

Desert National Wildlife Refuge Complex

*Draft Comprehensive Conservation Plan
and Environmental Impact Statement*

Volume 2



Disclaimer

CCPs provide long term guidance for management decisions and set forth goals, objectives, and strategies needed to accomplish refuge purposes and identify the Service's best estimate of future needs. These plans detail program planning levels that are sometimes substantially above current budget allocations and, as such, are primarily for Service strategic planning and program prioritization purposes. The plans do not constitute a commitment for staffing increases, operational and maintenance increases, or funding for future land acquisition.

Desert National Wildlife Refuge Complex

**Ash Meadows, Desert, Moapa Valley, and
Pahranagat National Wildlife Refuges**

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References

- Ackerman, Thomas L. 2003. A Flora of the Desert National Wildlife Range, Nevada. *Mentzelia: The Journal of the Nevada Native Plant Society*. Number 7, 2003.
- Air Warfare Center. 1999. *Integrated Natural Resource Management Plan*. Nellis Air Force Base.
- Altenbach, J.S., W. Amy, P.V. Bradley, P.E. Brown, K. Dewberry, D.B. Hall, J. Jeffers, B. Lund, J. E. Newmark, M. J. O'Farrell, M. Rahn, R. E. Sherwin, C. R. Tomlinson, J. A. Williams. 2002. *Nevada Bat Conservation Plan*. Nevada Bat Working Group. Austin, Nevada. 188 pp.
- Andre, J.M. and T.A. Knight. 1999. An overview of special-status plants in the Mojave Desert. Presented at the Mojave Desert Science Symposium, February 25–27, 1999.
- Balda, R.P. and G.C. Bateman. 1971. Flocking and annual cycle of the piñon jay, *Gymnorhinus cyanocephalus*. *Condor* 73:287-302.
- Basgall, Mark and M.C. Hall. 1994. Perspective on the early Holocene archaeological record of the Mojave Desert. Kelso Conference Papers, 1987–1992, pp 63–81. Museum of Anthropology, California State University, Bakersfield, Occasional Papers in Anthropology No. 4.
- Basgall, Mark and M.C. Hall. 1991. Relationship between fluted and stemmed points in the Mojave Desert. *Current Research in the Pleistocene* 8:61–64.
- Bedinger, M.S. and J.R. Harrill. 2004. Regional Potential for Interbasin Flow of Ground Water. Appendix 1 of *Death Valley Regional Ground-Water Flow System, Nevada and California—Hydrogeologic Framework and Transient Ground-Water Flow Model*, edited by W.R. Belcher. Scientific Investigations Report 2004-5205. U.S. Geological Survey.
- Benson, A.J., M.M. Richerson, and E. Maynard. 2008. *Dreissena rostriformis bugensis*. USGS Nonindigenous Aquatic Species Database, Gainesville, FL. Available on the Internet: <http://nas.er.usgs.gov/queries/FactSheet.asp?speciesID=95>. 3/27/2008. Accessed May 2008.
- Blair, W.N. and A.K. Armstrong. 1979. Hualapai limestone member of the Muddy Creek Formation: the youngest deposit predating the Grand Canyon, southeastern Nevada and northwestern Arizona. U.S. Geological Survey Professional Paper 1111. 14p.
- Brown, Stephen, Catherine Hickey, Brian Harrington, and Robert Gill, editors. 2001. *United States Shorebird Conservation Plan*. Second Edition. May.
- Brussard, Peter F. and David S. Dobkin. 1996. Great Basin-Mojave Desert Region. USGS. Available on the Internet: <http://biology.usgs.gov/s+t/SNT/noframe/gb150.htm>. Accessed June 2003.
- Buqo, T. 2002. Pers. comm. with Erin Cole, SWCA. Hydrologist, Moapa Valley Water District.
- Burbey, T.J., and Prudic, D.E. 1991. *Conceptual evaluation of regional ground-water flow in the carbonate-rock province of the Great Basin, Nevada, Utah, and adjacent states*. U.S. Geological Survey Professional Paper 1409-D, 84p.
- Campbell, E.W, W.H. Campbell, Ernst Antevs, Charles A. Amsden, Joseph A. Barbieri, and Francis D. Bode. 1937. The archaeology of Pleistocene Lake Mojave: A symposium. *Southwest Museum Papers* 11. Los Angeles, California.

- CH2M Hill. 2002. *Desert National Wildlife Refuge Complex Transportation Study*. Prepared for Central Federal Lands Highway Division of the Federal Highway Administration. December.
- Clark County. 2001. PM10 State Implementation Plan, Las Vegas Valley Nonattainment Area, Clark County, Nevada. Clark County Department of Comprehensive Planning. June, 2001. Available on the Internet: <http://www.co.clark.nv.us/air-quality/SIP/ExecSumm.pdf>.
- Clark County. 2000. Carbon Monoxide State Implementation Plan, Las Vegas Valley Nonattainment Area, Clark County, Nevada. Clark County Department of Comprehensive Planning. August 2000. Available on the Internet: <http://www.co.clark.nv.us/air-quality/SIP/COPlanChap1-8Final.pdf>.
- Clark County and U.S. Fish and Wildlife Service (Service). 2000. Clark County Multiple Species Habitat Plan and Environmental Impact Statement for Issuance of a Permit to Allow Incidental Take of 79 Species in Clark County, Nevada. Las Vegas, NV. September.
- Clark County Department of Air Quality Management (CCDAQM). 2003a. Air Monitoring Network Report 2002, NAMS/SLAMS Network Review Report. Clark County Department of Air Quality Management. July 2003. Available on the Internet: <http://www.ccairquality.org/report/NAMS-SLAMs2002.doc>.
- Clark County Department of Air Quality Management (CCDAQM). 2003b. Personal communication with Catherine MacDougell. May 2003.
- Cornwall, H.R. 1972. Geology and mineral deposits of southern Nye County, Nevada. *Nevada Bureau of Mines and Geology, Bulletin 77*, 49 p.
- D'Azevedo, Warren L, editor. 1986. Great Basin. In *Handbook of North American Indians*, Vol. 11, W.C. Sturtevant, general editor, pp 1–14. Smithsonian Institution, Washington.
- Denny, C.S. and H. Drewes. 1965. *Geology of the Ash Meadows Quadrangle Nevada-California*. U.S. Geological Survey Bulletin 1181-L, 56 p. Available on the Internet: <http://pubs.er.usgs.gov/usgspubs/b/b1181L>.
- Dettinger, M.D. 1989. *Distribution of carbonate-rock aquifers in southern Nevada and the potential for their development—Summary of Findings, 1985–88: Carson City, Nevada, Program for the Study and Testing of Carbonate Rock Aquifers in eastern and southern Nevada*. Summary Report No. 1, 37 pp.
- Ducks Unlimited. 2002. Upper Pahranaagat Lake water management recommendations. February 19, 2002.
- Dudley, W.W., Jr. and J.D. Larson. 1976. *Effect of irrigation pumping on desert pupfish habitats in Ash Meadows, Nye County, Nevada*. U.S. Geological Survey, Professional Paper 927. Available on the Internet: <http://pubs.er.usgs.gov/usgspubs/pp/pp927>.
- Eakin, T.E. and D.O. Moore. 1964. *Uniformity of discharge of Muddy River Springs, Southeastern Nevada, and relation to inter-basin movement of ground water*. Geological Survey Research 1964. U.S. Geological Survey, Professional Paper 501-D, pp. 171–176.
- Elzinga, C.L., D.W. Salzer, and J.W. Willoughby. 2005. Measuring and monitoring plant populations. BLM Technical Reference 1730-1. Available on the Internet: <http://www.blm.gov/nste/library/pdf/MeasAndMon.pdf>.

- Faunt, Claudia C., Frank A. D'Agnesse, and Grady M. O'Brien. 2004. Hydrology. Chapter D in *Death Valley Regional Ground-Water Flow System, Nevada and California—Hydrogeologic Framework and Transient Ground-Water Flow Model*. edited by W.R. Belcher. Scientific Investigations Report 2004-5205. U.S. Geological Survey.
- Federal Highway Administration. 2000. *The Road Inventory of Desert National Wildlife Range*. Prepared by Federal Highway Administration, Central Federal Lands Highway Division, U.S. Department of Transportation. December.
- Fergusson, Aaron and Anne DuBarton. 2003. *Desert National Wildlife Refuge Complex Comprehensive Conservation Plan and Environmental Impact Statement Cultural Resources Overview*. SWCA Environmental Consultants, Las Vegas. Prepared for the U.S. Fish and Wildlife Service.
- Fisher, A.K. 1983. Report on the ornithology of the Death Valley Expedition of 1891, comprising notes on the birds observed in southern California, southern Nevada, and parts of Arizona and Utah. In *The Death Valley Expedition, a Biological Survey of Parts of California, Nevada, Arizona, and Utah*. North American Fauna, Number 7, pp. 7–158.
- Garside, L. 1979. Radioactive mineral occurrences in Nevada. *Nevada Bureau of Mines and Geology Bulletin* 79-2.
- Goodchild, Shawn. 2004. Sensitive Species at Moapa NWR. E-mail communication between Shawn Goodchild, FWS, and Erin Cole, SWCA. September 27, 2004.
- Great Basin Bird Observatory. 2005. *Landbirds of Nevada and the Habitats They Need: A Resource Manager's Guide to Conservation Priority Species*. Great Basin Bird Observatory Technical Report No. 05-01. Reno, Nevada.
- Harrington, M.R. 1933. Gypsum Cave. *Southwest Museum Papers* 8, Los Angeles, California.
- Hess, R.H. and G. Johnson. 2000. *Nevada County Digital Geologic Maps*. Nevada Bureau of Mines and Geology Open-File Report 97-1.
- Holland, R.F. 1986. *Preliminary Descriptions for the Terrestrial Natural Communities of California*. California Department of Fish and Game.
- Hunt, C.B. and T.W. Robinson. 1960. *Possible Interbasin Circulation of Ground Water in the Southern Part of the Great Basin*. U.S. Geological Survey Professional Paper 400-B, pp. B273–B274.
- Kelly, Isabel. 1934. Southern Paiute Bands. *American Anthropologist* 36(4):548–560.
- Kelly, Isabel T. and Catherine S. Fowler. 1986. Southern Paiute. In *Great Basin*, edited by Warren L. d'Azevedo, pp. 368–397. In *Handbook of North American Indians*, Vol. 11, W. C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.
- Koronkiewicz, T.J., M.A. McLeod, B.T. Brown, and S.W. Carothers. 2006. *Southwestern Willow Flycatcher Surveys, Demography, and Ecology Along the Lower Colorado River and Tributaries, 2005*. Annual report submitted to U.S. Bureau of Reclamation, Boulder City, NV, by SWCA Environmental Consultants, Flagstaff, AZ. 176 pp.

- Kushlan, James A, Melanie J. Steinkamp, Katharine C. Parsons, Jack Capp, Martin Acosta Cruz, Malcolm Coulter, Ian Davidson, Loney Dickson, Naomi Edelson, Richard Elliot, R. Michael Erwin, Scott Hatch, Stephen Kress, Robert Milko, Steve Miller, Kyra Mills, Richard Paul, Roberto Phillips, Jorge E. Saliva, Bill Sydeman, John Trapp, Jennifer Wheeler, and Kent Wohl. 2002. *Waterbird Conservation for the Americas: The North American Waterbird Conservation Plan, Version 1*. Waterbird Conservation for the Americas, Washington, D.C, 78 pp.
- La Rivers, I. 1962. *Fishes and Fisheries of Nevada*. Nevada Fish and Game Commission, Reno. 782 pp.
- Las Vegas Valley Water District (LVVWD). 2001. *Water Resources and Ground-Water Modeling in the White River and Meadow Valley Flow Systems, Clark, Lincoln, Nye and White Pine Counties, Nevada*. Sections 1–9 and Appendices.
- Le’au Courtright, Callie. 2006. Desert Complex visitor estimates. Personal communication with Leslie Wagner, SWCA. U.S. Fish and Wildlife Service, Desert NWR Complex. October 18, 2006.
- Lincoln County. 2001. Lincoln County Master Plan: Final.
- Lincoln County Conservation District. 1980. *Pahranagat Valley Water Quality Project*. Prepared for the U.S. Fish and Wildlife Service.
- Longwell, C.R., E.H. Pampeyan, B. Bowyer, and R.J. Roberts. 1965. Geology and mineral deposits of Clark County, Nevada. *Nevada Bureau of Mines and Geology Bulletin* 62, 218p.
- Lovering, T.G. 1954. Radioactive Deposits of Nevada. *U.S. Geological Survey Bulletin* 1009-C.
- Lund, B. 2002. Upper Muddy River bird community. Presented at the Upper Muddy River Integrated Science Workshop, July 17–19.
- MacMahon, James A. 1992. *The Audubon Society Nature Guides: Deserts*. New York: Alfred A. Knopf, Inc.
- Martineau, Lavan. 1992. *The Southern Paiutes: Legends, Lore, Language, and Lineage*. KC Publications, Las Vegas, Nevada.
- Maxwell, Merry. 2007. Mule deer use of Pahrnagat National Wildlife Refuge. Personal communication with Mark Pelz, USFWS. Comments on Administrative Draft Environmental Impact Statement.
- Mayer, T. 2006. Water monitoring results at Ash Meadows National Wildlife Refuge. Presented for the Amargosa Desert Hydrographic Basin Protest Hearing, June 12–16, 2006. Nevada Division of Water Resources, Carson City, NV.
- Mayer, Tim. 2003. *Water Monitoring Plan: Ash Meadows National Wildlife Refuge*. Prepared by the Water Resources Branch, U.S. Fish and Wildlife Service Regional Office. Portland, Oregon. Revised February 6, 2003.
- Mayer, T. and W. Van Liew. 2003. *Possible impacts of groundwater pumping on springs and dace habitat at the Moapa Valley NWR*. Abstracts of technical presentations, Nevada Water Resources Association Annual Conference, February 26–28.

- McIvor, D.E. 2005. *Important Bird Areas of Nevada*. Lahontan Audubon Society. 149 p.
- McLeod, M.A., T.J. Koronkiewicz, B.T. Brown, and S.W. Carothers. 2007. *Southwestern Willow Flycatcher Surveys, Demography, and Ecology Along the Lower Colorado River and Tributaries, 2005*. Annual report submitted to U.S. Bureau of Reclamation, Boulder City, NV, by SWCA Environmental Consultants, Flagstaff, AZ. 194 pp.
- Miller, Linda. 2003. Desert NWR Complex noxious weed list. Unpublished. Prepared for the Wildlife and Habitat Review Notebook. U.S. Fish and Wildlife Service. April.
- Miller, Robert R. 1948. *The Cyprinodont Fishes of the Death Valley System of Eastern California and Southwestern Nevada*. Miscellaneous Publications, Museum of Zoology, University of Michigan, 68:1-155 + plates.
- Myrick, David F. 1991. *The Southern Roads. Railroads of Nevada and Eastern California, Volume II*. University of Nevada Press, Reno.
- Nachlinger, J., K. Sochi, P. Comer, G. Kittel, and D. Dorfman. 2001. Great Basin: an ecoregion-based conservation blueprint. The Nature Conservancy, Reno, Nevada.
- National Audubon Society. 2004. The Important Bird Areas Historical Results. Available on the Internet: <http://www.audubon.org/bird/iba>. December.
- Natural Resources Conservation Service (NRCS). 2003a. National STATSGO database data access. Available on the Internet: <http://www.ftw.nrcs.usda.gov/stat-data.html>.
- Natural Resources Conservation Service (NRCS). 2003b. Soil Survey Geographic database. Available on the Internet: <http://www.ncgc.nrcs.usda.gov/branch/ssb/products/ssurgo>.
- Natural Resources Conservation Service (NRCS). 1980. *Soil Survey of Virgin River Area, Nevada – Arizona, Parts of Clark and Lincoln Counties, Nevada and Part of Mohave County, Arizona*, 147 p. Previously Soil Conservation Service, U.S. Department of Agriculture.
- Natural Resources Conservation Service (NRCS). 1968. *Soil Survey of the Pahranaagat-Penoyer Areas, Nevada*. Previously Soil Conservation Service, U.S. Department of Agriculture.
- Nellis Air Force Base (NAFB). 2007. *Draft Integrated Natural Resources Management Plan, Nellis Air Force Base/Nevada Test and Training Range*. Nellis Air Force Base, Nevada, 99th Civil Engineering Squadron, Environmental Management Flight. May.
- Nevada Department of Transportation (NDOT). 2004. Traffic counts on SR 168 in 2004.
- Nevada Department of Wildlife (NDOW). 2007a. 2006-2007 Big Game Status. Available on the Internet: http://www.ndow.org/about/pubs/reports/Big%20Game%20Status%20Book_06_07.pdf.
- Nevada Department of Wildlife (NDOW). 2007b. Montane vole surveys at Pahranaagat National Wildlife Refuge. Personal communication with Mark Pelz, USFWS, and Leslie Wagner, SWCA. Comments on the Administrative Draft Environmental Impact Statement.
- Nevada Department of Wildlife (NDOW). 2006. Nevada Hunt Book 2006. Available on the Internet: <http://www.ndow.org/law/regs/huntregs/huntbook/index.shtm>.

- Nevada Department of Wildlife (NDOW). 2005a. State of Nevada Comprehensive Wildlife Conservation Strategy. Nevada Department of Wildlife, Reno, NV. 605 p. Available on the Internet: <http://www.ndow.org/wild/conservation/cwcs/index.shtm#plan>.
- Nevada Department of Wildlife (NDOW). 2005b. Nevada Predator Management Plan FY 2006. Prepared by Russel Woolstenholme. August 2005.
- Nevada Department of Wildlife (NDOW). 2002. Fishing: angler information guides—southern Nevada, top southern Nevada waters: Upper Pahrnagat Lake. Available on the Internet: <http://ndow.org/fish/waters/south.shtm>. Accessed 01/03.
- Nevada Department of Wildlife (NDOW). 2001. *Bighorn Sheep Management Plan*. Wildlife Restoration Federal Aid Project, Reno. 38 pp. October.
- Nevada Development Authority. 2004. Las Vegas' Economy Will Continue Increasing Population Growth. Available on the Internet: <http://www.nevadadevelopment.org>.
- Nevada Division of Environmental Protection. 2003. State of Nevada, Bureau of Air Quality, 1990–2001 Trend Report. Available on the Internet: <http://ndep.nv.gov/baqp/Trend%20Report%202001.pdf>.
- Nevada Division of Water Resources (NDWR). 2003. Groundwater pumpage inventories and basin water right abstracts.
- Nevada Division of Water Resources (NDWR). 2002. State Engineer's Order 1169, holding in abeyance carbonate-rock aquifer system groundwater applications pending or to be filed in Coyote Spring Valley (Basin 210), Black Mountains Area (Basin 215) Garnet Valley (Basin 216), Hidden Valley (Basin 217), Muddy River Springs a.k.a. Upper Moapa Valley (Basin 219), Lower Moapa Valley (Basin 220) and for further study of the appropriation of water from the Carbonate-Rock Aquifer System, Lincoln and Clark Counties, Nevada, March 8, 2002.
- Nevada Division of Water Resources (NDWR). 2001. *Las Vegas Valley Water Usage Report*, Clark County, Nevada, Annual Report, 24 p.
- Nevada Natural Heritage Program (NNHP). 2004. Nevada At-Risk Plant and Lichen List. March 18, 2004. Available on the Internet: <http://heritage.nv.gov/sensplnt.htm>.
- Nevada Natural Heritage Program (NNHP). 2000. 66 highest priority conservation sites. In *Scorecard 2000: Highest Priority Conservation Sites*. Available on the Internet: <http://heritage.nv.gov/reports/scor2000.pdf>.
- Nevada Partners in Flight. 1999. *Nevada Partners in Flight Bird Conservation Plan*, edited by Larry A. Neel. November 29, 1999.
- Nevada Steering Committee. 2005. *Coordinated Implementation Plan for Bird Conservation in Nevada*. Intermountain West Joint Venture. Version 2.1.
- Laczniak, Randell J., Guy A. DeMeo, Steven R. Reiner, J. LaRue Smith, and Walter E. Nylund. 1999. *Estimates of Ground-Water Discharge as Determined From Measurements of Evapotranspiration, Ash Meadows Area, Nye County, Nevada*. Water-Resources Investigations Report 99-4079. U.S. Geological Survey.

- Noxious Weed Action Committee. 2001. Noxious weed control activities: Lincoln County. Available on the internet: http://www.agri.state.nv.us/nwac/noxious_weed_control_activites.htm. Accessed 3/03.
- O'Farrell, Michael J. and W. Glen Bradley. 1970. Activity patterns of bats over a desert spring. *Journal of Mammalogy*. 51: 18–26. February 1970.
- Oring, L, L. Neel, and K. Oring. 2000. *Intermountain West Regional Shorebird Plan*. Version 1.0.
- Otis Bay Ecological Consultants. 2003. *Final Corn Creek Field Station Rehabilitation Alternatives Including Spring Restoration and Construction of a Poolfish Refugium at the Desert National Wildlife Range, Nevada* Prepared for the U.S. Fish and Wildlife Service, Desert National Wildlife Range. June 10, 2003.
- Otis Bay, Inc. and Stevens Ecological Consulting, LLC. 2006. *Ash Meadows Geomorphic and Biological Assessment: Draft Final Report*.
- Ramsar Convention. 2004. The Ramsar Convention on Wetlands. Available on the Internet: <http://www.ramsar.org/>. Frequently updated. Accessed 4/ 13/04.
- Rich, T.D., C. J. Beardmore, H. Berlanga, P. J. Blancher, M. S. W. Bradstreet, G. S. Butcher, D. W. Demarest, E. H., Dunn, W. C. Hunter, E. E. Iñigo-Elias, J. A. Kennedy, A. M. Martell, A. O. Panjabi, D. N. Pashley, K. V. Rosenberg, C., M. Rustay, J. S. Wendt, T. C. Will. 2004. *Partners in Flight North American Landbird Conservation Plan*. Cornell Lab of Ornithology. Ithaca, NY.
- Riggs, Alan C. and James E. Deacon. 2002. Connectivity in Desert Aquatic Ecosystems: The Devils Hole Story. In *Conference Proceedings. Spring-fed Wetlands: Important Scientific and Cultural Resources of the Intermountain Region*. Available on the Internet: <http://hegel.lewiscenter.org/users/mhuffine/subprojects/Student%20Led%20Research/pupworld/pdf/riggsdeacon.pdf>.
- Roberts, H.R. and R.V.N. Ahlstrom. 2003. *Coyote Named This Place Pakonapanti: An Archaeological Survey of the Corn Creek Site in the Desert National Wildlife Refuge, Clark County, Nevada*. HRA Inc., Conservation Archaeology Report No. 02-03.
- Rowlands, P.G., H. Johnson, E. Ritter, and A. Endo. 1982. The Mojave Desert. In *Reference Handbook on the Deserts of North America*, edited by G.L. Bender. Westport, Connecticut and London, England: Greenwood Press.
- Royo, A. R. 2002. The Mojave Desert. Desert USA. Available on the Internet: http://desertusa.com/du_mojave.html. Accessed 6/03.
- Sada, D. 2002. Aquatic macroinvertebrate community. Presented at the Upper Muddy River Integrated Science Workshop, July 17–19.
- Sanchez, P. 1981. *The Ash Meadows Scenario*. Transactions of the California-Nevada Section of the Wildlife Society. 1981.
- Scoppettone, G.G., H.L. Burge, and P.L. Tuttle. 1992. Life history, abundance, and distribution of Moapa dace (*Moapa coriacea*). *Great Basin Naturalist* 52(3):216–225.

- Shackleton, D.M. 1985. *Ovis canadensis*. Mammalian Species. Published by The American Society of Mammalogists. 230: 1–9.
- Singer, D. (editor). 1996. *An Analysis of Nevada's Metal-Bearing Mineral Resources*. Nevada Bureau of Mines and Geology Open File Report 96-2.
- Sjoberg, Jon. 2006. Comments on Administrative Draft CCP/EIS. Personal communication with Leslie Wagner, SWCA. Nevada Department of Wildlife. January 11, 2006.
- Sprunger-Allworth, Amy. 2006. Responses to comments on Administrative Draft CCP/EIS. Personal communication with Leslie Wagner, SWCA. U.S. Fish and Wildlife Service, Desert National Wildlife Refuge Complex. May 8, 2006.
- Steward, J.H. 1997. *Basin-Plateau Aboriginal Sociopolitical Groups*. University of Utah Press, Salt Lake City. Originally printed in 1938, *Smithsonian Institution Bureau of American Ethnology Bulletin* 120, United States Government Printing Office, Washington, D.C.
- Stoffle, Richard W., Rebecca S. Toupal, and M. Nieves Zedeño. 2002. *East of Nellis: Cultural Landscapes of the Sheep and Pahrnagat Mountain Ranges: An Ethnographic Assessment of American Indian Places and Resources in the Desert National Wildlife Range and the Pahrnagat National Wildlife Refuge of Nevada*. Bureau of Applied Research in Anthropology, University of Arizona, Tucson and Science Applications International Corporation.
- Sweetkind, Donald S., Wayne R. Belcher, Claudia C. Faunt, and Christopher J. Potter. 2004. Geology and Hydrogeology. In *Death Valley Regional Ground-Water Flow System, Nevada and California—Hydrogeologic Framework and Transient Ground-Water Flow Model*, edited by Wayne R. Belcher. Scientific Investigations Report 2004-5205. U.S. Geological Survey.
- The Nature Conservancy (TNC). 2000. Upper Muddy River Site Conservation Plan. August.
- Thomas, J.M., J.L. Mason, and J.D. Crabtree. 1986. *Ground-water Levels in the Great Basin Region of Nevada, Utah, and Adjacent States*. U.S. Geological Survey Hydrologic Investigations Atlas HA-694-B, scale 1:1,000,000, 2 sheets.
- Thomas, J. M., Welch, A. H., and M. D. Dettinger. 1996. *Geochemistry and Isotope Hydrology of Representative Aquifers in the Great Basin Region of Nevada, Utah, and Adjacent States*. USGS Professional Paper 1409-C, 100 p.
- Tingley, Joseph. 1998. Mining districts of Nevada. *Nevada Bureau of Mines and Geology Report* 47.
- Tingley, J.V., S.B. Castor, L.J. Garside, H.F. Bonham, Jr., T.P. Lugaski, and P.J. Lechler. 1993. *Energy and Mineral Resource Assessment of the Desert National Wildlife Range, Eastern Section. Clark and Lincoln Counties, Nevada*. Nevada Bureau of Mines and Geology, University of Nevada, Reno. NBMG Open File Report 93-2. January 12.
- Tschanz, C.M. and E.H. Pameyan. 1970. Geology and mineral deposits of Lincoln County, Nevada. *Nevada Bureau of Mines and Geology Bulletin* 73, 187 p.
- Tuttle, Peter, Gary Scoppettone, and Donna Withers. 1990. *Status and Life History (of) Pahrnagat River Fishes: Completion Report (1990)*. National Fisheries Research Center, Reno Field Station and Nevada Department of Wildlife, Reno, Nevada.

- U.S. Air Force (USAF). 2007. *Draft Environmental Assessment for the Integrated Resource Management Plan for Nellis Air Force Base and Nevada Test and Training Range*. May.
- U.S. Bureau of Land Management (BLM). Unknown date. Nevada Federal Agency Acres Managed by County. Available on the Internet: http://www.nv.blm.gov/landsales/land_sales.htm.
- U.S. Bureau of Land Management (BLM). 2007. Mining claims. BLM's LR2000. Available on the Internet: <http://www.blm.gov/lr2000/>.
- U.S. Bureau of Land Management (BLM). 2002. Herd Management Areas in Nevada: Las Vegas map. Available on the Internet: http://www.nv.blm.gov/hma/las_vegas/index.htm. Accessed 6/03.
- U.S. Bureau of Land Management (BLM). 2001. *Draft Nevada Test and Training Range Resource Management Plan and Environmental Impact Statement*. U.S. Department of the Interior, U.S. Bureau of Land Management, Las Vegas Field Office, Nevada.
- U.S. Bureau of Land Management (BLM). 1994. Land and Mineral Withdrawal for Desert National Wildlife Range.
- U.S. Bureau of Land Management (BLM). 1990. *Draft Environmental Impact Statement, Flood Control Master Plan, Clark County Regional Flood Control District. Volume 1*. Prepared by Dames & Moore.
- U.S. Census Bureau. 2006. State and County QuickFacts. Data derived from Population Estimates, 2000 Census of Population and Housing, 1990 Census of Population and Housing, Small Area Income and Poverty Estimates, County Business Patterns, 1997 Economic Census, Minority- and Women-Owned Business, Building Permits, Consolidated Federal Funds Report, 1997 Census of Governments. Available on the Internet: <http://quickfacts.census.gov/qfd/states/32000.html>. Last revised 6/8/06.
- U.S. Census Bureau. 2000. Various Census Data. Available on the Internet: <http://www.census.gov/main/www/cen2000.html>. Accessed 10/06.
- U.S. Department of Energy (DOE). 2002. *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada, February 2002*. Available on the Internet: http://www.ocrwm.doe.gov/documents/feis_a/index.htm.
- U.S. Department of Energy (DOE) and U.S. Bureau of Land Management (BLM). 2007. *Programmatic Environmental Impact Statement, Designation of Energy Corridors on Federal Land in the 11 Western States (DOE/EIS-0386)*. Prepared in cooperation with U.S. Forest Service, U.S. Department of Defense, and U.S. Fish and Wildlife Service. October.
- U.S. Department of the Interior and Timbisha Shoshone Tribe. 2000. Appendix S: Timbisha Shoshone tribal homeland: a draft secretarial report to Congress to establish a permanent tribal land base and related cooperative activities. In *Final Legislative Environmental Impact Statement: Timbisha Shoshone Homeland, Volume 1*, by United States Department of the Interior and Timbisha Shoshone Tribe.
- U.S. Environmental Protection Agency. 1998. Climate Change and Nevada. Office of Policy, EPA 236-F-98-007o. September.
- U.S. Fish and Wildlife Service (Service). No date. Protest of Application 63360 through 63372.

- U.S. Fish and Wildlife Service (Service). 2007. *Desert National Wildlife Refuge Visitor Facilities Draft Environmental Assessment*. Prepared by SWCA Environmental Consultants for the U.S. Fish and Wildlife Service, Desert National Wildlife Refuge. June.
- U.S. Fish and Wildlife Service (Service). 2006a. Desert National Wildlife Refuge Complex homepage and associated refuge pages. Available on the Internet: <http://desertcomplex.fws.gov/>.
- U.S. Fish and Wildlife Service (Service). 2006b. *Integrated Pest Management Plan for Ash Meadows National Wildlife Refuge*. U.S. Fish and Wildlife Service, Southern Nevada Field Office. May.
- U.S. Fish and Wildlife Service (Service). 2004a. *Wildland Fire Management Plan: Moapa Valley National Wildlife Refuge*. September 20, 2004.
- U.S. Fish and Wildlife Service (Service). 2004b. *Wildland Fire Management Plan: Ash Meadows National Wildlife Refuge*. September.
- U.S. Fish and Wildlife Service (Service). 2004c. *Wildland Fire Management Plan: Desert National Wildlife Refuge*. September.
- U.S. Fish and Wildlife Service (Service). 2002a. *Moapa Valley National Wildlife Refuge Spring Head Restoration (Phase I) Environmental Assessment*. Prepared by the Desert National Wildlife Range, U.S. Fish and Wildlife Service, U.S. Department of the Interior. February 2002.
- U.S. Fish and Wildlife Service (Service). 2002b. *Southwestern Willow Flycatcher Recovery Plan*. Albuquerque, New Mexico.
- U.S. Fish and Wildlife Service (Service). 2001b. *Wildland Fire Management Plan: Pahrnagat National Wildlife Refuge*. September.
- U.S. Fish and Wildlife Service (Service). 2000a. *Ash Meadows National Wildlife Refuge*. Public Information Pamphlet. Revised September.
- U.S. Fish and Wildlife Service (Service). 2000b. *Environmental Assessment Proposed Land and Mineral Withdrawal at the Ash Meadows National Wildlife Refuge, Nye County, Nevada NV-056-00-16*. Las Vegas, NV.
- U.S. Fish and Wildlife Service (Service). 1999a. *Mineral Potential Report, Proposed Land and Mineral Withdrawal, Ash Meadows National Wildlife Refuge, Nye County, Nevada*. Prepared by SWCA Environmental Consultants. August.
- U.S. Fish and Wildlife Service (Service). 1999b. *Reconnaissance assessment of contaminants in Pahrnagat Valley, Lincoln County, Nevada*. Nevada Fish and Wildlife Office.
- U.S. Fish and Wildlife Service (Service). 1998a. *Draft Ash Meadows National Wildlife Refuge Public Use Management Plan*. May.
- U.S. Fish and Wildlife Service (Service). 1998b. *Recovery Plan for the Aquatic and Riparian Species of Pahrnagat Valley*. Portland, Oregon. 82 pp.
- U.S. Fish and Wildlife Service (Service). 1996. *Recovery Plan for the Rare Aquatic Species of the Muddy River Ecosystem*. Portland, Oregon. 60 pp.

- U.S. Fish and Wildlife Service (Service). 1994a. *Final Environmental Impact Statement, Mineral Withdrawal Desert National Wildlife Range*. In Cooperation with U.S. Bureau of Land Management and U.S. Air Force.
- U.S. Fish and Wildlife Service (Service). 1994b. *Frogging Plan for Ash Meadows National Wildlife Refuge*. U.S. Fish and Wildlife Service, Department of the Interior.
- U.S. Fish and Wildlife Service (Service). 1992. *Pahranagat National Wildlife Refuge Annual Narrative Report, Calendar Year 1992*. U.S. Department of the Interior, NWRS.
- U.S. Fish and Wildlife Service (Service). 1990a. *Recovery Plan for the Endangered and Threatened Species of Ash Meadows, Nevada*. Prepared by Don W. Sada, Reno, Nevada. September.
- U.S. Fish and Wildlife Service (Service). 1990b. *Water Management Plan: Pahranagat National Wildlife Refuge*. With approval memorandum dated July 20, 1990. June.
- U.S. Fish and Wildlife Service. 1987a. *Refuge Management Plan Parts I & II: Ash Meadows National Wildlife Refuge, Nevada*. September.
- U.S. Fish and Wildlife Service. 1987b. *Status of populations of the endemic plants of Ash Meadows, Nye County, Nevada*. USFS Great Basin Complex, Reno, NV. 110 pp.
- U.S. Fish and Wildlife Service (Service). 1986. *North American Waterfowl Management Plan: A Strategy for Cooperation*. Original version May.
- U.S. Fish and Wildlife Service (Service). 1984a. *Endangered species recovery plan research project, life history and ecological requirements of the Moapa dace (Moapa coriacea)*, October.
- U.S. Fish and Wildlife Service. 1984b. *Land protection plan: proposed acquisition to establish Ash Meadows National Wildlife Refuge, Nye County, Nevada*. Region 1, Portland, OR. December.
- U.S. Fish and Wildlife Service (Service). 1983. *Moapa Dace Recovery Plan*. February.
- U.S. Fish and Wildlife Service (Service). 1980. *Devils Hole Pupfish Recovery Plan*. Prepared in cooperation with the Devils Hole Pupfish Recovery Team. July.
- U.S. Fish and Wildlife Service (Service). 1979. *Environmental Assessment of Proposed Land Acquisition for Moapa Dace*.
- U.S. Fish and Wildlife Service (Service). 1977. *Draft Environmental Assessment: Proposed Acquisition of Additional Lands for the Desert National Wildlife Range, Nevada*. U.S. Department of the Interior.
- U.S. Fish and Wildlife Service (Service). 1975. *Final Environmental Impact Statement: Desert National Wildlife Range Wilderness Proposal*. August.
- U.S. Fish and Wildlife Service (Service). 1971a. *Desert Wilderness Proposal: Desert National Wildlife Range*. Includes changes as a result of the public hearing. October.
- U.S. Fish and Wildlife Service (Service). 1971b. *Desert Wilderness Study Area, Desert National Wildlife Range, Clark and Lincoln Counties: Wilderness Study Report*. U.S. Department of the Interior, Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife. 4/16/71.

- U.S. Geological Survey (USGS). 2004. National Gap Analysis Program: Provisional Digital Land Cover Map for the Southwestern United States. Version 1.0. RS/GIS Laboratory, College of Natural Resources, Utah State University.
- U.S. Geological Survey. 2003a. Great Basin, Mojave Desert Region. Available on the Internet: <http://biology.usgs.gov/s+t/SNT/noframe/gb150.htm>. Accessed 6/03.
- U.S. Geological Survey (USGS). 2003b. Ground and surface water data for Nevada. Available on the Internet: <http://waterdata.usgs.gov/nv/nwis>.
- U.S. Geological Survey (USGS). 2003c. Southern Nevada carbonate aquifer system: well and spring networks. Available on the Internet: <http://nevada.usgs.gov/gw/carb/carb-table.htm>.
- U.S. Geological Survey (USGS). 1999. *Estimates of Ground-water Discharge as Determined from Measurements of Evapotranspiration, Ash Meadows Area, Nye County, Nevada*. Water Resources Investigation Report 99-4079, 70 p.
- U.S. Geological Survey (USGS). 1983 (Provisional Edition). 7.5-Minute Moapa West, Nevada Topographic Map.
- Usinger, R.L., ed. 1956. *Aquatic Insects of California*. University of California Press, Berkeley. 508 p.
- Vasek, F.C. and M.G. Barbour. 1977. Mojave Desert scrub vegetation. In *Terrestrial Vegetation of California*, edited by M.G. Barbour and J. Major. New York: John Wiley and Sons. pp. 835–867.
- Walker, G.E. and T.E. Eakin. 1963. *Geology and Ground Water of Amargosa Desert, Nevada-California*. Nevada Department of Conservation and Natural Resources Ground-Water Resources Reconnaissance Survey Report 14, 45 p.
- Warren, Claude N. 1980. Pinto points and problems in Mojave Desert archeology. In *Anthropological Papers in Memory of Earl H. Swanson, Jr.*, pp. 57–76. Special Publications of the Idaho Museum of Natural History, Pocatello.
- Warren, Claude N. and Carl Phagan. 1988. Fluted points in the Mojave Desert: their technology and cultural context. In *Early Human Occupation in Far Western North America: The Clovis-Archaic Interface*, edited by Judith A. Willig, C. Melvin Aikens, and John L. Fagan. *Nevada State Museum Anthropological Papers* No. 21, Reno, Nevada.
- Warrick, G.D. and P.R. Krausman. 1989. Barrel cacti consumption by desert bighorn sheep. *The Southwestern Naturalist*. 34:483–486.
- Webb, Robert H., Todd C. Esque, Philip A. Medica, Lesley A. DeFalco, and Marilyn B. Murov. 2000. *Monitoring of Ecosystem Dynamics in the Mojave Desert: the Beatley Permanent Plots*. USGS Fact Sheet 041-01. Available on the Internet: <http://pubs.usgs.gov/fs/FS-040-01/>.
- Western Regional Climate Center. 2003. Climate data. Available on the Internet: <http://www.wrcc.dri.edu>. Accessed 2003.
- Williams, J. 2002. Bat Species Assemblage. Presented at the Upper Muddy River Integrated Science Workshop, July 17–19.

Additional References Not Directly Cited:

- Anonymous. No date. Invertebrate and fish experiments in Ash Meadows, Nevada. Pamphlet. 9 pp.
- Anonymous. No date. The hydrogeology of Ash Meadows. 1-page flyer from the refuge office.
- Anonymous. Reviewed 2001. Devil's Hole Death Valley National Park. 1-page flyer from the refuge office.
- Anonymous. 1999. Ash Meadows NWR habitats classification. Draft October 1999. Color map from refuge office.
- Anonymous. 1999. Fact Sheet for *Melanoides tuberculata* (Müller, 1774). Available on the Internet: http://nis.gsmfc.org/nis_factsheet.php?toc_id=144. Revision Date 11/21/2003. Accessed 1/14/2005.
- Anderson, Loran C. 1973. Unique *Chrysothamnus* hybridizations in Ash Meadows, Nevada. *Bulletin of the Torrey Botanical Club* 100(3):171-177.
- Bailey, Vernon. 1900. Revision of American Voles of the Genus *Microtus*. *North American Fauna* 17:6-7, 33.
- Baugh, Thomas M. and James E. Deacon. 1982. Maintaining the Devil's Hole pupfish, *Cyprinodon diabolis* Wales in aquaria. *Journal of Aquaculture and Aquatic Sciences* 3(4):73-75. Available on the Internet: <http://216.168.47.67/cis-fishnet/JAAS/D046.htm>. Accessed 4/14/2004.
- Beatley, Janice C. 1977. *Ash Meadows Nevada's unique oasis in the Mojave Desert*. *Mentzelia* 3:20-24.
- Beatley, Janice C. 1977. *Threatened plant species of the Nevada Test Site, Ash Meadows, and Central-Southern Nevada*. 66 pp.
- Beatley, Janice C. 1971. *Vascular plants of Ash Meadows, Nevada*. University of California Laboratory of Nuclear Medicine and Radiation Biology Atomic Energy Commission Contract at (04-1) Gen-12. Los Angeles, CA. 59 pp.
- Benson, A. 2005. *Melanoides tuberculatus*. Nonindigenous Aquatic Species Database, Gainesville, FL. Available on the Internet: <http://nas.er.usgs.gov/queries/FactSheet.asp?speciesID=1037>. Revision Date 11/23/2004. Accessed 1/14/2005.
- Bleich, Vernon. 1980. *Amargosa vole study*. Job Final Report. 8pp.
- Bleich, Vernon. 1979. *Microtus californicus scirpensis* not extinct. *Journal of Mammology* 60(4):851-852.
- Bradley, W. Glen and James E. Deacon. 1967. The biotic communities of southern Nevada. *Nevada State Museum Anthropological Papers* 13(4):203-295.
- Brooks, M. L., T. C. Esque and C. R. Schwalbe. 1999. Effects of exotic grasses via wildfire on desert tortoises and their habitat. Proceedings of the 24th Annual Meeting and Symposium of the Desert Tortoise Council, March 5-8, 1999.

- Brooks, M. L., T. C. Esque and J. R. Matchett. 2003. Current status and management of alien plants and fire in desert tortoise habitat. Proceedings of the 28th Annual Meeting and Symposium of the Desert Tortoise Council, February 21-23, 2003.
- Brown, D. E. and R. A. Minnich. 1986. Fire and changes in creosote bush scrub of the western Sonoran Desert, California. *American Midland Naturalist* 116:411-422.
- Brown, James H. and C. Robert Feldmeth. 1971. Evolution in Constant and Fluctuating Environments: Thermal Tolerances of Desert Pupfish (*Cyprinodon*). *Evolution*, vol. 25 (2): pp. 390-398.
- Byron, B. 1997. *Local contraction along the Pahrnanagat Shear System, southeastern Nevada*. U.S. Geological Survey, Bulletin 2153-M.
- Bunnell, Sterling. 1970. The desert pupfish. *California Tomorrow* 2-13.
- Charlet, D. 2002. Creosote-mixed scrub matrix and saltbush shrubland matrix, desired future condition summaries. Presented at the Upper Muddy River Integrated Science Workshop, July 17-19.
- Clark County. 2002. *Clark County Species Account Manual Final Draft*. Clark County Department of Comprehensive Planning.
- Clark County. 1997. Clark County Comprehensive Plan. Adopted July 1, 1997. Clark County Department of Comprehensive Planning. Available on the Internet: http://www.co.clark.nv.us/comprehensive_planning/CompPlanElements/FederalLands_Element/fedland_exist.HTM. Accessed February 24, 2005.
- Cochrane, Susan A. 1981. *Grindelia fraxino-pratensis* Reveal and Beatley. California Department of Fish and Game, Sacramento, CA.
- Cowardin, L.M., Carter, V., Golet, F.C., and E.T. LaRoe. 1979. *Classification of wetlands and deepwater habitats of the United States*. Prepared for the Department of Interior, U.S. Fish and Wildlife Service.
- Dames and Moore. 1991. *Paleontological survey of Clark County Regional Flood Control District sites in Clark County, Nevada*. Prepared for Las Vegas, Nevada and the Clark County Regional Flood Control District. 9p.
- Davis, W.B. 1933. Field notes. Texas Cooperative Wildlife Collection, Department of Wildlife and Fisheries Sciences, Texas A&M University. College Station, TX. 136 pp.
- Deacon, James E. and Jack E. Williams. 1984. Annotated list of the fishes of Nevada. *Proceedings of the Biological Society of Washington* 97(1):103-118.
- Deacon, James and Sterling Bunnell. 1970. Man and pupfish. *California Tomorrow* 14-21.
- Echelle, Anthony A. and Thomas E. Dowling. 1992. Mitochondrial DNA variation and evolution of the Death Valley pupfishes (*Cyprinodon*, *Cyprinodontidae*). *Evolution* 46(1):193-206.
- Feldmeth, C. Robert. 1981. The evolution of thermal tolerance in the desert pupfish (Genus *Cyprinodon*). In *Naiman*, Robert J. and David L. Soltz, ed. *Fishes in North American Deserts*. John Wiley and Sons, New York. Pp. 357-384.

- Fink, B.H. and J.B. Zedler. 1990. Endangered plant recovery: experimental approaches with *Cordylanthus maritimus* spp. *maritimus*. In H.G. Hughes and T.M. Bonnicksen (Eds.), *Proceedings of the 1st Annual Conference 1989*. Society of Ecological Restoration and Management, Madison, Wisconsin. Pp. 460-468.
- Fraser, Jody and Cynthia Martinez. 2002. Restoring a desert oasis. *Endangered Species Bulletin* 17(2):18-19. Available on the Internet: <http://www.fws.gov/endangered/esb/2002/03-06/18-19.pdf>. Accessed 4/14/2004.
- Fuller, Pam and Tom Brandt. 1997. Exotic snail and trematode affecting endangered fish. The Newsletter of the Texas Chapter of the American Fisheries Society 23(3). Available on the Internet: www.sdafs.org/tcafs/news/97vol23/news23_3/v23n3.pdf. Accessed 1/14/2005.
- Furnish, Joseph, McIver, James, and Mark Teiser. 2002. Algae and invertebrates of a Great Basin Desert hot lake: a description of the Borax Lake ecosystem of southeastern Oregon. Conference Proceedings. Spring-fed Wetlands: Important Scientific and Cultural Resources of the Intermountain Region, 2002. Available on the Internet: www.wetlands.dri.edu/2002/Furnish.pdf. Accessed 5/12/2005.
- Gerking, Shelby D. 1981. The contribution of the desert pupfish (*Cyprinodon nevadensis*) to fish reproduction in stressful environments. In Naiman, Robert J. and David L. Soltz, ed. *Fishes in North American Deserts*. John Wiley and Sons, New York. Pp. 335-355.
- Glennie, Gina. 1998. Ash Meadows Overview. Unpublished report.
- Guimarães, Carlos Tito, de Souza, Cecília Pereira, and Delza de Moura Soares. 2001. Possible competitive displacement of planorbids by *Melanoides tuberculata* in Minas Gerais, Brazil. *Mem. Inst. Oswaldo Cruz, Rio de Janeiro* 96:173-176. Available on the Internet: <http://memorias.ioc.fiocruz.br/96sup/23x.pdf>. Accessed 1/14/2005.
- Gulf States Marine Fisheries Commission. 2006. Fact sheet for *Melanoides tuberculata*. April 13, 2005. Available on the Internet: http://nis.gsmfc.org/nis_factsheet.php?toc_id=144.
- Hall, Raymond. 1946. *Microtus montanus nevadensis* Bailey. In Hall, Raymond E. *Mammals of Nevada*. University of California Press. Berkeley and Los Angeles, CA. p. 549.
- Hall, Raymond. 1935. Nevadan races of the *Microtus montanus* group of meadow mice. *University of California Publications in Zoology* 40(12):417-428.
- Hallock, Linda L. 1991. *Ash Meadows and recovery efforts for its endangered aquatic species*. *Endangered Species Technical Bulletin* 16(4):1-6).
- Hardcastle, Jeff. 2002. Population projections for Nevada and Nevada's counties from 2002 to 2022. Nevada State Demographer's Office. Available on the Internet: http://www.nsbdc.org/what/data_statistics/demographer/pubs/pdfs/2004proj.pdf.
- Hardy, Alan R. and Fred G. Andrews. 1978. Studies in the Coleoptera of western sand dunes I. Five New Polyphylla Harris (Scarabidae). *The Pan-Pacific Entomologist* 54(1):1-8.
- Harrill, J.R. and Bedinger, M.S. 2000. Ground-water level fluctuations in Devil's Hole, 1962-1999, regional stresses and water-level changes in the Death Valley region. Unpublished report on file with the National Park Service at Death Valley National Park Headquarters. 126 pp.

- Hershler, Robert. 1998. A systematic review of the hydrobiid snails (Gastropoda: Rissooidea) of the Great Basin, Western United States. Part I. Genus *Pyrgulopsis*. *The Veliger* 41(1):1-133.
- Hershler, Robert. 1989. Springsnails (Gastropoda: Hydrobiidae) of Owens and Amargosa River (Exclusive of Ash Meadows) Drainages, Death Valley System, California-Nevada. *Proceedings of the Biological Society of Washington* 102(1):176-248.
- Hershler, Robert and Donald W. Sada. 2002. Biogeography of Great Basin aquatic snails of the genus *Pyrgulopsis*. In Hershler, Robert, Madsen, David B. and Donald R. Currey, ed. *Great Basin Aquatic Systems History*. Smithsonian Contributions to the Earth Sciences 33:255-276.
- Hershler, Robert and Donald W. Sada. 1987. Springsnails (Gastropoda: Hydrobiidae) of Ash Meadows, Amargosa Basin, California-Nevada. *Proc. Biol. Soc. Wash.* 100(4):776-843.
- Hershler, Robert, Liu, Hsiu-Ping, and Margaret Mulvey. 1999. Phylogenetic relationships within the aquatic snail genus *Tryonia*: implications for biogeography of the North American Southwest. *Molecular Phylogenetics and Evolution* 13(2):377-391.
- Hershler, Robert, Mulvey, Margaret, and Hsiu-Ping Liu. In Press. Biogeography in the Death Valley Region: evidence from springsnails (Hydrobiidae: Tryonia). *Zoological Journal of the Linnean Society of London*.
- Hoff, K. 2002. Amphibian species assemblage. Presented at the Upper Muddy River Integrated Science Workshop, July 17–19.
- Hubbs, Carl L. and Robert R. Miller. 1948. The zoological evidence: correlation between fish distribution and hydrographic history in the desert basins of western United States. *Bulletin of the University of Utah* 38:17-166.
- Humphrey, R. R. 1974. Fire in the deserts and desert grassland of North America. In: Kozlowski, T. T.; Ahlgren, C. E., eds. *Fire and ecosystems*. New York: Academic Press: 365-400.
- Ivey, G. L., and C. P. Herziger, compilers. 2005. *Intermountain West Waterbird Conservation Plan—A plan associated with the Waterbird Conservation for the Americas initiative*. Version 1.0. Intermountain West Joint Venture, West Valley City, Utah.
- Jensen, Eva. 2003. Personal communication with A. DuBarton of SWCA, July 2003.
- Kodric-Brown, Astrid. 1981. Variable breeding systems in pupfishes (genus *Cyprinodon*): adaptations to changing environments. In Naiman, Robert J. and David L. Soltz, ed. *Fishes in North American Deserts*. John Wiley and Sons, New York. Pp. 205-235.
- La Rivers, Ira. 1956. A new species of *Pelocoris shoshone* from the Death Valley drainage (Hemiptera: Naucoridae). *The Wasmann Journal of Biology* 14(1):155-158.
- La Rivers, Ira. 1953. New gelastocorid and naucorid records and miscellaneous notes, with a description of the new species, *Ambrysus amargosus* (Hemiptera: Naucoridae). *The Wasmann Journal of Biology* 11(1):83-96.
- Las Vegas Audubon Society. 1997. Birds, Ash Meadows National Wildlife Refuge, Nevada. Las Vegas Audubon Society. 20 pp. Available on the Internet: <http://www.npwrc.usgs.gov/resource/othrdata/chekbird/r1/ashmead.htm>. Accessed 2/14/2005.

- Lee, Ronald M. 1981. Field trip report. Ash Meadows Reservoir Site, December 15, 1981. Nevada Department of Wildlife. 3 pp.
- Leech, Hugh B. 1964. A new species of *Agabus* from the Death Valley region of California (Coleoptera: Dytiscidae). *The Coleopterist's Bulletin* 18:79-82.
- Litton, Martin. 1970. Saving the pupfish. *California Tomorrow* 22-25.
- Liu, Hsiu-Ping, Hershler, Robert, and Kayla Clift. 2003. Mitochondrial DNA sequences reveal extensive cryptic diversity within a western American springsnail. *Molecular Ecology* 12:2771-2782.
- Lovich, J. E. and D. Bainbridge. 1999. Anthropogenic degradation of the southern California desert ecosystem and prospects for natural recovery and restoration. *Environmental Management* 24(3):309-326.
- Lyle, D.A. Jan. 1878. The springs of southern Nevada. *The American Naturalist* 12(1):18-27. Available on the Internet: <http://www.jstor.org/>.
- Maldonado, Florian, D. L. Schmidt. 1991. Geologic map of southern Sheep Range, Fossil Ridge and Castle Rock area, Clark County, Nevada. U.S. Geological Survey Map Series I-2086.
- Miller, Robert R. 1981. Coevolution of deserts and pupfishes (genus *Cyprinodon*) in the American Southwest. In Naiman, Robert J. and David L. Soltz, ed. *Fishes in North American Deserts*. John Wiley and Sons, New York. Pp. 39-93.
- Miller, Robert R. 1967. Letter to Frank W. Groves regarding black molly introduction.
- Miller, Robert R. and James E. Deacon. 1973. *New localities of the rare Warm Spring pupfish, Cyprinodon nevadensis pectoralis, from Ash Meadows, Nevada*. *Copeia* 1973(1):137-140.
- Mitchell, Andrew J. and Thomas M. Brandt. 2003. Thermal limits of red-rimmed Melania *Melanoides tubercuata*, (Gastropoda: Prosobranchia: Thiaridae): implications for control and distribution of a snail that vectors a gill trematode causing serious infections in fish. 28th Annual Eastern Fish Health Workshop April 21-25, 2003. Available on the Internet: <http://www.lsc.usgs.gov/FHB/workshops/28/52.htm>. Revision Date 4/14/2002. Accessed 1/14/2005.
- Minckley, W.L. and James E. Deacon. 1991. *Battle against extinction native fish management in the American West*. The University of Arizona Press, Tucson, AZ.
- Minnich, R. A. 1983. Fire mosaics in southern California and northern Baja California. *Science* 219:1287-1294.
- Mozingo, H.N. and M. Williams. 1980. *Threatened and endangered plants of Nevada. An illustrated manual*. U.S. Fish and Wildlife Service, Portland, OR, and U.S. Bureau of Land Management, Reno, NV.
- National Register of Historic Places (NRHP). 2004. National Register of Historic Places: Nevada, Clark County. Available on the Internet: <http://nationalregisterofhistoricplaces.com/NV/Clark/state.html>. Accessed 4/04.
- The Nature Conservancy. No date. Ash Meadows pupfish preserve. 9 pp. + appendices.

- The Nature Conservancy. 1997. *Restoration of the Kings Spring drainage in Ash Meadows, Nevada. Design for the Reconstruction of the Pool and Outflow Channel of Kings Spring*. Las Vegas, NV. Report prepared by Otis Bay.
- The Nature Conservancy and U.S. Fish and Wildlife Service. 1996. *A checklist of the vascular plants of Ash Meadows National Wildlife Refuge, Nye County, Nevada*. 18 pp.
- NAXOS Resources, Inc. 1990. A survey for *Nitrophila mohavensis* Munz & Roos on the Naxos Trespass Area, Inyo County, California. Twentynine Palms, CA. 10 pp. Report prepared by Teri A. Knight.
- Nevada Department of Agriculture, Plant Industry Division. 2006. Noxious Weed List. Available on the Internet: http://agri.nv.gov/nwac/PLANT_No WeedList.htm.
- Nevada Department of Agriculture. Unknown date. *Noxious Weeds: How Do They Affect You*, pamphlet.
- Nevada Department of Wildlife. 2005. Nevada bats our aerial allies. Poster.
- Nevada Department of Wildlife. 2005. Summary of aerial desert bighorn sheep surveys: 2005. Survey dates range from May 11 to October 14, 2005.
- Nevada Department of Wildlife. 1989. *Fishery Management Plan for Pahranaagat National Wildlife Refuge*. Statewide Fisheries Program, NDOW. January.
- Nevada Division of Environmental Protection. 1999. *Nevada Smoke Management Program Plan*. July.
- O'Leary, J. F. and R. A. Minnich. 1981. Postfire recovery of creosote bush scrub vegetation in the western Colorado Desert. *Madroo* 23:61-66.
- Pal Consultants, Inc. 1995. *A conceptual model of the Death Valley ground-water flow system, Nevada and California*. December 1995.
- Palmer, Allison R. and Robert B. Halley. 1979. Physical stratigraphy and trilobite biostratigraphy of the Carrara Formation (Lower and Middle Cambrian) in the southern Great Basin. USGS Professional Paper 1047. 131 pp. Available on the Internet: <http://pubs.er.usgs.gov/usgspubs/pp/pp1047>.
- Parker, Michael S., Scopettone, G. Gary, and Bridget Neilsen. 2000. *Ecological investigation of two naucorid species (Ambrysus amargosus and A. relictus) endemic to thermal springs of the Ash Meadows National Wildlife Refuge*. USFS Southern Nevada Field Office, Las Vegas, NV. FWS Document Control Number 14320-8-6002. 54 pp. Report prepared for U.S. Fish and Wildlife Service.
- Pister, Edwin P. 1974. Desert fishes and their habitats. *Transactions of the American Fisheries Society*, No. 3, pp. 531-540.
- Polhemus, Dan A. and John T. Polhemus. 2002. Basins and ranges: the biogeography of aquatic true bugs (Insecta: Heteroptera) in the Great Basin. In Hershler, Robert, Madsen, David B. and Donald R. Currey, ed. Great Basin Aquatic Systems History. *Smithsonian Contributions to the Earth Sciences* 33:235-254.

- Polhemus, John T. and Dan A. Polhemus. 1994. A new species of *Ambrysus* Stal from Ash Meadows, Nevada (Heteroptera: Naucoridae). *Journal of the New York Entomological Society* 102(2):261-265.
- Polhemus, John T. and Robert W. Sites. 1995. The identity of *Pelocoris biimpressus montandon* and synonymy of *Pelocoris* species in the southwestern United States (Heteroptera: Naucoridae). *Proc. Entomol. Soc. Wash.* 97(3):654-658.
- Rabeni, Charles F. and Robert B. Jacobson. 1993. The importance of fluvial hydraulics to fish-habitat restoration in low-gradient alluvial streams. *Freshwater Biology* 29:211-220.
- Reveal, James L. 1978. *Status report on Astragalus phoenix Barneby (Ash Meadow milk-vetch)*. Draft. 30 pp.
- Reveal, James L. 1978. *Status Report on Mentzelia leucophylla Brandgee (Ash Meadows stick-leaf)*. Draft. 35 pp.
- Riggs, Alan C. and James E. Deacon. 2002. Connectivity in Desert Aquatic Ecosystems: The Devils Hole Story. Conference Proceedings. Spring-fed Wetlands: Important Scientific and Cultural Resources of the Intermountain Region, 2002.
- Ross, R.J. Jr. and Chester R. Longwell. 1964. Middle and Lower Ordovician formations in southernmost Nevada and adjacent California. USGS Bulletin 1180-C. 101 pp. Available on the Internet: <http://pubs.er.usgs.gov/usgspubs/b/b1180C>.
- Rouse, Leigh. 1998. *Riparian vegetation, avian diversity and hydrology of springs in Ash Meadows National Wildlife Refuge, Nevada*. M.S. Thesis. Arizona State University, Tempe, AZ. 105 pp.
- Russell, David E. 1995. *Death Valley June Beetle Project*. Report for the National Biological Survey and Death Valley National Park. 67pp.
- Sada, Donald W. 1985. *Collection of hydrobiid snails in Ash Meadows November 6-11, 1985*. Report to the U.S. Fish and Wildlife Service. 15 pp.
- Sada, Donald W. and Gary L. Vinyard. 2002. Anthropogenic changes in biogeography of Great Basin aquatic biota. In Hershler, Robert, Madsen, David B. and Donald R. Currey, ed. Great Basin Aquatic Systems History. *Smithsonian Contributions to the Earth Sciences* 33:277-293.
- Sada, Donald W., Britten, Hugh B., and Peter F. Brussard. 1995. Desert aquatic ecosystems and the genetic and morphological diversity of Death Valley system speckled dace. *American Fisheries Society Symposium* 17:350-359.
- Schmude, K.L. 1999. Riffle beetles in the genus *Stenelmis* (Coleoptera: Elmidae) from warm springs in southern Nevada: new species, new status, and a key. *Entomological News* 110(1):1-12.
- Schmude, Kurt Lyle. 1992. *Revision of the riffle beetle genus Stenelmis (Coleoptera: Elmidae) in North America with notes on bionomics*. Ph.D. thesis. University of Wisconsin, Madison, 30 pp.
- Scoppettone, Gary G. 2006. Personnel communication to David Bergendorf, U.S. Fish and Wildlife Service. U.S. Geological Survey. March 28, 2006.

- Scoppettone, G. Gary, Rissler, Peter H., Byers, Stephanie, Shea, Sean, Nielsen, Bridget, and Jon C. Sjoberg. 1995. *Information on the Status and Ecology of Ash Meadows Fishes and Ambryus*. 90 pp.
- Scoppettone, G. Gary, Rissler, Peter H., Gourley, Chad, and Cynthia Martinez. 2005. Habitat restoration as a means of controlling non-native fish in a Mojave Desert oasis. *Restoration Ecology* 13(2):247-256.
- Shepard, William D. 1992. Riffle beetles (Coleoptera: Elmidae) of Death Valley National Monument, California. *Great Basin Nat.* 52:378-381.
- Shepard, William D. and Doug Threlhoff. 1997. Additional records of riffle beetles (Coleoptera: Elmidae) in Death Valley National Park, California. *Southwestern Naturalist* 42(4):494-497.
- Sheviak, Charles J. 1989. A new *Spiranthes* (Orchidaceae) from Ash Meadows, Nevada. *Rhodora Journal of the New England Botanical Club* 91(867):225-234.
- Smith, G.R., Dowling, T.E., Gobalet, K.W., Lugaski, T., Shiozawa, and R.P. Evans. 2002. Biogeography and timing of evolutionary events among Great Basin fishes. In Hershler, Robert, Madsen, David B. and Donald R. Currey, ed. *Great Basin Aquatic Systems History*. Smithsonian Contributions to the Earth Sciences 33:175-234.
- Soil Ecology and Research Group. 2004. Demographics and ecology of the Amargosa niterwort (*Nitrophila mohavensis*) and Ash Meadows gumplant (*Grenedia fraxino-pratensis*) of the Carson Slough area. 16 pp. Available on the Internet: <http://www.serg.sdsu.edu/SERG/restorationproj/mojave%20desert/deathvalleyfinal.htm>. Accessed 10/31/2006.
- Soil Ecology and Research Group. 2002. Death Valley. Available on the Internet: <http://www.serg.sdsu.edu/SERG/restorationproj/mojave%20desert/deathvalley.html>. Accessed 10/31/2006.
- Soltz, David L. and Michael F. Hirshfield. 1981. Genetic differentiation of pupfishes (Genus *Cyprinodon*) in the American Southwest. In Naiman, Robert J. and David L. Soltz, ed. *Fishes in North American Deserts*. John Wiley and Sons, New York. Pp. 292-332.
- Soltz, David L. and Robert J. Naiman. 1978. The natural history of native fishes in the Death Valley system. Natural History Museum of Los Angeles County in conjunction with The Death Valley Natural History Association. *Science Series* 30. 75 pp.
- Southwestern Willow Flycatcher Recovery Team Technical Subgroup. 2002. *Final recovery plan for the southwestern willow flycatcher (Empidonax traillii extimus)*. Prepared for Region 2 U.S. Fish and Wildlife Service, Albuquerque, New Mexico. August 30, 2002.
- Stewart, John H. and Harley Barnes. 1967. Cambrian and PreCambrian rocks of the Desert Range. USGS Bulletin 1244-A. p. A35 - A42.
- Stoffle, R.W., Evans, M.J., Halmo, D.B., Niles, W.E., and J.T. O'Farrell. 1989. Native American plant resources in the Yucca Mountain Area, Nevada. DOE/NV/10576—19. November 1.
- Stoffle, Richard W., Halmo, David B., Olmsted, John E., and Michael J. Evans. 1992. Native American Cultural Resources at Yucca Mountain, Nevada. *American Indian Quarterly*, Vol. 16, No. 2 (Spring, 1992), pp. 286-288.

- Stoffle, R., Ilihaime, H., and Rebecca Stuart. 1999. American Indian Transportation Committee Field Assessment of Cultural Sites Regarding the U.S. Department of Energy Pre-Approval Draft Environmental Assessment of Intermodal Transportation of Low-Level Radioactive Waste to the Nevada Test Site. Tucson: Bureau of Applied Research in Anthropology, University of Arizona.
- Threlloff, Douglas. 1992. *Draft report: a comprehensive wetland restoration plan for the northern Ash Meadows ecosystem*. Ash Meadows NWR. Pahrump, NV. 25 pp.
- Threlloff, Douglas. 1991. Ash Meadows invertebrate survey. Correspondence to Project Leader, Desert NWR Complex.
- Turbak, Gary. 1993. *Survivors in the shadows threatened and endangered mammals of the American West*. Northland Publishing. Flagstaff, AZ. Pp. 1-2.
- U.S. Bureau of Land Management. Unpublished. Southern Nevada Mesquite Woodland Habitat Management Plan. Draft. Las Vegas, NV. 89 pp.
- U.S. Bureau of Land Management. 2006. Nevada BLM Sensitive Species. June 6, 2006. Available on the Internet: <http://www.nv.blm.gov/wildlife/documents/sensitivespecies.pdf>.
- U.S. Bureau of Land Management. 2005. Nevada State Office. GIS metadata for State of Nevada.
- U.S. Bureau of Land Management. 2003. BLM News September 15, 2003. Available on the Internet at: <http://www.nv.blm.gov/vegas/PDF/eisnewsrelease.pdf>.
- U.S. Bureau of Land Management. 2000. *Environmental Assessment for the Proposed Land and Mineral Withdrawal at the Ash Meadows National Wildlife Refuge, Nye County, Nevada*. March.
- U.S. Bureau of Land Management. 1999. *Final Draft: Southern Nevada Mesquite Woodland Habitat Management Plan*. Las Vegas Field Office.
- U.S. Bureau of Land Management. 1999. Partners against weeds. Available on the Internet: http://www.nv.blm.gov/Resources/noxious_weeds.htm. Accessed 6/03.
- U.S. Bureau of Land Management. 1998. *Proposed Las Vegas Resource Management Plan and Final Environmental Impact Statement*. U.S. Department of the Interior, U.S. Bureau of Land Management, Las Vegas Field Office, Nevada.
- U.S. Department of Agriculture. 1893. The Death Valley expedition: a biological survey of parts of California, Nevada, Arizona, and Utah. *North American Fauna* No. 7. Washington Government Printing Office. Washington, D.C.
- U.S. Department of the Interior. 1972. *Proposed desert pupfish preserve supplemental LARC report* September, 1972.
- U.S. Department of the Interior. 1970. *Reconnaissance Report of the Proposed Desert Pupfish Preserve Nye County, Nevada*.
- U.S. Energy Research and Development Administration (ERDA). 1977. Final Environmental Impact Statement, Nevada Test Site, Nye County, Nevada. Report No. ERDA-1551, Washington, DC.

- U.S. Environmental Protection Agency. 1998. Compilation of air pollutant emission factors AP-42, fifth edition, volume I: Stationary point and area sources. Chapter 13.2.2, Unpaved Roads. Office of Mobile Sources. September.
- U.S. Fish and Wildlife Service. 2004. *Moapa Valley National Wildlife Refuge Phase II Restoration Final Environmental Assessment. Prepared by SWCA Environmental Consultants. Prepared for Moapa Valley National Wildlife Refuge, U.S. Fish and Wildlife Service, U.S. Department of the Interior.* October 2004.
- U.S. Fish and Wildlife Service. 2001. *Amargosa Station Management Plan for the School Springs and Point of Rocks Refugia. Ash Meadows National Wildlife Refuge.* Prepared by Eric Hopson, Refuge Manager.
- U.S. Fish and Wildlife Service. 2001. *Point of Rocks Springs Revegetation Plan, Ash Meadows National Wildlife Refuge* Nye County, Nevada. USFS Southern Nevada Field Office. Las Vegas, NV. 6 pp.
- U.S. Fish and Wildlife Service. 1985. Endangered and threatened wildlife and plants: determination of threatened status with critical habitat for six plants and one insect in Ash Meadows, Nevada and California; and endangered status with critical habitat for one plant in Ash Meadows, Nevada and California. *Federal Register* 50(97):20777-20794.
- U.S. Fish and Wildlife Service. 1983. Eight more Ash Meadows species proposed as endangered. *Endangered Species Technical Bulletin* 8(11):1-10.
- U.S. Fish and Wildlife Service. 1983. Endangered and threatened wildlife and plants: proposed endangered status and critical habitats for seven plant and one insect species in Ash Meadows, Nevada and California. *Federal Register* 48(199):46590-46598.
- U.S. Fish and Wildlife Service. 1983. *Proposed land acquisition for Moapa dace (Moapa coriacea), an endangered species. Clark County, Nevada.* Prepared by Region 1, Department of the Interior, U.S. Fish and Wildlife Service, Portland, Oregon. June.
- U.S. Fish and Wildlife Service. 1983. *Yuma Clapper Rail Recovery Plan.* U.S. Fish and Wildlife Service, Albuquerque, New Mexico.
- U.S. Fish and Wildlife Service. 1981. *Environmental Assessment Proposed Land Acquisition for Moapa Dace (Moapa coriacea) an Endangered Species* (A Revision of Original E.A., January 1979), U.S. Department of the Interior, U.S. Fish and Wildlife Service, Portland, Oregon. July 1981.
- Unmack, Peter and Tom Webster. No date. Desert Habitats: a photographic perspective, 1937-2001. Available on the Internet: <http://www.pupfish.net/habitats/index.htm>. Accessed 4/14/2004.
- Williams, Jack E. and James E. Deacon. 1986. Subspecific Identity of the Amargosa Pupfish, *Cyprinodon nevadensis*, from Crystal Spring, Ash Meadows, Nevada. *Great Basin Naturalist* 46(2):220-223.
- Williams, Jack E. and Donald W. Sada. 1985. Status of two endangered fishes, *Cyprinodon nevadensis mionectes* and *Rhinichthys osculus nevadensis*, from two springs in Ash Meadows, Nevada. *The Southwestern Naturalist* 30(4):475-484.

- Williams, Jack E., Bowman, David B., Brooks, James E., Echelle, Anthony A., Edwards, Robert J., Hendrickson, Dean A., and Jerry J. Landye. 1985. Endangered aquatic ecosystems in North American deserts with a list of vanishing fishes of the region. *Journal of the Arizona-Nevada Academy of Science* 20:1-62.
- York, A. L., McMullen, R. E., deLespinasse, P., and W. G. Spaulding. 1996. *Rock art sites on the Nellis Range Complex, Nellis Air Force Base, Nevada*. Technical Report submitted to U.S. Air Force, Nellis Air Force Base by Dames & Moore, Inc., Las Vegas, Nevada.

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Appendix E.
Applicable Laws, Policies,
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The following tables provide a list of laws and regulations applicable to the proposed activities at the Desert National Wildlife Refuge Complex. Implementation of the Proposed Action would require compliance with these laws and regulations.

Environmental Laws and Regulations

<i>Law (all as amended)</i>	<i>Record</i>
American Indian Religious Freedom Act of 1978	42 USC 1996
Americans With Disabilities Act of 1990	42 USC 12101 et seq.
Anadromous Fish Conservation Act of 1974	16 USC 757
Antiquities Act of 1906	16 USC 431 et seq.
Archeological Resources Protection Act of 1974	16 USC 470aa et seq.
Bald Eagle Protection Act of 1940	16 USC 668 et seq.
Clean Air Act, including Conformity requirements	42 USC 7401 et seq.
Clean Water Act of 1974	33 USC 1251 et seq.
Disaster Relief Act of May 22, 1974	88 Stat. 143, 42 USC 5121
Economy Act of June 30, 1932	31 USC 1535
Emergency Wetlands Resources Act of 1986	16 USC 3901 et seq.
Endangered Species Act of 1973	16 USC 1531 et seq.
Farmland Protection Policy Act of 1981	7 USC 4201 et seq.
Federal Fire Prevention and Control Act of October 29, 1974	88 Stat. 1535; 15 USC 2201
Federal Noxious Weed Act of 1990	7 USC 2801 et seq.
Fish and Wildlife Act of 1956	16 USC 742 et seq.
Fish and Wildlife Coordination Act of 1958	16 USC 661 et seq.
Fishery (Magnuson) Conservation and Management Act of 1976	16 USC 1801 et seq.
Migratory Bird Conservation Act of 1929	16 USC 715 et seq.
Migratory Bird Hunting and Conservation Stamp Act of 1934	16 USC 718
Migratory Bird Treaty Act of 1918	16 USC 703 et seq.
National Environmental Policy Act of 1969 (NEPA)	42 USC 4321 et seq.
National Historic Preservation Act of 1966	16 USC 470 et seq.
National Wildlife Refuge System Administration Act of 1966	16 USC 668dd, 668ee
National Wildlife Refuge System Improvement Act of 1997	16 USC 668dd
Native American Graves Protection and Repatriation Act of 1990	25 USC 3001 et seq.
Protection Act of September 20, 1922	42 Stat. 857, USC 594
Reciprocal Fire Protection Act of May 27, 1955	69 Stat. 66, 67; 42 USC 1856, 1856a and b
Refuge Recreation Act of 1962	16 USC 460k et seq.
Water Resources Planning Act of 1965 (sole-source aquifers)	42 USC 1962 et seq.
Wilderness Act of 1964	16 USC 1131 et seq.
Wildlife Suppression Assistance Act of 1989	PL 100-428, as amended by PL 101-11

Executive Orders

Use of Off-Road Vehicles on Public Land	EO 11644
Exotic Organisms	EO 11987
Floodplain Management	EO 11988
Protection of Wetlands	EO 11990
Environmental Justice for Minority Populations	EO 12898
Recreational Fisheries	EO 12962
Management & General Public Use of the National Wildlife Refuge System	EO 12996
Indian Sacred Sites	EO 13007
Consultation and Coordination With Indian Tribal Governments	EO 13175
Responsibilities of Federal Agencies to Protect Migratory Birds	EO 13186

Other Policy and Guidance

Department of the Interior Manual, Part 620 DM, Chapter 1, Wildland Fire Management: General Policy and Procedures	April 10, 1998
Federal Wildland Fire Management Policy	2001
National Policy Issuance #94-10: Native American Policy	June 29, 1994
Secretarial Order 3206: American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act	June 5, 1997
U.S. Fish and Wildlife Service Manual, Part 621, Fire Management	February 7, 2000

Appendix F.
Goals, Objectives, and Strategies
for Preferred Alternative

Ash Meadows National Wildlife Refuge

Species Management (Goal 1). Restore and maintain viable populations of all endemic, endangered and threatened species within the Refuge's Mojave Desert oasis ecosystem.

Objective 1.1: Within three years complete baseline population density, presence/absence, abundance and/or cover on all plants, listed endemic invertebrates and nonnative fish. Collect the same baseline data for non-listed endemic invertebrates within ten years.

Rationale: Obtaining baseline information on the distribution and abundance of Refuge plants and wildlife will inform management as well as monitoring and evaluation of restoration efforts.

Strategies

- 1.1.1 Conduct baseline inventories on vegetation communities, small mammals, herps, and pollinators
- 1.1.2 Complete a four year baseline inventory and monitoring for endemic fish species and a three year baseline inventory and monitoring for the southwest willow flycatcher
- 1.1.3 Continue and improve inventory of native species diversity and distribution
- 1.1.4 Continue and improve inventory of non-native species diversity and distribution
- 1.1.5 Implement monitoring for all non-listed endemic and game species
- 1.1.6 Characterize faunal associations of plant communities
- 1.1.7 Characterize historic changes in species and habitat distribution
- 1.1.8 Work with USGS for determination of crayfish distribution and for monitoring recommendations
- 1.1.9 Utilize IPM techniques for long-term management of invasive species
- 1.1.10 Continue current monitoring strategies for special status plants and wildlife
- 1.1.11 Conduct baseline and periodic monitoring of endangered or threatened bird species
- 1.1.12 Conduct periodic monitoring of secretive marsh birds and sensitive species of waterfowl

Objective 1.2: Within seven years create, test and implement monitoring protocols for all listed endemic species and non-native species that are negatively impacting endemic species and within 15 years complete the same protocols for all non-listed endemic and game species.

Rationale: Monitoring the distribution and abundance of native and non-native species on the Refuge will allow analysis of trends in distribution and abundance over time. Analysis of trends in distribution and abundance of Refuge species will allow managers to gage the effects of restoration and management actions and to identify species that require additional or intensive management.

Strategies

- 1.2.1 Utilize independent science review to develop and apply rigorous statistical sampling techniques for all native endemic and non-native species
- 1.2.2 Work towards the use of key ecosystem health indicator species as a reasonable alternative to comprehensive ecosystem sampling and analysis

Objective 1.3: Within fifteen years restore endemic fish populations to 25-50% of historic range as described in the Recovery Plan for the Endangered and Threatened Species of Ash Meadows Nevada.

Rationale: From the 1990 Recovery Plan for the Endangered and Threatened Species of Ash Meadows Nevada, the pre-1950 estimated amount of occupied aquatic habitat was; Warm Springs pupfish (*Cyprinodon nevadensis pectoralis*) (0.49 acres = net loss of 0.05 acres), Ash Meadows Amargosa pupfish (*Cyprinodon nevadensis mionectes*) (599.90 acres = net loss of 592.81 acres), Ash Meadows speckled dace (*Rhinichthys osculus nevadensis*) (599.11 acres = net loss of 597.95 acres), Devil's Hole pupfish (*Cyprinodon diabolis*) (0.019 acres = no change) (USFWS 1990). Restoration of historic flows and aquatic habitat type should increase native fish populations and decrease non-native fish populations simultaneously (Scoppettone et al. 2005) since native fish species are best adapted to historic flows.

Negative impacts to endemic fish and naucorids have occurred from the introduction of crayfish and other human treatments (i.e.. habitat alteration: leveling land for crops, stripping riparian vegetation and well drilling for irrigation water [Pister 1974]). Restoration of natural flows (21.7cm/sec - 30cm/sec) should favor pupfish and speckled dace over non-native fish (i.e.. sailfin molly and mosquito fish, which prefer flows of <9.0 cm/sec) (Scoppettone et al. 2005).

Strategies	
1.3.1	Develop and implement habitat restoration and translocation protocols for target species, including consideration of timing of habitat restoration and genetics
1.3.2	Consider and implement if practical, captive refugia for all sensitive species
1.3.3	Develop life history and habitat conservation models of target species
1.3.4	Monitor success of species post-restoration and correlate with habitat parameters (ex. flow, depth, temperature, etc.)
1.3.5	Update MOU with NDOW, USFWS Ecological Services, and NPS on management responsibilities under the Ash Meadows Recovery Plan
1.3.6	Complete and implement restoration plans for Upper Point of Rocks, Jackrabbit Spring, the Warm Springs Unit (North and South Indian Springs and School Springs), Lower Point of Rocks, Lower Kings Pool, Marsh, Big, and Fairbanks Springs
1.3.7	Develop a restoration plan for Crystal Spring Unit by 2009
1.3.8	Manage and monitor previously restored springs
1.3.10	Develop and implement restoration plans for Tubbs, Bradford, Crystal, Forest, and North and South Scruggs Springs
1.3.11	Based on outcome of Carson Slough Restoration Plan, develop and implement restorations plans for Longstreet and Rogers Springs

Objective 1.4: Within 10 years restore Ash Meadow's naucorid (*Ambrysus amargosus*) population to 200% of current population size by doubling the current range to a minimum of 20-40 square meters within the 10 acre watershed that they inhabit.

