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STATE OF CALIFORNIA

Energy Resources Conservation and Development Commission

In the Matter of:

APPLICATION FOR CERTIFICATION
FOR THE PALEN SOLAR ENERGY
GENERATING SYSTEM

DOCKET NO. 09-AFC-7

INTERVENOR CENTER FOR BIOLOGICAL DIVERSITY

Exhibit 3050

Testimony of Allan Muth

Summary of Testimony

Direct and indirect effects of the proposed project will have significant adverse impacts on Mojave fringe-toed lizards and their habitat. Indirect effects will result in deflation and stabilization of habitat downwind of the project. Qualitative estimation of indirect impacts is subjective, unreliable, and inappropriate given the lack of detailed methods used to derive the estimated impacts. Descriptions of Mojave fringe-toed lizard habitat as “loose sand” are inadequate and obfuscate known, quantitative measures of habitat substrate.

Qualifications

My qualifications are provided on my Curriculum Vitae attached to this Testimony and as discussed below.

I have 45 years of experience as a herpetologist working in the California desert. My current area of research concerns lizards that live in sand systems and for the last 32 years I have been involved with research and conservation biology of the Coachella Valley fringe-toed lizard, *Uma inornata*.

I have a BA and MA from California State University, Fullerton and a Ph.D. from the University of Wisconsin, Madison.

I have been the director of a University of California desert research station for 32 years.

I was an active participant and science advisor to the Coachella Valley Fringe-toed Lizard Habitat Conservation Plan and the Coachella Valley Multiple Species Habitat Conservation Plan. I represent the University of California on the Coachella Valley Mountains Conservancy, a State agency, and I've served on three federal advisory committees with appoints from the Department of State, Secretary of Agriculture, and Secretary of Interior.

Statement

I have reviewed the biological sections of the Final Staff Assessment of Palen Solar Electric Generating System FSA - Part A (FSA). I concur with the FSA assessment of impacts to the Mojave fringe-toed lizard (MFTL) and their habitat. However, I disagree on the compensation ratios recommended by the FSA. As discussed below and noted in docketed reports by Dr. Andrew Collison, Dr. Miles Kenney, Dr. Nicholas Lancaster et al., and Mr. Fred Nials, the aeolian system of the Chuckwalla Valley is a dynamic system with changes to the land forms that occur on short- and long-term time scales. Source areas of sediments, aeolian transport areas, and areas of deposition and deflation of sediments are not static, but vary in relative importance and location on the landscape over time. Hence the selection of different mitigation ratios for impacts to MFTL habitat used by staff in the FSA are based on a snapshot in time and as such discount future functionality of the habitat in the project area and the long-term impacts of the project. The mitigation ratios are proxies for contemporary substrate conditions and they disregard the nature of landscape scale dynamic systems. I recommend a common mitigation ratio, 3:1, for direct and indirect impact areas irrespective of the contemporary substrate conditions. Alternatively almost all of the MFTL habitat issue could be resolved by moving the project out of the active sand transport area.

Applicant's Opening Testimony

In my opinion the Applicant's Opening Testimony obfuscates matters of temporal and spatial scale and ignores the results of previous biological research and physical studies of ecosystem processes in an attempt to minimize the scope and effect of the impacts to the MFTL and its habitat. The following specific comments follow excerpts from the Applicant's Opening Testimony document.

1. "Staff commissioned a study to evaluate the potential for the PSEGS to interfere with sand transport which generally occurs in the northeastern portion of the site. We believe that Staff has made inappropriately relied on that study and has made some assumptions which has led to a severe overestimation of the project effects on the sand transport corridor. We also believe that Staff has severely overestimated whether those effects would cause actual loss of MFTL habitat."

