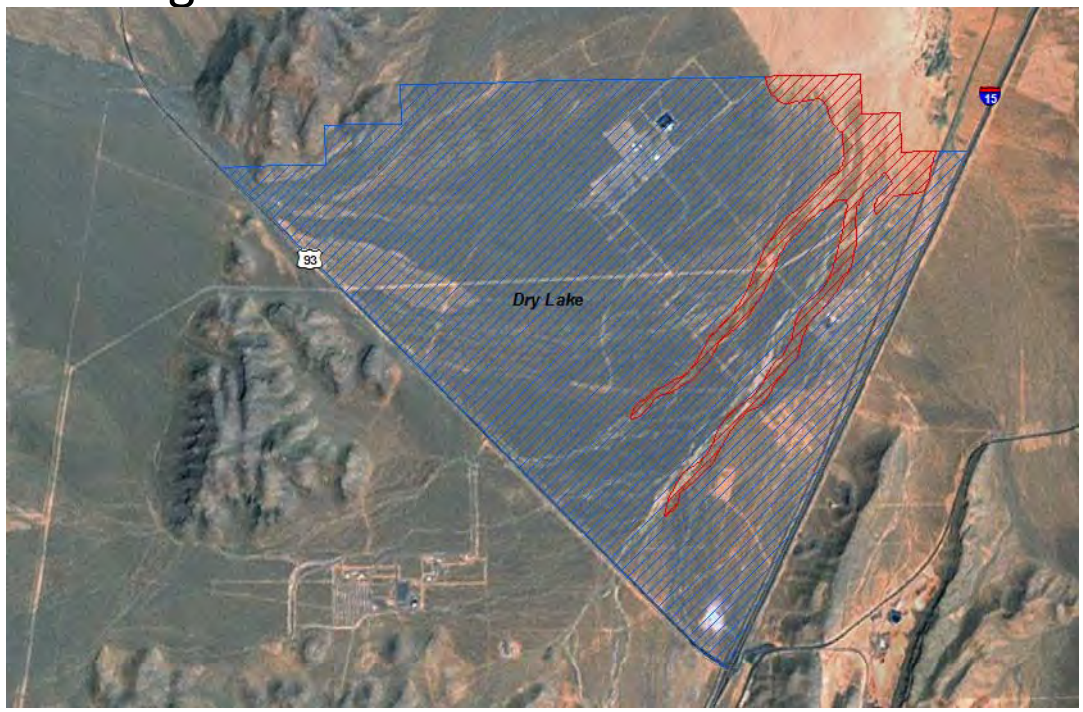
- There are no grazing allotments in the SEZ; therefore, no impacts to livestock and grazing.

Wild Horses and Burrows

- The SEZ is about 8 miles from any wild horse and burro Herd Management Area administered by the BLM. Solar energy development would not impact wild horses and burros.
- Programmatic Design Features (Final PEIS Section A.2.2.4):
  - WHB1-1: Consultation with BLM early in project planning.
  - WHB2-1: Road construction and maintenance should minimize impacts.
- SEZ-specific Design Features: None

Recreation

- Other than road use, there is little sign of recreation on the SEZ.
- Development on the SEZ would eliminate future recreation activities from portions of the SEZ and sever access to other public lands.
- Programmatic Design Features (Final PEIS Section A.2.2.6):
  - Consultation with BLM early in project planning
  - Facilities should not be sited in areas of important recreation resources
- SEZ-specific Design Features: None



Military and Civilian Aviation

- Proposed Dry Lake SEZ is located about 13.5 miles northeast of Nellis Air Force Base, but is not located under any military airspace, nor is it identified as a DoD Consultation Area in BLM land records.
- Nellis AFB has expressed concern that development in the SEZ might affect approach and departure activities, and/or military training activities.
- Nellis Testing and Training Range (NTTR) staff have indicated that facilities taller than 50 ft (15 m) may interfere with testing activities.
- Nearest public airport is the North Las Vegas Regional Airport, about 21 mi southwest of the SEZ, no impact on airport operations expected.
- Programmatic Design Features (Final PEIS Section A.2.2.7):
  - Consultation with DoD early in project planning
- SEZ-specific Design Features: None

Geologic Setting and Soil Resources

- Soils within the SEZ are predominantly very gravelly and stony loams.
- Impacts on soil resources would occur mainly as a result of ground-disturbing activities.
- Impacts would include soil compaction, soil horizon mixing, soil erosion and deposition by wind, soil erosion by water and surface runoff, sedimentation, and soil contaminants.
- Programmatic Design Features (Final PEIS Section A.2.2.8):
  - Many programmatic design features have been identified to avoid, minimize, and/or mitigate potential impacts and geologic hazards, including measures to avoid erosion and stabilize disturbed areas.
- SEZ-specific Design Features: None

Minerals (fluids, solids, and geothermal)

- A number of active mining claims are located within the SEZ.
- The area remains open for discretionary mineral leasing for oil and gas and other leasable minerals, and for disposal of salable minerals.
- A mineral potential assessment for the SEZ has been prepared and reviewed by BLM mineral specialists.
- The existing mining claims within the SEZ are prior existing rights and, if valid, would like preclude solar development in those areas.
- Programmatic Design Features (Final PEIS Section A.2.2.9):
  - Consultation with BLM early in project planning.
  - BLM retains the right to issue oil and gas or geothermal leases with a stipulation of No Surface Occupancy within the ROW area.
  - Projects shall be located to minimize conflicts with existing mineral rights.
- SEZ-specific Design Features: None

Water Resources

- Surface water occurs in a closed basin that is not connected to the Colorado River Basin.
- There are no perennial surface water features on the SEZ; part of a dry lake is within the SEZ boundary - these 469 acres have been identified as non-developable. Historical groundwater use in the region has led to declines in groundwater elevation of approximately 20 ft from the 1950s to 1980s.
- Depending on technology, groundwater withdrawals to support development on the SEZ may be as high as 4,586 ac-ft/yr (5.7 times the estimated total annual groundwater inputs into the basin).
- Water rights currently allocated by the Nevada Division of Water Resources in the basin are over 8 times the estimated perennial yield of the basin-fill aquifer.

Water Resources (cont.)

- Programmatic Design Features (Final PEIS Section A.2.2.10):
  - Many programmatic design features have been identified to avoid, minimize, and/or mitigate potential impacts on water resources
    - Control project site drainage and runoff
    - Conduct pre-development hydrologic studies
    - Early coordination with regulatory agencies
    - Avoid and/or minimize impacts on existing surface water features and groundwater resources
    - Adaptive management and compliance with terms and conditions for water resource mitigation
    - Minimizing impacts and restoring hydrologic processes during reclamation
- SEZ-specific Design Features:
  - Groundwater analyses suggest that full build-out of dry- and wet-cooled technologies is not feasible; for mixed-technology developments, any proposed project should utilize water conservation practices.

Vegetation

- A number of sensitive habitats expected to occur on the SEZ including: desert dry washes, dry wash woodlands, and wetland.
- Development within the SEZ would impact native vegetation, but this impact would be small compared to surrounding landscape.
- Potential impacts from noxious weeds, fugitive dust, and altered hydrology (runoff, sedimentation, groundwater withdrawals).
- Programmatic Design Features (Final PEIS Section A.2.2.11):
  - Several design features will avoid, minimize, or mitigate impacts to vegetation.
    - Early coordination and compliance with federal, state, and local regulations
- SEZ-specific Design Features:
  - Avoid sensitive habitats and minimize indirect impacts to those habitats
  - Limit groundwater withdrawals

Wildlife and Aquatic Biota

- Species that may occur in the affected area of the SEZ:
  - >17 amphibians and reptiles (including 3 special status species)
  - >32 birds (including 12 special status species)
  - >42 mammals (including 14 special status species)
  - No aquatic biota on the SEZ
- Development within the SEZ would directly impact wildlife species through direct mortality, habitat loss/alteration, and/or indirect effects.
- Groundwater withdrawals could affect aquatic habitats in springs and streams outside of the SEZ.

Wildlife and Aquatic Biota (cont.)

- Programmatic Design Features (Final PEIS Section A.2.2.11):
  - Several programmatic design features for ecological resources will avoid, minimize, or mitigate impacts to wildlife
    - Pre-disturbance surveys, monitoring plans, coordination with regulatory agencies.
- SEZ-specific Design Features:
  - Development should avoid any wetlands and sensitive habitats identified in pre-disturbance surveys.
  - Fencing around the development should not block the free movement of mammals, particularly big game species.
  - Engineering controls should be implemented to minimize the amount of runoff and fugitive dust entering Dry Lake, California Wash, and Gypsum Wash.
  - The impact of groundwater withdrawals on aquatic habitats near the SEZ, such as the Muddy River, should be minimized or eliminated.