Rationale: Habitat alteration is the stated cause of Ash Meadows naucorid (*Ambrysus amargosus*) decline from historic levels (USFWS 1990). Currently the Ash Meadows naucorid population is limited to 10-20 square meters, within a 10 acre watershed, with numbers fluctuating from summer highs to winter lows (Goodchild 2006). It may be more practical to focus on acres restored to suitable habitat

with Ash Meadows naucorids present instead of an absolute number of Ash Meadows naucorids, but staff should still monitor for the number of Ash Meadows naucorids present. While little is known about the Ash Meadows naucorid habitat needs, similar species feed on aquatic insect larvae as they swim over and through substrate (USFWS 1990). Approximately 10 acres at Point of Rocks Spring are designated critical habitat for this species (USFWS 1990). It will take approximately 10 years to restore Point of Rocks habitat and other springs with tolerable temperature to suitable habitat that can support at least some naucorids.

Strategies

- 1.4.1 Restore Point of Rocks spring outflow channel habitat to known suitability and monitor parameters (ex. temperature, flow, depth, etc.) to inform adaptive management

Objective 1.5: Maintain or expand current endemic plant population densities and distribution by identifying suitable habitat for range expansion within 10 years and within 15 years begin appropriate out planting.

Rationale: Of the endemic plants found on the Refuge, one plant species is listed as endangered and six are listed as threatened under the Federal Endangered Species Act. The Amargosa niterwort (*Nitrophila mohavensis*) is listed as endangered. The six threatened plant species found on the Refuge are Ash Meadows milk-vetch (*Astragalus phoenix*), Spring-loving centaury (*Centaureium namophilum*), Ash Meadows sunray (*Enceliopsis nudicaulis* var. *corrugata*), Ash Meadows gumplant (*Grindelia fraxino-pratensis*), Ash Meadows ivesia (*Ivesia kingii* var. *eremica*) and Ash Meadows blazing-star (*Mentzelia leucophylla*). Much of the Refuge's plant habitat has been degraded due to agricultural grading, off road vehicles and trampling by wild horses (USFWS 1990). Limited understanding of plant species life history and uncertainty about the suitability of degraded sites for restoration makes test plots an efficient method for site assessment. Tasks 224 and 225 in the Ash Meadows Species Recovery Plan (USFWS 1990) recommend actions consistent with this objective.

Strategies

- 1.5.1 Control non-native invasive plants, prioritizing areas with listed plant species and monitor the response of listed plant species with low-impact methods
- 1.5.2 Perform experimental planting and monitoring on test sites, representative of Refuge habitat
- 1.5.3 In addition to monitoring plant health, monitor environmental parameters that may be associated with establishment success (ex. % soil moisture, soil bulk density, texture, salt content, etc.)
- 1.5.4 Based on range of suitable restoration sites, nursery grow endemic species for out planting
- 1.5.5 Out plant endemic species to habitats with similar parameters to successful test plot sites
- 1.5.6 Look for sites where listed plants (ex. Niterwort) could occur and try to determine why they are not present
- 1.5.7 Complete a feasibility study for construction of an on-site greenhouse to supply plants for restoration on the Refuge

Objective 1.6: Within five years establish refugium population of: Ash Meadows speckled dace (*Rhinichthys osculus nevadensis*) and complete a feasibility assessment of refugia for other endemic species based on population trends and threats.

Rationale: All four endemic Refuge fish species are currently listed as endangered. Devil's Hole pupfish (*Cyprinodon diabolis*) live in a unique habitat, restricted to a limestone cave situated on the east central border of Ash Meadows (USFWS 1990). Refugium for Devil's Hole pupfish and Warm Springs pupfish will be constructed under the No Action Alternative. The necessary refugia requirements for Devil's Hole pupfish would not be suitable for other species that may require refugia. Ash meadows speckled dace (*Rhinichthys osculus nevadensis*) and Ash Meadows Amargosa pupfish (*Cyprinodon nevadensis mionectes*) historically shared the same habitat (USFWS 1990), but within different thermal niches (Goodchild 2006). The Ash Meadows speckled dace, which inhabit cooler water than Ash Meadows Amargosa pupfish, have not recovered as well after Refuge establishment and should be prioritized for refugia space. Additional research is required to determine if a single refugia could suit all or multiple other endemic species simultaneously.

Strategies

- 1.6.1 Maintain and monitor the one established pupfish refugium
- 1.6.2 Conduct quarterly fish counts and periodic water quality measurements
- 1.6.3 Within five years of CCP approval assess the feasibility and necessity of a refugium for the Ash Meadows speckled dace and implement if funding is available
- 1.6.4 Within five years, complete a feasibility assessment of on-site and off-site refugia for all other Ash Meadows NWR endemic species
- 1.6.5 Investigate feasibility and funding for captive populations of all sensitive species (ex. naucorids, aquatic snails, plants, etc.)
- 1.6.6 Investigate the use of private aquaria as refugia

Objective 1.7: Within two years complete evaluation of the Recovery Plan for the Endangered and Threatened Species of Ash Meadows Nevada progress and create contingency strategies for Ash Meadows speckled dace (*Rhinichthys osculus nevadensis*) and Warm Springs pupfish (*Cyprinodon nevadensis pectoralis*) protection.

Rationale: Tasks 253, 2531 and 2532, of the Recovery Plan for Ash Meadows species, recommend actions to monitor and assess factors controlling population size of Warm Springs pupfish (*Cyprinodon nevadensis pectoralis*), Ash Meadows Amargosa pupfish (*Cyprinodon nevadensis mionectes*) and Ash Meadows speckled dace (*Rhinichthys osculus nevadensis*) (USFWS 1990). While species monitoring has been ongoing, in the sixteen years since approval of the Recovery Plan for Ash Meadows species (USFWS 1990) no comprehensive evaluation of plan progress has been completed. Evaluating Recovery Plan progress and species status is essential to focus future recovery activities where they are most needed. Establishing a formal process to review and approve scientific protocols will allow valuable input from interdisciplinary scientists yet allow research and monitoring to proceed when uncertainty exists. Developing contingency strategies for endangered fish species, under advisement of the Recovery Team, can hedge against unforeseen events that could imperil a single, isolated population.

Data from past and current refugia such as: refugia at Hoover Dam; Ash Meadows pupfish station; and Point of Rocks Spring should provide valuable information on the habitat requirements of particular species. Preliminary review of information indicates that School Springs could be a favorable site for a multiple aquatic species refugia.

Strategies

- 1.7.1 Work with Recovery Team to assess progress on Recovery Plan

1.7.2	Work with Recovery Team to develop a contingency plan for Ash Meadows speckled dace and Warm Springs pupfish protection
1.7.3	Establish scientific review process and protocols
1.7.4	Same as 1.3.5

Habitat (Goal 2). Restore and maintain the ecological integrity of natural communities within the Ash Meadows National Wildlife Refuge.

Objective 2.1: Improve Refuge wide vegetation map through ground surveys and updating of GIS layers and initiate long-term, annual vegetation monitoring.

Rationale: Vegetation mapping is essential to plan for desired future conditions, to monitor vegetation recovery after restoration, for adaptive management and to plan for and monitor success of invasive species eradication.

<i>Strategies</i>	
2.1.1	Obtain normal color aerial photography on a decadal scale or more frequently if necessary
2.1.2	Supplement and improve on 2006 Geomorphic and Biological Assessment
2.1.3	Improve Refuge-wide vegetation map through ground surveys and updating of GIS layers and initiate long-term, annual vegetation monitoring by establishing permanent, long-term vegetation monitoring plots/transects
2.1.4	Obtain funding for and hire: 1 IPM Coordinator/Botanist, biological technician and 1 GIS specialist (part-time)
2.1.5	Obtain 1-2 foot contour data for Refuge to aid in restoration and planning activities

Objective 2.2: Maintain natural average and range of variability in spring discharge (annual discharge of 17,000 acre/feet per year from 30 known springs), flood frequency, water quality, historic spring temperature range between springs of 18-34 °C (64-93 °F), and water table elevation on Refuge.

Rationale: Ash Meadows endemic fish species have evolved and adapted to the historic natural conditions for flow, flooding and water elevation. Endemic aquatic community health is likely dependent on habitat characteristics including discharge, flood frequency and groundwater elevation. Studies have shown that restoration of natural channel configuration, temperature and flow favors native Ash Meadows endemic fishes and may reduce non-native fish populations (Scoppettone et al. 2005). Temperatures were probably historically very stable within particular springs, but variable between springs. According to the AMNWR Water Monitoring Plan, the discharge from approximately 30 springs is 17,000 acre-feet annually of which the Service has water rights for 16,360 acre-feet. Water temperatures vary between springs from 64 to 93° F (e.g., Cold Spring = 65° F, Bradford = 68-70° F, Tubbs = 70° F, North Scruggs = 93° F; all of the Warm Springs Complex is above 90° F) (Baldino 2006). Importantly, Ash Meadows Amargosa pupfish (*Cyprinodon nevadensis mionectes*) require relatively warmer temperatures for reproduction, and Ash Meadows Speckled dace (*Rhinichthys osculus nevadensis*) require relatively cooler temperatures. According to Scoppettone et al. (2005) Ash Meadows Speckled dace reproduce in temperatures ranging from 17.5 to 24° C (64 to 75° F). On the Refuge, Bradford Springs with a temperature of 69° F currently holds the largest population of Ash Meadows Speckled dace. The Ash Meadows Amargosa pupfish population has been

found in relatively warmer springs ranging in temperature from 21.2-33.1 °C (70-92 °F) (Brown and Feldmeth 1971). Obtaining baseline information on habitat parameters and monitoring for changes should, over time, clarify the relationship between variable parameters and aquatic community health. In addition, alteration of natural conditions can favor non-native species and disrupt habitat features essential for survival and reproduction of endemic species. Tasks 114, 211, 212 and 213 of the Ash Meadows Species Recovery Plan recommend actions to restore historic spring conditions (USFWS 1990).

<i>Strategies</i>	
2.2.1	Convene hydrologists to analyze existing spring discharge and groundwater elevation data
2.2.2	Maintain appropriate water temperature through techniques including restoration of historic stream channels, alternation of channel depth/width, increasing channel length, and re-establishing historic overstory plant communities
2.2.3	Protect spring discharge and groundwater elevation in both valley-fill and carbonate by working with partners to monitor spring discharge rates and other techniques similar to strategy 2.2.2
2.2.4	Within 10 years obtain baseline data on spring discharge, flood frequency, and groundwater elevation for seventeen springs identified in the Refuge Geomorphic and Biological Assessment
2.2.5	Evaluate nutrient input to streams from roads
2.2.6	Work with local land owners to develop more efficient water transport systems to manage water flow
2.2.7	Continue to monitor and assess water flows, levels, and temperatures at springs and wells identified in the current Water Monitoring Plan
2.2.8	Analyze water quality and quantity biannually, and implement measures in coordination with the State Engineer to defend water rights and mitigate substantial changes in temperature or flow
2.2.9	Maintain the existing spring outflow structures and stream channels at monitoring sites

Objective 2.3: Manage and monitor previously restored springs (Point of Rocks and Kings spring) and continue restoration of at least 17,400 linear feet of four spring systems and outflow channels (Jackrabbit Spring, Warm Springs, Fairbanks Spring and Big Spring and others if possible) to a series of riffles and runs, with open channels free of emergent vegetation and surrounding riparian plant communities with approximately 75% deciduous multiple story channel canopy cover including: 50% native tree cover of mesquite (*Prosopis spp.*) and leather-leaf ash (*Fraxinus velutina*); 75% shrub cover of willow (*Salix spp.*), Emory baccharis (*Baccharis emoryi*) and associated species; and 20% bare soil or alkali sacaton (*Sporobolus airoides*).

Rationale: Ash Meadows aquatic and terrestrial habitat was altered from historic conditions as development occurred in the late 1960s and 1970s. At least through 1972 significant habitat destruction was ongoing in Ash Meadows including; leveling land with heavy equipment, stripping streams of riparian vegetation, installing irrigation structures and well drilling (Pister 1974). The major impact was occurring from a lowering of the water table and decreased spring flows (Pister 1974). The Recovery Plan for Ash Meadows Species states that the greatest threats to endemic species are non-native introduced aquatic animals and exotic terrestrial plants. The Recovery Plan also emphasizes the importance of protecting spring outflows and restoring historic channels to enable free movement of listed fish between springs (USFWS 1990).

To allow native species to thrive it is necessary to restore habitats to approximate conditions that existed prior to significant human disturbance. A critical part of any restoration effort is the maintenance of water table levels similar to historic levels. Restoration of hydrologic conditions will increase the residence time of waters throughout the Refuge (Otis Bay 2006). Increasing this residence time should improve access to water resources by resident plant and animal communities as well as migratory birds.

The Refuge is recognized as an Important Bird Area (IBA) by Bird Life International, highlighting its importance to restricted range, migratory bird species and the use of habitat by Federal endangered species. The yellow-breasted chat (*Icteria virens*), a Nevada Partners in Flight focal species that is confined to the use of riparian and shrubby areas in the arid southwest and would benefit from riparian restoration. Habitat associated with spring outflows is also important for the endangered southwestern willow flycatcher (*Empidonax traillii extimus*), which would also benefit from riparian restoration.

Tasks 21 and 211 of the Ash Meadows Species Recovery Plan recommend actions to restore spring flows to historic channels (USFWS 1990). There are: 1,200 ft. of Fairbanks spring channel: Jackrabbit spring to the service road is 6,625 ft of channel; there are 2,346 feet of channel at Warm springs (North and South Indian springs and the associated marsh); and 7,300 feet of channel at Big Spring.

In 1997 Kings Pool water was routed into an excavated channel simulating the historic outflow stream. After the conversion of Kings Pool outflow to approximate historic conditions there was a shift in species composition from 23% to 91% native fish (Scoppettone et al. 2005), suggesting that restoration of habitat may be an effective recovery strategy for endangered fish on other parts of the Refuge. Removal of Ash Meadows Road is recommended to restore the historic outflow channels of Point of Rocks, Kings and Forest Springs and to reconnect ash and mesquite forest patches (Otis Bay 2006).

Strategies

- 2.3.1 Conduct an assessment of berms, ditches, dams, impoundments, and reservoir basins
- 2.3.2 After assessment initiate removal of berms, ditches, dams, impoundments, and unnecessary roads within the Warm Springs, Jackrabbit/Big Springs, Upper Carson Slough, and Crystal Springs units to restore natural hydrology on a landscape scale
- 2.3.3 Minimize and control impacts of cattail on aquatic habitat as detailed in the Refuge IPM plan (USFWS 2006), including removal from outflow channels at Kings, Point of Rocks, and Crystal springs
- 2.3.4 Restore natural average and range of variability, flood frequency, water quality and water table elevation for open water at Peterson Reservoir and Horseshoe Reservoir
- 2.3.5 Restore Crystal Spring outflow to historic channel, through the administrative area, when the office/visitor center is relocated
- 2.3.6 Incorporate the hydrologic and geomorphic restoration recommendations from the Geomorphic and Biological Assessment (Otis Bay 2006) into restoration and management activities
- 2.3.7 Identify and develop partnerships with providers of restoration nursery stock
- 2.3.8 Design control structure to allow water management and invasive species management as needed for restored springs
- 2.3.9 Evaluate nutrient input to streams from roads

- 2.3.10 Implement the plan for the modification or removal of Crystal Reservoir that minimizes adverse environmental impacts
- 2.3.11 Same as 1.5.7
- 2.3.12 Install temporary fish barriers until bass eradication is complete at Big and Jackrabbit springs
- 2.3.13 Inventory, assess, and mitigate landscape disturbances including graded lands, mines, fences and other disturbances

Objective 2.4: Within 10 years, reduce salt cedar (*Tamarix spp.*) and Russian knapweed (*Acroptilon repens*) distribution by 50 to 95% of the 2006, baseline distribution on 4,000 acres of Refuge land and work with the Bureau of Land Management (BLM) to control Russian knapweed and salt cedar on the adjacent BLM Area of Critical Environmental Concern.

Rationale: While many non-native species may impact native species and ecosystem function, salt cedar (*Tamarix spp.*) and Russian knapweed (*Acroptilon repens*) have been identified, by Refuge staff, as the most invasive, noxious weeds on the Refuge. Salt cedar is a Category C (currently established and widespread) noxious weed in Nevada and Russian knapweed is a Category B (established in scattered populations in State) noxious weed in Nevada (NDOA 2006). Both species degrade Refuge habitat and controlling Russian knapweed is a necessary partnership with Nevada resource agencies, to prevent its further spread. The Refuge has received funding, from the Southern Nevada Public Lands Management Act, to implement an integrated pest management (IPM) plan to control salt cedar, knapweed and other invasive plant species on the Refuge. Currently the NDOW recommends that goats not be used for invasive plant control, due to possible transmission of diseases carried by goats and domestic sheep to wild, big horn sheep (*Ovis canadensis nelsoni*) populations. The relative risks and benefits of various invasive species control methods, have been analyzed in the course of finalizing the Refuge IPM Plan.

Strategies

- 2.4.1 Implement non-native plant species control as outlined in the IPM plan for all habitat types
- 2.4.2 Within ten years, reduce salt cedar and Russian knapweed distribution by 75 to 95% of the 2006 distribution on 4,000 acres of Refuge land and work with BLM to control salt cedar and Russian knapweed on adjacent BLM land
- 2.4.3 Same as 1.5.7

Objective 2.5: Reduce or contain crayfish populations, Refuge wide, such that current distributions are not exceeded.

Rationale: Crayfish directly prey on native endemic species, such as fish, invertebrates and aquatic vegetation, directly impacting those species. Crayfish may also indirectly impact native invertebrate species through competition. Ash Meadows speckled dace (*Rhinichthys osculus nevadensis*), which typically occur near the bottom of spring systems are thought to be particularly vulnerable to predation by crayfish (Williams and Sada 1985). Crayfish have also been observed feeding on Ash Meadows Amargosa pupfish (*Cyprinodon nevadensis mionectes*) (Williams and Sada 1985). Removal of crayfish is necessary to sustain healthy populations of native endemic species. Task 2322 of the Ash Meadows Species Recovery Plan recommends actions consistent with this objective (USFWS 1990). On the Refuge crayfish are known to occur in all aquatic systems except for a few Warm Springs areas and a few seeps (Goodchild 2006).

Strategies

- 2.5.1 Regularly trap and remove crayfish from spring habitats by implementing crayfish control strategies identified during development of the Refuge IPM plan. Focus on 10 most infested and important aquatic systems (Marsh, N & S Indian, N & S Scruggs, Jackrabbit, Kings, Point of Rocks, Big, Crystal springs, and Bradford Spring) and expand program as necessary
- 2.5.2 Evaluate alternative crayfish control strategies (sterilization, biological control) in cooperation with other agencies

Objective 2.6: Manage 7,850 acres and within fifteen years restore 650 acres of alkaline meadow/wet meadow habitat for native plant communities dominated by alkali sacaton (*Sporobolus airoides*) and salt grass (*Distichlis spicata*) with other native vegetation cover ranging from 10-90% cover including Hall's meadow hawksbeard (*Crepis runcinata*), alkali cordgrass (*Spartina gracilis*), beardless wildrye (*Leymus triticoides*), Baltic rush (*Juncus balticus*), foxtail barley (*Hordeum jubatum*), *Atriplex spp.* and associated native plant species.

Rationale: Several endemic species are predominately found in alkaline wet meadow habitat including the threatened spring loving century (*Centaureum namophilum*) and Ash Meadows Ivesia (*Ivesia kingii var. eremica*) (Otis Bay 2006). Increasing the wet meadow to alkaline meadow ratio will more closely approximate historic conditions and mitigate historic human impacts to select areas. Restoring historic conditions should also minimize distribution of non-native plant species and favor native, endemic terrestrial and aquatic species. Restoration of native grassland conditions will increase suitable habitat for Ash Meadows montane voles (*Microtus montanus nevadensis*) a Species of Conservation Priority, which use this habitat type for foraging and nesting (NDOW 2005). In the Mojave Desert, alkali meadows are restricted to areas where the water table is 1-3 meters deep, making groundwater maintenance essential to the sustenance of this habitat type (Otis Bay 2006) and the resulting contribution to the biological integrity, diversity and environmental health of the Refuge ecosystem. Seasonally inundated wet meadows produce large quantities of insects that are a rich food source for bats and insectivorous birds (NDOW 2005). Lowland wet meadows also provide valuable habitat for amphibians which use the habitat as late-summer refugia and winter hibernacula (NDOW 2005).

In coordination with the FHA and Nye County a transportation plan is being developed that, in part, will address the impact of roads, on-road vehicles and off-road vehicles on habitat maintenance and restoration. Wet meadows are highly susceptible to damage by motorized recreation. Rutting from off road vehicles and soil compaction can alter the natural hydrology of the meadows reducing their value for wildlife (NDOW 2005). Poor road placement has also led to degradation of wet meadow habitat through erosion, changes in hydrology and other direct impacts (NDOW 2005). The NDOW has requested that primitive access to the north east portion of the refuge be allowed via an un-maintained road. The un-maintained road provides access to maintain two wildlife water developments on BLM land (NDOW 2006).

Strategies

- 2.6.1 Restore and maintain historic hydrology
- 2.6.2 Actively revegetate where appropriate with salt grass and alkali sacaton
- 2.6.3 Monitor changes over time as restoration is implemented

2.6.4	Same as 1.5.1
2.6.5	Develop restoration plan for entire Carson Slough
2.6.6	Remove and revegetate roads deemed unnecessary
2.6.7	Inventory, assess, mitigate, and initiate restoration of roads
2.6.8	Evaluate current land uses such as utility corridors and ensure regulatory compliance
2.6.9	Maintain Spring Meadows Road and allow non-commercial through traffic
2.6.10	Maintain existing boundary fence as a wild horse enclosure
2.6.11	Repair post and cable barriers and install other barriers where needed to protect resources
2.6.12	Replace or add gates on service or fire roads and sign them
2.6.13	Maintain closure of nonessential roads
2.6.14	Increase law enforcement to prevent off highway vehicles, fires, collecting of species, and other inappropriate activities
2.6.15	Add 11 to 15 road gates to prevent unauthorized use of roads and resource damage
2.6.16	Develop a Resurfacing Plan for main roads through and on the Refuge that considers the restoration of slough hydrology
2.6.17	Same as 1.5.7
2.6.18	Same as 2.4.1
2.6.19	Complete the Refuge Transportation Plan

Objective 2.7: Within fifteen years restore 550 acres of lowland riparian habitat with native plant communities including an overstory of leather-leaf Ash (*Fraxinus velutina*), narrow-leaved willow (*Salix exigua*), Goodding's willow (*Salix gooddingii*), Fremont cottonwood (*Populus fremontii*), quailbrush (*Atriplex lentiformis*), arrow weed (*Pluchea sericea*), Emory baccharis (*Baccharis emoryi*) and other associated native plant species.

Rationale: Lowland riparian habitat is important for many Federal endangered species act listed or species of concern including the endangered southwest willow flycatcher (*Empidonax traillii eximius*), American peregrine falcon (*Falco peregrinus*), vermilion flycatcher (*Pyrocephalus rubinus*), Phainopepla (*Phainopepla nitens*), long-eared myotis (*Myotis evotis*) as well as many other migratory birds and resident animals (Recon 2000). The Final Recovery Plan for Southwest Willow Flycatchers requires the establishment of 25 southwest willow flycatcher territories in the Amargosa management unit (an increase of 22 territories, from 2002 levels) to meet the recovery objectives (SWFRRTS 2002). The Refuge is listed as one of five river reaches, within the Amargosa unit, where southwest willow flycatcher habitat restoration efforts should be focused (SWFRRTS 2002). Riparian habitat is also critical to migratory species such as the yellow-breasted chat, a Partners in Flight focal species.

Restoring 550 acres of lowland riparian habitat on the Refuge would support the Nevada Steering Committee Intermountain West Joint Venture (NSCIWJV) Priority A objective for lowland riparian habitat to "Permanently protect and/or restore 300 linear miles of lowland riparian habitat in Nevada" (NSCIWJV 2005). Lowland riparian habitat is quite limited in the region and restoring lowland riparian habitat will contribute to the biological integrity, diversity and environmental health of the surrounding region and the National Wildlife Refuge System as a whole. The BLM plans to manage public lands, adjacent to the Refuge, to complement spring and aquatic habitat for special status species (Recon 2000). Restoring lowland riparian habitat to natural dynamic, heterogeneous conditions will simultaneously benefit many imperiled species (USFWS 2002c).

Strategies

2.7.1	Same as 2.4.1
2.7.2	Revegetate with native Ash, willows, cottonwood, etc.
2.7.3	Restore historic hydrologic conditions
2.7.4	Obtain historic plant distribution through pollen analysis and refine restoration acreage targets
2.7.5	Same as 2.6.7
2.7.6	Same as 2.3.10
2.7.7	Same as 1.5.7

Objective 2.8: Manage 2,000 acres of mesquite bosque for native habitat with a complex overstory of predominantly honey mesquite (*Prosopis glandulosa torreyana*), screw bean mesquite (*Prosopis pubescens*), narrow-leaved willow (*Salix exigua*), Goodding's willow (*Salix gooddingii*), Emory baccharis (*Baccharis emoryi*) and understory plants including saltbush (*Atriplex spp.*), bushy bluestem grass (*Andropogon glomeratus*), ryegrass (*Elymus cinereus*), foxtail barley (*Hordeum jubatum*), pine blue grass (*Poa scabrella*), salt grass (*Distichlis spicata*), aster (*Aster spp.*) and other associated native plant species.

Rationale: In many areas mesquite bosques are being lost to urban and suburban development, woodcutting, sand and gravel mining, human-caused wildfires and have been significantly invaded by non-native plants including salt cedar (*Tamarix spp.*) (NDOW 2005). Mesquite bosques are found in areas with deep soil and shallow water tables, such as riparian areas and the edges of dry lake beds and were historically dominated by honey mesquite (*Prosopis glandulosa*) (NDOW 2005). Mesquite bosques support a disproportionately greater number of wildlife species than the surrounding desert scrub (BLM 1999) and are especially critical in the summer and during drought years because often they retain the only green vegetation left in the Mojave landscape (NDOW 2005). Mesquite bosques are known to provide valuable habitat for many migratory bird species, as well as resident species native to the Mojave ecosystem. At least 65 species of birds have been observed using mesquite bosques as migratory stopover sites, breeding sites or wintering areas (BLM 1999) including species of concern such as Phainopepla (*Phainopepla nitens*), Lucy's warbler (*Vermivora luciae*) (NDOW 2005) and priority birds like the loggerhead shrike (*Lanius ludovicianus*) (NSCIWJV 2005). Lucy's warbler is also on the Partners in Flight watch list of Species of Continental Importance for the U.S. and Canada (Rich et al. 2004). Bats such as the California Leaf-nosed bat (*Macrotus californicus*), a species of concern, spend the majority of forage time in desert washes within bosques and other bat species use ephemeral water sources in washes seasonally (Altenbach et al. 2005). In addition, another species of concern, the Ash Meadows montane vole uses mesquite bosque habitat for burrowing and foraging (NDOW 2005).

An objective of the State of Nevada Comprehensive Wildlife Conservation Strategy is to: "Expand protected status for mesquite bosque and desert wash ecological systems through 2015 with stands in stable or increasing condition trend" (NDOW 2005). Managing mesquite bosque habitat on the Refuge supports a Priority A goal of the Coordinated Implementation Plan for Bird Conservation in Nevada to "Minimize the loss of mesquite and catclaw habitats whenever possible" (NSCIWJV 2005).

Strategies

2.8.1	Same as 2.4.1
2.8.2	Restore historic hydrology and revegetate mesquite bosques and dunes along spring channels and in former agricultural fields
2.8.3	Same as 2.6.7
2.8.4	Maintain policy of no mesquite wood collection on the Refuge through law enforcement as well as educational outreach to visitors
2.8.5	Use prescribed fire where appropriate to create, improve or maintain desired plant and animal communities, as well as to treat hazardous fuels
2.8.6	Manage wildland fires on the refuge using the fitting Appropriate Management Response which considers resource values at risk and potential negative impacts of various fire suppression measures (firefighter and public safety will be the highest priority on every incident)
2.8.7	Rehabilitate 30-45% of old agricultural fields by controlling invasive species and installing native plants

Objective 2.9: Manage 11,000 to 11,500 acres for a range of native upland desert plant communities including gradations between: warm desert scrub communities including creosote bush (*Cryptantha angustifolia*), white bursage (*Ambrosia dumosa*), white bursage four winged salt bush (*Atriplex canescens*), desert holly (*Atriplex hymenelytra*), beaver tail cactus (*Opuntia basilaris*), indigo bush (*Psoralea fremontii*), Mojave aster (*Xylorhiza tortifolia*) and desert chikory (*Rafinesquia neomexicana*); dry ridgetop plant communities of predominately cotton top (*Echinocactus polycephalus*), bevertail cactus (*Opuntia basilaris*), cholla (*Opuntia spp.*) and associated native plant species; shrub/scrub habitat including arrow saltbush (*Atriplex phyllostegia*), desert saltbush (*Atriplex polycarpa*), alkali rabbitbrush (*Chrysothamnus albidus*), box-thorn (*Lycium shockleyi*), greasewood (*Sarcobatus vermiculatus*) and other associated native plant species.

Rationale: Over 12,400 acres of the Refuge is currently passively managed as desert upland habitat (Otis Bay 2006). Two species of concern, chuckwalla (*Sauromalus ater*) and burrowing owl (*Athene cunicularia hypugae*) respectively use creosote dominated upland habitat for protection from predators and burrowing sites (NDOW 2005). After fencing to exclude wild horses and burrows, major threats to this habitat type on the Refuge include soil compaction and damage to shrubs by off-highway vehicles and invasive understory species (NDOW 2005).

Strategies

2.9.1	Same as 2.4.1
2.9.2	Same as 2.6.14
2.9.3	Develop and implement plan to remove dikes in uplands
2.9.4	Same as 2.6.7
2.9.5	Same as 2.6.10
2.9.6	Same as 1.5.7

Objective 2.10: Within fifteen years restore 150 acres of emergent marsh, as outlined in the 2006 Biological Assessment, through removal of barriers between stream channels and manage for plant communities dominated by bulrushes (*Scirpus spp.*), saw-grass (*Cladium californicum*) and rushes (*Juncus spp.*) with only minimal, sporadic patches of southern cattail (*Typha domingensis*).

Rationale: Refuge marshes provides rich habitat for native endemic fish, migratory birds, resident amphibians and resident aquatic invertebrates (NDOW 2005). Marsh habitat that is inundated year round, with spring water sources, is of particular importance for resident amphibians and endemic fish species of conservation priority including the Ash Meadows Amargosa pupfish (*Cyprinodon nevadensis mionectes*) (NDOW 2005). Breeding populations of the endangered Yuma clapper rail (*Rallus longirostris yumanensis*) and species of concern such as the black tern (*Chlidonias niger*) require marsh habitat for nesting and feeding (NDOW 2005). In addition, the threatened bald eagle (*Haliaeetus leucocephalus*) is known to find prey in marsh habitat (NDOW 2005), but have only inconsistently been reported at Ash Meadows (Baldino 2006).

Early successional stage cattail marsh is considered essential to maintain and expand breeding populations of Yuma clapper rail (USFWS 1983). Native, cattail species were not historically abundant in Ash Meadow’s marshes. Historically Ash Meadows marshes were dominated by bulrushes (*Scirpus spp.*), saw-grass (*Cladium californicum*) and rushes (*Juncus spp.*), but changes in hydrology and nutrient dynamics have led to marshes dominated by native cattail (*Typha domingensis*). According to Dr. Frank Coville, a botanist with the Death Valley Expedition of 1891, cattail occurred "...sparingly at several points...". Returning marshes to historic states will require replicating historic conditions such as open water, low nutrient input and short-term control of cattail until historic plant communities can become established.

Restoring Refuge marsh wetlands supports the statewide Priority A wetlands objective of the Coordinated Implementation Plan for Bird Conservation in Nevada to "Permanently protect and/or restore 25,000 acres of high-quality wetlands and associated habitats in Nevada" (NSCIWJV 2005). An objective of the State of Nevada Comprehensive Wildlife Conservation Strategy is: "(an) Increase in wetland management potential through purchase of water rights and wetland improvement projects by 2015" (NDOW 2005).

<i>Strategies</i>	
2.10.1	Restore spring systems as described in the 2006 Geomorphic and Biological Assessment
2.10.2	Design marsh habitat restoration with emphasis on bird and bat forage
2.10.3	Same as 2.5.1
2.10.4	Same as 2.4.1
2.10.5	Same as 2.6.7

Objective 2.11: By 2009, develop a step-down plan for the modification and/or removal of Crystal Reservoir and implement the plan if funding is available.

Rationale: Carson Slough and the associated riparian area was severely degraded due to late twentieth century agriculture, peat mining and construction of a dam which resulted in the creation of Crystal Reservoir. The artificial habitat formed by the impounded Crystal Reservoir is a site infested by predacious, non-native fish, which are identified within the Ash Meadows Recovery Plan for removal. The inadequately engineered Crystal dam shows signs of failing and poses a serious liability issue for the Refuge and a number of safety issues for Refuge visitors.

The Crystal Reservoir dam has the potential for catastrophic failure, and there is a need to remove the structure. Failure of this dam would scour habitat below the reservoir, which would likely destroy the largest population of the endangered Amargosa niterwort within Nevada. Other listed plants, including the Ash Meadows ivesia, spring-loving centaury and the Ash Meadows gumplant, also occur

downstream of the dam and are in danger, as is a large population of the endangered Ash Meadows Amargosa pupfish. The unique alkaline soils below the reservoir also support a unique ecosystem, which would be lost if Crystal dam failed. Riparian areas on the Refuge provide valuable habitat for migratory and resident bird species. Any restoration of riparian habitat, including Crystal Spring restoration, will increase the acreage of habitats used by migratory and resident birds.

Crystal Reservoir has also tended to attract uses that are unrelated to or that directly conflict with Refuge purposes. Ongoing public safety issues at Crystal Reservoir have included swimmers itch (dermatitis caused by parasite infection), large uncontrolled public fires, waste generated by large public barbeque events, stolen car disposal, waste dumping and illegal firearms discharge. Activities at this area are a potential liability risk for the Refuge and consume resources that would more appropriately be used for management activities related to Refuge purpose.

<i>Strategies</i>	
2.11.1	Obtain biological and geomorphic data to inform demolition and restoration plan for Crystal Reservoir
2.11.2	Develop methods to remove Crystal Reservoir that minimize environmental impacts, including impacts to threatened and endangered species
2.11.3	Consult independent science advisory team for review and improvement of the ecosystem approach to Refuge management
2.11.4	Refuge Manager will direct changes in management after consideration of science advisor team recommendations

Objective 2.12: Continue ongoing efforts to acquire remaining lands within the authorized Refuge boundary from willing sellers.

Rationale: The Service currently owns 13,827 acres within the approved refuge boundary. Another 9,460 acres are managed under cooperative agreement with the BLM. Approximately 40 acres of Refuge lands are managed by the NPS. The pending land and mineral withdrawal would transfer these lands to the Service. Another approximately 680 acres of land within the approved refuge boundary remain under private ownership. Completing acquisition of contiguous land within the Refuge boundary will optimize the Service’s ability to manage the Refuge for its intended purposes.

<i>Strategies</i>	
2.12.1	Continue coordination with private landowners to protect Refuge resources
2.12.2	Establish conservation agreements or acquire in-holdings from willing sellers
2.12.3	Complete the pending land and mineral withdrawal with the BLM
2.12.4	Continue ongoing efforts to acquire remaining lands within the approved Refuge boundary from willing sellers

Research (Goal 3). Encourage and provide opportunities for research which supports Refuge and Service objectives.

Objective 3.1: Monitor the impacts of non-native aquatic animals including red-rim melania (*Melanoides tuberculata*), bullfrog (*Rana catesbeiana*), crayfish (*Procambarus clarkii*) and non-native

fish on Refuge native aquatic species through laboratory/field experiments and adaptively develop/test eradication technologies in all Refuge aquatic environments.

Rationale: Loss of endemic, aquatic species is likely to occur due to non-native invasive aquatic animal predation on and competition with native species. Non-native fish that have been documented on the Refuge include; sailfin mollies (*Poecilia latipinna*), mosquito fish (*Gambusia affinis*), largemouth bass (*Micropterus salmoides*) and arawana (*Osteoglossum bicirrhosum*) (Williams and Sada 1985). By 1990 the arawana were not detectable, but the other exotic fish remained (USFWS 1990). Convict cichlids (*Archocentrus nigrofasciatus*, surviving), green sunfish (*Lepomis cyanellus*, surviving), koi (*Cyprinus carpio*, may not survive, but reported), goldfish (*Carassius auratus*, surviving) have been reported in Refuge reservoirs or have been detected in spring systems. Crayfish are not native to the Refuge or surrounding area, but have been introduced and have established breeding populations. By the early 1980s red swamp crayfish (*Procambarus clarkii*) were established in larger spring systems on the Refuge (Williams and Sada 1985). Crayfish have been observed feeding on endangered Ash Meadows Amargosa pupfish (*Cyprinodon nevadensis mionectes*). Ash Meadows speckled dace (*Rhinichthys osculus nevadensis*) are thought to be particularly vulnerable to crayfish predation due to the dace's benthic habit (Williams and Sada 1985). Presently crayfish are known to be present in at least 10 spring systems on the Refuge (Otis Bay 2006). The bullfrog (*Rana catesbeiana*) is not native to the Refuge or surrounding area and bullfrogs prey on, compete with and displace native species. The red-rim melania snail (*Melanoides tuberculata*) is not native to the Refuge or surrounding area and can compete with and displace native species. The red-rim melania is also a transmission vector for parasites that can impact resident species (GSMFC 2006).

Information obtained during adaptively managed control of invasive aquatic animals could also be applicable to numerous other Refuges and other locations throughout Nevada and the western US. The State of Nevada's Comprehensive Wildlife Conservation Strategy (2005) emphasizes preventing the spread of crayfish to new locations and eradicating introduced crayfish where they threaten other aquatic species. Tasks 232 and 2321 of the Ash Meadows Species Recovery Plan (USFWS 1990) recommend removal of non-native aquatic species and conducting research if necessary to determine the best removal methods while minimizing any impacts to listed and candidate species.

<i>Strategies</i>	
3.1.1	Conduct a literature review of aquatic invasive species ecology, trophic interactions and eradication treatments, for species identified as detrimental to native Refuge species
3.1.2	Conduct experiments on Refuge habitat and species impacts and trophic interactions due to aquatic invasive species
3.1.3	Develop funding partnerships for aquatic invasive species eradication studies
3.1.4	Conduct a study of crayfish ecology on Refuge
3.1.5	Conduct laboratory and field experiments on eradication/control techniques
3.1.6	Study exclusion methods to restrict movement of non-native fish (ex. large mouth bass, green sunfish, etc.) into native fish habitat
3.1.7	Use study results to inform an IPM plan for aquatic invasive species
3.1.8	Continue working with USGS, USFWS Endangered Species program, NDOW and other partners

Objective 3.2: Experiment with a variety of control methods for each invasive plant species on Refuge and monitor effectiveness of treatment.

Rationale: Invasive plants displace native and endemic plant species and alter fire regime, plant community composition and wildlife diversity. More precise and effective means of control are necessary in order to minimize impacts to desirable native species and maximize efficient use of Refuge resources while controlling or eradicating invasive plant species. Salt cedar (*Tamarix spp.*), an invasive tree species, dominates significant portions of habitat on the Refuge (Otis Bay 2006). Although southern cattail (*Typha domingensis*) is a native species, alteration of hydrologic and nutrient dynamics on the Refuge has caused cattail to form dense monocultural stands, degrading marsh habitat. Until restoration of the Refuge is complete, cattail will require management to reduce stands and to maintain cattail in an early successional state that is considered essential for breeding populations of endangered Yuma clapper rail (*Rallus longirostris yumanensis*) (USFWS 1983). According to Otis Bay (2006), many of the native plants on the Refuge may be fire sensitive and slow to recover from prescribed burning. By contrast non-native plant species such as salt cedar and annual grasses can regenerate and spread quickly after fires (Otis Bay 2006). It is likely that general use of prescribed burning would favor established non-native plant species such as salt cedar and annual grasses. For these reasons it will be necessary to carefully apply prescribed burning with full consideration of integrated pest management strategies for non-native plant species. Task 2221 of the AM Species Recovery Plan (USFWS 1990) recommends consultation with the agency most experienced with removal of salt cedar and Russian olive (*Elaeagnus angustifolia*) for advice and conducting supplemental research as needed. The NDOW recommends that goats not be used for invasive plant control, due to possible transmission of diseases carried by goats and domestic sheep to wild big horn sheep (*Ovis canadensis nelsoni*) populations.

Strategies

- | | |
|-------|---|
| 3.2.1 | Establish invasive plant control monitoring plots |
| 3.2.2 | Evaluate salt cedar control methods |
| 3.2.3 | Evaluate cattail control methods |
| 3.2.4 | Evaluate knapweed control methods |
| 3.2.5 | Evaluate control methods for other invasive plant species |
| 3.2.6 | Same as 2.8.5 |
| 3.2.7 | Same as 2.8.6 |

Objective 3.3: Conduct an ongoing study of Refuge ecosystem dynamics, energetics, taxonomy and ecology focusing on alkali meadow/springs habitat.

Rationale: Increased scientific knowledge of alkali meadow/springs habitat may support the legal protection of groundwater resources. Most Refuge endemic plant species occur in alkali meadow habitat and enhancing understanding of alkali meadow ecosystem dynamics will contribute to optimal management of this important habitat type.

Strategies

- | | |
|-------|--|
| 3.3.1 | Work to obtain funding for trophic level studies |
| 3.3.2 | Complete studies and analysis of historic data to link uplands, alkali meadows, and springs habitats |
| 3.3.3 | Conduct studies to obtain basic life history information for endemic and listed plant species |
| 3.3.4 | Conduct taxonomic studies of Refuge plant species |

- 3.3.5 Conduct monthly monitoring of ground water (ex. wells and flumes)
- 3.3.6 Conduct monthly monitoring of discharge from springs

Objective 3.4: Obtain baseline data on local climate within the three major Refuge drainage basins.

Rationale: Obtaining reliable and accurate climate data can support species recovery efforts, provide legal protection of water resources and can inform the evaluation of dams and impoundments. Currently Refuge staff have inadequate data on local climate trends to adequately support management decisions, necessitating the need for more accurate and reliable local climate data information.

Strategies

- 3.4.1 Install a weather station within each of the three major drainage basins
- 3.4.2 Obtain core samples from old spring mounds, Carson Slough, etc.
- 3.4.3 Conduct tree ring studies on local species to determine growth patterns over long periods of time, to infer past climate conditions, climate change over time and to inform fire management by determining past, natural fire regimes
- 3.4.4 Conduct studies of past pollen and spore distribution (palynology studies) to infer past climate conditions and climate change over time
- 3.4.5 Maintain a GIS based weather database

Objective 3.5: Refine understanding of terrestrial habitat use by mammals, herpetofauna, birds and invertebrates through ongoing faunal inventory.

Rationale: To fulfill the Refuge purpose, the Service needs reliable data on Refuge habitat use by threatened and endangered species. Accurate data on habitat use by Federal endangered species act listed species, bats, reptiles, amphibians and other native species is currently lacking. Little is known about the distribution and abundance of terrestrial fauna, making species management difficult or impossible. Of particular importance is an assessment of the population status of the Ash Meadows montane vole (*Microtus montanus nevadensis*), a species of conservation priority (NDOW 2005). The Ash Meadows montane vole may already be extinct, but was known to live on the Refuge property historically. Task 6512 of the Ash Meadows Species Recovery Plan recommends conducting surveys to determine the location, extent and size of existing terrestrial species populations (USFWS 1990).

Strategies

- 3.5.1 Develop funding sources and partnerships
- 3.5.2 Conduct comprehensive Refuge terrestrial species inventory
- 3.5.3 Conduct bat studies
- 3.5.4 Obtain baseline information on reptiles and amphibians
- 3.5.5 Conduct a one-year assessment on the relationship between coarse woody debris and terrestrial invertebrates and continue annual monitoring if feasible
- 3.5.6 Assess contribution of invertebrates associated with coarse woody debris to terrestrial macrofauna diet

Objective 3.6: Conduct a two year study of impacts of road-generated dust on each listed plant.

Rationale: Roads often lead to direct wildlife mortality, through vehicle collisions as well as indirect impacts through habitat fragmentation. Refuge roads cross known areas of endemic plant species critical habitat, likely having a negative impact on that critical habitat.

Strategies

- 3.6.1 Develop funding sources and partnerships
- 3.6.2 Evaluate dust impacts to listed plants through two-year studies (lab and field work) and generate recommendations to inform road management

Objective 3.7: Conduct a study to assess the composition, distribution, fire regimes, drought patterns and flood regimes of Refuge vegetation communities prior to circa 1850.

Rationale: Increasing scientific understanding of vegetation community change through time will inform Refuge staff and improve the efficiency of restoration and recovery efforts. Given the range of disciplines necessary for the successful completion of a complex study of historic vegetation patterns, it will likely be necessary to partner with others to achieve this objective. Tasks 221, 2211 and 2212 of the Ash Meadows Species Recovery Plan recommend actions consistent with this objective (USFWS 1990).

Strategies

- 3.7.1 Same as 3.6.1
- 3.7.2 As funds become available establish a cooperative agreement with a university program to complete studies leading to a final report
- 3.7.3 Use disciplines such as paleontology, and archeology to research historic conditions
- 3.7.4 Same as 3.4.3
- 3.7.5 Same as 3.4.4
- 3.7.6 Attempt to determine the historic fire regime for Ash Meadows prior to broad establishment of invasive species

Objective 3.8: Develop and implement an information management system at the Refuge, in part through GIS database creation and management.

Rationale: Significant progress has been made on a GIS database in the course of completing the Refuge Geomorphic and Biological Assessment (Otis Bay 2006). Allowing access to as much relevant data as possible in a single location on the Refuge will allow Refuge staff and partners access to the information necessary for applied research and monitoring of Refuge resources. Increasing the accessibility of information such as vegetation monitoring data, wildlife monitoring data and water resource data at a single location on Refuge will facilitate the best possible management of Refuge resources.

Strategies

- 3.8.1 Develop funding sources and partnerships
- 3.8.2 Develop a data management plan and adopt relevant data standards
- 3.8.3 Identify and archive existing datasets, including hard copy only data (ex. maps, photos, diaries, etc.)
- 3.8.4 Partner with NPS, BLM and State

Objective 3.9: By 2010, complete a feasibility study to clarify the need for construction of an on-site research facility.

Rationale: Lack of facilities at the remote Refuge site has limited the ability of scientists to conduct research that would enhance Refuge management. Given that wetlands on the Refuge are recognized as of international importance, by the Ramsar convention on wetlands treaty, it is likely that providing facilities and access to independent scientists would result in an increase in applied research on resident species. Providing adequate facilities for visiting researchers, on the remote Refuge, should increase understanding of resident Refuge species and communities. Ongoing and planned restoration activities will provide a wealth of opportunities to monitor the response of managed species and their habitats and additional monitoring by independent researchers would likely yield useful information for adaptive management.

<i>Strategies</i>	
3.9.1	Secure funding for a feasibility study for an on-site research facility
3.9.2	Contract a feasibility study for location and design of an on-site research facility

Visitor Services (Goal 4). *Provide visitors with wildlife-dependent recreation, interpretation, and environmental education opportunities that are compatible with, and foster an appreciation and understanding of Ash Meadows National Wildlife Refuge’s wildlife and plant communities.*

Objective 4.1: Develop and begin implementing an Environmental Education Plan by 2010.

Rationale: Environmental education is a priority public uses identified in the NWRS Improvement Act of 1997 and is an important component of resource protection, conservation and wildlife-dependent recreational opportunities available at the Refuge. Development of an Environmental Education Plan will provide a management tool for Refuge staff to evaluate opportunities for education on and off the Refuge. Providing scientifically based, age-appropriate education to the public on the unique species and habitats present on the Refuge should enhance understanding and increase appreciation of Refuge resources. Providing environmental education at local community events would continue to inform the public about recreational opportunities on the Refuge and could increase the number of visitors to the Refuge. The development, implementation and ongoing improvement of a program for education, interpretation, and outreach will require additional resources, as well as coordination with local schools, other resource agencies as well as conservation and user groups.

<i>Strategies</i>	
4.1.1	Incorporate volunteers in habitat restoration and maintenance efforts, such as litter removal
4.1.2	Provide visitor information on endangered species protection measures at the visitor contact station and entrance kiosk
4.1.3	Assess visitor education needs and opportunities
4.1.4	Incorporate environmental education goals of Ash Meadows Recovery Plan, Clark County Multiple Species Habitat Conservation Plan and Ramsar Convention on Wetlands
4.1.5	Contact local schools and provide at least three to five on-site programs a year

4.1.6	Work with possible public, NGO, and private partners to develop off-site refugium for pupfish to promote awareness of the endangered pupfish and other endemic species at the Refuge
4.1.7	Develop cooperative agreements with public, non-government entities and private partners to provide off-Refuge educational outreach to the local public on the value of the Refuge for wildlife and the public
4.1.8	Have staff provide off-Refuge educational outreach to the local public on the value for wildlife and the public of Ash Meadows NWR by participating in two to three local community events annually
4.1.9	Create and maintain a list of local community events
4.1.10	Contact event organizers to arrange for not for profit booth/table space or other opportunities for participation
4.1.11	Handout Refuge related educational materials and/or make presentations at local events
4.1.12	Develop an outreach Plan to support the Carson Slough Restoration Plan
4.1.13	Develop a an educational video on the endemic fish and other wildlife of Ash Meadows NWR
4.1.14	Obtain funding for and hire: 1 interpretive staff

Objective 4.2: Begin implementation of the Ash Meadows NWR Interpretation Plan.

Rationale: Interpretation is a priority public use identified in the NWRS Improvement Act of 1997 and is an important component of visitor recreational opportunities available at the Refuge. Providing both user-directed and staff facilitated high quality interpretation of the unique species, habitats and other resources present on the Refuge will enhance the visitor's passive and active experience. Development of an Interpretation Plan will provide a structure for the Refuge staff to evaluate opportunities for visitor experiences while engaging in interpretation related recreation on the Refuge. The implementation and ongoing improvements of an Interpretive Plan will require additional resources, as well as coordination with other resource agencies, tribes and user groups.

<i>Strategies</i>	
4.2.1	Design and construct boardwalks to follow Kings Pool Stream from parking lot to Kings Pool, with a pool overlook
4.2.2	Design and construct interpretative displays for new boardwalks to be installed at Point of Rocks
4.2.3	Design and construct boardwalk to the Longstreet Cabin and an overlook for the Longstreet Spring pool
4.2.4	Maintain designated roads and visitor use areas
4.2.5	Improve Point of Rocks and Longstreet Cabin parking areas
4.2.6	Maintain current visitor services for wildlife-dependent recreational activities in accordance with existing Public Use Management Plan
4.2.7	Conduct a study of Refuge visitation to determine the number and purpose of visits
4.2.8	Improve signs on Refuge boundary
4.2.9	Include location of Devils Hole and pupfish life history information in Refuge brochures, fact sheets, and maps

4.2.10	Coordinate with Death Valley National Park staff to provide Devils Hole pupfish interpretive materials
4.2.11	Develop multi-lingual interpretative materials and construct new interpretive facilities at Fairbanks Springs
4.2.12	Design and construct other interpretive facilities identified in the Interpretive Plan
4.2.13	Staff visitor contact station five days per week
4.2.14	Improve existing roadways and parking areas to good condition as described in the Ash Meadows Refuge Roads Inventory (2004), based on Geomorphic and Biological Assessment

Objective 4.3: Develop and begin implementing a Refuge Visitor Services Plan by 2008.

Rationale: Visitation of the Refuge has been increasing over time despite minimal Refuge outreach actions. An increase in the regional population and ongoing efforts to inform the public about recreational opportunities have resulted in increasing numbers of visitors to the Refuge. Increasing visitation creates the need for an effective method to evaluate and manage compatible public uses and to assess visitor impacts to the fragile ecosystems on the Refuge. Visitor use facilities need to be designed to accommodate increasing visitation and to promote appropriate wildlife-dependent activities on the Refuge. A Visitor Services Plan will evaluate and prescribe strategies to develop and manage compatible wildlife-dependent recreational opportunities, related infrastructure, and associated staffing and funding needs on the Refuge. A Visitor Services Plan will be useful to engage, educate and coordinate with private property owners, local governments and user groups, and other agencies with jurisdictional responsibilities for Refuge resources.

<i>Strategies</i>	
4.3.1	Same as 4.2.7
4.3.2	Same as 4.2.15
4.3.3	Identify and develop funding sources and partnerships
4.3.4	Design and implement visitor services that enhance visitor satisfaction and optimize protection of Refuge resources
4.3.5	Same as 2.6.15
4.3.6	Same as 4.2.8
4.3.7	Same as 4.2.1
4.3.8	Same as 4.2.3

Objective 4.4: Coordinate with Death Valley National Park to provide a consistent message regarding Refuge and Park resources, focusing on Devils Hole pupfish and influences upon its unique environment.

Rationale: The National Park Service manages 40 acres on the Refuge and has staff with responsibility for interpretation and environmental education regarding Devil's Hole pupfish (*Cyprinodon diabolis*) and their environment. As a globally significant natural feature located within the Refuge and far from Death Valley National Park (Park) proper, the protection and conservation of the fragile Devil's hole ecosystem can be improved through increased coordination between the Refuge and the Park. While Devils hole pupfish can not be viewed by the public in their protected environment, visitors to the Refuge can view related pupfish such as the Ash Meadows Amargosa

pupfish (*Cyprinodon nevadensis mionectes*) in restored Refuge environments. By allowing visitors to view related pupfish, the Refuge offers a unique opportunity to teach visitors about the Devil's hole pupfish and about threatened and endangered pupfish in general. A Cooperative Management Agreement between the Refuge and the Park can optimize protection of the Devil's hole ecosystem by defining partnership roles and responsibilities, decreasing counter productive and duplicative efforts, standardizing research methods and enhancing conservation and environmental education strategies.

Strategies

4.4.1 Meet with Park staff to discuss challenges and opportunities for optimizing interpretation of Devil's Hole resources

4.4.2 Create and distribute interpretative materials about threatened and endangered pupfish

Objective 4.5: Obtain baseline hunting information and within three years create a hunting step-down plan that addresses waterfowl and upland hunting on the Refuge.

Rationale: Development of a step-down hunt plan is necessary to balance stakeholder requests for hunting access with Refuge purposes and other visitor services. Hunting is a priority public use identified in the NWRS Improvement Act of 1997, but hunting must be managed to assure human safety and compatibility with Refuge purposes. Several Refuge areas used by interpretative programs physically overlap with areas of existing hunting use. For safety, other uses should be separated from hunting and an appropriate buffer zone between any interpretative program area and hunting area should be maintained. Little baseline information exists on hunting, so it will likely require in excess of two years to obtain baseline information, analyze the information and create a realistic step down hunting management plan. To protect public safety it will also be necessary to assure an adequate buffer is maintained between Refuge hunting areas and private lands.

Hunting was a public use on some private land at Ash Meadows before it came under Refuge ownership, after Refuge establishment, in 1984. In 1986, an interim Hunt Plan was approved. The interim Hunt Plan authorized hunting until a master plan could be written in 1989. Although the Hunt Plan did not specify where hunting was to occur, it did allow small game, upland game and waterfowl to be hunted. The plan also prohibited off-highway vehicle (OHV) use, swimming in springs and streams, and dispersed camping. In 1994, a revised Compatibility Determination for migratory bird, upland game and waterfowl hunting at Ash Meadows was approved. It was anticipated in the stipulations section of the Compatibility Determination that hunting areas would be restricted to the northern portion of the Refuge to also allow for Refuge use by environmental educators, photographers, hikers, the general public as well as hunters during the hunt season. During the course of this CCP's preparation, NDOW has requested opening a relatively small area along the eastern boundary of the Refuge to bighorn sheep (*Ovis canadensis nelsoni*) hunting, to alleviate confusion with existing hunting units on adjacent BLM land.

Strategies

4.5.1 Continue hunt program under the Interim Hunt Plan until a revised Hunt Plan is completed

4.5.2 Obtain baseline information on Refuge hunting and within 3 years create a hunting step-down plan that addresses waterfowl and upland game hunting

4.5.3 Obtain funding for and hire: 2 law enforcement officers and 1/2 wildlife biologist

4.5.4 Have Complex law enforcement officer monitor hunting occurring on refuge

Objective 4.6: Within five years of funding, complete design and construction of a new Refuge Headquarters/Visitor Contact Station building.

Rationale: Increasing staffing levels will require additional office and storage space and increasing public visitation will require additional facilities to provide visitor services. The historic drainage of the Crystal spring outflow passed through the current office location. To maintain consistency with Refuge purposes, any new facility should be designed with consideration of the historic Crystal Spring drainage and the likely benefits of restoring the historic drainage.

Strategies

4.6.1 Secure funding for a new Refuge Headquarters/Visitor Contact Station building

4.6.2 Contract for a feasibility study for location and design of new building

4.6.3 Contract for construction of the new facility

Cultural and Historic Resources (Goal 5). Manage cultural resources for their educational, scientific, and traditional cultural values for the benefit of present and future generations of refuge users, communities, and culturally affiliated tribes.

Objective 5.1: Create and implement a basic Cultural Resources Management capability at the Refuge to respond to the basic compliance requirements of federal cultural resources legislation.

Rationale: Cultural resources are a non-renewable resource and need to be protected and preserved on the Refuge. Relatively little is known about cultural resources that may be present on the Refuge. Cultural resources discovery, planning, protection and interpretative are generally the result of a habitat- or visitor use-related project effort, but efforts to improve conservation and interpretation of cultural resources should be a priority. The Refuge will require additional resources to conduct the develop of a Cultural Resources Management Plan with appropriate site and project prioritization, surveys, documentation, and conservation, restoration and interpretation strategies. The story of the Refuge and its historic role in the region and the nation are important and exciting elements to be shared with visitors both on- and off-Refuge.

Strategies

5.1.1 Notify the Regional Office Archaeologist when site-specific projects are initiated so that appropriate resource assessments and coordination with Nevada State Historic Preservation Office and culturally affiliated tribes are conducted

5.1.2 Update Refuge brochures and interpretive signage, as staffing and funding allow, with appropriate cultural resources information

5.1.3 Solicit funding for site-specific project efforts from non-Refuge sources, such as Federal Highway Administration, Southern Nevada Public Lands Management Plan, Nevada State Historic Preservation Office, etc.

5.1.4 Incorporate cultural resource values, issues, and requirements into design and implementation of the other habitat, wildlife, and public use activities and strategies conducted by the Desert NWR Complex

- 5.1.5 Compile all existing baseline data on cultural resources sites, surveys, and reports within, and near, the Ash Meadows NWR and create secure digital, GIS, and hard copy databases, maps, and a library

Objective 5.2: Create and implement a proactive historic preservation program in compliance with Section 110 of the National Historic Preservation Act.

Rationale: The National Historic Preservation Act requires the inventory and evaluation of cultural resources on Ash Meadows NWR for planning, scientific, educational, and preservation purposes, and mitigation of adverse impacts caused by erosion and deterioration at significant cultural resources. Creating a proactive cultural resources preservation program is the most effective way to assure compliance with Section 110 of the National Historic Preservation Act. Fulfilling this objective will require incorporation of expertise in cultural resource interpretation and archaeology, beyond current Refuge staff.

Strategies

- 5.2.1 Prepare evaluation criteria and conduct a cultural resource inventory at all public use facilities and areas that would be affected by Refuge projects
- 5.2.2 Inventory, evaluate, and nominate to the National Register Traditional Cultural Properties and sacred sites in consultation with culturally affiliated tribes
- 5.2.3 Inventory, evaluate, and mitigate adverse effects and stabilize samples of cultural resources on Ash Meadows NWR using a research design prepared in consultation with culturally affiliated tribes and the scientific community
- 5.2.4 Conduct a study of ethnobotany and traditional plant use locations on Ash Meadows NWR in consultation with culturally affiliated tribes
- 5.2.5 Create a cultural resource layer in the Complex's GIS that aids in the identification, planning, monitoring and interpretation of cultural sites
- 5.2.6 Secure Refuge System and non-Refuge System funding to develop and implement mitigation, stabilization, or research projects

Objective 5.3: Manage cultural resources and cultural resource information for research, education and interpretation in consultation with appropriate tribes and the public.

Rationale: Many sites on the Refuge may be considered sensitive due to cultural significance for Tribes and the public or susceptibility to damage from visitation. Cultural sites selected for interpretation should be the least sensitive as determined through best professional judgment of the Refuge manager after consultation with a Service archaeologist, relevant tribes and the public. The majority of Ash Meadows NWR was Southern Paiute Aboriginal land, prior to European settlement (SWCA 2004). A small portion of the northern section of the refuge was Western Shoshone Aboriginal land, prior to European settlement (SWCA 2004). Both Tribes should be consulted to assure cultural sensitivity of management activities and to enhance the cultural perspective of interpretation. Accomplishing this objective will require hiring an interpretative specialist.

Strategies

- 5.3.1 Identify and evaluate cultural resources that can educate Refuge visitors on how humans have interacted with wildlife and habitats in the past
- 5.3.2 Consult with culturally affiliated tribes and other stakeholders on ways to use these resources to achieve educational, scientific, and traditional cultural needs
- 5.3.3 Forge partnerships with culturally affiliated tribes and cultural interest organizations
- 5.3.4 Cultivate the Consolidated Group of Tribal Organizations to assist in the development of educational, scientific, and traditional cultural needs for cultural resources management
- 5.3.5 Work with culturally affiliated tribes on projects to restore habitats of important native plants and to harvest (for traditional non-commercial purposes) native plant foods
- 5.3.6 Coordinate with the Complex's recreation and education planners and programs to incorporate cultural resources information into education and interpretive programs and media
- 5.3.7 Consult with culturally affiliated tribes and other stakeholders to design and implement educational materials, programs and activities that would address traditional or sacred resources, and to increase awareness on- and off-Refuge about the sensitivity of cultural resources to visitor impacts and the penalties for vandalism
- 5.3.8 Update Refuge brochures and interpretive signs with appropriate cultural resources information
- 5.3.9 Implement projects to restore habitats associated with important native plants and to harvest (for traditional, non-commercial purposes) native plant foods in coordination with culturally affiliated tribes
- 5.3.10 Conduct a study of ethnobotany and traditional plant use on Ash Meadows NWR in consultation with culturally affiliated tribes
- 5.3.11 Create and implement a site stewardship volunteer program to assist in site monitoring, educational and interpretive programs, and to promote cultural resources conservation in neighboring communities

Objective 5.4: Protect cultural resources by decreasing or preventing looting, vandalism, and deterioration.

Rationale: Protecting Refuge cultural sites will benefit the current and future public by providing them with information on historic human uses of Refuge lands and the importance of preserving the Refuge land and its unique cultural resources. All of the cultural resource sites on the Refuge are currently susceptible to vandalism because of inadequate Refuge staff and funding. Vandalism is likely to increase as Refuge visitation increases with the growing regional and local population and will likely result in damage or destruction of non-renewable cultural resources, preventing those resources from being enjoyed by future generations of Americans. Once the Refuge has been surveyed for cultural resources in the course of developing the Cultural Resources Management Plan, Refuge staff should evaluate the known resources and select a sub-set of cultural resources for both on and off Refuge interpretation. Additional resources would be necessary to develop the interpretive materials, the sites themselves and to monitor the selected sites for visitor use-related impacts.

Strategies

- 5.4.1 Identify and evaluate cultural resources subject to looting/vandalism, erosion, or deterioration and implement steps, including barriers and signs to reduce these threats and preserve the resources
- 5.4.2 Coordinate with the Regional Office, the Nevada State Historic Preservation Office, tribes, special interest groups, and neighboring land management agencies to support cultural resources monitoring and enforcement activities and to decrease impacts to cultural resources
- 5.4.3 Coordinate future research, management, and planning on cultural resources with culturally affiliated tribes, the Consolidated Group of Tribal Organizations, the Nevada State Historic Preservation Office, neighboring land management agencies, and other special interest groups

Desert National Wildlife Refuge

Bighorn Sheep (Goal 1). Maintain and, where necessary, restore healthy population levels of bighorn sheep on Desert National Wildlife Refuge within each of the six major mountain ranges.

Objective 1.1: Increase the bighorn sheep (*Ovis canadensis nelsoni*) populations in the Sheep Range up to 1,000 individuals, increase the East Desert Range up to 100 individuals, increase the Desert and Pintwater Range subpopulations up to 250 and 300 individuals each and maintain the remaining subpopulations at or near their current levels over the next 15 years.

Rationale: Desert National Wildlife Refuge was established to protect, enhance, and maintain wildlife resources, including bighorn sheep (*Ovis canadensis nelsoni*). The Service and the Nevada Department of Wildlife (NDOW) have conducted annual comprehensive helicopter surveys of the Desert Refuge since 1974. The refuge-wide desert bighorn sheep population objective, as listed in the Refuge Management Plan, Part II (1987) and draft Sheep Management Plan (1990), is 2,000. Based on helicopter survey data gathered between 1974 and 1988, the refuge-wide desert bighorn population was typically at or very near the population objective. During the last fifteen years, 1989-2003, the refuge-wide desert bighorn population was approximately 1,000 individuals below the objective level. Therefore, a 100% increase, from the current baseline, is required to reach the objective level.

Most of the shortfall is accounted for by declines in the Sheep Mountains sub-population and the smaller, more transitory sub-population of the adjunct East Desert Mountains. Highly variable environmental factors play the major role in determining bighorn sheep population levels. Additionally, sheep regularly shift from one range on the refuge to another as natural conditions change from year to year. Due to this natural habitat variation, specific range population goals for bighorn sheep are difficult to achieve.

Appendix J contains a detailed review of desert bighorn sheep population status and management on Desert NWR, including factors potentially affecting distribution and abundance on the Refuge.

Strategies

- 1.1.1 Maintain existing water sources (springs and rainwater catchments) based on distributional data obtained from helicopter surveys and radio-tracking studies.
- 1.1.2 Protect bighorn habitat which encompasses upper alluvial fans, canyon bottoms and ridge tops as well as the precipitous mountain flanks from unauthorized uses, including off-road vehicle use, by installing signs, barricading/fencing and patrols by Law Enforcement Officers.
- 1.1.3 Minimize the potential for disease transmission to the bighorn sheep by continuing to prohibit domestic stock grazing on the Desert Refuge, particularly sheep and goats.
- 1.1.4 Continue current –NDOW-managed hunt program based on annual population surveys
- 1.1.5 Conduct a minimum of one annual fall helicopter survey to estimate the adult sex ratio, ram age structure, lamb survival/recruitment and populations size with NDOW.
- 1.1.6 Continue to allow bighorn sheep research on the refuge through special use permits.
- 1.1.7 Conduct yearly spring helicopter survey to identify lambing and recruitment sites.
- 1.1.8 Monitor vegetation response to burns in the Sheep Refuge.

- 1.1.9 Determine connectivity between sub-populations and their habitats on- and off-Refuge using historical records, random sightings, and radio-tracking data. Identify those corridors where exclusion removal of obstacles is most important to maximize connectivity and coordinate with appropriate partners to develop an approach to improve connectivity between subpopulations.
- 1.1.10 Document monitoring protocols so that they are consistently implemented when personnel changes occur in the Desert Refuge staff and/or in the NDOW staff.
- 1.1.11 Remove highly flammable vegetation around catchments as needed to protect from wildfires
- 1.1.12 Evaluate and adjust as necessary the current population monitoring methodology to determine adequacy for trend analyses.
- 1.1.13 Construct additional rainwater catchments if existing sources are determined to be inadequate.
- 1.1.14 Translocate bighorn sheep to the Refuge and outside of the Refuge to maintain desert bighorn sheep sub-populations and provide genetic diversity, as necessary based on the best information available, in coordination with NDOW; all sheep should receive health assessments, as time and funding allow.
- 1.1.15 Conduct a radio telemetry study to assess bighorn sheep mortality factors, particularly mountain lion predation, home ranges and habitat utilization/abandonment, and other research priorities. Coordinate radio telemetry with Air Force so that an appropriate band can be assigned to prevent transmission problems or equipment failure.
- 1.1.16 Collect blood and fecal samples to determine general health of herd, diet composition and nutrient uptake, and genetic diversity.
- 1.1.17 Monitor mountain lion populations on the Refuge
- 1.1.18 Develop and implement a Sheep Management Plan in cooperation with NDOW. The Plan would be flexible and address a number of issues such as management of water developments, herd health, predator management, habitat management (prescribed fire) and population management (translocations).
- 1.1.19 Develop formal agreement with NDOW covering management of desert bighorn sheep on the Refuge
- 1.1.20 Continue monitoring well water use and spring discharge at Corn Creek
- 1.1.21 Work with the State Engineer to defend water rights and mitigate substantial changes in temperature or flow

Wildlife Diversity (Goal 2). Maintain the existing natural diversity of native wildlife and plants, including special-status species, at Desert National Wildlife Refuge.

Objective 2.1: Within five years of the plan’s approval, conduct baseline presence-absence surveys of federally listed, proposed, candidate and species of concern on the refuge and develop and implement monitoring plans for these species. Within the same period, conduct baseline inventories of Refuge plant communities to determine plant and wildlife species composition and abundance. Repeat inventories every five years to track long term trends in community composition.

Rationale: Situated at the transition between the Mojave and Great Basin Deserts, with over 9,000 feet of elevation range, the Desert National Wildlife Refuge is a rich reservoir of biodiversity. A total of 702 plant species representing 80 different families have been documented on the refuge. However, despite being protected for over 70 years, little is known about the natural communities or listed and candidate species use of the Refuge. Desert is an important expanse of Mojave Desert lowland and montane habitat. In order to properly manage the Desert Refuge, Refuge staff need to obtain presence and population data on wildlife and plant species and their habitats. The existing baseline

information for species in the Desert Refuge is rather limited, but includes birds (Audubon Society cooperative surveys, Great Basin Bird Observatory) and bighorn sheep (*Ovis canadensis nelsoni*) (NDOW cooperative surveys). This data does not provide adequate information on the wide diversity of species that are likely present on the Refuge.

Long term monitoring on the Refuge will be critical to understanding trends in plant and animal communities and informing adaptive management. Monitoring data will also be important to understanding the effects of global climate change on refuge resources. For example, hotter, drier weather could increase the frequency and intensity of wildfires, threatening Refuge plant communities. Climate changes could also alter the distribution of forest and woodlands (EPA) and increase the vulnerability of desert bighorn sheep populations inhabiting lower and drier mountain ranges to extinction (Epps et al 2004).

Strategies

- 2.1.1 Continue current partnerships with federal and state agencies, academic institutions, and public and private interest groups to assist in the survey and assessment efforts.
- 2.1.2 Continue to monitor the health of Pahrump poolfish (*Empetrichthys latos*) in refugium.
- 2.1.3 Conduct regular bird surveys at Corn Creek and maintain a record of raptors observed during helicopter surveys for bighorn sheep.
- 2.1.4 Develop survey and mapping data using GIS tools and following the standards provided in the USFWS WH8 Promises Team report regarding biotic and abiotic data layers.
- 2.1.5 Develop and implement an inventory and monitoring plan in coordination with FWS Endangered Species Program, NDOW, DOD and academic institutions.
- 2.1.6 Establish permanent, representative sample plots in each major plant community on the refuge. At each site, conduct baseline inventory of plant and animal species composition and abundance. Repeat inventories every five years.

Objective 2.2: Within 2 years of the plan’s approval, eliminate 75 percent of the illegal recreational activities occurring along the southern boundary and prevent them from occurring along the eastern boundary to protect plant communities and wildlife, including the threatened desert tortoise (*Gopherus agassizii*). Within 15 years after plan approval, develop and implement a plan to rehabilitate areas along the southern and eastern boundaries that have damaged by these illegal activities (such as off-road vehicle use).

Rationale: Non-compatible recreational uses on the Refuge, such as off-road vehicles, degrade or functionally destroy habitat and adversely affect wildlife and plant species. Refuge System policy and the National Wildlife Refuge Improvement Act of 1997 also provide that “...the biological integrity, diversity, and environmental health of the System (Refuge) are maintained for the benefit of present and future generations.” A variety of non-compatible recreational uses are currently occurring on the Desert Refuge; however, the limited resources available to monitor these activities prevent prohibitions of these activities from being enforced. Enhanced law enforcement and improvements to signs along designated roads are critical to the initial stage of protecting species and habitats on the Desert. Installing adequate fencing along the Refuge boundaries or where new, un-designated roads have been formed by off-road vehicles would additionally aid in protecting the Refuge resources.

Strategies

- 2.2.1 Maintain designated roads and visitor use areas as staffing and funding allow.
- 2.2.2 Maintain and replace regulatory signs along boundaries and designated roadways.
- 2.2.3 Continue utilization of volunteers for habitat restoration and maintenance efforts.
- 2.2.4 Promote awareness of and solicit support to combat trespassing and ESA violations along the boundaries in cooperation with Law Enforcement staff, various SNPLMA conservation initiative teams, FWS-ES, Clark County MSHCP and Clark County Metropolitan Police.
- 2.2.5 Use aerial photography, satellite imagery, and/or GPS to monitor damage caused by off-road vehicle trespass on refuge lands.
- 2.2.6 Install boundary signs at regular intervals along the entire southern, eastern, and northern boundary. Include regulatory, direction and interpretive elements as appropriate.
- 2.2.7 Expand litter removal efforts with increases in staffing and volunteer recruitment.
- 2.2.8 Increase law enforcement presence and patrols on the Refuge with an emphasis on the southern boundary.
- 2.2.9 Construct and maintain a steel post and cable fence along the southern boundary, with consideration for desert tortoise movement between suitable habitat.
- 2.2.10 Designate one or two points of entry on the southeast boundary of the Refuge and enforce it as the only access routes.
- 2.2.11 Coordinate with local jurisdictions to ensure development adjacent to boundary is compatible (ex. green belt, walled residential).
- 2.2.12 Where necessary, fence and maintain the eastern boundary using a steel post and cable construction method. Ensure that fence design does not act as wildlife barrier, especially for sheep.
- 2.2.13 Increase law enforcement patrols throughout the Refuge with an emphasis on the eastern boundary.
- 2.2.14 Develop and implement plan to close illegal trails and rehabilitate damaged habitat along the southern boundary in coordination with NDOW and adjacent land owner(s).
- 2.2.15 Track citations issued by law enforcement to estimate changes in trends of illegal activities on the Refuge.

Objective 2.3: Within 3 years of plan approval, begin restoration of vegetation characteristics including cover, composition, and structure characteristic of a natural fire regime within the ponderosa pine plant communities on the refuge.

Rationale: Typically, Ponderosa pine communities are favorably affected by fire. Exclusion of fire has been shown to allow encroachment of shade tolerant species such as various fir and oak species which often act as ladder fuels during a fire. These ladder fuels change the characteristics of a fire from one of low to moderate intensity with positive overall effects to one of high intensity with negative overall effects.

Studies need to be conducted in the Ponderosa pine communities to determine the historic fire return interval, and what impacts a lack of fire has had (if any) on species composition and density. Based on these studies, a plan to use fire (prescribed or natural) may be developed that will maintain or improve the health of the Ponderosa pine systems on the refuge.

Strategies

- 2.3.1 Manage wildland fires on the refuge using an Appropriate Management Response which considers resource values at risk and potential negative impacts of various fire suppression measures. Response may range from monitoring high elevation fires (above 5,000') to full suppression. Firefighter and public safety will be the highest priority on every incident, regardless of other resources at risk.
- 2.3.2 Use prescribed fire and naturally ignited fires to restore vegetation characteristics representative of a natural fire regime.
- 2.3.3 Allow some naturally ignited fires to burn under prescribed conditions. These incidents would be managed as Fire Use Events, with appropriate staffing to reflect the complexity of the incident.
- 2.3.4 Work with partners to fill data gaps in fire ecology of Desert NWR plant communities.
- 2.3.5 Consider habitat needs of Gilbert's skink (*Eumeces gilberti*), an NDOW species of conservation priority as well as Partners in Flight Priority Birds such as pinon jay (*Gymnorhinus cyanocephalus*) and gray vireo (*Vireo vicinior*) when doing prescribed burns in pinon-juniper habitat.

Specially-designated Areas (Goal 3). Manage specially-designated areas such that they augment the purposes of the Desert Refuge.

Objective 3.1: Renegotiate the Memorandum of Understanding (MOU) with the U.S. Air Force by 2009.

Rationale: The U.S. Air Force effectively co-manages a portion of the Desert Range and a Memorandum of Understanding is in place that provides both agencies with specific directives for managing the resources on their respective portions of the Desert Range. The MOU enables a more effective and coordinated management of the unique wildlife and plant species and the wilderness character of the Desert Range. Public Law 106-65 requires the Service and the Air Force “. . . to extend the memorandum of understanding for a period that coincides with the duration of the withdrawal of the lands constituting Nellis Air Force Range . . .”. Amendments to the memorandum of understanding “. . .take effect 90 days after the date on which the Secretary of the Interior submits notice of such amendments to the Committees on Environment and Public Works, Energy and Natural Resources, and Armed Services of the Senate and the Committees on Resources and Armed Services of the House of Representatives.”.

Strategies

- 3.1.1 Work with the Air Force to update the MOU as required by Public Law 106-65.
- 3.1.2 Offer opportunities for the DOD Environmental staff and Refuge staff to cooperate more effectively through shared management, biological efforts, and regular site visits.

Objective 3.2: By 2010 develop a research and management program to utilize the existing Research Natural Areas (RNAs) per Refuge System policy as test plots for research on habitat health and community succession.

Rationale: The five RNAs designated on the Desert Refuge have not been fully utilized as Refuge System policy prescribes. The purpose of RNAs is to allow natural processes to predominate without human intervention. Depending on the specific RNA, compatible recreation opportunities may be allowed within the RNA. To satisfy their purpose, the RNAs on the Desert Range could be employed

as test plots for prescribed burn methodologies, as baseline experimental controls for fire management, and as baseline data plots for habitat restoration and habitat health research efforts. Additional resources will be needed to develop appropriate research protocols for these areas.

Strategies

- 3.2.1 Survey and rectify the RNA boundaries with accurate legal descriptions and ground markers.
- 3.2.2 Conduct photographic reconnaissance and documentation of all RNAs.
- 3.2.3 Use the RNAs as experimental control habitat/vegetation communities baseline data plots to assist in development and testing of habitat restoration methodologies.
- 3.2.4 Encourage academic and agency scientists to conduct non-manipulative research in the RNAs to support Refuge management.
- 3.2.5 Submit a request to the FWS Director to de-designate Papoose Lake RNA.

Objective 3.3: Protect and maintain the wilderness character of the proposed 1.37 million-acre Desert Wilderness Area. Within five years of plan completion, prepare a revised wilderness proposal which includes technical corrections such as: correcting overlaps with the bombing range; allowing repair or relocation of hazardous sections of road; and allowing the use of helicopters to repair and maintain water developments and access remote areas for wildlife surveys.