All parties agree that the Collison model has limitations and simplified assumptions. However, as noted by Lancaster et al. "Despite its limitations, the PWA is the best available and so was used to ensure compatibility and comparison with prior studies." The model was rerun with updated assumptions of wind regimes and porosity assumptions of the project boundary fence. In

addition Lancaster et al. quantitatively assessed the impact of the modified project heliostat array and concluded that "...the Modified Project element array should be highly effective in both arresting sand transport and keeping any flux at very low levels in comparison to sand flux on an un-obstructed surface." The Lancaster et al. analysis predicted a 93% reduction in sand flux through the project. Hence the array analysis is consistent with the modeled effects of the Collison model. However the PSEGS Opening Testimony proposed discarding the model and analytical results in favor of subjective estimations that are based on the field observations of one person on nearby obstructions to sand transport. In my opinion subjective estimations are inferior solutions to quantitative results that are based on transparent and repeatable methods. I recommend acceptance of the conclusions of the Lancaster et al. report regarding the area of direct and indirect impacts and that those areas be used as the basis for mitigation in the Chuckwalla Valley.

2. "In order to adequately evaluate potential effects on sand transport, the effects of fences, structures, orchards and agricultural fields in nearby areas were examined in order to see real, not modeled, effects of transport blockage. Based on these observations, extremely conservative estimates of impact on the sand transport system were calculated and a mitigation plan was devised based on the area of more than 50% estimated sand blockage."

The location and number of "nearby" fences, structures, orchards and agricultural fields is not given in the report. The areas examined have been subject to reduced sand transport for varying lengths of time and some downwind deflation has already taken place. There were no measurements taken to determine if the "real" effects of transport blockage resulted in substrates that were not consistent with known MFTL habitat characteristics. In addition there were no methods given to indicate how the percent blockage of sand transport was determined. The observations and conclusions are not repeatable with the information given.

3. Table 1, PSH LLC's Final Sand Transport Study, p. 13 – There is an error in the Table column headings. Zone II is incorrectly labeled as Zone III.

Table I. Estimated area of indirect impact resulting from construction of PSEGS facility.

Degree of Indirect Impact	ZONE III	ZONE III
0% - 50%	23 acres	158 acres
50% - 100%	67 acres	111 acres

4. "In order to provide a compromise, we have assumed that areas where the input of sand is predicted to be blocked by 50 percent or more (overestimate) will result in an indirect but significant impact to MFTL habitat."

The implicit argument in the above statement is that a certain percentage of sand blockage will result in some undefined "significant impact" to MFTL habitat. Presumably the impact will affect the "habitat quality", but defining habitat quality is an elusive metric. The subjective choice of 25% or 50% threshold for significant impact is not supported by quantitative data for

either position. An arbitrary choice of a threshold percentage ignores known metrics of habitat suitability that include particle size distribution and surface compaction.

5. “**ASSUMPTION:** Interruption of sand transport by removal of sand automatically and inevitably results in deflation and deflation automatically and inevitably results in loss of MFTL habitat.”

The above inferred assumption asserts immediate deflation and loss of MFTL habitat. That assertion is a misstatement of the basic physical processes and ignores appropriate temporal and spatial scales. Blockage of virtually all of the sand supply downwind of the project will create a sand shadow. The time required for deflation and stabilization of the surface varies due to a number of factors and the effect will not be immediate, but it will be inevitable (unless there is a major change in the aeolian environment). The effects of disruption to the aeolian sand transport and fringe-toed lizard occupancy of impacted areas are well documented in the Coachella Valley (Turner et al., 1984). In addition the assumption relied on conflates landscape scale processes with project sized local effects that create sand shadows.

6. “Further, both experts agree that the potential areas of effect, predicted by the PWA model and shown on Mr. Nials report, do not represent areas of erosion or deflation. They simply represent areas which receive less sand “transported” to them. In other words, despite receiving less sand than before, these areas can continue to maintain sand levels sufficient to support MFTL.”

The above statement would only be true in the short-term on the spatial scale of the proposed project. No evidence is provided to support the statement that “these areas can continue to maintain sand levels sufficient to support MFTL” in the long-term. The available data do not support the assertion.

7. “MFTL are loose sand specialists; this is the most consistent factor identifying fringe-toed lizard habitat in several studies (e.g., Barrows 1997).”