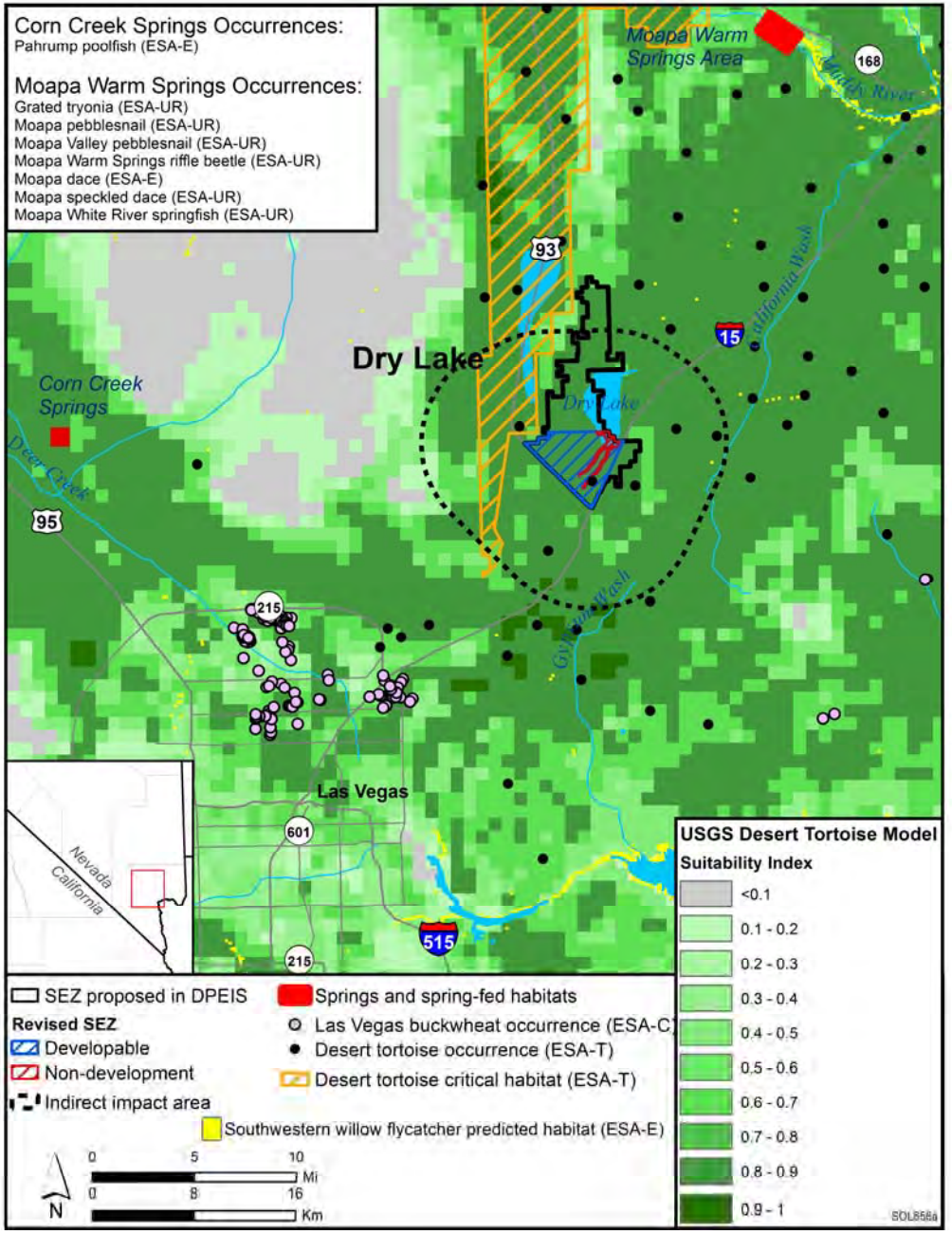
Special Status Species

- 73 special status species that may occur in the affected area of the SEZ:
  - 30 plants (1 ESA-listed, candidate, or under review species)
  - 10 invertebrates (4 ESA-listed, candidate, or under review species)*
  - 4 fish (all 4 ESA-listed, candidate, or under review species)*
  - 3 amphibians and reptiles (1 ESA-listed, candidate, or under review species)
  - 12 bird species (1 ESA-listed, candidate, or under review species)
  - 14 mammals (no ESA-listed, candidate, or under review species)

  **Inhabit aquatic habitats outside of the SEZ that are supported by the same groundwater basin as the SEZ.*
- Mormon Mesa Critical Habitat Unit for the desert tortoise occurs west of the SEZ in the area of indirect effects.
- Based on tortoise densities in the Mormon Mesa Critical Habitat Unit, the SEZ may support up to 80 desert tortoises.

Special Status Species (cont.)

- ESA-listed (or considered) species:
  - Las Vegas buckwheat (C)
  - Grated tryonia (UR)
  - Moapa pebblesnail (UR)
  - Moapa Valley pebblesnail (UR)
  - Moapa Warm Springs riffle beetle (UR)
  - Moapa dace (E)
  - Moapa speckled dace (UR)
  - Moapa White River springfish (UR)
  - Pahrump poolfish (E)
  - Desert tortoise (T)
  - Southwestern willow flycatcher (E)



Special Status Species (cont.)

- Programmatic Design Features (Final PEIS Section A.2.2.11):
  - Several programmatic design features for ecological resources will avoid, minimize, or mitigate impacts to special status species.
    - Pre-disturbance surveys, monitoring plans, ESA consultation with FWS (Biological Assessment and Biological Opinion)

- SEZ-specific Design Features:
  - Predisturbance surveys for the 73 identified species.
  - Avoid occupied and sensitive habitats (wetland, desert wash).
  - Consultation/coordination with FWS and NDOW for the 11 ESA species.
  - Avoiding or minimizing groundwater withdrawals would reduce or eliminate impacts to 14 groundwater-dependent special status species (5 of which are ESA-listed or considered).

Air Quality and Climate

- Prevailing wind direction is from south-southwest. Very low annual precipitation

- Severe weather events (thunderstorms and tornadoes) are rare; hail and flooding events are possible

- Construction could result in temporary exceedences of 24-hour and annual PM_{10} and 24-hour $PM_{2.5}$ at and beyond the SEZ boundary

  (Note: standards are used for comparison and are not directly applicable to construction activities).

- Programmatic Design Features (Final PEIS Section A.2.2.12):
  - Consultation with BLM early in project planning; compliance with terms and conditions
  - Facilities should be designed, sited, and operated to minimize impacts to air quality