Rationale: In 1974, the President Nixon submitted a wilderness proposal to Congress recommending 1.3 million acres of the Desert Refuge be designated wilderness. Congress has never acted on the proposal. Since then, Refuge staff have been managing the areas to protect its wilderness values. Clarification of the status of the Desert Range area will allow long-term planning for the Refuge to proceed with more certainty.

Strategies

- 3.3.1 Prohibit all public motorized activities within the proposed wilderness unless authorized by stipulations in 1974 proposal or an approved minimum tool analysis, until Congress acts on the wilderness proposal.
- 3.3.2 Prepare a revised wilderness proposal which includes technical corrections such as: correcting overlaps with the bombing range; allowing repair or relocation of hazardous sections of road; and allowing the use of helicopters to repair and maintain water developments and access remote areas for wildlife surveys.

Visitor Services (Goal 4). Visitors understand, appreciate, and enjoy the fragile Mojave/Great Basin Desert ecosystem.

Objective 4.1: By 2009, provide quality environmental education and interpretive opportunities for the public accommodate up to 200,000 visits per year.

Rationale: The Refuge Improvement Act of 1997 identifies six priority public uses of the Refuge System (hunting, fishing, wildlife observation, photography, environmental education, and interpretation) and encourages refuge managers to facilitate these uses when compatible with refuge purposes. Providing environmental education opportunities on and off the Desert Refuge is key to helping traditional and nontraditional user groups understand the importance of the Desert Refuge and its resources and can engender appreciation for all of the refuges in southern Nevada. A Refuge volunteer program is an effective way for Refuge staff to engage the public. Additional resources will be necessary to manage and monitor the compatible wildlife-dependent visitor activities accurately and effectively.

Strategies

- 4.1.1 Continue to coordinate promotion of the Refuge and operation of the Visitor Contact Station with the Southern Nevada Interpretive Association (SNIA).
- 4.1.2 Utilize volunteers, as available, to provide interpretation and guidance to visitors at the visitor contact station in coordination with the Desert Complex outdoor recreation coordinator.
- 4.1.3 Continue to utilize SNIA volunteers to provide interpretation and environmental education programs for refuge visitors.
- 4.1.4 Create environmental education program using Southern Nevada Public Lands Management Act (SNPLMA) funds.
- 4.1.5 Expand volunteer program on refuge with a target of staffing visitor contact station full time during peak use and 4 hours/day during other seasons.
- 4.1.6 Establish seasonal volunteer resident campground host/docent at Mormon Wells picnic area.
- 4.1.7 Develop cultural resources interpretive and environmental education materials in coordination with the Native American tribes.
- 4.1.8 Develop live “sheep cam” at water development and stream video through website and to visitor contact station/center. Apply for SNPLMA funds, or other appropriate sources to develop the webcam.
- 4.1.9 Develop and install interpretive panels and signs at designated entry point(s) (ex. the importance of Corn Creek as a migratory bird stop over site).
- 4.1.10 Complete planning, design, and construction of a visitor center and office space at Corn Creek.

Objective 4.2: Increase public awareness and appreciation of the Desert Refuge by participating in at least three local community events annually.

Rationale: Public outreach provides a way for the community to learn about the natural and cultural resources on the Desert Refuge and to encourage them to participate in recreational opportunities on the Refuge. Increasing participation in the number of local community events would allow Refuge staff to interact with the public and promote the Refuge.

Strategies

- 4.2.1 Develop and install a permanent environmental education/interpretive display at a prominent public venue such as McCarran International Airport
- 4.2.2 Conduct an annual public open house.
- 4.2.3 Develop and distribute a Desert Refuge video in the community.
- 4.2.4 Prepare and distribute an annual Congressional briefing summary.
- 4.2.5 Develop a quarterly Refuge newsletter.
- 4.2.6 Conduct annual surveys to measure program effectiveness.

Objective 4.3: By 2011, provide opportunities, including adequate facilities, for up to 200,000 visitors per year visitors to view, photograph, and enjoy the Refuge's unique natural communities and wildlife during all seasons.

Rationale: The Refuge Improvement Act of 1997 identifies six priority public uses of the Refuge System (hunting, fishing, wildlife observation, photography, environmental education, and interpretation) and encourages refuge managers to facilitate these uses when compatible with refuge purposes. According to the Refuge Recreation Act of 1962 as amended, recreational uses on refuges must be compatible with the purpose(s) for which the refuge was established. Providing compatible wildlife-dependent recreational opportunities on the Desert Refuge is important to management of the resources because it aids in educating the public about the importance of preserving the natural environment.

Strategies

- 4.3.1 Maintain visitor facilities (Mormon Well and Alamo Roads, parking areas, camping areas, and picnic areas) in current condition and as staff and funding allow.
- 4.3.2 Maintain and replace regulatory, directional, and interpretive signs as needed and as staff and funding allow.
- 4.3.3 Evaluate potential sites and construct blinds for wildlife observation and photography.
- 4.3.4 Improve and maintain Mormon Well and Alamo Roads to fair condition based on the 2002 Refuge Road Inventory.
- 4.3.5 Map existing trails using GPS. Manage trails to ensure impacts to bighorn sheep and other wildlife are minimized.
- 4.3.6 Use post and cable fencing to designate specific parking turnouts along Alamo, Mormon Well and Gass Peak Roads.
- 4.3.7 Construct an entrance sign and information kiosk at the east end of Mormon Well Road.
- 4.3.8 Evaluate the impacts on staff and the management benefits resulting from implementation of a recreation-fee program.

Objective 4.4: In partnership with NDOW and the Air Force, provide safe opportunities for hunting bighorn sheep (*Ovis canadensis nelsoni*) on the Refuge.

Rationale: Hunting, one of the six priority public uses identified in the Refuge Improvement Act, has occurred on Desert Refuge since it was established in 1936. Sustainable hunting programs can

promote understanding and appreciation of natural resources and their management on lands and waters in the Refuge System.

The hunt program on Desert Refuge is administered by NDOW. The majority of the refuge is contained within six hunt units (280, 281, 282, 283, 284, and 286). During the 14 year period between 1992 and 2005, a total of 182 tags were issued for these units with an average of 13 per year. The average success over the same period was 61 percent. The tags issued on the Desert NWR hunt units represent about 10 percent of the 128 on average issued State-wide each year. In this objective, *safe* means that there are no hunting-related safety incidents.

Strategies

- 4.4.1 Maintain current hunting program.
- 4.4.2 Conduct annual surveys and reporting of game species population numbers and the number of hunters, and species harvested in coordination with NDOW.
- 4.4.3 Provide Refuge-specific and NDOW hunting guidelines and regulations material to the public at the Refuge Headquarters.
- 4.4.4 Post and maintain designated hunting area signs on Refuge and provide hunting information to the public through brochures, fact sheets, and maps.

Cultural and Historic Resources (Goal 5). Manage cultural resources for their educational, scientific, and traditional cultural values for the benefit of present and future generations of refuge users, communities, and culturally affiliated tribes.

Objective 5.1: Create and implement a basic Cultural Resources Management capability at Desert NWR Complex to respond to the basic compliance requirements of federal cultural resources legislation

Rationale: Cultural resources are a non-renewable resource and need to be protected and preserved on the Refuge. The extent of valuable cultural resources present on the Desert Refuge is relatively unknown but likely to be considerable given the vastness of the Refuge lands, the presence of springs and some riparian habitat and the diversity of desert vegetation communities that could have supported prehistoric and historic peoples. Little is known about cultural resources on the Desert Refuge; therefore, Refuge staff need to obtain additional resources to conduct the necessary surveys. Once these resources are evaluated, some of them may be included in the interpretation and education of the Desert Refuge to explain their importance to the public.

Strategies

- 5.1.1 Incorporate cultural resource values, issues, and requirements into design and implementation of the other habitat, wildlife, and public use activities and strategies conducted by the Desert NWR Complex.
- 5.1.2 Compile all existing baseline data on cultural resources sites, surveys, and reports within, and near Desert NWR and create secure digital, GIS, and hard copy databases, maps, and library.
- 5.1.7 Communicate and consult with culturally affiliated Tribes, academic institutions, advocacy organizations, Agencies, and the Nevada SHPO for basic informational, compliance, research, and “government-to-government” purposes.

Objective 5.2: Create and implement a proactive historic preservation program in compliance with Section 110 of the National Historic Preservation Act (NHPA) on Desert NWR. This requires; inventory and evaluation of cultural resources on the Desert NWR for planning, scientific, educational, and preservation purposes, and mitigation of adverse impacts caused by erosion and deterioration at significant cultural resources.

Rationale: The cultural sites on the Refuge may currently be impacted by both vandalism and degradation from exposure to the natural elements. Additional resources are necessary to clean-up the littered and vandalized sites, stabilize eroded and deteriorated cultural features, and to monitor sites on a regular basis. The establishment of partnership and volunteer opportunities to assist in site restorations, stabilizations, and interpretation efforts would engender a sense of resource stewardship and increase compatible and productive types of interactions both on the Refuge and with the Refuge staff.

Strategies

- 5.2.1 Prepare evaluation criteria and conduct a cultural resource inventory at all public use facilities and Areas that would be affected by Refuge projects.
- 5.2.2 Inventory, evaluate, and nominate Traditional Cultural Properties and sacred sites to the National Register, in consultation with culturally affiliated Tribes.
- 5.2.3 Inventory, evaluate and mitigate adverse effects and stabilize samples of cultural resources on Desert NWR using a research design prepared in consultation with culturally affiliated Tribes and the scientific community.
- 5.2.4 Conduct a study of ethnobotany and traditional plant use at locations on Desert NWR in consultation with culturally affiliated Tribes.
- 5.2.5 Create a cultural resource layer in a NWR complex GIS database that aids in the identification, planning, monitoring, and interpretation of cultural sites.
- 5.2.6 Secure Refuge System and non-Refuge System funding to develop and implement a mitigation, stabilization, or research project.

Objective 5.3: Manage cultural resources and cultural resource information for research, education, and interpretation in consultation with culturally affiliated Tribes and the public.

Rationale: Many sites on the Refuge may be considered sensitive due to cultural significance for Tribes and the public or susceptibility to damage from visitation. Cultural sites selected for interpretation should be the least sensitive as determined through best professional judgment of the Refuge manager after consultation with a Service archaeologist, culturally affiliated Tribes and the public. There are 451 recorded prehistoric sites on the Refuge; many of these are on lands administered by the U.S. Air Force. These include sites from virtually all categories and time periods, including campsites, lithic scatters, rock shelters, rock art, quarries, special activity sites, and multi-component sites (Fergusson and DuBarton 2003). The Refuge also contains two National Register Archeological Districts, the 620,000 acre Sheep Mountain District and the 1,000 acre Corn Creek Campsite District.

Strategies

- 5.3.1 Identify and evaluate cultural resources that can educate refuge users on how humans have interacted with wildlife and habitats in the past. Consult with culturally affiliated Tribes and other stakeholders on ways to use these resources to achieve educational, scientific, and traditional cultural needs.
- 5.3.2 Form partnerships with culturally affiliated Tribes and cultural interest organizations. Cultivate the DOD-Consolidated Group of Tribal Organizations to assist in the development of educational, scientific, and traditional cultural Refuge needs for cultural resource management.
- 5.3.3 Coordinate with the Consolidated Group of Tribal Organizations to identify potential critical/priority cultural sites on the non-military overlay of the Desert Refuge. Develop a cooperative program to survey and record these sites.
- 5.3.4 Work with culturally affiliated Tribes on projects to restore habitats of important native plants and to harvest (for traditional non-commercial purposes) native plant foods.
- 5.3.5 Coordinate with the Complex and Refuge recreation and education planners and programs to incorporate cultural resource information into education and interpretive programs and media.
- 5.3.6 Consult with culturally affiliated Tribes and other stakeholders to design and implement educational materials, programs and activities that would be used to address traditional or sacred resources, and to increase awareness on- and off-Refuge about the sensitivity of cultural resources to visitor impacts and the penalties for vandalism.

Objective 5.4: Protect cultural resources by decreasing or preventing looting, vandalism, and deterioration.

Rationale: Protecting Refuge cultural sites will benefit the public by providing them with information on historic human uses of Refuge lands and the importance of preserving the Refuge land and its unique cultural resources. All of the cultural resource sites on the Refuge are currently susceptible to vandalism. Vandalism is likely to increase as Refuge visitation increases with the growing regional and local population. This would result in damage or destruction of non-renewable cultural resources, preventing those resources from being enjoyed by future generations of Americans. Additionally, the establishment of partnership and volunteer opportunities to assist in site restorations, stabilizations, and interpretation efforts would engender a sense of resource stewardship and increase compatible and productive types of interactions both on the Refuge and with the Refuge staff. This objective assumes that Objective 5.1 is adopted.

Strategies

- 5.4.1 Identify and evaluate cultural resources subject to looting/vandalism, erosion, or deterioration and implement steps, including barriers and signs to reduce these threats and preserve the resources
- 5.4.2 Coordinate with the Regional Office, the Nevada State Historic Preservation Office, the DOD, culturally affiliated tribes, special interest groups, and neighboring land management agencies to support cultural resources monitoring and enforcement activities and to decrease impacts to cultural resources.
- 5.4.3 Coordinate future research, management, and planning on cultural resources with culturally affiliated tribes, the Consolidated Group of Tribal Organizations, the Nevada State Historic Preservation Office, neighboring land management agencies, and other special interest groups.
- 5.4.4 Create and implement a site stewardship volunteer program to assist in site monitoring, delivery of educational and interpretive literature and programs, and to promote cultural resources conservation in the region.

Moapa Valley National Wildlife Refuge

Endemic and Special Status Species (Goal 1). Protect and restore, when possible, healthy populations of endemic and special status species, such as the endangered Moapa dace, within the Muddy River headwaters.

Objective 1.1: Complete the restoration of the springheads and outflow channels on the the Pedersen Unit by 2009 and on the Apcar Unit by 2015 where: water temperatures are maintained at 30-32 °C (86-89.6 °F), flows range from 0.3-1.0 m/s, native plant communities include herbaceous plants [e.g. *Chara* and other algae, waternymph (*Najas sp.*), watercress (*Nasturtium sp.*), spikerush (*Eleocharis sp.*), sedges (*Carex sp.*) and grasses] in and surrounding spring sources, and herbaceous and woody communities [e.g. velvet ash (*Fraxinus velutina*), Cottonwood (*Populus sp.*), willow (*Salix spp.*), screwbean mesquite (*Prosopis pubescens*) and understory sedges (*Carex sp.*)] near larger channels and other water parameters are within acceptable levels for Moapa dace (3.4-8.4 mg/L dissolved oxygen, 606-867 mg/L total dissolved solids and pH of 7.1-7.9).

Rationale: The endangered Moapa dace (*Moapa coriacea*) depends on the health and integrity of the local hydrologic system to survive. Suitable Moapa dace habitat consists of: consistent springhead and outflow channel water temperature in the range of 30-32°C (86-89.6 °F), water velocity of 0.3-1.0 m/s, dissolved oxygen of 3.4-8.4 mg/L, total dissolved solids of 606-867 mg/L and pH of 7.1-7.9 (USFWS 1995). Suitable native plant communities vary from areas surrounding spring source and small outflow areas including *Chara spp.* and other algae, waternymph (*Najas sp.*), watercress (*Nasturtium sp.*), spikerush (*Eleocharis sp.*), sedges (*Carex sp.*) and grasses to communities lining larger channels including velvet ash (*Fraxinus velutina*), willow (*Salix spp.*), screwbean mesquite (*Prosopis pubescens*) and understory sedges (*Carex sp.*) (USFWS 1981). Non-native plants, in particular non-native palm trees such as *Washingtonia filifera* and *Phoenix dactylifera*, have largely replaced native plant communities surrounding spring heads and outflow channels, degrading aquatic habitat and crowding out desirable native plant species (SWCA 2004). Restoration of historic hydrology and native plant communities should not only favor Moapa dace and other native species (Moapa White River springfish, Moapa pebblesnail, grated tryponia, Moapa warm spring riffle beetle, Amargosa naucorid, and Moapa naucorid), but should also discourage non-native fish species such as Tilapia (*Oreochromis aureus*) which energetically favor lower flow, lentic systems (Scoppettone 2006). Non-native mosquito fish (*Gambusia affinis*) will likely continue to co-exist in springhead and outflow channels even after habitat restoration and will require additional effort for control or eradication. Coordinated planning and implementation of Moapa dace habitat improvement strategies will benefit other resident and migratory bird species that also rely on the Refuge springs and streams.

Lowland riparian habitat is important for many ESA listed or species of concern that occur on the Refuge including the southwest willow flycatcher (*Empidonax traillii extimus*), vermilion flycatcher (*Pyrocephalus rubinus*), Phainopepla (*Phainopepla nitens*), long-eared myotis (*Myotis evotis*) as well as many other migratory birds and resident animals (Recon 2000). Completing restoration of the lowland riparian habitat on the Plummer, Pedersen and Apcar units will support the Nevada Steering Committee Intermountain West Joint Venture (NSCIWJV) Priority A objective for lowland riparian habitat to "Permanently protect and/or restore 300 linear miles of lowland riparian habitat in Nevada" (NSCIWJV 2005). Lowland riparian habitat is quite limited in the region and restoring this important lowland riparian habitat will contribute to the biological integrity, diversity and environmental health of the surrounding region and the National Wildlife Refuge System as a whole. Restoring spring systems as outlined in this objective is consistent with the first recovery action recommended by the Recovery Plan for the Rare Aquatic Species of the Muddy River Ecosystem

(USFWS 1996). Additional resources are vital to achieve the objectives defined in the Recovery Plan for the Rare Aquatic Species of the Muddy River Ecosystem (USFWS 1996).

Strategies

- 1.1.1 Continue channel restoration on the Pedersen Unit by planting native species.
- 1.1.2 Complete restoration of the spring heads and channels on Aparcar Unit.
- 1.1.3 Restore native overstory, mid-level and understory vegetation (using local seed and/or seedlings) to riparian corridors, transitional upland sites and any disturbed or newly exposed areas.
- 1.1.4 Consider habitat needs of other special status fish and invertebrates when designing and implementing restoration projects (Moapa White River springfish, Moapa pebblesnail, grated tryponia, Moapa warm spring riffle beetle, Amargosa naucorid, and Moapa naucorid)
- 1.1.5 Monitor streams before and after rehabilitation, to determine benefits or detriments to endemic fish and invertebrate populations.
- 1.1.6 Continue to solicit and utilize volunteers to assist with habitat restoration projects.
- 1.1.7 Coordinate with BLM for local seed collection and National Park Service for germination/production of native species.
- 1.1.8 Develop strategies to remove non-native fish species, including mollies and mosquito fish, from Refuge streams in coordination with the USFWS Endangered Species program and NDOW.
- 1.1.9 Maintain restored habitat after restoration activities are completed

Objective 1.2: Continue to conduct annual surveys and monitoring of Moapa dace (*Moapa coriacea*) and annual surveys of Moapa White River springfish (*Crenichthys baileyi moapae*).

Rationale: Critical monitoring of Moapa dace (*Moapa coriacea*) and snorkel surveys of Moapa White River springfish (*Crenichthys baileyi moapae*) have been conducted annually although uncertainty exists about long-term staff levels. Collecting regular monitoring data on Moapa dace and their habitats within the Refuge is vital to achieve the Refuge purposes, for staff to properly conserve and manage Refuge resources and to develop visitor use opportunities in the future. Annual monitoring of Moapa dace is recommended as recovery action number two in the Recovery Plan for the Rare Aquatic Species of the Muddy River Ecosystem (USFWS 1996). Moapa White River springfish is a species of concern that requires monitoring on the Refuge to assess long-term population trends.

Strategies

- 1.2.1 Coordinate with USFWS Endangered Species program and NDOW for technical and financial assistance with inventories and monitoring of listed fish species and fish species of concern.
- 1.2.2 Inventory Refuge habitat consistent with the Moapa Dace Recovery Plan
- 1.2.3 Develop a GIS-enabled species inventory program, beginning with Moapa dace inventory data.
- 1.2.4 Develop and implement an inventory and monitoring plan for listed fish species and fish species of concern.

Objective 1.3: Collect monthly monitoring data for water flow and temperature of Pedersen and Pedersen East springs and Warm Springs West flume and collect monthly monitoring data for water

quality parameters including temperature, flow, dissolved oxygen, pH and total dissolved solids at other Refuge springs as needed by 2009.

Rationale: The springs and outflow channels provide habitat for resident birds, reptiles, amphibians, mammals and migratory bird species. Many factors have historically affected water levels and water quality, including on and off Refuge human impacts from resource developments as well as natural climatic conditions. Water resource impacts will be ongoing considerations during planning and management of finite water resources. Preventing deleterious changes in the condition of water resources is critical to fulfilling the Refuge purposes, thus they require constant and increasing monitoring efforts. Increasing and diversifying monitoring efforts will provide timely direction and guidance to Refuge staff as they continue habitat enhancement and restoration and investigate the potential for visitor use opportunities. Water quality characteristics suitable for Moapa dace (*Moapa coriacea*): springhead and outflow channel temperatures of 30-32 °C (86-89.6 °F), flows of 0.3-1.0 m/s, dissolved oxygen of 3.4-8.4 mg/L, total dissolved solids of 606-867 mg/L and pH of 7.1-7.9 (USFWS 1995) are a target for suitable habitat and a baseline for assessing significant changes from suitability that may require mitigation.

Strategies

- 1.3.1 Participate in local and regional water resource management efforts to assess impacts and to protect water resources on the Refuge.
- 1.3.2 Participate in the Muddy River Regional water monitoring planning process.
- 1.3.3 Coordinate with Regional Office hydrology staff, USFWS Endangered Species program, USGS, Moapa Valley Water District, and other entities as appropriate to share monitoring data and maintain monitoring equipment and sites.
- 1.3.4 Collect monthly monitoring data for water flow and temperature of Pedersen and Pedersen East springs and Warm Springs West flume and collect monthly monitoring data for water quality parameters including temperature, flow, dissolved oxygen, pH and total dissolved solids at other Refuge springs as needed.
- 1.3.5 Develop a long-term water resources management plan for the Refuge by 2010.
- 1.3.6 Obtain basic water quality data collected by other agencies; share data with other agencies
- 1.3.7 Purchase and install equipment.
- 1.3.8 Continue monitoring water quality parameters if other agencies stop.
- 1.3.9 Determine appropriate equipment needs and monitoring site locations within each spring area.
- 1.3.10 Determine appropriate water quality parameters to be measured in coordination with Regional Office hydrology staff and Moapa dace fish biologists.

Objective 1.4: Protect and maintain historic natural habitat including water quality and quantity in the Refuge springs and channels suitable for Moapa dace (*Moapa coriacea*) survival, reproduction and recruitment: springhead and outflow channel temperatures of 30-32°C (86-89.6 °F), flows of 0.3-1.0 m/s, dissolved oxygen of 3.4-8.4 mg/L, total dissolved solids of 606-867 mg/L and pH of 7.1-7.9.

Rationale: Protection of existing, enhanced, and restored/created Moapa dace (*Moapa coriacea*) habitat is a fundamental component of the recovery and conservation of this species (USFWS 1983). Threats to Moapa dace and their habitat occur on and off Refuge and include fire, floods, recreational/commercial/agricultural developments, water resources development, invasive species encroachment, vandalism and visitor activities. Suitable water quality required for Moapa dace

includes: consistent springhead and outflow channel water temperature in the range of 30-32°C (86-89.6 °F), water velocity of 0.3-1.0 m/s, dissolved oxygen of 3.4-8.4 mg/L, total dissolved solids of 606-867 mg/L and pH of 7.1-7.9 (USFWS 1995). Maintaining adequate water quality will also require ongoing control of non-native invasive plants within corridors surrounding springheads and outflow channels (SWCA 2004). In order to achieve this objective, efforts will need to be comprehensive and range from increasing public knowledge of the fragility and uniqueness of the Refuge ecosystem to improving signs, developing visitor access infrastructure and dismantling over 40 years of pre-Refuge resort-related infrastructure. Achieving Refuge protection, as described in this objective, will require additional resources.

Strategies

- 1.4.1 Maintain existing boundary fencing and gates, and replace as needed.
- 1.4.2 Maintain regulatory signs on the Refuge in good condition and replace as needed.
- 1.4.3 Remove dead fan palm fronds and thin the underbrush and overgrowth as needed to reduce risk of fire
- 1.4.4 Extinguished unwanted fires as fast as safely possible in order to minimize potential negative impacts to Moapa dace.
- 1.4.5 Continue periodic removal of nonnative aquatic species
- 1.4.6 Develop and implement an Integrated Pest Management Plan to control and eradicate invasive species encroachment.
- 1.4.7 Use prescribed fire where appropriate to reduce hazardous fuels and treat unwanted vegetation.
- 1.4.8 Participate in community based fire safe planning both on and off the Refuge. Explore other options for protecting the Refuge from fire.
- 1.4.9 Develop regulatory, directional, interpretative signs and materials, such as brochures and fact sheets, to guide and enhance the visitor experience.
- 1.4.10 Monitor habitat changes, maintain and continue improvements for restoration efforts and other landscape improvements, and provide adequate level of monitoring and maintenance for invasive species control and fire management.

Objective 1.5: Within five years of the CCP’s approval, conduct baseline inventories of federally listed, proposed, candidate and species of concern on the refuge; conduct baseline inventories of aquatic habitat for invertebrates and amphibians to determine species composition and abundance; and inventory existing upland habitat for migratory birds, mammals, and reptiles.

Rationale: Collecting data on the species and their habitats within the Refuge is vital to achieve the Refuge purposes, for staff to properly conserve and manage Refuge resources and to develop visitor use opportunities in the future. A comprehensive understanding of the diversity, presence and habitat needs of wildlife species is currently lacking. To date, species inventories on the Refuge have been limited by limited staff availability. Inventories have only been conducted on a project-by-project basis. Additional resources will be needed to fulfill this objective.

Strategies

- 1.5.1 Conduct baseline inventories of federally listed, proposed, candidate and species of concern on the refuge; conduct baseline inventories of aquatic habitat for invertebrates and amphibians to

determine species composition and abundance; and inventory existing upland habitat for migratory birds, mammals, and reptiles.

- 1.5.2 Coordinate with USFWS Endangered Species program and NDOW for technical and financial assistance with species inventories and monitoring.
- 1.5.3 Repeat inventories every 5 years to track long term trends in community composition.
- 1.5.4 Develop a GIS-enabled species inventory program.
- 1.5.5 Develop a long-term inventory and monitoring plan for federally listed, proposed, candidate and species of concern on the Refuge
- 1.5.6 Coordinate with NDOW to conduct surveys for the presence and use of fan palm habitat by migratory and resident bat species.

Objective 1.6: Work with partners to protect 1,665 acres of habitat within the Muddy River Headwaters area for the Moapa dace and other special status species.

Rationale: Protection of the lands considered would fulfill the habitat criterion of the Recovery Plan for the Rare Aquatic Species of the Muddy River Ecosystem (Recovery Plan) (USFWS 1995). The proposed expansion area includes about 1,665 acres of spring, riverine, riparian, wetland, and mesquite bosque habitats land adjacent to the Refuge that are occupied by species listed as threatened or endangered under the Endangered Species Act of 1973, The proposed expansion area also contains other species of concern including yellow-billed cuckoo, southwestern willow flycatcher, others???. The proposed project provides opportunities for Federal, Tribal, State, and local government partnerships with private property owners. These partnerships are the basis for achieving mutual conservation goals while maintaining the rural lifestyle and economic vitality of the Moapa Valley.

Strategies

- 1.6.1 Expand the Refuge Acquisition Boundary by 1,665 acres and work with partners to protect habitat within the expanded boundary through purchase, transfer, and/or agreement (see Land Protection Plan, Appendix ??)
- 1.6. Prepare step down habitat management plan for lands acquired within the expansion area.

Visitor Services (Goal 2). Local communities and others enjoy and learn about the resources of Moapa Valley NWR and participate in its restoration.

Objective 2.1: Open the refuge to the general public every day for interpretive self-guided or Refuge staff guided tours with a capacity of up to 1,000 visits annually and continue providing opportunities for volunteers to assist in habitat restoration projects with oversight from Refuge staff.

Rationale: The sensitivity of the natural resources on the Refuge to visitor impacts is an issue that must be evaluated prior to opening the Refuge to the general public and monitored after any additional visitation policy changes. Appropriate interpretive and educational materials should be developed and provided to the local communities and area schools to increase people's awareness and minimize impacts to fragile Refuge habitats and restoration efforts. The Refuge grounds are currently unsafe for the general public due to the deteriorating condition of pre-Refuge, resort related structures, the lack of visitor use facilities such as potable water and shade structures and the lack of staff to plan for, coordinate and supervise wildlife-dependent recreation activities. Opening the Refuge to the public will increase their understanding and appreciation of the unique endemic wildlife species and other resident and migratory species found in the Warm Springs area. Guided tours along designated trail routes would allow visitors to enjoy the Refuge resources while limiting disturbance to riparian habitat. Visitors would also benefit from interactions with knowledgeable staff. Providing public information and education is recommended as recovery action number four in the Recovery Plan for the Rare Aquatic Species of the Muddy River Ecosystem (USFWS 1996). Additional resources will be required to achieve this objective.

Strategies

- 2.1.1 Complete volunteer needs assessment, create position descriptions, and coordinate with outdoor recreation planner to recruit, hire, and train volunteers
- 2.1.2 Continue participation in local community events (e.g., Clark County Fair, Moapa Day Celebration, Earth Day) as staff and funding allow.
- 2.1.4 Organize local school contacts to generate enthusiasm for the Refuge and its endemic species.
- 2.1.5 Develop one environmental education program at the Refuge by 2009.
- 2.1.6 Develop interpretive and environmental education materials.
- 2.1.7 Work with NDOT to erect signs on Interstate-15 and US-93 promoting the Refuge and directing the public to the Refuge.
- 2.1.8 Erect a Refuge entrance sign near Warm Springs Road.
- 2.1.9 Plan and construct a self-guided trail system along the spring head, pools and riparian corridor on the Plummer and Pedersen Units
- 2.1.10 Conduct an annual public open house to encourage interactions and foster relationships between Refuge staff and the local community.
- 2.1.11 Coordinate with Desert Complex Outdoor Recreation Coordinator to recruit docents to staff the Refuge and to facilitate visitor interpretative tours.
- 2.1.12 Monitor the number of refuge visitors.
- 2.1.13 Seek opportunities for community based outreach, such as participation in off Refuge activities.
- 2.1.14 Develop regionally focused cultural resources environmental education and interpretation materials for self guided tours.

- 2.1.16 Confer with the Moapa Band of Paiutes to incorporate their history and native plant and animal species knowledge as part of the interpretive program at the Refuge.
- 2.1.17 Coordinate the installation of a permanent environmental education display at the Moapa Valley Community Center or other suitable public venue
- 2.1.18 Construct an overlook trail with interpretive panels and shade structure on top of the hill on the Plummer unit for viewing the Refuge and the Moapa Valley.
- 2.1.19 Design and install new interpretive panels .

Pahranagat National Wildlife Refuge

Wetland Habitat (Goal 1). Restore and maintain wetland habitat for waterfowl and other migratory birds with an emphasis on spring and fall migration feeding and resting habitat requirements.

Objective 1.1: Within the life of the Plan, manage the 640 acres of open water in North Marsh/Upper Pahranagat Lake to optimize the growth of submerged aquatic vegetation as foraging habitat for waterfowl while using the water primarily to manage habitats downstream.

Rationale: Several species of waterfowl require open water for resting and foraging during their annual migrations. Because of the importance of open water for insects, many species of birds and bats forage over open water. Open water habitats are also particularly important to nesting and staging grebes, and as foraging sites for fish-eating waterbirds (Ivey and Herziger 2005).

Currently, the quality of waterfowl habitat in Upper Lake and North Marsh is limited due to the lack of submerged aquatic vegetation. Non-native carp (*Cyprinus carpio*) uproot aquatic vegetation when spawning and feeding and suspend benthic sediments resulting in limited light for plant growth. Upper Pahranagat Lake draw downs in spring and summer would promote the growth of submerged aquatic vegetation, by warming soils and increasing available sunlight. In addition, draw downs during peak spring migration would benefit migrating shorebirds and other migratory birds. Since no inflow is currently available during the summer, water is stored in Upper Pahranagat Lake at a level of between 4 feet in October and 11 feet in April to maintain the sport bass fishery and water is released into areas south of Upper Pahranagat Lake including Middle Marsh and Lower Pahranagat Lake to provide waterfowl habitat during spring and fall migrations. Draw downs are likely to reduce warm water sport fisheries in Upper Pahranagat Lake. A comprehensive Refuge water budget and an evaluation of different habitat management strategies is planned to formulate options for improving open water habitat for waterfowl, waterbirds, shorebirds and other migratory birds and to develop alternative management strategies for relatively wet and dry years. In addition the two levees that maintain water levels in Upper Pahranagat Lake may pose a threat to human safety, as they are compromised by vegetation and leaks due to the exclusive use of gravels and rock to maintain the levees.

Pahranagat NWR is a Focal Area for the lake and reservoir ecological systems in Nevada's Comprehensive Wildlife Conservation Strategy (CWCS). This CCP objective directly addresses the CWCS objective to "Manage lakes and reservoirs to benefit associated fish and wildlife, and meet population objectives established in regional plans" (NDOW 2006). Scattered patches of cottonwoods (*Populus fremontii*) on the Refuge provide some of the last remaining habitat where the yellow-billed cuckoo (*Coccyzus americanus*), a species of conservation priority, can be found (NDOW 2006). While the yellow-billed cuckoo was thought likely to be present, its presence on the Refuge was not documented until July, 2006 (Maxwell per. comm. 2006). Many other bird species that are endangered, threatened or of concern also regularly utilize habitat on the Refuge. The rarity and isolation of lakes in the Mojave Desert makes the lakes on the Refuge of great importance for wildlife (NDOW 2006).

Strategies

- 1.1.1 Reconsider the current water management plan, which includes maintaining water levels in Upper Lake at 11 feet by April 1 and not less than 4 feet by October 1, to address the needs of the new Fisheries Management Plan in coordination with NDOW.
- 1.1.2 Discharge water into Middle Marsh and Lower Pahranaagat Lake to provide migratory waterfowl habitat during spring and fall.
- 1.1.3 Initiate annual clearing of irrigation ditches by all available methods.
- 1.1.4 Draw down water levels in Upper Lake in summer to control carp and encourage growth of submerged aquatic vegetation.
- 1.1.5 Assess the effectiveness of rotenone treatments to control carp and encourage growth of submerged aquatic vegetation.
- 1.1.6 Collect surface water data from the Upper Pahranaagat Lake flume if additional staff becomes available.
- 1.1.7 Maintain current periodic maintenance, repair, and improvement efforts on North Marsh and Upper Pahranaagat Lake appurtenances as staffing and other resources allow.
- 1.1.8 Encourage the routine reduction of carp populations on private and state-managed lands through coordination with upstream water resources management entities and users.
- 1.1.9 Implement a geotechnical engineering study of Upper Pahranaagat Lake to evaluate levee integrity and water loss through the lake bottom.
- 1.1.10 Continue regular monitoring and reporting for structural integrity of the North Marsh levee and Upper Pahranaagat Lake dam.
- 1.1.11 Develop a rainfall-runoff analysis for Upper Pahranaagat Lake to support management decisions on lake capacity and species and habitat enhancements.
- 1.1.12 Monitor carp populations and submerged aquatic plant species health using GIS tools with the assistance of NDOW.
- 1.1.13 Develop and implement a habitat management plan to improve quality of existing open water habitat for waterfowl, waterbirds, shorebirds and other migratory birds.
- 1.1.14 Every three years, conduct surveys of nesting colonial waterbirds (great blue heron, black-crowned night heron, western grebe) (from Ivey and Herziger 2005) as additional staff and funding become available.

Objective 1.2: Maintain seasonal flooding in marshes fringing Middle Marsh and North Marsh in fall and winter with a target ratio of 50 percent open water and 50 percent emergent vegetation, including hard-stemmed bulrush (*Scirpus acutus*), cattail (*Typha domingensis*) and other vegetation to support waterfowl.

Rationale: Marshes are some of the most diverse and productive wildlife habitats in Nevada. They are critical to both breeding and migratory resting and forage needs of many species of birds. Seven bat species of concern may occur in and around marsh habitat on the Refuge (see Appendix G). The Pahranaagat Refuge protects about 10 percent of this relatively rare habitat in the Mojave Desert portion of Nevada. Dabbling ducks prefer to feed in shallow water, between 2 to 10 inches deep, with an equal ratio of open water and emergent vegetation (Fredrickson and Reid 1988). Deeper water habitats provide foraging sites for diving ducks. This range of wetland and aquatic habitat, equally interspersed with tall emergent vegetation such as cattail and hardstem bulrush, provides excellent cover and loafing habitat for a variety of waterfowl. A variety of strategies are available to reduce

decadent vegetation and increase open water habitat for migratory birds, while simultaneously providing sufficient foraging and nesting habitat around the edges of open water. Pahrnagat Refuge is listed as a Focal Area for the marsh habitat type in Nevada's Comprehensive Wildlife Conservation Strategy (NDOW 2005). Implementation of this objective and its supporting strategies help meet CWCS and Intermountain West Joint Venture objectives for wetland management and protection (NDOW 2005, Ivey and Herziger 2005).

Strategies

- 1.2.1 Use prescribed fire, mechanical, and chemical methods to control vegetation as needed.
 - 1.2.2 Supplement flows into Middle Marsh with pumped well water to help maintain water levels.
 - 1.2.3 Continue flooding Middle Marsh from fall through winter.
 - 1.2.4 Every three years, coordinate surveys of birds and bats utilizing the marsh habitat
 - 1.2.5 Control spread of bulrush at Middle marsh by chemical and mechanical means using the Integrated Pest Management (IPM) Plan protocol.
-

Objective 1.3: Maintain approximately 700 acres of wet meadow habitat north of the Middle Marsh; including Baltic rush (*Juncus balticus*), saltgrass (*Distichlis spicata*) and yerba mansa (*Anemopsis californica*) and grassland habitat in a diversity of successional stages to provide foraging and nesting habitat for migratory waterfowl such as Canada goose (*Branta canadensis*), mallard (*Anas platyrhynchos*), gadwall (*Anas strepera*), pintail (*Anas acuta*), teal (*Anas spp.*) and greater sandhill crane (*Grus canadensis tabida*).

Rationale: The Refuge meadow and grassland habitats support a variety of waterfowl, and other birds during fall and spring migrations. There is also some use of the wet meadow habitat for nesting and by mallards, gadwall, and cinnamon teal (*Anas cyanoptera*). The Pahrnagat Valley montane vole (*Microtus montanus fucosus*) is a BLM Nevada State Sensitive species and a Nevada Species of Conservation Priority (NDOW 2005) endemic to the Pahrnagat Valley which also occurs in wet meadow, alkaline and grassland plant communities. The vole occupies shallow burrows and surface runways and eats grasses, sedges, and a wide variety of forbs (NDOW 2005). Providing a variety of successional stages in these communities greatly increases the variety of birds that can use them. For example, short grass habitat in recently burned areas provides forage for sandhill cranes and geese while areas with tall grasses provide nesting habitat for waterfowl. Implementation of this objective will help meet the Nevada CWCS goal for wet meadow habitat and conservation priority species, to achieve: "Thriving self-sustaining wildlife populations in healthy plant communities on saturated soils maintained by high water tables; residual plant cover maintained to meet the life history needs of species dependent on this habitat type." (NDOW 2005).

Strategies

- 1.3.1 Use prescribed fire and mowing as needed.
 - 1.3.2 Investigate methods to increase efficiency of water delivery from Upper Lake.
 - 1.3.3 Conduct spring waterfowl surveys using volunteers and refuge staff .
 - 1.3.4 Continue to coordinate with NDOW for fall and winter waterfowl surveys, to support ongoing monitoring and research.
 - 1.3.5 Obtain waterfowl data collected by other agencies on a seasonal basis.
 - 1.3.6 Continue limited IPM efforts in existing 112-acre grassland habitat to contain spread by knapweed and reduce its extent.
 - 1.3.7 Determine population status, distribution and demography of Pahrnagat Valley montane vole on the Refuge
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Objective 1.4 Maintain approximately 350 acres of alkali flat habitat including saltgrass (*Distichlis spicata*) and alkali sacaton (*Sporobolus airoides*) dominated plant communities, flooded from for 0 to 1.5 feet from September through June for breeding and migrating waterfowl, waterbirds and shorebirds including; avocet (*Recurvirostra americana*), black necked stilt (*Himantopus mexicanus*), grebe (*Aechmophorus spp.*, *Podiceps spp.*), mallard (*Anas platyrhynchos*), green-wing teal (*Anas crecca*), gadwall (*Anas strepera*) and redhead (*Aythya americana*).

Rationale: About a million shorebirds breed in the Intermountain West and millions more migrate through the area each year (Oring et. al. 2000). Lower Pahrnatag Lake provides important habitat for shorebirds, dabbling ducks, grebes and other waterbirds. During wet years, when water persists on the alkali flats through early summer, Avocet, black necked stilt and green-wing teal have been observed using the habitat for breeding. Nevada's marshes have astonishing capability to produce prolific populations of macro invertebrates that provide food resources for migratory birds, resident fish, shorebirds and small water birds. Hundreds of thousands of shorebirds migrate north and south through Nevada annually and are dependent on the availability of these high quality invertebrate stocks to enhance fat reserves critical to reaching their breeding and wintering destinations.

Strategies

- 1.4.1 Control salt cedar and other invasive species on 215 acres near Lower Pahrnatag Lake and the Pahrnatag Wash/Lower Lake area and restore Lower Pahrnatag Lake edge with native plant species.
- 1.4.2 Maintain 0-1.5 feet of water on alkali flat habitat in the area near Lower Pahrnatag Lake and the Pahrnatag Wash/Lower Lake area from early fall through summer.
- 1.4.3 Develop and implement a species inventory and monitoring plan to identify species composition, relative abundance, seasonality, health and distribution of waterfowl, waterbirds and shorebirds as staff and funding become available.

Objective 1.5: Protect and maintain water supplies and maintain and improve management and use of surface and ground water by repairing, or removing water delivery system infrastructure to restore and improve the water delivery and storage system by 2010. Update the Water Resources Management Plan for the Refuge by 2012.

Rationale: Pahrnatag Refuge encompasses one of the most significant wetland habitats in southern Nevada and is an important resting site for waterfowl, waterbirds, shorebirds and other migratory birds along the Pacific Flyway. Additionally, the Refuge purpose and past management plans mandate the conservation and enhancement of these wetlands for migratory waterfowl and other birds. To fulfill the Refuge purpose, water resources should be managed to restore native habitats for waterfowl, waterbirds, shorebirds and other migratory birds. To date, staffing and other resources have been inadequately allocated to fully realize this mandate. Refuge surface and ground water resources must be inventoried and opportunities for obtaining additional water must be assessed. Furthermore, the staffing and funding necessary to fulfill these goals must be secured. Additional water supplies and/or the restoration of water diversion systems from seasonal to year-round would improve waterfowl breeding habitat and fisheries during the dry summer months, create opportunities for managing aquatic vegetation through manipulation of water levels, support irrigation of grasslands and grain crops that provide forage for migratory waterfowl and upland birds such as sandhill cranes, and help to restore riparian habitats crucial to the survival of the endangered Southwestern willow flycatcher and other riparian dependant breeding and migrant song birds.

Strategies

- 1.5.1 Monitor water inflow at Upper Pahranaagat Lake to support water rights.
 - 1.5.2 Pursue 1996 application to the Nevada Division of Water Resources (DWR) for year-round water discharges.
 - 1.5.3 Survey existing groundwater wells and repair or cap as appropriate.
 - 1.5.4 Install a new pump in Well No. 3 and monitor for flow to document beneficial use of allocation and support the water right.
 - 1.5.5 Install a flume or weir at the outflow of Lower Pahranaagat Lake to assist in development of the water budget.
 - 1.5.6 Install and monitor flow meters and data loggers on each of the three ground water wells located on the Refuge.
 - 1.5.7 Develop a Refuge-wide water budget
 - 1.5.8 Install gages and data logging equipment at springs adjacent to Middle Marsh.
 - 1.5.9 Maintain water rights through annual reporting of beneficial use of allocation to the Nevada State Engineer.
 - 1.5.10 Repair existing water infrastructure as staffing and funding allow.
 - 1.5.11 Determine the status of ground water wells of record, and repair and/or abandon as appropriate, and apply for change(s) in point of use with Nevada Division of Water Resources by 2006.
 - 1.5.12 Determine the appropriate water restoration delivery system changes , prioritize restoration and develop an implementation strategy
 - 1.5.13 Apply for Southern Nevada Public Lands Management Act monies to fund water resources management and enhancement efforts.
-

Objective 1.6: Within the life of the Plan, assess the needs of sandhill crane use between Upper Pahranaagat Lake and Middle Marsh to determine the foraging habitat needs for migrating sandhill cranes (*Grus canadensis*).

Rationale: Pahranaagat NWR is one of two known migration staging areas for the Lower Colorado River Valley (LCRV) population of greater sandhill cranes (*Grus canadensis tabida*). Anecdotal reports suggest that in 2003 and 2004 migrating sandhill cranes remained on the Refuge for less than 24 hours but in 2006 sandhill cranes remained in the Middle Marsh area for approximately 30 days (Maxwell per. comm.). During the 1990's, almost 25 percent of the Lower Colorado River population used the Refuge. The longer stopover may be related to the availability of grain crops in previous years that are no longer being provided on the Refuge. Native grasslands on the Refuge could provide better foraging and resting habitat for migrating cranes and thus contribute to their overall survival. In addition, upland game hunting must be accessed during fall migration in order to understand the possible disturbance effects on sandhill cranes.

Strategies

- 1.6.1 Continue to use prescribed burning, mowing, and spraying as needed.
- 1.6.2 Investigate the feasibility of planting native grasses between Upper Pahranaagat Lake and Middle Marsh, to control invasives such as knapweed and provide forage for sandhill cranes, waterfowl and geese.
- 1.6.3 Informally monitor sandhill crane usage of the refuge.

Objective 1.7: Complete and implement a Refuge Integrated Pest Management (IPM) Plan by 2009.

Rationale: Invasive plant species have been documented on the Refuge, some possessing the potential to detrimentally impact sensitive, endemic and/or listed species, while others have gained a foothold in various vegetation communities and are out-competing native plant species. The primary invasive weeds found on the Refuge include salt cedar, Russian olive (*Elaeagnus angustifolia*), Scotch thistle (*Onopordum acanthium*), and Russian knapweed (*Acroptilon repens*). Salt cedar (*Tamarix spp.*) and Russian olive can invade riparian areas and out-compete native cottonwoods (*Populus fremontii*) and willows (*Salix spp.*); Scotch thistle invades wet meadow habitat; and Russian knapweed can dominate grassland habitat and outcompete native grasses. An integrated pest management plan is necessary to guide Refuge staff in efficiently and effectively combating invasive species and restoring the habitat to historical plant species composition and diversity. Refuge staff should confer with the Regional IPM Coordinator to develop the IPM Plan, which should include appropriate, integrated methods to control or eradicate plant species (mechanical, cultural, chemical, etc.) and establish adaptive management strategies for monitoring native habitat succession as invasive species control or eradication proceeds. Additional resources will be necessary to complete the IPM Plan and implement its strategies, including soliciting assistance from and coordinating with other governmental agencies and conservation groups.

Strategies

1.7.1	Apply for SNPLMA and other funding to support development of a Refuge IPM plan
1.7.2	Complete and implement an IPM Plan.
1.7.3	Control salt cedar, Russian olive, Russian knapweed, Scotch thistle, and other invasive species using appropriate methods (mechanical, chemical, cultural, biological, etc.).
1.7.4	Solicit funding to support implementation of the IPM Plan from Refuge System and non-Refuge System sources.
1.7.5	Coordinate IPM Plan projects with upstream property owners.

Wildlife Diversity (Goal 2). Restore and maintain the ecological integrity of natural communities within Pahrnagat Refuge and contribute to the recovery of listed and other special status species.

Objective 2.1: Maintain 100 acres of riparian habitats; including cottonwood (*Populus fremontii*), coyote willow (*Salix exigua*) and Gooding’s willow (*Salix gooddingii*) around the North Marsh and Upper Pahrnagat Lake to provide breeding habitat for southwestern willow flycatcher (*Empidonax traillii extimus*) and other migratory birds. Secure additional water rights to establish new areas of riparian habitat, including native willow (*Salix sp.*).

Rationale: The Pahrnagat River drainage is one of only five Southwestern willow flycatcher breeding sites in Nevada. The southwestern willow flycatcher is listed as endangered, and the primary cause of its decline has been loss and modification of habitat (USFWS 2002c). In the Pahrnagat valley, habitat has been lost primarily to water diversions and land conversion to agricultural uses. The southwestern willow flycatcher usually breeds in patchy to dense riparian or wetland habitat with common native plant species such as willows (*Salix spp.*), mulefat (*Baccharis spp.*) and cottonwood (*Populus fremontii*) as well as non-native species such as salt cedar (*Tamarix spp.*) and Russian Olive (*Elaeagnus angustifolia*) (USFWS 2002c). Nest sites typically have dense foliage to 4 meters in height, but the dense foliage may only be at the at the shrub level or as a low dense canopy (USFWS 2002c).

The Refuge currently supports about 100 acres of cottonwood/willow riparian habitat (Fremont's cottonwood, coyote and Gooding's willows). Riparian habitat in around the North Marsh and Upper Pahranaagat Lake provides nesting, breeding and foraging habitat for neotropical migrants including the Southwestern Willow Flycatcher. An additional 430 acres could be restored to native willow habitat potentially suitable for the flycatcher and other species. In 2004, 29 Southwestern willow flycatchers were recorded at the Refuge nesting in a total of 14 territories (with one non-breeding adult). Thirteen of the nests were found in coyote or Goodings willow and one was found in a cottonwood; no nesting was observed in salt cedar or Russian olive thickets. The dense salt cedar thickets dominating Lower Pahranaagat Lake, that are slated for restoration, were surveyed and no willow flycatcher nests were found though flycatchers have been known to nest in salt cedar when other habitat is unavailable.

Recovery criterion for the southwestern willow flycatcher focus on include increasing populations and nesting territories in geographically distributed locations throughout the West (USFWS 2002c). As of 2001 there were 34 nesting territories in the Pahranaagat Valley. The Recovery Plan sets a target of 50 nesting territories, in the Pahranaagat Valley, as part of the overall criteria to down-list the southwestern willow flycatcher to threatened status (USFWS 2002c). Expanding native willow riparian habitat on the Refuge would provide more potential nesting habitat for the flycatcher and help support the recovery of this endangered species. In addition, management strategies designed to benefit the Southwestern Willow Flycatcher would also benefit blue grosbeak (*Passerina caerulea*), yellow warbler (*Dendroica petechia*), yellow-breasted chat (*Icteria virens*), and Bell's vireo (*Vireo bellii*) – all species considered for prioritization by Nevada Partners in Flight (Neel 1999).

Strategies

- 2.1.1 Use mechanical methods and prescribed fire to reduce fuels in the cottonwood/willow areas of Upper Pahranaagat Lake and north Marsh
- 2.1.2 Secure (apply for, re-apply for) additional water rights to provide necessary water for establishment of new willow wetland habitat.
- 2.1.3 Continue to cooperate with USBR on limited presence-absence surveys for the southwestern willow flycatcher.
- 2.1.4 Continue to coordinate vegetation surveys with other governmental agencies as directed by their project objectives and efforts.
- 2.1.5 Continue to coordinate with USFWS Endangered Species Program (USFWS-ES) for technical and financial assistance with plant species and/or habitat inventories and monitoring.
- 2.1.6 Participate in the annual Christmas bird count.
- 2.1.7 Conduct wetland habitat vegetation surveys that include percent cover, density, age, and structure.
- 2.1.8 Monitor the response of migratory birds, the southwestern willow flycatcher in particular, to the wetland establishment efforts.
- 2.1.9 Restore wetland habitat on the east side of Upper Pahranaagat Lake and North of the North Marsh.

Objective 2.2: By 2012 develop and begin implementation of a restoration plan for the 6 springs on the Refuge.

Rational: The spring habitats on Pahranaagat Refuge are important elements of the Refuge's biodiversity. In surveys conducted during 1986, a unique form of the endemic Pahranaagat speckled dace was found in Cottonwood Spring North and Lone Tree Spring (Tuttle et. al. 1990). The current status of these populations is not known. Elsewhere in Nevada, similar spring and spring outflows support important populations of endemic gastropods and other aquatic invertebrates. Three of the

spring outflows; Cottonwood Spring, Cottonwood Spring North and Lone Tree Spring have been dredged or trenched to varying degrees. The Pahrnagat Valley is a focal area for spring and springbrook habitat type in the Nevada CWCS (NDOW 2005). Implementation of this objective will help achieve the CWCS objectives for spring/springbrook function and spring/springbrook dependant species of conservation priority.

Strategies

- 2.2.1 Apply for SNPLMA and other funding to support the development and implementation of a restoration plan for springs.
- 2.2.2 Conduct fish, invertebrate, bird, mammal and plant inventories of each spring head.
- 2.2.3 Investigate historic photos and other records to determine pre-development characteristics of springs.
- 2.2.4 Prepare a restoration plan in coordination with NDOW and USFWS Endangered Species Program.
- 2.2.5 Implement springhead and channel restoration.

Objective 2.3: Protect or restore the existing 1,000 acres of Mojave mixed scrub and creosote-bursage habitat throughout the Refuge for resident and migratory species.

Rationale: A variety of migratory birds such as Gambel's quail (*Callipepla gambelii*) and roadrunner (*Geococcyx californianus*) utilize the larger shrubs, cacti, and yucca for nesting and foraging, and some raptors use the habitat to hunt. The threatened desert tortoise (*Gopherus agassizii*) may also occur in the upland areas at low densities. Two species of concern, chuckwalla (*Sauromalus ater*) and burrowing owls (*Athene cunicularia hypugea*) respectively use creosote dominated upland habitat for protection from predators and burrowing sites (NDOW 2005). Upland habitat should be protected from degradation due to unauthorized off-road and other vehicle use and encroachment by cattle grazing primarily on adjacent lands. Ungrazed desert/scrub vegetation adjacent to grasslands and wetlands is not well represented in the Pahrnagat Valley and can contribute significantly to native biodiversity.

Strategies

- 2.3.1 Continue enforcing prohibitions for off-road vehicle traffic.
- 2.3.2 Continue maintaining Refuge fence to reduce encroachment from cattle on adjacent BLM lands.
- 2.3.3 Close unused roads, as necessary.
- 2.3.4 Install physical barriers to prevent vehicle traffic in closed areas.
- 2.3.5 Inventory and monitor upland habitat on a regular basis.
- 2.3.6 Coordinate road closures with BLM
- 2.3.7 Prepare wilderness study report and NEPA document which evaluates options for preserving wilderness values of three wilderness study areas along the western boundary
- 2.3.8 Manage wildland fires on the refuge using the fitting Appropriate Management Response which considers resource values at risk and potential negative impacts of various fire suppression measures; firefighter and public safety will be the highest priority on every incident

Objective 2.4: Establish a self-sustaining population of the endangered Pahrnagat roundtail chub (*Gila robusta jordani*) and associated native fish such as the Pahrnagat speckled dace (*Rhinichthys osculus velifer*) by planning a refugium on the Refuge by 2012.

Rationale: The endangered Pahranaagat roundtail chub and the associated species of concern, the Pahranaagat speckled dace, are not currently found on the Refuge. However, historical records indicate that the roundtail chub's range once encompassed all major waters of the Pahranaagat Valley (USFWS 1998). The most important factor currently limiting adult Pahranaagat roundtail chub is thought to be a lack of relatively cool, shaded, summer water. Spawning of Pahranaagat roundtail chub peaks in mid-February and occurs in pools with gravel substrate, at depths of 0.58 to 1.04 meters (1.9 to 3.4 feet), water velocity ranging from 0.08 to 0.54 meter per second (0.25 to 1.2 feet per second), with temperature in the range of 17.0 to 24.5 °C (63 to 76 °F) and dissolved oxygen concentrations from 5.2 to 6.3 milligrams per liter (parts per million) (USFWS 1998). One study of adult Pahranaagat roundtail chub in the Ash Springs outflow found that they varied seasonally in habitat preference between a total depth of 0.82 to 0.73 meters and a mean stream velocity of 0.25 to 0.36 meters per second with adults occupying significantly deeper and slower water in summer than in spring and winter (Tuttle et al. 1990). The two major threats to the Pahranaagat roundtail chub are the introduction of non-native aquatic species and riparian habitat degradation, primarily the partial conversion of Pahranaagat Creek to irrigation ditches.

Strategies

- 2.4.1 Plan and design a refugium on the Refuge in coordination with NDOW and FWS-ES
- 2.4.2 Construct a refugium for the roundtail chub on the refuge

Visitor Services (Goal 3). Provide visitors with compatible wildlife-dependent recreation, interpretation, and environmental education opportunities that foster an appreciation and understanding of Pahranaagat NWR's wildlife and plant communities..

Objective 3.1: The Refuge will provide safe opportunities for hunting upland game species such as mourning dove (*Zenaida macroura*) and Gambel's quail (*Callipepla gambelii*), waterfowl and rabbits (*Lepus sp.*) on approximately 2,000 acres, south of Dove dike, where hunters will have a reasonable chance of success in uncrowded conditions.

Rationale: Hunting, one of the six priority public uses identified in the Refuge Improvement Act, has occurred on Pahranaagat Refuge since it was established in 1963. Hunting programs can promote understanding and appreciation of natural resources and their management on lands and waters in the Refuge System. In this objective, *safe* means that there are no hunting-related safety incidents. *Reasonable chance of success* means that the average harvest per hunter visit would be greater than or equal to the State average. *Uncrowded* means that there would be no more than one hunter per 20 acres.

Upland game hunting should be restricted to areas south of Dove Dike to reduce safety risks within the nearby Headquarters Unit, reduce disturbance to migrating sandhill cranes, and clarify hunt areas. . Currently hunt areas near Cutler Field and the Headquarters Unit cannot be clearly posted because there are no land forms or fences that intuitively suggest a boundary and that can be marked and understood by hunters. Hunters regularly report confusion to Refuge staff, about the permissibility of hunting in Cutler Field areas (Maxwell per. comm. 2006). Because water delivery system maintenance occurs regularly in the Headquarters Unit and planned visitor Center/Administrative Buildings will increase visitor use within the Headquarter Unit, continued hunting north of Dove Dike could pose a serious safety risk to staff and public visitors.

Strategies

- 3.1.1 Redirect hunting to areas of the Refuge that are south of Dove Dike.
- 3.1.2 Provide Refuge-specific and NDOW hunting guidelines and regulations material to the public at the Refuge Headquarters.
- 3.1.3 Post and maintain designated hunting area signs on Refuge and provide hunting information to the public through brochures, fact sheets and maps.
- 3.1.4 Monitor the number of hunters using the Refuge each day by establishing a registration box at multiple Refuge entry points along US Hwy 93 for visitors engaging in hunting activities.

Objective 3.2: Within 3 years of CCP completion, update and begin implementation of the Fisheries Management Plan for the Refuge.

Rationale: Fishing, one of the six priority public uses identified in the Refuge Improvement Act, has been permitted on the Refuge since the early 1970s. In general fishing programs promote understanding and appreciation of natural resources and their management on all lands and waters in the Refuge System.

After attempting to eradicate carp (*Cyprinus carpio*) from the refuge in 1969, Florida strain largemouth bass (*Micropterus salmoides floridanus*) were introduced to the refuge during 1971. Despite several stocking attempts, fluctuating water levels and large carp populations kept bass populations low during the 1970s. After a draw down (1976-1978) and rotenone treatment during 1978, white crappie (*Pomoxis annularis*) and black bullhead (*Ictalurus melas*) were stocked during 1979 and redear sunfish (*Lepomis microlophus*) during 1980. Although bass were not restocked by NDOW at this time, they either remained in the system after drawdown and rotenone treatment or were reintroduced into the system. During the 1980s the Service requested the assistance of NDOW in maintaining the fishery on the refuge. The 1989 Fisheries Management Plan indicated that “Water manipulation needed to maintain feed and habitat for migrating waterfowl can affect the water levels on the refuge creating a negative impact on the fishery, especially during drought years.” As a result, a compromise was reached and a cooperative agreement developed during 1990 with NDOW to maintain a minimum depth, of 4.0 ft. on the outlet structure gauge, to maintain water levels for fish.

Currently, the Refuge supports a bass fishery that is relatively well known in the region. Though stocking was allowed on the refuge in the past, current Refuge System policy prohibits the stocking of exotic species on a refuge (7 RM 10, 7 RM 12, and 601 FW 3) and requires that refuges be managed to “...ensure that the biological integrity, diversity, and environmental health of the System are maintained...”. The Fisheries Management Plan needs to be updated to reflect current Refuge policies and to address the likely impact that proposed draw downs, of Upper Pahrnagat Lake to enhance bird habitat, will have on warm water fisheries in Upper Pahrnagat Lake.

Strategies

- 3.2.1 Continue to allow sport fish in Upper Pahrnagat Lake and Middle Marsh
 - 3.2.2 Update the Fisheries Management Plan for the Refuge in coordination with NDOW
 - 3.2.3 Conduct carp and other invasive fish control and eradication efforts in Upper Pahrnagat Lake
 - 3.2.4 Coordinate with NDOW to implement state fishing regulations
 - 3.2.5 Develop strategy to reinstall fish screens for upstream control of fish passage.
 - 3.2.6 Continue to maintain visitor facilities and structures at Upper Pahrnagat Lake.
 - 3.2.7 Maintain swimming prohibitions at all open water locations and maintain regulatory signs at those locations.
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- 3.2.8 Monitor impacts of fishing on bird use of riparian and wetland habitats and adopt seasonal closure of sensitive areas if necessary.
- 3.2.9 Improve and maintain existing restroom facilities for visitor use at Upper Pahrnagat Lake.
- 3.2.10 Assess the effects of increased water withdrawals from Upper Pahrnagat Lake and North Marsh for wetlands management in Middle Marsh and Lower Pahrnagat Lake on sport fisheries
- 3.2.11 Close the existing campground and convert to a walk-in day use area
- 3.2.12 Close boat ramps and designate an alternative car-top boat launch site

Objective 3.3: The Service will provide wildlife dependant recreational opportunities, including maintenance and management of current and anticipated new Headquarters facilities, sufficient to accommodate from 30,000 to 60,000 visitors per year to view, photograph, learn about, appreciate and enjoy the Refuge’s unique natural communities and wildlife during all seasons.

Rationale: The Refuge is well known, by the public, for the diversity of migratory bird species that stop at the Refuge to rest, feed and breed. Wildlife observation and photography are priority public uses identified in the National Wildlife Refuge System Improvement Act. Visitor participation in wildlife observation and photography can instill an appreciation for the value of and need for fish and wildlife habitat conservation. Pahrnagat Refuge can enhance visitor opportunities to view wildlife in their natural habitat by providing observation trails, platforms, viewing equipment and brochures.

Strategies

- 3.3.1 Maintain existing visitor facilities and anticipated addition to Headquarters building.
 - 3.3.2 Monitor the number of visitors using the Refuge each day.
 - 3.3.3 Design and construct a wildlife viewing trail system possibly along historic farming and ranching roads and trails.
 - 3.3.4 Construct photography and observation blinds along the trail route.
 - 3.3.5 Maintain the observation deck, on the south levee of Upper Pahrnagat Lake, and trail throughout the Refuge to accommodate visitors.
 - 3.3.6 Continue to offer wildlife lists at the Refuge headquarters.
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Objective 3.4: The Refuge will encourage educators from the southern Nevada region to use Pahrnagat Refuge’s unique natural communities as an outdoor environmental education and interpretation classroom, with a target of 25 school groups annually within five years.

Rationale: Environmental education and interpretation are priority public uses of refuges identified in the National Wildlife Refuge System Improvement Act. Environmental education is a process designed to teach citizens and visitors the history and importance of conservation and the biological and the scientific knowledge of our Nation’s natural resources. Through environmental education, we can help develop a citizenry that has the awareness, knowledge, attitudes, skills, motivation, and commitment to work cooperatively towards the conservation of our Nation’s environmental resources. Interpretive programs include activities, talks, publications, audio-visual media, signs, and exhibits that convey key natural and cultural resource messages to visitors. By providing opportunities to connect to the Refuge resources, interpretation provokes participation in resource stewardship. It helps refuge visitors understand their relationships to, and impacts on, Refuge resources.

Strategies

- 3.4.1 Monitor the number of visitors using the Refuge each day and the number of people participating in Refuge-related off-site activities.
- 3.4.2 Develop and implement an interpretive plan for the Refuge by working with partners.
- 3.4.3 Develop Refuge-specific environmental education materials.
- 3.4.4 Develop signs, such as "least-wanted" posters, for invasive plant species.
- 3.4.5 Construct office space to accommodate additional staff.
- 3.4.6 Coordinate with Nevada Department of Transportation (NDOT) to install directional signage for US Hwy 15 and US Hwy 93 to promote Refuge visitation, prevent accidents, improve circulation, and decrease inappropriate visitor uses.
- 3.4.7 Construct a new visitor contact station and office space at refuge headquarters unit
- 3.4.8 Construct interpretive walking trail that connects Upper Pahranaagat Lake with the Headquarters Unit
- 3.4.9 Coordinate with NDOT to create turn lanes so visitors can safely exit highway to visit the Refuge

Objective 3.5: Within three years, the Refuge will offer a minimum of 6 outreach activities each year.

Rationale: Offering additional outreach events on the Refuge is one method to increase community awareness of the Refuge and its unique resources, especially among nontraditional user groups. While offering additional outreach and outreach events can not guarantee additional Refuge visitors, over time it is likely to.

Strategies

- 3.5.1 Coordinate with NDOT to install directional signage for US Hwy 15 and US Hwy 93 to promote Refuge visitation, prevent accidents, improve circulation, and decrease inappropriate visitor uses.
- 3.5.2 Focus outreach effort on six major Refuge System events: International Migratory Bird Day, the Junior Duck Stamp Program, and the National Wildlife Refuge Week, Public Lands Day, Earth Day, National Fishing Day

Cultural Resources (Goal 4). Manage cultural resources for their educational, Scientific, and traditional cultural values for the benefit of present and future generations of Refuge users, communities, and culturally affiliated tribes.

Objective 4.1: Create and implement a basic Cultural Resources Management capability at Pahranaagat NWR Complex to respond to the basic compliance requirements of federal cultural resources legislation.

Rationale: Cultural resources are a non-renewable resource and are protected under federal law and Service/refuge policy. The full extent of cultural resources on Pahranaagat Refuge is relatively unknown but likely to be considerable given the location of the Refuge lands, the abundance of springs and riparian habitat and the diversity of desert vegetation communities that could have supported prehistoric and historic peoples. A cultural resources inventory and evaluation is necessary to characterize and manage these non-renewable resources and improve our understanding of past human use of this area. Once Refuge cultural resources are evaluated, some of them may be included in the interpretation and education of the Refuge to explain their importance to the public.

Strategies

- 4.1.1 Incorporate cultural resource values, issues, and requirements into design and implementation of the other habitat, wildlife, and public use activities and strategies conducted by the Desert NWR Complex.
- 4.1.2 Compile all existing baseline data on cultural resources sites, surveys, and reports within, and near, Pahrnagat NWR and create secure digital, GIS, and hard copy databases, maps, and library.
- 4.1.3 Communicate and consult with culturally affiliated Tribes, academic institutions, advocacy organizations, Agencies, and the Nevada SHPO for basic informational, compliance, research, and “government-to-government” purposes.

Objective 4.2: Create and implement a proactive historic preservation program in compliance with Section 110 of the National Historic Preservation Act (NHPA). Inventory and evaluate of cultural resources on the Pahrnagat NWR for planning, scientific, educational, and preservation purposes, and mitigation of adverse impacts caused by erosion and deterioration at significant cultural resources.

Rationale: The cultural sites on the Pahrnagat Refuge may currently be impacted by vandalism and degradation from exposure to the natural elements. Additional resources are necessary to clean-up the littered and vandalized sites, stabilize eroded and deteriorated cultural features, and monitor them on a regular basis. Additionally, the establishment of partnership and volunteer opportunities to assist in site restorations, stabilizations, and interpretation efforts would engender a sense of resource stewardship and increase compatible and productive types of interactions both on the Refuge and with the Refuge staff.

Strategies

- 4.2.1 Prepare evaluation criteria and conduct a cultural resource inventory at all public use facilities and Areas that would be affected by Refuge projects.
- 4.2.2 Inventory, evaluate, and nominate Traditional Cultural Properties and sacred sites to the National Register, in consultation with culturally affiliated Tribes.
- 4.2.3 Inventory, evaluate, mitigate adverse effects on and stabilize samples of cultural resources on Pahrnagat NWR using a research design prepared in consultation with culturally affiliated Tribes and the scientific community.
- 4.2.4 Conduct a study of ethnobotany and traditional plants use locations on Pahrnagat NWR in consultation with culturally affiliated Tribes.
- 4.2.5 Create a cultural resource layer in the NWR complex GIS that aids in the identification, planning and monitoring, and interpretation of cultural sites.
- 4.2.6 Secure Refuge System and non-Refuge System funding to develop and implement a mitigation, stabilization, or research project.

Objective 4.3: Manage cultural resources and cultural resource information for research, education, and interpretation in consultation with culturally affiliated Tribes and the public.

Rationale: Many sites on the Refuge may be considered sensitive due to cultural significance for Tribes and the public or susceptibility to damage from visitation. Cultural sites selected for interpretation should be the least sensitive as determined through best professional judgment of the Refuge manager after consultation with a Service archaeologist, culturally affiliated Tribes and the public. Twenty-five pre-historic archeological sites have been documented on the Refuge including several lithic debris (stone tool) sites, campsites and the Black Canyon Petroglyphs, a National Register of Historic Places listed rock art site (SWCA 2004). At least one historic house still exists on

the Refuge and other historic sites could provide researchers with information related to mining, the development of ranching and the relationship between Native Americans and Euro-Americans during the Protohistoric Period (SWCA 2004).

Strategies

- 4.3.1 Identify and evaluate cultural resources that can educate refuge users on how humans have interacted with wildlife and habitats in the past. Consult with culturally affiliated Tribes and other stakeholders on ways to use these resources to achieve educational, scientific, and traditional cultural needs.
- 4.3.2 Forge partnerships with culturally affiliated Tribes and cultural interest organizations. Cultivate the Consolidated Group of Tribal Organizations to assist in the development of educational, scientific, and traditional cultural needs for the cultural resources management.
- 4.3.3 Work with culturally affiliated Tribes on projects to restore habitats of important native plants and to harvest (for traditional non-commercial purposes) native plant foods.
- 4.3.4 Coordinate with the Complex and Refuge recreation and education planners and programs to incorporate cultural resources information into education and interpretive programs and media.
- 4.3.5 Consult with culturally affiliated Tribes and other stakeholders to design and implement educational materials, programs and activities that would address traditional or sacred resources, and to increase awareness on- and off-Refuge about the sensitivity of cultural resources to visitor impacts and the penalties for vandalism.

Objective 4.4: Protect cultural resources by decreasing or preventing looting, vandalism, and deterioration.

Rationale: Protecting Refuge cultural sites will benefit the current and future public by providing them with information on historic human uses of Refuge lands and the importance of preserving the Refuge land and its unique cultural resources. All of the cultural resource sites on the Refuge are currently susceptible to vandalism. Vandalism is likely to be ongoing and will likely result in damage or destruction of non-renewable cultural resources, preventing those resources from being enjoyed by future generations of Americans. Once the Refuge has been surveyed for cultural resources Refuge staff should work with stewardship volunteers to assist in site monitoring and the delivery of interpretative programs.

Strategies

- 4.4.1 Identify and evaluate cultural resources subject to looting/vandalism, erosion, or deterioration and implement steps, including barriers and signs to reduce these threats and preserve the resources.
- 4.4.2 Coordinate with the Regional Office, the Nevada State Historic Preservation Office, culturally affiliated Tribes, special interest groups, and neighboring land management agencies to support cultural resources monitoring and enforcement activities and to decrease impacts to cultural resources.
- 4.4.3 Coordinate future research, management, and planning on cultural resources with culturally affiliated Tribes, the Consolidated Group of Tribal Organizations, the Nevada State Historic Preservation Office, neighboring land management agencies, and other special interest groups.
- 4.4.4 Create and implement a site stewardship volunteer program to assist in site monitoring, delivery of educational and interpretive literature and programs, and to promote cultural resources conservation in neighboring communities.

Appendix G.
Compatibility Determinations
for Existing and Proposed Uses

Appropriate Use Policy

This policy describes the initial decision process the refuge manager follows when first considering whether or not to allow a proposed use on a refuge. The refuge manager must find a use appropriate before undertaking a compatibility review of the use. An appropriate use, as defined by the Appropriate Use Policy (603 FW 1 of the Service Manual), is a proposed or existing use on a refuge that meets at least one of the following four conditions:

- The use is a wildlife-dependant recreational use as identified in the Improvement Act.
- The use contributes to the fulfilling of the refuge purpose(s), the Refuge System mission, or goals or objectives described in a refuge management plan approved after October 9, 1997, the date the Improvement Act was signed into law.
- The use involves the take of fish and wildlife under State regulations.
- The use has been found to be appropriate as specified in section 1.11 (603 FW 1 of the Service Manual).

If an existing use is not appropriate, the refuge manager will eliminate or modify the use as expeditiously as practicable. If a new use is not appropriate, the refuge manager will deny the use without determining compatibility. If a use is determined to be an appropriate refuge use, the refuge manager will then determine if the use is compatible (see Compatibility section below). Although a use may be both appropriate and compatible, the refuge manager retains the authority to not allow the use or modify the use. Uses that have been administratively determined to be appropriate are the six wildlife-dependent recreational uses (hunting, fishing, wildlife observation and photography, environmental education, and interpretation) and take of fish and wildlife under State regulations. Table 1 summarizes the appropriateness findings for existing and proposed uses on each refuge.

Compatibility Policy

Lands within the NWRS are different from other multiple use public lands in that they are closed to all public uses unless specifically and legally opened. The Improvement Act states “. . . the Secretary shall not initiate or permit a new use of a Refuge or expand, renew, or extend an existing use of a Refuge, unless the Secretary has determined that the use is a compatible use and that the use is not inconsistent with public safety.” The Improvement Act also states that “. . . compatible wildlife-dependent recreational uses [hunting, fishing, wildlife observation and photography, or environmental education and interpretation] are the priority general public uses of the System and shall receive priority consideration in Refuge planning and management.”

In accordance with the Improvement Act, the Service has adopted a Compatibility Policy (603 FW 2) that includes guidelines for determining if a use proposed on a National Wildlife Refuge is compatible with the purposes for which the refuge was established. A compatible use is defined in the policy as a proposed or existing wildlife-dependent recreational use or any other use of a National Wildlife Refuge that, based on sound professional judgment, will not materially interfere with or detract from the fulfillment of the NWRS mission or the purposes of the Refuge. The Policy also includes procedures for documentation and periodic review of existing refuge uses.

When a determination is made as to whether a proposed use is compatible or not, this determination is provided in writing and is referred to as a compatibility determination. An opportunity for public review and comment is required for all compatibility determinations. For compatibility determinations prepared concurrently with a CCP or step-down management plan, the opportunity for public review and comment is provided during the public review period for the draft plan and associated NEPA document. Table 1 summarizes the compatibility findings for each refuge. Draft compatibility determinations for the existing and proposed uses on each refuge follow Table 1.

Table 1. Summary of Appropriateness and Compatibility Findings, Desert NWR Complex

<i>Existing/Proposed Use</i>	<i>Use Appropriate?</i>	<i>Use Compatible?¹</i>
<i>Ash Meadows NWR</i>		
Wildlife Observation & Photography	yes	yes
Environmental Education & Interpretation	yes	yes
Hunting; Waterfowl, Upland	yes	yes
Fishing	yes	yes
Boating	no	
Research	yes	yes
Virtual Geocaching	yes	yes
Geocaching	no	
Swimming	no	
Horseback riding	no	
Off-Road Vehicle Use	no	
Camping	no	
Use of incendiary devices	no	
<i>Desert NWR</i>		
Wildlife Observation & Photography	yes	yes
Environmental Education & Interpretation	yes	yes
Hunting; Sheep	yes	yes
Research	yes	yes
Geocaching	no	
Pine Nut Gathering	yes	yes
Camping; Dispersed and at Mormon Wells	yes	yes
Hiking and Backpacking	yes	yes
Rock Climbing	no	
Horseback Riding	yes	yes
Fun Run	no	
Robotics Automotive Testing	no	
Dog Burials	no	
Group Camping/Festival	no	
Large Group Picnics	no	
Off-Road Vehicle Use	no	
Water Monitoring	yes	yes
<i>Moapa NWR</i>		
Wildlife Observation & Photography	yes	yes
Environmental Education & Interpretation	yes	yes
Research	yes	yes
Water Monitoring	yes	Yes

¹ Compatibility determinations are not prepared for uses found not appropriate.

Pahrnagat NWR

Wildlife Observation & Photography	yes	yes
Environmental Education & Interpretation	yes	yes
Hunting; Waterfowl, Upland	yes	yes
Fishing	yes	yes
Boating	yes	yes
Motorized Boating	no	
Research	yes	yes
Camping	no	
Swimming	no	
Horseback Riding	no	
Weddings	no	

COMPATIBILITY DETERMINATION

Use: Wildlife Observation and Photography

Refuge Name: Ash Meadows National Wildlife Refuge, located in Nye County, Nevada.

Establishing and Acquisition Authority(ies): Ash Meadows National Wildlife Refuge (Refuge) was established on June 18, 1984 under authority of the Endangered Species Act of 1973.

Refuge Purpose(s): The purpose of Ash Meadows comes from the Endangered Species Act of 1973:

“...to conserve (A) fish or wildlife which are listed as endangered species or threatened species...or (B) plants...” (16 USC Sec. 1534).

National Wildlife Refuge System Mission: “To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.” (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-ee]).

Description of Use: The National Wildlife Refuge System Improvement Act of 1997 identifies wildlife observation and photography as well as hunting, fishing, interpretation, and environmental education as wildlife dependent public uses for NWR’s. As two of the six priority public uses of the Refuge System, these uses are to be encouraged when compatible with the purposes of the Refuge. Wildlife observation and photography are considered simultaneously in this compatibility determination. Many elements of wildlife observation and photography program are also similar to opportunities provided in the environmental education and interpretation programs.

Ash Meadows Refuge is open to the public for wildlife observation and photography daily from sunrise to sunset. Currently, there are nearly 65,000 visits annually to the Refuge. Typical use is by individuals, family groups, school groups, and large groups during Refuge-sponsored special events. Year round hiking is permitted along designated roads and trails. Crystal Springs Interpretive Boardwalk (1/3 mile long) provides an up-close view of the springs, fish and plants of the Refuge without disturbing the fragile habitat.

All motorized vehicles must be properly licensed and restricted to designated roads and all off-highway vehicles are prohibited. Watercrafts are not allowed for use in Refuge waters.

Wildlife observation and photography are considered together in this compatibility determination because both are considered to be wildlife-dependent, non-consumptive uses and many elements of these programs are similar. Both of these public uses are dependent upon establishing access within the Refuge. An estimated 65,000 annual visitors participate in various wildlife-dependent activities on the Refuge.

Future access within the Refuge will be increased through the careful planning and construction of interpretive boardwalks and back country trails, photography/hunting blinds, and observation decks. These access points will be planning to potentially improve visitors’ wildlife observation and photography opportunities. Interpretive panels will be designed for each of these access points so as to assist those unfamiliar with the area in determining what they may be able to observe and photograph there. Written materials will also be developed with wildlife checklists.