Characterizing the lizard as “loose sand” specialists is misleading and the term “loose sand” is qualitative and essentially meaningless as an appropriate term for discussion of MFTL habitat. All fringe-toed lizards occupy substrates with a narrowly constrained range of particle size and surface compaction. Introducing the term “loose sand” into the discussion leaves the impression that any sand will do, and that is not the case.

8. “Staff’s assumption that sand blockage equates to deflation at a level that cannot support MFTL is simply not supported by the model and is not supported by field observations. While some areas of deflation are likely to occur in Chuckwalla Valley, deflation is not inevitable, nor is it uniform. As long as there is sufficient loose sand in the indirectly affected sand sheets, then MFTL could still occupy them.”

The Lancaster et al. analysis supports the assumption that the project will block most, 93%, of the sand transport downwind from the footprint of the project. Therefore, deflation is inevitable downwind from the project. No one would disagree with the general statement that ...”some areas of deflation are likely to occur in Chuckwalla Valley, deflation is not inevitable, nor is it

uniform.” However the site of deflation under discussion is immediately downwind of the project and discussion on the scale of the entire Chuckwalla Valley is irrelevant.

9. “... As long as there is sufficient loose sand in the indirectly affected sand sheets, then MFTL could still occupy them.”

The length of time that MFTL would occupy the indirectly affected sites would vary with the wind regime at a given location and the degree of sand reduction to the site, but in the long term the substrate will stabilize and MFTL will not occupy the area.

10. “Other factors such as patch size, grain size, distance to other occupied patches, sand depth, vegetation, exotic species, and patch location have been observed to be important components of fringe-toed lizard habitat. However, even with the well studied Coachella Valley fringe-toed lizard, the influences of these factors are variable over time (e.g., Barrows and Allen 2007, Barrows 1997) and their contributions or synergistic effects not entirely clear.”

The general statement that other factors are important components of habitat is accurate however, Barrows, 1997 and Barrows and Allen, 2007, studied isolated populations of CVFTL in 26 small habitat patches and correlated those factors with survival of the populations. The analyses did not examine the contributions or synergistic effects of the “other factors” as variables on Coachella Valley fringe-toed lizard habitat. The variables noted above were evaluated in the context of survival of small isolated populations (Barrows and Allen, 2007). Between 1993 and 2006 50% of the populations went extinct in spite of the fact that there were no observed changes to substrate characteristics. The results of the Barrows (1997) and Barrows and Allen (2007) studies were correlations of patch occupancy and persistence of small populations. The results of the studies are consistent with results that would be expected outcomes of metapopulation dynamics.

DECLARATION OF Allan Muth

I, Allan Muth, declare as follows:

1. I am a biologist currently employed by the University of California, Riverside.
2. I do not represent the University of California nor do my comments represent a position of the University of California.
3. I am not under contract to any of the participants in these proceedings and I do not receive compensation from any of the participants.
4. My professional qualifications are given in the attached Curriculum Vitae.
5. I prepared the attached testimony relating to Biological Resources for the Petition for Amendment for the Palen Solar Electric Generating System (California Energy Commission Docket Number 09-AFC-OC).

6. It is my professional opinion that the attached prepared testimony is valid and accurate with respect to issues that it addresses.

7. I am personally familiar with the facts and conclusions related in the attached prepared testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury, under the laws of the State of California, that the foregoing is true and correct to the best of my knowledge and that this declaration was executed on October 15, 2013.

A handwritten signature in cursive script, appearing to read "M. Smith", positioned above a horizontal line.

CURRICULUM VITAE

Allan Muth
October 2013

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Education:

- 9/61 - 6/64 Cerritos College
A.A. (6/64)
- 9/64 - 6/66 California State University, Fullerton
B.A. (6/66)
- 9/68 - 8/72 California State University, Fullerton
M.A. (8/72)
- 8/72 - 8/80 University of Wisconsin, Madison
Ph.D. (8/80)

Grant/Contract Support:

- 1984 - 1989 California Department of Fish and Game, Research Contract, Population Biology of the Coachella Valley Fringe-toed Lizard, *Uma inornata*. (\$45,200)
- 1987 - 1988 US Fish and Wildlife Service, Research Contract, Status of Lizard Populations in the Vicinity of Salton Sea Naval Base, San Diego, CA. (\$2,500)
- 1990 - 1992 California Department of Fish and Game, Research Contract, Population Biology of the Flat-tailed Horned Lizard, *Phrynosoma mcallii*. (\$44,200)
- 1991 - 1993 National Science Foundation, Improvement of Laboratory and Housing Facilities at Philip L. Boyd Deep Canyon Desert Research Center. (\$140,000)
- 1991 - 1993 University of California Natural Reserve System, Improvement of Laboratory and Housing Facilities at Philip L. Boyd Deep Canyon Desert Research Center. (\$120,000)
- 1993 - 2001 Negotiated Support (\$100,000) and 140 acre Land Donation (\$120,000) for Philip L. Boyd Deep Canyon Desert Research Center, The Reserve Club.
- 1996 - 1998 US Fish and Wildlife Service, Desert Riparian Restoration and Enhancement. (\$2,500)

- 1999 - 2000 Negotiated support and donations for Philip L. Boyd Deep Canyon Desert Research Center, The Reserve Community Association and Building Contractors. (\$30,000)
- 2003 - 2004 Negotiated donation of 40 acres of land (\$200,000) for Philip L. Boyd Deep Canyon Desert Research Center, Ironwood Country Club.
- 2004 – 2005 Negotiated donations of support (\$250,000) for Tevis Research Center Building at Philip L. Boyd Deep Canyon Desert Research Center.
- 2013 - 2016 Proposition 84 Grant (\$1,576,000) Facilities Improvements at Boyd Deep Canyon Desert Research Center.

Service Awards:

- 6/85 County of Riverside Proclamation. Recognition for efforts toward the preservation of the Coachella Valley fringe-toed lizard and the establishment of the Coachella Valley Preserve System.
- 10/85 Award of Merit, Desert Protective Council. Recognition for efforts to establish the Coachella Valley Preserve.
- 4/86 Silver Eagle Award, U.S. Fish and Wildlife Service. Recognition for leadership and contribution to the conservation and wise use of natural resources.
- 5/87 Service Award, California Nature Conservancy. Recognition for significantly furthering the goals of protecting natural lands and endangered species in California.
- 7/89, 10/91, 12/93, 12/94, 6/95, 12/97, 6/98, 6/99, 6/00, 6/02, 6/03, 6/04, 6/07, 6/08 Professional Development Award, Administrative and Professional Staff, University of California, Riverside.
- 12/03 Regional Access Project Foundation, Volunteer Appreciation Award for conservation activities having a significant impact within the Coachella Valley.
- 5/04 American Planning Association, Inland Empire Section, Education Project Award.
- 6/04, 6/06, 4/08, 6/09 Individual Incentive Award, Recognition for contributions to the UC Riverside Natural Reserve System.
- 4/05 Service Award, Desert Tortoise Council.

Current Position:

- 1/82 - Director, Philip L. Boyd Deep Canyon Desert Research Center, University of

California, Natural Reserve System.

Academic Positions:

- 9/68 - 9/70 Teaching Assistant, Biology Department, California State University at Fullerton (General Biology, Zoology, Genetics)
- 9/70 - 6/72 Instructor, Biology Department, California State University at Fullerton (Human Anatomy & Physiology)
- 9/70 - 9/71 Instructor, Biology Department, California State Polytechnic College at Pomona (Human Anatomy and Physiology, Zoology)
- 9/74 - 12/74 Teaching Assistant, Zoology Department, University of Wisconsin-Madison (Biophysical Ecology)
- 9/72 - 8/80 Research Assistant, Department of Zoology, University of Wisconsin-Madison. Dissertation research in the laboratory of Dr. Warren P. Porter.
- 12/80 - 12/81 Postdoctoral Fellow, Department of Zoology, Colorado State University. Research in the laboratory of Dr. Charles L. Ralph.
- 4/86 – 6/04 Adjunct Assistant Professor, Department of Biology, University of California, Riverside.