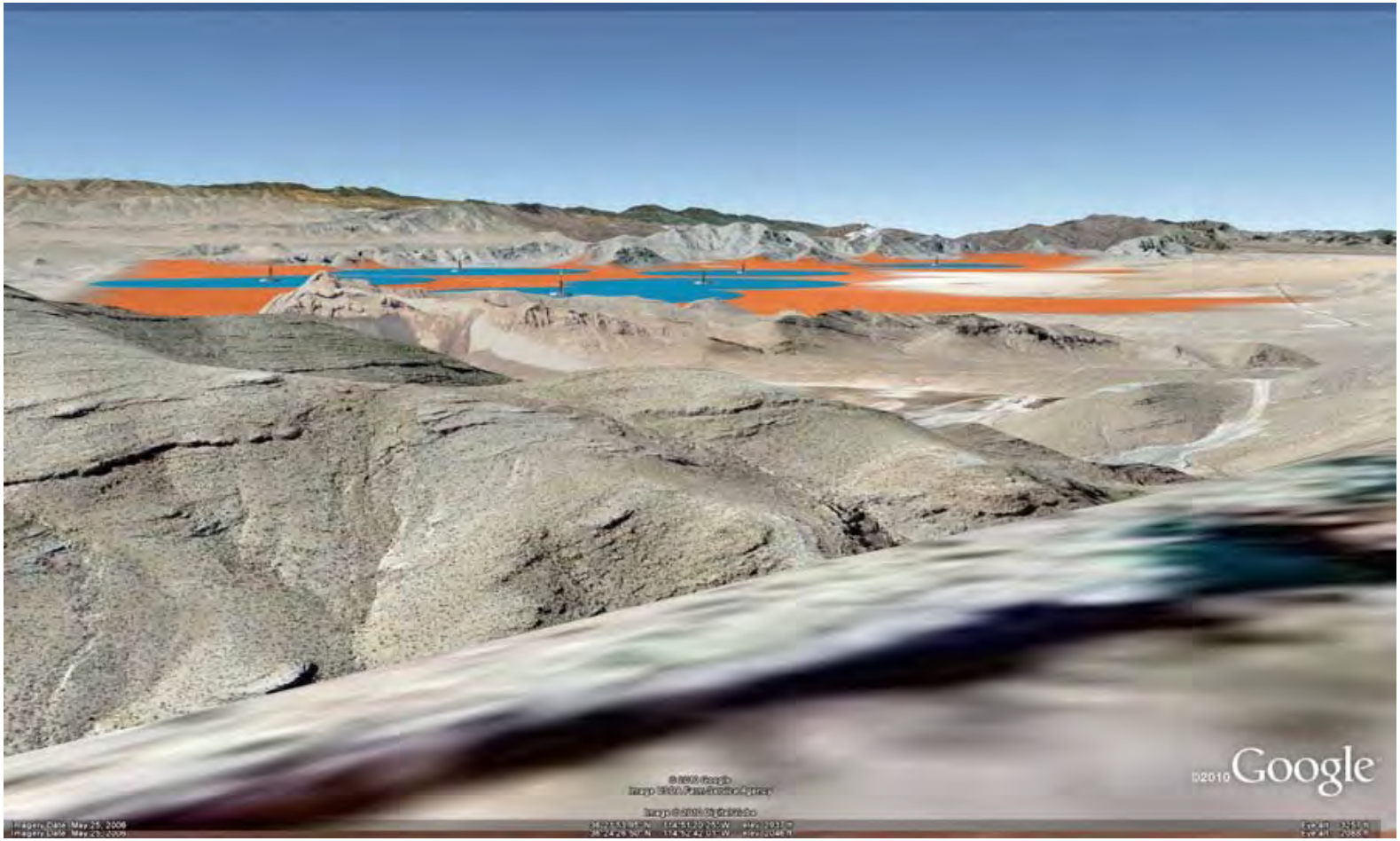
- SEZ-specific Design Features: None

Visual Resources

- Area of low scenic quality; major cultural disturbances already present
- Potential for large visual impacts on the SEZ and surrounding lands
- Potential visual impacts to visitors to Desert National Wildife Range, Old Spanish National Historic Trail, Arrow Canyon WA, Muddy Mountains WA and SRMA, Nellis Dunes SRMA, and travelers on I-15 and U.S. 93.
- Programmatic Design Features (Final PEIS Section A.2.2.13):
  - Consultation with BLM early in project planning; compliance with terms and conditions
  - Solar facilities should be designed and sited to minimize glint and glare, night-sky effects, and visual dominance
- SEZ-specific Design Features: None

Visual Resources (cont.)

Google Earth Visualization of the SEZ, with Power Tower Model, as Seen from the Old Spanish National Historic Trail 2.5 mi from the SEZ.



Acoustic Environment

- Assumes one project would be under development at any one time (3,000 acres).

- Construction and operation noise levels from the SEZ are estimated at 34 to 52 dBA at nearby receptor points, upper end of range is slightly above background. Some noise might be masked by traffic on I-15.

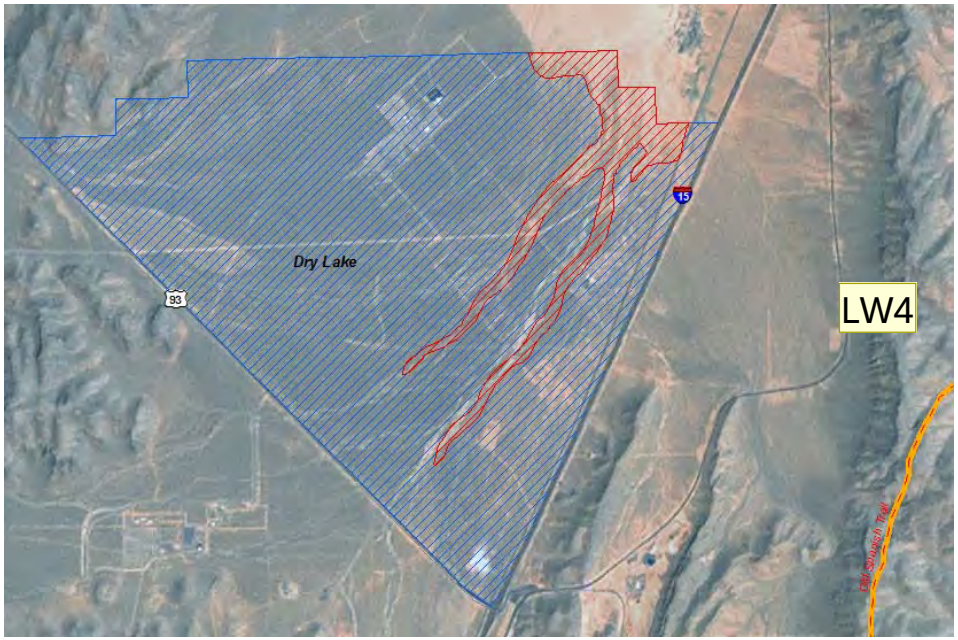
- Construction and operations would cause negligible but unavoidable, localized, short-term noise impacts on neighboring communities.

- Programmatic Design Features (Final PEIS Section A.2.2.14):
  - Consultation with BLM early in project planning; compliance with terms and conditions
  - Solar facilities should be designed and sited to minimize impacts on sensitive noise receptors

- SEZ-specific Design Features: None

Paleontological and Cultural Resources

- Few, if any, impacts on paleontological resources are likely; however, further investigation is necessary.
- Direct impacts on significant cultural resources could occur in the proposed Dry Lake SEZ.
- A large area of the SEZ (48%) has been surveyed, with 6 sites recorded. Surveys may not meet current standards.
- Programmatic Design Features (Final PEIS Sections A.2.2.15 and A.2.2.16):
  - Consultation with BLM early in project planning; compliance with terms and conditions
  - Solar facilities should be designed
  - and sited to minimize cultural impacts
- SEZ-specific Design Features
  - For projects within the viewshed of the Old Spanish Trail, a National Trail inventory will be required.



Slide 25

LW4 This graphic shows the SEZ in relation to the Old Spanish Trail
LW, 8/23/2012

Native American Concerns

- SEZ is adjacent to Moapa Valley, a traditional center of Southern Paiute culture. Plant and animal species of cultural importance could be destroyed by development in the SEZ. The cultural importance of this loss must be determined through future consultation with the Tribes.

- Programmatic Design Features (Final PEIS Section A.2.2.17):
  - Consultation with tribes; compliance with NHPA
  - Solar facilities should be designed and sited to minimize cultural impacts

- SEZ-specific Design Features:
  - Formal contact with the Moapa Band of Paiute Indians requested for any projects on or near the Muddy River, Virgin River, Colorado River, Arrow Canyon Range, Potato Woman, and the Apex Pleistocene Lake

  - Compensatory mitigation could be used to cultivate or access culturally significant plants (such as mesquite)

Socioeconomics

- Construction: from 221 to 2,921 temporary jobs; $14 to 181 million income.
- Operations: from 13 to 300 permanent jobs; $0.5 to 11 million annual income.
- Programmatic Design Features (Final PEIS Section A.2.2.18):
  - Consultation with BLM; identify and minimize impacts
- SEZ-specific Design Features: None

Environmental Justice

- There are both minority and low income populations within 50 miles of the SEZ. Impacts to these populations, although small, could occur as a result of any adverse impact from development on the SEZ.

- Programmatic Design Features (Final PEIS Setion A.2.2.19):
  - Consultation with BLM; identify and minimize impacts

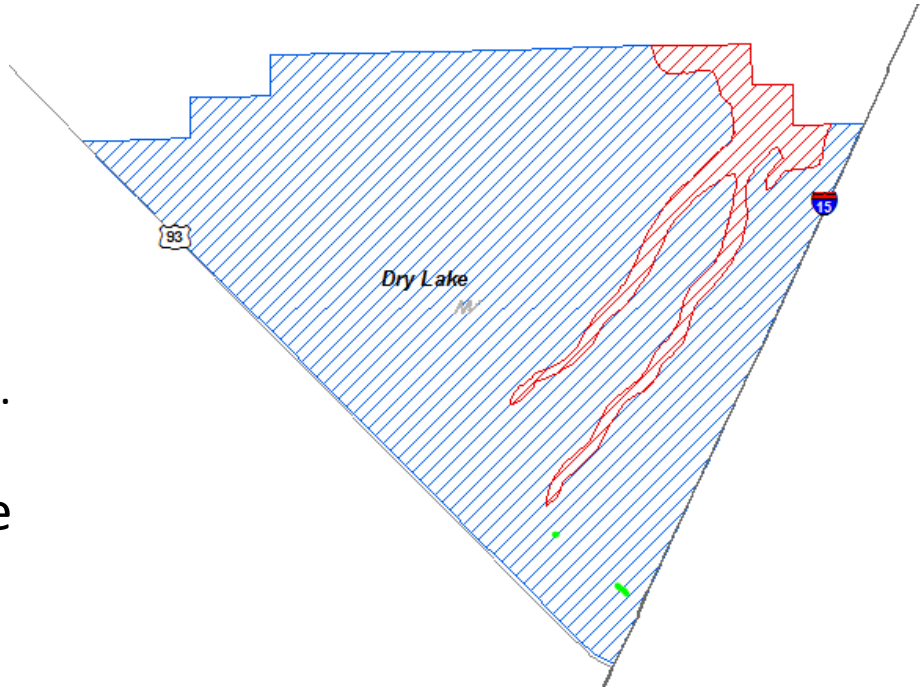
- SEZ-specific Design Features: None

Transportation

- Primary impacts would be from commuting worker traffic - up to additional 2,000 vehicle trips per day during construction
- Would represent an increase in traffic of about 10% to 20% on I-15
- If all projects were routed through U.S. 93, traffic levels would more than double north of its junction with I-15.