Availability of Resources:

The Refuge receives approximately 65,000 visitors each year. Most of those visitors are hoping to observe the unique set of wildlife found only at Ash Meadows NWR. Fewer attempt to capture Refuge inhabitants on film or in digital form but that sector seems to be growing. Once the infrastructure is in place, some of which will be completed (POR and Longstreet interpretive boardwalks) before the end of 2008, the maintenance of that infrastructure and the program should be easily managed.

The following funding/annual costs (based on FY 2008 costs) would be required to administer and manage the activities as described above:

	One-time Costs	Annual Costs
Administration		\$2,500
Interpretation/Education Materials Production	\$10,000	\$1,000
Law enforcement		\$120,000
Construction of two interpretive boardwalks with panels, parking, restrooms, and habitat restoration	\$1,200,000	
Maintenance of two boardwalks, etc.		\$4,200
Construction of back country trail system with interpretive panels	\$1,000,000	
Maintenance of back country trail system		\$5,000
Construction of at least three photography/hunting blinds	\$8,000	
Maintenance of photography/hunting blinds		\$2,000
Construction of an observation deck at Peterson Reservoir area with interpretive panels	\$50,000	
Maintenance of observation deck		\$2,000
Improve refuge roads and construct/improve eight parking areas	\$1,600,000	
Maintenance refuge roads and parking areas		\$66,000
TOTAL	\$3,868,000	\$202,700

Refuge operational funds are currently available through the Service budget process to administer these uses. The majority of the one-time costs for these projects has been obtained or will be proposed for through the Southern Nevada Public Lands Management Act.

Anticipated Impacts of Use: Once considered “non-consumptive”, it is now recognized that wildlife observation and wildlife photography can negatively impact wildlife by altering wildlife behavior, reproduction, distribution, and habitat (Purdy et al. 1987, Knight and Cole 1995).

Purdy et al. (1987) and Pomerantz et al. (1988) described six categories of impacts to wildlife as a result of visitor activities. They are:

- 1) Direct mortality: immediate, on-site death of an animal;
- 2) Indirect mortality: eventual, premature death of an animal caused by an event or agent that predisposed the animal to death;
- 3) Lowered productivity: reduced fecundity rate, nesting success, or reduced survival rate of young before dispersal from nest or birth site;
- 4) Reduced use of refuge: wildlife not using the refuge as frequently or in the manner they normally would in the absence of visitor activity;
- 5) Reduced use of preferred habitat on the refuge: wildlife use is relegated to less suitable habitat on the refuge due to visitor activity; and
- 6) Aberrant behavior/stress: wildlife demonstrating unusual behavior or signs of stress that are likely to result in reduced reproductive or survival rates.

Individual animals may be disturbed by human contact to varying degrees. Human activities on trails can result in direct effects on wildlife through harassment, a form of disturbance that can cause physiological effects, behavioral modifications, or death (Smith and Hunt 1995). Many studies have shown that birds can be impacted from human activities on trails when they are disturbed and flushed from feeding, resting, or nesting areas. Flushing, especially repetitive flushing, can strongly impact habitat use patterns of many bird species. Flushing from an area can cause birds to expend more energy, be deterred from using desirable habitat, affect resting or feeding patterns, and increase exposure to predation or cause birds to abandon sites with repeated disturbance (Smith and Hunt 1995). Migratory birds are observed to be more sensitive than resident species to disturbance (Klein 1989).

Nest predation for songbirds (Miller et al. 1998), raptors (Glinski 1976), colonial nesting species (Buckley and Buckley 1976), and waterfowl (Boyle and Samson 1985) tends to increase in areas more frequently visited by people. In addition, for many passerine species, primary song occurrence and consistency can be impacted by a single visitor (Gutzwiller et al. 1994). In areas where primary song was affected by disturbance, birds appeared to be reluctant to establish nesting territories (Reijnen and Foppen 1994).

Depending on the species (especially migrants vs. residents), some birds may habituate to some types of recreation disturbance and either are not disturbed or will immediately return after the initial disturbance (Hockin et al. 1992; Burger et al. 1995; Knight & Temple 1995; Madsen 1995; Fox & Madsen 1997). Rodgers & Smith (1997) calculated buffer distances that minimize disturbance to foraging and loafing birds based on experimental flushing distances for 16 species of waders and shorebirds. They recommended 100 meters as an adequate buffer against pedestrian traffic, however, they suggest this distance may be reduced if physical barriers (e.g., vegetation screening) are provided, noise levels are reduced, and traffic is directed tangentially rather than directly toward birds. Screening may not effectively buffer noise impacts, thus visitors should be educated on the effects of noise and noise restrictions should be enforced (Burger 1981, 1986; Klein 1993; Bowles 1995; Burger & Gochfeld 1998). Seasonally restricting or prohibiting recreation activity may be necessary during spring and fall migration to alleviate disturbance to migratory birds (Burger 1981, 1986; Boyle & Samson 1985; Klein et al. 1995; Hill et al. 1997).

Of the wildlife observation techniques, wildlife photographers tend to have the largest disturbance impacts (Klein 1993, Morton 1995, Dobb 1998). While wildlife observers frequently stop to view species, wildlife photographers are more likely to approach wildlife (Klein 1993). Even slow approach by wildlife photographers tends to have behavioral consequences to wildlife species (Klein 1993). Other impacts include the potential for photographers to remain close to wildlife for extended periods of time, in an attempt to habituate the wildlife subject to their presence (Dobb 1998) and the tendency of casual photographers, with low-power lenses, to get much closer to their subjects than other activities would require (Morton 1995), including wandering off trails. This usually results in increased disturbance to wildlife and habitat, including trampling of plants. Klein (1993) recommended that refuges provide observation and photography blinds to reduce disturbance of waterbirds when approached by visitors.

Education is critical for making visitors aware that their actions can have negative impacts on birds, and will increase the likelihood that visitors will abide by restrictions on their actions. For example, Klein (1993) demonstrated that visitors who spoke with refuge staff or volunteers were less likely to disturb birds. Increased surveillance and imposed fines may help reduce visitor caused disturbance (Knight & Gutzwiller 1995). Monitoring is recommended to adjust management techniques over time, particularly because it is often difficult to generalize about the impacts of specific types of recreation in different environments. Local and site -specific knowledge is necessary to determine effects on birds and to develop effective management strategies (Hockin et al. 1992; Klein et al. 1995; Hill et al. 1997).

The construction and maintenance of trails, photography blinds, and parking lots will have minor impacts on soils and vegetation around the trails. This could include an increased potential for erosion, soil compaction (Liddle 1975), reduced seed emergence (Cole and Landres 1995), alteration of vegetative structure and composition, and sediment loading (Cole and Marion 1988). However, by concentrating foot traffic onto the trails other habitats on the Refuge will remain undisturbed.

Disturbance of wildlife is the primary concern regarding these uses. Disturbance to wildlife, such as the flushing of feeding, resting, or nesting birds, is inherent to these activities. There is some temporary disturbance to wildlife due to human activities on trails (hiking, bird watching) however, the disturbance is generally localized and will not adversely impact overall populations. Increased facilities and visitation would cause some displacement of habitat and increase some disturbance to wildlife, although this is expected to be minor given the size of the Refuge and by avoiding or minimizing intrusion into important wildlife habitat.

Public Review and Comment: Public review and comments will be solicited in conjunction with distribution of the Draft CCP for Ash Meadows NWR. Following the public review and comment period, comments and actions taken to address comments will be summarized here.

Determination: This program as described is determined to be compatible. Potential impacts of research activities on Refuge resources will be minimized because sufficient stipulations and safeguards will be included in this Compatibility Determination and the required Special Use Permit and because research activities will be monitored by Refuge staff. The refuge manager and biologist would ensure that proposed monitoring and research investigations would contribute to the enhancement, protection, conservation, and management of native Refuge wildlife populations and their habitats thereby helping the Refuge fulfill the purposes for which it was established, the mission of the National Wildlife Refuge System, and the need to maintain ecological integrity, diversity, and environmental health.

Use is Not Compatible

Use is Compatible with the Following Stipulations

Stipulations necessary to ensure compatibility: The criteria for evaluating a research proposal, outlined in the Description of Use section above, will be used when determining whether a proposed study will be approved on the Refuge. If proposed research methods are evaluated and determined to have potential adverse impacts on refuge wildlife or habitat, then the refuge would determine the utility and need of such research to conservation and management of refuge wildlife and habitat. If the need was demonstrated by the research permittee and accepted by the refuge, then measures to minimize potential impacts (e.g., reduce the numbers of researchers entering an area, restrict research in specified areas) would be developed and included as part of the study design and on the SUP. SUPs will contain specific terms and conditions that the researcher(s) must follow relative to activity, location, duration, seasonality, etc. to ensure continued compatibility. All Refuge rules and regulations must be followed unless alternatives are otherwise accepted in writing by Refuge management.

All information, reports, data, collections, or documented sightings and observations, that are obtained as a result of this permit are the property of the Service and can be accessed by the Service at any time from the permittee at no cost, unless specific written arrangements are made to the contrary. The Refuge also requires the submission of annual or final reports and any/all publications associated with the work done on the Refuge. Each SUP may have additional criteria. Each SUP will also be evaluated individually to determine if a fee will be charged and for the length of the permit.

Extremely sensitive wildlife habitat areas would be avoided unless sufficient protection from research activities (i.e., disturbance, collection, capture and handling) is implemented to limit the area and/or wildlife potentially impacted by the proposed research. Where appropriate, some areas may be temporarily/seasonally closed so that research would be permitted when impacts to wildlife and habitat are less of a concern. Research activities will be modified to avoid harm to sensitive wildlife and habitat when unforeseen impacts arise.

Refuge staff will monitor researcher activities for potential impacts to the refuge and for compliance with conditions on the SUP. The refuge manager may determine that previously approved research and special use permits be terminated due to observed impacts. The refuge manager will also have the ability to cancel a SUP if the researcher is out of compliance with the stated conditions.

Justification: This program as described is determined to be compatible. Based upon impacts described in the Comprehensive Conservation Plan and Environmental Assessment (USFWS 2005), it is determined that research within the Refuge, as described herein, will not materially interfere with or detract from the purposes for which the Refuge was established or the mission of the Refuge System. Refuge monitoring and research will directly benefit and support refuge goals, objectives and management plans and activities. Fish, wildlife, plants and their habitat will improve through the application of knowledge gained from monitoring and research. Biological integrity, diversity and environmental health would benefit from scientific research conducted on natural resources at the refuge. The wildlife-dependent, priority public uses (wildlife viewing and photography, environmental education and interpretation, fishing and hunting) would also benefit as a result of increased biodiversity and wildlife and native plant populations from improved restoration and management plans and activities associated with monitoring and research investigations which address specific restoration and management questions.

Mandatory Re-Evaluation Date:

- Mandatory 15-year Re-Evaluation (for priority public uses)
- Mandatory 10-year Re-Evaluation, Date will be provided in Final EIS/CCP (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

- Categorical Exclusion without Environmental Action Statement
- Categorical Exclusion and Environmental Action Statement
- Environmental Assessment and Finding of No Significant Impact
- Environmental Impact Statement and Record of Decision

References Cited

Bowles A. E. 1995. Response of wildlife to noise. Pages 109-156. in R.L. Knight and D.N. Cole, editors. Wildlife and recreationists: coexistence through management and research. Washington, D.C., Island Press.

Boyle, S. A. and F. B. Samson. 1985. Effects of non-consumptive recreation on wildlife: a review. Wildl. Soc. Bull. 13:110-116.

Buckley, P. A. and F. G. Buckley. 1976. Guidelines for protection and management of colonially nesting waterbirds. North Atlantic Regional Office, National Park Service, Boston, MA. 52pp.

- Burger, J. 1981. The effect of human activity on birds at a coastal bay. *Biol. Cons.* 21:231-241.
- Burger, J. 1986. The effect of human activity on shorebirds in two coastal bays in northeastern United States. *Biological Conservation* 13:123-130.
- Burger, J. and M. Gochfeld. 1991. Human distance and birds: tolerance and response distances of resident and migrant species in India. *Environ. Conserv.* 18:158-165.
- Burger, J., and M. Gochfeld. 1998. Effects of ecotourists on bird behavior at Loxahatchee National Wildlife Refuge, Florida. *Environmental Conservation* 25:13-21.
- Burger, J., M. Gochfeld, and L. J. Niles. 1995. Ecotourism and birds in coastal New Jersey: Contrasting responses of birds, tourists, and managers. *Environmental Conservation* 22:56-65.
- Fox, A. D., and J. Madsen. 1997. Behavioural and distributional effects of hunting disturbance on waterbirds in Europe: implications for refuge design. *The Journal of Applied Ecology* 34:1-13.
- Glinski, R. L. 1976. Birdwatching etiquette: the need for a developing philosophy. *Am. Bird* 30(3):655-657.
- Goff, G.R., D.J. Decker and G. Pomerantz. 1988. A diagnostic tool for analyzing visitor impacts on wildlife refuges: A basis for a systematic approach to visitor management. *Trans. Northeast Sect. Wildl. Soc.* 45:82.
- Gutzwiller, K. J., R. T. Wiedenmann, K. L. Clements, and S. H. Anderson. 1994. Effects on human intrusion on song occurrence and singing consistency in subalpine birds. *Auk* 111:28-37.
- Hill, D., D. Hockin, D. Price, G. Tucker, R. Morris, and J. Treweek. 1997. Bird disturbance: improving the quality and utility of disturbance research. *Journal of Applied Ecology* 34:275-288.
- Hockin, D., M. Ounsted, M. Gorman, D. Hill, V. Keller, and M. A. Barker. 1992. Examination of the effects of disturbance on birds with reference to its importance in ecological assessments. *Journal of Environmental Management* 36:253-286.
- Klein, M. 1989. Effects of high levels of human visitation on foraging waterbirds at J. N. "Ding" Darling National Wildlife Refuge, Sanibel Florida. Masters thesis. Gainesville, Florida: University of Florida.
- Klein, M. L. 1993. Waterbird behavioral responses to human disturbances. *Wildl. Soc. Bull.* 21:31-39.
- Klein, M. L., S. R. Humphrey, and H. F. Percival. 1995. Effects of ecotourism on distribution of waterbirds in a wildlife refuge. *Conservation Biology* 9:1454-1465.
- Knight, R.L., and K. J. Gutzwiller, ed. 1995. *Wildlife and Recreationists: coexistence through management and research*. Island Press, Washington, D. C. 372pp.
- Knight, R. L. and S. A. Temple. 1995. Origin of wildlife responses to recreationists. In *Wildlife and recreation: coexistence through management and research*. R. L. Knight and K. J. Gutzwiller, eds. Island Press, Washington, D. C., pp 81-91.
- Madsen, J. 1995. Impacts of disturbance on migratory waterfowl. *Ibis* 137 Supplemental: S67-S74

- Miller, S. G., R. L. Knight, and C. K. Miller. 1998. Influence of recreational trails on breeding bird communities. *Ecol. Appl.* 8:162-169.
- Purdy, K. G., G. R. Goff, D. J. Decker, G. A. Pomerantz, N. A. Connelly. 1987. A guide to managing human activity on National Wildlife Refuges. Office of Information Transfer, U.S. Fish and Wildlife Service, Ft. Collins, CO. 57pp.
- Reijnen, R. and R. Foppen. 1994. The effects of car traffic on breeding bird populations in woodland. I. Evidence of reduced habitat quality for willow warbler (*Pyloscopus trochilus*) breeding close to a highway. *J. Appl. Ecol* 31: 85-94.
- Rodgers, J. A., and H. T. Smith. 1997. Buffer zone distances to protect foraging and loafing waterbirds from human disturbance in Florida. *Wildlife Society Bulletin* 25:139-145.
- Smith, L. and J. D. Hunt. 1995. Nature tourism: impacts and management. Pp. 203-219 in Knight, R. L.; Gutzwiller, K. J. (Wildlife and recreationists: coexistence through management and research, eds.). Island Press, Washington, D. C.
- USFWS. 2008. Desert National Wildlife Refuge Draft Comprehensive Conservation Plan and Environmental Impact Statement. U.S. Fish and Wildlife Service, Region 8.

Refuge Determination

Refuge Manager: _____
(Signature) (Date)

Project Leader
Approval: _____
(Signature) (Date)

Concurrence

Refuge Supervisor: _____
(Signature) (Date)

Assistant Regional
Director - Refuges: _____
(Signature) (Date)

COMPATIBILITY DETERMINATION

Use: Environmental Education and Interpretation

Refuge Name: Ash Meadows National Wildlife Refuge, located in Nye County, Nevada.

Establishing and Acquisition Authority(ies): Ash Meadows National Wildlife Refuge (Refuge) was established on June 18, 1984 under authority of the Endangered Species Act of 1973.

Refuge Purpose(s): The purpose of Ash Meadows comes from the Endangered Species Act of 1973:

“...to conserve (A) fish or wildlife which are listed as endangered species or threatened species...or (B) plants...” (16 USC Sec. 1534).

National Wildlife Refuge System Mission: “To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.” (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-ee]).

Description of Use: The National Wildlife Refuge System Improvement Act of 1997 identifies environmental education and interpretation, as well as hunting, fishing, wildlife observation and photography as priority public uses for refuges, where compatible with the Refuge purposes. Environmental education is defined as a process designed to teach citizens and visitors the history and importance of conservation and the biological and the scientific knowledge of our Nation’s natural resources (605 FW 6). Interpretation is defined as a communication process that forges emotional and intellectual connections between the audience and the resource (605 FW 7).

Ash Meadows Refuge is open to the public for environmental education as scheduled and provides interpretive materials throughout the Refuge, with interpretive programs being offered as scheduled. Currently, there are approximately 65,000 visits annually to the Refuge. Typical use is by individuals, family groups, school groups, and large groups during Refuge-sponsored special events. Crystal Springs Interpretive Boardwalk (1/3 mile long) provides an up-close view of one of the springs, and native fish and plants of the Refuge without disturbing the fragile habitat.

The Refuge is in the process of developing an Environmental Education Plan, Interpretation Plan, and programming for each. The Environmental Education Plan will assess visitor education needs and opportunities and incorporate the environmental education goals of Ash Meadows Recovery Plan, Clark County Multiple Species Habitat Conservation Plan, the RAMSAR Convention, and the state’s education standards for grade levels on which focus will be given. An objective of the Recovery Plan is to minimize human disturbance. This objective will be met by focusing on public education in concert with rare species protection. The Service will work with the public, non-government entities, and private partners to develop an offsite refugium for pupfish, in order to promote awareness of the endangered pupfish and other endemic species at the refuge. The Service will also contact local schools and provide on-site programs for school children.

The Interpretation Plan will assess interpretation needs and opportunities. The Service will develop multi-lingual interpretative materials and construct new interpretive facilities at Longstreet Springs and Point of Rocks. Interpretive displays at Devils Hole will be improved with assistance of Death Valley National Park staff, and educational materials will be developed. A volunteer program is being developed to staff the visitor contact station on a year-round basis and provide other services. The

Service would also prepare plans to identify additional locations for interpretive facilities and identify locations for new signs and replace existing signs.

The Point of Rocks area, including proposed boardwalk, is an outstanding location for an outdoor classroom. Students can see first-hand examples of many environmental concepts including: endangered species, endemic species, wetlands, riparian corridors, habitat restoration, water issues in the west, Native American history, cultural resources, geology, and a diversity of wildlife.

The Service will also participate in annual events, which may include the Nye County Fair, Pahrump Fall Festival, and Earth Day and speak at monthly community events, as invited.

The Refuge will develop a comprehensive Visitor Services Management Plan to describe compatible recreation opportunities for the public and evaluate improvements to visitor services on the Refuge. The plan would discuss additional sites for environmental education and interpretation, compatibility of non-wildlife dependent public uses, implementation of a recreation-fee program, and identify public uses that are not allowed on the Refuge. A Sign Management Plan will also develop a consistent and comprehensive message for signs, waysides, visitor road use and parking on the Refuge.

Environmental education and interpretation are considered together in this compatibility determination because both are considered to be wildlife-dependent, non-consumptive uses and many elements of these programs are similar. Both of these public uses are dependent upon establishing trail systems and vehicle parking areas in the Refuge. Though the Refuge currently hosts 65,000 visitors annually, that number is expected to increase, especially due to the movement of Nevada and California metropolis dwellers outward, closer to the Refuge.

Availability of Resources: Refuge operational funds are currently available through the Service budget process to administer these uses. The majority of the one-time costs for these projects has been obtained through the Southern Nevada Public Lands Management Act.

Anticipated Impacts of Use: The Refuge provides habitat consisting of spring-fed wetlands and alkaline desert uplands for at least 24 plants and animals found nowhere else in the world. The Ash Meadows NWR has a greater concentration of endemic life than any other area in the United States and the second greatest concentration in all of North America.

Disturbance of wildlife is the primary concern regarding these uses. Disturbance to wildlife, such as the flushing of feeding, resting, or nesting birds, is inherent to these activities. There is some temporary disturbance to wildlife due to human activities on trails (hiking, bird watching) however, the disturbance is generally localized and will not adversely impact overall populations. Visitors participating in education or interpretive programming are asked to respect the environment they are visiting. Increased facilities and visitation would cause some displacement of habitat and increase some disturbance to wildlife, although this is expected to be minor given the size of the Refuge and by avoiding or minimizing intrusion into important wildlife habitat.

Individual animals may be disturbed by human contact to varying degrees. Human activities on trails can result in direct effects on wildlife through harassment, a form of disturbance that can cause physiological effects, behavioral modifications, or death (Smith and Hunt 1995). Many studies have shown that birds can be impacted from human activities on trails when they are disturbed and flushed from feeding, resting, or nesting areas. Flushing, especially repetitive flushing, can strongly impact habitat use patterns of many bird species. Flushing from an area can cause birds to expend more energy, be deterred from using desirable habitat, affect resting or feeding patterns, and increase exposure to predation or cause birds to abandon sites with repeated disturbance (Smith and Hunt 1995). Migratory birds are observed to be more sensitive than resident species to disturbance (Klein 1989).

Hérons and shorebirds were observed to be the most easily disturbed (when compared to gulls, terns and ducks) by human activity and flushed to distant areas away from people (Burger 1981). A reduced number of shorebirds were found near people who were walking or jogging, and about 50 percent of flushed birds flew elsewhere (Burger 1981). In addition, the foraging time of sanderlings decreased and avoidance (e.g., running, flushing) increased as the number of humans within 100 meters increased (Burger and Gochfeld 1991). Nest predation for songbirds (Miller et al. 1998), raptors (Glinski 1976), colonial nesting species (Buckley and Buckley 1976), and waterfowl (Boyle and Samson 1985) tends to increase in areas more frequently visited by people. In addition, for many passerine species, primary song occurrence and consistency can be impacted by a single visitor (Gutzwiller et al. 1994). In areas where primary song was affected by disturbance, birds appeared to be reluctant to establish nesting territories (Reijnen and Foppen 1994).

Depending on the species (especially migrants vs. residents), some birds may habituate to some types of recreation disturbance and either are not disturbed or will immediately return after the initial disturbance (Hockin et al. 1992; Burger et al. 1995; Knight & Temple 1995; Madsen 1995; Fox & Madsen 1997). Rodgers & Smith (1997) calculated buffer distances that minimize disturbance to foraging and loafing birds based on experimental flushing distances for 16 species of waders and shorebirds. They recommended 100 meters as an adequate buffer against pedestrian traffic, however, they suggest this distance may be reduced if physical barriers (e.g., vegetation screening) are provided, noise levels are reduced, and traffic is directed tangentially rather than directly toward birds. Screening may not effectively buffer noise impacts, thus visitors should be educated on the effects of noise and noise restrictions should be enforced (Burger 1981, 1986; Klein 1993; Bowles 1995; Burger & Gochfeld 1998). Seasonally restricting or prohibiting recreation activity may be necessary during spring and fall migration to alleviate disturbance to migratory birds (Burger 1981, 1986; Boyle & Samson 1985; Klein et al. 1995; Hill et al. 1997).

Education is critical for making visitors aware that their actions can have impacts on wildlife, and will increase the likelihood that visitors will abide by restrictions on their actions. For example, Klein (1993) demonstrated that visitors who spoke with refuge staff or volunteers were less likely to disturb birds. Increased surveillance and imposed fines may help reduce visitor caused disturbance (Knight & Gutzwiller 1995). Monitoring is recommended to adjust management techniques over time, particularly because it is often difficult to generalize about the impacts of specific types of recreation in different environments. Local and site -specific knowledge is necessary to determine effects on birds and to develop effective management strategies (Hockin et al. 1992; Klein et al. 1995; Hill et al. 1997). Informed management decisions coupled with sufficient public education could do much to mitigate disturbance effects of wildlife-dependent recreations (Purdy et al 1987).

Environmental education and interpretation activities generally support Refuge purposes and impacts can largely be minimized (Goff et al. 1988). The minor resource impacts attributed to these activities are generally outweighed by the benefits gained by educating present and future generations about refuge resources. Environmental education is a public use management tool used to develop a resource protection ethic within society. While it is associated with school-age children, it is not limited to this group. This tool allows us to educate refuge visitors about endangered and threatened species management, wildlife management and ecological principles and communities. A secondary benefit of environmental education is that it instills an 'ownership' or 'stewardship' ethic in visitors which could reduce vandalism, littering and poaching; it also strengthens service visibility in the local community.

The disturbance by environmental education activities is considered to be of minimal impact because: (1) the total number of students permitted through the reservation system will be limited to 100 per day; (2) students and teachers will be instructed in trail etiquette and the best ways to view wildlife with minimal disturbance; (3) education groups will be required to have a sufficient number of adults to supervise the group; (4) trail design will provide adequate cover for wildlife; and (5) observation areas and scopes are provided to view wildlife at a distance which reduces disturbance.

Education staff will coordinate with biologists regarding activities associated with restoration or monitoring projects to ensure that impacts to both wildlife and habitat are minimal. As with any restoration and monitoring activities conducted by Refuge personnel, these activities conducted by students would be at a time and place where the least amount of disturbance would occur.

Anticipated Impacts of Uses on Future Lands within the Approved Boundary: The implementation of environmental education and interpretation programs will not threaten human health or safety. The programs and associated infrastructure not only will have minimal impacts on the natural and cultural resources of Ash Meadows NWR but, they will promote the messages of stewardship and awareness in order to further lessen the impacts in those areas. Implementing the environmental education and interpretation programs will be done in a manner that is consistent with current Refuge management goals. There are no anticipated conflicts with other priority uses on the Refuge.

Public Review and Comment: Public review and comments will be solicited in conjunction with distribution of the Draft CCP/EIS for the Desert National Wildlife Refuge Complex.

Determination:

Use is Not Compatible

Use is Compatible with the Following Stipulations

Stipulations necessary to ensure compatibility:

- Participants in the Refuge's environmental education program will be restricted to established trails, the visitor contact station, and other designated sites.
- All groups using the Refuge for environmental education will be encouraged to make reservations in advance through the Refuge office. This process, which takes the place of a Special Use Permit (SUP), allows refuge staff to manage the number and location of visitors for each unit. There is a current refuge policy that educational groups are not charged a fee or required to have a SUP. A daily limit of 100 students participating in the education program at any one site will be maintained through this reservation system. Efforts will be made to spread out use by large groups while reservations are made, reducing disturbance to wildlife and overcrowding of Refuge facilities during times of peak demand.
- Trail etiquette, including ways to reduce wildlife disturbance, will be discussed with teachers during orientation workshops and with students upon arrival during their welcome session. On the Refuge, the teacher(s) is(are) responsible for ensuring that students follow required trail etiquette.
- Refuge biologists and public use specialists will conduct regular surveys of public activities on the refuge. The data will be analyzed and used by the refuge manager to develop future modifications if necessary to ensure compatibility of environmental education programs.
- Educational groups are required to have a sufficient number of adults to supervise their groups, a minimum of 1 adult per 8 students.

Justification: These wildlife-dependent uses are priority public uses of the National Wildlife Refuge System. Providing opportunities for environmental education and interpretation, would contribute toward fulfilling provisions of the National Wildlife Refuge System Administration Act, as amended in 1997, and one of the goals of the Ash Meadows Refuge (Goal 3, Chapter 3, CCP). Environmental education and interpretation would provide an excellent forum for allowing public access and increasing understanding of Refuge resources. The stipulations outlined above should minimize

potential impacts relative to wildlife/human interactions. Based upon impacts described in the Draft Comprehensive Conservation Plan and Environmental Impact Statement (USFWS 2008), it is determined that environmental education and interpretation within the Ash Meadows National Wildlife Refuge, as described herein, will not materially interfere with or detract from the purposes for which the Refuge was established or the mission of the Refuge System. These wildlife dependent uses will not conflict with the national policy to maintain the biological diversity, integrity, and environmental health of the refuge.

Mandatory Re-Evaluation Date:

Mandatory 15-year Re-Evaluation, Date will be provided in Final EIS/CCP (for priority public uses)

Mandatory 10-year Re-Evaluation (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

Categorical Exclusion without Environmental Action Statement

Categorical Exclusion and Environmental Action Statement

Environmental Assessment and Finding of No Significant Impact

Environmental Impact Statement and Record of Decision

References Cited

- Bowles A. E. 1995. Response of wildlife to noise. Pages 109-156. in R.L. Knight and D.N. Cole, editors. Wildlife and recreationists: coexistence through management and research. Washington, D.C., Island Press.
- Boyle, S. A. and F. B. Samson. 1985. Effects of non-consumptive recreation on wildlife: a review. Wildl. Soc. Bull. 13:110-116.
- Buckley, P. A. and F. G. Buckley. 1976. Guidelines for protection and management of colonially nesting waterbirds. North Atlantic Regional Office, National Park Service, Boston, MA. 52pp.
- Burger, J. 1981. The effect of human activity on birds at a coastal bay. Biol. Cons. 21:231-241.
- Burger, J. 1986. The effect of human activity on shorebirds in two coastal bays in northeastern United States. Biological Conservation 13:123-130.
- Burger, J. and M. Gochfeld. 1991. Human distance and birds: tolerance and response distances of resident and migrant species in India. Environ. Conserv. 18:158-165.
- Burger, J., and M. Gochfeld. 1998. Effects of ecotourists on bird behavior at Loxahatchee National Wildlife Refuge, Florida. Environmental Conservation 25:13-21.
- Burger, J., M. Gochfeld, and L. J. Niles. 1995. Ecotourism and birds in coastal New Jersey: Contrasting responses of birds, tourists, and managers. Environmental Conservation 22:56-65.

- Fox, A. D., and J. Madsen. 1997. Behavioural and distributional effects of hunting disturbance on waterbirds in Europe: implications for refuge design. *The Journal of Applied Ecology* 34:1-13.
- Glinski, R. L. 1976. Birdwatching etiquette: the need for a developing philosophy. *Am. Bird* 30(3):655-657.
- Goff, G.R., D.J. Decker and G. Pomerantz. 1988. A diagnostic tool for analyzing visitor impacts on wildlife refuges: A basis for a systematic approach to visitor management. *Trans. Northeast Sect. Wildl. Soc.* 45:82.
- Gutzwiller, K. J., R. T. Wiedenmann, K. L. Clements, and S. H. Anderson. 1994. Effects on human intrusion on song occurrence and singing consistency in subalpine birds. *Auk* 111:28-37.
- Hill, D., D. Hockin, D. Price, G. Tucker, R. Morris, and J. Treweek. 1997. Bird disturbance: improving the quality and utility of disturbance research. *Journal of Applied Ecology* 34:275-288.
- Hockin, D., M. Ounsted, M. Gorman, D. Hill, V. Keller, and M. A. Barker. 1992. Examination of the effects of disturbance on birds with reference to its importance in ecological assessments. *Journal of Environmental Management* 36:253-286.
- Klein, M. 1989. Effects of high levels of human visitation on foraging waterbirds at J. N. "Ding" Darling National Wildlife Refuge, Sanibel Florida. Masters thesis. Gainesville, Florida: University of Florida.
- Klein, M. L. 1993. Waterbird behavioral responses to human disturbances. *Wildl. Soc. Bull.* 21:31-39.
- Klein, M. L., S. R. Humphrey, and H. F. Percival. 1995. Effects of ecotourism on distribution of waterbirds in a wildlife refuge. *Conservation Biology* 9:1454-1465.
- Knight, R.L., and K. J. Gutzwiller, ed. 1995. *Wildlife and Recreationists: coexistence through management and research*. Island Press, Washington, D. C. 372pp.
- Knight, R. L. and S. A. Temple. 1995. Origin of wildlife responses to recreationists. In *Wildlife and recreation: coexistence through management and research*. R. L. Knight and K. J. Gutzwiller, eds. Island Press, Washington, D. C., pp 81-91.
- Madsen, J. 1995. Impacts of disturbance on migratory waterfowl. *Ibis* 137 Supplemental: S67-S74
- Miller, S. G., R. L. Knight, and C. K. Miller. 1998. Influence of recreational trails on breeding bird communities. *Ecol. Appl.* 8:162-169.
- Purdy, K. G., G. R. Goff, D. J. Decker, G. A. Pomerantz, N. A. Connelly. 1987. *A guide to managing human activity on National Wildlife Refuges*. Office of Information Transfer, U.S. Fish and Wildlife Service, Ft. Collins, CO. 57pp.
- Reijnen, R. and R. Foppen. 1994. The effects of car traffic on breeding bird populations in woodland. I. Evidence of reduced habitat quality for willow warbler (*Pyloscopus trochilus*) breeding close to a highway. *J. Appl. Ecol* 31: 85-94.
- Rodgers, J. A., and H. T. Smith. 1997. Buffer zone distances to protect foraging and loafing waterbirds from human disturbance in Florida. *Wildlife Society Bulletin* 25:139-145.

Smith, L. and J. D. Hunt. 1995. Nature tourism: impacts and management. Pp. 203-219 in Knight, R. L.; Gutzwiller, K. J. (Wildlife and recreationists: coexistence through management and research, eds.). Island Press, Washington, D. C.

USFWS. 2008. Desert National Wildlife Refuge Draft Comprehensive Conservation Plan and Environmental Impact Statement. U.S. Fish and Wildlife Service, Region 8.

Refuge Determination

Refuge Manager: _____
(Signature) (Date)

Project Leader
Approval: _____
(Signature) (Date)

Concurrence

Refuge Supervisor: _____
(Signature) (Date)

Assistant Regional
Director - Refuges: _____
(Signature) (Date)

COMPATIBILITY DETERMINATION

Use: Hunting

Refuge Name: Ash Meadows National Wildlife Refuge, located in Nye County, Nevada.

Establishing and Acquisition Authority(ies): Ash Meadows National Wildlife Refuge (Refuge) was established on June 18, 1984 under authority of the Endangered Species Act of 1973.

Refuge Purpose(s): The purpose of Ash Meadows comes from the Endangered Species Act of 1973:

“...to conserve (A) fish or wildlife which are listed as endangered species or threatened species...or (B) plants...” (16 USC Sec. 1534).

National Wildlife Refuge System Mission: “To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.” (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-ee]).

Description of Use: Hunting is identified in the National Wildlife Refuge System Improvement Act of 1997 (16 U.S.C. 668dd-ee) as a priority use for refuges when it is compatible with the refuge purposes and mission of the Refuge System. An Interim Hunting Plan was published for Ash Meadows NWR in 1986 in order to address the tradition of hunting during the establishment of the Refuge. That document allowed for the continuation of “small game, upland game, and waterfowl hunting as in the past on the Ash Meadows National Wildlife Refuge, Nye County, Nevada for a period of approximately three (3) years or until a master plan is completed.”

With the writing of the CCP, Ash Meadows NWR has re-evaluated the hunt opportunities on the Refuge. As a result, Ash Meadows NWR is proposing to allow duck, coot, snipe, dove, and quail hunting on approximately 7,000 acres of land owned in fee-title by the USFWS or, 51% of the Refuge owned in fee-title by the USFWS. Maps and descriptions of the hunt units are included in the Ash Meadows Hunt Management Plan. The hunting program will provide high quality, safe hunting opportunities, and will be carried out consistently with State regulations and Refuge-specific regulations found in 50 CFR 32.47.

The guiding principles of the Refuge System’s hunting programs (Service Manual 605 FW 2.4) are to:

- Manage wildlife populations consistent with Refuge System-specific management plans approved after 1997 and, to the extent practicable, State fish and wildlife conservation plans;
- Promote visitor understanding of and increase visitor appreciation for America’s natural resources;
- Provide opportunities for quality recreational and educational experiences consistent with criteria describing quality found in 605 FW 1.6;
- Encourage participation in this tradition deeply rooted in America’s natural heritage and conservation history; and
- Minimize conflicts with visitors participating in other compatible wildlife-dependent recreational activities.

Though the Refuge does not manage for any of the hunted species specifically, their ability to utilize the Refuge resources is important. The Refuge must ensure that practices within the Refuge boundary do not put populations outside of the Refuge at risk. Therefore, management of the hunt

program will be based on good science and the ability to maintain a quality hunt program which, according to the Service Manual 605 FW 1.6:

- Promotes safety of participants, other visitors, and facilities;
- Promotes compliance with applicable laws and regulations and responsible behavior;
- Minimizes or eliminates conflict with fish and wildlife population or habitat goals or objectives in an approved plan;
- Minimizes or eliminates conflicts with other compatible wildlife-dependent recreation;
- Minimizes conflicts with neighboring landowners;
- Promotes accessibility and availability to a broad spectrum of the American people;
- Promotes resource stewardship and conservation;
- Promotes public understanding and increases public appreciation of America’s natural resources and our role in managing and conserving these resources;
- Provides reliable/reasonable opportunities to experience wildlife;
- Uses facilities that are accessible to people and blend into natural setting; and
- Uses visitor satisfaction to help define and evaluate programs.

The Refuge has approximately 3,100 annual hunting visits. Hunting success has been harder to determine as few hunters have participated in voluntary reporting of harvests, which has been requested the past two years.

Contact with staff is encouraged, as the Refuge visitor center/office is generally open seven days per week. Although a check station is not a feasible means of maintaining contact with area hunters, they are invited to stop by the visitor center/office for information, to report the success of/displeasure with their hunt experience, and to report illegal activity on the Refuge. Refuge staff also make contact with hunters in parking areas or on the way to hunt areas, when possible.

Attention has been given to where a majority of Refuge hunters go for the various types of allowed hunting. These observations were used in determining which parts of the Refuge are best for hunting, with the least amount of conflicts, allowing for the creation of hunt units. Areas not included in the hunt units either contain sub-prime habitat for hunted species, are in close proximity to private in-holdings with residents, or are high-use areas for non-hunting visitors during the same time periods as hunt seasons. Because endangered plants are managed for by the Refuge, attention had to be given to population distribution of endangered and threatened plant species. In addition, the Refuge is surrounded by Bureau of Land Management lands, all of which are open to hunting, according to State regulations.

Weapons allowed for these hunts include shotguns and non-toxic shot only. The number of hunters per hunt day will not be limited unless, through future evaluation, a carrying capacity has been documented and met. Hunters may use trained retrieving dogs, which must be under the hunter’s voice control at all times. Watercraft may not be used in Refuge waters. With the threat of invasive aquatic species, watercraft are no longer allowed for use in Refuge waters.

Availability of Resources: Annual costs are currently maintainable through funding and staff resources available to the Refuge.

The following funding/annual costs (based on FY 2007 costs) would be required to administer and manage hunting activities as described above:

	One-Time Costs	Annual Costs
Printing (brochures, signs, posters, etc)		\$5,000
Law Enforcement (permit compliance, access control, protection. Approx. 600		\$30,000

hours.)		
Monitoring (bird pop. surveys)		\$4,400
Maintenance (parking lot, trash cleanup, toilet. Approx. 150 hours.)		\$5,100
Road Maintenance (grading)		\$7,000
Administrative Services		\$3,600
TOTAL		\$55,100

Anticipated Impacts of Use: Direct effects of hunting include mortality, wounding, and disturbance (De Long 2002). Hunting can alter behavior (i.e. foraging time), population structure, and distribution patterns of wildlife (Owens 1977, Raveling 1979, White-Robinson 1982, Thomas 1983, Bartelt 1987, Madsen 1985, and Cole and Knight 1990). There also appears to be an inverse relationship between the numbers of birds using an area and hunting intensity (DeLong 2002). In Connecticut, lesser scaup were observed to forage less in areas that were heavily hunted (Cronan 1957). In California, the numbers of northern pintails on Sacramento Refuge non-hunt areas increased after the first week of hunting and remained high until the season was over in early January (Heitmeyer and Raveling 1988). Following the close of hunting season, ducks generally increased their use of the hunt area; however, use was lower than before the hunting season began. Human disturbance associated with hunting includes loud noises and rapid movements, such as those produced by shotguns and boats powered by outboard motors. This disturbance, especially when repeated over a period of time, compels waterfowl to change food habits, feed only at night, lose weight, or desert feeding areas (Madsen 1995, Wolder 1993).

These impacts can be reduced by the presence of adjacent sanctuary areas where hunting does not occur, and birds can feed and rest relatively undisturbed. Sanctuaries or non-hunt areas have been identified as the most common solution to disturbance problems caused from hunting (Havera et. al 1992). Prolonged and extensive disturbances may cause large numbers of waterfowl to leave disturbed areas and migrate elsewhere (Madsen 1995, Paulus 1984). In Denmark, hunting disturbance effects were experimentally tested by establishing two sanctuaries (Madsen 1995). Over a 5-year period, these sanctuaries became two of the most important staging areas for coastal waterfowl. Numbers of dabbling ducks and geese increased 4 to 20 fold within the sanctuary (Madsen 1995). Thus, sanctuary and non-hunt areas are very important to minimize disturbance to waterfowl populations to ensure their continued use of the Refuges.

Intermittent hunting can be a means of minimizing disturbance, especially if rest periods in between hunting events are weeks rather than days (Fox and Madsen 1997). It is common for Refuges to manage hunt programs with non-hunt days. At Sacramento National Wildlife Refuge, 3-16 percent of pintails were located on hunted units during non-hunt days, but were almost entirely absent in those same units on hunt days (Wolder 1993). In addition, northern pintails, American wigeon, and northern shovelers decreased time spent feeding on days when hunting occurred on public shooting areas, as compared to non-hunt days (Heitmeyer and Raveling 1988). The intermittent hunting program of three hunt days per week at Sacramento Refuge results in lower pintail densities on hunt areas during non-hunt days than non-hunt areas (Wolder 1993). However, intermittent hunting alone may not always significantly reduce hunting impacts.

Hunting is a highly regulated activity, and generally takes place at specific times and seasons (fall and winter) when the game animals are less vulnerable, reducing the magnitude of disturbance to refuge wildlife. Managed and regulated hunting will not reduce species populations to levels where other wildlife-dependent uses will be affected.

The use of trained retrieving dogs would be permitted and encouraged in all areas open to bird hunting as a means of reducing waste. These dogs would be required to be under voice or physical control at all

times. Any hunter who allows his/her dog to disturb wildlife is not well received by other hunters who do not want waterfowl disturbed on the ponds that they are hunting.

Hunting is an appropriate wildlife management tool that can be used to manage wildlife populations. Some wildlife disturbance will occur during the hunting seasons. Proper zoning, regulations, and Refuge seasons will be designated to minimize any negative impacts to wildlife populations using the Refuges. Harvesting hunted species will not result in a substantial decrease in biological diversity on the Refuge.

Conflicts between hunting and other public uses will be minimized by the following:

- Physically separating non-hunting and hunting acres to spatially divide the activities.
- Limiting hunting to certain days of the week, based on input from Refuge Biologists, to allow for resting periods, season openers, and law enforcement availability. Generally, though, at least three (3) days per seven-day period will be available for hunting on the Refuge.
- Posting boundary and hunting areas and maintaining that signage to clearly define the designated hunting areas.
- Allowing vehicle traffic only on designated roads and parking areas. Only pedestrian access will be allowed beyond designated parking areas within a hunt unit.
- Regular field checks by refuge law enforcement officers in order to maintain compliance with regulations.
- Providing information about the refuge hunting program through staff in the visitor center/office, signs, and flyers.

Wildlife populations on the Refuge are able to sustain hunting and support other wildlife-dependent priority uses. To manage the populations to support hunting, the Refuge adopts harvest regulations set by the State within Federal framework guidelines. Regular surveys of hunted species will be maintained and harvest records kept, as possible, to determine if further restrictions on harvest limits need to be made.

By its very nature, hunting has very few positive effects on the target species while the activity is occurring. If hunt programs are managed properly, though, the populations of the target species can benefit overall. Also, hunting can give people a deeper appreciation of wildlife and a better understanding of the importance of conserving wildlife habitat, which ultimately contributes to fulfilling the Refuge System mission.

Though hunting may not have a direct impact on the endangered and threatened fish, wildlife, and plant species on the Refuge, consideration was given to indirect impacts, such as the introduction of exotic and invasive species due to the regular presence of hunters. It has not been determined that hunting significantly impacts these populations, although direct study has not been done on the Refuge.

Public Review and Comment: Public review and comments will be solicited in conjunction with distribution of the Draft CCP for Ash Meadows NWR. Following the public review and comment period, comments and actions taken to address comments will be summarized here.

Determination:

Use is Not Compatible

Use is Compatible with the Following Stipulations

Stipulations necessary to ensure compatibility:

- Bag limits will be based on those set by Nevada Department of Wildlife unless statistically

sound surveys indicate a significant drop in target species populations, at which point, at the discretion of the Refuge Manager, more restrictive bag limits will be set, evaluated on an annual basis.

- Hunters are allowed onto the Refuge one (1) hour before sunrise and may stay until one (1) hour after sunset. Actual legal hunt hours are as determined by Nevada Department of Wildlife.
- Weapons must be unloaded and either dismantled or cased while traveling on/through the Refuge in a vehicle.
- Hunters requiring special assistance must contact the Refuge two business days before hunting to obtain any necessary permits or information.
- Hunting over spring pools is not allowed. Hunters must stay 100 feet off outer edge of a spring pool and cannot shoot across it.
- Hunters are not allowed to hunt across boundary lines of the Refuge or its hunt units. Hunters should keep their shots 100 feet inward from boundaries so as to not endanger private residents in or around the Refuge boundaries and to keep from having wounded birds outside of huntable areas.
- Longstreet Spring and Cabin is a popular jumping off point for hunters and a point of interest for non-hunting visitors. Access to hunting areas is encouraged from the Longstreet parking area but, hunters must stay beyond the signage indicating the area closed to hunting immediately around the spring and historic cabin, which are set aside for non-hunting visitors.
- All or any part of the Refuge may be closed to hunting by the Refuge Manager whenever necessary to protect the resources of the area or in the event of an emergency endangering life or property.

Justification: Allowing the continuation of hunting on the Refuge does not materially interfere with or detract from fulfilling the Refuge purpose of protecting endangered and threatened fish, wildlife, or plants nor does it interfere with or detract from fulfilling the Refuge System mission. The interim hunt program has been evaluated and subsequent changes made to reflect the management goals of the Refuge, the availability of resources, and impacts of use on an endangered species refuge.

Mandatory Reevaluation Date (October 2023):

Mandatory 15-Year Reevaluation Date will be provided in Final
EIS/CCP (for priority public uses)

Mandatory 10-Year Reevaluation Date (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

Categorical Exclusion without Environmental Action Statement

Categorical Exclusion and Environmental Action Statement

Environmental Assessment and Finding of No Significant Impact

Environmental Impact Statement and Record of Decision

References Cited:

Bartelt, G. A. 1987. Effects of disturbance and hunting on the behavior of Canada goose family groups in east central Wisconsin. *J. Wildl. Manage.* 51:517-522.

- Cole, D. N. and R. L. Knight. 1990. Impacts of recreation on biodiversity in wilderness. Utah State University, Logan, Utah.
- Cronan, J. M. 1957. Food and feeding habits of the scaups in Connecticut waters. *Auk* 74(4):459-468.
- DeLong, A. 2002. Managing Visitor Use & Disturbance of Waterbirds. A Literature Review of Impacts and Mitigation Measures.
- Fox, A. D. and J. Madsen. 1997. Behavioral and distributional effects of hunting disturbance on waterbirds in Europe: implications for refuge design. *J. Appl. Ecol.* 34:1-13.
- Havera, S. P., L. R. Boens, M. M. Georgi, and R. T. Shealy. 1992. Human disturbance of waterfowl on Keokuk Pool, Mississippi River. *Wildl. Soc. Bull.* 20:290-298.
- Heitmeyer, M. E. and D. G. Raveling. 1988. Winter resource use by three species of dabbling ducks in California. Dept. Wildlife and Fisheries Biology, Univ. of Calif., Davis. Final Report to Delta Waterfowl and Wetlands Research Center, Portage La Prairie, Manitoba, Canada. 200pp.
- Madsen, J. 1985. Impact of disturbance on field utilization of pink-footed geese in West Jutland, Denmark. *Biol. Conserv.* 33:53-63.
- Madsen, J. 1995. Impacts of disturbance on migratory waterfowl. *Ibis* 137:S67-S74.
- Owens, N. W. 1977. Responses of wintering brant geese to human disturbance. *Wildfowl* 28:5-14.
- Paulus, S.L. 1984. Activity budgets of nonbreeding gadwalls in Louisiana. *J. Wildl. Manage.* 48:371-380.
- Raveling, D. G. 1979. The annual cycle of body composition of Canada geese with special reference to control of reproduction. *Auk* 96:234-252.
- Thomas, V. G. 1983. Spring migration: the prelude to goose reproduction and a review of its implication. *In* Fourth Western Hemispheric Waterfowl and Waterbird Symposium, ed., H. Boyd. 73-81. Ottawa, Canada: Canadian Wildlife Service.
- USFWS. 2008. Desert National Wildlife Refuge Complex Draft Comprehensive Conservation Plan/Environmental Impact Statement. U.S. Fish and Wildlife Service, California/Nevada Office.
- White-Robinson, R. 1982. Inland and salt marsh feeding of wintering brent geese in Essex. *Wildfowl* 33:113-118.
- Wolder, M. 1993. Disturbance of wintering northern pintails at Sacramento National Wildlife Refuge, California. M. S. Thesis, Humboldt State Univ., Arcata. 62pp.

Refuge Determination

Refuge Manager:

(Signature)

(Date)

Project Leader
Approval:

(Signature)

(Date)

Concurrence

Refuge Supervisor:

(Signature)

(Date)

Assistant Regional
Director - Refuges:

(Signature)

(Date)

COMPATIBILITY DETERMINATION

Use: Fishing (Bullfrogging)

Refuge Name: Ash Meadows National Wildlife Refuge, located in Nye County, Nevada.

Establishing and Acquisition Authority(ies): Ash Meadows National Wildlife Refuge (Refuge) was established on June 18, 1984 under authority of the Endangered Species Act of 1973.

Refuge Purpose(s): The purpose of Ash Meadows comes from the Endangered Species Act of 1973:

“...to conserve (A) fish or wildlife which are listed as endangered species or threatened species...or (B) plants...” (16 USC Sec. 1534).

National Wildlife Refuge System Mission: “To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.” (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-ee]).

Description of Use: Fishing for non-native bullfrogs (*Rana catesbeiana*) is usually done by gigging. The State of Nevada addresses the harvest of bullfrogs and crayfish under their sport fishing regulations, which must be followed for harvesting on the Refuge. General fishing for game fish has never been officially opened on the Refuge; however, game fishing has occurred on the Refuge, at Crystal Reservoir (a.k.a. Amargosa Lake) for many years, until 2001. Although some introduced game fish still exist on the refuge, habitat enhancement and restoration efforts are expected to reduce or eliminate these non-native, predatory fish from Refuge waters. Part of that habitat enhancement includes the removal of aquatic exotic species from the Refuge waters.

Availability of Resources:

As the number of visitors expected to perform this activity is relatively small, fishing for bullfrogs should not pose a problem and can be handled with existing Refuge staff. The U.S. Fish and Wildlife Service Law Enforcement Officer stationed at the Refuge patrols and enforces state and federal laws and regulations.

Anticipated Impacts of the Use(s): Shoreline activities, such as human noise, could cause some birds to flush and go elsewhere. Disturbance and destruction of riparian vegetation, bank stability, and water quality may result from high levels of bank fishing activities. Due to the limited number of people attempting this activity, these negative impacts are anticipated to be insignificant when compared to the positive impacts of exotic predator reduction.

These impacts will be minimized further by the following:

- Requiring anyone who wants to fish for bullfrog or crayfish to obtain a Special Use Permit, and any licensing required by the State of Nevada.
- Providing information about exotics and their impacts on the native resources to permittees.
- Monitor fishing activities to ensure facilities are adequate and wildlife disturbance is minimal.
- Law enforcement patrols will be conducted by refuge officers to enforce state and federal regulations.

- Limit fishing activities during the Migratory Bird Treaty Act critical period (March 15 – August 15) if nesting activity is recorded by Refuge staff. Nesting activity should be monitored at the beginning of this period by Refuge staff annually.
- Provide information about the Refuge fishing program by installing informational signs/kiosks, creating and distributing brochures, and utilizing the Refuge’s website.
- Install public use ethics panel, including the importance of not littering and displaying the “pack it in and pack it out” message at appropriate access points.

The Refuge believes that there will be minimal conflicts between fishers for bullfrog and the other wildlife-dependent recreational users.

Public Review and Comment: Public review and comments will be solicited in conjunction with distribution of the Draft CCP for Desert NWRC. Following the public review and comment period, comments and actions taken to address comments will be summarized here.

Determination:

Use is Not Compatible

Use is Compatible with the Following Stipulations

Stipulations necessary to ensure compatibility:

- Refuge staff will submit for Refuge Specific Regulations: Recreational Fishing. We allow recreational fishing for bullfrogs by gigging only in Refuge waters in accordance with State regulations subject to the following conditions:
- All fishers must obtain a Special Use Permit from the Refuge staff prior to any fishing activity on the Refuge.
- Refuge staff will monitor fishing for bullfrog to ensure that facilities are adequate and disturbance to wildlife continues to be minimal.
- Users will park in signed parking areas, stay on designated roads, and recreate in a manner that prevents erosion or habitat damage.
- Refuge staff will provide information about fishing for bullfrog closures to each permitted user.
- Refuge staff will work to ensure proper signing and to distribute regulations in order to better inform the visiting public.
- Refuge Law Enforcement Officers will patrol regularly to enforce state and federal regulations.

Justification: Harvesting bullfrogs is an appropriate wildlife-dependent recreational activity for this Refuge. Based upon impacts described in the Comprehensive Conservation Plan, it is determined that harvesting bullfrogs within the Ash Meadows National Wildlife Refuge, as described herein, will not materially interfere with or detract from the purposes for which the Refuge was established or mission of the National Wildlife Refuge System.

Fishing is a priority public use listed in the Improvement Act of 1997. Although regular sport fishing is not appropriate on this endangered species Refuge, by facilitating fishing for bullfrogs on the Refuge, the visitors’ knowledge and appreciation of fish and wildlife is likely to increase. Harvesting bullfrogs is a form of public stewardship of wildlife and their habitats on the Refuge. Increased public stewardship supports and complements the Service’s actions in achieving the Refuge’s purposes and the mission of the National Wildlife Refuge System.

The harvesting bullfrogs is a component of the Recovery Plan for the Endangered and Threatened Species of Ash Meadows, Nevada (1990), under recovery action #232 that states “remove non-native competitive/predatory aquatic species.” Additionally, a goal of Refuge management is to provide opportunities for wildlife-dependent recreation “that are compatible with, and foster an appreciation and understanding of, Ash Meadows NWR’s wildlife and plant communities.”

Mandatory Re-Evaluation Date:

 X Mandatory 15-year Re-Evaluation, Date will be provided in Final EA/CCP (for priority public uses)

 Mandatory 10-year Re-Evaluation (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

 Categorical Exclusion without Environmental Action Statement

 Categorical Exclusion and Environmental Action Statement

 Environmental Assessment and Finding of No Significant Impact

 X Environmental Impact Statement and Record of Decision

References Cited

Knight, R.L. and D .N. Cole. 1995. Wildlife responses to recreationists. *in* Wildlife and Recreationists (R.L. Knight and K.J. Gutzwiller, eds.) Island Press, Covelo, California.

Nevada Revised Statutes. NRS 503.290. Manner and means of fishing; requirements for use of second combination of hook, line and rod; taking frogs.

Nevada Fishing Seasons and Regulations, Effective March 1, 2005 – February 28, 2006. Department of Wildlife, 1100 Valley Road, Reno, Nevada 89512-2817. 45pp.

U.S. Fish and Wildlife Service. 1990. Recovery Plan for the Endangered and Threatened Species of Ash Meadows, Nevada. U.S. Fish and Wildlife Service, Portland, Oregon. 123pp.

Refuge Determination

Refuge Manager: _____
(Signature) (Date)

Project Leader Approval: _____
(Signature) (Date)

Concurrence

Refuge Supervisor: _____
(Signature) (Date)

Assistant Regional Director - Refuges: _____
(Signature) (Date)

COMPATIBILITY DETERMINATION

Use: Research

Refuge Name: Ash Meadows National Wildlife Refuge, located in Nye County, Nevada.

Establishing and Acquisition Authority(ies): Ash Meadows National Wildlife Refuge (Refuge) was established on June 18, 1984 under authority of the Endangered Species Act of 1973.

Refuge Purpose(s): The purpose of Ash Meadows comes from the Endangered Species Act of 1973:

“...to conserve (A) fish or wildlife which are listed as endangered species or threatened species...or (B) plants...” (16 USC Sec. 1534).

National Wildlife Refuge System Mission: “To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.” (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-ee]).

Description of Use: There is much that can be learned from field research within the Refuge. Baseline information in the biological, geophysical, hydrological and other fields is still in need of being collected. There are many opportunities for consultants, colleges and universities, and other agencies to obtain permission to conduct critical and noteworthy research on the Refuge.

Two provisions of the National Wildlife Refuge Improvement Act are to “maintain biological integrity, diversity and environmental health” and to conduct “inventory and monitoring.” Monitoring and research are an integral part of National Wildlife Refuge management. Plans and actions based on thorough research and consistent monitoring provide an informed approach to management affects on wildlife and habitat.

Currently, research applicants are required to submit a proposal that outlines: (1) objectives of the study; (2) justification for the study; (3) detailed methodology and schedule; (4) potential impacts on Refuge wildlife or habitat, including disturbance (short and long term), injury, or mortality (this includes a description of measures the researcher will take to reduce disturbance or impacts); (5) research personnel required; (6) costs to Refuge, if any; and (7) progress reports and end products (i.e., reports, thesis, dissertations, publications). Research proposals are reviewed by Refuge staff and conservation partners, as appropriate, for approval.

Evaluation criteria currently includes, but is not limited to, the following:

- Research that will contribute to specific Refuge management issues will be given higher priority over other research requests.
- Research that will conflict with other ongoing research, monitoring, or management programs will not be granted.
- Research projects that can be accomplished off-Refuge are less likely to be approved.
- Research which causes undue disturbance or is intrusive will likely not be granted. Level and type of disturbance will be carefully evaluated when considering a request.
- Refuge evaluation will determine if any effort has been made to minimize disturbance through

study design, including considering adjusting location, timing, scope, number of permittees, study methods, number of study sites, etc.

- If staffing or logistics make it impossible for the Refuge to monitor researcher activity in a sensitive area, the research request may be denied, depending on the specific circumstances.
- The length of the project will be considered and agreed upon before approval. Projects will be reviewed annually.

These criteria will also apply to any properties acquired in the future within the approved boundary of the Refuge.

Availability of Resources:

The Refuge receives approximately 10-12 research requests per year. Some permit requests require 4-8 hours to process, others may take as long as 20 hours, depending on the complexity and whether pre-research surveys are required. Refuge operational funds are currently available through the Service budget process to administer this program.

Anticipated Impacts of Use: Use of the Refuge to conduct research will benefit Refuge fish, wildlife, plant populations, and their habitats. Monitoring and research investigations are an important component of adaptive management. Research investigations would be used, in part, to evaluate habitat restoration projects and ecosystem health. Specific restoration and habitat management questions could be addressed in most research investigations to improve habitat and benefit wildlife populations. Standardized monitoring would be used to insure data compatibility for comparisons from across the landscape so that natural resource bottleneck areas could be identified for habitat enhancement and restoration (Elzinga et al. 1998; Ralph et al. 1993).

An expected short-term effect of monitoring and research investigations is that Refuge management activities would be modified to improve habitat and wildlife populations, as a result of new information. Expected long-term and cumulative effects include a growing body of science-based data and knowledge as new and continued monitoring and new research compliments and expands upon previous investigations, as well as an expanded science-based body of data and information from which to draw upon to implement the best Refuge management practices possible. Natural resources inventory, monitoring and research are not only provisions of the Refuge Improvement Act, but they are necessary tools to maintain biological integrity and diversity and environmental health, which are also key provisions of the act.

Some direct and indirect effects would occur through disturbance which is expected with some research activities, especially where researchers are entering sanctuaries. Researcher disturbance could include altering wildlife behavior, going off designated trails, collecting soil and plant samples or trapping and handling wildlife. Most of these effects would be short-term because only the minimum of samples (e.g., water, soils, vegetative litter, plants, macro-invertebrates) are required for identification and/or experimentation. Statistical analysis will be encouraged and captured and marked wildlife will be released. Long-term effects would be eliminated/ reduced because refuge evaluation of research proposals would insure only proposals with adequate safeguards to avoid/minimize impacts would be accepted. Potential impacts associated with research activities would be minimized because sufficient restrictions would be included as part of the study design and researcher activities would be monitored by Refuge staff. Refuge staff would ensure research projects contribute to the enhancement, protection, preservation, and management of native Refuge wildlife populations and their habitats thereby helping the Refuge fulfill the purposes for which it was established, the mission of the National Wildlife Refuge System, and the need to maintain ecological integrity. Additionally, the special use permit would include conditions to further ensure that impacts to wildlife and habitats are avoided and minimized.

Public Review and Comment: Public review and comments will be solicited in conjunction with distribution of the Draft CCP for Ash Meadows NWR. Following the public review and comment period, comments and actions taken to address comments will be summarized here.

Determination: This program as described is determined to be compatible. Potential impacts of research activities on Refuge resources will be minimized because sufficient stipulations and safeguards will be included in this Compatibility Determination and the required Special Use Permit and because research activities will be monitored by Refuge staff. The refuge manager and biologist would ensure that proposed monitoring and research investigations would contribute to the enhancement, protection, conservation, and management of native Refuge wildlife populations and their habitats thereby helping the Refuge fulfill the purposes for which it was established, the mission of the National Wildlife Refuge System, and the need to maintain ecological integrity, diversity, and environmental health.

Use is Not Compatible

Use is Compatible with the Following Stipulations

Stipulations necessary to ensure compatibility: The criteria for evaluating a research proposal, outlined in the Description of Use section above, will be used when determining whether a proposed study will be approved on the Refuge. If proposed research methods are evaluated and determined to have potential adverse impacts on refuge wildlife or habitat, then the refuge would determine the utility and need of such research to conservation and management of refuge wildlife and habitat. If the need was demonstrated by the research permittee and accepted by the refuge, then measures to minimize potential impacts (e.g., reduce the numbers of researchers entering an area, restrict research in specified areas) would be developed and included as part of the study design and on the SUP. SUPs will contain specific terms and conditions that the researcher(s) must follow relative to activity, location, duration, seasonality, etc. to ensure continued compatibility. All Refuge rules and regulations must be followed unless alternatives are otherwise accepted in writing by Refuge management.

All information, reports, data, collections, or documented sightings and observations, that are obtained as a result of this permit are the property of the Service and can be accessed by the Service at any time from the permittee at no cost, unless specific written arrangements are made to the contrary. The Refuge also requires the submission of annual or final reports and any/all publications associated with the work done on the Refuge. Each SUP may have additional criteria. Each SUP will also be evaluated individually to determine if a fee will be charged and for the length of the permit.

Extremely sensitive wildlife habitat areas would be avoided unless sufficient protection from research activities (i.e., disturbance, collection, capture and handling) is implemented to limit the area and/or wildlife potentially impacted by the proposed research. Where appropriate, some areas may be temporarily/seasonally closed so that research would be permitted when impacts to wildlife and habitat are less of a concern. Research activities will be modified to avoid harm to sensitive wildlife and habitat when unforeseen impacts arise.

Refuge staff will monitor researcher activities for potential impacts to the refuge and for compliance with conditions on the SUP. The refuge manager may determine that previously approved research and special use permits be terminated due to observed impacts. The refuge manager will also have the ability to cancel a SUP if the researcher is out of compliance with the stated conditions.

Justification: This program as described is determined to be compatible. Based upon impacts described in the Comprehensive Conservation Plan and Environmental Assessment (USFWS 2005), it is determined that research within the Refuge, as described herein, will not materially interfere with or detract from the purposes for which the Refuge was established or the mission of the Refuge

System. Refuge monitoring and research will directly benefit and support refuge goals, objectives and management plans and activities. Fish, wildlife, plants and their habitat will improve through the application of knowledge gained from monitoring and research. Biological integrity, diversity and environmental health would benefit from scientific research conducted on natural resources at the refuge. The wildlife-dependent, priority public uses (wildlife viewing and photography, environmental education and interpretation, fishing and hunting) would also benefit as a result of increased biodiversity and wildlife and native plant populations from improved restoration and management plans and activities associated with monitoring and research investigations which address specific restoration and management questions.

Mandatory Re-Evaluation Date:

 X Mandatory 15-year Re-Evaluation (for priority public uses)

 Mandatory 10-year Re-Evaluation, Date will be provided in Final EIS/CCP (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

 Categorical Exclusion without Environmental Action Statement

 Categorical Exclusion and Environmental Action Statement

 X Environmental Assessment and Finding of No Significant Impact

 Environmental Impact Statement and Record of Decision

References Cited

Elzinga, C.L., D.W. Salzer, and J.W. Willoughby. 1998. Measuring and Monitoring Plant Populations. U.S. Bureau of Land Management, Denver, CO.

Ralph, C.J., G.R. Geupel, P. Pyle, T.E. Martin and D.F. DeSante. 1993. Handbook of Field Methods for Monitoring Landbirds. U.S. Forest Service, Pacific Southwest Research Station, General Technical Report PSW-GTR-144. Albany, CA.

Refuge Determination

Refuge Manager: _____
(Signature) (Date)

Project Leader
Approval: _____
(Signature) (Date)

Concurrence

Refuge Supervisor: _____
(Signature) (Date)

Assistant Regional
Director - Refuges: _____
(Signature) (Date)

COMPATIBILITY DETERMINATION

Use: Geocaching (Virtual Only)

Refuge Name: Ash Meadows National Wildlife Refuge, located in Nye County, Nevada.

Establishing and Acquisition Authority(ies): Ash Meadows National Wildlife Refuge (Refuge) was established on June 18, 1984 under authority of the Endangered Species Act of 1973.

Refuge Purpose(s): The purpose of Ash Meadows comes from the Endangered Species Act of 1973:

“...to conserve (A) fish or wildlife which are listed as endangered species or threatened species...or (B) plants...” (16 USC Sec. 1534).

National Wildlife Refuge System Mission: “To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.” (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-ee]).

Description of Use: Geocaching is a game of adventure using handheld Geographic Positioning System (GPS) devices. The handhelds are used to locate caches of “prizes”, which are found using coordinates points only. Often a cache is a container of some sort filled with treasures and a log, among other things. The idea is that “cachers” obtain coordinates to a cache, use their GPS handheld to make their way to the cache, record their adventure, take a prize and leave a prize. The placement of these caches, depending on the location, can require digging into the ground, moving rocks or vegetation, or other alterations to the area in order to somewhat hide the cache. This is an aspect of the caching that gives federal land managers pause. An ideal alternative to the physical cache is a virtual cache, or waypoint cache.

A waypoint cache uses existing landmarks and the “cache” is held at a manned site. The “cachers” have to visit a starting landmark (determined by given coordinates). Then, the site manager can have the “cachers” follow somewhat of a scavenger hunt, going from landmark to landmark, using clues or additional coordinate points until a final clue is given, leading the “cachers” to the manned site (an office, or the like). “Cachers” can then pick up their prize from the manned site, leave a prize, if they like, and write in the virtual cache log. The challenge of using the GPS handheld can be just as great as, if not more than, that of looking for a physical cache and without the impact on areas outside of the normal public use areas.

Availability of Resources:

The Refuge does not receive many requests for geocaching, physical or virtual ones. Setting up a waypoint geocache may take 2-3 hours. Law enforcement may require some time to ensure waypoint geocaches are not followed up with physical ones. Refuge operational funds are currently available through the Service budget process to administer this program.

Anticipated Impacts of Use: Use of the Refuge for virtual geocaching will benefit Refuge fish, wildlife, plant populations, and their habitats because it will introduce a different audience to the National Wildlife Refuge System and its purpose.

Geocachers, as a community, are warned against establishing caches, physical or virtual, on federal public lands without permission of the land manager. That being said, there have been cases where

physical caches have been found on National Wildlife Refuges that were not authorized. The same could be true for waypoint caches but, the impact of that would be less so on the Refuge. Law enforcement would likely concentrate on unauthorized physical sites.

There could be an increased impact to the public use landmarks used in a waypoint cache. Damage could occur that would not otherwise be realized for a much longer period of time with regular use. This impact may be minimized with regular maintenance of the area. A regular presence of staff on the Refuge may minimize vandalism of landmark sites, as well.

The greatest impact of allowing a waypoint cache would be the staff time required to set up the landmark route and the cache.

Public Review and Comment: Public review and comments will be solicited in conjunction with distribution of the Draft CCP for Ash Meadows NWR. Following the public review and comment period, comments and actions taken to address comments will be summarized here.

Determination: This program as described is determined to be compatible. Virtual geocaching would contribute to the enhancement, protection, conservation, and management of native Refuge wildlife populations and their habitats thereby helping the Refuge fulfill the purposes for which it was established, the mission of the National Wildlife Refuge System, and the need to maintain ecological integrity, diversity, and environmental health.

Use is Not Compatible

Use is Compatible with the Following Stipulations

Stipulations necessary to ensure compatibility:

- Only virtual or waypoint geocaches will be authorized by use of a Special Use Permit or established by Refuge Staff.
- Physical geocaches will not be authorized under any circumstance and violators may be fined, at the discretion of the Refuge Law Enforcement Officer.
- Virtual or waypoint geocaches must be established in partnership with Refuge staff to ensure landmarks used are acceptable public use sites.
- The final cache should be maintained at the Refuge headquarters and information about the Refuge will accompany all cache prizes taken by participants.
- No other collecting from the Refuge will be authorized.

Justification: Waypoint geocaching will indirectly benefit and potentially create support for refuge goals, objectives, management plans and activities. It will offer added opportunities to introduce visitors to the Refuge, its purposes, and its mission. Waypoint geocaching will likely open resource-dependent connections between geocachers and Refuges. The impact on the resource and staff will be minimal with measurable returns. Virtual geocaching may also be used as an education tool, introducing local students to GPS technologies in a real-world environment while broadening their knowledge of the Refuge and their relation to it.

Mandatory Re-Evaluation Date:

Mandatory 15-year Re-Evaluation (for priority public uses)

Mandatory 10-year Re-Evaluation, Date will be provided in Final EIS/CCP (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

- _____ Categorical Exclusion without Environmental Action Statement
- _____ Categorical Exclusion and Environmental Action Statement
- _____ Environmental Assessment and Finding of No Significant Impact
- X Environmental Impact Statement and Record of Decision

Refuge Determination

Refuge Manager: _____ (Date)
(Signature)

Project Leader Approval: _____ (Date)
(Signature)

Concurrence

Refuge Supervisor: _____ (Date)
(Signature)

Assistant Regional Director - Refuges: _____

COMPATIBILITY DETERMINATION

Use: Wildlife Observation and Photography

Refuge Name: Desert National Wildlife Refuge (Refuge), located in Clark and Lincoln counties, Nevada.

Establishing and Acquisition Authority(ies): Desert National Wildlife Range was established by Executive Order Number 7373 of President Franklin D. Roosevelt on May 20, 1936. Originally named the Desert Game Range and under the joint administration of the Fish and Wildlife Service and the Bureau of Land Management, it contained a total of 2,250,000 acres, including lands both north and south of U.S. Highway 95. Public Land Order 4079, issued on August 26, 1966 and corrected on September 23, 1966, revoked Executive Order 7373, changed the name to Desert National Wildlife Range, reduced its size to 1,588,000 acres, and transferred sole administration to the Fish and Wildlife Service. Between 1935 and 1989, an additional 760 acres in the vicinity of Corn Creek were acquired under various authorities, including the Migratory Bird Conservation Act, Endangered Species Act, and Refuge Recreation Act. The Military Lands Withdrawal Act of 1999 (Public Law 106-65) transferred primary jurisdiction of 110,000 acres of bombing impact areas on the Refuge from the Service to Department of Defense. In 2002, the Clark County Conservation of Public Land and Natural Resources Act (Public Law 107-282) transferred 26,433 acres of BLM land adjacent to Desert NWR's east boundary to the Service. In 2004, the Lincoln County Conservation, Recreation, and Development Act (Public Law 108-424) transferred approximately 8,382 acres the eastern boundary of Desert NWR to the BLM for use as a utility corridor. In addition, 8,503 acres of BLM-administered land adjacent to the northeast corner of the Refuge were transferred to the Service.

Refuge Purpose(s):

- For lands acquired under Public Land Order 4079, dated August 31, 1966, the purpose is “. . . for the protection, enhancement, and maintenance of wildlife resources, including bighorn sheep.”
- For lands acquired under 16 USC 715d (Migratory Bird Conservation Act): “...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds...” .
- For lands acquired under 16 U.S.C. § 1534 (Endangered Species Act of 1973) the purpose is “. . . to conserve (a) fish or wildlife which are listed as endangered species or threatened species . . . or (b) plants.”
- For lands acquired under 16 U.S.C. § 460k-460l (Refuge Recreation Act) the purpose is “. . . suitable for - (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species”

National Wildlife Refuge System Mission: “To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans” (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-ee]).

Description of Use: The National Wildlife Refuge System Improvement Act of 1997 identifies wildlife observation and photography as well as hunting, fishing, interpretation, and environmental education as wildlife dependent public uses for NWR's. As two of the six priority public uses of the Refuge system, these uses are to be encouraged when compatible with the purposes of the Refuge. Desert Refuge is open to the public year-round for wildlife observation and photography. Currently, there are nearly 70,000 visits to the Refuge annually. Typical use is by individuals, family groups, school groups, and large groups during Refuge-sponsored special events. The majority of this use

occurs at Corn Creek. Current facilities include a wildlife observation/interpretive trail and the Pahrump poolfish refugium viewing area.

Wildlife observation also occurs throughout the eastern portion of the Refuge, often in association with other uses, including: backpacking and hiking; camping; recreational use of pack and saddle stock; hunting; and pine nut gathering. See the compatibility determinations for these uses for more information.

All public access to the western portion of the Desert Refuge is prohibited by federal law. This area, part of the U.S. Air Force’s Nevada Test and Training Range, is used as a bombing, gunnery and aerial warfare training facility.

Under alternative C of the CCP/EIS (the preferred alternative), the Service would continue to maintain visitor facilities that facilitate wildlife observation and photography, including roads, trails, and parking, camping, and picnic areas. In addition, the Service proposes to make several facility improvements to enhance opportunities for wildlife observation and photography, improve public safety, and minimize impacts on the Refuge’s resources.

At Corn Creek, the Service proposes to construct an additional wheel-chair accessible interpretive trail which will tie in to the existing trail system and the new visitor’s center and offices. A photography blind and new interpretive signs are also planned for this area. The Service also proposes to develop bighorn sheep web cam which will stream images to the new visitor center.

In addition, the Service proposes to improve Alamo, Mormon Well, and Gass Peak Roads to ensure the public has continued access to the Refuge. Post and cable fencing would be installed at designated parking turnouts along these three roads to prevent resource damage. In addition, the Service would map existing trails on Gass Peak and the Sheep Range with GPS and develop and distribute a trail guide for the public.

With these improvements, the construction of the visitor center and population growth in the Las Vegas Area, visitation to the Refuge is expected to increase but not dramatically.

Availability of Resources: The following funding/annual costs (based on FY 2008 costs) would be required to administer and manage the activities as described above:

	One-time Costs	Annual Costs
Managing current use		
Administration		500
Maintain visitor facilities		2,000
Maintain and replace regulatory, directional, and interpretive signs		1,000
Maintain roads		2,000
Improving/Enhancing Use		
Improve Mormon Well and Gass Peak Roads to “fair” condition	10,000,000	
Repair Alamo Road		
Plan and construct photography blinds		3,000
TOTAL		

Anticipated Impacts of Use: Once considered “non-consumptive”, it is now recognized that wildlife observation and wildlife photography can negatively impact wildlife by altering wildlife behavior, reproduction, distribution, and habitat (Purdy et al. 1987, Knight and Cole 1995).

Purdy et al. (1987) and Pomerantz et al. (1988) described six categories of impacts to wildlife as a result of visitor activities. They are:

- 1) Direct mortality: immediate, on-site death of an animal;
- 2) Indirect mortality: eventual, premature death of an animal caused by an event or agent that predisposed the animal to death;
- 3) Lowered productivity: reduced fecundity rate, nesting success, or reduced survival rate of young before dispersal from nest or birth site;
- 4) Reduced use of refuge: wildlife not using the refuge as frequently or in the manner they normally would in the absence of visitor activity;
- 5) Reduced use of preferred habitat on the refuge: wildlife use is relegated to less suitable habitat on the refuge due to visitor activity; and
- 6) Aberrant behavior/stress: wildlife demonstrating unusual behavior or signs of stress that are likely to result in reduced reproductive or survival rates.

Individual animals may be disturbed by human contact to varying degrees. Human activities on trails can result in direct effects on wildlife through harassment, a form of disturbance that can cause physiological effects, behavioral modifications, or death (Smith and Hunt 1995). Many studies have shown that birds can be impacted from human activities on trails when they are disturbed and flushed from feeding, resting, or nesting areas. Flushing, especially repetitive flushing, can strongly impact habitat use patterns of many bird species. Flushing from an area can cause birds to expend more energy, be deterred from using desirable habitat, affect resting or feeding patterns, and increase exposure to predation or cause birds to abandon sites with repeated disturbance (Smith and Hunt 1995). Migratory birds are observed to be more sensitive than resident species to disturbance (Klein 1989).

Nest predation for songbirds (Miller et al. 1998), raptors (Glinski 1976), colonial nesting species (Buckley and Buckley 1976), and waterfowl (Boyle and Samson 1985) tends to increase in areas more frequently visited by people. In addition, for many passerine species, primary song occurrence and consistency can be impacted by a single visitor (Gutzwiller et al. 1994). In areas where primary song was affected by disturbance, birds appeared to be reluctant to establish nesting territories (Reijnen and Foppen 1994).

Depending on the species (especially migrants vs. residents), some birds may habituate to some types of recreation disturbance and either are not disturbed or will immediately return after the initial disturbance (Hockin et al. 1992; Burger et al. 1995; Knight & Temple 1995; Madsen 1995; Fox & Madsen 1997). Rodgers & Smith (1997) calculated buffer distances that minimize disturbance to foraging and loafing birds based on experimental flushing distances for 16 species of waders and shorebirds. They recommended 100 meters as an adequate buffer against pedestrian traffic, however, they suggest this distance may be reduced if physical barriers (e.g., vegetation screening) are provided, noise levels are reduced, and traffic is directed tangentially rather than directly toward birds. Screening may not effectively buffer noise impacts, thus visitors should be educated on the effects of noise and noise restrictions should be enforced (Burger 1981, 1986; Klein 1993; Bowles 1995; Burger & Gochfeld 1998). Seasonally restricting or prohibiting recreation activity may be necessary during spring and fall migration to alleviate disturbance to migratory birds (Burger 1981, 1986; Boyle & Samson 1985; Klein et al. 1995; Hill et al. 1997).