Professional Service:

- 1/82 - 12/90 Coachella Valley Ecological Reserve Foundation. Chairman, Board of Trustees.
- 6/83 - 8/84 The Lizard Consortium. Ecologist and environmental representative to the consortium of government agencies and private sector groups concerned with the Endangered Species Act of 1973 and the preparation of the Habitat Conservation Plan for the Coachella Valley fringe-toed lizard.
- 6/83 - 4/86 Coachella Valley Fringe-toed Lizard Habitat Conservation Plan Steering Committee, chaired by The Nature Conservancy.
- 9/83 - 3/84 United States Fish and Wildlife Service, Consultant, Endangered Species Information System Project; Coachella Valley Fringe-toed Lizard.
- 2/83 - 4/86 California Department of Fish and Game/United States Fish and Wildlife Service. Consultant, Coachella Valley Fringe-toed Lizard Recovery Team.
- 12/83 - 12/93 California State Senate Committee on Natural Resources and Wildlife, Desert Bighorn Sheep Habitat Management and Acquisition Advisor Group.
- 7/84 – 6/86 California Department of Fish and Game, Desert Slender Salamander Reserve, Hidden Palms Reserve Advisory Committee.
- 6/86 - 4/03 Coachella Valley Preserve System Management Group, Environmental

Representative and Ecological Consultant.

- 3/89 - 1/11 Society for the Study of Amphibians and Reptiles, Editorial Board.
- 5/89 - 4/93 Desert Tortoise Council, Chairman, Research Advisory Committee.
- 1/90 - 3/95 Desert Tortoise Council, Board of Directors.
- 2/91 - 4/93 Desert Tortoise Council, Co-Chairman.
- 1/94 - Coachella Valley Mountains Conservancy, a State Agency within the Department of Resources, University of California Representative, Board of Directors.
- 4/94 - 1/97 Coachella Valley Mountains Conservancy, Vice Chairman.
- 1/97 - 6/05 Coachella Valley Mountains Conservancy, Chairman.
- 3/94 - 12/96 U.S. Fish and Wildlife Service, Flat-tailed Horned Lizard Conservation Team, Consultant.
- 4/94 – 10/98 United States Man and The Biosphere Program, U.S. State Department, Directorate for Biosphere Reserves.
- 1/95 – 12/00 Northern and Eastern Colorado Desert Ecosystem Management Plan, Bureau of Land Management, Interest Group Committee, representing Desert Tortoise Interest.
- 1/96 – 9/08 Coachella Valley Multiple Species Habitat Conservation Plan, Scientific Advisory Committee.
- 5/98 – 11/03 University of California Natural Reserve System, Systemwide Advisory Committee, Reserve Managers and Coordinators Representative.
- 6/99 - 7/03 University of California, Centers for Water and Wildlands Resources, Wildlands Resources Center Policy Board Member.
- 10/98 - 9/10 University of California, Riverside, Center for Conservation Biology Steering Committee
- 11/01 - 12/11 University of California Representative, Santa Rosa and San Jacinto National Monument Advisory Board. A joint appointment by US Secretary of Agriculture and US Secretary of Interior.
- 1/12 - Bureau of Land Management California Desert District Advisory Council, a FACA appointment by US Secretary of Interior.

Additional Experience:

Military Service

3/61 - 6/66 U.S. Navy, Reserve. Hospital Corpsman, 3rd Class Petty Officer (E4).

6/66 - 7/68 U.S. Navy, Active Duty. Hospital Corpsman, 2nd Class Petty Officer (E5).
Honorable Discharge.

Professional Organizations:

American Association for the Advancement of Science; American Society of Ichthyologists and Herpetologists; Herpetologists League; Organization of Biological Field Stations; Society for the Study of Amphibians and Reptiles.

Theses:

1972. Behavioral thermoregulation of the zebra-tailed lizard, *Callisaurus draconoides*. Masters Thesis, California State University, Fullerton. Advisors: Bayard Brattstrom (Major Professor), Lon McClanahan, and Jerome Wilson.