- Programmatic Design Features (Final PEIS Section A.2.2.17):
  - Consultation with BLM and other federal, state, and local agencies regarding need for measures such as planned site access locations, road improvements, staggered work schedules, and ride-sharing programs.

- SEZ-specific Design Features: None

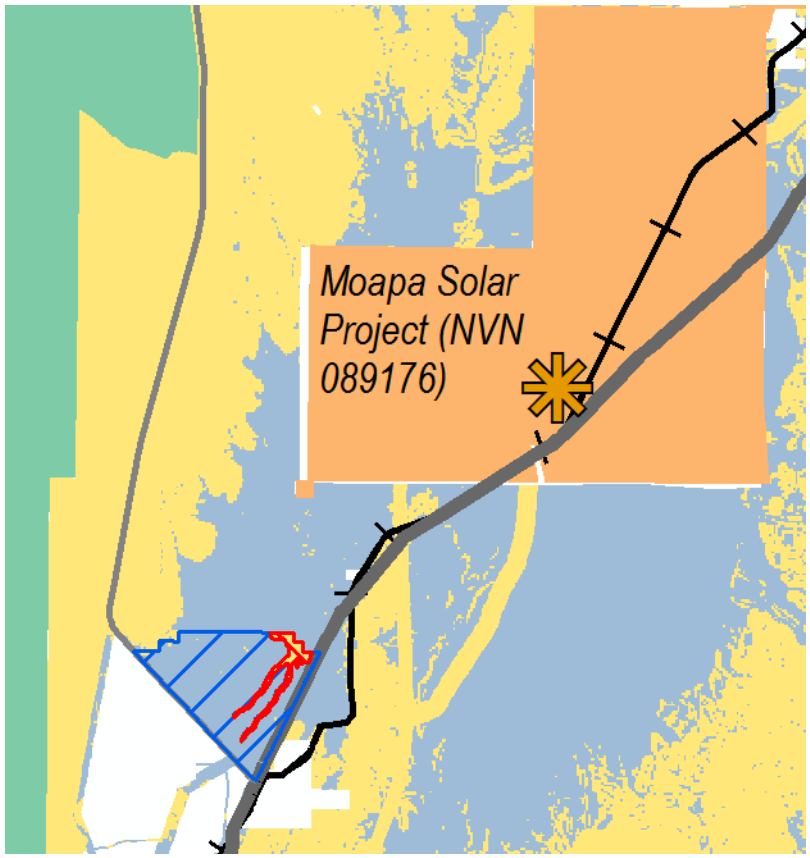


Cumulative Impacts

- Geographic extent of cumulative impacts analysis varied by resource
  - Ecological: 50-mile radius
  - Visual: viewshed within a 25-mile radius
  - Acoustic environment: adjacent areas
- Final PEIS identified ongoing and reasonably foreseeable actions within or adjacent to the SEZ:
  - Apex Generating Station
  - Chuck Lenzie Generation Station
  - Harry Allen Generating Station and Expansion
  - Silverhawk Generating Station
  - Kern River Gas Transmission System; UNEV Pipeline Project; Clark, Lincoln and White Pine Counties Groundwater Development Project; Groundwater Testing/Monitoring Wells, NV Energy Microwave and Mobile Radio Project

Cumulative Impacts (continued)

- 350 MW solar PV project approved on Moapa River Indian Reservation, 5 miles northeast of the SEZ
  - Groundwater impacts (up to72 ac-ft/yr)
  - Ecological impacts (e.g., desert tortoise, cactus and yucca species)
- Four solar applications occur within or near the SEZ (total of 1,975 MW proposed). Also a new 200 MW project proposed on Moapa Reservation



Transmission Assessment

- Dry Lake SEZ estimated to have the potential to generate up to 915 MW of marketable power
- Possible load areas
  - Las Vegas, NV
  - Los Angeles, CA and Phoenix, AZ
- Dedicated-line transmission (DLT) Analysis:
  - Assumes all new transmission construction
  - Scenario 1: Line constructed to Las Vegas would include 3 substations, extend about 31 miles and disturb 669 acres.
  - Scenario 2: Lines constructed to Los Angeles and Phoenix would include 5 substations, extend about 605 miles and disturb 2,873 acres.

Photo by W. Gretz, NREL

Summary of Impacts

- Development may prevent access to public lands to the west of the SEZ
- Development may have a significant adverse effect on specially designated areas
- Development may adversely affect recreation
- Development may adversely affect military aviation activities
- Existing mining claims may adversely affect solar development
- Groundwater withdrawals for development may cause declines in groundwater elevations that can impact water availability for surface water features, vegetation, ecological habitats, regional groundwater flow paths, and other groundwater users in the basin
- Development may alter ephemeral stream channels that can impact flooding and debris flows during storms, groundwater recharge, ecological habitats, and riparian vegetation communities
- Soils may be impacted through compaction and erosion

Summary of Impacts (continued):

- Development may adversely affect vegetation, for example, through destruction of sensitive habitat or through establishing noxious weeds
- Development may adversely affect specific wildlife species or aquatic biota (especially 73 identified special-status species within 5 miles of SEZ)
- Solar PEIS analyses do not predict exceedance of ambient air quality monitoring standards during operations
- Development may adversely affect sensitive visual resources
- Solar PEIS analyses do not predict exceedance of noise guideline levels
- Although the Solar PEIS analyses do not predict impacts to paleontological resources, potential impacts to these resources may occur.
- Development may adversely affect cultural resources (including the Old Spanish NHT)
- Development may adversely affect socioeconomics (e.g., in terms of community services), and may adversely affect environmental justice
- Development may adversely affect transportation
- Development may result in adverse cumulative impacts

Framework and Action Plan for Developing the Regional Mitigation Plan for the Dry Lake Solar Energy Zone (SEZ)

Michael Dwyer

BLM

Goal of Regional Mitigation Planning for SEZs

- *For those impacts that cannot be avoided or minimized, the BLM will consider the implementation of measures to offset (or mitigate) impacts with the goal of ensuring viability of resources over time. To accomplish this goal in a streamlined and standardized way for SEZs, the BLM proposes to establish regional mitigation plans.*

Solar PEIS A.2.5.2.2

Dry Lake SEZ Regional Mitigation Plan Pilot Project

- **Goals:**
  - Develop a Regional Mitigation Plan for the Dry Lake SEZ
  - Apply the lessons learned to produce guidance for the development of regional mitigation plans for the remaining SEZs.

Framework & Action Plan

- Proposed Framework
  - Proposed content of the Regional Mitigation Plan for the Dry Lake SEZ
- Proposed Action Plan
  - How the BLM plans to develop the Regional Mitigation Plan for the Dry Lake SEZ

Proposed Framework for the Regional Mitigation Plan for the Dry Lake SEZ

- Derived from two frameworks presented in the Solar PEIS:
  - *Framework for Developing Regional Mitigation Plans (Appendix A.2.5)*
  - *Framework for Developing a Monitoring and Adaptive Management Plan for the BLM's Solar Energy Zones (Appendix A.2.5)*

Framework for Developing Regional Mitigation Plans

Elements:

1. A transparent and legally defensible stakeholder engagement process.
2. A baseline upon which unavoidable impacts are assessed
3. Assessment and quantification of unavoidable impacts.
4. Mitigation obligations or costs for individual projects.
5. A structure to hold and apply mitigation investments
6. Regional objectives regarding where and how mitigation investments will be made.
7. Monitoring and adaptive management

Long-Term Solar Monitoring and Adaptive Management Plan (LTMP)

Component parts:

1. Frame the Issue
2. Understand the System
3. Develop Objectives
4. Assemble Background/Existing Information
5. Develop Monitoring and Sampling Schema
6. Create and Finalize Monitoring Plan
7. Implement Data Collection and Management
8. Analyze and Report
9. Adaptive Management Loop

Outline of the Regional Mitigation Plan for the Dry Lake SEZ

1. What are the unavoidable impacts?
2. Which impacts should the BLM mitigate?
3. What are the mitigation objectives?
4. What mitigation projects/actions will be undertaken to off-set the selected impacts?
5. How will the mitigation actions be funded?
6. How will we know if the mitigations actions have achieved the desired objectives?