Of the wildlife observation techniques, wildlife photographers tend to have the largest disturbance impacts (Klein 1993, Morton 1995, Dobb 1998). While wildlife observers frequently stop to view species, wildlife photographers are more likely to approach wildlife (Klein 1993). Even slow approach by wildlife photographers tends to have behavioral consequences to wildlife species (Klein 1993). Other impacts include the potential for photographers to remain close to wildlife for extended periods of time, in an attempt to habituate the wildlife subject to their presence (Dobb 1998) and the tendency of casual photographers, with low-power lenses, to get much closer to their subjects than other activities would require (Morton 1995), including wandering off trails. This usually results in increased disturbance to

wildlife and habitat, including trampling of plants. Klein (1993) recommended that refuges provide observation and photography blinds to reduce disturbance of waterbirds when approached by visitors.

Education is critical for making visitors aware that their actions can have negative impacts on birds, and will increase the likelihood that visitors will abide by restrictions on their actions. For example, Klein (1993) demonstrated that visitors who spoke with refuge staff or volunteers were less likely to disturb birds. Increased surveillance and imposed fines may help reduce visitor caused disturbance (Knight & Gutzwiller 1995). Monitoring is recommended to adjust management techniques over time, particularly because it is often difficult to generalize about the impacts of specific types of recreation in different environments. Local and site -specific knowledge is necessary to determine effects on birds and to develop effective management strategies (Hockin et al. 1992; Klein et al. 1995; Hill et al. 1997).

The construction and maintenance of trails, photography blinds, and parking lots will have minor impacts on soils and vegetation around the trails. This could include an increased potential for erosion, soil compaction (Liddle 1975), reduced seed emergence (Cole and Landres 1995), alteration of vegetative structure and composition, and sediment loading (Cole and Marion 1988). However, by concentrating foot traffic onto the trails other habitats on the Refuge will remain undisturbed.

Disturbance of wildlife is the primary concern regarding these uses. Disturbance to wildlife, such as the flushing of feeding, resting, or nesting birds, is inherent to these activities. There is some temporary disturbance to wildlife due to human activities on trails (hiking, bird watching) however, the disturbance is generally localized and will not adversely impact overall populations. Increased facilities and visitation would cause some displacement of habitat and increase some disturbance to wildlife, although this is expected to be minor given the size of the Refuge and by avoiding or minimizing intrusion into important wildlife habitat.

Public Review and Comment: Public review and comments will be solicited in conjunction with distribution of the Draft CCP/EIS for the Desert National Wildlife Refuge Complex.

Determination:

Use is Not Compatible

Use is Compatible with the Following Stipulations

Stipulations necessary to ensure compatibility:

- Regulations and wildlife friendly behavior (e.g., requirements to stay on designated trails, dogs must be kept on a leash, etc.) will be described in brochures and posted at the Visitor Contact Station(s).
- Regulatory and directional signs will clearly mark areas closed to the public and designated routes of travel.
- Maps and public use information will be available at the visitor contact station and kiosks.
- Refuge staff will conduct regular surveys of public activities on the refuge. The data will be analyzed and used by the refuge manager to develop future modifications if necessary to ensure compatibility of the wildlife observation and photography programs.
- Use will be directed to public use facilities which are not in or near sensitive areas.
- Interpretive presentations and products will continue to include messages on minimizing disturbance to wildlife.

- Commercial photography would require a Special Use Permit.

Justification: These wildlife-dependent uses are priority public uses of the National Wildlife Refuge System. Providing opportunities for wildlife observation and photography would contribute toward fulfilling provisions of the National Wildlife Refuge System Administration Act, as amended in 1997, and one of the goals of the Desert Refuge (Goal 4, Appendix E, CCP/EIS). Wildlife observation and photography would provide an excellent forum for allowing public access and increasing understanding of Refuge resources. The stipulations outlined above should minimize potential impacts relative to wildlife/human interactions. Based upon impacts described in the Draft Comprehensive Conservation Plan and Environmental Impact Statement (USFWS 2008), it is determined that wildlife observation and photography within the Desert National Wildlife Refuge, as described herein, will not materially interfere with or detract from the purposes for which the Refuge was established or the mission of the Refuge System. In our opinion, these wildlife dependent uses will not conflict with the national policy to maintain the biological diversity, integrity, and environmental health of the refuge.

Mandatory Re-Evaluation Date (March 2023):

- Mandatory 15-year Re-Evaluation, Date will be provided in Final EIS/CCP (for priority public uses)
- Mandatory 10-year Re-Evaluation (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

- Categorical Exclusion without Environmental Action Statement
- Categorical Exclusion and Environmental Action Statement
- Environmental Assessment and Finding of No Significant Impact
- Environmental Impact Statement and Record of Decision

References Cited

- Bowles A. E. 1995. Response of wildlife to noise. Pages 109-156. in R.L. Knight and D.N. Cole, editors. Wildlife and recreationists: coexistence through management and research. Washington, D.C., Island Press.
- Boyle, S. A. and F. B. Samson. 1985. Effects of non-consumptive recreation on wildlife: a review. Wildl. Soc. Bull. 13:110-116.
- Buckley, P. A. and F. G. Buckley. 1976. Guidelines for protection and management of colonially nesting waterbirds. North Atlantic Regional Office, National Park Service, Boston, MA. 52pp.
- Burger, J. 1986. The effect of human activity on shorebirds in two coastal bays in northeastern United States. Biological Conservation 13:123-130.
- Burger, J. and M. Gochfeld. 1991. Human distance and birds: tolerance and response distances of resident and migrant species in India. Environ. Conserv. 18:158-165.

- Burger, J., and M. Gochfeld. 1998. Effects of ecotourists on bird behavior at Loxahatchee National Wildlife Refuge, Florida. *Environmental Conservation* 25:13-21.
- Burger, J., M. Gochfeld, and L. J. Niles. 1995. Ecotourism and birds in coastal New Jersey: Contrasting responses of birds, tourists, and managers. *Environmental Conservation* 22:56-65.
- Cole, D. N. and P. B. Landres. 1995. Indirect effects of recreation on wildlife. Pages 183-201 in R. L. Knight and K. J. Gutzwiller, ed. *Wildlife and Recreationists: coexistence through management and research*, Island Press, Washington, D. C. 372pp.
- Cole, D. N. and J. L. Marion. 1988. Recreation impacts in some riparian forests of the eastern United States. *Env. Manage.* 12:99-107.
- Dobb, E. 1998. Reality check: the debate behind the lens. *Audubon*: Jan.-Feb.
- Fox, A. D., and J. Madsen. 1997. Behavioural and distributional effects of hunting disturbance on waterbirds in Europe: implications for refuge design. *The Journal of Applied Ecology* 34:1-13.
- Gliniski, R. L. 1976. Birdwatching etiquette: the need for a developing philosophy. *Am. Bird* 30(3):655-657.
- Gutzwiller, K. J., R. T. Wiedenmann, K. L. Clements, and S. H. Anderson. 1994. Effects on human intrusion on song occurrence and singing consistency in subalpine birds. *Auk* 111:28-37.
- Hill, D., D. Hockin, D. Price, G. Tucker, R. Morris, and J. Treweek. 1997. Bird disturbance: improving the quality and utility of disturbance research. *Journal of Applied Ecology* 34:275-288.
- Hockin, D., M. Ounsted, M. Gorman, D. Hill, V. Keller, and M. A. Barker. 1992. Examination of the effects of disturbance on birds with reference to its importance in ecological assessments. *Journal of Environmental Management* 36:253-286.
- Klein, M. 1989. Effects of high levels of human visitation on foraging waterbirds at J. N. "Ding" Darling National Wildlife Refuge, Sanibel Florida. Masters thesis. Gainesville, Florida: University of Florida.
- Klein, M. L. 1993. Waterbird behavioral responses to human disturbances. *Wildl. Soc. Bull.* 21:31-39.
- Knight, R. L. and D. N. Cole. 1995. Wildlife responses to recreationists. Pages 71-79 in R. L. Knight and K. J. Gutzwiller, ed. *Wildlife and Recreationists: coexistence through management and research*. Island Press, Washington, D. C. 372pp.
- Klein, M. L., S. R. Humphrey, and H. F. Percival. 1995. Effects of ecotourism on distribution of waterbirds in a wildlife refuge. *Conservation Biology* 9:1454-1465.
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- Knight, R. L. and S. A. Temple. 1995. Origin of wildlife responses to recreationists. In *Wildlife and recreation: coexistence through management and research*. R. L. Knight and K. J. Gutzwiller, eds. Island Press, Washington, D. C., pp 81-91.
- Liddle, M. J. 1975. A selective review of the ecological effects on human trampling on natural ecosystems. *Biol. Conserv.* 7:17-36.

- Madsen, J. 1995. Impacts of disturbance on migratory waterfowl. Ibis 137 Supplemental: S67-S74
- Miller, S. G., R. L. Knight, and C. K. Miller. 1998. Influence of recreational trails on breeding bird communities. Ecol. Appl. 8:162-169.
- Morton, J. M. 1995. Management of human disturbance and its effects on waterfowl. Pages F59-F86 in W. R. Whitman, T. Strange, L. Widjeskog, R. Whittemore, P. Kehoe, and L. Roberts (eds.). Waterfowl habitat restoration, enhancement and management in the Atlantic Flyway. Third Ed. Environmental Manage. Comm., Atlantic Flyway Council Techn. Sect., and Delaware Div. Fish and Wildl., Dover, DE. 1114pp.
- Pomerantz, G. A., D. J. Decker, G. R. Goff, and K. G. Purdy. 1988. Assessing impact of recreation on wildlife: a classification scheme. Wildl. Soc. Bull. 16:58-62.
- Purdy, K. G., G. R. Goff, D. J. Decker, G. A. Pomerantz, N. A. Connelly. 1987. A guide to managing human activity on National Wildlife Refuges. Office of Information Transfer, U.S. Fish and Wildlife Service, Ft. Collins, CO. 57pp.
- Reijnen, R. and R. Foppen. 1994. The effects of car traffic on breeding bird populations in woodland. I. Evidence of reduced habitat quality for willow warbler (*Pyrrhuloxia trochilus*) breeding close to a highway. J. Appl. Ecol 31: 85-94.
- Rodgers, J. A., and H. T. Smith. 1997. Buffer zone distances to protect foraging and loafing waterbirds from human disturbance in Florida. Wildlife Society Bulletin 25:139-145.
- Smith, L. and J. D. Hunt. 1995. Nature tourism: impacts and management. Pp. 203-219 in Knight, R. L.; Gutzwiller, K. J. (Wildlife and recreationists: coexistence through management and research, eds.). Island Press, Washington, D. C.
- USFWS. 2008. Desert National Wildlife Refuge Draft Comprehensive Conservation Plan and Environmental Impact Statement. U.S. Fish and Wildlife Service, Region 8.

Refuge Determination

Refuge Manager: _____
 (Signature) (Date)

Project Leader
 Approval: _____
 (Signature) (Date)

Concurrence

Refuge Supervisor: _____
 (Signature) (Date)

Assistant Regional
 Director - Refuges: _____
 (Signature) (Date)

COMPATIBILITY DETERMINATION

Use: Environmental Education and Interpretation

Refuge Name: Desert National Wildlife Refuge (Refuge), located in Clark and Lincoln counties, Nevada.

Establishing and Acquisition Authority(ies): Desert National Wildlife Range was established by Executive Order Number 7373 of President Franklin D. Roosevelt on May 20, 1936. Originally named the Desert Game Range and under the joint administration of the Fish and Wildlife Service and the Bureau of Land Management, it contained a total of 2,250,000 acres, including lands both north and south of U.S. Highway 95. Public Land Order 4079, issued on August 26, 1966 and corrected on September 23, 1966, revoked Executive Order 7373, changed the name to Desert National Wildlife Range, reduced its size to 1,588,000 acres, and transferred sole administration to the Fish and Wildlife Service. Between 1935 and 1989, an additional 760 acres in the vicinity of Corn Creek were acquired under various authorities, including the Migratory Bird Conservation Act, Endangered Species Act, and Refuge Recreation Act. The Military Lands Withdrawal Act of 1999 (Public Law 106-65) transferred primary jurisdiction of 110,000 acres of bombing impact areas on the Refuge from the Service to Department of Defense. In 2002, the Clark County Conservation of Public Land and Natural Resources Act (Public Law 107-282) transferred 26,433 acres of BLM land adjacent to Desert NWR's east boundary to the Service. In 2004, the Lincoln County Conservation, Recreation, and Development Act (Public Law 108-424) transferred approximately 8,382 acres the eastern boundary of Desert NWR to the BLM for use as a utility corridor. In addition, 8,503 acres of BLM-administered land adjacent to the northeast corner of the Refuge were transferred to the Service.

Refuge Purpose(s): Desert National Wildlife Refuge purposes include:

- For lands acquired under Public Land Order 4079, dated August 31, 1966, the purpose is “. . . for the protection, enhancement, and maintenance of wildlife resources, including bighorn sheep.”
- For lands acquired under 16 USC 715d (Migratory Bird Conservation Act): “. . . for use as an inviolate sanctuary, or for any other management purpose, for migratory birds. . .”
- For lands acquired under 16 U.S.C. § 1534 (Endangered Species Act of 1973) the purpose is “. . . to conserve (a) fish or wildlife which are listed as endangered species or threatened species . . . or (b) plants.”
- For lands acquired under 16 U.S.C. § 460k-460l (Refuge Recreation Act) the purpose is “. . . suitable for - (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species . . .”

National Wildlife Refuge System Mission: “To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans” (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-ee]).

Description of Use: The National Wildlife Refuge System Improvement Act of 1997 identifies wildlife observation and photography as well as hunting, fishing, interpretation, and environmental education as wildlife dependent public uses for NWRs. As two of the six priority public uses of the Refuge system, these uses are to be encouraged when compatible with the purposes of the Refuge. The public and communities desire more opportunities for these uses.

Environmental education and interpretation are considered together in this compatibility determination because they both are wildlife-dependent, non-consumptive uses and many elements of these programs are similar.

The Service allows the year-round access to designated open areas for environmental education and interpretation. Desert Refuge is open to the public for environmental education and interpretation daily from sunrise to sunset. Currently, there are nearly 70,000 visits to the Refuge annually. Most of these visits are to Corn Creek Field Station. Typical use is by individuals, family groups, school groups, and large groups during Refuge-sponsored special events.

Under alternative C of the CCP (the preferred alternative), the Refuge would continue to maintain visitor facilities, including parking, camping, and picnic areas, and they would replace regulatory, directional, and interpretive signs along designated roads and trails and at the refugium, as needed. Volunteers, including Southern Nevada Interpretive Association members, would continue to be utilized at the visitor contact station to provide interpretation and guidance for visitors.

In addition, the Service would expand and improve the refuge environmental education program. A new visitor center with interpretive and educational displays would be constructed at Corn Creek. Interpretive panels and signs would be replaced along trails and at the refugium and installed at the designated entry points. The Service would expand the volunteer program on the Refuge with a target of staffing the visitor center full-time during peak use periods and for 4 hours per day during lower-use periods.

Interpretation efforts would be expanded through the development of cultural resources materials in coordination with local Native American tribes. The Service would also develop a live “sheep cam” at water sources to educate the public on the bighorn sheep. The video would be streamed through the web site and at the visitor contact station for viewing by the public.

Both of these public uses are dependent upon establishing boardwalks and vehicle parking areas in the Refuge. An estimated 70,000 annual visits will be to participate in these activities. These uses are identified and discussed in detail in Chapter 3 of the CCP (USFWS 2008) and are incorporated by reference.

Availability of Resources: The following funding/annual costs (based on FY 2008 costs) would be required to administer and manage the activities as described above:

	One-time Costs	Annual Costs
Administration		1,200
Maintain visitor center		83,000
Develop environmental education and interpretive materials		2,000
TOTAL		86,200

Anticipated Impacts of Use: Once considered “non-consumptive”, it is now recognized that activities such as environmental education and interpretation can negatively impact wildlife by altering wildlife behavior, reproduction, distribution, and habitat (Purdy et al. 1987, Knight and Cole 1995).

Purdy et al. (1987) and Pomerantz et al. (1988) described six categories of impacts to wildlife as a result of visitor activities. They are:

- 1) Direct mortality: immediate, on-site death of an animal;
- 2) Indirect mortality: eventual, premature death of an animal caused by an event or agent that predisposed the animal to death;
- 3) Lowered productivity: reduced fecundity rate, nesting success, or reduced survival rate of young before dispersal from nest or birth site;
- 4) Reduced use of refuge: wildlife not using the refuge as frequently or in the manner they normally would in the absence of visitor activity;

- 5) Reduced use of preferred habitat on the refuge: wildlife use is relegated to less suitable habitat on the refuge due to visitor activity; and
- 6) Aberrant behavior/stress: wildlife demonstrating unusual behavior or signs of stress that are likely to result in reduced reproductive or survival rates.

Individual animals may be disturbed by human contact to varying degrees. Human activities on trails can result in direct effects on wildlife through harassment, a form of disturbance that can cause physiological effects, behavioral modifications, or death (Smith and Hunt 1995). Many studies have shown that birds can be impacted from human activities on trails when they are disturbed and flushed from feeding, resting, or nesting areas. Flushing, especially repetitive flushing, can strongly impact habitat use patterns of many bird species. Flushing from an area can cause birds to expend more energy, be deterred from using desirable habitat, affect resting or feeding patterns, and increase exposure to predation or cause birds to abandon sites with repeated disturbance (Smith and Hunt 1995). Migratory birds are observed to be more sensitive than resident species to disturbance (Klein 1989).

Nest predation for songbirds (Miller et al. 1998), raptors (Glinski 1976) and waterfowl (Boyle and Samson 1985) tends to increase in areas more frequently visited by people. In addition, for many passerine species, primary song occurrence and consistency can be impacted by a single visitor (Gutzwiller et al. 1994). In areas where primary song was affected by disturbance, birds appeared to be reluctant to establish nesting territories (Reijnen and Foppen 1994).

Depending on the species (especially migrants vs. residents), some birds may habituate to some types of recreation disturbance and either are not disturbed or will immediately return after the initial disturbance (Hockin et al. 1992; Burger et al. 1995; Knight & Temple 1995; Madsen 1995; Fox & Madsen 1997). Rodgers & Smith (1997) calculated buffer distances that minimize disturbance to foraging and loafing birds based on experimental flushing distances for 16 species of waders and shorebirds. They recommended 100 meters as an adequate buffer against pedestrian traffic, however, they suggest this distance may be reduced if physical barriers (e.g., vegetation screening) are provided, noise levels are reduced, and traffic is directed tangentially rather than directly toward birds. Screening may not effectively buffer noise impacts, thus visitors should be educated on the effects of noise and noise restrictions should be enforced (Burger 1981, 1986; Klein 1993; Bowles 1995; Burger & Gochfeld 1998). Seasonally restricting or prohibiting recreation activity may be necessary during spring and fall migration to alleviate disturbance to migratory birds (Burger 1981, 1986; Boyle & Samson 1985; Klein et al. 1995; Hill et al. 1997).

Education is critical for making visitors aware that their actions can have negative impacts on birds, and will increase the likelihood that visitors will abide by restrictions on their actions. For example, Klein (1993) demonstrated that visitors who spoke with refuge staff or volunteers were less likely to disturb birds. Increased surveillance and imposed fines may help reduce visitor caused disturbance (Knight & Gutzwiller 1995). Monitoring is recommended to adjust management techniques over time, particularly because it is often difficult to generalize about the impacts of specific types of recreation in different environments. Local and site -specific knowledge is necessary to determine effects on birds and to develop effective management strategies (Hockin et al. 1992; Klein et al. 1995; Hill et al. 1997). Informed management decisions coupled with sufficient public education could do much to mitigate disturbance effects of wildlife-dependent recreations (Purdy et al 1987).

The disturbance by environmental education activities is considered to be of minimal impact because: (1) the total number of students permitted through the reservation system is limited to 100 per day; (2) students and teachers will be instructed in trail etiquette and the best ways to view wildlife with minimal disturbance; (3) education groups will be required to have a sufficient number of adults to supervise the group; (4) trail design will provide adequate cover for wildlife; and (5) observation areas and scopes are provided to view wildlife at a distance which reduces disturbance.

Education staff will coordinate with biologists regarding activities associated with restoration or monitoring projects to ensure that impacts to both wildlife and habitat are minimal. As with any restoration and monitoring activities conducted by Refuge personnel, these activities conducted by students would be at a time and place where the least amount of disturbance would occur.

Public Review and Comment: Public review and comments will be solicited in conjunction with distribution of the Draft CCP/EIS for the Desert National Wildlife Refuge Complex.

Determination:

Use is Not Compatible

Use is Compatible with the Following Stipulations

Stipulations necessary to ensure compatibility:

- Participants in the Refuge's environmental education program will be restricted to established trails, the visitor contact station, and other designated sites.
- All groups using the Refuge for environmental education will be required to make reservations in advance through the Refuge office. This process, which takes the place of a Special Use Permit (SUP), allows refuge staff to manage the number and location of visitors for each unit. There is a current refuge policy that educational groups are not charged a fee or required to have a SUP. A daily limit of 100 students participating in the education program will be maintained through this reservation system. Efforts will be made to spread out use by large groups while reservations are made, reducing disturbance to wildlife and over-crowding of Refuge facilities during times of peak demand.
- Trail etiquette including ways to reduce wildlife disturbance will be discussed with teachers during orientation workshops and with students upon arrival during their welcome session. On the Refuge, the teacher(s) is responsible for ensuring that students follow required trail etiquette.
- Refuge biologists and public use specialists will conduct regular surveys of public activities on the refuge. The data will be analyzed and used by the refuge manager to develop future modifications if necessary to ensure compatibility of environmental education programs.
- Educational groups are required to have a sufficient number of adults to supervise their groups, a minimum of 1 adult per 12 students.

Justification: These wildlife-dependent uses are priority public uses of the National Wildlife Refuge System. Providing opportunities for environmental education and interpretation would contribute toward fulfilling provisions of the National Wildlife Refuge System Administration Act, as amended in 1997, and one of the goals of the Desert Refuge (Goal 4, Chapter 3, CCP). Environmental education and interpretation would provide an excellent forum for allowing public access and increasing understanding of Refuge resources. Environmental education and interpretation activities generally support Refuge purposes and impacts can largely be minimized (Goff et al. 1988). The minor resource impacts attributed to these activities are generally outweighed by the benefits gained by educating present and future generations about refuge resources. Environmental education is a public use management tool used to develop a resource protection ethic within society. While it targets school age children, it is not limited to this group. This tool allows us to educate refuge visitors about endangered and threatened species management, wildlife management and ecological principles and communities.

A secondary benefit of environmental education is that it instills an 'ownership' or 'stewardship' ethic in visitors and most likely reduces vandalism, littering and poaching; it also strengthens service visibility in the local community.

The stipulations outlined above should minimize potential impacts relative to wildlife/human interactions. Based upon impacts described in the Draft Comprehensive Conservation Plan and Environmental Impact Statement (USFWS 2008), it is determined that environmental education and interpretation within the Desert National Wildlife Refuge, as described herein, will not materially interfere with or detract from the purposes for which the Refuge was established or the mission of the Refuge System. In our opinion, these wildlife dependent uses will not conflict with the national policy to maintain the biological diversity, integrity, and environmental health of the refuge.

Mandatory Re-Evaluation Date :

Mandatory 15-year Re-Evaluation, Date will be provided in Final EIS/CCP (for priority public uses)

Mandatory 10-year Re-Evaluation (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

Categorical Exclusion without Environmental Action Statement

Categorical Exclusion and Environmental Action Statement

Environmental Assessment and Finding of No Significant Impact

Environmental Impact Statement and Record of Decision

References Cited

- Bowles A. E. 1995. Response of wildlife to noise. Pages 109-156. in R.L. Knight and D.N. Cole, editors. Wildlife and recreationists: coexistence through management and research. Washington, D.C., Island Press.
- Boyle, S. A. and F. B. Samson. 1985. Effects of non-consumptive recreation on wildlife: a review. Wildl. Soc. Bull. 13:110-116.
- Buckley, P. A. and F. G. Buckley. 1976. Guidelines for protection and management of colonially nesting waterbirds. North Atlantic Regional Office, National Park Service, Boston, MA. 52pp.
- Burger, J. 1986. The effect of human activity on shorebirds in two coastal bays in northeastern United States. Biological Conservation 13:123-130.
- Burger, J., and M. Gochfeld. 1998. Effects of ecotourists on bird behavior at Loxahatchee National Wildlife Refuge, Florida. Environmental Conservation 25:13-21.
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- Burger, J. and M. Gochfeld. 1991. Human distance and birds: tolerance and response distances of resident and migrant species in India. *Environ. Conserv.* 18:158-165.
- Fox, A. D., and J. Madsen. 1997. Behavioural and distributional effects of hunting disturbance on waterbirds in Europe: implications for refuge design. *The Journal of Applied Ecology* 34:1-13.
- Glinski, R. L. 1976. Birdwatching etiquette: the need for a developing philosophy. *Am. Bird* 30(3):655-657.
- Goff, G.R., D.J. Decker and G. Pomerantz. 1988. A diagnostic tool for analyzing visitor impacts on wildlife refuges: A basis for a systematic approach to visitor management. *Trans. Northeast Sect. Wildl. Soc.* 45:82.
- Gutzwiller, K. J., R. T. Wiedenmann, K. L. Clements, and S. H. Anderson. 1994. Effects on human intrusion on song occurrence and singing consistency in subalpine birds. *Auk* 111:28-37.
- Hill, D., D. Hockin, D. Price, G. Tucker, R. Morris, and J. Treweek. 1997. Bird disturbance: improving the quality and utility of disturbance research. *Journal of Applied Ecology* 34:275-288.
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- Knight, R. L. and S. A. Temple. 1995. Origin of wildlife responses to recreationists. In *Wildlife and recreation: coexistence through management and research*. R. L. Knight and K. J. Gutzwiller, eds. Island Press, Washington, D. C., pp 81-91.
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USFWS. 2008. Desert National Wildlife Refuge Draft Comprehensive Conservation Plan and Environmental Impact Statement. U.S. Fish and Wildlife Service, Region 8.

Refuge Determination

Refuge Manager: _____
(Signature) (Date)

Project Leader Approval: _____
(Signature) (Date)

Concurrence

Refuge Supervisor: _____
(Signature) (Date)

Assistant Regional Director - Refuges: _____
(Signature) (Date)

COMPATIBILITY DETERMINATION

Use: Hunting (desert bighorn sheep)

Refuge Name: Desert National Wildlife Refuge (Refuge), located in Clark and Lincoln counties, Nevada.

Establishing and Acquisition Authority(ies): Desert National Wildlife Range was established by Executive Order Number 7373 of President Franklin D. Roosevelt on May 20, 1936. Originally named the Desert Game Range and under the joint administration of the Fish and Wildlife Service and the Bureau of Land Management, it contained a total of 2,250,000 acres, including lands both north and south of U.S. Highway 95. Public Land Order 4079, issued on August 26, 1966 and corrected on September 23, 1966, revoked Executive Order 7373, changed the name to Desert National Wildlife Range, reduced its size to 1,588,000 acres, and transferred sole administration to the Fish and Wildlife Service. Between 1935 and 1989, an additional 760 acres in the vicinity of Corn Creek were acquired under various authorities, including the Migratory Bird Conservation Act, Endangered Species Act, and Refuge Recreation Act. The Military Lands Withdrawal Act of 1999 (Public Law 106-65) transferred primary jurisdiction of 110,000 acres of bombing impact areas on the Refuge from the Service to Department of Defense. In 2002, the Clark County Conservation of Public Land and Natural Resources Act (Public Law 107-282) transferred 26,433 acres of BLM land adjacent to Desert NWR's east boundary to the Service. In 2004, the Lincoln County Conservation, Recreation, and Development Act (Public Law 108-424) transferred approximately 8,382 acres the eastern boundary of Desert NWR to the BLM for use as a utility corridor. In addition, 8,503 acres of BLM-administered land adjacent to the northeast corner of the Refuge were transferred to the Service.

Refuge Purpose(s):

- For lands acquired under Public Land Order 4079, dated August 31, 1966, the purpose is “. . . for the protection, enhancement, and maintenance of wildlife resources, including bighorn sheep.”
- For lands acquired under 16 USC 715d (Migratory Bird Conservation Act): “...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds...”.
- For lands acquired under 16 U.S.C. § 1534 (Endangered Species Act of 1973) the purpose is “. . . to conserve (a) fish or wildlife which are listed as endangered species or threatened species . . . or (b) plants.”
- For lands acquired under 16 U.S.C. § 460k-460l (Refuge Recreation Act) the purpose is “. . . suitable for - (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species . . . ”

National Wildlife Refuge System Mission: “To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans” (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-ee]).

Description of Use: Hunting is identified in the National Wildlife Refuge System Improvement Act of 1997 (16 U.S.C. 668dd-ee) as a priority use for refuges when it is compatible with the refuge purposes and mission of the Refuge System. As a result, the Service is proposing to continue desert bighorn sheep hunting on approximately 1.37 million acres of Desert Refuge. Camping often occurs in association with hunting. See the compatibility determinations for camping for more information.

The hunting program will provide high quality, safe, and cost-effective hunting opportunities, and will be carried out consistent with State regulations. The guiding principles of the Refuge System’s hunting programs (Service Manual 605 FW 2) are to:

- Manage wildlife populations consistent with Refuge System-specific management plans approved after 1997 and, to the extent practicable, State fish and wildlife conservation plans;
- Promote visitor understanding of and increase visitor appreciation for America’s natural resources;
- Provide opportunities for quality recreational and educational experiences consistent with criteria describing quality found in 605 FW 1.6;
- Encourage participation in this tradition deeply rooted in America’s natural heritage and conservation history; and
- Minimize conflicts with visitors participating in other compatible wildlife-dependent recreational activities.

The Refuge’s hunting program will comply with the Code of Federal Regulations Title 50, 32.1 and be managed in accordance with Service Manual 605 FW2, Hunting and applicable State regulations.

The sheep hunt program on Desert NWR began in 1954 and has continued each season except one (1955). The hunt program is currently administered by Nevada Department of Wildlife (NDOW). Six hunting units comprising portions of six mountain ranges have been established by NDOW, within Desert NWR (Figure 1). A specific number of permits are issued each season based on the size and composition of the sheep population and the age structure of the ram segment in each unit. Two separate hunts are conducted each year on Desert NWR with the first starting mid-November and ending mid-December. This coincides with the annual state-wide desert bighorn sheep hunt. This hunt occurs in units 283, 284, and 286. The second hunt starts mid December and continues to the first of January within units 280, 281, and 282. These units lie within the Nevada Test and Training Range and as regulated by the Memorandum of Understanding between the Air Force and the Service; military use is suspended for the duration of the hunting period. Table 1 shows the opening and closing dates and quotas for each unit during the 2007 season.

Table 1. 2007 desert bighorn sheep hunt season dates and quotas.

Hunt Unit	2007 Season Dates	2007 Quotas
280	Dec 15 - Jan 1	3
281	Dec 15 - Jan 1	4
282	Dec 15 - Jan 1	2
283, 284	Nov 10 - Dec 10	4
286	Nov 10 - Dec 10	2

The number of permits issued each season for each hunt is equal to 8% of the ram population estimate. After coordination with the Service, Nevada Department of Wildlife issues the permits through random computer drawing and NDOW retains the fees derived from the permits to cover costs. All hunters who draw a bighorn sheep tag in Nevada are required to attend an NDOW indoctrination class prior to receiving their sheep tag. This course is designed to teach hunters ram recognition and aging techniques as well as some life history data and general hunting procedures. Both lecture and outdoor session are roughly four hours long with the outdoor portion used to instruct and test sheep aging techniques using a 15 power spotting scope, which is a mandatory item to carry into the field. Hunters

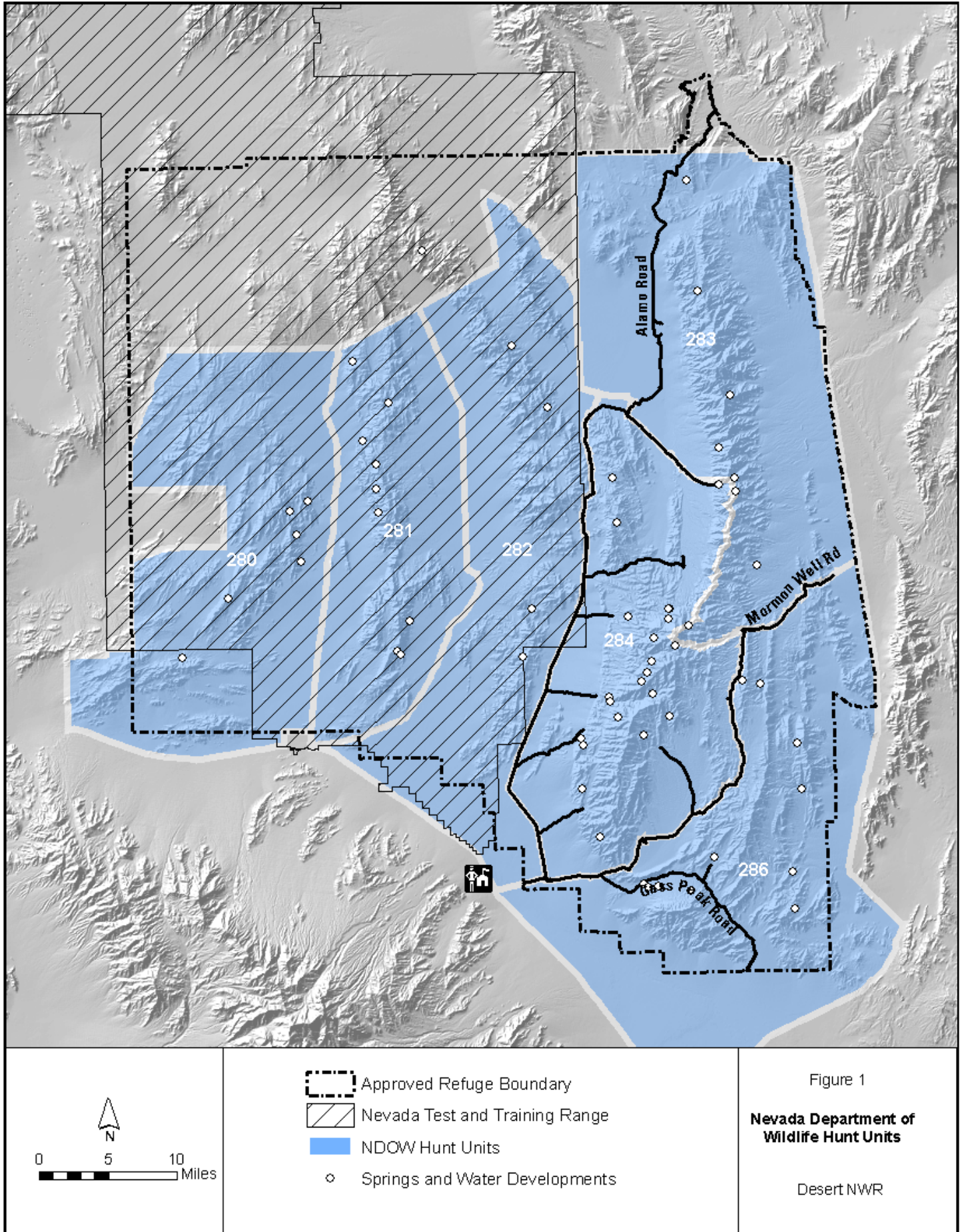


Figure 1

Nevada Department of Wildlife Hunt Units

Desert NWR

are instructed that bighorn sheep managers are interested in removing only older rams even though young lambs are legal to kill. Both State and Federal laws and regulations relating to sheep hunting and governing the use of Desert NWR are explained. Hunters within the portion of DNWR overlain by the Nevada Test and Training Range (units 280, 281, 282) are also required to attend a Department of Defense safety briefing and pass a background check prior to hunting.

Federal and State laws and regulations are enforced by Desert NWRC law enforcement personnel and NDOW game wardens, respectively..

In general, hunters travel in vehicles on established roads to the unit which they have drawn a tag for and then they travel on foot. However, hunters occasionally travel via horseback to their desired destination (C. McDermott pers. com.). Camping is allowed anywhere within the eastern portion of Desert NWR outside the NTTR (units 283, 284, and 286), except within ¼ mile of any water development. However, within the NTTR (Units 280, 281, and 282), hunters must camp at designated sites.

During the 15 year period between 1992 and 2006, a total of 196 tags were issued for the six Desert NWR units with an average of 13 per year. The average success over the same period was 59 percent. The tags issued on the Desert NWR hunt units represent about 11 percent of the 120 on average issued State-wide each year. Each tag holder spent an average of 8.5 days hunting within the Desert Refuge units. Table 2 summarizes the results by hunt unit from 1992 - 2006.

Table 2. Desert NWR Bighorn Sheep Hunt Results Summary: 1992 - 2006

Unit Group	# Tags Issued	Percent Success	Sheep Taken	Average Days Hunted	Average Age of Ram	Average B&C Score	Maximum B&C Score
280	7	57%	4	7	7.5	157 7/8	161 7/8
281	59	39%	23	8.6	6.8	153 3/8	177 3/8
282	33	58%	19	7.5	6.4	147 1/8	162 6/8
283, 284	55	60%	33	10.2	5.6	148 4/8	163 2/8
286	42	79%	33	9.1	5.8	151 7/8	171 6/8
SUM	196		112	42.4			
Average	13.1	57%	7.5	8.48	6.1		
State Average	120	83%		6.7	6.2	149 5/8	183 2/8

Source: NDOW 2007

Availability of Resources: The following funding/annual costs (based on FY 2008 costs) would be required to administer and manage the activities as described above:

	One-time Costs	Annual Costs
General Administration		\$500
Law Enforcement personnel		\$1500
Annual aerial sheep surveys - personnel		\$1500
-flight time		\$15,000
Sheep harvest data collection and analysis and interpretation		\$20,000
TOTAL		

Anticipated Impacts of Use:

Possible impacts of sheep hunting include: the direct take of bighorn sheep rams and its indirect effects on the remaining population; disturbance to sheep and other wildlife; and habitat modification. All these impacts are expected to be relatively minor and localized due to the low levels of use on the refuge.

Direct and Indirect Effects of Trophy Hunting

During the last 15 years (1992 to 2006), an average of 7.5 rams total were taken each year on Desert Refuge. The average age of the rams was 6.1 years (NDOW 2007)

Hunters tend to target the oldest rams with the biggest horns in a given population. This can have a variety of indirect effects on the remaining sheep population. In a life history study on Desert NWR reviewing 20 years of data, Bradley and Baker (1967) found that mortality for hunting was not an important factor relative to the sex ratio of the Refuge bighorn sheep population. Singer and Zeigenfuss (2002) found that that young rams in trophy-hunted populations of mountain sheep were more involved in breeding activities and harassed ewes more frequently. However, the same study found no compelling evidence for any deleterious effects on ewe energetics or ewe reproductive success. Singer and Zeigenfuss (2002) also found that trophy hunting decreased competition between rams for obtaining copulations because rut groups in hunted populations had fewer rams than groups in unhunted populations. They also found compelling evidence for depressed survivorship of young rams in heavily hunted populations, but not in lightly trophy-hunted populations (<3 percent of the total population or <10 percent of standing ram population). By this standard, Desert NWR's sheep population would be considered lightly hunted since the number of tags issued is based on 8 percent of the ram population and about 60 percent of tags on average result in a successful hunt each year.

Disturbance-Related Impacts on Wildlife:

Immediate responses by wildlife to recreational activity can range from behavioral changes including nest abandonment or change in food habits, physiological changes such as elevated heart rates due to flight, or even death (Knight and Cole 1995). The long term effects are more difficult to assess but may include altered behavior, vigor, productivity or death of individuals; altered population abundance, distribution, or demographics; and altered community species composition and interactions.

According to Knight and Cole (1991), there are three wildlife responses to human disturbance: 1) avoidance; 2) habituation; and 3) attraction. The magnitude of the avoidance response may depend on a number of factors including the type, distance, movement pattern, speed, and duration of the disturbance, as well as the time of day, time of year, weather; and the animal's access to food and cover, energy demands, and reproductive status (Knight and Cole 1991; Gabrielsen and Smith 1995).

In otherwise suitable habitat, sheep have been observed to abandon an area, either temporarily or permanently, when their tolerance to disturbance is exceeded (Welles and Welles 1961, Light 1971, Wehausen 1980, Papouchis et al. 2001, Thompson et al. 2007). If the resulting loss of habitat is significant, the population's carrying capacity could be reduced (Light and Weaver 1973). Furthermore, when disturbance elicits a flight response in sheep, resulting energetic losses and loss of foraging time could negatively affect the physiology of individuals, potentially reduce their survival and reproductive success (MacArthur et al. 1979). Papouchis et al. (2001) found that response of female bighorn sheep to disturbance was greater during the spring lambing period and the response of male sheep was greatest during the fall rut.

In some circumstances, sheep may habituate to predictable human activity (Wehausen et al. 1977, Kovach 1979), including highway traffic (Horesji 1976), hiking (Hicks and Elder 1979, Hamilton et al. 1982, Holl and Bleich 1987), and aircraft (Krausman et al. 1998). Habituation is defined as a form of learning in which individuals stop responding to stimuli that carry no reinforcing consequences for the individuals that are exposed to them (Alcock 1993). A key factor for predicting how wildlife would

respond to disturbance is predictability. Gabrielsen and Smith (1995) suggest that most animals seem to have a greater defense response to humans moving unpredictably in the terrain than to humans following a distinct path.

Wildlife may also be attracted to human presence. For example, wildlife may be converted to “beggars” lured by handouts (Knight and Temple 1995), and scavengers are attracted to road kills (Rosen and Lowe 1994).

Impacts on Habitat:

Hunters can also have adverse impacts on vegetation and soil conditions. Hiking or walking can alter habitats by trampling vegetation, compacting soil, and increasing the potential of erosion (Liddle 1975; Hendee *et al.* 1990). Soil compaction makes root penetration more difficult, making it difficult for seedlings to become established (Cole and Landres 1995). In moderate cases of soil compaction, plant cover and biomass is decreased. In highly compacted soils, plant species abundance and diversity is reduced in the long-term as only the most resistant species survive (Liddle 1975). Impacts from vegetation trampling can lower species richness, decrease ground cover and plant species density, increase weedy annuals, and induce changes in species composition (Grabherr 1983).

Public Review and Comment: Public review and comments will be solicited in conjunction with distribution of the Draft CCP/EIS for the Desert National Wildlife Refuge Complex.

Determination:

- Use is Not Compatible
- Use is Compatible with the Following Stipulations

Stipulations necessary to ensure compatibility:

- Aerial surveys of each unit will be conducted each fall to develop population estimates and ram/ewe/lamb/ratios.
- The number of bighorn sheep tags issues each year will not exceed 8 percent of the current ram population estimate for each unit.
- Hunts will be scheduled in accordance with the NDOW in mid-November through December, which is after the breeding season when all animals are scattered and are not dependant on a water supply and yearling lambs are able to care for themselves if separated from the ewes.
- Hunters will be required to attend an NDOW indoctrination class prior to hunting which covers specific Federal and State wildlife regulations.
- Hunters within the portion of DNWR overlain by the Nevada Test and Training Range (units 280, 281, 282) are also required to attend a Department of Defense safety briefing prior to hunting.
- Bighorn sheep guides are required to obtain a Special Use Permit prior to taking clients onto the Refuge.
- Natural bighorn sheep mortality (pickup heads) found on the Refuge are government property and possession or removal of them from the Refuge is not permitted.
- Desert NWR law enforcement personnel will conduct random patrols throughout the hunt season.
- No camping is allowed within ¼ mile of springs and water developments.
- Each sheep taken on Desert NWR must be checked out by Refuge personnel at Corn Creek Field Station

Justification: Hunting is a priority public use of the National Wildlife Refuge System. Providing opportunities for desert bighorn sheep hunting would contribute toward fulfilling provisions of the

National Wildlife Refuge System Administration Act, as amended in 1997, and one of the goals of the Desert Refuge (Goal 4, Chapter 3, CCP/EIS). The stipulations outlined above should minimize potential direct and indirect impacts of the hunt. Based upon impacts described here and in the Draft Comprehensive Conservation Plan/Environmental Impact Statement (USFWS 2008), it is determined that hunting of desert bighorn sheep within the Desert National Wildlife Refuge, as described herein, will not materially interfere with or detract from the purposes for which the Refuge was established or the mission of the Refuge System.

Mandatory Re-Evaluation Date:

Mandatory 15-year Re-Evaluation, Date will be provided in Final EIS/CCP (for priority public uses)

Mandatory 10-year Re-Evaluation (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

Categorical Exclusion without Environmental Action Statement

Categorical Exclusion and Environmental Action Statement

Environmental Assessment and Finding of No Significant Impact

Environmental Impact Statement and Record of Decision

References Cited

Alcock, J. 1993. Animal behavior: an evolutionary approach. Fifth ed. Sinauer Assoc., Sunderland, MA. 625pp.

Bradley, W.G. and D.P. Baker. 1967. Life tables for nelson bighorn sheep on the desert game range. Desert Bighorn Council Transactions. 11(1967):142-170.

Cole, D. N. and P. B. Landres. 1995. Indirect effects of recreation on wildlife. Pages 183-201 in R. L. Knight and K. J. Gutzwiller, ed. Wildlife and Recreationists: coexistence through management and research. Island Press, Washington, D. C. 372pp.

Gabrielson, G. W. and E. N. Smith. 1995. Physiological responses of wildlife to disturbance. Pages 95-107 in R. L. Knight and K. J. Gutzwiller, ed. Wildlife and Recreationists: coexistence through management and research. Island Press, Washington, D. C. 372pp.

Grabherr, G. 1983. Damage to vegetation by recreation in the Austrian and German Alps. Pages 74-91 in N.G. Bayfield and G.c. Barrow eds. The ecological impacts of outdoor recreation on mountain areas in Europe and North America, Rept. 9. 203pp.

Hamilton, K. M., S. Holl and C. L. Douglas. 1982. An evaluation of the effects of recreational activities on bighorn sheep in the San Gabriel Mountains, California. Desert Bighorn Council Transactions 26:50-55.

Hendee, Jr., G.H. Stankey, and R.C. Lucas. 1990. Wilderness Management. North American Press, Golden, CO.

Hicks, L. L. and J. M. Elder. 1979. Human disturbance of Sierra Nevada bighorn sheep. Journal of Wildlife Management 43:909-915.

- Holl, S.A. and V. C. Bleich. 1987. Mineral Lick use by mountain sheep in the San Gabriel Mountains, California. *Journal of Wildlife Management* 51:383-385.
- Horesji, B. 1976. Some thoughts and observations on harassment and bighorn sheep. Pages 149-155 in T. Thorne, chairman. *Proceedings of the Biennial Symposium of North American Bighorn Sheep Council*. Jackson, Wyoming, USA.
- Knight, R. L. and D. N. Cole. 1991. Effects of recreational activity on wildlife in wildlands in *Transactions of the North American Wildlife and Natural Resources Conference*. 56:238-247.
- Knight, R. L. and D. N. Cole. 1995. Wildlife responses to recreationists. Pages 71-79 in R. L. Knight and K. J. Gutzwiller, ed. *Wildlife and Recreationists: coexistence through management and research*. Island Press, Washington, DC.
- Knight, R. L. and S. A. Temple. 1995. Origin of wildlife responses to recreationists. In *Wildlife and recreation: coexistence through management and research*. R. L. Knight and K. J. Gutzwiller, eds. Island Press, Washington, D. C., pp 81-91.
- Kovach, S. D. 1979. An ecological survey of the White Mountain bighorn. *Desert Bighorn Council Transactions* 23:57-61.
- Krausman, P. R., Wallace, C. L. Hayes, and D.W. DeYoung. 1998. Effects of jet aircraft on mountain sheep. *Journal of Wildlife Management* 62:1246-1254.
- Liddle, M. J. 1975. A selective review of the ecological effects of human trampling on natural ecosystems. *Biol. Conserv.* 7:17-36.
- Light, J.T. 1971. An ecological view of bighorn habitat on Mt. San Antonio. *Transactions of the North American Wild Sheep Conference* 1:150-157. U.S. Forest Service, San Bernardino National Forest, California, USA.
- Light, J.T. and R. Weaver. 1973. Report on bighorn sheep habitat study in the area for which an application was made to expand the Mt. Baldy winter sports facility.
- MacArthur, R. A., R. H. Johnson, and V. Geist. 1979. Factors influencing heart rate in free ranging bighorn sheep: a physiological approach to the study of wildlife harassment. *Canadian Journal of Zoology* 57:2010-2021.
- Papouchis, C.M., F. J. Singer, and W.B. Sloan. 2001. Responses of desert bighorn sheep to increased human recreation. *Journal of Wildlife Management*, 65(3):573-582.
- Rosen, P. C. and C. H. Lowe. 1994. Highway mortality of snakes in the Sonoran Desert of southern Arizona. *Biol. Conserv.* 68:143-148.
- Singer, F.J. and L.C. Zeigenfuss. 2002. Influence of trophy hunting and horn size on mating behavior and survivorship of mountain sheep. *J of Mammalogy*, 83(3):682-698.
- Thompson, D., K. Longshore and C. Lowery. 2007. The impact of human disturbance on desert bighorn sheep (*Ovis canadensis nelsoni*) in the Wonderland of Rocks / Queen Mountain region of Joshua Tree National Park, California. A final report prepared for Joshua Tree National Park, CA.

USFWS. 2008. Desert National Wildlife Refuge Draft Comprehensive Conservation Plan and Environmental Impact Statement. U.S. Fish and Wildlife Service, Region 8.

Wehausen, J. D., L. L. Hicks, D. P. Gardner, and J. Elder. 1977. Bighorn sheep management in the Sierra Nevada. Desert Bighorn Council Transactions 21:30-32.

Wehausen, J. D. 1980. Sierra Nevada bighorn sheep: history and population ecology. Ph.D Dissertation, University of Michigan, Ann Arbor, 240 pp.

Welles, R.E. and F.B. Welles. 1961. The bighorn of Death Valley. U.S. Govt. Printing Office, Washington D.C. Fauna Series No. 6. 242 pp.

Refuge Determination

Refuge Manager:

(Signature)

(Date)

Project Leader
Approval:

(Signature)

(Date)

Concurrence

Refuge Supervisor:

(Signature)

(Date)

Assistant Regional
Director - Refuges:

(Signature)

(Date)

COMPATIBILITY DETERMINATION

Use: Research

Refuge Name: Desert National Wildlife Refuge, located in Clark and Lincoln Counties, Nevada.

Establishing and Acquisition Authority(ies): Desert National Wildlife Range was established by Executive Order Number 7373 of President Franklin D. Roosevelt on May 20, 1936. Originally named the Desert Game Range and under the joint administration of the Fish and Wildlife Service and the Bureau of Land Management, it contained a total of 2,250,000 acres, including lands both north and south of U.S. Highway 95. Public Land Order 4079, issued on August 26, 1966 and corrected on September 23, 1966, revoked Executive Order 7373, changed the name to Desert National Wildlife Range, reduced its size to 1,588,000 acres, and transferred sole administration to the Fish and Wildlife Service. Between 1935 and 1989, an additional 760 acres in the vicinity of Corn Creek were acquired under various authorities, including the Migratory Bird Conservation Act, Endangered Species Act, and Refuge Recreation Act. The Military Lands Withdrawal Act of 1999 (Public Law 106-65) transferred primary jurisdiction of 110,000 acres of bombing impact areas on the Refuge from the Service to Department of Defense. In 2002, the Clark County Conservation of Public Land and Natural Resources Act (Public Law 107-282) transferred 26,433 acres of BLM land adjacent to Desert NWR's east boundary to the Service. In 2004, the Lincoln County Conservation, Recreation, and Development Act (Public Law 108-424) transferred approximately 8,382 acres the eastern boundary of Desert NWR to the BLM for use as a utility corridor. In addition, 8,503 acres of BLM-administered land adjacent to the northeast corner of the Refuge were transferred to the Service.

Refuge Purpose(s):

- For lands acquired under Public Land Order 4079, dated August 31, 1966, the purpose is “. . . for the protection, enhancement, and maintenance of wildlife resources, including bighorn sheep.”
- For lands acquired under 16 USC 715d (Migratory Bird Conservation Act): “...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds...”
- For lands acquired under 16 U.S.C. § 1534 (Endangered Species Act of 1973) the purpose is “. . . to conserve (a) fish or wildlife which are listed as endangered species or threatened species . . . or (b) plants.”
- For lands acquired under 16 U.S.C. § 460k-460l (Refuge Recreation Act) the purpose is “. . . suitable for - (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species . . . ”

National Wildlife Refuge System Mission: “To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.” (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-ee]).

Description of Use: Two provisions of the National Wildlife Refuge Improvement Act are to “maintain biological integrity, diversity and environmental health” and to conduct “inventory and monitoring.” Monitoring and research are an integral part of National Wildlife Refuge management. Plans and actions based on research and monitoring provide an informed approach, which analyzes the management affects on refuge wildlife.

When the Refuge receives requests to conduct scientific research at the Refuge, Special Use Permits (SUPs) are required to be issued for research and monitoring. SUPs are only issued for monitoring and investigations which contribute to the enhancement, protection, preservation, and management of

native Refuge plant and wildlife populations and their habitats. Research applicants are required to submit a proposal that outlines: (1) objectives of the study; (2) justification for the study; (3) detailed methodology and schedule; (4) potential impacts on Refuge wildlife or habitat, including disturbance (short and long term), injury, or mortality (this includes a description of measures the researcher will take to reduce disturbance or impacts); (5) research personnel required; (6) costs to Refuge, if any; and (7) progress reports and end products (i.e., reports, thesis, dissertations, publications). Research proposals are reviewed by Refuge staff and conservation partners, as appropriate. SUPs are issued by the refuge manager, if the proposal is approved.

Evaluation criteria will include, but not be limited to, the following:

- Research that will contribute to specific Refuge management issues will be given higher priority over other research requests.
- Research that will conflict with other ongoing research, monitoring, or management programs will not be granted.
- Research projects that can be accomplished off-Refuge are less likely to be approved.
- Research which causes undue disturbance or is intrusive will likely not be granted. Level and type of disturbance will be carefully evaluated when considering a request.
- Refuge evaluation will determine if any effort has been made to minimize disturbance through study design, including considering adjusting location, timing, scope, number of permittees, study methods, number of study sites, etc.
- If staffing or logistics make it impossible for the Refuge to monitor researcher activity in a sensitive area, the research request may be denied, depending on the specific circumstances.
- The length of the project will be considered and agreed upon before approval. Projects will be reviewed annually.

These criteria will also apply to any properties acquired in the future within the approved boundary of the Refuge.

Availability of Resources:

The Refuge receives approximately 5 - 7 research requests per year. Some permit requests require up to one hour to process, others could take longer, depending on the complexity of the research request. On average, the program costs approximately \$500.00/year. Refuge operational funds are currently available through the Service budget process to administer this program.

	One-time Costs	Annual Costs
General Administration		\$500
TOTAL		\$500

Anticipated Impacts of Use: Possible impacts of research include disturbance to wildlife and habitat modification. Potential impacts associated with research activities would be mitigated/minimized because sufficient restrictions would be included as part of the study design and researcher activities would be monitored by Refuge staff. Due to the small number of researchers that use the Refuge, the impacts on sheep and other wildlife and their habitat are expected to be relatively minor and localized. These potential impacts are described below.

Impacts on Wildlife:

According to Knight and Cole (1991), there are three categories of wildlife responses to human disturbance: 1) avoidance; 2) habituation; and 3) attraction. The magnitude of the avoidance response may depend on a number of factors including the type, distance, movement pattern, speed, and duration of the disturbance, as well as the time of day, time of year, weather; and the animal's access to food and cover, energy demands, and reproductive status (Knight and Cole 1991; Gabrielsen and Smith 1995).

In otherwise suitable habitat, sheep have been observed to abandon an area, either temporarily or permanently, when their tolerance to disturbance is exceeded (Welles and Welles 1961, Light 1971, Wehausen 1980, Papouchis *et al.* 2001, Thompson *et al.* 2007). If the resulting loss of habitat is significant, the population's carrying capacity could be reduced (Light and Weaver 1973). Furthermore, when disturbance elicits a flight response in sheep, resulting energetic losses and loss of foraging time could negatively affect the physiology of individuals, potentially reduce their survival and reproductive success (MacArthur *et al.* 1979). Papouchis *et al.* (2001) found that response of female bighorn sheep to disturbance was greater during the spring lambing period and the response of male sheep was greatest during the fall rut.

In some circumstances, sheep may habituate to predictable human activity (Wehausen *et al.* 1977, Kovach 1979), including highway traffic (Horesji 1976), hiking (Hicks and Elder 1979, Hamilton *et al.* 1982, Holl and Bleich 1987), and aircraft (Krausman *et al.* 1998). Habituation is defined as a form of learning in which individuals stop responding to stimuli that carry no reinforcing consequences for the individuals that are exposed to them (Alcock 1993). A key factor for predicting how wildlife would respond to disturbance is predictability. Gabrielsen and Smith (1995) suggest that most animals seem to have a greater defense response to humans moving unpredictably in the terrain than to humans following a distinct path.

Wildlife may also be attracted to human presence. For example, wildlife may be converted to "beggars" lured by handouts (Knight and Temple 1995), and scavengers are attracted to road kills (Rosen and Lowe 1994).

Impacts on Habitat:

Research activities could also have adverse impacts on vegetation and soil conditions. However, most of these effects would be short-term because only the minimum of samples (e.g., water, soils, vegetative litter, plants, ect.) required for identification and/or experimentation and statistical analysis would be permitted. Off trail walking by researchers could have similar effects as hikers in general who can alter habitats by trampling vegetation, compacting soil, and increasing the potential of erosion (Liddle 1975; Hendee *et al.* 1990). Soil compaction makes root penetration more difficult, making it difficult for seedlings to become established (Cole and Landres 1995). In moderate cases of soil compaction, plant cover and biomass is decreased. In highly compacted soils, plant species abundance and diversity is reduced in the long-term as only the most resistant species survive (Liddle 1975). Impacts from vegetation trampling can lower species richness, decrease ground cover and plant species density, increase weedy annuals, and induce changes in species composition (Grabherr 1983).

Public Review and Comment: Public review and comments will be solicited in conjunction with distribution of the Draft CCP/EIS for the Desert National Wildlife Refuge Complex. Comments received (including those regarding research) will be addressed in the Response to Comments.

Determination:

Use is Not Compatible

Use is Compatible with the Following Stipulations

Stipulations necessary to ensure compatibility: The criteria for evaluating a research proposal, outlined in the Description of Use section above, will be used when determining whether a proposed study will be approved on the Refuge. If proposed research methods are evaluated and determined to have potential adverse impacts on refuge wildlife or habitat, then the refuge would determine the utility and need of such research to conservation and management of refuge wildlife and habitat. If the need was demonstrated by the research permittee and accepted by the refuge, then measures to minimize potential impacts (e.g., reduce the numbers of researchers entering an area, restrict research in specified areas) would be developed and included as part of the study design and on the SUP. SUPs will contain specific terms and conditions that the researcher(s) must follow relative to activity, location, duration, seasonality, etc. to ensure continued compatibility. All Refuge rules and regulations must be followed unless otherwise accepted in writing by Refuge management.

All information, reports, data, collections, or documented sightings and observations, that are obtained as a result of this permit are the property of the Service and can be accessed by the Service at any time from the permittee at no cost. The Refuge also requires the submission of annual or final reports and any/all publications associated with the work done on the Refuge. Each SUP may have additional criteria. Each SUP will also be evaluated individually to determine if a fee will be charged and for the length of the permit.

Extremely sensitive wildlife habitat areas would be avoided unless sufficient protection from research activities (i.e., disturbance, collection, capture and handling) is implemented to limit the area and/or wildlife potentially impacted by the proposed research. Where appropriate, some areas may be temporarily/seasonally closed so that research would be permitted when impacts to wildlife and habitat are no longer a concern. Research activities will be modified to avoid harm to sensitive wildlife and habitat when unforeseen impacts arise.

Refuge staff will monitor researcher activities for potential impacts to the refuge and for compliance with conditions on the SUP. The refuge manager may determine that previously approved research and SUPs be terminated due to observed impacts. The refuge manager will also have the ability to cancel a SUP if the researcher is out of compliance with the conditions of the SUP.

Justification: Refuge monitoring and research will directly benefit and support refuge goals, objectives and management plans and activities. Fish, wildlife, plants and their habitat will improve through the application of knowledge gained from monitoring and research. Biological integrity, diversity and environmental health would benefit from scientific research conducted on natural resources at the refuge. The wildlife-dependent, priority public uses (wildlife viewing and photography, environmental education and interpretation, fishing and hunting) would also benefit as a result of increased biodiversity and wildlife and native plant populations from improved restoration and management plans and activities associated with monitoring and research investigations which address specific restoration and management questions.

Mandatory Re-Evaluation Date:

- Mandatory 15-year Re-Evaluation (for priority public uses)
- Mandatory 10-year Re-Evaluation, Date will be provided in Final EIS/CCP (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

- Categorical Exclusion without Environmental Action Statement
- Categorical Exclusion and Environmental Action Statement

Environmental Assessment and Finding of No Significant Impact

Environmental Impact Statement and Record of Decision

References Cited

- Alcock, J. 1993. *Animal behavior: an evolutionary approach*. Fifth ed. Sinauer Assoc., Sunderland, MA. 625pp.
- Cole, D. N. and P. B. Landres. 1995. Indirect effects of recreation on wildlife. Pages 183-201 in R. L. Knight and K. J. Gutzwiller, ed. *Wildlife and Recreationists: coexistence through management and research*. Island Press, Washington, D. C. 372pp.
- Gabrielson, G. W. and E. N. Smith. 1995. Physiological responses of wildlife to disturbance. Pages 95-107 in R. L. Knight and K. J. Gutzwiller, ed. *Wildlife and Recreationists: coexistence through management and research*. Island Press, Washington, D. C. 372pp.
- Grabherr, G. 1983. Damage to vegetation by recreation in the Austrian and German Alps. Pages 74-91 in N.G. Bayfield and G.C. Barrow eds. *The ecological impacts of outdoor recreation on mountain areas in Europe and North America*, Rept. 9. 203pp.
- Hamilton, K. M., S. Holl and C. L. Douglas. 1982. An evaluation of the effects of recreational activities on bighorn sheep in the San Gabriel Mountains, California. *Desert Bighorn Council Transactions* 26:50-55.
- Hendee, Jr., G.H. Stankey, and R.C. Lucas. 1990. *Wilderness Management*. North American Press, Golden, CO.
- Hicks, L. L. and J. M. Elder. 1979. Human disturbance of Sierra Nevada bighorn sheep. *Journal of Wildlife Management* 43:909-915.
- Holl, S.A. and V. C. Bleich. 1987. Mineral Lick use by mountain sheep in the San Gabriel Mountains, California. *Journal of Wildlife Management* 51:383-385.
- Horesji, B. 1976. Some thoughts and observations on harassment and bighorn sheep. Pages 149-155 in T. Thorne, chairman. *Proceedings of the Biennial Symposium of North American Bighorn Sheep Council*. Jackson, Wyoming, USA.
- Knight, R. L. and D. N. Cole. 1991. Effects of recreational activity on wildlife in wildlands in *Transactions of the North American Wildlife and Natural Resources Conference*. 56:238-247.
- Knight, R. L. and S. A. Temple. 1995. Origin of wildlife responses to recreationists. In *Wildlife and recreation: coexistence through management and research*. R. L. Knight and K. J. Gutzwiller, eds. Island Press, Washington, D. C., pp 81-91.
- Kovach, S. D. 1979. An ecological survey of the White Mountain bighorn. *Desert Bighorn Council Transactions* 23:57-61.
- Krausman, P. R., Wallace, C. L. Hayes, and D.W. DeYoung. 1998. Effects of jet aircraft on mountain sheep. *Journal of Wildlife Management* 62:1246-1254.

- Liddle, M. J. 1975. A selective review of the ecological effects of human trampling on natural ecosystems. *Biol. Conserv.* 7:17-36.
- Light, J.T. 1971. An ecological view of bighorn habitat on Mt. San Antonio. *Transactions of the North American Wild Sheep Conference* 1:150-157. U.S. Forest Service, San Bernardino National Forest, California, USA.
- Light, J.T. and R. Weaver. 1973. Report on bighorn sheep habitat study in the area for which an application was made to expand the Mt. Baldy winter sports facility.
- MacArthur, R. A., R. H. Johnson, and V. Geist. 1979. Factors influencing heart rate in free ranging bighorn sheep: a physiological approach to the study of wildlife harassment. *Canadian Journal of Zoology* 57:2010-2021.
- Papouchis, C. M., F. J. Singer and W. B. Sloan. 2001. Responses of desert bighorn sheep to increased human recreation. *Journal of Wildlife Management* 65:573-582.
- Rosen, P. C. and C. H. Lowe. 1994. Highway mortality of snakes in the Sonoran Desert of southern Arizona. *Biol. Conserv.* 68:143-148.
- Thompson, D. K. Longshore, and C. Lowrey. 2007. The impact of human disturbance on desert bighorn sheep (*Ovis canadensis nelsoni*) in the Wonderland of Rocks / Queen Mountain region of Joshua Tree National Park, California: A final report prepared for Joshua Tree National Park, CA.
- USFWS. 2008. Desert National Wildlife Refuge Draft Comprehensive Conservation Plan and Environmental Impact Statement. U.S. Fish and Wildlife Service, Region 8.
- Wehausen, J. D., L. L. Hicks, D. P. Gardner, and J. Elder. 1977. Bighorn sheep management in the Sierra Nevada. *Desert Bighorn Council Transactions* 21:30-32.
- Wehausen, J. D. 1980. Sierra Nevada bighorn sheep: history and population ecology. Ph.D Dissertation, University of Michigan, Ann Arbor, 240 pp.
- Welles, R.E. and F.B. Welles. 1961. The bighorn of Death Valley. U.S. Govt. Printing Office, Washington D.C. Fauna Series No. 6. 242 pp.

Refuge Determination

Refuge Manager: _____
(Signature) (Date)

Project Leader
Approval: _____
(Signature) (Date)

Concurrence

Refuge Supervisor: _____
(Signature) (Date)

Assistant Regional
Director - Refuges: _____

(Signature)

(Date)

COMPATIBILITY DETERMINATION

Use: Pine Nut Gathering

Refuge Name: Desert National Wildlife Range, located in Clark and Lincoln Counties, Nevada.

Establishing and Acquisition Authority(ies): Desert National Wildlife Range was established by Executive Order Number 7373 of President Franklin D. Roosevelt on May 20, 1936. Originally named the Desert Game Range and under the joint administration of the Fish and Wildlife Service and the Bureau of Land Management, it contained a total of 2,250,000 acres, including lands both north and south of U.S. Highway 95. Public Land Order 4079, issued on August 26, 1966 and corrected on September 23, 1966, revoked Executive Order 7373, changed the name to Desert National Wildlife Range, reduced its size to 1,588,000 acres, and transferred sole administration to the Fish and Wildlife Service. Between 1935 and 1989, an additional 760 acres in the vicinity of Corn Creek were acquired under various authorities, including the Migratory Bird Conservation Act, Endangered Species Act, and Refuge Recreation Act. The Military Lands Withdrawal Act of 1999 (Public Law 106-65) transferred primary jurisdiction of 110,000 acres of bombing impact areas on the Refuge from the Service to Department of Defense. In 2002, the Clark County Conservation of Public Land and Natural Resources Act (Public Law 107-282) transferred 26,433 acres of BLM land adjacent to Desert NWR's east boundary to the Service. In 2004, the Lincoln County Conservation, Recreation, and Development Act (Public Law 108-424) transferred approximately 8,382 acres the eastern boundary of Desert NWR to the BLM for use as a utility corridor. In addition, 8,503 acres of BLM-administered land adjacent to the northeast corner of the Refuge were transferred to the Service.

Refuge Purpose(s):

- For lands acquired under Public Land Order 4079, dated August 31, 1966, the purpose is “. . . for the protection, enhancement, and maintenance of wildlife resources, including bighorn sheep.”
- For lands acquired under 16 USC 715d (Migratory Bird Conservation Act): “...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds...” .
- For lands acquired under 16 U.S.C. § 1534 (Endangered Species Act of 1973) the purpose is “. . . to conserve (a) fish or wildlife which are listed as endangered species or threatened species . . . or (b) plants.”
- For lands acquired under 16 U.S.C. § 460k-460l (Refuge Recreation Act) the purpose is “. . . suitable for - (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species . . . ”

National Wildlife Refuge System Mission: “To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.” (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-ee]).

Description of Use: Pine nut gathering is a tradition passed down in Native American and pioneer families. The gathering of pine nuts in and around Desert National Wildlife Refuge (Refuge) by Native Americans occurred historically and continues to be an ongoing use today. The amount of pine nuts being harvested is traditionally low and is not expected to increase. The use of refuge lands as a gathering site is considered to be of vital importance to the Southern Paiutes and other tribes.

This use does not occur on an annual basis because pinyon tree production is linked to moisture cycles. The refuge contains approximately 185,000 acres of pinyon-juniper woodlands. The only trees accessible by car are those located along the upper reaches of Mormon Well Road and at the end of Pine Nut Road. The infrequent removal of pine cones and nuts in these areas has had no noticeable effect on the overall status of this vegetative type. Pinyon-juniper woodlands lack a well-developed understory because of the closed canopy, so trampling of vegetation is not expected to be significant.

As proposed, compatible wild food gathering would be allowed on those areas of the Refuge already open for other forms of public use. Based upon historical use, it is estimated that less than 100 users per year would directly pursue this activity. Other users may passively pursue this activity while visiting the refuge for another purpose.

Gathering of wild foods is not one of the 6 legislated uses of the National Wildlife Refuge System. However, the use of refuge lands as a gathering site is considered to be of vital importance to Native American cultural groups. Given the small number of users are not expected to significantly impact the amount of food available for wildlife, the Refuge proposes to allow pine nut gathering to continue by Special Use Permit. If the number of users increases, or adverse impacts to habitat or wildlife begin to occur, the Refuge will re-evaluate this use.

Availability of Resources: No additional resources will be needed to support this use

Anticipated Impacts of Use: Anticipated impacts from this use are minor damage to vegetation, littering, and disturbance to wildlife. No long-term or cumulative impacts are expected on wildlife or habitat.

Possible impacts pine nut gathering could have include disturbance to wildlife, and habitat modification. Wildlife can be affected by the sight and sound of recreationists (Boyle and Sampson 1985). Habitat can be affected through vegetation trampling, soil compaction, and erosion (Cole 1983, 1990). Due to the small number of pine nut gatherers that use the Refuge, the impacts on sheep and other wildlife and their habitat are expected to be relatively minor and localized. These potential impacts are described below.

Impacts on Wildlife:

Immediate responses by wildlife to recreational activity can range from behavioral changes including nest abandonment or change in food habits, physiological changes such as elevated heart rates due to flight, or even death (Knight and Cole 1995). The long term effects are more difficult to assess but may include altered behavior, vigor, productivity or death of individuals; altered population abundance, distribution, or demographics; and altered community species composition and interactions.

According to Knight and Cole (1991), there are three categories of wildlife responses to human disturbance: 1) avoidance; 2) habituation; and 3) attraction. The magnitude of the avoidance response may depend on a number of factors including the type, distance, movement pattern, speed, and duration of the disturbance, as well as the time of day, time of year, weather; and the animal's access to food and cover, energy demands, and reproductive status (Knight and Cole 1991; Gabrielsen and Smith 1995).

Though bighorn sheep do not consume pine nuts, they do utilize the grasses, shrubs, and forbs in the pinyon-juniper understory and will use the woodlands for thermoregulation (Zeller 2003). In otherwise suitable habitat, sheep have been observed to abandon an area, either temporarily or permanently, when their tolerance to disturbance is exceeded (Welles and Welles 1961, Light 1971, Wehausen 1980, Papouchis *et al.* 2001, Thompson *et al.* 2007). If the resulting loss of habitat is significant, the population's carrying capacity could be reduced (Light and Weaver 1973). Furthermore, when disturbance elicits a flight response in sheep, resulting energetic losses and loss of foraging time could negatively affect the physiology of individuals, potentially reduce their survival and reproductive

success (MacArthur et al. 1979). Papouchis *et al.* (2001) found that response of female bighorn sheep to disturbance was greater during the spring lambing period and the response of male sheep was greatest during the fall rut.

Other species, like the pinyon jay and pinyon mouse, that rely on pine nuts as a food source, or bird species that utilize the pinyon-juniper overstory (Scott's oriole, gray vireo, ash-throated flycatcher and ferruginous hawk) (NDOW 2005) could be more directly affected by pine nut gathering. However, the use has been, and will continue to be, confined to areas adjacent to access roads leaving the majority of the habitat relatively undisturbed. Though wildlife will certainly be disturbed when pine nut gathering is occurring, the use is expected to be very limited, less than 100 users per season, and thus the overall impact is considered to be low. The amount of plant material being harvested is small enough not to constitute any measurable impact on habitat or food sources. Since gathering activities are limited, disturbance to wildlife and impact on wild food supply is also expected to be limited.

In some circumstances, sheep may habituate to predictable human activity (Wehausen et al. 1977, Kovach 1979), including highway traffic (Horesji 1976), hiking (Hicks and Elder 1979, Hamilton et al. 1982, Holl and Bleich 1987), and aircraft (Krausman et al. 1998). Habituation is defined as a form of learning in which individuals stop responding to stimuli that carry no reinforcing consequences for the individuals that are exposed to them (Alcock 1993). A key factor for predicting how wildlife would respond to disturbance is predictability. Gabrielsen and Smith (1995) suggest that most animals seem to have a greater defense response to humans moving unpredictably in the terrain than to humans following a distinct path.

Wildlife may also be attracted to human presence. For example, wildlife may be converted to "beggars" lured by handouts (Knight and Temple 1995), and scavengers are attracted to road kills (Rosen and Lowe 1994).

Impacts on Habitat:

Pine nut gathering can also have adverse impacts on vegetation and soil conditions. Pine nut gatherers can alter habitats by trampling vegetation, compacting soil, and increasing the potential of erosion (Liddle 1975; Hendee *et al.* 1990). Soil compaction makes root penetration more difficult, making it difficult for seedlings to become established (Cole and Landres 1995). In moderate cases of soil compaction, plant cover and biomass is decreased. In highly compacted soils, plant species abundance and diversity is reduced in the long-term as only the most resistant species survive (Liddle 1975). Impacts from vegetation trampling can lower species richness, decrease ground cover and plant species density, increase weedy annuals, and induce changes in species composition (Grabherr 1983).

Public Review and Comment: Public review and comments will be solicited in conjunction with distribution of the Draft CCP/EA for the Desert National Wildlife Refuge. Comments received will be addressed in the Response to Comments.

Determination:

Use is Not Compatible

Use is Compatible with the Following Stipulations

Stipulations necessary to ensure compatibility: In order to allow public access to the Refuge for pine nut gathering, the following measures will be taken.

1. Pine nut gathering activities will be reviewed at the annual meeting with tribal representatives. If impacts from gathering increase so that the activity is adversely affecting wildlife habitat or if disturbance to wildlife is occurring, then tribal representatives will be

asked to adjust pine nut gathering activities to reduce impacts. Adjustments may include reductions in harvest, changes in timing of gathering to reduce wildlife or management conflicts, or reductions in numbers of visitors or frequency of visitors.

2. Refuge staff will monitor the impact of the number of users and re-evaluate the compatibility of this use as necessary.
3. Commercial gathering of wild foods is prohibited.
4. Pine nuts will only be gathered from the ground.
5. Vehicles will stay on designated roads.

Justification: As proposed, wild food gathering would allow the small number of interested individuals to enjoy the refuge with little or no additional cost to the refuge. The goals of the National Wildlife Refuge System (System) include providing an understanding and appreciation of fish and wildlife ecology, wildlife habitat, and the human role in the environment. The Service strives to provide priority public uses when compatible with the purpose and goals of the Refuge and the mission of the System. The National Wildlife Refuge System Improvement Act of 1997 identifies environmental education and interpretation as priority public uses for National Wildlife Refuges, along with hunting, fishing, wildlife observation and photography. This use, while not wildlife dependent, is a traditional use that contributes to environmental education and awareness. An understanding of plant ecology and annual moisture cycles is essential to successful pine nut harvesting, thus this activity helps to educate participants about Desert Refuge habitats, while sustaining cultural practices.

Mandatory Re-Evaluation Date:

- Mandatory 15-year Re-Evaluation (for priority public uses)
- Mandatory 10-year Re-Evaluation, Date will be provided in Final EIS/CCP (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

- Categorical Exclusion without Environmental Action Statement
- Categorical Exclusion and Environmental Action Statement
- Environmental Assessment and Finding of No Significant Impact
- Environmental Impact Statement and Record of Decision

References Cited

- Alcock, J. 1993. Animal behavior: an evolutionary approach. Fifth ed. Sinauer Assoc., Sunderland, MA. 625pp.
- Bainbridge, D.A. 1974. Trail Management. Bulletin of the Ecological Society of America. 5:8-10.
- Beck, K.G. 1993. How do weeds affect us all. Proc. Eighth Grazing Lands Forum. Washington, D.C. December 2, 1993. pp5- 13.

- Benninger-Truax, M., J. L. Vankat and R. L. Schaefer. 1992. Trail corridors as habitat and conduits for movement of plant species in Rocky Mountain National Park, CO. *Landscape Ecology* 6(4):269-278.
- Boyle S.A, and F.B. Samson. 1985. Effects of nonconsumptive recreation on wildlife. A review.
- Bright, J.A. 1986. Hiker impact on herbaceous vegetation along trails in evergreen woodland of central Texas. *Biol. Conserv.* 36: 53-69
- Cole, D.N. 1983. Campsite conditions in the Bob Marshall Wilderness, Montana. Res. Paper INT312. U.S. Forest Service. Internat. For. Range Exp. Sta. 18pp.
- _____. 1990. Ecological impacts of wilderness recreation and their management. Pages 425-466. in J.C. Hendee, G.H. Stankey, and R.C. Lucas, eds. *Wilderness Management*. North American Press. Golden, CO.
- Cole, D. N. and P. B. Landres. 1995. Indirect effects of recreation on wildlife. Pages 183-201 in R. L. Knight and K. J. Gutzwiller, ed. *Wildlife and Recreationists: coexistence through management and research*. Island Press, Washington, D. C. 372pp.
- Gabrielson , G. W. and E. N. Smith. 1995. Physiological responses of wildlife to disturbance. Pages 95-107 in R. L. Knight and K. J. Gutzwiller, ed. *Wildlife and Recreationists: coexistence through management and research*. Island Press, Washington, D. C. 372pp.
- Grabherr, G. 1983. Damage to vegetation by recreation in the Austrian and German Alps. Pages 74-91 in N.G. Bayfield and G.C. Barrow eds. *The ecological impacts of outdoor recreation on mountain areas in Europe and North America*, Rept. 9. 203pp.
- Hamilton, K. M., S. Holl and C. L. Douglas. 1982. An evaluation of the effects of recreational activities on bighorn sheep in the San Gabriel Mountains, California. *Desert Bighorn Council Transactions* 26:50-55.
- Hammitt, W.E. and D.N. Cole. 1987. *Wildland recreation: ecology and management*. John Wiley and Sons, New York, NY. 341 pp.
- Hendee, Jr., G.H. Stankey, and R.C. Lucas. 1990. *Wilderness Management*. North American Press, Golden, CO.
- Hicks, L. L. and J. M. Elder. 1979. Human disturbance of Sierra Nevada bighorn sheep. *Journal of Wildlife Management* 43:909-915.
- Holl, S.A. and V. C. Bleich. 1987. Mineral Lick use by mountain sheep in the San Gabriel Mountains, California. *Journal of Wildlife Management* 51:383-385.
- Horesji, B. 1976. Some thoughts and observations on harassment and bighorn sheep. Pages 149-155 in T. Thorne, chairman. *Proceedings of the Biennial Symposium of North American Bighorn Sheep Council*. Jackson, Wyoming, USA.
- Knight, R. L. and D. N. Cole. 1991. Effects of recreational activity on wildlife in wildlands in *Transactions of the North American Wildlife and Natural Resources Conference*. 56:238-247.