1979. Biophysical ecology of desert iguana (*Dipsosaurus dorsalis*) eggs: temperature and water relations. Ph.D. Thesis, University of Wisconsin, Madison. Advisors: Warren Porter (Major Professor), Calvin DeWitt, Timothy Moermond, Stanley Dodson and James Kitchell.

Research Publications:

Muth, Allan. 1977. Body temperatures and associated postures of the zebra-tailed lizard, *Callisaurus draconoides*. *Copeia* 1977 (1):122-125.

_____ 1977. Eggs and hatchlings of captive *Dipsosaurus dorsalis*.
Copeia 1977 (1):189-190.

_____ 1977. Thermoregulatory postures and orientation to the sun: a mechanistic evaluation for the zebra-tailed lizard, *Callisaurus draconoides*. *Copeia* 1977 (4):710-720.

_____ 1978. Calculation of KCl solution water potentials. Tech. Rept. #3,
Biophysical Ecology Laboratory, University of Wisconsin, Madison, 25 pp.

_____ 1980. Physiological ecology of desert iguana (*Dipsosaurus dorsalis*) eggs: temperature and water relations. *Ecology* 61(6):1335-1343.

_____ 1981. Water relations of desert iguana (*Dipsosaurus dorsalis*) eggs.
Physiol. Zool. 54(4):441-451.

- _____ and J. J. Bull. 1980. Sex determination in desert iguanas: does incubation temperature make a difference? *Copeia* 1981 (4):869-870.
- _____ R. Philbin and J. V. Muth. 1978. A temperature sensitive tracking telemetry system for small reptiles. *J. Herpetol.* 12(4):533-536.
- Barrows, C., A. Muth, M. Fisher, and J. Lovich. 1995. Coachella Valley fringe-toed lizards. In: LaRoe, E. T., G. S. Farris, C. E. Puckett, P. D. Doran, and M. J. Mac, eds. 1995. *Our Living Resources: a report to the nation on the distribution, abundance, and health of U.S. plants, animals, and ecosystems.* U.S. Department of Interior, National Biological Service, Washington, DC. 530 pp.
- Fisher, M. and A. Muth. 1989. A technique for permanently marking lizards. *Herp. Rev.* 20(2):45-46.
- Fisher, M. and A. Muth. 1995. A backpack method for mounting radio transmitters to small lizards. *Herp. Rev.* 26(3):139-140.
- Griffiths P. G., R. H. Webb, A. Muth, and M. Fisher. 2009. Plants and ventifacts delineate late Holocene high wind vectors in the Coachella Valley, U.S.A. *Quaternary Research*: In Press.
- Consulting Reports:
- Muth, A. 1984. The Coachella Valley Fringe-toed Lizard, *Uma inornata*. Endangered Species Information System, Species Workbook; Part 1 Species Distribution, 38 pp.; Part 2 Species Biology, 42 pp.; Part 3 Species Administration, 16 pp.; Office of Endangered Species, U.S. Fish and Wildlife Service, Kearneysville, West Virginia.
- _____ 1987. Population Biology of The Coachella Valley Fringed-toed Lizard. 23 pp; California Department of Fish and Game, Contract 85/86 C 1330, Rancho Cordova, California.
- _____ and M. Fisher. 1989. A Report on the Status of Native Lizards on the Salton Sea Naval Base, Imperial County, California. 36 pp; U.S. Department of Interior, Fish and Wildlife Service Contract 10120-87-350, Endangered Species Office, Sacramento, California.
- _____ 1990. Population Biology of the Coachella Valley Fringe-toed Lizard: Five Year Report. 85 pp; California Department of Fish and Game, Contract C2056, Rancho Cordova, California.
- _____ 1991. Population Biology of the Coachella Valley Fringe-toed Lizard. Final Report, 80 pp; California Department of Fish and Game, Contract C2056, Rancho Cordova, California.

_____ 1992. Development of baseline data and procedures for monitoring populations of the flat-tailed horned lizard, *Phrynosoma mcallii*. Final Report, 82 pp., California Department of Fish and Game, Contract FG9268 AM2, Rancho Cordova, California.