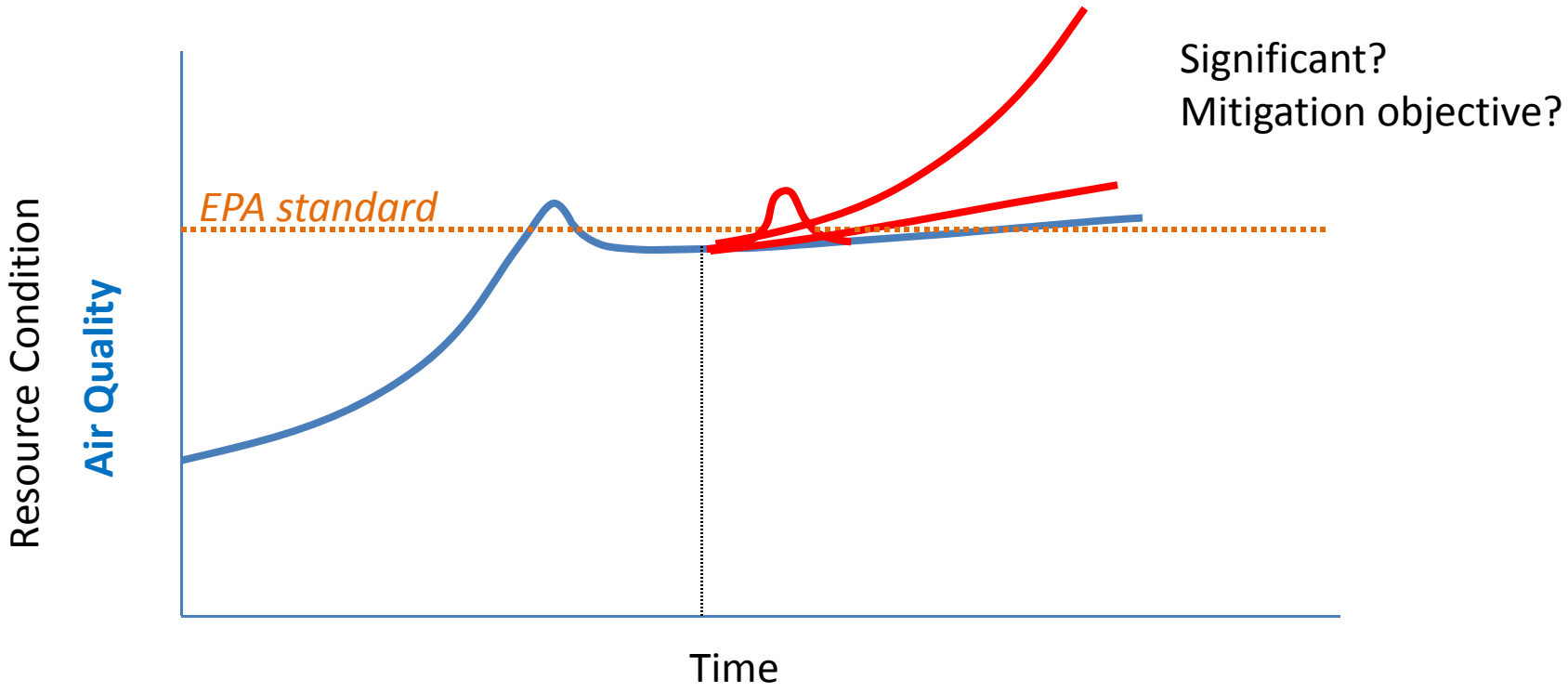
1. What are the unavoidable impacts?

- What assumptions are made about the development of the SEZ?
- What are the unavoidable impacts associated with the development of the Dry Lake SEZ?
- What is the region of influence for each impact?

2. Which impacts should the BLM mitigate?

- Which impacts represent significant threats to the resilience and/or sustainability of the ecological, social, and cultural systems in the region?
  - What are the relevant ecological, social, and cultural systems in the region?
  - What are the current trends in the resilience and/or sustainability of the relevant ecological, social, economic, and cultural systems in the region?
  - What roles do the unavoidable impacts play in the resilience and/or sustainability of the relevant ecological, social, economic, and cultural systems in the region?
  - How significant are the impacts of development in the SEZ on the resilience and/or sustainability of the relevant ecological, social, and cultural systems in the region?
- To what degree can the impacts be mitigated?

Regional Models



System Dynamics

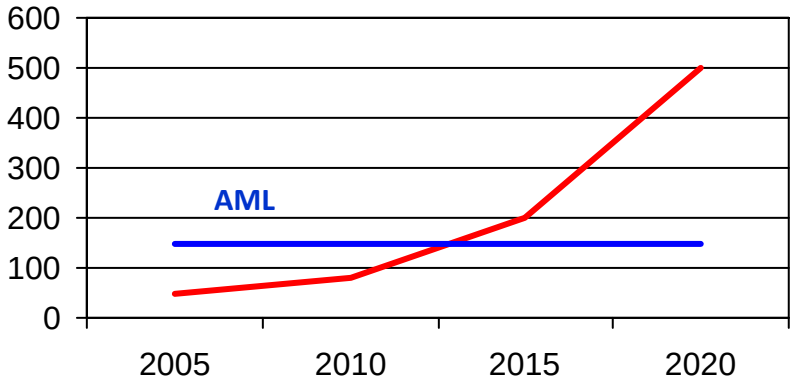
– A method for modeling dynamic problems (problematic behavior that changes over time)

and…

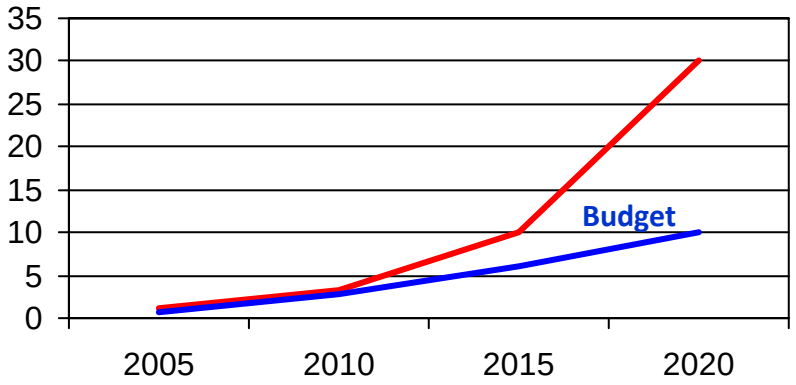
– For testing policy alternatives for their effects

Dynamic Problems

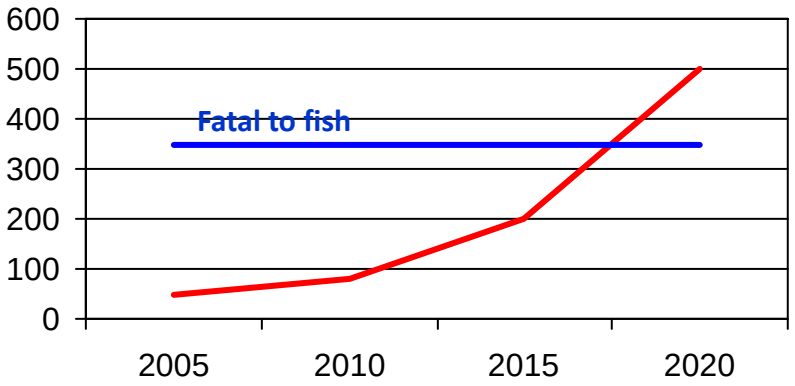
Wild Horse Population in a HMA



Projected Costs – Wild Horse Sanctuary



Salinity – Walker Lake



Rule of thumb:
System Dynamics can help with problems that can be expressed as behavior plotted over time

SD Problem Solving Process

- Construct a model that explains the trend
  - Develop a hypothesis about what is causing the problematic behavior
  - Represent the structure of the system as a stock-and-flow model
  - Validate the model
- Identify opportunities to alter outcomes (add them to the model)
- Use the model to provide insight into the consequences of various policy scenarios.