- Knight, R. L. and D. N. Cole. 1995. Wildlife responses to recreationists. Pages 71-79 in R. L. Knight and K. J. Gutzwiller, ed. *Wildlife and Recreationists: coexistence through management and research*. Island Press, Washington, DC.
- Knight, R. L. and S. A. Temple. 1995. Origin of wildlife responses to recreationists. In *Wildlife and recreation: coexistence through management and research*. R. L. Knight and K. J. Gutzwiller, eds. Island Press, Washington, D. C., pp 81-91.
- Kovach, S. D. 1979. An ecological survey of the White Mountain bighorn. *Desert Bighorn Council Transactions* 23:57-61.
- Krausman, P. R., Wallace, C. L. Hayes, and D.W. DeYoung. 1998. Effects of jet aircraft on mountain sheep. *Journal of Wildlife Management* 62:1246-1254.
- Lee, R.G. 1975. The management of human components in the Yosemite National Park ecosystem. Yosemite National Park, CA. 134pp.
- Liddle, M . J. 1975. A selective review of the ecological effects of human trampling on natural ecosystems. *Biol. Conserv.* 7:17-36.
- Light, J.T. 1971. An ecological view of bighorn habitat on Mt. San Antonio. *Transactions of the North American Wild Sheep Conference* 1:150-157. U.S. Forest Service, San Bernardino National Forest, California, USA.
- Light, J.T. and R. Weaver. 1973. Report on bighorn sheep habitat study in the area for which an application was made to expand the Mt. Baldy winter sports facility.
- MacArthur, R. A., R. H. Johnson, and V. Geist. 1979. Factors influencing heart rate in free ranging bighorn sheep: a physiological approach to the study of wildlife harassment. *Canadian Journal of Zoology* 57:2010-2021.
- McQuaid-Cook, J. 1978. Effects of hikers and horses on mountain trails. *J. Env. Manage.* 6:209-212.
- Nagy, J.A.S. and G.W. Scotter. 1974. A quantitative assessment of the effects of human and horse trampling on natural areas, Waterton Lakes National Park. *Can. Wildl. Serv.*, Edmonton, AB. . 145pp.
- NDOW. 2005. *Comprehensive Wildlife Conservation Strategy*. Reno, Nevada
- Oberbillig, D.R. 2000. Providing positive wildlife viewing experiences. Deborah Richie Communications, Missoula, MT.
- Papouchis, C. M., F. J. Singer and W. B. Sloan. 2001. Responses of desert bighorn sheep to increased human recreation. *Journal of Wildlife Management* 65:573-582.
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USFWS. 2008. Desert National Wildlife Refuge Draft Comprehensive Conservation Plan / Environmental Impact Statement. U.S. Fish and Wildlife Service, Region 8.

Weaver, T. and D. Dale. 1978. Trampling effects of hikers, motorcycles, and horses in meadows and forests. *J App. Ecol.* 15:451-457.

Wehausen, J. D., L. L. Hicks, D. P. Gardner, and J. Elder. 1977. Bighorn sheep management in the Sierra Nevada. *Desert Bighorn Council Transactions* 21:30-32.

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Welles, R.E. and F.B. Welles. 1961. The bighorn of Death Valley. U.S. Govt. Printing Office, Washington D.C. Fauna Series No. 6. 242 pp.

Whitson, P.D. 1974. The impact of human use upon the Chisos Basin and adjacent lands. USDO, NPS.

Whittaker, P.L. 1978. Comparison of surface impact by hiking and horseback riding in the Great Smoky Mountain National Park. USDO, NPS Management Report 24.

Wilson, J.P. and J.P. Seney. 1994. Mountain Research and Development, Vol. 14, No. 1. pp. 77-88.

Zeller, Bruce. 2003. USFWS. Discussion of Bighorn Sheep Population Status and Management on DNWR. USFWS.

Refuge Determination

Refuge Manager: _____
(Signature) (Date)

Project Leader Approval: _____
(Signature) (Date)

Concurrence

Refuge Supervisor: _____
(Signature) (Date)

Assistant Regional Director - Refuges: _____
(Signature) (Date)

COMPATIBILITY DETERMINATION

Use: Camping

Refuge Name: Desert National Wildlife Refuge (Refuge), located in Clark and Lincoln counties, Nevada.

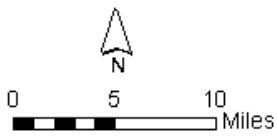
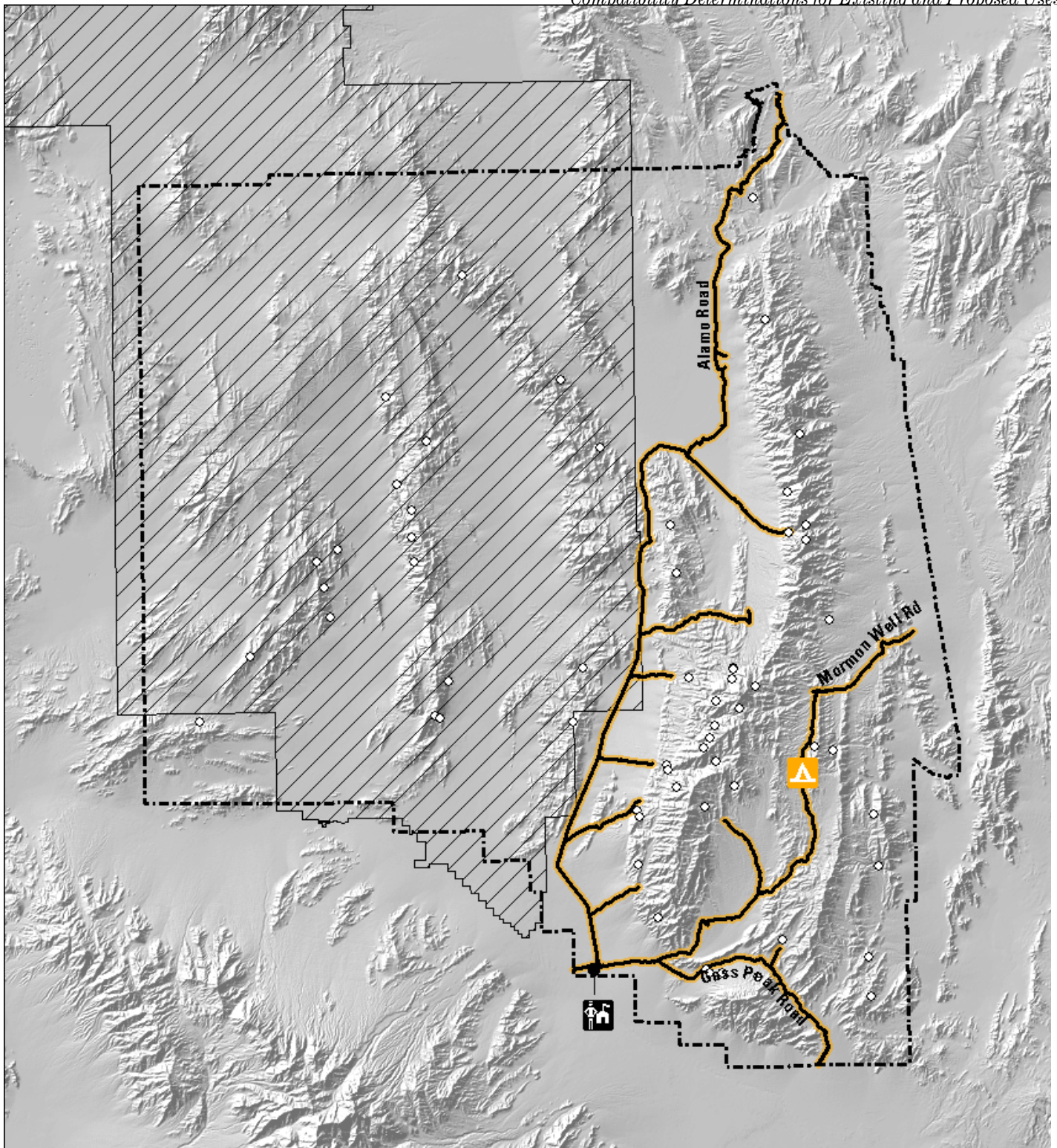
Establishing and Acquisition Authority(ies): Desert National Wildlife Range was established by Executive Order Number 7373 of President Franklin D. Roosevelt on May 20, 1936. Originally named the Desert Game Range and under the joint administration of the Fish and Wildlife Service and the Bureau of Land Management, it contained a total of 2,250,000 acres, including lands both north and south of U.S. Highway 95. Public Land Order 4079, issued on August 26, 1966 and corrected on September 23, 1966, revoked Executive Order 7373, changed the name to Desert National Wildlife Range, reduced its size to 1,588,000 acres, and transferred sole administration to the Fish and Wildlife Service. Between 1935 and 1989, an additional 760 acres in the vicinity of Corn Creek were acquired under various authorities, including the Migratory Bird Conservation Act, Endangered Species Act, and Refuge Recreation Act. The Military Lands Withdrawal Act of 1999 (Public Law 106-65) transferred primary jurisdiction of 110,000 acres of bombing impact areas on the Refuge from the Service to Department of Defense. In 2002, the Clark County Conservation of Public Land and Natural Resources Act (Public Law 107-282) transferred 26,433 acres of BLM land adjacent to Desert NWR's east boundary to the Service. In 2004, the Lincoln County Conservation, Recreation, and Development Act (Public Law 108-424) transferred approximately 8,382 acres the eastern boundary of Desert NWR to the BLM for use as a utility corridor. In addition, 8,503 acres of BLM-administered land adjacent to the northeast corner of the Refuge were transferred to the Service.

Refuge Purpose(s):

- For lands acquired under Public Land Order 4079, dated August 31, 1966, the purpose is “. . . for the protection, enhancement, and maintenance of wildlife resources, including bighorn sheep.”
- For lands acquired under 16 USC 715d (Migratory Bird Conservation Act): “...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds...” .
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- For lands acquired under 16 U.S.C. § 460k-460l (Refuge Recreation Act) the purpose is “. . . suitable for - (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species . . . ”

National Wildlife Refuge System Mission: “To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans” (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-ee]).

Description of Use: Currently, car camping is permitted year-round, within 50 feet of designated roads or existing pull-outs and parking areas, on the portion of Desert NWR outside the Nevada Test and Training Range (Figure 1). Back country camping is permitted virtually anywhere on the Refuge primarily east of the Alamo Road. The Refuge currently has over 180 miles of designated roads. Camping is also allowed at Desert Pass Campground (formerly Mormon Well Campground). This







-  Approved Refuge Boundary
-  Nevada Test and Training Range
-  Area Open to Road-Side Camping (50 ft from road centerline)
-  Desert Pass Campground
-  Springs and Water Developments

Figure 1

Area Open to Camping

Desert NWR

campground is located on the west side of Mormon Well Road in ponderosa pine woodland. It has eight designated sites with tables, fire rings, and vault toilets. Water is not available at the campground.

Camping is limited to 14 consecutive days. Campfires are permitted unless fire restrictions are in place. However, campers must bring their own wood and must use existing fire rings. Water is scarce and critical to wildlife, so campers must carry their own water. We propose to continuation of camping on Desert Refuge at or near current levels.

In general, use of Desert Pass Campground is heaviest on Memorial Day, Labor Day and holiday weekends. All eight sites are usually filled on these weekends (C. McDermott pers. com.). Use during other times of year is sporadic, with more use on weekends and less on weekdays and during winter.

Under the proposed action (Alternative C), the Service would recruit a seasonal volunteer resident host/docent at the Desert Pass Campground. Under the Alternative C, the Service would also use post and cable fencing to designate parking turnouts along Alamo, Mormon Well, and Gass Peak Roads. These improvements would help minimize impacts to desert habitat from car camping by limiting the tendency of pullouts to expand over time do to vehicular use.

Availability of Resources: The following funding/annual costs (based on FY 2008 costs) would be required to administer and manage the activities as described above:

	One-time Costs	Annual Costs
Administration and management	\$500	\$500
Maintenance (road grading for access to pullouts, etc)	\$1,000	\$1000
Post and cable fencing to define pull outs.	\$5,000	\$1,000
TOTAL	\$6500	\$2000

Anticipated Impacts of Use: Anticipated Impacts of the Use

Possible impacts of camping include disturbance to wildlife and habitat modification. Wildlife can be affected by the sight and sound of recreationists (Boyle and Sampson 1985). Habitat can be affected through vegetation trampling, soil compaction, and erosion (Cole 1983, 1990). Due to the small number of campers that use the Refuge, the impacts on sheep and other wildlife and their habitat are expected to be relatively minor and localized. These potential impacts are described below.

Impacts on Wildlife:

Immediate responses by wildlife to recreational activity can range from behavioral changes including nest abandonment or change in food habits, physiological changes such as elevated heart rates due to flight, or even death (Knight and Cole 1995). The long term effects are more difficult to assess but may include altered behavior, vigor, productivity or death of individuals; altered population abundance, distribution, or demographics; and altered community species composition and interactions.

According to Knight and Cole (1991), there are three categories of wildlife responses to human disturbance: 1) avoidance; 2) habituation; and 3) attraction. The magnitude of the avoidance response may depend on a number of factors including the type, distance, movement pattern, speed, and duration of the disturbance, as well as the time of day, time of year, weather; and the animal's access to food and cover, energy demands, and reproductive status (Knight and Cole 1991; Gabrielsen and Smith 1995).

In otherwise suitable habitat, sheep have been observed to temporarily or permanently abandon an area when their tolerance to disturbance is exceeded (Welles and Welles 1961, Light 1971, Wehausen 1980, Papouchis *et al.* 2001, Thompson *et al.* 2007). If the resulting loss of habitat is substantial, the

population's carrying capacity could be reduced (Light and Weaver 1973). Furthermore, when disturbance elicits a flight response in sheep, resulting energetic losses and loss of foraging time could negatively affect the physiology of individuals, potentially reduce their survival and reproductive success (MacArthur et al. 1979). Papouchis *et al.* (2001) found that response of female bighorn sheep to disturbance was greater during the spring lambing period and the response of male sheep was greatest during the fall rut.

In some circumstances, sheep may habituate to predictable human activity (Wehausen et al. 1977, Kovach 1979), including highway traffic (Horesji 1976), hiking (Hicks and Elder 1979, Hamilton et al. 1982, Holl and Bleich 1987), and aircraft (Krausman et al. 1998). Habituation is defined as a form of learning in which individuals stop responding to stimuli that carry no reinforcing consequences for the individuals that are exposed to them (Alcock 1993). A key factor for predicting how wildlife would respond to disturbance is predictability. Gabrielsen and Smith (1995) suggest that most animals seem to have a greater defense response to humans moving unpredictably in the terrain than to humans following a distinct path.

Wildlife may also be attracted to human presence. For example, wildlife may be converted to "beggars" lured by handouts (Knight and Temple 1995), and scavengers are attracted to road kills (Rosen and Lowe 1994).

Impacts on Habitat:

Campers can also have adverse impacts on vegetation and soil conditions. Hiking or walking can alter habitats by trampling vegetation, compacting soil, and increasing the potential of erosion (Liddle 1975; Hendee *et al.* 1990). Soil compaction makes root penetration more difficult, making it difficult for seedlings to become established (Cole and Landres 1995). In moderate cases of soil compaction, plant cover and biomass is decreased. In highly compacted soils, plant species abundance and diversity is reduced in the long-term as only the most resistant species survive (Liddle 1975). Impacts from vegetation trampling can lower species richness, decrease ground cover and plant species density, increase weedy annuals, and induce changes in species composition (Grabherr 1983).

Campers often spend more time at their campsite than anywhere else during their visit, which can potentially result in a source of pollution (Hendee *et al.* 1990). Bacterial contamination is a concern in wilderness settings and can be estimated by evaluating the densities of fecal coliforms (indicators of fecal contamination) and fecal streptococci (found in warm-blooded organisms, including humans).

Public Review and Comment: Public review and comments will be solicited in conjunction with distribution of the Draft CCP/EIS for the Desert National Wildlife Refuge Complex.

Determination:

Use is Not Compatible

Use is Compatible with the Following Stipulations

Stipulations necessary to ensure compatibility:

- Pets are allowed, but they must be on a leash and under camper's physical control at all times.
- Vehicle travel is only permitted on designated roads. All motor vehicles, including off-road vehicles, must be licensed and insured for highway use (i.e., street legal). All vehicle operators must have a valid operator's license in their possession.
- Back country camping is not permitted within 1/4 mile or within sight of any water development or spring.

- Car camping is only permitted within 50 feet of designated roads, and preferably within existing pull outs and parking areas.
- Restroom and other facilities at Desert Pass Campground will be maintained to minimize impacts on surrounding habitat.
- All campers are limited to a 14-consecutive day stay limit.
- All educational and interpretive materials for campers will emphasize Leave-No-Trace principles (www.lnt.org).
- Existing turnouts will be designated with post and cable fencing or other perimeter delineators, to prevent enlargement.
- Seasonal fire restrictions will be strictly enforced.
- Limitations on the number and size of groups may be implemented at more heavily used

Justification: While not one of the six priority wildlife dependent public uses listed or identified in the National Wildlife Refuge System Administration Act as amended (1997), camping is believed to be a compatible public use under the stipulations outlined in this compatibility determination. The primary reasons for this determination include:

1. Camping can facilitate priority public uses such as hunting, wildlife observation, and photography.
2. Due to its large size and remote nature, much of the refuge is very difficult to access. Camping facilitate this access.
2. Campers are a target audience not reached through other opportunities; they are potential partners and a potential source of support for the Refuges.
3. Impacts associated camping would be minimized through implementation of the stipulations noted above.
4. Camping impacts will be monitored and the use modified if necessary.

Based upon the information presented here and in the Draft Comprehensive Conservation Plan and Environmental Impact Statement (USFWS 2008), it is determined that hiking and backpacking within the Desert National Wildlife Refuge, will not materially interfere with or detract from the purposes for which the Refuge was established or the mission of the Refuge System.

Mandatory Re-Evaluation Date :

_____ Mandatory 15-year Re-Evaluation, Date will be provided in Final EIS/CCP (for priority public uses)

X Mandatory 10-year Re-Evaluation (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

_____ Categorical Exclusion without Environmental Action Statement

_____ Categorical Exclusion and Environmental Action Statement

_____ Environmental Assessment and Finding of No Significant Impact

X Environmental Impact Statement and Record of Decision

References Cited

Alcock, J. 1993. Animal behavior: an evolutionary approach. Fifth ed. Sinauer Assoc., Sunderland, MA. 625pp.

Bainbridge, D.A. 1974. Trail Management. Bulletin of the Ecological Society of America. 5:8-10.

- Beck, K.G. 1993. How do weeds affect us all. Proc. Eighth Grazing Lands Forum. Washington, D.C. December 2, 1993. pp5- 13.
- Benninger-Truax, M., J. L. Vankat and R. L. Schaefer. 1992. Trail corridors as habitat and conduits for movement of plant species in Rocky Mountain National Park, CO. *Landscape Ecology* 6(4):269-278.
- Boyle S.A, and F.B. Samson. 1985. Effects of nonconsumptive recreation on wildlife. A review.
- Bright, J.A. 1986. Hiker impact on herbaceous vegetation along trails in evergreen woodland of central Texas. *Biol. Conserv.* 36: 53-69
- Cole, D.N. 1983. Campsite conditions in the Bob Marshall Wilderness, Montana. Res. Paper INT312. U.S. Forest Service. Internat. For. Range Exp. Sta. 18pp.
- _____. 1990. Ecological impacts of wilderness recreation and their management. Pages 425-466. in J.C. Hendee, G.H. Stankey, and R.C. Lucas, eds. *Wilderness Management*. North American Press. Golden, CO.
- Cole, D. N. and P. B. Landres. 1995. Indirect effects of recreation on wildlife. Pages 183-201 in R. L. Knight and K. J. Gutzwiller, ed. *Wildlife and Recreationists: coexistence through management and research*. Island Press, Washington, D. C. 372pp.
- Gabrielson , G. W. and E. N. Smith. 1995. Physiological responses of wildlife to disturbance. Pages 95-107 in R. L. Knight and K. J. Gutzwiller, ed. *Wildlife and Recreationists: coexistence through management and research*. Island Press, Washington, D. C. 372pp.
- Grabherr, G. 1983. Damage to vegetation by recreation in the Austrian and German Alps. Pages 74-91 in N.G. Bayfield and G.C. Barrow eds. *The ecological impacts of outdoor recreation on mountain areas in Europe and North America*, Rept. 9. 203pp.
- Hamilton, K. M., S. Holl and C. L. Douglas. 1982. An evaluation of the effects of recreational activities on bighorn sheep in the San Gabriel Mountains, California. *Desert Bighorn Council Transactions* 26:50-55.
- Hammitt, W.E. and D.N. Cole. 1987. *Wildland recreation: ecology and management*. John Wiley and Sons, New York, NY. 341 pp.
- Hendee, Jr., G.H. Stankey, and R.C. Lucas. 1990. *Wilderness Management*. North American Press, Golden, CO.
- Hicks, L. L. and J. M. Elder. 1979. Human disturbance of Sierra Nevada bighorn sheep. *Journal of Wildlife Management* 43:909-915.
- Holl, S.A. and V. C. Bleich. 1987. Mineral Lick use by mountain sheep in the San Gabriel Mountains, California. *Journal of Wildlife Management* 51:383-385.
- Horesji, B. 1976. Some thoughts and observations on harassment and bighorn sheep. Pages 149-155 in T. Thorne, chairman. *Proceedings of the Biennial Symposium of North American Bighorn Sheep Council*. Jackson, Wyoming, USA.

- Knight, R. L. and D. N. Cole. 1991. Effects of recreational activity on wildlife in wildlands in Transactions of the North American Wildlife and Natural Resources Conference. 56:238-247.
- Knight, R. L. and D. N. Cole. 1995. Wildlife responses to recreationists. Pages 71-79 in R. L. Knight and K. J. Gutzwiller, ed. Wildlife and Recreationists: coexistence through management and research. Island Press, Washington, DC.
- Knight, R. L. and S. A. Temple. 1995. Origin of wildlife responses to recreationists. In Wildlife and recreation: coexistence through management and research. R. L. Knight and K. J. Gutzwiller, eds. Island Press, Washington, D. C., pp 81-91.
- Kovach, S. D. 1979. An ecological survey of the White Mountain bighorn. Desert Bighorn Council Transactions 23:57-61.
- Krausman, P. R., Wallace, C. L. Hayes, and D.W. DeYoung. 1998. Effects of jet aircraft on mountain sheep. Journal of Wildlife Management 62:1246-1254.
- Lee, R.G. 1975. The management of human components in the Yosemite National Park ecosystem. Yosemite National Park, CA. 134pp.
- Liddle, M . J. 1975. A selective review of the ecological effects of human trampling on natural ecosystems. Biol. Conserv. 7:17-36.
- Light, J.T. 1971. An ecological view of bighorn habitat on Mt. San Antonio. Transactions of the North American Wild Sheep Conference 1:150-157. U.S. Forest Service, San Bernardino National Forest, California, USA.
- Light, J.T. and R. Weaver. 1973. Report on bighorn sheep habitat study in the area for which an application was made to expand the Mt. Baldy winter sports facility.
- MacArthur, R. A., R. H. Johnson, and V. Geist. 1979. Factors influencing heart rate in free ranging bighorn sheep: a physiological approach to the study of wildlife harassment. Canadian Journal of Zoology 57:2010-2021.
- McQuaid-Cook, J. 1978. Effects of hikers and horses on mountain trails. J. Env. Manage. 6:209-212.
- Nagy, J.A.S. and G.W. Scotter. 1974. A quantitative assessment of the effects of human and horse trampling on natural areas, Waterton Lakes National Park. Can. Wild. Serv., Edmonton, AB. . 145pp.
- Oberbillig, D.R. 2000. Providing positive wildlife viewing experiences. Deborah Richie Communications, Missoula, MT.
- Papouchis, C. M., F. J. Singer and W. B. Sloan. 2001. Responses of desert bighorn sheep to increased human recreation. Journal of Wildlife Management 65:573-582.
- Rosen, P. C. and C. H. Lowe. 1994. Highway mortality of snakes in the Sonoran Desert of southern Arizona. Biol. Conserv. 68:143-148.
- Thompson, D. K. Longshore, and C. Lowrey. 2007. The impact of human disturbance on desert bighorn sheep (*Ovis canadensis nelsoni*) in the Wonderland of Rocks / Queen Mountain region of Joshua Tree National Park, California: A final report prepared for Joshua Tree National Park, CA.

USFWS. 2008. Desert National Wildlife Refuge Draft Comprehensive Conservation Plan and Environmental Impact Statement. U.S. Fish and Wildlife Service, Region 8.

Weaver, T. and D. Dale. 1978. Trampling effects of hikers, motorcycles, and horses in meadows and forests. *J App. Ecol.* 15:451-457.

Wehausen, J. D., L. L. Hicks, D. P. Gardner, and J. Elder. 1977. Bighorn sheep management in the Sierra Nevada. *Desert Bighorn Council Transactions* 21:30-32.

Wehausen, J. D. 1980. Sierra Nevada bighorn sheep: history and population ecology. Ph.D Dissertation, University of Michigan, Ann Arbor, 240 pp.

Welles, R.E. and F.B. Welles. 1961. The bighorn of Death Valley. U.S. Govt. Printing Office, Washington D.C. Fauna Series No. 6. 242 pp.

Whitson, P.D. 1974. The impact of human use upon the Chisos Basin and adjacent lands. USDO, NPS.

Whittaker, P.L. 1978. Comparison of surface impact by hiking and horseback riding in the Great Smoky Mountain National Park. USDO, NPS Management Report 24.

Wilson, J.P. and J.P. Seney. 1994. Mountain Research and Development, Vol. 14, No. 1. pp. 77-88.

Refuge Determination

Refuge Manager:

(Signature)

(Date)

Project Leader
Approval:

(Signature)

(Date)

Concurrence

Refuge Supervisor:

(Signature)

(Date)

Assistant Regional
Director - Refuges:

(Signature)

(Date)

COMPATIBILITY DETERMINATION

Use: Hiking and Backpacking

Refuge Name: Desert National Wildlife Refuge (Refuge), located in Clark and Lincoln counties, Nevada.

Establishing and Acquisition Authority(ies): Desert National Wildlife Range was established by Executive Order Number 7373 of President Franklin D. Roosevelt on May 20, 1936. Originally named the Desert Game Range and under the joint administration of the Fish and Wildlife Service and the Bureau of Land Management, it contained a total of 2,250,000 acres, including lands both north and south of U.S. Highway 95. Public Land Order 4079, issued on August 26, 1966 and corrected on September 23, 1966, revoked Executive Order 7373, changed the name to Desert National Wildlife Range, reduced its size to 1,588,000 acres, and transferred sole administration to the Fish and Wildlife Service. Between 1935 and 1989, an additional 760 acres in the vicinity of Corn Creek were acquired under various authorities, including the Migratory Bird Conservation Act, Endangered Species Act, and Refuge Recreation Act. The Military Lands Withdrawal Act of 1999 (Public Law 106-65) transferred primary jurisdiction of 110,000 acres of bombing impact areas on the Refuge from the Service to Department of Defense. In 2002, the Clark County Conservation of Public Land and Natural Resources Act (Public Law 107-282) transferred 26,433 acres of BLM land adjacent to Desert NWR's east boundary to the Service. In 2004, the Lincoln County Conservation, Recreation, and Development Act (Public Law 108-424) transferred approximately 8,382 acres the eastern boundary of Desert NWR to the BLM for use as a utility corridor. In addition, 8,503 acres of BLM-administered land adjacent to the northeast corner of the Refuge were transferred to the Service.

Refuge Purpose(s):

- For lands acquired under Public Land Order 4079, dated August 31, 1966, the purpose is “. . . for the protection, enhancement, and maintenance of wildlife resources, including bighorn sheep.”
- For lands acquired under 16 USC 715d (Migratory Bird Conservation Act): “...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds...”
- For lands acquired under 16 U.S.C. § 1534 (Endangered Species Act of 1973) the purpose is “. . . to conserve (a) fish or wildlife which are listed as endangered species or threatened species . . . or (b) plants.”
- For lands acquired under 16 U.S.C. § 460k-460l (Refuge Recreation Act) the purpose is “. . . suitable for - (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species”

National Wildlife Refuge System Mission: “To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans” (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-ee]).

Description of Use: Currently, hiking and backpacking are permitted year round on 747,000 acres of Desert NWR outside the Nevada Test and Training Range (Figure 1). Most of these lands are located on the eastern part of the Refuge generally east of Alamo Road. The area includes three mountain ranges (Las Vegas, Sheep, and East Desert Ranges). We propose the continuation of hiking and backpacking at the current levels on the Refuge.

The most popular backpacking area on the Refuge is Hidden Forest Canyon. Several groups use this area each weekend for most of the year (C. McDermott per. com). The 5.7-mile trail follows an old road through desert scrub and ponderosa pine forest to an old cabin. Most groups camp near the cabin. Wiregrass Spring is 0.15 miles past the cabin.

Other hiking/backpacking destinations on the Refuge include and Sawmill Canyon, Blackgate Canyon, Gass Peak, Hayford Peak, Joe May Canyon, Long Valley, Quartzite Mountain, and Yucca Peak. Some hikes follow abandoned roads and established trails. Others require strenuous off-trail hiking over steep, rugged terrain.

Camping associated with backpacking is permitted throughout this area except within 1/4 mile or within sight of any water development or spring. Backpackers must bring their own water. Spring water can be consumed, but should be treated first by filtration

Under the proposed action (Alternative C), the Service would map existing trails on Gass Peak and the Sheep Range using GPS and develop a trail guide for visitors. Trails would be managed to minimize impacts to sheep.

Availability of Resources: The following funding/annual costs (based on FY 2008 costs) would be required to administer and manage the activities as described above:

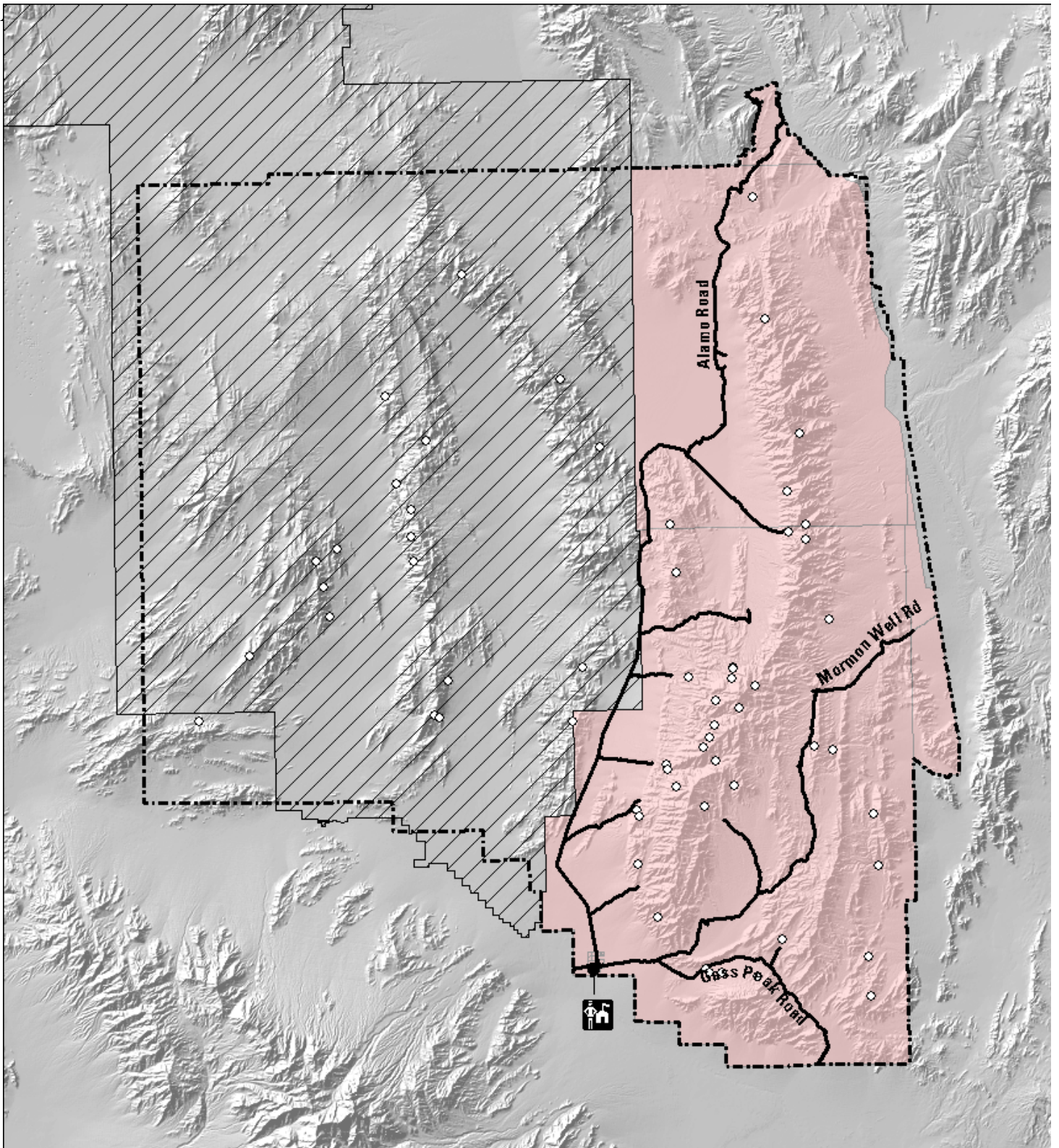
	One-time Costs	Annual Costs
Managing current use		
Administration and management	1,500	\$500
Improving/Enhancing Use		
Map trails / develop trail guide	1,000	
TOTAL	\$2,500	\$500

Anticipated Impacts of Use: Anticipated Impacts of the Use

Possible impacts of hiking and backpacking include disturbance to wildlife and habitat modification. Wildlife can be affected by the sight and sound of recreationists (Boyle and Samson 1985). Habitat can be affected through vegetation trampling, soil compaction, and erosion (Cole 1983, 1990). Due to the small number of hikers and backpackers that use the Refuge, the impacts on sheep and other wildlife and their habitat are expected to be relatively minor and localized. These potential impacts are described below.

Impacts on Wildlife:

Immediate responses by wildlife to recreational activity can range from behavioral changes including nest abandonment or change in food habits, physiological changes such as elevated heart rates due to flight, or even death (Knight and Cole 1995). The long term effects are more difficult to assess but may include altered behavior, vigor, productivity or death of individuals; altered population abundance, distribution, or demographics; and altered community species composition and interactions.







-  Approved Refuge Boundary
-  Nevada Test and Training Range
-  Area Open to Hiking and Backpacking
-  Springs and Water Developments

Figure 1
Area Open to Hiking and Backpacking

Desert NWR

According to Knight and Cole (1991), there are three categories of wildlife responses to human disturbance: 1) avoidance; 2) habituation; and 3) attraction. The magnitude of the avoidance response may depend on a number of factors including the type, distance, movement pattern, speed, and duration of the disturbance, as well as the time of day, time of year, weather; and the animal's access to food and cover, energy demands, and reproductive status (Knight and Cole 1991; Gabrielsen and Smith 1995).

In otherwise suitable habitat, sheep have been observed to abandon an area, either temporarily or permanently, when their tolerance to disturbance is exceeded (Welles and Welles 1961, Light 1971, Wehausen 1980, Papouchis *et al.* 2001, Thompson *et al.* 2007). If the resulting loss of habitat is significant, the population's carrying capacity could be reduced (Light and Weaver 1973). Furthermore, when disturbance elicits a flight response in sheep, resulting energetic losses and loss of foraging time could negatively affect the physiology of individuals, potentially reduce their survival and reproductive success (MacArthur *et al.* 1979). Papouchis *et al.* (2001) found that response of female bighorn sheep to disturbance was greater during the spring lambing period and the response of male sheep was greatest during the fall rut.

In some circumstances, sheep may habituate to predictable human activity (Wehausen *et al.* 1977, Kovach 1979), including highway traffic (Horesji 1976), hiking (Hicks and Elder 1979, Hamilton *et al.* 1982, Holl and Bleich 1987), and aircraft (Krausman *et al.* 1998). Habituation is defined as a form of learning in which individuals stop responding to stimuli that carry no reinforcing consequences for the individuals that are exposed to them (Alcock 1993). A key factor for predicting how wildlife would respond to disturbance is predictability. Gabrielsen and Smith (1995) suggest that most animals seem to have a greater defense response to humans moving unpredictably in the terrain than to humans following a distinct path.

Wildlife may also be attracted to human presence. For example, wildlife may be converted to "beggars" lured by handouts (Knight and Temple 1995), and scavengers are attracted to road kills (Rosen and Lowe 1994).

Impacts on Habitat:

Hiking and backpacking can also have adverse impacts on vegetation and soil conditions. Hiking or walking can alter habitats by trampling vegetation, compacting soil, and increasing the potential of erosion (Liddle 1975; Hendee *et al.* 1990). Soil compaction makes root penetration more difficult, making it difficult for seedlings to become established (Cole and Landres 1995). In moderate cases of soil compaction, plant cover and biomass is decreased. In highly compacted soils, plant species abundance and diversity is reduced in the long-term as only the most resistant species survive (Liddle 1975). Impacts from vegetation trampling can lower species richness, decrease ground cover and plant species density, increase weedy annuals, and induce changes in species composition (Grabherr 1983).

Backpackers often spend more time at their campsite than anywhere else during their visit, which can potentially result in a source of pollution (Hendee *et al.* 1990). Bacterial contamination is a concern in wilderness settings and can be estimated by evaluating the densities of fecal coliforms (indicators of fecal contamination) and fecal streptococci (found in warm-blooded organisms, including humans).

Public Review and Comment: Public review and comments will be solicited in conjunction with distribution of the Draft CCP/EIS for the Desert National Wildlife Refuge Complex.

Determination:

Use is Not Compatible

Use is Compatible with the Following Stipulations

Stipulations necessary to ensure compatibility:

- Pets are allowed, but they must be on a leash and under hiker/backpacker's physical control at all times.
- Vehicle travel is only permitted on designated roads. All motor vehicles, including off-road vehicles, must be licensed and insured for highway use (i.e., street legal). All vehicle operators must have a valid operator's license in their possession.
 - Camping associated with backpacking is permitted throughout this area except within 1/4 mile or within sight of any water development or spring.
 - Access to certain portions of the Refuge may be restricted during bighorn sheep lambing season and fall rut
 - All educational and interpretive materials for hikers/backpackers will emphasize Leave-No-Trace principles (www.lnt.org).
 - Seasonal fire restrictions will be strictly enforced.
 - Open fires will not be permitted

Justification: While not one of the six priority wildlife dependent public uses listed or identified in the National Wildlife Refuge System Administration Act as amended (1997), hiking and backpacking is believed to be a compatible public use under the stipulations outlined in this compatibility determination. The primary reasons for this determination include:

1. Hiking and backpacking can facilitate priority public uses such as hunting, wildlife observation, and photography.
2. Due to its large size and remote nature, much of the refuge is very difficult to access. Hiking and backpacking help facilitate this access.
2. Hikers and backpackers are a target audience not reached through other opportunities; they are potential partners and a potential source of support for the Refuges.
3. Impacts associated with hiking and backpacking would be minimized through implementation of the stipulations noted above.
4. Hiking and backpacking impacts will be monitored and the use modified if necessary.

Based upon the information presented here and in the Draft Comprehensive Conservation Plan and Environmental Impact Statement (USFWS 2008), it is determined that hiking and backpacking within the Desert National Wildlife Refuge, will not materially interfere with or detract from the purposes for which the Refuge was established or the mission of the Refuge System.

Mandatory Re-Evaluation Date:

Mandatory 15-year Re-Evaluation, Date will be provided in Final EIS/CCP (for priority public uses)

Mandatory 10-year Re-Evaluation (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

Categorical Exclusion without Environmental Action Statement

Categorical Exclusion and Environmental Action Statement

Environmental Assessment and Finding of No Significant Impact

X Environmental Impact Statement and Record of Decision

References Cited

Alcock, J. 1993. Animal behavior: an evolutionary approach. Fifth ed. Sinauer Assoc., Sunderland, MA. 625pp.

Boyle S.A, and F.B. Samson. 1985. Effects of nonconsumptive recreation on wildlife. A review.

Cole, D.N. 1983. Campsite conditions in the Bob Marshall Wilderness, Montana. Res. Paper INT312. U.S. Forest Service. Internt. For. Range Exp. Sta. 18pp.

_____ 1990. Ecological impacts of wilderness recreation and their management. Pages 425-466. in J.C. Hendee, G.H. Stankey, and R.C. Lucas, eds. Wilderness Management. North American Press. Golden, CO.

Cole, D. N. and P. B. Landres. 1995. Indirect effects of recreation on wildlife. Pages 183-201 in R. L. Knight and K. J. Gutzwiller, ed. Wildlife and Recreationists: coexistence through management and research. Island Press, Washington, D. C. 372pp.

Gabrielson , G. W. and E. N. Smith. 1995. Physiological responses of wildlife to disturbance. Pages 95-107 in R. L. Knight and K. J. Gutzwiller, ed. Wildlife and Recreationists: coexistence through management and research. Island Press, Washington, D. C. 372pp.

Grabherr, G. 1983. Damage to vegetation by recreation in the Austrian and German Alps. Pages 74-91 in N.G. Bayfield and G.C. Barrow eds. The ecological impacts of outdoor recreation on mountain areas in Europe and North America, Rept. 9. 203pp.

Hamilton, K. M., S. Holl and C. L. Douglas. 1982. An evaluation of the effects of recreational activities on bighorn sheep in the San Gabriel Mountains, California. Desert Bighorn Council Transactions 26:50-55.

Hendee, Jr., G.H. Stankey, and R.C. Lucas. 1990. Wilderness Management. North American Press, Golden, CO.

Hicks, L. L. and J. M. Elder. 1979. Human disturbance of Sierra Nevada bighorn sheep. Journal of Wildlife Management 43:909-915.

Holl, S.A. and V. C. Bleich. 1987. Mineral Lick use by mountain sheep in the San Gabriel Mountains, California. Journal of Wildlife Management 51:383-385.

Horesji, B. 1976. Some thoughts and observations on harassment and bighorn sheep. Pages 149-155 in T. Thorne, chairman. Proceedings of the Biennial Symposium of North American Bighorn Sheep Council. Jackson, Wyoming, USA.

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- Knight, R. L. and S. A. Temple. 1995. Origin of wildlife responses to recreationists. In *Wildlife and recreation: coexistence through management and research*. R. L. Knight and K. J. Gutzwiller, eds. Island Press, Washington, D. C., pp 81-91.
- Kovach, S. D. 1979. An ecological survey of the White Mountain bighorn. *Desert Bighorn Council Transactions* 23:57-61.
- Krausman, P. R., Wallace, C. L. Hayes, and D.W. DeYoung. 1998. Effects of jet aircraft on mountain sheep. *Journal of Wildlife Management* 62:1246-1254.
- Liddle, M. J. 1975. A selective review of the ecological effects of human trampling on natural ecosystems. *Biol. Conserv.* 7:17-36.
- Light, J.T. 1971. An ecological view of bighorn habitat on Mt. San Antonio. *Transactions of the North American Wild Sheep Conference* 1:150-157. U.S. Forest Service, San Bernardino National Forest, California, USA.
- Light, J.T. and R. Weaver. 1973. Report on bighorn sheep habitat study in the area for which an application was made to expand the Mt. Baldy winter sports facility.
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- Nagy, J.A.S. and G.W. Scotter. 1974. A quantitative assessment of the effects of human and horse trampling on natural areas, Waterton Lakes National Park. *Can. Wild. Serv.*, Edmonton, AB. . 145pp.
- Papouchis, C. M., F. J. Singer and W. B. Sloan. 2001. Responses of desert bighorn sheep to increased human recreation. *Journal of Wildlife Management* 65:573-582.
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- USFWS. 2008. Desert National Wildlife Refuge Draft Comprehensive Conservation Plan and Environmental Impact Statement. U.S. Fish and Wildlife Service, Region 8.
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- Wehausen, J. D. 1980. Sierra Nevada bighorn sheep: history and population ecology. Ph.D Dissertation, University of Michigan, Ann Arbor, 240 pp.
- Welles, R.E. and F.B. Welles. 1961. The bighorn of Death Valley. U.S. Govt. Printing Office, Washington D.C. Fauna Series No. 6. 242 pp.

Refuge Determination

Refuge Manager: _____
(Signature) (Date)

Project Leader
Approval: _____
(Signature) (Date)

Concurrence

Refuge Supervisor: _____
(Signature) (Date)

Assistant Regional
Director - Refuges: _____
(Signature) (Date)

COMPATIBILITY DETERMINATION

Use: Recreational Use of Pack and Saddle Stock

Refuge Name: Desert National Wildlife Refuge (Refuge), located in Clark and Lincoln counties, Nevada.

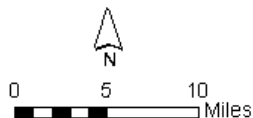
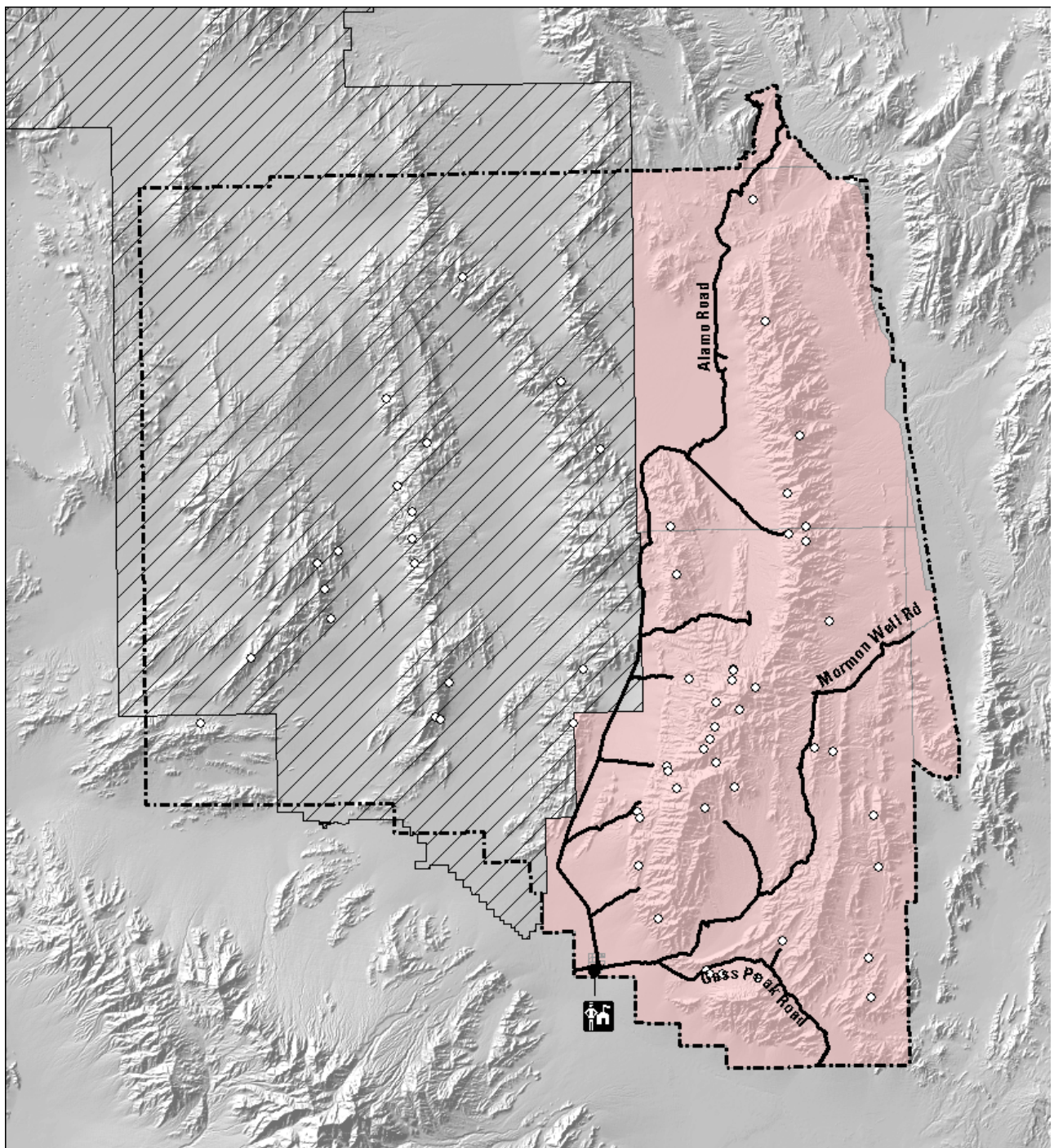
Establishing and Acquisition Authority(ies): Desert National Wildlife Range was established by Executive Order Number 7373 of President Franklin D. Roosevelt on May 20, 1936. Originally named the Desert Game Range and under the joint administration of the Fish and Wildlife Service and the Bureau of Land Management, it contained a total of 2,250,000 acres, including lands both north and south of U.S. Highway 95. Public Land Order 4079, issued on August 26, 1966 and corrected on September 23, 1966, revoked Executive Order 7373, changed the name to Desert National Wildlife Range, reduced its size to 1,588,000 acres, and transferred sole administration to the Fish and Wildlife Service. Between 1935 and 1989, an additional 760 acres in the vicinity of Corn Creek were acquired under various authorities, including the Migratory Bird Conservation Act, Endangered Species Act, and Refuge Recreation Act. The Military Lands Withdrawal Act of 1999 (Public Law 106-65) transferred primary jurisdiction of 110,000 acres of bombing impact areas on the Refuge from the Service to Department of Defense. In 2002, the Clark County Conservation of Public Land and Natural Resources Act (Public Law 107-282) transferred 26,433 acres of BLM land adjacent to Desert NWR's east boundary to the Service. In 2004, the Lincoln County Conservation, Recreation, and Development Act (Public Law 108-424) transferred approximately 8,382 acres the eastern boundary of Desert NWR to the BLM for use as a utility corridor. In addition, 8,503 acres of BLM-administered land adjacent to the northeast corner of the Refuge were transferred to the Service.

Refuge Purpose(s): Desert National Wildlife Refuge purposes include:

- For lands acquired under Public Land Order 4079, dated August 31, 1966, the purpose is “. . . for the protection, enhancement, and maintenance of wildlife resources, including bighorn sheep.”
- For lands acquired under 16 USC 715d (Migratory Bird Conservation Act): “...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds...” .
- For lands acquired under 16 U.S.C. § 1534 (Endangered Species Act of 1973) the purpose is “. . . to conserve (a) fish or wildlife which are listed as endangered species or threatened species . . . or (b) plants.”
- For lands acquired under 16 U.S.C. § 460k-460l (Refuge Recreation Act) the purpose is “. . . suitable for - (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species . . . ”

National Wildlife Refuge System Mission: “To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans” (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-ee]).

Description of Use: Currently, the recreational use of pack and saddle stock is permitted on the eastern 747,000 acres of Desert NWR outside the Nevada Test and Training Range (Figure 1). These lands are located primarily east of Alamo Road, and include three mountain ranges (Las Vegas, Sheep, and East Desert Ranges).







-  Approved Refuge Boundary
-  Nevada Test and Training Range
-  Area Open Recreational Use of Pack and Saddle Stock
-  Springs and Water Developments

Figure 1
**Area Open to
 Recreation Use of
 Pack and Saddle Stock**

Desert NWR

Horses and other pack/saddle stock are used on the refuge for recreation and/or in support of other uses (e.g. hunting, wildlife observation, wildlife photography). Though the refuge lacks hard numbers about this use, annual observations from staff indicate that this use is infrequent with about one or two groups per month. About 80 percent are horseback riders originate from Corn Creek . The remaining 20 percent trailer their pack/saddle stock into the Refuge for trips in the backcountry (C. McDermott pers. com.). The majority of trips are short day rides. Multi-day trips in the backcountry are uncommon. We propose to continue to allow the recreational use of pack and saddle stock on the Refuge.

Availability of Resources: The following funding/annual costs (based on FY 2008 costs) would be required to administer and manage the activities as described above:

	One-time Costs	Annual Costs
Administration and management	\$400	\$400
Maintenance (includes treatment for weeds as needed)	\$400	\$500
Special equipment (signs, trailhead establishment, etc)	\$1000	\$500
TOTAL	\$1,800	\$1,400

Refuge funds will be used to administer these uses.

Anticipated Impacts of Use: Anticipated Impacts of the Use

Possible impacts of the recreational use of pack and saddle stock include disturbance to wildlife and habitat modification. Wildlife can be affected by the sight and sound of recreationists (Boyle and Sampson 1985). Habitat can be affected through vegetation trampling, soil compaction, and erosion (Cole 1983, 1990). Due to the small number of recreational pack and saddle stock users on the Refuge, the impacts on sheep and other wildlife and their habitat are expected to be relatively minor and localized. These potential impacts are described below.

Impacts on Wildlife:

Immediate responses by wildlife to recreational activity can range from behavioral changes including nest abandonment or change in food habits, physiological changes such as elevated heart rates due to flight, or even death (Knight and Cole 1995). The long term effects are more difficult to assess but may include altered behavior, vigor, productivity or death of individuals; altered population abundance, distribution, or demographics; and altered community species composition and interactions.

According to Knight and Cole (1991), there are three wildlife responses to human disturbance: 1) avoidance; 2) habituation; and 3) attraction. The magnitude of the avoidance response may depend on a number of factors including the type, distance, movement pattern, speed, and duration of the disturbance, as well as the time of day, time of year, weather; and the animal's access to food and cover, energy demands, and reproductive status (Knight and Cole 1991; Gabrielsen and Smith 1995).

In otherwise suitable habitat, sheep have been observed to abandon an area, either temporarily or permanently, when their tolerance to disturbance is exceeded (Welles and Welles 1961, Light 1971, Wehausen 1980, Papouchis *et al.* 2001, Thompson *et al.* 2007). If the resulting loss of habitat is significant, the population's carrying capacity could be reduced (Light and Weaver 1973). Furthermore, when disturbance elicits a flight response in sheep, resulting energetic losses and loss of foraging time could negatively affect the physiology of individuals, potentially reduce their survival and reproductive success (MacArthur *et al.* 1979). Papouchis *et al.* (2001) found that response of female bighorn sheep to disturbance was greater during the spring lambing period and the response of male sheep was greatest during the fall rut.

In some circumstances, sheep may habituate to predictable human activity (Wehausen *et al.* 1977, Kovach 1979), including highway traffic (Horesji 1976), hiking (Hicks and Elder 1979, Hamilton *et al.*

1982, Holl and Bleich 1987), and aircraft (Krausman et al. 1998). Habituation is defined as a form of learning in which individuals stop responding to stimuli that carry no reinforcing consequences for the individuals that are exposed to them (Alcock 1993). A key factor for predicting how wildlife would respond to disturbance is predictability. Gabrielsen and Smith (1995) suggest that most animals seem to have a greater defense response to humans moving unpredictably in the terrain than to humans following a distinct path. Observations by Owen (1973) and others suggest that many species of wildlife are habituated to livestock and are less likely to flee when approached by an observer on horseback than by an observer on foot.

Wildlife may also be attracted to human presence. For example, wildlife may be converted to “beggars” lured by handouts (Knight and Temple 1995), and scavengers are attracted to road kills (Rosen and Lowe 1994).

Impacts on Habitat:

Public use activities can also have adverse impacts on vegetation and soil conditions. Impacts from vegetation trampling can lower species richness, decrease ground cover and plant species density, increase weedy annuals, and induce changes in species composition (Grabherr 1983).

Impacts related to horseback riding include exotic plant seed dispersal (Beck 1993, Hammitt and Cole 1987), soil compaction and erosion (Bainbridge 1974, Hendee et al. 1990, Hammitt and Cole 1987), trail widening (Whitaker 1978), vegetation trampling (Nagy and Scotter 1974, Weaver and Dale 1978, Whitaker 1978), aesthetic concerns relative to horse manure (Lee 1975), direct wildlife disturbance (Owen 1973), and direct and indirect conflicts with other recreationists.

Invasive plant species can be spread to new sites through forage (e.g., hay containing invasive weed seeds brought in to feed horses) and manure (Beck 1993, Benninger-Truax et al. 1992). Invasive weed establishment is further facilitated by increased trail disturbance, as many exotic plants gain a competitive advantage in highly disturbed sites. Additionally, hoof action tends to dig up and puncture the soil surface (McQuaid-Cook 1978), which causes greater sediment loss than any other form of recreational trail use (Seney and Wilson 1994), and increases the potential for disturbance-tolerant vegetation (e.g., invasive species) to establish. Trail widening is also a consideration, as horses tend to walk on the down slope sides of trails (Whitson 1974). Anticipated results include a wider trail, a much wider area of disturbance, and ongoing trail maintenance problems. Vegetation impacts can be much more pronounced considering that hikers tend to flatten vegetation while horses tend to churn up soil, thus, cutting plants off at the rootstalk (Whittaker 1978). This can increase spread of previously established invasives by providing loose disturbed soil for germination and spreading reproductive plant structures. This impact initially increases invasive plant species encroachment with light to moderate trail use, and eventually lowers (native) species richness values to near zero with heavy impacts (Hendee et al. 1990).

Public Review and Comment: Public review and comments will be solicited in conjunction with distribution of the Draft CCP/EIS for the Desert National Wildlife Refuge Complex.

Determination:

- Use is Not Compatible
- Use is Compatible with the Following Stipulations

Stipulations necessary to ensure compatibility:

- Vehicles and horse trailers will be restricted to designated roads and parking areas
- The use of certified weed-free hay is required to minimize weed spread.

- Recreational saddle/pack stock users will be required to carry their own water and food for their stock. Water from springs and water developments must not be used.
- Tying off pack/saddle stock to trees is discouraged. If no other tie offs are available, the lead ropes or tie lines must be attached to tree savers (wide straps with round rings attached that prevent damage to tree bark.) Hobbling of horses is strongly encouraged as an alternative.
- Access to certain portions of the Refuge may be restricted during bighorn sheep lambing season and fall rut
- All educational and interpretive materials for riders will emphasize principles of the Leave-No-Trace backcountry horse use (www.lnt.org).
- Seasonal fire restrictions will be strictly enforced.
- Open fires will not be permitted

Justification: While not one of the six priority wildlife dependent public uses listed or identified in the National Wildlife Refuge System Administration Act as amended (1997), recreational use of pack and saddle stock is believed to be a compatible public use under the stipulations outlined in this compatibility determination. The primary reasons for this determination include:

1. The recreational use of pack and saddle stock can facilitate priority public uses such as hunting, wildlife observation, and photography.
2. Due to its large size and remote nature, much of the refuge is very difficult to access. Pack and saddle stock help facilitate this access.
2. Pack and saddle stock uses are a target audience not reached through other opportunities; they are potential partners and a potential source of support for the Refuges.
3. Impacts associated with the use of pack and saddle stock would be minimized through implementation of the stipulations noted above.
4. Pack/saddle stock use and impacts will be monitored and the use modified if necessary.

Based upon the information presented here and in the Draft Comprehensive Conservation Plan / Environmental Impact Statement (USFWS 2008), it is determined that recreational use of pack and saddle stock within the Desert National Wildlife Refuge, will not materially interfere with or detract from the purposes for which the Refuge was established or the mission of the Refuge System.

Mandatory Re-Evaluation Date:

Mandatory 15-year Re-Evaluation, Date will be provided in Final EIS/CCP (for priority public uses)

Mandatory 10-year Re-Evaluation (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

Categorical Exclusion without Environmental Action Statement

Categorical Exclusion and Environmental Action Statement

Environmental Assessment and Finding of No Significant Impact

Environmental Impact Statement and Record of Decision

References Cited

Alcock, J. 1993. Animal behavior: an evolutionary approach. Fifth ed. Sinauer Assoc., Sunderland, MA. 625pp.

- Bainbridge, D.A. 1974. Trail Management. *Bulletin of the Ecological Society of America*. 5:8-10.
- Beck, K.G. 1993. How do weeds affect us all. *Proc. Eighth Grazing Lands Forum*. Washington, D.C. December 2, 1993. pp5- 13.
- Benninger-Truax, M., J. L. Vankat and R. L. Schaefer. 1992. Trail corridors as habitat and conduits for movement of plant species in Rocky Mountain National Park, CO. *Landscape Ecology* 6(4):269-278.
- Boyle S.A, and F.B. Samson. 1985. Effects of nonconsumptive recreation on wildlife. A review.
- Bright, J.A. 1986. Hiker impact on herbaceous vegetation along trails in evergreen woodland of central Texas. *Biol. Conserv.* 36: 53-69
- Cole, D.N. 1983. Campsite conditions in the Bob Marshall Wilderness, Montana. Res. Paper INT312. U.S. Forest Service. Internat. For. Range Exp. Sta. 18pp.
- _____. 1990. Ecological impacts of wilderness recreation and their management. Pages 425-466. in J.C. Hendee, G.H. Stankey, and R.C. Lucas, eds. *Wilderness Management*. North American Press. Golden, CO.
- Gabrielson , G. W. and E. N. Smith. 1995. Physiological responses of wildlife to disturbance. Pages 95-107 in R. L. Knight and K. J. Gutzwiller, ed. *Wildlife and Recreationists: coexistence through management and research*. Island Press, Washington, D. C. 372pp.
- Grabherr, G. 1983. Damage to vegetation by recreation in the Austrian and German Alps. Pages 74-91 in N.G. Bayfield and G.c. Barrow eds. *The ecological impacts of outdoor recreation on mountain areas in Europe and North America*, Rept. 9. 203pp.
- Hammitt, W.E. and D.N. Cole. 1987. *Wildland recreation: ecology and management*. John Wiley and Sons, New York, NY. 341 pp.
- Hamilton, K. M., S. Holl and C. L. Douglas. 1982. An evaluation of the effects of recreational activities on bighorn sheep in the San Gabriel Mountains, California. *Desert Bighorn Council Transactions* 26:50-55.
- Hendee, J.C., G.H. Stankey, and R.C. Lucas. 1990. *Wilderness Management*. North American Press, Golden, CO.
- Hicks, L. L. and J. M. Elder. 1979. Human disturbance of Sierra Nevada bighorn sheep. *Journal of Wildlife Management* 43:909-915.
- Holl, S.A. and V. C. Bleich. 1987. Mineral Lick use by mountain sheep in the San Gabriel Mountains, California. *Journal of Wildlife Management* 51:383-385.
- Horesji, B. 1976. Some thoughts and observations on harassment and bighorn sheep. Pages 149-155 in T. Thorne, chairman. *Proceedings of the Biennial Symposium of North American Bighorn Sheep Council*. Jackson, Wyoming, USA.
- Krausman, P. R., Wallace, C. L. Hayes, and D.W. DeYoung. 1998. Effects of jet aircraft on mountain sheep. *Journal of Wildlife Management* 62:1246-1254.

- Knight, R. L. and D. N. Cole. 1991. Effects of recreational activity on wildlife in wildlands in Transactions of the North American Wildlife and Natural Resources Conference. 56:238-247.
- Knight, R. L. and D. N. Cole. 1995. Wildlife responses to recreationists. Pages 71-79 in R. L. Knight and K. J. Gutzwiller, ed. Wildlife and Recreationists: coexistence through management and research. Island Press, Washington, DC.
- Knight, R. L. and S. A. Temple. 1995. Origin of wildlife responses to recreationists. In Wildlife and recreation: coexistence through management and research. R. L. Knight and K. J. Gutzwiller, eds. Island Press, Washington, D. C., pp 81-91.
- Kovach, S. D. 1979. An ecological survey of the White Mountain bighorn. Desert Bighorn Council Transactions 23:57-61.
- Lee, R.G. 1975. The management of human components in the Yosemite National Park ecosystem. Yosemite National Park, CA. 134pp.
- Light, J.T. and R. Weaver. 1973. Report on bighorn sheep habitat study in the area for which an application was made to expand the Mt. Baldy winter sports facility.
- Light, J.T. 1971. An ecological view of bighorn habitat on Mt. San Antonio. Transactions of the North American Wild Sheep Conference 1:150-157. U.S. Forest Service, San Bernardino National Forest, California, USA.
- MacArthur, R. A., R. H. Johnson, and V. Geist. 1979. Factors influencing heart rate in free ranging bighorn sheep: a physiological approach to the study of wildlife harassment. Canadian Journal of Zoology 57:2010-2021.
- McQuaid-Cook, J. 1978. Effects of hikers and horses on mountain trails. J. Env. Manage. 6:209-212.
- Nagy, J.A.S. and G.W. Scotter. 1974. A quantitative assessment of the effects of human and horse trampling on natural areas, Waterton Lakes National Park. Can. Wildl. Serv., Edmonton, AB. . 145pp.
- Oberbillig, D.R. 2000. Providing positive wildlife viewing experiences. Deborah Richie Communications, Missoula, MT.
- Owen, M. 1973. The management of grassland areas for wintering geese. Wildfowl 24:123- 130.
- Papouchis, C. M., F. J. Singer and W. B. Sloan. 2001. Responses of desert bighorn sheep to increased human recreation. Journal of Wildlife Management 65:573-582.
- Rosen, P. C. and C. H. Lowe. 1994. Highway mortality of snakes in the Sonoran Desert of southern Arizona. Biol. Conserv. 68:143-148
- Thompson, D. K. Longshore, and C. Lowrey. 2007. The impact of human disturbance on desert bighorn sheep (*Ovis canadensis nelsoni*) in the Wonderland of Rocks / Queen Mountain region of Joshua Tree National Park, California: A final report prepared for Joshua Tree National Park, CA.
- USFWS. 2008. Desert National Wildlife Refuge Draft Comprehensive Conservation Plan and Environmental Impact Statement. U.S. Fish and Wildlife Service, Region 8.

Weaver, T. and D. Dale. 1978. Trampling effects of hikers, motorcycles, and horses in meadows and forests. *J App. Ecol.* 15:451-457.

Wehausen, J. D., L. L. Hicks, D. P. Gardner, and J. Elder. 1977. Bighorn sheep management in the Sierra Nevada. *Desert Bighorn Council Transactions* 21:30-32.

Wehausen, J. D. 1980. Sierra Nevada bighorn sheep: history and population ecology. Ph.D Dissertation, University of Michigan, Ann Arbor, 240 pp.

Welles, R.E. and F.B. Welles. 1961. The bighorn of Death Valley. U.S. Govt. Printing Office, Washington D.C. Fauna Series No. 6. 242 pp.

Whitson, P.D. 1974. The impact of human use upon the Chisos Basin and adjacent lands. USDO, NPS.

Whittaker, P.L. 1978. Comparison of surface impact by hiking and horseback riding in the Great Smoky Mountain National Park. USDO, NPS Management Report 24.

Wilson, J.P. and J.P. Seney. 1994. Mountain Research and Development, Vol. 14, No. 1. pp. 77-88.

Refuge Determination

Refuge Manager:

(Signature)

(Date)

Project Leader
Approval:

(Signature)

(Date)

Concurrence

Refuge Supervisor:

(Signature)

(Date)

Assistant Regional
Director - Refuges:

(Signature)

(Date)

COMPATIBILITY DETERMINATION

Use: Wildlife Observation and Photography

Refuge Name: Moapa Valley National Wildlife Refuge (Refuge), Clark County, Nevada.

Establishing and Acquisition Authority: Moapa Valley National Wildlife Refuge was established on September 10, 1979, to secure and protect habitat for the endangered Moapa dace (*Moapa coriacea*). This unique native fish lives out its life within the Warm Springs area of the Upper Muddy River headwaters. These headwaters are composed of up to 20 thermal springs which are essential to the Moapa dace's life cycle. Historic uses of the spring pools and the surrounding landscape for agricultural and recreational purposes have altered the habitat of the Moapa dace.

Refuge Purpose(s): Moapa Valley National Wildlife Refuge purpose includes:

“... to conserve (A) fish or wildlife which are listed as endangered species or threatened species ... or (B) plants ...” 16 U.S.C. §1534 (Endangered Species Act of 1973)

National Wildlife Refuge System Mission: “To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans” (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-ee]).

Description of Use: The National Wildlife Refuge System Improvement Act of 1997 identifies wildlife observation and photography as well as hunting, fishing, interpretation, and environmental education as wildlife dependent public uses for NWR's. As two of the six priority public uses of the Refuge system, these uses are to be encouraged when compatible with the purposes of the Refuge. The public and communities desire more opportunities for these uses. The Refuge will allow access to designated open areas for observing and photographing scenery and associated flora and fauna. The Refuge will also provide some facilities to support wildlife observation and photography.

Due to the Moapa Valley NWR's small size, fragile habitats, on-going restoration work, and the need to remove unsafe structures, the Refuge has been closed to the public since acquisition began. Agency scientists with the U.S. Geological Survey (USGS) and Nevada Department of Wildlife (NDOW), as well as local conservation and community organizations, are working with Service staff to restore the historical landscape and habitat on the Refuge, which is critical to the survival of the Moapa dace, other rare fish and invertebrates, and a variety of migratory birds.

Under alternative C of the CCP (the preferred alternative), the Service would open the Refuge to the public daily. Visitor services would be improved to target 1,000 visitors annually. Interpretive materials, such as brochures and fact sheets, would be developed to guide and enhance visitor experience and provide information on the Moapa dace, its habitat requirements and the history of the Refuge. To encourage schools to visit the Refuge, the Service would organize local school contacts and generate enthusiasm for visiting the Refuge and experiencing its endemic species.

Several new facilities would be constructed or installed for visitor use, including:

- a) Potable water lines and public restrooms
- b) Shade structures, parking areas, and a school bus/RV turnout
- c) Self-guided trail system
- d) An overlook trail on the top of the hill on the Plummer Unit,

- e) A wheelchair-accessible trail along the spring heads, pools, and riparian corridor on the Plummer Unit.
- f) Visitor contact station.

Signs would also be installed along Interstate 15, U.S. Highway 93 and NV 168 to promote and direct the public to the Refuge.

Wildlife observation and photography are considered together in this compatibility determination because all are considered to be wildlife-dependent, non-consumptive uses and many elements of these programs are similar. Both of these public uses are dependent upon the completion of the trail system, potable water lines, public restrooms, a visitor contact station, and parking areas on the Refuge. An estimated 1,000 annual visitors will participate in these activities.

Availability of Resources: The following funding/annual costs (based on FY 2008 costs) would be required to administer and manage the activities as described above:

	One-time Costs	Annual Costs
Administration (Refuge Manager, utilities, vehicle, etc)	\$325,000	\$250,000
Maintain public restrooms, trails, parking lot, shade structure		\$5,000
Maintenance worker	\$200,000	\$150,000
TOTAL	\$525,000	\$405,000

Anticipated Impacts of Use: Once considered “non-consumptive”, it is now recognized that wildlife observation and wildlife photography can negatively impact wildlife by altering wildlife behavior, reproduction, distribution, and habitat (Purdy et al. 1987, Knight and Cole 1995).

Purdy et al. (1987) and Pomerantz et al. (1988) described six categories of impacts to wildlife as a result of visitor activities. They are:

- 1) Direct mortality: immediate, on-site death of an animal;
- 2) Indirect mortality: eventual, premature death of an animal caused by an event or agent that predisposed the animal to death;
- 3) Lowered productivity: reduced fecundity rate, nesting success, or reduced survival rate of young before dispersal from nest or birth site;
- 4) Reduced use of refuge: wildlife not using the refuge as frequently or in the manner they normally would in the absence of visitor activity;
- 5) Reduced use of preferred habitat on the refuge: wildlife use is relegated to less suitable habitat on the refuge due to visitor activity; and
- 6) Aberrant behavior/stress: wildlife demonstrating unusual behavior or signs of stress that are likely to result in reduced reproductive or survival rates.

Individual animals may be disturbed by human contact to varying degrees. Human activities on trails can result in direct effects on wildlife through harassment, a form of disturbance that can cause physiological effects, behavioral modifications, or death (Smith and Hunt 1995). Many studies have shown that birds can be impacted from human activities on trails when they are disturbed and flushed from feeding, resting, or nesting areas. Flushing, especially repetitive flushing, can strongly impact habitat use patterns of many bird species. Flushing from an area can cause birds to expend more energy, be deterred from using desirable habitat, affect resting or feeding patterns, and increase exposure to predation or cause birds to abandon sites with repeated disturbance (Smith and Hunt 1995). Migratory birds are observed to be more sensitive than resident species to disturbance (Klein 1989).

Nest predation for songbirds (Miller et al. 1998), raptors (Glinski 1976), colonial nesting species (Buckley and Buckley 1976), and waterfowl (Boyle and Samson 1985) tends to increase in areas more frequently visited by people. In addition, for many passerine species, primary song occurrence and consistency can be impacted by a single visitor (Gutzwiller et al. 1994). In areas where primary song was affected by disturbance, birds appeared to be reluctant to establish nesting territories (Reijnen and Foppen 1994).

Of the wildlife observation techniques, wildlife photographers tend to have the largest disturbance impacts (Klein 1993, Morton 1995, Dobb 1998). While wildlife observers frequently stop to view species, wildlife photographers are more likely to approach wildlife (Klein 1993). Even slow approach by wildlife photographers tends to have behavioral consequences to wildlife species (Klein 1993). Other impacts include the potential for photographers to remain close to wildlife for extended periods of time, in an attempt to habituate the wildlife subject to their presence (Dobb 1998) and the tendency of casual photographers, with low-power lenses, to get much closer to their subjects than other activities would require (Morton 1995), including wandering off trails. This usually results in increased disturbance to wildlife and habitat, including trampling of plants. Klein (1993) recommended that refuges provide observation and photography blinds to reduce disturbance of waterbirds when approached by visitors.

Education is critical for making visitors aware that their actions can have negative impacts on birds, and will increase the likelihood that visitors will abide by restrictions on their actions. For example, Klein (1993) demonstrated that visitors who spoke with refuge staff or volunteers were less likely to disturb birds. Increased surveillance and imposed fines may help reduce visitor caused disturbance (Knight & Gutzwiller 1995). Monitoring is recommended to adjust management techniques over time, particularly because it is often difficult to generalize about the impacts of specific types of recreation in different environments. Local and site -specific knowledge is necessary to determine effects on birds and to develop effective management strategies (Hockin et al. 1992; Klein et al. 1995; Hill et al. 1997).

The construction and maintenance of trails and parking lots will have minor impacts on soils and vegetation around the trails. This could include an increased potential for erosion, soil compaction (Liddle 1975), reduced seed emergence (Cole and Landres 1995), alteration of vegetative structure and composition, and sediment loading (Cole and Marion 1988). However, by concentrating foot traffic onto the trails other habitats on the Refuge will remain undisturbed.

Disturbance of wildlife is the primary concern regarding these uses. Disturbance to wildlife, such as the flushing of feeding, resting, or nesting birds, is inherent to these activities. There is some temporary disturbance to wildlife due to human activities on trails (walking, bird watching) however, the disturbance is generally localized and will not adversely impact overall populations. Increased facilities and visitation would cause some displacement of habitat and increase some disturbance to wildlife, although this is expected to be minor given the size of the Refuge and by avoiding or minimizing intrusion into important wildlife habitat.

Anticipated Impacts of Uses on Future Lands within the Approved Boundary: The following conditions must be met before allowing existing uses to occur on newly acquired lands: (1) There is no indirect, direct, or cumulative threat anticipated to human health or safety; (2) There is no indirect, direct, or cumulative threat anticipated to natural or cultural resources; (3) The use is consistent with management of existing Moapa Valley NWR lands and would contribute to achieving Refuge goals. In particular, existing Refuge regulations would not be compromised; (4) The newly acquired lands represent a meaningful unit within which to manage the activity; and (5) There are no anticipated conflicts with priority public uses.

Public Review and Comment: Public review and comments will be solicited in conjunction with distribution of the Draft CCP/EIS for the Desert National Wildlife Refuge Complex.

Determination:

Use is Not Compatible

Use is Compatible with the Following Stipulations

Stipulations necessary to ensure compatibility:

- Regulations and wildlife friendly behavior (e.g., requirements to stay on designated trails, etc.) will be described in brochures and posted.
- Access to the Refuge will be allowed only between sunrise and sunset.
- Seasonally restricting or prohibiting recreation activity may be necessary during spring and fall migration to alleviate disturbance to migratory birds (Burger 1981, 1986; Boyle & Samson 1985; Klein et al. 1995; Hill et al. 1997).
- Regulatory and directional signs will clearly mark areas closed to the public and designated routes of travel.
- Maps and public use information will be available at the visitor contact station.
- Refuge staff will conduct regular monitoring of public activities on the Refuge. The data will be analyzed and used by the Refuge Manager to develop modifications, if necessary, to ensure compatibility of the wildlife observation and photography programs.
- Commercial photography would require a Special Use Permit.

Justification: These wildlife-dependent uses are priority public uses of the National Wildlife Refuge System. Providing opportunities for wildlife observation and photography, would contribute toward fulfilling provisions of the National Wildlife Refuge System Administration Act, as amended in 1997, and one of the goals of the Moapa Valley National Wildlife Refuge (Goal 3, Chapter 3, CCP). Wildlife observation and photography would provide an excellent forum for allowing public access and increasing understanding of Refuge resources. The stipulations outlined above should minimize potential impacts relative to wildlife/human interactions. Based upon impacts described in the Draft Comprehensive Conservation Plan and Environmental Impact Statement (USFWS 2008), it is determined that wildlife observation and photography within the Moapa Valley National Wildlife Refuge, as described herein, will not materially interfere with or detract from the purposes for which the Refuge was established or the mission of the Refuge System. In our opinion, these wildlife dependent uses will not conflict with the national policy to maintain the biological diversity, integrity, and environmental health of the refuge.

Mandatory Re-Evaluation Date:

Mandatory 15-year Re-Evaluation, Date will be provided in Final EIS/CCP (for priority public uses)

Mandatory 10-year Re-Evaluation (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

Categorical Exclusion without Environmental Action Statement

- _____ Categorical Exclusion and Environmental Action Statement
- _____ Environmental Assessment and Finding of No Significant Impact
- X Environmental Impact Statement and Record of Decision

References Cited

- Boyle, S. A. and F. B. Samson. 1985. Effects of non-consumptive recreation on wildlife: a review. *Wildl. Soc. Bull.* 13:110-116.
- Buckley, P. A. and F. G. Buckley. 1976. Guidelines for protection and management of colonially nesting waterbirds. North Atlantic Regional Office, National Park Service, Boston, MA. 52pp.
- Burger, J. 1981. The effect of human activity on birds at a coastal bay. *Biol. Cons.* 21:231-241.
- Burger, J. 1986. The effect of human activity on shorebirds in two coastal bays in northeastern United States. *Biological Conservation* 13:123-130.
- Cole, D. N. and P. B. Landres. 1995. Indirect effects of recreation on wildlife. Pages 183-201 in R. L. Knight and K. J. Gutzwiller, ed. *Wildlife and Recreationists: coexistence through management and research*, Island Press, Washington, D. C. 372pp.
- Cole, D. N. and J. L. Marion. 1988. Recreation impacts in some riparian forests of the eastern United States. *Env. Manage.* 12:99-107.
- Dobb, E. 1998. Reality check: the debate behind the lens. *Audubon*: Jan.-Feb.
- Glinski, R. L. 1976. Birdwatching etiquette: the need for a developing philosophy. *Am. Bird* 30(3):655-657.
- Gutzwiller, K. J., R. T. Wiedenmann, K. L. Clements, and S. H. Anderson. 1994. Effects on human intrusion on song occurrence and singing consistency in subalpine birds. *Auk* 111:28-37.
- Hill, D., D. Hockin, D. Price, G. Tucker, R. Morris, and J. Treweek. 1997. Bird disturbance: improving the quality and utility of disturbance research. *Journal of Applied Ecology* 34:275-288.
- Hockin, D., M. Ounsted, M. Gorman, D. Hill, V. Keller, and M. A. Barker. 1992. Examination of the effects of disturbance on birds with reference to its importance in ecological assessments. *Journal of Environmental Management* 36:253-286.
- Klein, M. 1989. Effects of high levels of human visitation on foraging waterbirds at J. N. "Ding" Darling National Wildlife Refuge, Sanibel Florida. Masters thesis. Gainesville, Florida: University of Florida.
- Klein, M. L. 1993. Waterbird behavioral responses to human disturbances. *Wildl. Soc. Bull.* 21:31-39.
- Klein, M. L., S. R. Humphrey, and H. F. Percival. 1995. Effects of ecotourism on distribution of waterbirds in a wildlife refuge. *Conservation Biology* 9:1454-1465.
- Knight, R. L. and D. N. Cole. 1995. Wildlife responses to recreationists. Pages 71-79 in R. L. Knight and K. J. Gutzwiller, ed. *Wildlife and Recreationists: coexistence through management and research*. Island Press, Washington, D. C. 372pp.