Causality

- A ⟶ B

  A is the independent variable

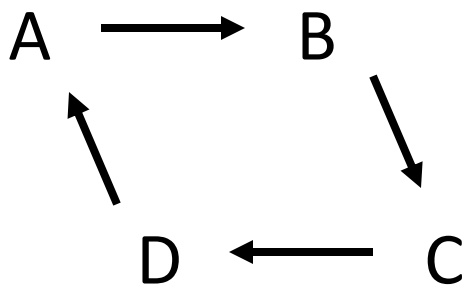
  B is the dependent variable

  B is a function of A

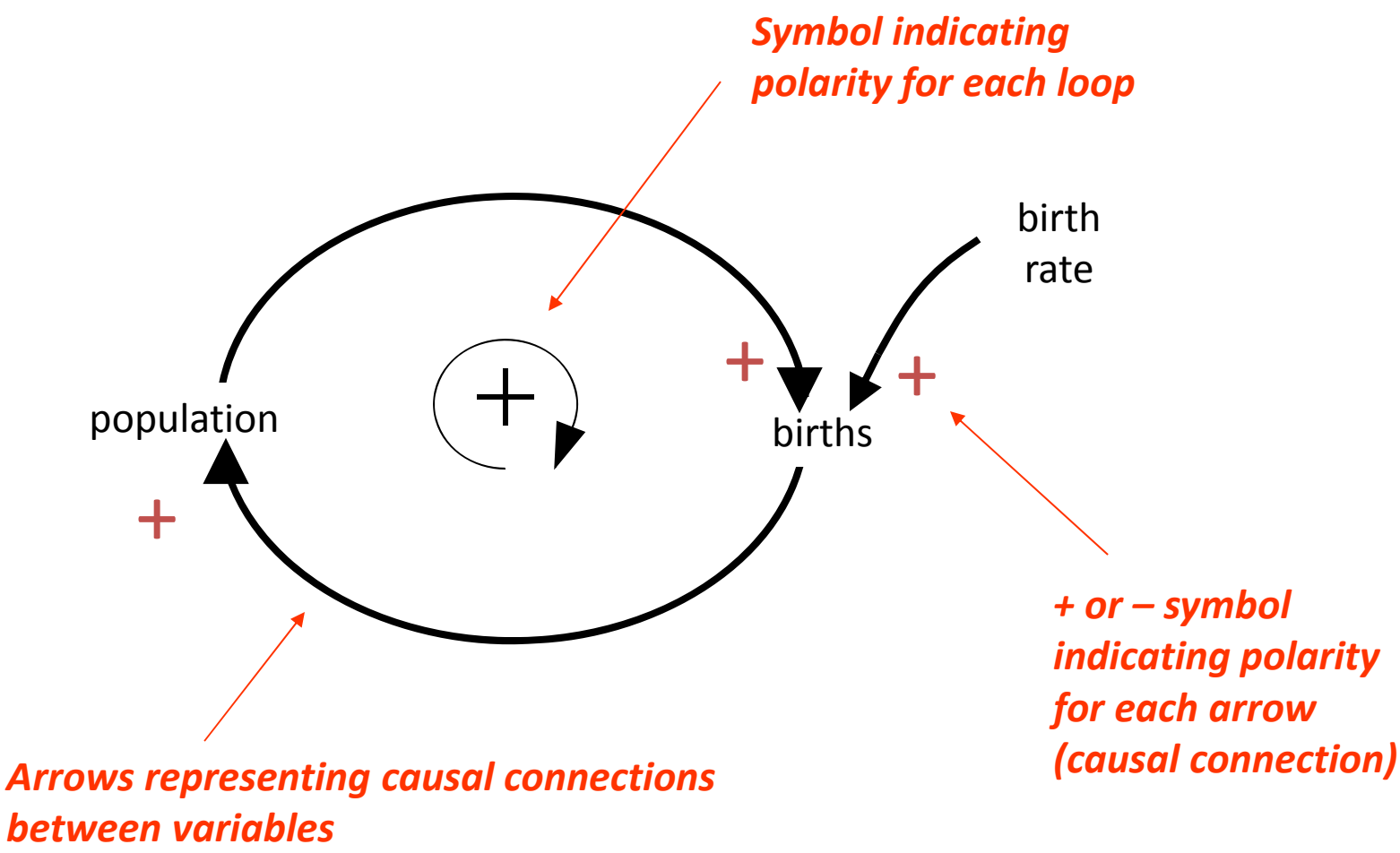
- Causal Chain:

  A ⟶ B ⟶ C ⟶ D

- Causal Loop:

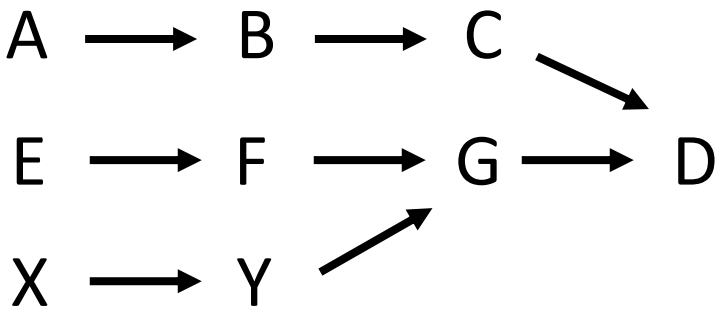


Causal Loop Diagram (CLD)

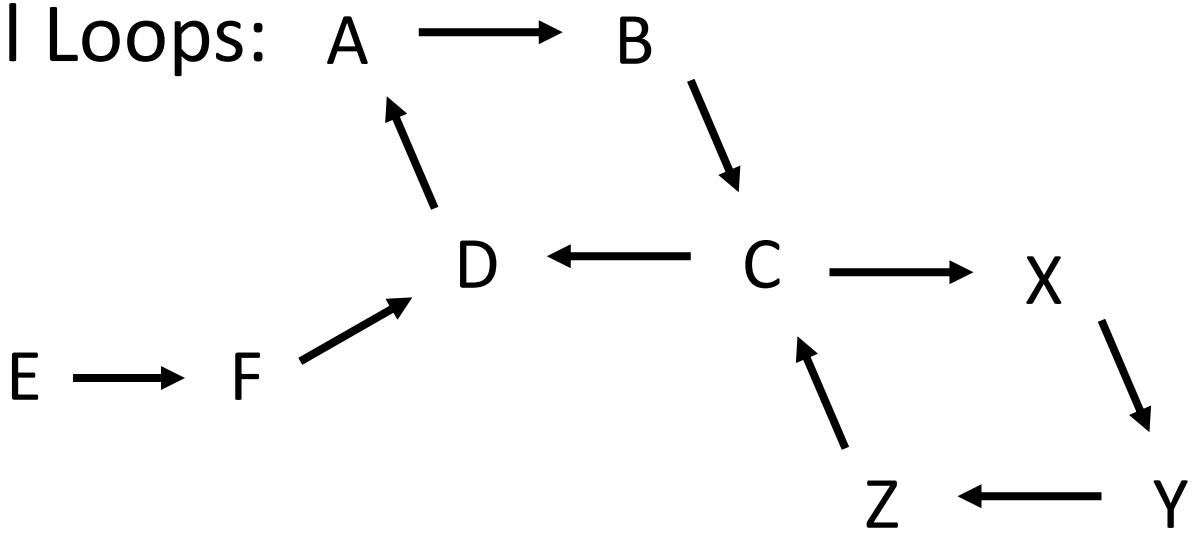


Causality

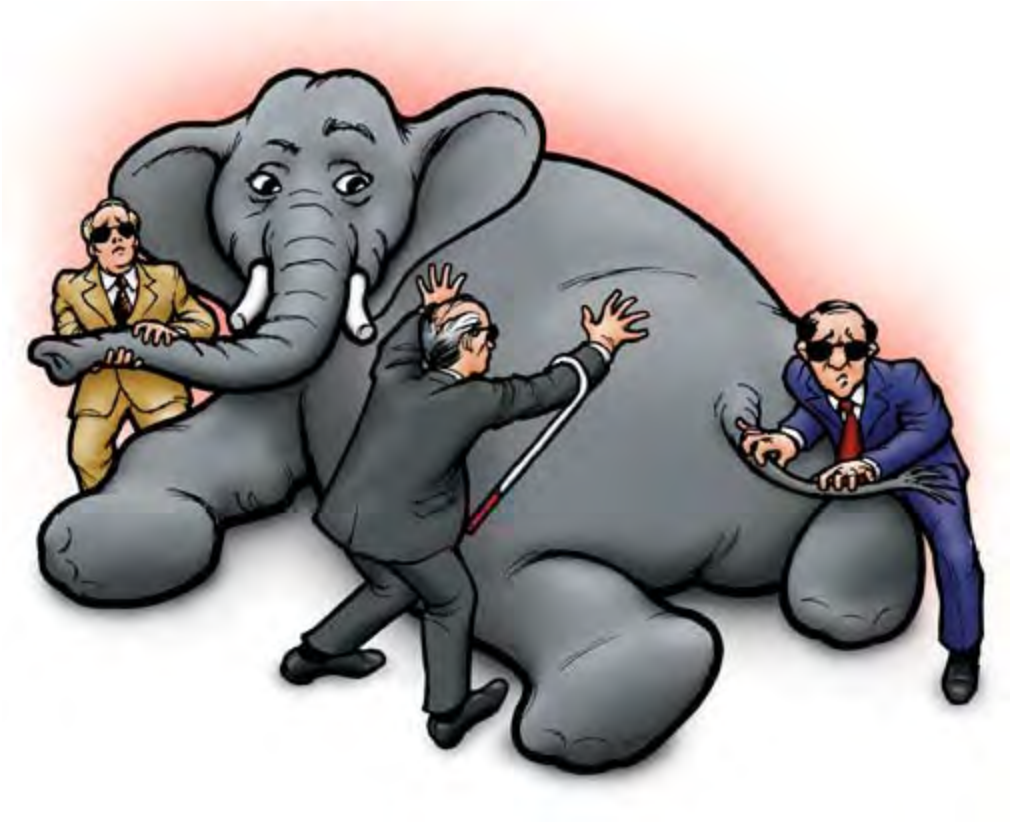
- Multiple Causal Chains:



- Causal Loops:

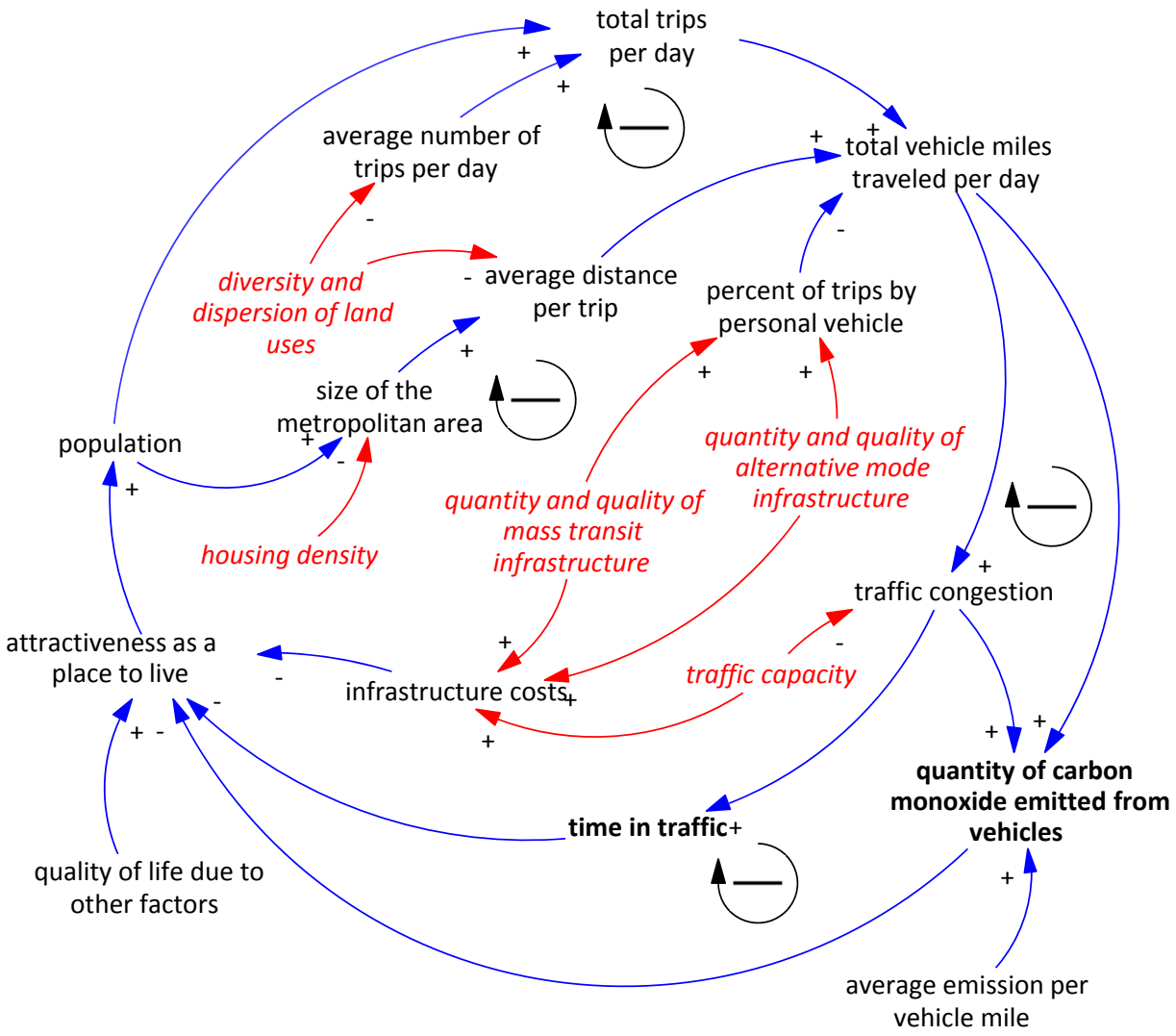


If we fail to make the causal relationships explicit…



LUTAQ CLD

Problem: Increasing traffic congestion and poorer air quality

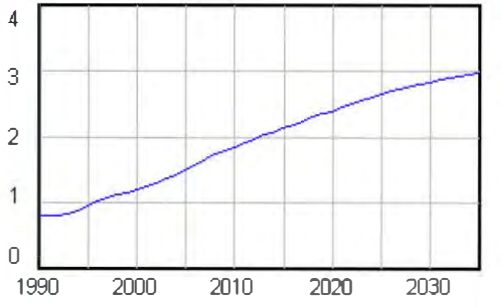


Regional Policy Targets

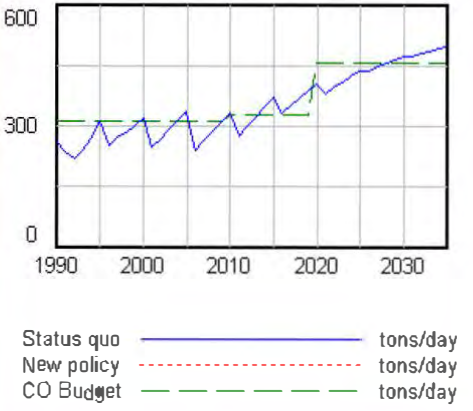
	Policy for Redone Core	Policy for Non-core New Development
Areas Subject to New Policy		
percent to which new policy applies each year	0 — 10	0 — 00
Land Use Factors		
housing density (dwelling units/ total acres)	1 — 20	1 — 10
average distance per trip (miles/trip)	0 — 10	0 — 10
average number of trips per person per day	0 — 6	0 — 6
Public Mass Transit and Alternative Modes		
percent of travel satisfied by mass transit and alternative modes	0 — 20	0 — 20
Traffic Flow Factors		
percent increase in traffic flow	0 — 15	0 — 15

Regional Policy Effects

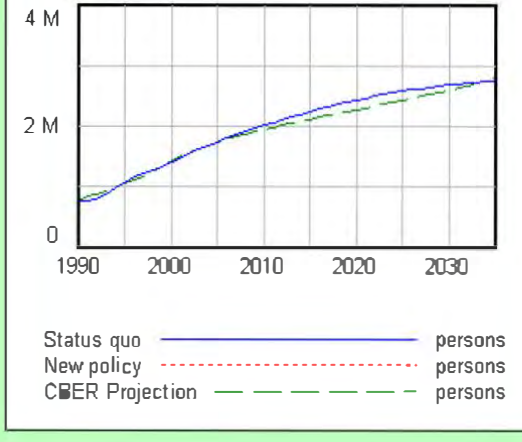
Time in Traffic



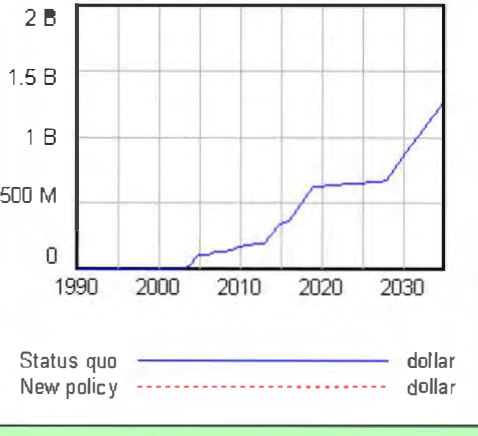
Air Pollution (CO)