- Knight, R.L., and K. J. Gutzwiller, ed. 1995. Wildlife and Recreationists: coexistence through management and research. Island Press, Washington, D. C. 372pp.
- Liddle, M. J. 1975. A selective review of the ecological effects on human trampling on natural ecosystems. Biol. Conserv. 7:17-36.
- Miller, S. G., R. L. Knight, and C. K. Miller. 1998. Influence of recreational trails on breeding bird communities. Ecol. Appl. 8:162-169.
- Morton, J. M. 1995. Management of human disturbance and its effects on waterfowl. Pages F59-F86 in W. R. Whitman, T. Strange, L. Widjeskog, R. Whittemore, P. Kehoe, and L. Roberts (eds.). Waterfowl habitat restoration, enhancement and management in the Atlantic Flyway. Third Ed. Environmental Manage. Comm., Atlantic Flyway Council Techn. Sect., and Delaware Div. Fish and Wildl., Dover, DE. 1114pp.
- Pomerantz, G. A., D. J. Decker, G. R. Goff, and K. G. Purdy. 1988. Assessing impact of recreation on wildlife: a classification scheme. Wildl. Soc. Bull. 16:58-62.
- Purdy, K. G., G. R. Goff, D. J. Decker, G. A. Pomerantz, N. A. Connelly. 1987. A guide to managing human activity on National Wildlife Refuges. Office of Information Transfer, U.S. Fish and Wildlife Service, Ft. Collins, CO. 57pp.
- Reijnen, R. and R. Foppen. 1994. The effects of car traffic on breeding bird populations in woodland. I. Evidence of reduced habitat quality for willow warbler (*Pyloscopus trochilus*) breeding close to a highway. J. Appl. Ecol 31: 85-94.
- Smith, L. and J. D. Hunt. 1995. Nature tourism: impacts and management. Pp. 203-219 in Knight, R. L.; Gutzwiller, K. J. (Wildlife and recreationists: coexistence through management and research, eds.). Island Press, Washington, D. C.
- USFWS. 2008. Desert National Wildlife Refuge Draft Comprehensive Conservation Plan and Environmental Impact Statement. U.S. Fish and Wildlife Service, Region 8.

Refuge Determination

Refuge Manager: _____
(Signature) (Date)

Project Leader
Approval: _____
(Signature) (Date)

Concurrence

Refuge Supervisor: _____
(Signature) (Date)

Assistant Regional
Director - Refuges: _____

(Signature)

(Date)

COMPATIBILITY DETERMINATION

Use: Environmental Education and Interpretation

Refuge Name: Moapa Valley National Wildlife Refuge (Refuge), Clark County, Nevada.

Establishing and Acquisition Authority: Moapa Valley National Wildlife Refuge was established on September 10, 1979, to secure and protect habitat for the endangered Moapa dace (*Moapa coriacea*). This unique small fish lives out its life within the Warm Springs area of the Upper Muddy River headwaters. These headwaters are composed of up to 20 thermal springs which are essential to the Moapa dace's life cycle. Historic uses of the spring pools and the surrounding landscape for recreational purposes and agriculture have altered the habitat of the Moapa dace.

Refuge Purpose(s): Moapa Valley National Wildlife Refuge's purpose is:

"... to conserve (A) fish or wildlife which are listed as endangered species or threatened species ... or (B) plants ..." 16 U.S.C. §1534 (Endangered Species Act of 1973)

National Wildlife Refuge System Mission: "To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans" (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-ee]).

Description of Use: The National Wildlife Refuge System Improvement Act of 1997 identifies wildlife observation and photography as well as hunting, fishing, interpretation, and environmental education as wildlife dependent public uses for NWR's. As two of the six priority public uses of the Refuge system, these uses are to be encouraged when compatible with the purposes of the Refuge. The public and communities desire more opportunities for these uses. The Refuge will allow access to designated open areas for environmental education and interpretation. The Refuge will also provide some facilities to support environmental education and interpretation.

Due to Moapa Valley NWR's small size, fragile habitats, on-going restoration work, and the need to remove unsafe structures, the Refuge has been closed to the public since acquisition began. Agency scientists with the U.S. Geological Survey (USGS) and Nevada Department of Wildlife (NDOW), as well as local conservation and community organizations, are working with Service staff to restore the historical landscape and habitat on the Refuge, which is critical to the survival of the Moapa dace.

With funding from the Southern Nevada Public Lands Management Act, the Service has completed several facilities that are necessary for environmental education and interpretation to occur on the Refuge, including: parking for buses and cars; restrooms; shade structures; self-guided trail system; and a stream profile viewing chamber.

Under Alternative C of the CCP (the preferred alternative), the Service would open the Refuge to the public daily. Visitor services would be improved to target 1,000 visitors annually. Interpretive materials, such as brochures and fact sheets, would be developed to guide and enhance visitor experience and provide information on the Moapa dace, its habitat requirements, and the history of the Refuge. To encourage schools to visit the Refuge, the Service would organize local school contacts and generate enthusiasm for visiting the Refuge and experiencing its endemic species.

To improve outreach for the Refuge, the Service would conduct an annual public open house to encourage interactions and foster relationships between Refuge staff and local constituents, and they would explore opportunities for community-based outreach, such as participation in off-Refuge activities. Docents would be recruited to staff the Refuge on weekends and facilitate tours, and the Service would collect data on the number of visitors to modify their visitor services accordingly.

The Service would construct a permanent environmental education display at the Moapa Valley Community Center (Moapa, NV) or another public venue. Cultural resources interpretive efforts would be incorporated into Refuge interpretation materials through development of regionally-focused cultural resources materials for self-guided tours and incorporation of the history of the Moapa Band of the Paiutes, including their knowledge of native plant and animal species.

The Service would also work with NDOT to install signs along Interstate 15, U.S. Highway 93, and NV 168 to promote and direct the public to the Refuge.

Environmental education and interpretation are considered together in this compatibility determination because all are considered to be wildlife-dependent, non-consumptive uses and many elements of these programs are similar. Both of these public uses are dependent upon the completion of the trail system, potable water lines, public restrooms, a visitor contact station, and parking areas on the Refuge. An estimated 1,000 annual visitors will participate in these activities.

Availability of Resources: The following funding/annual costs (based on FY 2008 costs) would be required to administer and manage the activities as described above:

	One-time Costs	Annual Costs
Administration and management	\$60,000	\$60,000
Develop interpretive materials	\$35,000	\$2,500
Education display at Moapa Valley Community Center	\$2,000	\$200
Maintain public use facilities and grounds		\$55,000
TOTAL	97,000	\$117,700

Anticipated Impacts of Use: Once considered “non-consumptive”, it is now recognized that activities such as environmental education and interpretation can negatively impact wildlife by altering wildlife behavior, reproduction, distribution, and habitat (Purdy et al. 1987, Knight and Cole 1995).

Purdy et al. (1987) and Pomerantz et al. (1988) described six categories of impacts to wildlife as a result of visitor activities. They are:

- 1) Direct mortality: immediate, on-site death of an animal;
- 2) Indirect mortality: eventual, premature death of an animal caused by an event or agent that predisposed the animal to death;
- 3) Lowered productivity: reduced fecundity rate, nesting success, or reduced survival rate of young before dispersal from nest or birth site;
- 4) Reduced use of refuge: wildlife not using the refuge as frequently or in the manner they normally would in the absence of visitor activity;
- 5) Reduced use of preferred habitat on the refuge: wildlife use is relegated to less suitable habitat on the refuge due to visitor activity; and
- 6) Aberrant behavior/stress: wildlife demonstrating unusual behavior or signs of stress that are likely to result in reduced reproductive or survival rates.

Individual animals may be disturbed by human contact to varying degrees. Human activities on trails can result in direct effects on wildlife through harassment, a form of disturbance that can cause physiological effects, behavioral modifications, or death (Smith and Hunt 1995). Many studies have

shown that birds can be impacted from human activities on trails when they are disturbed and flushed from feeding, resting, or nesting areas. Flushing, especially repetitive flushing, can strongly impact habitat use patterns of many bird species. Flushing from an area can cause birds to expend more energy, be deterred from using desirable habitat, affect resting or feeding patterns, and increase exposure to predation or cause birds to abandon sites with repeated disturbance (Smith and Hunt 1995). Migratory birds are observed to be more sensitive than resident species to disturbance (Klein 1989).

Nest predation for songbirds (Miller et al. 1998), raptors (Glinski 1976) and waterfowl (Boyle and Samson 1985) tends to increase in areas more frequently visited by people. In addition, for many passerine species, primary song occurrence and consistency can be impacted by a single visitor (Gutzwiller et al. 1994). In areas where primary song was affected by disturbance, birds appeared to be reluctant to establish nesting territories (Reijnen and Foppen 1994).). Seasonally restricting or prohibiting recreation activity may be necessary during spring and fall migration to alleviate disturbance to migratory birds (Burger 1981, 1986; Boyle & Samson 1985; Klein et al. 1995; Hill et al. 1997).

Education is critical for making visitors aware that their actions can have negative impacts on birds, and will increase the likelihood that visitors will abide by restrictions on their actions. For example, Klein (1993) demonstrated that visitors who spoke with refuge staff (or volunteers) were less likely to disturb birds. Increased surveillance and imposed fines may help reduce visitor caused disturbance (Knight & Gutzwiller 1995). Monitoring is recommended to adjust management techniques over time, particularly because it is often difficult to generalize about the impacts of specific types of recreation in different environments. Local and site -specific knowledge is necessary to determine effects on birds and to develop effective management strategies (Hockin et al. 1992; Klein and Temple 1995; Hill et al. 1997). Informed management decisions coupled with sufficient public education could do much to mitigate disturbance effects of wildlife-dependent recreations (Purdy et al 1987).

The disturbance by environmental education activities is considered to be of minimal impact because: (1) students and teachers will be instructed in trail etiquette and the best ways to view wildlife with minimal disturbance; (2) education groups will be required to have a sufficient number of adults to supervise the group; (3) trail design will provide adequate cover for wildlife; and (4) observation areas and scopes are provided to view wildlife at a distance which reduces disturbance.

Education staff will coordinate with biologists regarding activities associated with restoration or monitoring projects to ensure that impacts to both wildlife and habitat are minimal. As with any restoration and monitoring activities conducted by Refuge personnel, these activities conducted by students would be at a time and place where the least amount of disturbance would occur.

Anticipated Impacts of Uses on Future Lands within the Approved Boundary: The following conditions must be met before allowing existing uses to occur on newly acquired lands: (1) There is no indirect, direct, or cumulative threat anticipated to human health or safety; (2) There is no indirect, direct, or cumulative threat anticipated to natural or cultural resources; (3) The use is consistent with management of existing Moapa Valley NWR lands and would contribute to achieving Refuge goals. In particular, existing Refuge regulations would not be compromised; (4) The newly acquired lands represent a meaningful unit within which to manage the activity; and (5) There are no anticipated conflicts with priority public uses.

Public Review and Comment: Public review and comments will be solicited in conjunction with distribution of the Draft CCP/EIS for the Desert National Wildlife Refuge Complex.

Determination:

_____ Use is Not Compatible

X Use is Compatible with the Following Stipulations

Stipulations necessary to ensure compatibility:

- Participants in the Refuge’s environmental education program will be restricted to established trails including the kiosk and parking areas, the visitor contact station, and other designated sites.
- All groups using the Refuge for environmental education will be required to make reservations in advance through the Refuge office. This process, which takes the place of a Special Use Permit (SUP), allows Refuge staff and volunteers to manage the number of Refuge visitors on a given day. There is a current refuge policy that educational groups are not charged a fee or required to have a SUP. A daily limit of 100 students participating in the education program will be maintained through this reservation system. Efforts will be made to spread out use by large groups while reservations are made, reducing disturbance to wildlife and over-crowding of Refuge facilities during times of peak demand.
- Trail etiquette including ways to reduce wildlife disturbance will be discussed with teachers during orientation workshops and with students upon arrival during their welcome session. On the Refuge, the teacher(s) is responsible for ensuring that students follow required trail etiquette.
- The Refuge manager will conduct regular surveys of public activities on the refuge. The data will be analyzed and used by the Refuge Manager to develop future modifications if necessary to ensure compatibility of environmental education programs.
- Educational groups are required to have a sufficient number of adults to supervise their groups, a minimum of 1 adult per 12 students.

Justification: These wildlife-dependent uses are priority public uses of the National Wildlife Refuge System. Providing opportunities for environmental education and interpretation, would contribute toward fulfilling provisions of the National Wildlife Refuge System Administration Act, as amended in 1997, and one of the goals of the Moapa Valley Refuge (Goal 3, Chapter 3, CCP). Environmental education and interpretation would provide an excellent forum for allowing public access and increasing understanding of Refuge resources. Environmental education and interpretation activities generally support Refuge purposes and impacts can largely be minimized (Goff et al. 1988). The minor resource impacts attributed to these activities are generally outweighed by the benefits gained by educating present and future generations about refuge resources. Environmental education is a public use management tool used to develop a resource protection ethic within society. While it targets school age children, it is not limited to this group. This tool allows us to educate refuge visitors about endangered and threatened species management, wildlife management and ecological principles and communities. A secondary benefit of environmental education is that it instills an ‘ownership’ or ‘stewardship’ ethic in visitors and most likely reduces vandalism, littering and poaching; it also strengthens service visibility in the local community.

The stipulations outlined above should minimize potential impacts relative to wildlife/human interactions. Based upon impacts described above and in the Draft Comprehensive Conservation Plan /Environmental Impact Statement (USFWS 2008), it is determined that environmental education and interpretation within the Moapa Valley National Wildlife Refuge, as described herein, will not materially interfere with or detract from the purposes for which the Refuge was established or the mission of the Refuge System. In our opinion, these wildlife dependent uses will not conflict with the national policy to maintain the biological diversity, integrity, and environmental health of the refuge.

Mandatory Re-Evaluation Date:

- Mandatory 15-year Re-Evaluation, Date will be provided in Final EIS/CCP (for priority public uses)
- Mandatory 10-year Re-Evaluation (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

- Categorical Exclusion without Environmental Action Statement
- Categorical Exclusion and Environmental Action Statement
- Environmental Assessment and Finding of No Significant Impact
- Environmental Impact Statement and Record of Decision

References Cited

- Boyle, S. A. and F. B. Samson. 1985. Effects of non-consumptive recreation on wildlife: a review. *Wildl. Soc. Bull.* 13:110-116.
- Glinski, R. L. 1976. Birdwatching etiquette: the need for a developing philosophy. *Am. Bird* 30(3):655-657.
- Gutzwiller, K. J., R. T. Wiedenmann, K. L. Clements, and S. H. Anderson. 1994. Effects on human intrusion on song occurrence and singing consistency in subalpine birds. *Auk* 111:28-37.
- Hill, D., D. Hockin, D. Price, G. Tucker, R. Morris, and J. Treweek. 1997. Bird disturbance: improving the quality and utility of disturbance research. *Journal of Applied Ecology* 34:275-288.
- Hockin, D., M. Ounsted, M. Gorman, D. Hill, V. Keller, and M. A. Barker. 1992. Examination of the effects of disturbance on birds with reference to its importance in ecological assessments. *Journal of Environmental Management* 36:253-286.
- Klein, M. 1989. Effects of high levels of human visitation on foraging waterbirds at J. N. "Ding" Darling National Wildlife Refuge, Sanibel Florida. Masters thesis. Gainesville, Florida: University of Florida.
- Klein, M. L. 1993. Waterbird behavioral responses to human disturbances. *Wildl. Soc. Bull.* 21:31-39.
- Knight, R. L. and D. N. Cole. 1995. Wildlife responses to recreationists. Pages 71-79 in R. L. Knight and K. J. Gutzwiller, ed. *Wildlife and Recreationists: coexistence through management and research*. Island Press, Washington, D. C. 372pp.
- Knight, R.L., and K. J. Gutzwiller, ed. 1995. *Wildlife and Recreationists: coexistence through management and research*. Island Press, Washington, D. C. 372pp.

Knight, R. L. and S. A. Temple. 1995. Origin of wildlife responses to recreationists. In *Wildlife and recreation: coexistence through management and research*. R. L. Knight and K. J. Gutzwiller, eds. Island Press, Washington, D. C., pp 81-91.

Miller, S. G., R. L. Knight, and C. K. Miller. 1998. Influence of recreational trails on breeding bird communities. *Ecol. Appl.* 8:162-169.

Pomerantz, G. A., D. J. Decker, G. R. Goff, and K. G. Purdy. 1988. Assessing impact of recreation on wildlife: a classification scheme. *Wildl. Soc. Bull.* 16:58-62.

Purdy, K. G., G. R. Goff, D. J. Decker, G. A. Pomerantz, N. A. Connelly. 1987. A guide to managing human activity on National Wildlife Refuges. Office of Information Transfer, U.S. Fish and Wildlife Service, Ft. Collins, CO. 57pp.

Reijnen, R. and R. Foppen. 1994. The effects of car traffic on breeding bird populations in woodland. I. Evidence of reduced habitat quality for willow warbler (*Pyloscopus trochilus*) breeding close to a highway. *J. Appl. Ecol* 31: 85-94.

Smith, L. and J. D. Hunt. 1995. Nature tourism: impacts and management. Pp. 203-219 in Knight, R. L.; Gutzwiller, K. J. (*Wildlife and recreationists: coexistence through management and research*, eds.). Island Press, Washington, D. C.

USFWS. 2008. Desert National Wildlife Refuge Draft Comprehensive Conservation Plan / Environmental Impact Statement. U.S. Fish and Wildlife Service, Region 8.

Refuge Determination

Refuge Manager:

(Signature)

(Date)

Project Leader
Approval:

(Signature)

(Date)

Concurrence

Refuge Supervisor:

(Signature)

(Date)

Assistant Regional
Director - Refuges:

(Signature)

(Date)

COMPATIBILITY DETERMINATION

Use: Research

Refuge Name: Moapa Valley National Wildlife Refuge (Refuge), Clark County, Nevada.

Establishing and Acquisition Authority: Moapa Valley National Wildlife Refuge was established on September 10, 1979, to secure and protect habitat for the endangered Moapa dace (*Moapa coriacea*). This unique small fish lives out its life within the Warm Springs area of the Upper Muddy River headwaters. These headwaters are composed of up to 20 thermal springs which are essential to the Moapa dace's life cycle. Historic uses of the spring pools and the surrounding landscape for recreational purposes and agriculture have altered the habitat of the Moapa dace.

Refuge Purpose(s): Moapa Valley National Wildlife Refuge's purpose is:

"... to conserve (A) fish or wildlife which are listed as endangered species or threatened species ... or (B) plants ..." 16 U.S.C. §1534 (Endangered Species Act of 1973)

National Wildlife Refuge System Mission: "To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans" (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-ee]).

Description of Use: Two provisions of the National Wildlife Refuge Improvement Act are to "maintain biological integrity, diversity and environmental health" and to conduct "inventory and monitoring." Monitoring and research are an integral part of National Wildlife Refuge management. Plans and actions based on research and monitoring provide an informed approach, which analyzes the management affects on refuge wildlife.

When the Refuge receives requests to conduct scientific research at the Refuge, Special Use Permits (SUPs) are required to be issued for research and monitoring. SUPs are only issued for monitoring and investigations which contribute to the enhancement, protection, preservation, and management of native Refuge plant and wildlife populations and their habitats. Research applicants are required to submit a proposal that outlines: (1) objectives of the study; (2) justification for the study; (3) detailed methodology and schedule; (4) potential impacts on Refuge wildlife or habitat, including disturbance (short and long term), injury, or mortality (this includes a description of measures the researcher will take to reduce disturbance or impacts); (5) research personnel required; (6) costs to Refuge, if any; and (7) progress reports and end products (i.e., reports, thesis, dissertations, publications). Research proposals are reviewed by Refuge staff and conservation partners, as appropriate. SUPs are issued by the refuge manager, if the proposal is approved.

Evaluation criteria will include, but not be limited to, the following:

- Research that will contribute to specific Refuge management issues will be given higher priority over other research requests.
- Research that will conflict with other ongoing research, monitoring, or management programs will not be granted.
- Research projects that can be accomplished off-Refuge are less likely to be approved.
- Research which causes undue disturbance or is intrusive will likely not be granted. Level and type of disturbance will be carefully evaluated when considering a request.

- Refuge evaluation will determine if any effort has been made to minimize disturbance through study design, including considering adjusting location, timing, scope, number of permittees, study methods, number of study sites, etc.
- If staffing or logistics make it impossible for the Refuge to monitor researcher activity in a sensitive area, the research request may be denied, depending on the specific circumstances.
- The length of the project will be considered and agreed upon before approval. Projects will be reviewed annually.

These criteria will also apply to any properties acquired in the future within the approved boundary of the Refuge.

Availability of Resources: The Refuge receives approximately 1 - 3 research requests per year. Some permit requests require up to one hour to process, others could take longer, depending on the complexity of the research request. On average, the program costs approximately \$500.00/year. Refuge operational funds are currently available through the Service budget process to administer this program.

	One-time Costs	Annual Costs
General Administration		\$500
TOTAL		

Anticipated Impacts of Use: Possible impacts of research include disturbance to wildlife and habitat modification. Potential impacts associated with research activities would be mitigated/minimized because sufficient restrictions would be included as part of the study design and researcher activities would be monitored by Refuge staff. Due to the small number of researchers that use the Refuge and with the restrictions outlined in the stipulations section below, the impacts on migratory birds and other wildlife and their habitat are expected to be relatively minor and localized. These potential impacts are described below.

Impacts on Wildlife:

According to Knight and Cole (1991), there are three categories of wildlife responses to human disturbance: 1) avoidance; 2) habituation; and 3) attraction. The magnitude of the avoidance response may depend on a number of factors including the type, distance, movement pattern, speed, and duration of the disturbance, as well as the time of day, time of year, weather; and the animal's access to food and cover, energy demands, and reproductive status (Knight and Cole 1991; Gabrielsen and Smith 1995).

Individual animals may be disturbed by human contact to varying degrees. Many studies have shown that birds can be impacted from human activities when they are disturbed and flushed from feeding, resting, or nesting areas. Flushing, especially repetitive flushing, can strongly impact habitat use patterns of many bird species. Flushing from an area can cause birds to expend more energy, be deterred from using desirable habitat, affect resting or feeding patterns, and increase exposure to predation or cause birds to abandon sites with repeated disturbance (Smith and Hunt 1995). Migratory birds are observed to be more sensitive than resident species to disturbance (Klein 1989). Nest predation for songbirds (Miller et al. 1998), raptors (Glinski 1976), colonial nesting species (Buckley and Buckley 1976), and waterfowl (Boyle and Samson 1985) tends to increase in areas more frequently visited by people. In addition, for many passerine species, primary song occurrence and consistency can be impacted by a single visitor (Gutzwiller et al. 1994). In areas where primary song was affected

by disturbance, birds appeared to be reluctant to establish nesting territories (Reijnen and Foppen 1994).

Habituation is defined as a form of learning in which individuals stop responding to stimuli that carry no reinforcing consequences for the individuals that are exposed to them (Alcock 1993). A key factor for predicting how wildlife would respond to disturbance is predictability. Gabrielsen and Smith (1995) suggest that most animals seem to have a greater defense response to humans moving unpredictably in the terrain than to humans following a distinct path.

Wildlife may also be attracted to human presence. For example, wildlife may be converted to “beggars” lured by handouts (Knight and Temple 1995), and scavengers are attracted to road kills (Rosen and Lowe 1994).

Impacts on Habitat:

Research activities could also have impacts on vegetation, soil, and/or water. However, most of these effects would be short-term because only the minimum of samples (e.g., water, soils, vegetative litter, plants, macroinvertebrates) required for identification and/or experimentation and statistical analysis would be permitted. Off trail walking by researchers could have similar effects as hikers in general who can alter habitats by trampling vegetation, compacting soil, and increasing the potential of erosion (Liddle 1975; Hendee *et al.* 1990). Soil compaction makes root penetration more difficult, making it difficult for seedlings to become established (Cole and Landres 1995). In moderate cases of soil compaction, plant cover and biomass is decreased. In highly compacted soils, plant species abundance and diversity is reduced in the long-term as only the most resistant species survive (Liddle 1975). Impacts from vegetation trampling can lower species richness, decrease ground cover and plant species density, increase weedy annuals, and induce changes in species composition (Grabherr 1983).

Anticipated Impacts of Uses on Future Lands within the Approved Boundary: The following conditions must be met before allowing existing uses to occur on newly acquired lands: (1) There is no indirect, direct, or cumulative threat anticipated to human health or safety; (2) There is no indirect, direct, or cumulative threat anticipated to natural or cultural resources; (3) The use is consistent with management of existing Moapa Valley NWR lands and would contribute to achieving Refuge goals. In particular, existing Refuge regulations would not be compromised; (4) The newly acquired lands represent a meaningful unit within which to manage the activity; and (5) There are no anticipated conflicts with priority public uses.

Public Review and Comment: Public review and comments will be solicited in conjunction with distribution of the Draft CCP/EIS for the Desert National Wildlife Refuge Complex. Comments received (including those regarding research) will be addressed in the Response to Comments.

Determination:

Use is Not Compatible

Use is Compatible with the Following Stipulations

Stipulations necessary to ensure compatibility: The criteria for evaluating a research proposal, outlined in the Description of Use section above, will be used when determining whether a proposed study will be approved on the Refuge. If proposed research methods are evaluated and determined to have potential adverse impacts on refuge wildlife or habitat, then the refuge would determine the utility and need of such research to conservation and management of refuge wildlife and habitat. If the need was demonstrated by the research permittee and accepted by the refuge, then measures to minimize potential impacts (e.g., reduce the numbers of researchers entering an area, restrict research in specified areas) would be developed and included as part of the study design and on the SUP. SUPs will contain specific terms and conditions that the researcher(s) must follow relative to activity,

location, duration, seasonality, etc. to ensure continued compatibility. All Refuge rules and regulations must be followed unless otherwise accepted in writing by Refuge management.

All information, reports, data, collections, or documented sightings and observations, that are obtained as a result of this permit are the property of the Service and can be accessed by the Service at any time from the permittee at no cost. The Refuge also requires the submission of annual or final reports and any/all publications associated with the work done on the Refuge. Each SUP may have additional criteria. Each SUP will also be evaluated individually to determine if a fee will be charged and for the length of the permit.

Extremely sensitive wildlife habitat areas would be avoided unless sufficient protection from research activities (i.e., disturbance, collection, capture and handling) is implemented to limit the area and/or wildlife potentially impacted by the proposed research. Where appropriate, some areas may be temporarily/seasonally closed so that research would be permitted when impacts to wildlife and habitat are no longer a concern. Research activities will be modified to avoid harm to sensitive wildlife and habitat when unforeseen impacts arise.

Refuge staff will monitor researcher activities for potential impacts to the refuge and for compliance with conditions on the SUP. The refuge manager may determine that previously approved research and SUPs be terminated due to observed impacts. The refuge manager will also have the ability to cancel a SUP if the researcher is out of compliance with the conditions of the SUP.

Justification: Refuge monitoring and research will directly benefit and support refuge goals, objectives and management plans and activities. Fish, wildlife, plants and their habitat will improve through the application of knowledge gained from monitoring and research. Biological integrity, diversity and environmental health would benefit from scientific research conducted on natural resources at the refuge. The wildlife-dependent, priority public uses (wildlife viewing and photography, environmental education and interpretation, fishing and hunting) would also benefit as a result of increased biodiversity and wildlife and native plant populations from improved restoration and management plans and activities associated with monitoring and research investigations which address specific restoration and management questions.

Mandatory Re-Evaluation Date:

Mandatory 15-year Re-Evaluation, Date will be provided in Final EIS/CCP (for priority public uses)

Mandatory 10-year Re-Evaluation (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

Categorical Exclusion without Environmental Action Statement

Categorical Exclusion and Environmental Action Statement

Environmental Assessment and Finding of No Significant Impact

Environmental Impact Statement and Record of Decision

References Cited

- Alcock, J. 1993. Animal behavior: an evolutionary approach. Fifth ed. Sinauer Assoc., Sunderland, MA. 625pp.
- Boyle, S. A. and F. B. Samson. 1985. Effects of non-consumptive recreation on wildlife: a review. *Wildl. Soc. Bull.* 13:110-116.
- Buckley, P. A. and F. G. Buckley. 1976. Guidelines for protection and management of colonially nesting waterbirds. North Atlantic Regional Office, National Park Service, Boston, MA. 52pp.
- Cole, D. N. and P. B. Landres. 1995. Indirect effects of recreation on wildlife. Pages 183-201 in R. L. Knight and K. J. Gutzwiller, ed. *Wildlife and Recreationists: coexistence through management and research*, Island Press, Washington, D. C. 372pp.
- Gabrielson, G. W. and E. N. Smith. 1995. Physiological responses of wildlife to disturbance. Pages 95-107 in R. L. Knight and K. J. Gutzwiller, ed. *Wildlife and Recreationists: coexistence through management and research*. Island Press, Washington, D. C. 372pp.
- Glinski, R. L. 1976. Birdwatching etiquette: the need for a developing philosophy. *Am. Bird* 30(3):655-657.
- Grabherr, G. 1983. Damage to vegetation by recreation in the Austrian and German Alps. Pages 74-91 in N.G. Bayfield and G.C. Barrow eds. *The ecological impacts of outdoor recreation on mountain areas in Europe and North America*, Rept. 9. 203pp.
- Gutzwiller, K. J., R. T. Wiedenmann, K. L. Clements, and S. H. Anderson. 1994. Effects on human intrusion on song occurrence and singing consistency in subalpine birds. *Auk* 111:28-37.
- Hendee, Jr., G.H. Stankey, and R.C. Lucas. 1990. *Wilderness Management*. North American Press, Golden, CO.
- Klein, M. 1989. Effects of high levels of human visitation on foraging waterbirds at J. N. "Ding" Darling National Wildlife Refuge, Sanibel Florida. Masters thesis. Gainesville, Florida: University of Florida.
- Knight, R. L. and D. N. Cole. 1991. Effects of recreational activity on wildlife in wildlands in *Transactions of the North American Wildlife and Natural Resources Conference*. 56:238-247.
- Knight, R. L. and S. A. Temple. 1995. Origin of wildlife responses to recreationists. In *Wildlife and recreation: coexistence through management and research*. R. L. Knight and K. J. Gutzwiller, eds. Island Press, Washington, D. C., pp 81-91.
- Liddle, M. J. 1975. A selective review of the ecological effects on human trampling on natural ecosystems. *Biol. Conserv.* 7:17-36.
- Miller, S. G., R. L. Knight, and C. K. Miller. 1998. Influence of recreational trails on breeding bird communities. *Ecol. Appl.* 8:162-169.
- Reijnen, R. and R. Foppen. 1994. The effects of car traffic on breeding bird populations in woodland. I. Evidence of reduced habitat quality for willow warbler (*Pyloscopus trochilus*) breeding close to a highway. *J. Appl. Ecol* 31: 85-94.
- Rosen, P. C. and C. H. Lowe. 1994. Highway mortality of snakes in the Sonoran Desert of southern Arizona. *Biol. Conserv.* 68:143-148.

Smith, L. and J. D. Hunt. 1995. Nature tourism: impacts and management. Pp. 203-219 in Knight, R. L.; Gutzwiller, K. J. (Wildlife and recreationists: coexistence through management and research, eds.). Island Press, Washington, D. C.

Refuge Determination

Refuge Manager: _____
(Signature) (Date)

Project Leader
Approval: _____
(Signature) (Date)

Concurrence

Refuge Supervisor: _____
(Signature) (Date)

Assistant Regional
Director - Refuges: _____
(Signature) (Date)

COMPATIBILITY DETERMINATION

Use: Wildlife Observation and Photography

Refuge Name: Pahrnagat National Wildlife Refuge (Refuge), located in Lincoln County, Nevada.

Establishing and Acquisition Authority(ies): Pahrnagat National Wildlife Refuge was established on August 16, 1963, to provide habitat for migratory birds, especially waterfowl. It encompasses 5,380 acres of marshes, open water, native grass meadows, cultivated croplands, and riparian habitat approximately 90 miles north of Las Vegas.

Refuge Purpose(s): Pahrnagat National Wildlife Refuge purpose includes:

“...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds...” (16 USC 715d).

National Wildlife Refuge System Mission: “To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans” (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-ee]).

Description of Use: The National Wildlife Refuge System Improvement Act of 1997 identifies wildlife observation and photography as well as hunting, fishing, interpretation, and environmental education as priority public uses for the National Wildlife Refuge System. The uses are to be encouraged when compatible with the purposes of the refuge. This compatibility determination covers both wildlife observation and photography. Many elements of wildlife observation and photography are similar to opportunities provided in the environmental education and interpretation programs.

Pahrnagat NWR allows the year-round access to designated open areas for observing and photographing scenery and associated flora and fauna. Wildlife observation is available throughout the Refuge, and bird watching is the most common activity. A bird list is available at the Refuge office or online. The large bodies of water and riparian habitat provide excellent opportunities for birders to view a variety of waterfowl and other migratory birds.

Pahrnagat NWR receives visitors from the nearby communities as well as from other states and foreign countries. Visitation numbers are gathered in two ways on the Refuge: traffic counters at the entrances and a sign-in sheet at the Refuge headquarters. Visitation at the Refuge is expected to increase as the nearby communities grow. Based on current estimates, the Refuge accommodates approximately 30,000 visitors per year (USFWS 2008). The nature trails and fishing/observation pier are the most common facilities used by the public. In FY 2007, over 500 people visited the Refuge to fish, and more than 25,000 people hiked along the nature trails or participated in wildlife observation of some kind.

The Service provides several facilities to support wildlife observation and photography activities on the Refuge. The Refuge administrative office serves as a visitor contact station with brochures, maps, and fact sheets. The office is open Monday through Friday from 8:00 a.m. to 4:00 p.m., or as staff is available. An outside contact station and interpretive kiosk is located at the north end of the Refuge just east of the dike which separates North Marsh from Upper Pahrnagat Lake. Vault toilets and dumpsters are also provided in this area. A fishing pier/observation platform is located at the south end of Upper Pahrnagat Lake. In addition, a natural trail runs from this point and traverses the east side of Upper Pahrnagat Lake. A hunting blind/observation platform is also available at Middle Marsh. Parking is available in several places along designated roads.

Principal public access to Pahrnagat NWR is from Highway 93, about 60 miles north of the junction with Interstate 15. Two unpaved roads lead to Lower Lake and Middle Marsh from the highway. A sign along the highway marks the gravel road to the Refuge headquarters. This road connects to Alamo Road and continues through the Refuge and onto the Desert NWR. About four miles north of the headquarters road, an unpaved road leads to the North Marsh and Upper Pahrnagat Lake and associated facilities. Vehicles must remain on the designated roads. All-terrain vehicles are prohibited on the Refuge. Boat launching is limited to car-top only (no ramps) and only non-motorized boats or boats with electric motors are permitted on Upper Pahrnagat Lake, Middle Marsh, and Lower Lake. No boats, rafts or any other types of flotation devices are allowed at North Marsh.

The Refuge will continue to provide wildlife observation opportunities and photography opportunities. Under Alternative D of CCP (the preferred alternative), the Service would improve opportunities for these two uses on the Refuge. A wildlife observation trail system potentially along historic farming and ranching roads would be developed. Photography and observation blinds along the trail route would also be constructed. To improve public access and awareness of the Refuge, the Service would install directional signs along Highway 93 and Interstate 15 with assistance of Nevada Department of Transportation.

Availability of Resources: The following funding/annual costs (based on FY 2008 costs) would be required to administer and manage the activities as described above:

	One-time Costs	Annual Costs
Manage Current Use		
Administration		\$15,000
Law enforcement		\$2,000
Volunteers		\$4,000
Improve and Enhance Use		
Design and construct wildlife observation trail system	\$5,000	\$500
Construct photography/observation blinds along trail route.	\$3,000	\$500
TOTAL	\$7,000	\$22,000

Anticipated Impacts of Use: Once considered “non-consumptive”, it is now recognized that wildlife observation and wildlife photography can negatively impact wildlife by altering wildlife behavior, reproduction, distribution, and habitat (Purdy et al. 1987, Knight and Cole 1995).

Purdy et al. (1987) and Pomerantz et al. (1988) described six categories of impacts to wildlife as a result of visitor activities. They are:

- 1) Direct mortality: immediate, on-site death of an animal;
- 2) Indirect mortality: eventual, premature death of an animal caused by an event or agent that predisposed the animal to death;
- 3) Lowered productivity: reduced fecundity rate, nesting success, or reduced survival rate of young before dispersal from nest or birth site;
- 4) Reduced use of refuge: wildlife not using the refuge as frequently or in the manner they normally would in the absence of visitor activity;
- 5) Reduced use of preferred habitat on the refuge: wildlife use is relegated to less suitable habitat on the refuge due to visitor activity; and
- 6) Aberrant behavior/stress: wildlife demonstrating unusual behavior or signs of stress that are likely to result in reduced reproductive or survival rates.

Individual animals may be disturbed by human contact to varying degrees. Human activities on trails can result in direct effects on wildlife through harassment, a form of disturbance that can cause physiological effects, behavioral modifications, or death (Smith and Hunt 1995). Many studies have shown that birds can be impacted from human activities on trails when they are disturbed and flushed from feeding, resting, or nesting areas. Flushing, especially repetitive flushing, can strongly impact habitat use patterns of many bird species. Flushing from an area can cause birds to expend more energy, be deterred from using desirable habitat, affect resting or feeding patterns, and increase exposure to predation or cause birds to abandon sites with repeated disturbance (Smith and Hunt 1995). Migratory birds are observed to be more sensitive than resident species to disturbance (Klein 1989).

Hérons and shorebirds were observed to be the most easily disturbed (when compared to gulls, terns and ducks) by human activity and flushed to distant areas away from people (Burger 1981). A reduced number of shorebirds were found near people who were walking or jogging, and about 50 percent of flushed birds flew elsewhere (Burger 1981). In addition, the foraging time of sanderlings decreased and avoidance (e.g., running, flushing) increased as the number of humans within 100 meters increased (Burger and Gochfeld 1991). Nest predation for songbirds (Miller et al. 1998), raptors (Glinski 1976), colonial nesting species (Buckley and Buckley 1976), and waterfowl (Boyle and Samson 1985) tends to increase in areas more frequently visited by people. In addition, for many passerine species, primary song occurrence and consistency can be impacted by a single visitor (Gutzwiller et al. 1994). In areas where primary song was affected by disturbance, birds appeared to be reluctant to establish nesting territories (Reijnen and Foppen 1994).

Depending on the species (especially migrants vs. residents), some birds may habituate to some types of recreation disturbance and either are not disturbed or will immediately return after the initial disturbance (Hockin et al. 1992; Burger et al. 1995; Knight & Temple 1995; Madsen 1995; Fox & Madsen 1997). Rodgers & Smith (1997) calculated buffer distances that minimize disturbance to foraging and loafing birds based on experimental flushing distances for 16 species of waders and shorebirds. They recommended 100 meters as an adequate buffer against pedestrian traffic, however, they suggest this distance may be reduced if physical barriers (e.g., vegetation screening) are provided, noise levels are reduced, and traffic is directed tangentially rather than directly toward birds. Screening may not effectively buffer noise impacts, thus visitors should be educated on the effects of noise and noise restrictions should be enforced (Burger 1981, 1986; Klein 1993; Bowles 1995; Burger & Gochfeld 1998). Seasonally restricting or prohibiting recreation activity may be necessary during spring and fall migration to alleviate disturbance to migratory birds (Burger 1981, 1986; Boyle & Samson 1985; Klein et al. 1995; Hill et al. 1997).

Of the wildlife observation techniques, wildlife photographers tend to have the largest disturbance impacts (Klein 1993, Morton 1995, Dobb 1998). While wildlife observers frequently stop to view species, wildlife photographers are more likely to approach wildlife (Klein 1993). Even slow approach by wildlife photographers tends to have behavioral consequences to wildlife species (Klein 1993). Other impacts include the potential for photographers to remain close to wildlife for extended periods of time, in an attempt to habituate the wildlife subject to their presence (Dobb 1998) and the tendency of casual photographers, with low-power lenses, to get much closer to their subjects than other activities would require (Morton 1995), including wandering off trails. This usually results in increased disturbance to wildlife and habitat, including trampling of plants. Klein (1993) recommended that refuges provide observation and photography blinds to reduce disturbance of waterbirds when approached by visitors.

Education is critical for making visitors aware that their actions can have negative impacts on birds, and will increase the likelihood that visitors will abide by restrictions on their actions. For example, Klein (1993) demonstrated that visitors who spoke with refuge staff or volunteers were less likely to disturb birds. Increased surveillance and imposed fines may help reduce visitor caused disturbance (Knight & Gutzwiller 1995). Monitoring is recommended to adjust management techniques over time, particularly because it is often difficult to generalize about the impacts of specific types of recreation in

different environments. Local and site -specific knowledge is necessary to determine effects on birds and to develop effective management strategies (Hockin et al. 1992; Klein et al. 1995; Hill et al. 1997).

The construction and maintenance of trails, photography blinds, and parking lots will have minor impacts on soils and vegetation around the trails. This could include an increased potential for erosion, soil compaction (Liddle 1975), reduced seed emergence (Cole and Landres 1995), alteration of vegetative structure and composition, and sediment loading (Cole and Marion 1988). However, by concentrating foot traffic onto the trails other habitats on the Refuge will remain undisturbed.

Disturbance of wildlife is the primary concern regarding wildlife observation and photography. Disturbance to wildlife, such as the flushing of feeding, resting, or nesting birds, is inherent to these activities. There is some temporary disturbance to wildlife due to human activities on trails (hiking, bird watching) however, the disturbance is generally localized and will not adversely impact overall populations. Increased facilities and visitation would cause some displacement of habitat and increase some disturbance to wildlife, although this is expected to be minor given the size of the Refuge and by avoiding or minimizing intrusion into important wildlife habitat.

Anticipated Impacts of Uses on Future Lands within the Approved Boundary: The following conditions must be met before allowing existing uses to occur on newly acquired lands: (1) There is no indirect, direct, or cumulative threat anticipated to human health or safety; (2) There is no indirect, direct, or cumulative threat anticipated to natural or cultural resources; (3) The use is consistent with management of existing Pahrnagat NWR lands and would contribute to achieving Refuge goals. In particular, existing Refuge regulations would not be compromised; (4) The newly acquired lands represent a meaningful unit within which to manage the activity; and (5) There are no anticipated conflicts with priority public uses.

Public Review and Comment: Public review and comments will be solicited in conjunction with distribution of the Draft CCP/EIS for the Desert National Wildlife Refuge Complex.

Determination:

Use is Not Compatible

Use is Compatible with the Following Stipulations

Stipulations necessary to ensure compatibility:

- Regulations and wildlife friendly behavior (e.g., requirements to stay on designated trails, dogs must be kept on a leash, etc.) will be described in brochures and posted at the Visitor Contact Station(s).
- Access to the Refuge will be allowed only between sunrise and sunset.
- Regulatory and directional signs will clearly mark areas closed to the public and designated routes of travel.
- Maps and public use information will be available at the Refuge Headquarters and kiosk.
- Refuge staff will conduct regular monitoring of public activities on the Refuge. The data will be analyzed and used by the refuge manager to develop future modifications if necessary to ensure compatibility of the wildlife observation and photography programs.
- Commercial photography would require a Special Use Permit.

Justification: These wildlife-dependent uses are priority public uses of the National Wildlife Refuge System. Providing opportunities for wildlife observation and photography, would contribute toward fulfilling provisions of the National Wildlife Refuge System Administration Act, as amended in 1997, and one of the goals of the Pahrangat Refuge (Goal 3, Chapter 3, CCP). Wildlife observation and photography would provide an excellent forum for allowing public access and increasing understanding of Refuge resources. The stipulations outlined above should minimize potential impacts relative to wildlife/human interactions. Therefore, it is determined that wildlife observation and photography within the Pahrangat National Wildlife Refuge, as described herein, will not materially interfere with or detract from the purposes for which the Refuge was established or the mission of the Refuge System. In our opinion, these wildlife dependent uses will not conflict with the national policy to maintain the biological diversity, integrity, and environmental health of the refuge.

Mandatory Re-Evaluation Date:

Mandatory 15-year Re-Evaluation, Date will be provided in Final EIS/CCP (for priority public uses)

Mandatory 10-year Re-Evaluation (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

Categorical Exclusion without Environmental Action Statement

Categorical Exclusion and Environmental Action Statement

Environmental Assessment and Finding of No Significant Impact

Environmental Impact Statement and Record of Decision

References Cited

- Bowles A. E. 1995. Response of wildlife to noise. Pages 109-156. in R.L. Knight and D.N. Cole, editors. Wildlife and recreationists: coexistence through management and research. Washington, D.C., Island Press.
- Boyle, S. A. and F. B. Samson. 1985. Effects of non-consumptive recreation on wildlife: a review. Wildl. Soc. Bull. 13:110-116.
- Buckley, P. A. and F. G. Buckley. 1976. Guidelines for protection and management of colonially nesting waterbirds. North Atlantic Regional Office, National Park Service, Boston, MA. 52pp.
- Burger, J. 1981. The effect of human activity on birds at a coastal bay. Biol. Cons. 21:231-241.
- Burger, J. 1986. The effect of human activity on shorebirds in two coastal bays in northeastern United States. Biological Conservation 13:123-130.
- Burger, J. and M. Gochfeld. 1991. Human distance and birds: tolerance and response distances of resident and migrant species in India. Environ. Conserv. 18:158-165.
- Burger, J., and M. Gochfeld. 1998. Effects of ecotourists on bird behavior at Loxahatchee National Wildlife Refuge, Florida. Environmental Conservation 25:13-21.

- Burger, J., M. Gochfeld, and L. J. Niles. 1995. Ecotourism and birds in coastal New Jersey: Contrasting responses of birds, tourists, and managers. *Environmental Conservation* 22:56-65.
- Cole, D. N. and P. B. Landres. 1995. Indirect effects of recreation on wildlife. Pages 183-201 in R. L. Knight and K. J. Gutzwiller, ed. *Wildlife and Recreationists: coexistence through management and research*, Island Press, Washington, D. C. 372pp.
- Cole, D. N. and J. L. Marion. 1988. Recreation impacts in some riparian forests of the eastern United States. *Env. Manage.* 12:99-107.
- Dobb, E. 1998. Reality check: the debate behind the lens. *Audubon*: Jan.-Feb.
- Fox, A. D., and J. Madsen. 1997. Behavioural and distributional effects of hunting disturbance on waterbirds in Europe: implications for refuge design. *The Journal of Applied Ecology* 34:1-13.
- Glinski, R. L. 1976. Birdwatching etiquette: the need for a developing philosophy. *Am. Bird* 30(3):655-657.
- Gutzwiller, K. J., R. T. Wiedenmann, K. L. Clements, and S. H. Anderson. 1994. Effects on human intrusion on song occurrence and singing consistency in subalpine birds. *Auk* 111:28-37.
- Hill, D., D. Hockin, D. Price, G. Tucker, R. Morris, and J. Treweek. 1997. Bird disturbance: improving the quality and utility of disturbance research. *Journal of Applied Ecology* 34:275-288.
- Hockin, D., M. Ounsted, M. Gorman, D. Hill, V. Keller, and M. A. Barker. 1992. Examination of the effects of disturbance on birds with reference to its importance in ecological assessments. *Journal of Environmental Management* 36:253-286.
- Klein, M. 1989. Effects of high levels of human visitation on foraging waterbirds at J. N. "Ding" Darling National Wildlife Refuge, Sanibel Florida. Masters thesis. Gainesville, Florida: University of Florida.
- Klein, M. L. 1993. Waterbird behavioral responses to human disturbances. *Wildl. Soc. Bull.* 21:31-39.
- Klein, M. L., S. R. Humphrey, and H. F. Percival. 1995. Effects of ecotourism on distribution of waterbirds in a wildlife refuge. *Conservation Biology* 9:1454-1465.
- Knight, R. L. and D. N. Cole. 1995. Wildlife responses to recreationists. Pages 71-79 in R. L. Knight and K. J. Gutzwiller, ed. *Wildlife and Recreationists: coexistence through management and research*. Island Press, Washington, D. C. 372pp.
- Knight, R.L., and K. J. Gutzwiller, ed. 1995. *Wildlife and Recreationists: coexistence through management and research*. Island Press, Washington, D. C. 372pp.
- Knight, R. L. and S. A. Temple. 1995. Origin of wildlife responses to recreationists. In *Wildlife and recreation: coexistence through management and research*. R. L. Knight and K. J. Gutzwiller, eds. Island Press, Washington, D. C., pp 81-91.
- Liddle, M. J. 1975. A selective review of the ecological effects on human trampling on natural ecosystems. *Biol. Conserv.* 7:17-36.
- Madsen, J. 1995. Impacts of disturbance on migratory waterfowl. *Ibis* 137 Supplemental: S67-S74

- Miller, S. G., R. L. Knight, and C. K. Miller. 1998. Influence of recreational trails on breeding bird communities. *Ecol. Appl.* 8:162-169.
- Morton, J. M. 1995. Management of human disturbance and its effects on waterfowl. Pages F59-F86 in W. R. Whitman, T. Strange, L. Widjeskog, R. Whittemore, P. Kehoe, and L. Roberts (eds.). *Waterfowl habitat restoration, enhancement and management in the Atlantic Flyway*. Third Ed. Environmental Manage. Comm., Atlantic Flyway Council Techn. Sect., and Delaware Div. Fish and Wildl., Dover, DE. 1114pp.
- Pomerantz, G. A., D. J. Decker, G. R. Goff, and K. G. Purdy. 1988. Assessing impact of recreation on wildlife: a classification scheme. *Wildl. Soc. Bull.* 16:58-62.
- Purdy, K. G., G. R. Goff, D. J. Decker, G. A. Pomerantz, N. A. Connelly. 1987. A guide to managing human activity on National Wildlife Refuges. Office of Information Transfer, U.S. Fish and Wildlife Service, Ft. Collins, CO. 57pp.
- Reijnen, R. and R. Foppen. 1994. The effects of car traffic on breeding bird populations in woodland. I. Evidence of reduced habitat quality for willow warbler (*Pyloscopus trochilus*) breeding close to a highway. *J. Appl. Ecol* 31: 85-94.
- Rodgers, J. A., and H. T. Smith. 1997. Buffer zone distances to protect foraging and loafing waterbirds from human disturbance in Florida. *Wildlife Society Bulletin* 25:139-145.
- Smith, L. and J. D. Hunt. 1995. Nature tourism: impacts and management. Pp. 203-219 in Knight, R. L.; Gutzwiller, K. J. (Wildlife and recreationists: coexistence through management and research, eds.). Island Press, Washington, D. C.
- USFWS. 2008. Desert National Wildlife Refuge Draft Comprehensive Conservation Plan and Environmental Impact Statement. U.S. Fish and Wildlife Service, Region 8.

Refuge Determination

Refuge Manager: _____
 (Signature) _____ (Date)

Project Leader
 Approval: _____
 (Signature) _____ (Date)

Concurrence

Refuge Supervisor: _____
 (Signature) _____ (Date)

Assistant Regional
 Director - Refuges: _____
 (Signature) _____ (Date)

COMPATIBILITY DETERMINATION

Use: Environmental Education and Interpretation

Refuge Name: Pahrnagat National Wildlife Refuge (Refuge), located in Lincoln County, Nevada.

Establishing and Acquisition Authority(ies): Pahrnagat National Wildlife Refuge was established on August 16, 1963, to provide habitat for migratory birds, especially waterfowl. It encompasses 5,380 acres of marshes, open water, native grass meadows, cultivated croplands, and riparian habitat approximately 90 miles north of Las Vegas.

Refuge Purpose(s): Pahrnagat National Wildlife Refuge purpose includes:

“...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds...” (16 USC 715d).

National Wildlife Refuge System Mission: “To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans” (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-ee]).

Description of Use: The National Wildlife Refuge System Improvement Act of 1997 identifies wildlife observation, photography well as hunting, fishing, interpretation, and environmental education as priority public uses for National Wildlife Refuge System. These wildlife-dependent uses are to be encouraged when compatible with the purposes of the refuge. This compatibility determination covers both environmental education and interpretation. Many elements of environmental education and interpretation programs are also similar to opportunities provided in the wildlife observation and photography programs.

Pahrnagat NWR allows the year-round access to designated areas for environmental education and interpretation. Numerous recreational opportunities are available at Pahrnagat NWR. Wildlife observation, fishing, and hunting are the more popular activities enjoyed by Refuge visitors (USFWS 2008).

Pahrnagat NWR receives visitors from the nearby communities as well as from other states and foreign countries. Specific data on visitation are not available; however, visitation at the Refuge is expected to increase as the nearby communities grow. Based on current estimates, the Refuge accommodates approximately 30,000 visitors per year. Refuge staff estimate approximately 700 people travel to the refuge to participate in environmental education activities annually.

The Refuge provides limited facilities to support environmental education and interpretation. The Refuge administrative office currently serves as a visitor contact station with brochures, maps, and fact sheets. The office is open Monday through Friday from 8:00 a.m. to 4:00 p.m., or as staff is available. An outside contact station and interpretive kiosk is located at the north end of the Refuge just east of the dike between North Marsh and Upper Pahrnagat Lake. Vault toilets and dumpsters are also provided in this area. Parking is available in several places along designated roads. Principal public access to Pahrnagat NWR is from Highway 93, about 60 miles north of the junction with Interstate 15.

The Refuge will continue to provide environmental education and interpretation opportunities. Under Alternative D of CCP (the preferred alternative), the Service would enhance existing and provide new opportunities for environmental education and interpretation. A new visitor contact station and parking area would be constructed at the headquarters unit. Existing interpretive panels would be replaced and new panels would be developed. Environmental education and interpretive materials would also be developed including “wanted posters” for invasive plant species. Education and interpretive programs would incorporate information about traditional and/or sacred cultural resources to increase public awareness about these sensitive resources. The Service would also construct a new interpretive walking trail that connects Upper Pahrnagat Lake with the Headquarters Unit. To improve public access and awareness of the Refuge, the Service would install directional signs along Highway 93 and Interstate 15 with assistance of Nevada Department of Transportation. In addition, an interpretive plan for the refuge would be developed.

Availability of Resources: The following funding/annual costs (based on FY 2008 costs) would be required to administer and manage the activities as described above:

	One-time Costs	Annual Costs
Manage Existing Use		
Administration		\$15,000
Develop environmental education and interpretive materials	\$12,000	\$3,000
Improve/Enhance Use		
Construct and maintain new visitor contact station	\$1,000,000	\$15,000
Develop kiosk and interpretive panels	\$5,000	
Develop interpretive walking trail	\$5,000	\$500
Volunteers		\$4,000
TOTAL	\$1,019,000	\$37,500

Anticipated Impacts of Use: Once considered “non-consumptive”, it is now recognized that uses such as environmental education and interpretation can negatively impact wildlife by altering wildlife behavior, reproduction, distribution, and habitat (Purdy et al. 1987, Knight and Cole 1995).

Purdy et al. (1987) and Pomerantz et al. (1988) described six categories of impacts to wildlife as a result of visitor activities. They are:

- 1) Direct mortality: immediate, on-site death of an animal;
- 2) Indirect mortality: eventual, premature death of an animal caused by an event or agent that predisposed the animal to death;
- 3) Lowered productivity: reduced fecundity rate, nesting success, or reduced survival rate of young before dispersal from nest or birth site;
- 4) Reduced use of refuge: wildlife not using the refuge as frequently or in the manner they normally would in the absence of visitor activity;
- 5) Reduced use of preferred habitat on the refuge: wildlife use is relegated to less suitable habitat on the refuge due to visitor activity; and
- 6) Aberrant behavior/stress: wildlife demonstrating unusual behavior or signs of stress that are likely to result in reduced reproductive or survival rates.

Disturbance of wildlife is the primary concern regarding these uses. Disturbance to wildlife, such as the flushing of feeding, resting, or nesting birds, is inherent to these activities. There is some temporary disturbance to wildlife due to human activities on trails (walking, bird watching) however, the disturbance is generally localized and will not adversely impact overall populations. Increased visitation and new facilities such as the interpretive trail and visitor contact station would cause some loss of habitat and increase disturbance to some wildlife, although this is expected to be minor given the size of the Refuge and by avoiding or minimizing intrusion into important wildlife habitat.

Individual animals may be disturbed by human contact to varying degrees. Human activities on trails can result in direct effects on wildlife through harassment, a form of disturbance that can cause physiological effects, behavioral modifications, or death (Smith and Hunt 1995). Many studies have shown that birds can be impacted from human activities on trails when they are disturbed and flushed from feeding, resting, or nesting areas. Flushing, especially repetitive flushing, can strongly impact habitat use patterns of many bird species. Flushing from an area can cause birds to expend more energy, be deterred from using desirable habitat, affect resting or feeding patterns, and increase exposure to predation or cause birds to abandon sites with repeated disturbance (Smith and Hunt 1995). Migratory birds are observed to be more sensitive than resident species to disturbance (Klein 1989).

Hérons and shorebirds were observed to be the most easily disturbed (when compared to gulls, terns and ducks) by human activity and flushed to distant areas away from people (Burger 1981). A reduced number of shorebirds were found near people who were walking or jogging, and about 50 percent of flushed birds flew elsewhere (Burger 1981). In addition, the foraging time of sanderlings decreased and avoidance (e.g., running, flushing) increased as the number of humans within 100 meters increased (Burger and Gochfeld 1991). Nest predation for songbirds (Miller et al. 1998), raptors (Glinski 1976), colonial nesting species (Buckley and Buckley 1976), and waterfowl (Boyle and Samson 1985) tends to increase in areas more frequently visited by people. In addition, for many passerine species, primary song occurrence and consistency can be impacted by a single visitor (Gutzwiller et al. 1994). In areas where primary song was affected by disturbance, birds appeared to be reluctant to establish nesting territories (Reijnen and Foppen 1994).

Depending on the species (especially migrants vs. residents), some birds may habituate to some types of recreation disturbance and either are not disturbed or will immediately return after the initial disturbance (Hockin et al. 1992; Burger et al. 1995; Knight & Temple 1995; Madsen 1995; Fox & Madsen 1997). Rodgers & Smith (1997) calculated buffer distances that minimize disturbance to foraging and loafing birds based on experimental flushing distances for 16 species of waders and shorebirds. They recommended 100 meters as an adequate buffer against pedestrian traffic, however, they suggest this distance may be reduced if physical barriers (e.g., vegetation screening) are provided, noise levels are reduced, and traffic is directed tangentially rather than directly toward birds. Screening may not effectively buffer noise impacts, thus visitors should be educated on the effects of noise and noise restrictions should be enforced (Burger 1981, 1986; Klein 1993; Bowles 1995; Burger & Gochfeld 1998). Seasonally restricting or prohibiting recreation activity may be necessary during spring and fall migration to alleviate disturbance to migratory birds (Burger 1981, 1986; Boyle & Samson 1985; Klein et al. 1995; Hill et al. 1997).

Education is critical for making visitors aware that their actions can have negative impacts on birds, and will increase the likelihood that visitors will abide by restrictions on their actions. For example, Klein (1993) demonstrated that visitors who spoke with refuge staff or volunteers were less likely to disturb birds. Increased surveillance and imposed fines may help reduce visitor caused disturbance (Knight & Gutzwiller 1995). Monitoring is recommended to adjust management techniques over time, particularly because it is often difficult to generalize about the impacts of specific types of recreation in different environments. Local and site -specific knowledge is necessary to determine effects on birds and to develop effective management strategies (Hockin et al. 1992; Klein et al. 1995; Hill et al. 1997). Informed management decisions coupled with sufficient public education could do much to mitigate disturbance effects of wildlife-dependent recreations (Purdy et al 1987).

The disturbance by environmental education activities is considered to be of minimal impact because: (1) the total number of students permitted through the reservation system is limited to 100 per day; (2) students and teachers will be instructed in trail etiquette and the best ways to view wildlife with minimal disturbance; (3) education groups will be required to have a sufficient number of adults to

supervise the group; (4) trail design will provide adequate cover for wildlife; and (5) observation areas and scopes are provided to view wildlife at a distance which reduces disturbance.

Refuge staff will coordinate with biologists regarding activities associated with restoration or monitoring projects to ensure that impacts to both wildlife and habitat are minimal. As with any restoration and monitoring activities conducted by Refuge personnel, these activities conducted by students would be at a time and place where the least amount of disturbance would occur.

Public Review and Comment: Public review and comments will be solicited in conjunction with distribution of the Draft CCP/EIS for the Desert National Wildlife Refuge Complex.

Determination:

Use is Not Compatible

Use is Compatible with the Following Stipulations

Stipulations necessary to ensure compatibility:

- Participants in the Refuge's environmental education program will be restricted to established trails, the visitor contact station, and other designated sites.
- All groups using the Refuge for environmental education will be required to make reservations in advance through the Refuge office. This process, which takes the place of a Special Use Permit (SUP), allows refuge staff to manage the number and location of visitors for each unit. There is a current refuge policy that educational groups are not charged a fee or required to have a SUP. A daily limit of 100 students participating in the education program will be maintained through this reservation system. Efforts will be made to spread out use by large groups while reservations are made, reducing disturbance to wildlife and over-crowding of Refuge facilities during times of peak demand.
- Trail etiquette including ways to reduce wildlife disturbance will be discussed with teachers during orientation workshops and with students upon arrival during their welcome session. On the Refuge, the teacher(s) is responsible for ensuring that students follow required trail etiquette.
- Refuge staff will conduct regular monitoring of public activities on the refuge. The data will be analyzed and used by the refuge manager to develop future modifications if necessary to ensure compatibility of environmental education programs.
- Educational groups are required to have a sufficient number of adults to supervise their groups, a minimum of 1 adult per 12 students.
- Regulations and wildlife friendly behavior (e.g., requirements to stay on designated trails, dogs must be kept on a leash, etc.) will be described in brochures and posted at the Visitor Contact Station(s).
- Access to the Refuge will be allowed only between sunrise and sunset.
- Regulatory and directional signs will clearly mark areas closed to the public and designated routes of travel.

Justification: These wildlife-dependent uses are priority public uses of the National Wildlife Refuge System. Providing opportunities for environmental education and interpretation, would contribute toward fulfilling provisions of the National Wildlife Refuge System Administration Act, as amended in

1997, and one of the goals of the Pahrnatagat Refuge (Goal 3, Chapter 3, CCP). Environmental education and interpretation would provide an excellent forum for allowing public access and increasing understanding of Refuge resources. Environmental education and interpretation activities generally support Refuge purposes and impacts can largely be minimized (Goff et al. 1988). The minor resource impacts attributed to these activities are generally outweighed by the benefits gained by educating present and future generations about refuge resources. Environmental education is a public use management tool used to develop a resource protection ethic within society. While it targets school age children, it is not limited to this group. This tool allows us to educate refuge visitors about endangered and threatened species management, wildlife management and ecological principles and communities. A secondary benefit of environmental education is that it instills an 'ownership' or 'stewardship' ethic in visitors and most likely reduces vandalism, littering and poaching; it also strengthens service visibility in the local community.

The stipulations outlined above should minimize potential impacts relative to wildlife/human interactions. Therefore, it is determined that environmental education and interpretation within the Pahrnatagat National Wildlife Refuge, as described herein, will not materially interfere with or detract from the purposes for which the Refuge was established or the mission of the Refuge System. In our opinion, these wildlife dependent uses will not conflict with the national policy to maintain the biological diversity, integrity, and environmental health of the refuge.

Mandatory Re-Evaluation Date:

- Mandatory 15-year Re-Evaluation, Date will be provided in Final EIS/CCP (for priority public uses)
- Mandatory 10-year Re-Evaluation (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

- Categorical Exclusion without Environmental Action Statement
- Categorical Exclusion and Environmental Action Statement
- Environmental Assessment and Finding of No Significant Impact
- Environmental Impact Statement and Record of Decision

References Cited

- Bowles A. E. 1995. Response of wildlife to noise. Pages 109-156. in R.L. Knight and D.N. Cole, editors. Wildlife and recreationists: coexistence through management and research. Washington, D.C., Island Press.
- Boyle, S. A. and F. B. Samson. 1985. Effects of non-consumptive recreation on wildlife: a review. Wildl. Soc. Bull. 13:110-116.
- Buckley, P. A. and F. G. Buckley. 1976. Guidelines for protection and management of colonially nesting waterbirds. North Atlantic Regional Office, National Park Service, Boston, MA. 52pp.
- Burger, J. 1981. The effect of human activity on birds at a coastal bay. Biol. Cons. 21:231-241.

- Burger, J. 1986. The effect of human activity on shorebirds in two coastal bays in northeastern United States. *Biological Conservation* 13:123-130.
- Burger, J. and M. Gochfeld. 1991. Human distance and birds: tolerance and response distances of resident and migrant species in India. *Environ. Conserv.* 18:158-165.
- Burger, J., and M. Gochfeld. 1998. Effects of ecotourists on bird behavior at Loxahatchee National Wildlife Refuge, Florida. *Environmental Conservation* 25:13-21.
- Burger, J., M. Gochfeld, and L. J. Niles. 1995. Ecotourism and birds in coastal New Jersey: Contrasting responses of birds, tourists, and managers. *Environmental Conservation* 22:56-65.
- Fox, A. D., and J. Madsen. 1997. Behavioural and distributional effects of hunting disturbance on waterbirds in Europe: implications for refuge design. *The Journal of Applied Ecology* 34:1-13.
- Glinski, R. L. 1976. Birdwatching etiquette: the need for a developing philosophy. *Am. Bird* 30(3):655-657.
- Goff, G.R., D.J. Decker and G. Pomerantz. 1988. A diagnostic tool for analyzing visitor impacts on wildlife refuges: A basis for a systematic approach to visitor management. *Trans. Northeast Sect. Wildl. Soc.* 45:82.
- Gutzwiller, K. J., R. T. Wiedenmann, K. L. Clements, and S. H. Anderson. 1994. Effects on human intrusion on song occurrence and singing consistency in subalpine birds. *Auk* 111:28-37.
- Hill, D., D. Hockin, D. Price, G. Tucker, R. Morris, and J. Treweek. 1997. Bird disturbance: improving the quality and utility of disturbance research. *Journal of Applied Ecology* 34:275-288.
- Hockin, D., M. Ounsted, M. Gorman, D. Hill, V. Keller, and M. A. Barker. 1992. Examination of the effects of disturbance on birds with reference to its importance in ecological assessments. *Journal of Environmental Management* 36:253-286.
- Klein, M. 1989. Effects of high levels of human visitation on foraging waterbirds at J. N. "Ding" Darling National Wildlife Refuge, Sanibel Florida. Masters thesis. Gainesville, Florida: University of Florida.
- Klein, M. L. 1993. Waterbird behavioral responses to human disturbances. *Wildl. Soc. Bull.* 21:31-39.
- Klein, M. L., S. R. Humphrey, and H. F. Percival. 1995. Effects of ecotourism on distribution of waterbirds in a wildlife refuge. *Conservation Biology* 9:1454-1465.
- Knight, R. L. and D. N. Cole. 1995. Wildlife responses to recreationists. Pages 71-79 in R. L. Knight and K. J. Gutzwiller, ed. *Wildlife and Recreationists: coexistence through management and research*. Island Press, Washington, D. C. 372pp.
- Knight, R.L., and K. J. Gutzwiller, ed. 1995. *Wildlife and Recreationists: coexistence through management and research*. Island Press, Washington, D. C. 372pp.
- Knight, R. L. and S. A. Temple. 1995. Origin of wildlife responses to recreationists. In *Wildlife and recreation: coexistence through management and research*. R. L. Knight and K. J. Gutzwiller, eds. Island Press, Washington, D. C., pp 81-91.
- Madsen, J. 1995. Impacts of disturbance on migratory waterfowl. *Ibis* 137 Supplemental: S67-S74

Miller, S. G., R. L. Knight, and C. K. Miller. 1998. Influence of recreational trails on breeding bird communities. *Ecol. Appl.* 8:162-169.

Pomerantz, G. A., D. J. Decker, G. R. Goff, and K. G. Purdy. 1988. Assessing impact of recreation on wildlife: a classification scheme. *Wildl. Soc. Bull.* 16:58-62.

Purdy, K. G., G. R. Goff, D. J. Decker, G. A. Pomerantz, N. A. Connelly. 1987. A guide to managing human activity on National Wildlife Refuges. Office of Information Transfer, U.S. Fish and Wildlife Service, Ft. Collins, CO. 57pp.

Reijnen, R. and R. Foppen. 1994. The effects of car traffic on breeding bird populations in woodland. I. Evidence of reduced habitat quality for willow warbler (*Pyloscopus trochilus*) breeding close to a highway. *J. Appl. Ecol* 31: 85-94.

Rodgers, J. A., and H. T. Smith. 1997. Buffer zone distances to protect foraging and loafing waterbirds from human disturbance in Florida. *Wildlife Society Bulletin* 25:139-145.

Smith, L. and J. D. Hunt. 1995. Nature tourism: impacts and management. Pp. 203-219 in Knight, R. L.; Gutzwiller, K. J. (Wildlife and recreationists: coexistence through management and research, eds.). Island Press, Washington, D. C.

USFWS. 2008. Desert National Wildlife Refuge Draft Comprehensive Conservation Plan and Environmental Impact Statement. U.S. Fish and Wildlife Service, Region 8.

Refuge Determination

Refuge Manager:

(Signature)

(Date)

Project Leader
Approval:

(Signature)

(Date)

Concurrence

Refuge Supervisor:

(Signature)

(Date)

Assistant Regional
Director - Refuges:

(Signature)

(Date)

COMPATIBILITY DETERMINATION

Use: Hunting

Refuge Name: Pahrnagat National Wildlife Refuge (Refuge), located in Lincoln County, Nevada.

Establishing and Acquisition Authority(ies): Pahrnagat National Wildlife Refuge was established on August 16, 1963, to provide habitat for migratory birds, especially waterfowl. It encompasses 5,380 acres of marshes, open water, native grass meadows, cultivated croplands, and riparian habitat approximately 90 miles north of Las Vegas.

Refuge Purpose(s): Pahrnagat National Wildlife Refuge purpose includes:

“...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds...” (16 USC 715d).

National Wildlife Refuge System Mission: “To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans” (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-ee]).

Description of Use: Hunting is identified in the National Wildlife Refuge System Improvement Act of 1997 (16 U.S.C. 668dd-ee) as a priority use for refuges when it is compatible with the refuge purposes and mission of the Refuge System. As a result, the Service is proposing to continue to allow goose, duck, coot, moorhen, snipe, dove, quail, and rabbit hunting on approximately 900 acres of Pahrnagat Refuge. The Proposed Action (Alternative D) analyzed in the Draft Comprehensive Conservation Plan (CCP/EIS) (USFWS 2008), which is incorporated by reference, contains maps and descriptions of where hunting will be allowed on the Refuge. The hunting program will provide high quality, safe, and cost-effective hunting opportunities, and will be carried out consistent with State regulations. The guiding principles of the Refuge System’s hunting programs (Service Manual 605 FW 2) are to:

- Manage wildlife populations consistent with Refuge System-specific management plans approved after 1997 and, to the extent practicable, State fish and wildlife conservation plans;
- Promote visitor understanding of and increase visitor appreciation for America’s natural resources;
- Provide opportunities for quality recreational and educational experiences consistent with criteria describing quality found in 605 FW 1.6;
- Encourage participation in this tradition deeply rooted in America’s natural heritage and conservation history; and
- Minimize conflicts with visitors participating in other compatible wildlife-dependent recreational activities.

The Refuges’ hunting program will comply with the Code of Federal Regulations Title 50, 32.1 and be managed in accordance with Service Manual 605 FW2, Hunting.

Hunting will be permitted in accordance with State and Federal regulations and seasons (Table 1 gives an example of annual State hunt seasons for areas within the Refuges) to ensure that it will not interfere with the conservation of fish and wildlife and their habitats. Therefore, the sport hunting of migratory birds and upland game birds on the Refuges is in compliance with State regulations and seasons, the National Wildlife Refuge System Administration Act of 1966 as amended by the National Wildlife Refuge System Improvement Act of 1997 (16 U.S.C. 668dd-ee), and the Refuge Recreation Act of 1962 (16 U.S.C. 460k).

Table 1. Pahrnagat Refuge, Hunting Season Bag Limit Summary for 2006-2007

Species	Dates	Daily Bag Limits
Waterfowl – Ducks	October 14 – January 27	Up to 7 ducks; see below; possession double the bag limit*
Waterfowl – Geese	October 21 – January 28	Up to 4 geese any species; possession double the bag limit
American Coot and Common Moorhen	Concurrent with duck season	25/day, 25 in possession, either all of one species or a mixture of these species
Snipe	Concurrent with duck season	8/day; possession double the bag limit
Dove	September 1 - 30	10/day; possession double the bag limit
Quail	October 14 – January 31	10/day; possession double the bag limit
Rabbit	October 14 – February 28	10/day; possession double the bag limit

*Duck Bag Limits: 7 ducks/ but not more than 2 hen mallards, 1 pintail, 1 canvasback, 2 redhead, 3 scaup, throughout the season

Hunting is permitted on the designated portion of Pahrnagat Refuge (Figure 4.5.3 in the CCP/EIS). Hunting of waterfowl, coot, common moorhen, snipe, quail and rabbit is permitted Tuesdays, Thursday, and Saturday during hunting seasons established by the Nevada Fish and Game Commission. Dove hunting is permitted every day during the hunt season.

The Refuge has approximately 600 annual waterfowl hunting visits and 100 upland game visits each year. Field checks by refuge law enforcement officers will be planned, conducted, and coordinated with staff and other agencies to maintain compliance with regulations and assess species and number harvested. Dogs will be required to be kept on a leash, except for hunting dogs engaged in authorized hunting activities and under the immediate control of a licensed hunter.

Availability of Resources: The following funding/annual costs (based on FY 2008 costs) would be required to administer and manage hunting activities as described above:

	One-Time Costs	Annual Costs
Printing (brochures, signs, posters, etc)		0
Law Enforcement (permit compliance, access control, protection) (approx. 20 days/season)		\$5,500
Maintenance (parking lot, trash cleanup, toilet)		\$3,000
Personnel Services (managerial)		\$1,500
TOTAL		\$10,000

Anticipated Impacts of Use: Direct effects of hunting include mortality, wounding, and disturbance (De Long 2002). Hunting can alter behavior (i.e. foraging time), population structure, and distribution patterns of wildlife (Owens 1977, Raveling 1979, White-Robinson 1982, Thomas 1983, Bartelt 1987, Madsen 1985, and Cole and Knight 1990). There also appears to be an inverse relationship between the numbers of birds using an area and hunting intensity (DeLong 2002). In Connecticut, lesser scaup were observed to forage less in areas that were heavily hunted (Cronan 1957). In California, the numbers of northern pintails on Sacramento Refuge non-hunt areas increased after the first week of hunting and remained high until the season was over in early January (Heitmeyer and Raveling 1988). Following the close of hunting season, ducks generally increased their use of the hunt area; however, use was lower than before the hunting season began. Human disturbance associated with hunting includes loud noises and rapid movements, such as those produced by shotguns and boats powered by outboard motors. This disturbance, especially when repeated over a period of time, compels waterfowl to change food habits, feed only at night, lose weight, or desert feeding areas (Madsen 1995, Wolder 1993).

These impacts can be reduced by the presence of adjacent sanctuary areas where hunting does not occur, and birds can feed and rest relatively undisturbed. At Pahrnagat Refuge, Upper Pahrnagat Lake and North Marsh are the sanctuary areas. Sanctuaries or non-hunt areas have been identified as the most common solution to disturbance problems caused from hunting (Havera et. al 1992). Prolonged and extensive disturbances may cause large numbers of waterfowl to leave disturbed areas and migrate elsewhere (Madsen 1995, Paulus 1984). In Denmark, hunting disturbance effects were experimentally tested by establishing two sanctuaries (Madsen 1995). Over a 5-year period, these sanctuaries became two of the most important staging areas for coastal waterfowl. Numbers of dabbling ducks and geese increased 4 to 20 fold within the sanctuary (Madsen 1995). Thus, sanctuary and non-hunt areas are very important to minimize disturbance to waterfowl populations to ensure their continued use of the Refuges.

Intermittent hunting can be a means of minimizing disturbance, especially if rest periods in between hunting events are weeks rather than days (Fox and Madsen 1997). It is common for Refuges to manage hunt programs with non-hunt days. At Sacramento Refuge, 3-16 percent of pintails were located on hunted units during non-hunt days, but were almost entirely absent in those same units on hunt days (Wolder 1993). In addition, northern pintails, American wigeon, and northern shovelers decreased time spent feeding on days when hunting occurred on public shooting areas, as compared to non-hunt days (Heitmeyer and Raveling 1988). The intermittent hunting program of three hunt days per week at Sacramento Refuge results in lower pintail densities on hunt areas during non-hunt days than non-hunt areas (Wolder 1993). However, intermittent hunting may not always greatly reduce hunting impacts.

Hunting is a highly regulated activity, and generally takes place at specific times and seasons (fall and winter) when the game animals are less vulnerable, and other wildlife-dependent activities (e.g., wildlife observation, environmental education and interpretation) are less common, reducing the magnitude of disturbance to refuge wildlife. Managed and regulated hunting will not reduce species populations to levels where other wildlife-dependent uses will be affected.

The use of retrieving dogs would be permitted and encouraged in all areas open to waterfowl hunting. These dogs would be required to be under control at all times. Any hunter who allows his/her dog to disturb wildlife is not well received by other hunters who do not want waterfowl disturbed on the ponds that they are hunting. Law enforcement officers will enforce regulations requiring owners to maintain control over their dogs while on the Refuges. Although the use of dogs is not a form of wildlife-dependent recreation; they do in this case support a wildlife dependent use. Implementing the prescribed restrictions outlined in the Stipulations section should alleviate any substantial impacts.

Hunting is an appropriate wildlife management tool that can be used to manage wildlife populations. Some wildlife disturbance will occur during the hunting seasons. Proper zoning, regulations, and

Refuge seasons will be designated to minimize any negative impacts to wildlife populations using the Refuges. Harvesting these species, or any other hunted species, would not result in a substantial decrease in biological diversity on the Refuge.

Conflicts between hunting and other public uses will be minimized by the following:

Wildlife populations on the Refuge are able to sustain hunting and support other wildlife-dependent priority uses. To manage the populations to support hunting, the Refuge adopts harvest regulations set by the State within Federal framework guidelines.

By its very nature, hunting has very few positive effects on the target species while the activity is occurring. However, hunting can give people a deeper appreciation of wildlife and a better understanding of the importance of conserving their habitat, which ultimately contributes to fulfilling the Refuge System mission. Furthermore, despite the potential impacts of hunting, a goal of Pahrangat Refuge is to provide visitors of all ages an opportunity to enjoy wildlife-dependent recreation. Of key concern is to offer a safe and quality program and to ensure adverse impacts remain at an acceptable level.