Population



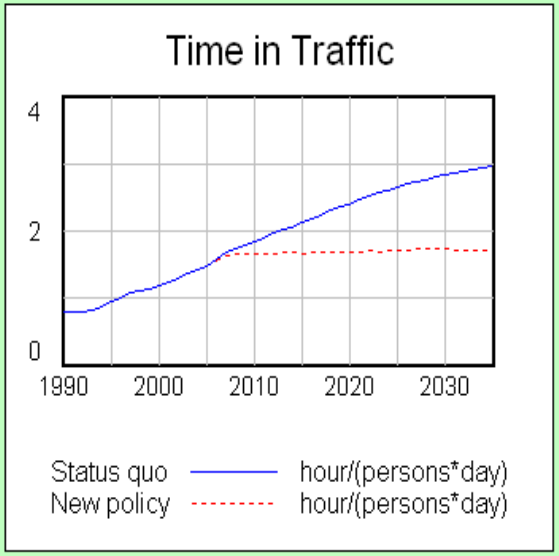
Cumulative Cost

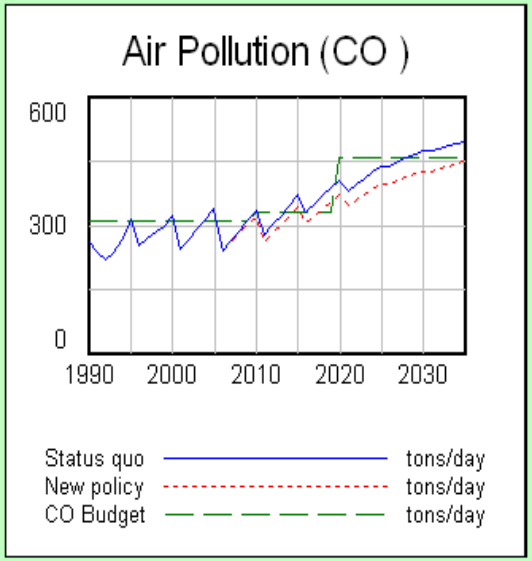


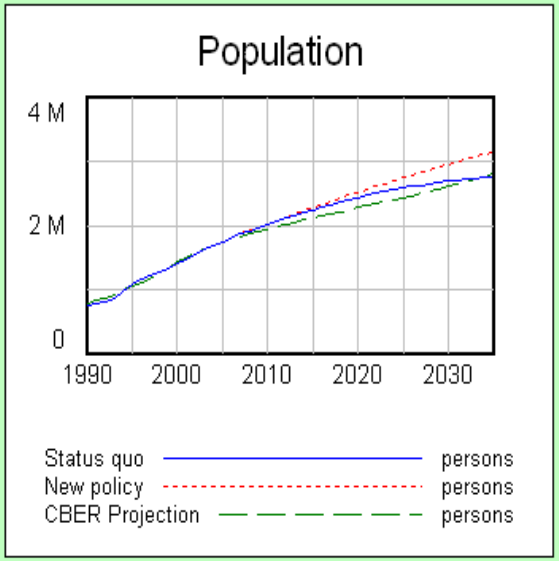
Regional Policy Targets

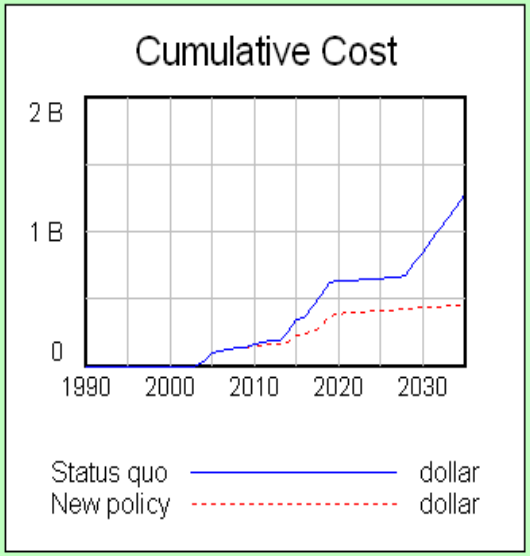
	Policy for Redone Core	Policy for Non-core New Development
Areas Subject to New Policy		
percent to which new policy applies each year	0 | 0 | 2.5 | 10	0 | 100 | 00
Land Use Factors		
housing density (dwelling units/ total acres)	1 | 2.1 | 20	1 | 4.7 | 10
average distance per trip (miles/trip)	0 | 6 | 5 | 10	0 | 9 | 8 | 10
average number of trips per person per day	0 | 3 | 2.75 | 6	0 | 3 | 2.75 | 6
Public Mass Transit and Alternative Modes		
percent of travel satisfied by mass transit and alternative modes	0 | 3.3 | 20	0 | 3.3 | 20
Traffic Flow Factors		
percent increase in traffic flow	0 | 0 | 15	0 | 0 | 15

Regional Policy Effects









On Models

- All models are simplified versions of reality
- Some are useful

Books on System Dynamics

- Ford, A., 1999, Modeling the Environment: An Introduction to System Dynamics Modeling of Environmental Systems, Island Press

- Sterman, J., 2000, Business Dynamics: Systems Thinking and Modeling for a Complex World, McGraw-Hill

- Meadows, Meadows & Randers, 1992, Beyond the Limits: Confronting Global Collapse, Envisioning a Sustainable Future, Chelsea Green

- Vennix, J., 2001, Group Model Building: Facilitating Team Learning Using System Dynamics, Wiley

3. What are the mitigation objectives?

– What constitutes success in mitigating the impacts associated with development of the SEZ?

4. What mitigation projects/actions will be undertaken to off-set the selected impacts?

- What mitigation projects/actions off-set the impacts and by how much?
- What will various mitigation projects/actions cost?
- Is there an overarching mitigation action strategy that can increase efficiency and/or effectiveness?
  - How will the BLM cooperate with other agencies and entities to implement mitigation actions that have the biggest bang for the buck?

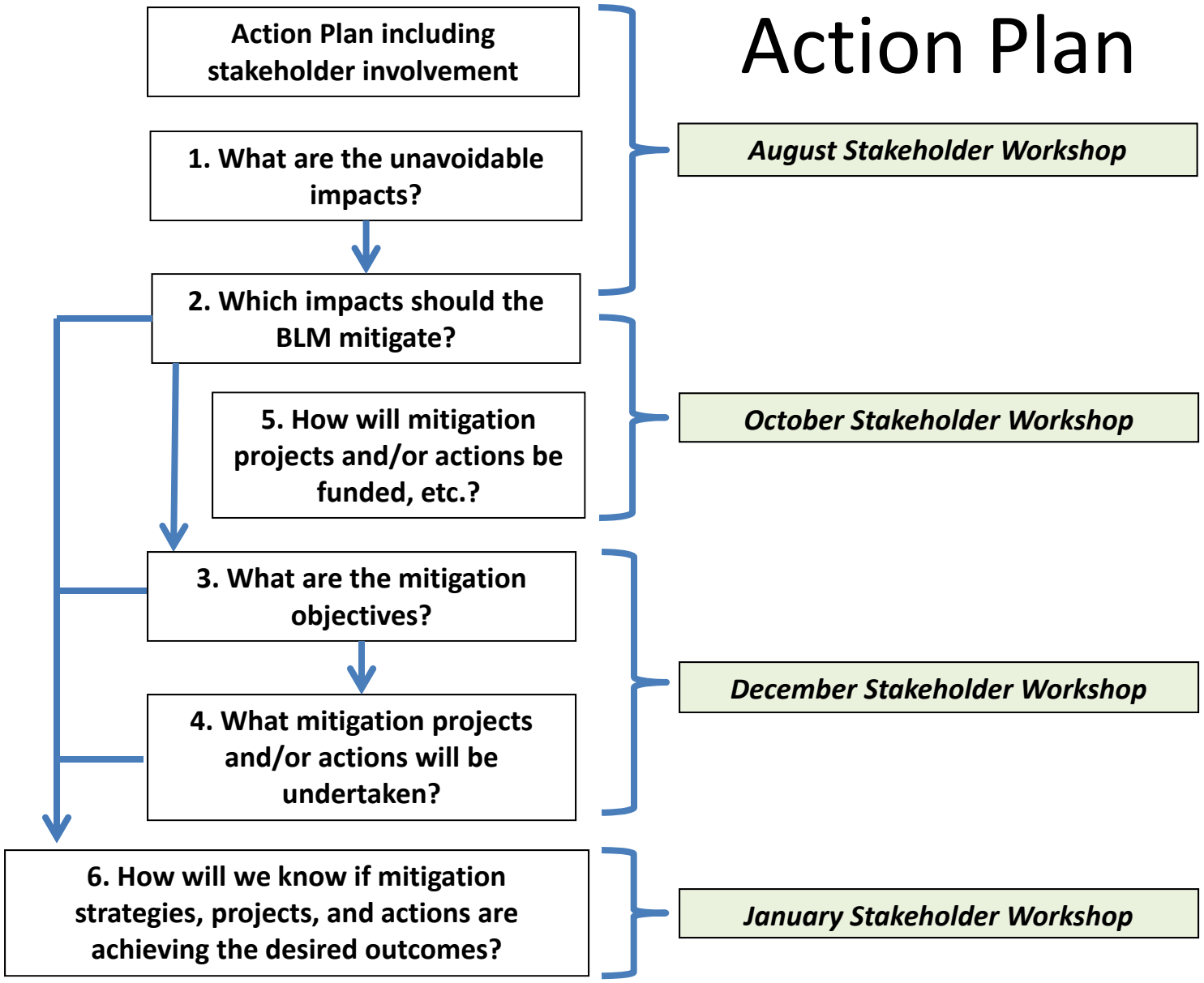
5. How will the mitigation actions be funded?

- Mitigation fee?
  - How much and on what basis?
  - How collected, held, and accounted for?
  - How will funds be allocated to projects/actions?
- What other mitigation obligations are required of developers?

6. How will we know if the mitigations actions have achieved the desired objectives?

- How will we monitor and assess success?
- What will the BLM do if mitigations actions are not achieving their desired objectives?

Action Plan


Action Plan including stakeholder involvement
1. What are the unavoidable impacts?
2. Which impacts should the BLM mitigate?
5. How will mitigation projects and/or actions be funded, etc.?
3. What are the mitigation objectives?
4. What mitigation projects and/or actions will be undertaken?
6. How will we know if mitigation strategies, projects, and actions are achieving the desired outcomes?
August Stakeholder Workshop
October Stakeholder Workshop
December Stakeholder Workshop
January Stakeholder Workshop

Action Plan

Workgroups Stakeholder Workshops BLM Management

- All preliminary, interim, and final products will be posted on the Web site for review & comment
- In addition to the six sections of the Plan, certain of the interim products will be presented for review and revision at planned or additional stakeholder workshops

The Pilot

- *Which methodologies or mechanisms best suit BLM's needs to assess impacts and translate impacts into dollars?*
- *How can the pooling of dollars for mitigation and monitoring in SEZs help reduce overall costs to developers?*

Break-out Group Activity

- Break into five groups
- Discuss the Framework & Action Plan
  - What you like, what you don't like, recommended changes, questions, ideas, things we should pay attention to, things you are concerned about, etc.
- Appoint a spokesperson
- Reassemble into the large group and present (15 minutes for each group).

Thanks!

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