Recreational hunting will remove individual animals, but does not negatively affect wildlife populations. To assure that populations are sustainable, the Nevada Fish and Game Commission, in consultation with the NDOW, annually review the population censuses to establish season lengths and harvest levels.

The Service believes that there will be minimal conflicts between hunters and the other wildlife-dependent recreational uses. The uses differ seasonally and are not occurring on the same area at the same time.

Public Review and Comment: Public review and comments will be solicited in conjunction with distribution of the Draft CCP/EIS for the Desert NWR Complex.

Determination:

Use is Not Compatible

Use is Compatible with the Following Stipulations

Stipulations necessary to ensure compatibility:

Refuge Specific Regulations:

- A. Migratory Game Bird Hunting. We allow hunting of goose, duck, coot, moorhen, snipe, and dove on designated areas of the refuge in accordance with State regulations subject to the following conditions:
 - 1. We allow hunting only on designated days.
 - 2. We only allow motorless boats or boats with electric motors on the refuge hunting area during the migratory waterfowl hunting season.
 - 3. You may only possess approved nontoxic shot while in the field (see Sec. 32.2(k)).
- B. Upland Game Hunting. We allow hunting of quail and rabbit on designated areas of the refuge in accordance with State regulations subject to the following conditions:
 - 1. We only allow hunting on designated days.
 - 2. Condition A3 applies.

- All hunting activities and operations will be reviewed annually to ensure compliance with all

applicable laws, regulations, and policies.

- Population censuses will be reviewed annually with the NDOW to ensure that harvest from hunting is not unacceptably impacting the targeted populations. The program will be modified accordingly.
- Refuge specific hunting information will be available via signs, information panels, and brochures
- Refuge officers will patrol, monitor, and collect data on hunting activities in the field to assure that it does not interfere with wildlife resources and other wildlife dependent uses on a weekly basis. The program will be modified accordingly.
- Non-hunting and hunting acres are physically separated.
- Hunting will be limited to occur only on Tuesday, Thursday, and Saturday during the hunt season. Exceptions are opening weekend. Dove hunting is allowed daily during the regular State season
- Boundary and hunting area signs will be maintained to clearly define the designated hunting areas.
- Allow vehicle traffic only on designated roads and parking areas.
- Parking areas will be signed and gated to allow only pedestrian access.
- The hunting program will be highly regulated and managed in strict accordance with all applicable Federal laws (Code of Federal Regulations, Title 50 subchapter C) and to the extent practicable, consistent with applicable State laws.
- Provide information about the refuge hunting program through signs, kiosks, and brochures
- No camping or tents are allowed on the Refuge

Justification: Hunting is a wildlife-dependent recreational use listed in the National Wildlife Refuge System Improvement Act. Providing a quality hunting program contributes to achieving one of the Refuge goals (Goal 3, Objective 3.1, Appendix E of the CCP). By facilitating this use on the Refuge, we will increase the visitors' knowledge and appreciation of fish and wildlife, which may lead to increased public stewardship of wildlife and their habitats on the Refuge. Increased public stewardship will support and complement the Service's actions in achieving the Refuge's purposes and the mission of the National Wildlife Refuge System.

Based upon impacts and stipulations described above, it is determined that hunting within Pahrangat National Wildlife Refuge, as described herein, will not materially interfere with or detract from the purposes for which the Refuge were established or the mission of the Refuge System.

Mandatory Re-Evaluation Date:

Mandatory 15-year Re-Evaluation, Date will be provided in Final EA/CCP (for priority public uses)

Mandatory 10-year Re-Evaluation (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

Categorical Exclusion without Environmental Action Statement

Categorical Exclusion and Environmental Action Statement

Environmental Assessment and Finding of No Significant Impact

Environmental Impact Statement and Record of Decision

References Cited

- Bartelt, G. A. 1987. Effects of disturbance and hunting on the behavior of Canada goose family groups in east central Wisconsin. *J. Wildl. Manage.* 51:517-522.
- Cole, D. N. and R. L. Knight. 1990. Impacts of recreation on biodiversity in wilderness. Utah State University, Logan, Utah.
- Cronan, J. M. 1957. Food and feeding habits of the scaups in Connecticut waters. *Auk* 74(4):459-468.
- DeLong, A. 2002. Managing Visitor Use & Disturbance of Waterbirds. A Literature Review of Impacts and Mitigation Measures.
- Fox, A. D. and J. Madsen. 1997. Behavioral and distributional effects of hunting disturbance on waterbirds in Europe: implications for refuge design. *J. Appl. Ecol.* 34:1-13.
- Havera, S. P., L. R. Boens, M. M. Georgi, and R. T. Shealy. 1992. Human disturbance of waterfowl on Keokuk Pool, Mississippi River. *Wildl. Soc. Bull.* 20:290-298.
- Heitmeyer, M. E. and D. G. Raveling. 1988. Winter resource use by three species of dabbling ducks in California. Dept. Wildlife and Fisheries Biology, Univ. of Calif., Davis. Final Report to Delta Waterfowl and Wetlands Research Center, Portage La Prairie, Manitoba, Canada. 200pp.
- Madsen, J. 1985. Impact of disturbance on field utilization of pink-footed geese in West Jutland, Denmark. *Biol. Conserv.* 33:53-63.
- Madsen, J. 1995. Impacts of disturbance on migratory waterfowl. *Ibis* 137:S67-S74.
- Owens, N. W. 1977. Responses of wintering brant geese to human disturbance. *Wildfowl* 28:5-14.
- Paulus, S.L. 1984. Activity budgets of nonbreeding gadwalls in Louisiana. *J. Wildl. Manage.* 48:371-380.
- Raveling, D. G. 1979. The annual cycle of body composition of Canada geese with special reference to control of reproduction. *Auk* 96:234-252.
- Thomas, V. G. 1983. Spring migration: the prelude to goose reproduction and a review of its implication. *In* Fourth Western Hemispheric Waterfowl and Waterbird Symposium, ed., H. Boyd. 73-81. Ottawa, Canada: Canadian Wildlife Service.
- USFWS. 2008. Desert National Wildlife Refuge Complex Draft Comprehensive Conservation Plan/Environmental Impact Statement. U.S. Fish and Wildlife Service, California/Nevada Office.
- White-Robinson, R. 1982. Inland and salt marsh feeding of wintering brant geese in Essex. *Wildfowl* 33:113-118.
- Wolder, M. 1993. Disturbance of wintering northern pintails at Sacramento National Wildlife Refuge, California. M. S. Thesis, Humboldt State Univ., Arcata. 62pp.

Refuge Determination

Refuge Manager:

(Signature)

(Date)

Project Leader
Approval:

(Signature)

(Date)

Concurrence

Refuge Supervisor:

(Signature)

(Date)

Assistant Regional
Director - Refuges:

(Signature)

(Date)

COMPATIBILITY DETERMINATION

Use: Fishing

Refuge Name: Pahrnat National Wildlife Refuge, located in Lincoln County, Nevada.

Establishing and Acquisition Authority(ies): Pahrnat National Wildlife Refuge (Refuge) was established in January 1964 under authority of the Migratory Bird Conservation Act. Additional lands were withdrawn from public domain for the Refuge by Public Land Order 3348 in March of 1964.

Refuge Purpose(s): Pahrnat National Wildlife Refuge purposes include:

“...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.” (Migratory Bird Conservation Act [16 U.S.C. 715d]) (Public Land Order 3348).

National Wildlife Refuge System Mission: “To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.” (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-ee]).

Description of Use: Fishing is identified in the National Wildlife Refuge System Improvement Act of 1997 (16 U.S.C. 668dd-ee) as a priority use for refuges when it is compatible with the refuge purposes and mission of the Refuge System. The Service is proposing to continue to allow fishing on Pahrnat Refuge. The fishing program will be carried out consistent Code of Federal Regulations Title 50, 32.5 and 32.47 and be managed in accordance with Service Manual 605 FW3, Fishing, and State of Nevada regulations. The guiding principles of the Refuge System’s fishing programs (Service Manual 605 FW 3) are to:

- A. Effectively maintain healthy and diverse fish communities and aquatic ecosystems through the use of scientific management techniques;
- B. Promote visitor understanding of, and increase visitor appreciation for, America’s natural resources;
- C. Provide opportunities for quality recreational and educational experiences consistent with criteria describing quality found in 605 FW 1.6;
- D. Encourage participation in this tradition deeply rooted in America’s natural heritage and conservation history; and
- E. Minimize conflicts with visitors participating in other compatible wildlife-dependent recreational activities.

Game fish species present in refuge waters include large-mouth bass, crappie, blue gill, catfish, and carp. The Upper Pahrnat Lake, Middle Pond, and Lower Pahrnat Lake will be open to fishing year-round. We allow both bank fishing and fishing from motorless boats or boats with electric motors in these Refuge waters. North Marsh will be open from February 2 to September 30 each year. We prohibit the use of boats, rubber rafts, or other flotation devices on the North Marsh.

In FY 2006, the Refuge received approximately 2,000 visits associated with fishing. The number of visitors is expected to increase if the populations of Alamo and the Coyote Springs Valley grow as expected.

Availability of Resources:

Limited funding and staffing would be required to manage the bank fishing on the Refuge. The U.S. Fish and Wildlife Service Nevada Zone law enforcement officer and game wardens from the Nevada Department of Wildlife (NDOW) both conduct law enforcement patrols and enforce state and federal

fishing and boating laws and regulations. Approximately \$7,500 per year is spent administering the fishing program at the Refuge.

Funding would be sought through the Service budget process. Other sources include: strengthened partnerships, grants, additional coordination with other law enforcement agencies, and additional Refuge operations. This funding will support a safe, quality public use program as described above.

Anticipated Impacts of the Use(s):

Fishing activities may also influence the composition of bird communities, as well as distribution, abundance, and productivity of waterbirds (Tydeman 1977, Burger 1981, Bouffard 1982, Bell and Austin 1985, Bordignon 1985, Edwards and Bell 1985, and Cooke 1987). Shoreline activities, such as human noise, do cause some birds to flush and go elsewhere (Klein 1993). Disturbance and destruction of riparian vegetation, bank stability, and water quality may result from high levels of bank fishing activities. Boating associated with fishing can alter bird distribution, reduce use of particular habitats or entire areas by waterfowl and other waterbirds, alter feeding behavior and nutritional status, and cause premature departure from areas (Knight and Cole 1995).

Cumulative impacts of increased use also have correlating effects on wildlife, habitat and the fisheries resource (Buckley and Buckley 1976; Glinski 1976; Miller et al. 1998; Reijnen and Foppen 1994; Smith and Hunt 1995).

Public Review and Comment: Public review and comments will be solicited in conjunction with distribution of the Draft CCP/EA for the Pahrnagat National Wildlife Refuge, expected to be released in March 2008. Comments received (including those regarding fishing) will be addressed in the Response to Comments. NDOW has determined that fish resources found within the Refuge are healthy and robust enough to support regulated fishing, complimenting the other activities available to the public in their enjoyment of their public resources.

Determination:

Use is Not Compatible

Use is Compatible with the Following Stipulations

Stipulations necessary to ensure compatibility:

- Refuge Specific Regulations: Sport Fishing. We allow sport fishing on designated areas of the refuge in accordance with State regulations subject to the following conditions:
- The North Marsh will be closed to all boating and floatation devices.
- The North Marsh will be closed to bank fishing at all times to diminish waterfowl disturbance and allow it to serve as a sanctuary for migratory waterfowl.
- Monitor fishing use to ensure that facilities are adequate and disturbance to wildlife continues to be minimal.
- Parking areas, roads, and related access facilities will be maintained as necessary to ensure public safety and to prevent erosion or habitat damage.
- Providing information in Refuge kiosks.
- Proper zoning and regulations will be designated.
- Law enforcement patrols by game wardens, and refuge officers to enforce state and federal regulations.
- Use Best Management Practices when maintaining parking areas, roads, and access facilities to prevent erosion or habitat damage.
- Providing educational information at Refuge kiosks.
- Monitor fishing activities to ensure facilities are adequate and wildlife disturbance is minimal.
- Law enforcement patrols will be conducted by game wardens, and refuge officers to enforce state and federal regulations.

- Some human disturbance of forest and shrub bird species may occur during nesting and spring/fall migration periods. Access to trails and fishing areas may be limiting during key nesting periods.
- Provide information about the Refuge fishing program by installing informational signs/kiosks, creating and distributing brochures, and utilizing the Refuge's website.
- Install public use ethics panel, including the importance of removing fishing line, not littering and displaying the "pack it in and pack it out" message at appropriate access points. .

Justification: Fishing is an appropriate wildlife-dependent recreational activity. Based upon impacts described in the Comprehensive Conservation Plan, it is determined that fishing within the Pahrangat National Wildlife Refuge will not materially interfere with or detract from the purposes for which the Refuge was established or mission of the National Wildlife Refuge System.

Fishing is a priority public use listed in the Improvement Act. By facilitating this use on the Refuge, the visitors' knowledge and appreciation of fish and wildlife will increase, which may lead to increased public stewardship of wildlife and their habitats on the Refuge. Increased public stewardship will support and complement the Service's actions in achieving the Refuge's purposes and the mission of the National Wildlife Refuge System.

Because of the number of visitors to the Refuge, this would not pose a problem and could be handled with existing staff. This program as described is determined to be compatible and will not conflict with the national policy to maintain the biological diversity, integrity, and environmental health of the refuge.

Mandatory Re-Evaluation Date:

- Mandatory 15-year Re-Evaluation, Date will be provided in Final EA/CCP (for priority public uses)
- Mandatory 10-year Re-Evaluation (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

- Categorical Exclusion without Environmental Action Statement
- Categorical Exclusion and Environmental Action Statement
- Environmental Assessment and Finding of No Significant Impact
- Environmental Impact Statement and Record of Decision

References Cited

- Bell, D.V. and L.W. Austin. 1985. The game-fishing season and its effects on overwintering wildfowl. *Biol. Conserv.* 33:65-80.
- Bordignon, L. 1985. Effetti del disturbo antropico su una popolazione di germano reale *Anas platyrhynchos*. (Effects of human disturbance on a population of mallard *Anas platyrhynchos*). *Avocetta* 9:87-88.
- Bouffard, S.H. 1982. Wildlife values versus human recreation: Ruby Lake National Wildlife Refuge. *N. Am. Wildl. Conf.* 47:553-556.

- Buckley, P. A. and F. G. Buckley. 1976. Guidelines for protection and management of colonially nesting waterbirds. North Atlantic Regional Office, National Park Service, Boston, MA. 52pp.
- Burger, J. 1981. The effect of human activity on birds at a coastal bay. *Biol. Cons.* 21:231-241.
- Cooke, A.S. 1987. Disturbance by anglers of birds at Grafham Water. *ITE Symposium* 19:15-22.
- Edwards, R.W. and D.V. Bell. 1985. Fishing in troubled waters. *New Science* 1446, 7 March: 19-21.
- Glinski, R. L. 1976. Bird watching etiquette: the need for a developing philosophy. *Am. Bird* 30(3):655-657.
- Knight, R.L. and D .N. Cole. 1995. Wildlife responses to recreationists. *in Wildlife and Recreationists* (R.L. Knight and K.J. Gutzwiller, eds.) Island Press, Covelo, California.
- Klein, M. L. 1993. Waterbird behavioral responses to human disturbances. *Wildl. Soc. Bull.* 21:31-39.
- Miller, S. G., R. L. Knight, and C. K. Miller. 1998. Influence of recreational trails on breeding bird communities. *Ecol. Appl.* 8:162-169.
- Reijnen, R. and R. Foppen. 1994. The effects of car traffic on breeding bird populations in woodland. I. Evidence of reduced habitat quality for willow warbler (*Pyloscopus trochilus*) breeding close to a highway. *J. Appl. Ecol* 31: 85-94.
- Smith, L. and J. D. Hunt. 1995. Nature tourism: impacts and management. Pp. 203-219 *in* Knight, R. L.; Gutzwiller, K. J. (Wildlife and recreationists: coexistence through management and research, eds.). Island Press, Washington, D. C.
- Tydeman, C.F. 1977. The importance of the close fishing season to breeding bird communities. *J. of Environmental Management* 5: 289-296.

Refuge Determination

Refuge Manager: _____
 (Signature) _____ (Date)

Project Leader Approval: _____
 (Signature) _____ (Date)

Concurrence

Refuge Supervisor: _____
 (Signature) _____ (Date)

Assistant Regional Director - Refuges: _____
 (Signature) _____ (Date)

COMPATIBILITY DETERMINATION

Use: Boating

Refuge Name: Pahrnagat National Wildlife Refuge, located in Lincoln County, Nevada.

Establishing and Acquisition Authority(ies): Pahrnagat National Wildlife Refuge (Refuge) was established in January 1964 under authority of the Migratory Bird Conservation Act. Additional lands were withdrawn from public domain for the Refuge by Public Land Order 3348 in March of 1964.

Refuge Purpose(s): Pahrnagat National Wildlife Refuge purposes include:

“...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.”
(Migratory Bird Conservation Act [16 U.S.C. 715d])

National Wildlife Refuge System Mission: “To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.” (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-ee]).

Description of Use: The Service plans to continue to offer recreational boating opportunities on Pahrnagat Refuge as a means of facilitating the wildlife-dependent priority public uses: hunting, fishing, and wildlife observation/photography. Both Upper and Lower Pahrnagat Lakes will be open to boating year round.

Boat ramps are currently located at the south end of Upper Pahrnagat Lake Campground and at campsite #6. Under Alternative D of the Draft CCP/EIS (the preferred alternative), the campground would be converted to a walk-in day use area. In addition, the boat ramps would be closed and converted to a car-top boat launch or a separate car-top launch site would be designated. Aside from human powered craft, only electric powered motors will be permitted. No boats with gas powered motors on board will be allowed to launch on waters of the Refuge.

Approximately 30,000 people visit Pahrnagat Refuge each year. Of those visitors, a very small percentage participates in some form of recreational boating on the Refuge. An estimated 20 boats per year are launched at Upper Pahrnagat Lake (M. Maxwell, pers. com.). Almost all the recreational boating is done in association with fishing.

Availability of Resources: Limited funding and staffing would be required to manage the boating program and could be handled with existing Refuge staff and volunteers. The U.S. Fish and Wildlife Service Nevada Zone law enforcement officer and game wardens from the Nevada Department of Wildlife (NDOW) both conduct periodic law enforcement patrols and enforce state and federal fishing and boating laws and regulations. Approximately \$7,500 per year is spent administering the boating program at the Refuge.

Anticipated Impacts of Use: Purdy et al. (1987) and Pomerantz et al. (1988) described six categories of impacts to wildlife as a result of visitor activities. They are:

- 1) Direct mortality: immediate, on-site death of an animal;
- 2) Indirect mortality: eventual, premature death of an animal caused by an event or agent that predisposed the animal to death;
- 3) Lowered productivity: reduced fecundity rate, nesting success, or reduced survival rate of young before dispersal from nest or birth site;
- 4) Reduced use of refuge: wildlife not using the refuge as frequently or in the manner they normally would in the absence of visitor activity;

- 5) Reduced use of preferred habitat on the refuge: wildlife use is relegated to less suitable habitat on the refuge due to visitor activity; and
- 6) Aberrant behavior/stress: wildlife demonstrating unusual behavior or signs of stress that are likely to result in reduced reproductive or survival rates.

Individual animals may be disturbed by human contact to varying degrees. Many studies have shown that birds can be impacted from human activities when they are disturbed and flushed from feeding, resting, or nesting areas. Flushing, especially repetitive flushing, can strongly impact habitat use patterns of many bird species. Flushing from an area can cause birds to expend more energy, be deterred from using desirable habitat, affect resting or feeding patterns, and increase exposure to predation or cause birds to abandon sites with repeated disturbance (Smith and Hunt 1995). Migratory birds are observed to be more sensitive than resident species to disturbance (Klein 1989).

Though motorized boats generally have a greater effect on wildlife, even non-motorized boat use can alter distribution, reduce use of particular habitats by waterfowl and other birds, alter feeding behavior and nutritional status, and cause premature departure from areas (Knight and Cole 1995). However, compared to motorboats, canoes and kayaks appear to have less disturbance effects on most wildlife species (Jahn and Hunt 1964, Huffman 1999, DeLong 2002) and disturbance to birds in general is reduced when boats travel at or below the 5 mph speed limit.

Hérons and shorebirds were observed to be the most easily disturbed (when compared to gulls, terns and ducks) by human activity and flushed to distant areas away from people (Burger 1981). In the Ozark National Scenic Riverway, green heron activity declined on survey routes when canoes and boat use increased on the main river channel (Kaiser and Fritzell 1984). Canoes or slow moving boats have also been observed to disturb nesting great blue herons (Vos et al. 1985).

Nest predation for songbirds (Miller et al. 1998), raptors (Glinski 1976), colonial nesting species (Buckley and Buckley 1976), and waterfowl (Boyle and Samson 1985) tends to increase in areas more frequently visited by people. In addition, for many passerine species, primary song occurrence and consistency can be impacted by a single visitor (Gutzwiller et al. 1994). In areas where primary song was affected by disturbance, birds appeared to be reluctant to establish nesting territories (Reijnen and Foppen 1994).

Depending on the species (especially migrants vs. residents), some birds may habituate to some types of recreation disturbance and either are not disturbed or will immediately return after the initial disturbance (Hockin et al. 1992; Burger et al. 1995; Knight & Temple 1995; Madsen 1995; Fox & Madsen 1997). Rodgers & Smith (1997) calculated buffer distances that minimize disturbance to foraging and loafing birds based on experimental flushing distances for 16 species of waders and shorebirds. They recommended 100 meters as an adequate buffer against pedestrian traffic, however, they suggest this distance may be reduced if physical barriers (e.g., vegetation screening) are provided, noise levels are reduced, and traffic is directed tangentially rather than directly toward birds. Screening may not effectively buffer noise impacts, thus visitors should be educated on the effects of noise and noise restrictions should be enforced (Burger 1981, 1986; Klein 1993; Bowles 1995; Burger & Gochfeld 1998). Seasonally restricting or prohibiting recreation activity may be necessary during spring and fall migration to alleviate disturbance to migratory birds (Burger 1981, 1986; Boyle & Samson 1985; Klein et al. 1995; Hill et al. 1997).

Education is critical for making visitors aware that their actions can have negative impacts on birds, and will increase the likelihood that visitors will abide by restrictions on their actions. For example, Klein (1993) demonstrated that visitors who spoke with refuge staff or volunteers were less likely to disturb birds. Increased surveillance and imposed fines may help reduce visitor caused disturbance (Knight & Gutzwiller 1995). Monitoring is recommended to adjust management techniques over time, particularly because it is often difficult to generalize about the impacts of specific types of recreation in

different environments. Local and site -specific knowledge is necessary to determine effects on birds and to develop effective management strategies (Hockin et al. 1992; Klein et al. 1995; Hill et al. 1997).

Public Review and Comment: Public review and comments will be solicited in conjunction with distribution of the Draft CCP/EIS for Desert NWRC.

Following the public review and comment period, comments and actions taken to address comments will be summarized here.

Determination:

Use is Not Compatible

Use is Compatible with the Following Stipulations

Stipulations necessary to ensure compatibility: The following stipulations are required to ensure that recreational boating is compatible:

1. Only electric powered motors will be permitted throughout Refuge waters.
2. Seasonal closures may be implemented to reduce disturbance to wintering, nesting and breeding birds and other wildlife.
3. The use of boats, rubber rafts, or other floatation devices is not permitted on the North Marsh.
4. Signs will be installed and maintained to mark closed areas on the Refuge.
5. Periodic law enforcement will help ensure compliance with regulations and area closures. Regulations will be described in brochures and posted at Refuge headquarters and at boat launch sites. Recreational boaters are required to be in compliance with all applicable Refuge, U.S. Coast Guard, and State of Nevada laws.
6. Monitoring of boating activities and associated effects on waterfowl, shorebirds, raptors and other wildlife will be conducted. Monitoring data will be used by the Refuge Manager in the periodic re-evaluation of this Compatibility Determination.

Justification: Boating itself is not considered a wildlife-dependent recreation, but many wildlife dependent recreational activities (waterfowl hunting, fishing, wildlife observation/photography, and environmental education and interpretation) are associated with boating. Providing opportunities for wildlife-dependent priority public uses would contribute toward fulfilling provisions under the National Wildlife Refuge System Administration Act as amended in 1997.

Although boating has a potential to impact wildlife, implementing the prescribed measures listed in the stipulations section will reduce many of these impacts. An adequate amount of habitat will be available to wintering and breeding waterfowl, raptors and other wetland birds because high wildlife use areas will be closed to boating during critical periods. Boating regulations will be maintained and enforced in order to minimize the impact of visitor use on wildlife and wildlife habitat. Thus, we anticipate that birds will find sufficient food resources and resting places such that their abundance and use of the Refuge will not be measurably lessened, the physiological condition and production of waterfowl and other waterbirds will not be impaired, their behavior and normal activity patterns will not be altered dramatically, and their overall status will not be impaired. The Refuge will also implement a monitoring program to help assess disturbance effects on wildlife and habitat. Improved outreach and

educational information for Refuge visitors involved in activities associated with boating would also help to reduce the impacts associated with boating activities.

Mandatory Reevaluation Date:

Mandatory 15-Year Reevaluation Date will be provided in Final EA/CCP (for priority public uses)

Mandatory 10-Year Reevaluation Date (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

Categorical Exclusion without Environmental Action Statement

Categorical Exclusion and Environmental Action Statement

Environmental Assessment and Finding of No Significant Impact

Environmental Impact Statement and Record of Decision

References Cited:

- Bowles A. E. 1995. Response of wildlife to noise. Pages 109-156. in R.L. Knight and D.N. Cole, editors. *Wildlife and recreationists: coexistence through management and research*. Washington, D.C., Island Press.
- Boyle, S. A. and F. B. Samson. 1985. Effects of non-consumptive recreation on wildlife: a review. *Wildl. Soc. Bull.* 13:110-116.
- Buckley, P. A. and F. G. Buckley. 1976. Guidelines for protection and management of colonially nesting waterbirds. North Atlantic Regional Office, National Park Service, Boston, MA. 52pp.
- Burger, J. 1981. The effect of human activity on birds at a coastal bay. *Biol. Cons.* 21:231-241.
- Burger, J. 1986. The effect of human activity on shorebirds in two coastal bays in northeastern United States. *Biological Conservation* 13:123-130.
- Burger, J. and M. Gochfeld. 1991. Human distance and birds: tolerance and response distances of resident and migrant species in India. *Environ. Conserv.* 18:158-165.
- Burger, J., and M. Gochfeld. 1998. Effects of ecotourists on bird behavior at Loxahatchee National Wildlife Refuge, Florida. *Environmental Conservation* 25:13-21.
- Burger, J., M. Gochfeld, and L. J. Niles. 1995. Ecotourism and birds in coastal New Jersey: Contrasting responses of birds, tourists, and managers. *Environmental Conservation* 22:56-65.
- DeLong, A. 2002. Managing Visitor Use & Disturbance of Waterbirds. A Literature Review of Impacts and Mitigation Measures.
- Dobb, E. 1998. Reality check: the debate behind the lens. *Audubon*: Jan.-Feb.
- Fox, A. D., and J. Madsen. 1997. Behavioural and distributional effects of hunting disturbance on waterbirds in Europe: implications for refuge design. *The Journal of Applied Ecology* 34:1-13.

- Glinski, R. L. 1976. Birdwatching etiquette: the need for a developing philosophy. *Am. Bird* 30(3):655-657.
- Gutzwiller, K. J., R. T. Wiedenmann, K. L. Clements, and S. H. Anderson. 1994. Effects on human intrusion on song occurrence and singing consistency in subalpine birds. *Auk* 111:28-37.
- Hill, D., D. Hockin, D. Price, G. Tucker, R. Morris, and J. Treweek. 1997. Bird disturbance: improving the quality and utility of disturbance research. *Journal of Applied Ecology* 34:275-288.
- Hockin, D., M. Ounsted, M. Gorman, D. Hill, V. Keller, and M. A. Barker. 1992. Examination of the effects of disturbance on birds with reference to its importance in ecological assessments. *Journal of Environmental Management* 36:253-286.
- Huffman, K. 1999. San Diego South Bay survey report-effects of human activity and water craft on wintering birds in South San Diego Bay. USFWS report.
- Jahn, L.R. and R.A. Hunt. 1964. Duck and coot ecology and management in Wisconsin. Wisconsin Conserv. Dep. Tech. Bull. No. 33. 212pp.
- Kaiser, M.S. and E.K. Fritzell. 1984. Effects of river recreationists on green-backed heron behavior. *J. Wildl. Manage.* 48: 561-567.
- Klein, M. 1989. Effects of high levels of human visitation on foraging waterbirds at J. N. "Ding" Darling National Wildlife Refuge, Sanibel Florida. Masters thesis. Gainesville, Florida: University of Florida.
- Klein, M. L. 1993. Waterbird behavioral responses to human disturbances. *Wildl. Soc. Bull.* 21:31-39.
- Klein, M. L., S. R. Humphrey, and H. F. Percival. 1995. Effects of ecotourism on distribution of waterbirds in a wildlife refuge. *Conservation Biology* 9:1454-1465.
- Knight, R. L. and D. N. Cole. 1995. Wildlife responses to recreationists. Pages 71-79 in R. L. Knight and K. J. Gutzwiller, ed. *Wildlife and Recreationists: coexistence through management and research*. Island Press, Washington, D. C. 372pp.
- Knight, R.L., and K. J. Gutzwiller, ed. 1995. *Wildlife and Recreationists: coexistence through management and research*. Island Press, Washington, D. C. 372pp.
- Knight, R. L. and S. A. Temple. 1995. Origin of wildlife responses to recreationists. In *Wildlife and recreation: coexistence through management and research*. R. L. Knight and K. J. Gutzwiller, eds. Island Press, Washington, D. C., pp 81-91.
- Liddle, M. J. 1975. A selective review of the ecological effects on human trampling on natural ecosystems. *Biol. Conserv.* 7:17-36.
- Madsen, J. 1995. Impacts of disturbance on migratory waterfowl. *Ibis* 137 Supplemental: S67-S74
- Miller, S. G., R. L. Knight, and C. K. Miller. 1998. Influence of recreational trails on breeding bird communities. *Ecol. Appl.* 8:162-169.
- Pomerantz, G. A., D. J. Decker, G. R. Goff, and K. G. Purdy. 1988. Assessing impact of recreation on wildlife: a classification scheme. *Wildl. Soc. Bull.* 16:58-62.

Purdy, K. G., G. R. Goft, D. J. Decker, G. A. Pomerantz, N. A. Connelly. 1987. A guide to managing human activity on National Wildlife Refuges. Office of Information Transfer, U.S. Fish and Wildlife Service, Ft. Collins, CO. 57pp.

Reijnen, R. and R. Foppen. 1994. The effects of car traffic on breeding bird populations in woodland. I. Evidence of reduced habitat quality for willow warbler (*Pyloscopus trochilus*) breeding close to a highway. J. Appl. Ecol 31: 85-94.

Rodgers, J. A., and H. T. Smith. 1997. Buffer zone distances to protect foraging and loafing waterbirds from human disturbance in Florida. Wildlife Society Bulletin 25:139-145.

Smith, L. and J. D. Hunt. 1995. Nature tourism: impacts and management. Pp. 203-219 in Knight, R. L.; Gutzwiller, K. J. (Wildlife and recreationists: coexistence through management and research, eds.). Island Press, Washington, D. C.

USFWS. 2008. Desert National Wildlife Refuge Draft Comprehensive Conservation Plan and Environmental Impact Statement. U.S. Fish and Wildlife Service, Region 8.

Vos, D.K., R.A. Ryder, and W.D. Graul. 1985. Response of breeding great blue herons to human disturbance in northcentral Colorado. Colonial Waterbirds 8:13-22.

Refuge Determination

Refuge Manager:

(Signature)

(Date)

Project Leader
Approval:

(Signature)

(Date)

Concurrence

Refuge Supervisor:

(Signature)

(Date)

Assistant Regional
Director - Refuges:

(Signature)

(Date)

COMPATIBILITY DETERMINATION

Use: Research

Refuge Name: Pahrnat National Wildlife Refuge, located in Lincoln County, Nevada.

Establishing and Acquisition Authority(ies): Pahrnat National Wildlife Refuge (Refuge) was established in January 1964 under authority of the Migratory Bird Conservation Act. Additional lands were withdrawn from public domain for the Refuge by Public Land Order 3348 in March of 1964.

Refuge Purpose(s): Pahrnat National Wildlife Refuge purposes include:

“...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.” 16 U.S.C. § 715d (Migratory Bird Conservation Act) (Public Land Order 3348).

National Wildlife Refuge System Mission: “To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.” (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-ee]).

Description of Use: Two provisions of the National Wildlife Refuge Improvement Act are to “maintain biological integrity, diversity and environmental health” and to conduct “inventory and monitoring.” Monitoring and research are an integral part of National Wildlife Refuge management. Plans and actions based on research and monitoring provide an informed approach, which analyzes the management affects on refuge wildlife.

When the Service receives requests to conduct scientific research at the Refuge, Special Use Permits (SUPs) are required before the use can be allowed. SUPs are only issued for monitoring and investigations which contribute to the enhancement, protection, preservation, and management of native Refuge plant and wildlife populations and their habitats. Research applicants are required to submit a proposal that outlines: (1) objectives of the study; (2) justification for the study; (3) detailed methodology and schedule; (4) potential impacts on Refuge wildlife or habitat, including disturbance (short and long term), injury, or mortality (this includes a description of measures the researcher will take to reduce disturbance or impacts); (5) research personnel required; (6) costs to Refuge, if any; and (7) progress reports and end products (i.e., reports, thesis, dissertations, publications). Research proposals are reviewed by Refuge staff and conservation partners, as appropriate. SUPs are issued by the refuge manager, if the proposal is approved.

Evaluation criteria will include, but not be limited to, the following:

- Research that will contribute to Refuge management issues and ecosystem understanding will be given higher priority over other research requests.
- Research that can be accomplished off-Refuge will be less likely to be approved.
- Research which causes undue disturbance or is intrusive will likely not be granted. Level and type of disturbance will be carefully evaluated when considering a request.
- Refuge evaluation will determine if any effort has been made to minimize disturbance through study design, including considering adjusting location, timing, scope, number of permittees, study methods, number of study sites, etc.
- If staffing or logistics make it impossible for the Refuge to monitor researcher activity in a sensitive area, the research request may be denied, depending on the specific circumstances.
- The length of the project will be considered and agreed upon before approval. Projects will be reviewed annually.

These criteria will also apply to any properties acquired in the future within the approved boundary of the Refuge.

Examples of types of research that have been permitted in the past include: nest and habitat investigations related to the productivity of southwest willow flycatchers, abundance of southwest willow flycatchers, the effects of brown-headed cowbird parasitism on southwestern willow Flycatchers, nest predation studies, spring inventory and monitoring, and yellow-billed cuckoo surveys. Use of the Refuge for research is not expected to increase substantially.

Availability of Resources: The Refuge receives approximately 2-5 research requests per year. Some special use permit requests require 4-8 hours to process, others may take as long as 20 hours, depending on the complexity of the request. Costs to administer this program average about \$500 per request.

Anticipated Impacts of Use: Possible impacts of research include disturbance to wildlife and habitat modification. Potential impacts associated with research activities would be mitigated/minimized because sufficient restrictions would be included as part of the study design and researcher activities would be monitored by Refuge staff. Due to the small number of researchers that use the Refuge and with the restrictions outlined in the stipulations section below, the impacts on migratory birds and other wildlife and their habitat are expected to be relatively minor and localized. These potential impacts are described below.

Impacts on Wildlife:

According to Knight and Cole (1991), there are three categories of wildlife responses to human disturbance: 1) avoidance; 2) habituation; and 3) attraction. The magnitude of the avoidance response may depend on a number of factors including the type, distance, movement pattern, speed, and duration of the disturbance, as well as the time of day, time of year, weather; and the animal's access to food and cover, energy demands, and reproductive status (Knight and Cole 1991; Gabrielsen and Smith 1995).

Individual animals may be disturbed by human contact to varying degrees. Many studies have shown that birds can be impacted from human activities when they are disturbed and flushed from feeding, resting, or nesting areas. Flushing, especially repetitive flushing, can strongly impact habitat use patterns of many bird species. Flushing from an area can cause birds to expend more energy, be deterred from using desirable habitat, affect resting or feeding patterns, and increase exposure to predation or cause birds to abandon sites with repeated disturbance (Smith and Hunt 1995). Migratory birds are observed to be more sensitive than resident species to disturbance (Klein 1989). Nest predation for songbirds (Miller et al. 1998), raptors (Glinski 1976), colonial nesting species (Buckley and Buckley 1976), and waterfowl (Boyle and Samson 1985) tends to increase in areas more frequently visited by people. In addition, for many passerine species, primary song occurrence and consistency can be impacted by a single visitor (Gutzwiller et al. 1994). In areas where primary song was affected by disturbance, birds appeared to be reluctant to establish nesting territories (Reijnen and Foppen 1994).

Habituation is defined as a form of learning in which individuals stop responding to stimuli that carry no reinforcing consequences for the individuals that are exposed to them (Alcock 1993). A key factor for predicting how wildlife would respond to disturbance is predictability. Gabrielsen and Smith (1995) suggest that most animals seem to have a greater defense response to humans moving unpredictably in the terrain than to humans following a distinct path.

Wildlife may also be attracted to human presence. For example, wildlife may be converted to "beggars" lured by handouts (Knight and Temple 1995), and scavengers are attracted to road kills (Rosen and Lowe 1994).

Impacts on Habitat:

Research activities could also have impacts on vegetation, soil, and/or water. However, most of these effects would be short-term because only the minimum of samples (e.g., water, soils, vegetative litter, plants, macroinvertebrates) required for identification and/or experimentation and statistical analysis would be permitted. Off trail walking by researchers could have similar effects as hikers in general who can alter habitats by trampling vegetation, compacting soil, and increasing the potential of erosion (Liddle 1975; Hendee *et al.* 1990). Soil compaction makes root penetration more difficult, making it difficult for seedlings to become established (Cole and Landres 1995). In moderate cases of soil compaction, plant cover and biomass is decreased. In highly compacted soils, plant species abundance and diversity is reduced in the long-term as only the most resistant species survive (Liddle 1975). Impacts from vegetation trampling can lower species richness, decrease ground cover and plant species density, increase weedy annuals, and induce changes in species composition (Grabherr 1983).

Public Review and Comment: Public review and comments will be solicited in conjunction with distribution of the Draft CCP/EIS for the Desert National Wildlife Refuge Complex. Comments received (including those regarding research) will be addressed in the Response to Comments.

Determination:

Use is Not Compatible

Use is Compatible with the Following Stipulations

Stipulations necessary to ensure compatibility: The criteria for evaluating a research proposal, outlined in the Description of Use section above, will be used when determining whether a proposed study will be approved on the Refuge. If proposed research methods are evaluated and determined to have potential adverse impacts on refuge wildlife or habitat, then the refuge would determine the utility and need of such research to conservation and management of refuge wildlife and habitat. If the need was demonstrated by the research permittee and accepted by the refuge, then measures to minimize potential impacts (e.g., reduce the numbers of researchers entering an area, restrict research in specified areas) would be developed and included as part of the study design and on the SUP. SUPs will contain specific terms and conditions that the researcher(s) must follow relative to activity, location, duration, seasonality, etc. to ensure continued compatibility. All Refuge rules and regulations must be followed unless otherwise accepted in writing by Refuge management.

All information, reports, data, collections, or documented sightings and observations, that are obtained as a result of this permit are the property of the Service and can be accessed by the Service at any time from the permittee at no cost. The Refuge also requires the submission of annual or final reports and any/all publications associated with the work done on the Refuge. Each SUP may have additional criteria. Each SUP will also be evaluated individually to determine if a fee will be charged and for the length of the permit.

Extremely sensitive wildlife habitat areas would be avoided unless sufficient protection from research activities (i.e., disturbance, collection, capture and handling) is implemented to limit the area and/or wildlife potentially impacted by the proposed research. Where appropriate, some areas may be temporarily/seasonally closed so that research would be permitted when impacts to wildlife and habitat are no longer a concern. Research activities will be modified to avoid harm to sensitive wildlife and habitat when unforeseen impacts arise.

Refuge staff will monitor researcher activities for potential impacts to the refuge and for compliance with conditions on the SUP. The refuge manager may determine that previously approved research and SUPs be terminated due to observed impacts. The refuge manager will also have the ability to cancel a SUP if the researcher is out of compliance with the conditions outlined in the SUP.

Justification: This program as described is determined to be compatible. Based upon impacts described above and in the Comprehensive Conservation Plan and Environmental Impact Statement (USFWS 2008), it is determined that research within the Refuge, as described herein, will not materially interfere with or detract from the purposes for which the Refuge was established or the mission of the Refuge System. Refuge monitoring and research will directly benefit and support refuge goals, objectives and management plans and activities. Fish, wildlife, plants and their habitat will improve through the application of knowledge gained from monitoring and research. Biological integrity, diversity and environmental health would benefit from scientific research conducted on natural resources at the Refuge. The wildlife-dependent, priority public uses (wildlife viewing and photography, environmental education and interpretation, fishing and hunting) would also benefit as a result of increased biodiversity and wildlife and native plant populations from improved restoration and management plans and activities associated with monitoring and research investigations which address specific restoration and management questions.

Mandatory Re-Evaluation Date:

- Mandatory 15-year Re-Evaluation (for priority public uses)
- Mandatory 10-year Re-Evaluation, Date will be provided in Final EIS/CCP (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

- Categorical Exclusion without Environmental Action Statement
- Categorical Exclusion and Environmental Action Statement
- Environmental Assessment and Finding of No Significant Impact
- Environmental Impact Statement and Record of Decision

References Cited

- Alcock, J. 1993. Animal behavior: an evolutionary approach. Fifth ed. Sinauer Assoc., Sunderland, MA. 625pp.
- Boyle, S. A. and F. B. Samson. 1985. Effects of non-consumptive recreation on wildlife: a review. Wildl. Soc. Bull. 13:110-116.
- Buckley, P. A. and F. G. Buckley. 1976. Guidelines for protection and management of colonially nesting waterbirds. North Atlantic Regional Office, National Park Service, Boston, MA. 52pp.
- Cole, D. N. and P. B. Landres. 1995. Indirect effects of recreation on wildlife. Pages 183-201 in R. L. Knight and K. J. Gutzwiller, ed. Wildlife and Recreationists: coexistence through management and research, Island Press, Washington, D. C. 372pp.
- Gabrielson, G. W. and E. N. Smith. 1995. Physiological responses of wildlife to disturbance. Pages 95-107 in R. L. Knight and K. J. Gutzwiller, ed. Wildlife and Recreationists: coexistence through management and research. Island Press, Washington, D. C. 372pp.
- Glinski, R. L. 1976. Birdwatching etiquette: the need for a developing philosophy. Am. Bird 30(3):655-657.

- Grabherr, G. 1983. Damage to vegetation by recreation in the Austrian and German Alps. Pages 74-91 in N.G. Bayfield and G.C. Barrow eds. The ecological impacts of outdoor recreation on mountain areas in Europe and North America, Rept. 9. 203pp.
- Gutzwiller, K. J., R. T. Wiedenmann, K. L. Clements, and S. H. Anderson. 1994. Effects on human intrusion on song occurrence and singing consistency in subalpine birds. *Auk* 111:28-37.
- Hendee, Jr., G.H. Stankey, and R.C. Lucas. 1990. *Wilderness Management*. North American Press, Golden, CO.
- Klein, M. 1989. Effects of high levels of human visitation on foraging waterbirds at J. N. "Ding" Darling National Wildlife Refuge, Sanibel Florida. Masters thesis. Gainesville, Florida: University of Florida.
- Knight, R. L. and D. N. Cole. 1991. Effects of recreational activity on wildlife in wildlands in *Transactions of the North American Wildlife and Natural Resources Conference*. 56:238-247.
- Knight, R. L. and S. A. Temple. 1995. Origin of wildlife responses to recreationists. In *Wildlife and recreation: coexistence through management and research*. R. L. Knight and K. J. Gutzwiller, eds. Island Press, Washington, D. C., pp 81-91.
- Liddle, M. J. 1975. A selective review of the ecological effects on human trampling on natural ecosystems. *Biol. Conserv.* 7:17-36.
- Miller, S. G., R. L. Knight, and C. K. Miller. 1998. Influence of recreational trails on breeding bird communities. *Ecol. Appl.* 8:162-169.
- Reijnen, R. and R. Foppen. 1994. The effects of car traffic on breeding bird populations in woodland. I. Evidence of reduced habitat quality for willow warbler (*Pyloscopus trochilus*) breeding close to a highway. *J. Appl. Ecol* 31: 85-94.
- Rosen, P. C. and C. H. Lowe. 1994. Highway mortality of snakes in the Sonoran Desert of southern Arizona. *Biol. Conserv.* 68:143-148.
- Smith, L. and J. D. Hunt. 1995. Nature tourism: impacts and management. Pp. 203-219 in Knight, R. L.; Gutzwiller, K. J. (*Wildlife and recreationists: coexistence through management and research*, eds.). Island Press, Washington, D. C.

Refuge Determination

Refuge Manager: _____
(Signature) (Date)

Project Leader
Approval: _____
(Signature) (Date)

Concurrence

Refuge Supervisor: _____
(Signature) (Date)

Assistant Regional
Director - Refuges:

(Signature)

(Date)

Appendix H.
Biological Resources

Vegetation

Table 1 displays a list of the sensitive plants that may occur on the refuges in the Desert National Wildlife Refuge Complex (Desert Complex). The table identifies the federal status (U.S. Fish and Wildlife Service [Service] and U.S. Bureau of Land Management [BLM]) and Nevada state status, if any. Species accounts for the federally listed species and some of the sensitive species are provided, in alphabetical order by common name, following the table.

Table 1. Sensitive Plant Species That May Occur at the Desert National Wildlife Refuge Complex

Common Name	Scientific Name	Status ¹				Refuge ²		
		FWS	NV	BLM	AHME	DEST	MOVA	PAHR
White bearpoppy	<i>Arctomecon merriamii</i>	NS	-	N	x	x		
Meadow Valley sandwort	<i>Arenaria stenomeris</i>	NS	-	-		x		
Ackerman milkvetch	<i>Astragalus ackermanii</i>	NS	-	-		x		
Sheep Mountain milkvetch	<i>Asrtragalus amphioxys</i> var. <i>musimonum</i>	NS	-	N		x		
Black woolly-pod	<i>Astragalus funereus</i>	NS	-	N		x		
Halfring milkvetch	<i>Astragalus mohavensis</i> var. <i>hemigyris</i>	NS	CE	S		x		
Nye milkvetch	<i>Astragalus nyensis</i>	NS	-	-				x
Ash Meadows milkvetch ³	<i>Astragalus phoenix</i>	T	CE	S	x			
Alkali mariposa lily	<i>Calochortus striatus</i>	NS	-	N	x			
Spring-loving centaury ³	<i>Centaurium</i> <i>namophilum</i>	T	CE	S	x			
Remote rabbitbush	<i>Chrysothamnus</i> <i>eremobius</i>	NS	-	N		x		
Virgin River thistle	<i>Cirsium virginense</i>	NS	-	-				x
Tecopa birdsbeak ³	<i>Cordylanthus tecopensis</i>	NS	-	N	x			
Ash Meadows sunray ³	<i>Enceliopsis nudicaulis</i> var. <i>corrugata</i>	T	CE	S	x			
Antelope Canyon goldenbush	<i>Ericameria cervina</i>	NS	-	-		x		
Charleston goldenbush	<i>Ericameria compacta</i>	NS	-	-		x		
Sheep fleabane	<i>Erigeron ovinus</i>	NS	-	N		x		
Darin buckwheat	<i>Eriogonum concinnum</i>	NS	-	-	x			
Clokey buckwheat	<i>Eriogonum heermanii</i> var. <i>clokeyi</i>	NS	-	N		x		
Smooth dwarf greasebush	<i>Glossopetalon pungens</i> var. <i>glabrum</i>	NS	-	N		x		
Rough dwarf greasebush	<i>Glossopetalon pungens</i> var. <i>pungens</i>	NS	-	N		x		
Ash Meadows gumplant ³	<i>Grindelia fraxino-</i> <i>pratensis</i>	T	CE	S	x			
Ash Meadows ivesia ³	<i>Ivesia kingii</i> var. <i>eremica</i>	T	CE	S	x			
Ash Meadows blazing star ³	<i>Mentzelia leucophylla</i>	T	CE	S	x			
Amargosa niterwort ³	<i>Nitrophila mohavensis</i>	E	CE	S	x			
Rosy twotone beardtongue	<i>Penstemon bicolor</i> ssp. <i>roseus</i>	NS	-	N		x		

Table 1. Sensitive Plant Species That May Occur at the Desert National Wildlife Refuge Complex

Common Name	Scientific Name	FWS	Status ¹				Refuge ²		
			NV	BLM	AHME	DEST	MOVA	PAHR	
Jaeger beardtongue	<i>Penstemon thompsoniae</i> ssp. <i>jaegeri</i>	NS	-	-			X		
Clarke phacelia	<i>Phacelia filiae</i>	NS	-	N			X		
Parish's phacelia	<i>Phacelia parishii</i>	NS	-	N	X		X		
Pygmy poreleaf	<i>Porophyllum pygmaeum</i>	NS	-	N			X		
Clokey mountain sage	<i>Salvia dorrii</i> var. <i>clokeyi</i>	NS	-	N			X		
Death Valley sage	<i>Salvia funerea</i>	NS	-	-	X				
Death Valley blue-eyed grass	<i>Sisyrinchium funereum</i>	NS	-	-	X				
Ash Meadows lady's tresses ³	<i>Spiranthes infernalis</i>	NS	-	-	X				
Charleston grounddaisy	<i>Townsendia jonesii</i> var. <i>tumulosa</i>	NS	-	N			X		

¹Status: E = Endangered

T = Threatened

NS = No Status; these species were previously considered species of concern

CE = Critically endangered

CE# = Proposed as critically endangered

N = Nevada special status species

S = Federally protected and/or protected by Nevada state law

²Refuges: AHME- Ash Meadows NWR; DEST- Desert NWR; MOVA- Moapa Valley NWR; PAHR- Pahrangat NWR

³Endemic to Refuge

Sources: Service 2006b; NNHP 2005; Otis Bay and Stevens Ecological Consulting 2006

Sensitive Species Accounts

Alkali mariposa lily (*Calochortus striatus*) is a member of the lily family (Liliaceae) (Morefield 2001). It is a perennial herb with an underground bulb and a height of 4 to 20 inches. This species has a subumbellate inflorescence with white to pale lavender flowers with a purple stripe. Preferred habitat includes moist alkaline meadows near springs in creosote bush scrub. This plant's elevation range is from 2,100 to 3,700 feet above mean sea level (msl). It is known to occur in a 13.2-mile range in Nevada and also occurs in portions of California.

Amargosa niterwort (*Nitrophila mohavensis*) is a member of the goosefoot family (Chenopodiaceae) and is a long-lived, herbaceous plant (Service 1985). It reaches a maximum height of about 3 inches and has small, bright green leaves and inconspicuous flowers. The Amargosa niterwort is found on salt-encrusted alkaline flats at the south end of Carson Slough and below Crystal Reservoir on the Ash Meadows National Wildlife Refuge (NWR). These flats are saline and alkaline sinks that occur near the terminuses of seepage from springs that are found in Ash Meadows, many miles to the north and east of Carson Slough. The niterwort's elevation range is from 2,100 to 2,160 feet above msl. This niterwort species was federally listed as endangered with associated critical habitat on May 20, 1985 (50 FR 20777). Critical habitat was designated in Inyo County, California, in Sections 5, 6, 7, and 8 of Township 25 North, Range 6 East. This designation includes 1,200 acres of salt-encrusted alkaline flats. An additional 1,360 acres were also proposed at the time of the original designation, and they were expected to be added in the near future. No final designation has been made on the additional

critical habitat. Threats to this species include off-road vehicles, mining, and groundwater depletion that has the potential to affect spring flow, which could dry up the plant's extremely restricted habitat.

Ash Meadows blazing star (*Mentzelia leucophylla*) is a member of the loasa family (Loasaceae) (Service 1985). It is a biennial or short-lived perennial plant with white stems and light yellow flowers. The number of stems varies from one to several, and they reach a height of about 20 inches. The flowers grow in broad inflorescences. This plant is endemic to Nevada and grows on upland alkaline soils found in arroyos and on knolls at an elevation range of 2,200 to 6,500 feet above msl. Ash Meadows blazing star is often associated with Ash Meadows milkvetch and Ash Meadows sunray. This blazing star species was listed as threatened with associated critical habitat on May 20, 1985 (50 FR 20777). Critical habitat was designated in four areas within Ash Meadows. This designation includes 1,240 acres of preferred habitat, which includes sandy or saline clay soils along canyon washes and on alkaline mounds in the more xeric portion of Ash Meadows. Historic populations (more than 30 years ago) have been greatly reduced due to habitat disturbance from road construction and peat mining in Carson Slough. Current threats include alteration of storm drainage patterns through arroyos, and habitat destruction in locations of proposed roads.

Ash Meadows gumplant (*Grindelia fraxino-pratensis*) is a member of the aster family (Service 1985). It is an erect biennial or perennial plant that averages 35 inches high. It has yellow flowers in heads measuring less than 0.5 inches across. This gumplant is not restricted to a specific habitat, but it primarily occurs in saltgrass meadows along streams and pools at elevations between 2,100 and 2,300 feet above msl. Other suitable habitat includes alkali clay soils in drier areas and other riparian areas where soil moisture is maintained by perched groundwater. This gumplant species was listed as threatened with associated critical habitat on May 20, 1985 (50 FR 20777). Critical habitat was designated in 14 areas within Ash Meadows in Inyo County, California, and Nye County, Nevada. This designation includes 1,968 acres of suitable habitat. An additional 40 acres of habitat in Inyo County were also proposed, but a final designation has not been made. Suitable habitat has been dramatically reduced by water diversion into pipes and concrete ditches, agricultural development, and groundwater depletion (Service 1985). Other threats to this species include mining of clay, road construction, and loss of moist habitat due to a decline in spring discharge that occurred during historical agricultural groundwater withdrawals.

Ash Meadows ivesia (*Ivesia eremica*) is a member of the rose family (Rosaceae) (Service 1985). It is a perennial plant with inflorescences and leaf tufts emerging from a woody root crown. There are only a few flowers, with 0.3-inch-long petals, on each inflorescence. This species is limited to specific soils, including light-colored clay uplands and saline seep areas at an elevation range of 2,190 to 2,300 feet above msl. Ash Meadows ivesia is endemic to Nevada. This ivesia species was listed as threatened with associated critical habitat on May 20, 1985 (50 FR 20777). Critical habitat was designated in six areas within Ash Meadows. This designation includes 880 acres of saline seep areas of light-colored clay uplands. Reasons for the decline of this species in the past have included loss of habitat due to road construction and agricultural development, including cropland development, spring alteration, and stream channelization and diversion (Service 1985). The main threat to the continued existence of this species is groundwater depletion, which can dry up ivesia habitat by decreasing spring discharge.

Ash Meadows lady's tresses (*Spiranthes infernalis*) is a member of the orchid family (Orchidaceae) (Morefield 2001). It is a tuberous perennial herb with small flowers that bloom in late spring or early summer. The flowers are yellowish-white with green at the base. This species closely resembles other species in the genus *Spiranthes*. It is limited to permanently to seasonally wet alkaline meadows and is often found near the edges of spring outflows. Associated vegetation includes creosote bush, bursage, and shadscale. The plant's elevation range is from 2,190 to 2,340 feet above msl. In Nevada, this species

is dependent on aquatic and wetland habitats, and its total population size is estimated at 1,107 individuals over 28.2 acres. It is endemic to Ash Meadows and is threatened by orchid collectors.

Ash Meadows milkvetch (*Astragalus phoenix*) is a member of the pea family (Fabaceae/ Leguminosae) (Service 1985). It is a low-matted perennial plant with pink or purple flowers on short, erect stems. The mat forms a 15- to 20-inch-wide mound, and the flowers are about one inch long. This milkvetch species was federally listed as threatened with associated critical habitat on May 20, 1985 (50 FR 20777). Critical habitat was designated in nine locations within Ash Meadows, Nye County, Nevada. This designation includes 1,200 acres of dry, hard, white, barren saline, clay flats, knolls, and slopes, which is the only suitable habitat for this plant. Its elevation range is from 2,200 to 2,380 feet above msl. Ash Meadows milkvetch is endemic to Nevada and grows in small, widely scattered populations throughout the eastern portion of the Ash Meadows NWR. The greatest decline in this species' population occurred between 1970 and 1985 due to loss of suitable habitat by farming activities. Other specific threats to the Ash Meadows milkvetch have included alterations of storm drainage patterns by road construction activities, mining on lands occupied by populations not located within Ash Meadows NWR, and elimination of individual plants during planned road construction.

Ash Meadows sunray (*Enceliopsis nudicaulis* var. *corrugata*) is a member of the aster family (Asteraceae/Compositae) (Service 1985). It is a perennial plant that grows in clumps averaging 10 inches high. The yellow flowers are borne singly on a leafless stalk and are one to 1.5 inches across. Preferred habitat is dry washes with whitish saline soil associated with outcrops of pale, hard limestone. The plant's elevation range is 2,200 to 2,360 feet above msl. This sunray species was listed as threatened with associated critical habitat on May 20, 1985 (50 FR 20777). Critical habitat was designated in nine areas within Ash Meadows. This designation includes 1,760 acres of dry washes and whitish, saline soil associated with outcrops of a pale whitish limestone. Ash Meadows sunray is a more common, endemic plant of Ash Meadows, but its population was dramatically reduced between 1970 and 1985 due to habitat loss from agricultural production, initial phases of development, and road construction. Current threats include off-road vehicles and road construction.

Death Valley sage (*Salvia funerea*) is a member of the mint family (Lamiaceae) (Morefield 2001). It is a shrub that flowers in the spring. Preferred habitat includes dry limestone cliffs, crevices, and adjacent wash gravels at an elevation range of 2,600 to 3,500 feet above msl. It typically grows in deep, sheltered canyons or on north-facing exposures, and nearby vegetation usually consists of shadscale and creosote bush. Four occurrences of this species have been mapped in Nye County, but the overall population size and range are unknown. This species also occurs in portions of California.

Parish's phacelia (*Phacelia parishii*) is a member of the waterleaf family (Hydrophyllaceae) (Morefield 2001). It is a small annual that flowers in late spring. This species grows in sparsely vegetated alkaline flats at an elevation range of 2,200 to 6,000 feet msl. Suitable habitat conditions include moist to superficially dry soils, mostly barren soils, and salt-crusts on silty-clay soils on valley bottom flats, lake deposits, and playa edges. It is often found near seepage areas and sometimes found on gypsum deposits. The dominant nearby habitat type is saltbush scrub. In Nevada, this species is dependent on wetland and aquatic habitats, and its estimated total population size is 37 million individuals over 4,600 acres. Although the population is fairly large, it is declining from historic estimates.

Nye milkvetch (*Astragalus nyensis*) is a member of the legume family (Morefield 2001). It is an annual herb that occurs at elevations between 1,100 and 5,600 feet above msl. This herb flowers in the spring and has one to four white flowers with upper petals that are tinted a faint lilac color. This plant is found on foothills of desert mountains, in calcareous outwash fans and gravelly flats, and sometimes in sandy soil. It is associated with the desert upland community in the Mojave and Great Basin Deserts. Its total estimated population is 1,126 individuals. Nye milkvetch is found in Lincoln, Nye, and Clark counties.

Spring-loving centaury (*Centaurium namophilum*) is a member of the pea family (Service 1985). It is an erect, annual plant with pink flowers that grows to a height of about 18 inches. Preferred habitat consists of moist to wet clay soils along the banks of streams or in seepage areas at an elevation range of at 2,100 to 2,350 feet above msl. The spring-loving centaury is found in similar habitat as the Ash Meadows gumplant and is often associated with this plant. This centaury species was listed as threatened with associated critical habitat on May 20, 1985 (50 FR 20777). Critical habitat was designated in 11 areas within Ash Meadows. This designation includes 1,840 acres of suitable habitat. The spring-loving centaury was historically (more than 30 years ago) found in several areas outside of Ash Meadows. As of 1973, it was considered extirpated from those areas and is now an endemic plant of Ash Meadows (Reveal et al. 1973). Reasons for the decline of this species in the past included loss of riparian habitat due to groundwater depletion, water diversion, spring alteration, peat mining in Carson Slough, and land development for agriculture and municipal facilities (Service 1985). Current threats include groundwater depletion leading to decreases in spring discharge, road construction through riparian areas, and trampling and overgrazing by horses.

Tecopa birdsbeak (*Cordylanthus tecopensis*) is a member of the figwort family (Scrophulariaceae) (Morefield 2001). It is an annual terrestrial hemiparasite that flowers in summer or early fall. This plant grows in open, moist to saturated, alkali-crusted clay soils of seeps, springs, outflow drainages, and meadows. In Nevada, this species is dependent on wetland margin areas, and its total population size is estimated at 4,379 individuals over 11.1 acres in Ash Meadows and Fishlake Valley (Nye and Esmeralda counties). This species also occurs in portions of California. Its elevation range is from 2,100 to 4,900 feet above msl.

Virgin River thistle (*Cirsium virginense*) is a member of the sunflower family (Morefield 2001). It is a spiny perennial herb that ranges from 20 to 80 inches in height. The stems are covered in white, wooly hairs, and the small, pale purple flowers bloom in late summer (June to September). This plant is found on open, moist, alkaline clay soils in seep and spring areas or on gypsum knolls. It is dependent on aquatic or wetland habitat in Nevada. This species can be found in Clark County and has a range of about 17 miles. Its Nevada population is estimated at approximately 105 individuals.

White bearpoppy (*Arctomecon merriamii*) is a member of the poppy family (Papaveraceae) (Morefield 2001). It is a flowering dicot and evergreen, perennial herb that grows on a wide variety of dry to sometimes moist basic soils, including alkaline clay and sand, gypsum, calcareous alluvial gravels, and carbonate rock outcrops. This plant's elevation range is from 2,000 to 6,280 feet above msl. Its current distribution includes Clark, Lincoln, and Nye counties in Nevada and parts of California. Past surveys have estimated a total of more than 20,000 individuals over an area of about 1,000 acres, but the plant's overall population trend is declining.

Noxious Weeds

Table 2 provides a list of the noxious weeds that may occur at each of the refuges in the Desert Complex. Some of these species are known to occur on one or more of the refuges, while others have not yet been identified. A brief description and comments on the species' growing patterns are also provided. Camelthorn is a common weed along streams and ditches (BLM 1999). Puncturevine is widespread, but is most common on farm and range land. Yellow starthistle is common along roads and in waste areas, but it can be found on various soil types. Salt cedar infests riparian areas and can cause streams, springs, and seeps to dry up. Tall whitetop can be found in wet areas, ditches, along roads, on croplands, and in waste areas (Young et al. 2005). Russian knapweed is not limited to specific habitat types, but it is typically found in disturbed areas and tends to avoid healthy, natural habitats (Carpenter and Murray 1998).

Table 2. Noxious Weeds in Southern Nevada

<i>Common Name</i>	<i>Scientific Name</i>	<i>Habit/ Duration</i> ¹	<i>Description</i>	<i>Comments</i>
Russian knapweed	<i>Acroptilon repens</i>	H/P	1–3 ft tall; cone-shaped pink or bluish flowers	Forms dense colonies in riparian areas; deeply-rooted
Camelthorn	<i>Alhagi maurorum</i>	S/P	1.5-4 ft tall; small, pealike, purplish to maroon flowers	Forms dense stands; extensive system of rhizomes
Sahara mustard	<i>Brassica tournefortii</i>	H/A	0.5-3.5 ft tall; dull yellow racemes	Relies on rain for blooming; common on wind-blown sand deposits and disturbed areas
Hoary cress	<i>Cardaria draba</i>	H/P	1-1.5 ft tall; white flat-top cluster flowers	Forms taproot; resprouts from damaged roots
Spotted knapweed	<i>Centaurea maculosa</i>	H/B	0.5-4 ft tall; purple to pink flower heads	Forms taproot; prefers well-drained, light-textured soils
Malta starthistle	<i>Centaurea melitensis</i>	H/A or B	1–2 ft tall; small, tubular yellow flowers on flower head	Grows from a taproot; common in disturbed areas
Yellow starthistle	<i>Centaurea solstitialis</i>	H/A	Up to 3 ft tall; 1-inch long stiff spines around single yellow flower heads	Forms dense, impenetrable stands; can harm horses
Leafy spurge	<i>Euphorbia esula</i>	H/P	2-3.5 ft tall; small, greenish-yellow flowers with yellow bracts	Most aggressive in dry soils; uses plant toxins to out-compete natives
Tall whitetop	<i>Lepidium latifolium</i>	H/P	1-3 ft tall; dense, white flowers in inflorescences	Grows in disturbed and wet areas; deep-seated rootstocks
White horse-nettle	<i>Solanum elaeagnifolium</i>	H/P	1-4 ft tall; blue or violet flowers with bright yellow stamens	Poisonous to livestock; crowds out native plants
Sorghum	<i>Sorghum bicolor</i>	G/P	1.5-15 ft tall; tall, grass-like plant with inflorescence and thick leaves	Poisonous to livestock; crowds out native plants
Johnson grass	<i>Sorghum halepense</i>	G/P	3–7 ft tall; bright green, 2-foot-long leaf blades; many branched flowering tops	Forms colonies in moist areas; forms underground roots and rhizomes that greatly branch
Tamarisk	<i>Tamarix parviflora</i>	T/P	10–20 ft tall; myriad of little, deep pink to white flowers	Scattered stands near ground or surface water
Salt cedar	<i>Tamarix ramosissima</i>	T/P	10–15 ft tall; myriad of little, deep pink to white flowers	Scattered stands near ground or surface water
Puncture vine	<i>Tribulus terrestris</i>	H/A	1–8 ft long stems; low-growing; solitary, bright yellow flowers; burr-like fruit	Thrives in sandy and sandy loam soils and in disturbed areas

¹Habit: G = Graminoid (grass or grass-like plant)
H = Herb/Forb (non-woody, vascular plant)
S = Shrub (multi-stemmed, woody plant, less than 15-ft tall)
T = Tree (single-stemmed, woody plant, or multi-stemmed, more than 15-ft tall)

Duration: A = Annual
B = Biennial
P = Perennial

Sources: Service 2006a; Parker 1990; Thunhorst and Swearingen 1999; Carpinelli 2003

Wildlife

This section contains a list of management priority bird species and species accounts for game species occurring on the Desert NWR, federally listed or candidate wildlife species, and birds of conservation concern that potentially occur on the refuges in the Desert Complex. Species accounts are provided in alphabetical order by common name. Table 3 provides status information for the sensitive species and identifies which refuge they may occur at. Lists of common wildlife species are also provided for each of the refuges at the end of this appendix.

Management Priority Bird Species

A variety of bird conservation plans have been developed to identify management goals for various bird species throughout the U.S., Intermountain West, and Nevada, including the North American Landbird Conservation Plan (LCP, Rich et al. 2004), Intermountain West Waterbird Conservation Plan (IWWCP, Ivey and Herziger 2005), North American Waterfowl Management Plan (WMP, Service 1986), United States Shorebird Conservation Plan (SCP, Brown et al. 2001), North American Waterbird Conservation Plan (NAWCP, Kushlan et al. 2002), Nevada Bird Plan (NBP, Nevada Partners in Flight 1999), and Nevada Wildlife Action Plan (WAP, NDOW 2005). These plans identify management priority bird species at a variety of different geographic scales. Many of the priority bird species occur on the refuges in the Desert Complex or have potential to occur based on the presence of suitable habitat. A list of these species and their status in various conservation plans is provided in Table 4. Those species shown in bold type in this table are the highest priority for the Refuge Complex. These species include:

- All Partners in Flight (PIF) Contentional Plan Watch List species with population objectives of “increase by 50 or 100 percent”
- All PIF Contentional Plan Watch List Species corroborated by concerns in the Audubon Draft Watch List
- All waterbird species categorized as moderate or high concern in the National Colonial Waterbird Conservation Plan which are also listed as high concern species in the Waterbird Conservation Plan of the Intermountain West.
- All shorebird species categorized as highly imperiled in the US Shorebird Conservation Plan.
- All waterfowl species with a a State Rank (S-Rank) of 3 (vulnerable) or less.

Table 5 summarizes which species would likely benefit for proposed restoration and/or management actions at each refuge.

Table 3. Sensitive Wildlife Species That May Occur at the Desert National Wildlife Refuge Complex

Common Name	Scientific Name	FWS	Status ¹			Refuge ²			
			NV	BLM	AHME	DEST	MOVA	PAHR	
Amphibian									
Southwestern toad	<i>Bufo microscaphus</i>	NS	SCP	N		x		x	
Relict leopard frog	<i>Rana onca</i>	C	SCP	-					x
Northern leopard frog	<i>Rana pipiens</i>	-	SCP	N					x
Reptiles									
Desert tortoise	<i>Gopherus agassizii</i>	T	SCP	S	x	x			x
Banded Gila monster	<i>Heloderma suspectum cinctum</i>	NS	SCP	S	x	x		x	x
Chuckwalla	<i>Sauromalus ater</i>	NS	SCP	N	x	x		x	x
Birds									
Northern goshawk	<i>Accipiter gentilis</i>	NS	SCP	P			x		x
Golden eagle	<i>Aquila chrysaetos</i>	-	SCP	N	x				x
Short-eared owl	<i>Asio flammeus</i>	-	SCP	N					x
Western burrowing owl	<i>Athene cunicularia hypugea</i>	BCC	SCP	P	x	x		x	x
Ferruginous hawk	<i>Buteo regalis</i>	BCC	SCP	P	x	x			x
Black tern	<i>Chlidonias niger</i>	NS	SCP	N	x	x		x	x
Yellow-billed cuckoo	<i>Coccyzus americanus</i>	BCC, C	SCP	P		x		x	x
Olive-sided flycatcher	<i>Contopus cooperi</i>	BCC	SCP	U	x	x		x	x
Yellow warbler	<i>Dendroica petechia</i>	BCC	SCP	P	x				x
Southwestern willow flycatcher	<i>Empidonax traillii extimus</i>	E	SCP	S	x			x	x
Gray flycatcher	<i>Empidonax wrightii</i>	BCC	SS	U	x	x		x	x
Peregrine falcon	<i>Falco peregrinus</i>	BCC	SCP	S	x	x			x
Common yellow throat	<i>Geothlypis trichas</i>	-	SCP	P	x				x
Blue grosbeak	<i>Guiraca caerulea</i>	NS	SS	U	x	x		x	x
Bald eagle	<i>Haliaeetus leucocephalus</i>	BCC	SCP	S	x	x			x
Least bittern	<i>Ixobrychus exilis hesperis</i>	NS	SCP	-	x	x		x	x
Osprey	<i>Pandion haliaetus</i>	-	SCP	P	x				x
American white pelican	<i>Pelecanus erythrorhynchos</i>	-	SCP	P	x				x
Phainopepla	<i>Phainopepla nitens</i>	NS	SCP	N	x	x		x	x
Summer tanager	<i>Piranga rubra</i>	NS	SS	U	x	x		x	x
White-faced ibis	<i>Plegadis chihi</i>	NS	SCP	P	x	x		x	x
Vermilion flycatcher	<i>Pyrocephalus rubinus</i>	-	-	-	x				
Yuma clapper rail	<i>Rallus longirostris yumanensis</i>	E	SCP	-	x			x	x

Table 3. Sensitive Wildlife Species That May Occur at the Desert National Wildlife Refuge Complex

Common Name	Scientific Name	FWS	Status ¹			Refuge ²			
			NV	BLM	AHME	DEST	MOVA	PAHR	
Birds, continued									
Lucy's warbler	<i>Vermivora luciae</i>	NS	SCP	U	x	x	x	x	x
Arizona Bell's vireo	<i>Vireo bellii arizonae</i>	BCC	SCP	P	x	x	x	x	x
Mammals									
Pygmy rabbit	<i>Brachylagus idahoensis</i>	NS	SCP	-					x
Townsend's big-eared bat	<i>Corynorhinus townsendii</i>	NS	SCP	N	x	x	x	x	x
Spotted bat	<i>Euderma maculatum</i>	NS	SCP	S	x	x	x	x	x
Greater western mastiff-bat	<i>Eumops perotis californicus</i>	NS	-	N	x	x	x	x	x
Allen's big-eared bat	<i>Idionycteris phyllotis</i>	NS	SCP	N	x	x	x	x	x
California leaf-nosed bat	<i>Macrotus californicus</i>	NS	SCP	N	x	x	x	x	x
Desert Valley kangaroo mouse	<i>Microdipodops megacephalus albiventer</i>	NS	SCP	-					x
Pahrnagat Valley montane vole	<i>Microtus montanus fucosus</i>	NS	SCP	N					x
Ash Meadows montane vole ^{3,4}	<i>Microtus montanus nevadensis</i>	NS	SCP	N	x				
Small-footed myotis	<i>Myotis ciliolabrum</i>	NS	SCP	N	x	x	x	x	x
Long-eared myotis	<i>Myotis evotis</i>	NS	SCP	N	x	x	x	x	x
Fringed myotis	<i>Myotis thysanodes</i>	NS	SCP	N	x	x	x	x	x
Cave myotis	<i>Myotis velifer</i>	NS	SCP	N	x	x	x	x	x
Long-legged myotis	<i>Myotis volans</i>	NS	-	N	x	x	x	x	x
Yuma myotis	<i>Myotis yumanensis</i>	NS	-	N	x	x	x	x	x
Big free-tailed bat	<i>Nyctinomops macrotis</i>	NS	SCP	N	x	x	x	x	x
Hidden Forest Uinta chipmunk	<i>Tamias umbrinus nevadensis</i>	NS	SCP	-		x			
Fish									
Moapa White River springfish ³	<i>Crenichthys baileyi moapae</i>	NS	SCP	-				x	
Devils Hole pupfish ³	<i>Cyprinodon diabolis</i>	E	SCP	S	x				
Ash Meadows Amargosa pupfish ³	<i>Cyprinodon nevadensis mionectes</i>	E	SCP	S	x				
Warm Springs Amargosa pupfish ³	<i>Cyprinodon nevadensis pectoralis</i>	E	SCP	S	x				
Pahrump poolfish	<i>Empetrichthys latos latos</i>	E	SCP	S		x			
Pahrnagat roundtail chub	<i>Gila robusta jordani</i>	E	SCP	S					x
Virgin River chub (Muddy River)	<i>Gila seminuda</i>	NS	SCP	S				x	
Moapa dace ³	<i>Moapa coriacea</i>	E	SCP	S				x	
Moapa speckled dace ³	<i>Rhinichthys osculus moapae</i>	NS	SCP	P				x	
Ash Meadows speckled dace ³	<i>Rhinichthys osculus nevadensis</i>	E	SCP	S	x				

Table 3. Sensitive Wildlife Species That May Occur at the Desert National Wildlife Refuge Complex

Common Name	Scientific Name	FWS	Status ¹				Refuge ²		
			NV	BLM	AHME	DEST	MOVA	PAHR	
Fish, continued									
Pahrnagat speckled dace	<i>Rhinichthys osculus velifer</i>	NS	SCP	P					x
Invertebrates									
Death Valley Agabus diving beetle	<i>Agabus runppi</i>	NS	-	-	x				
Ash Meadows naucorid ³	<i>Ambrysus amargosus</i>	T	-	S	x				
MacNeil sootywing skipper	<i>Hesperopsis graciae</i>	NS	-	N				x	
Nevada admiral	<i>Limenitus weidemeyerii nevadae</i>	NS	-	N		x			
Warm Springs naucorid ³	<i>Ambrysus relictus</i>	NS	-	-				x	
Amargosa naucorid	<i>Pelocoris shoshone amargosus</i>	NS	-	-	x				
Pahrnagat naucorid	<i>Pelocoris shoshone shoshone</i>	NS	-	N				x	x
Ash Meadows alkali skipperling	<i>Pseudocopaodes eunus alinea</i>	NS	-	-	x				
Moapa pebblesnail ³	<i>Pyrgulopsis avernalis</i>	NS	SCP	-				x	
Moapa Valley springsnail	<i>Pyrgulopsis carinifera</i>	NS	SCP	-				x	
Crystal Spring springsnail ³	<i>Pyrgulopsis crystalis</i>	NS	SCP	-	x				
Ash Meadows pebblesnail ³	<i>Pyrgulopsis erythropoma</i>	NS	-	-	x				
Fairbanks springsnail ³	<i>Pyrgulopsis fairbanksensis</i>	NS	SCP	-	x				
Corn Creek springsnail	<i>Pyrgulopsis fausta</i>	NS	SCP	-			x		
Elongate-gland springsnail ³	<i>Pyrgulopsis isolata</i>	NS	SCP	-	x				
Pahrnagat pebblesnail	<i>Pyrgulopsis merriami</i>	NS	SCP	N					x
Oasis Valley springsnail	<i>Pyrgulopsis micrococcus</i>	NS	SCP	N	x				
Distal-gland springsnail ³	<i>Pyrgulopsis nanus</i>	NS	SCP	-	x				
Median-gland Nevada springsnail ³	<i>Pyrgulopsis pisteri</i>	NS	SCP	-	x				
Southeast Nevada springsnail	<i>Pyrgulopsis turbatrix</i>	NS	SCP	-			x		
Devils Hole Warm Spring riffle beetle ³	<i>Stenelmis calida calida</i>	NS	-	N	x				
Moapa Warm Spring riffle beetle ³	<i>Stenelmis moapa</i>	NS	-	N				x	x
Sportinggoods tryonia ³	<i>Tryonia angulata</i>	NS	SCP	-	x				
Grated tryonia	<i>Tryonia clathrata</i>	NS	SCP	N				x	x
Point of Rocks tryonia ³	<i>Tryonia elata</i>	NS	SCP	-	x				
Minute tryonia ³	<i>Tryonia ericae</i>	NS	SCP	-	x				
Amargosa tryonia	<i>Tryonia variegata</i>	NS	SCP	-	x				

Table 3. Sensitive Wildlife Species That May Occur at the Desert National Wildlife Refuge Complex

<i>Common Name</i>	<i>Scientific Name</i>	<i>Status</i> ¹				<i>Refuge</i> ²		
		<i>FWS</i>	<i>NV</i>	<i>BLM</i>	<i>AHME</i>	<i>DEST</i>	<i>MOVA</i>	<i>PAHR</i>
Invertebrates, continued								
Virile Amargosa snail	Undescribed	-	-	-	x			
Amphipod	Undescribed	-	-	-	x			

¹Status: BCC=Bird of Conservation Concern; C=Candidate for listing under ESA; E=Endangered; N=Nevada special status species, sensitive; NS=No Status; these species were previously considered species of concern; P=proposed Nevada special status species, proposed sensitive; S=Nevada special status species, state or federal protected or federal candidate; SCP=Species of Conservation Priority; SS=Stewardship Species; T=Threatened; U=Unknown status

²Refuges: AHME- Ash Meadows NWR; DEST- Desert NWR; MOVA- Moapa Valley NWR; PAHR- Pahrangat NWR

³Endemic to Refuge

⁴Possibly extinct

Sources: Service 2006b; NNHP 2004; Service 2002a; NDOW 2005.

Table 4. Desert NWR Complex Priority Bird Species

<i>Common Name</i>	<i>Scientific Name</i>	<i>FWS</i>	<i>Global Rank</i>	<i>State Rank</i>	<i>Continental PIF Pop Objective</i>	<i>Continental PIF Status</i>	<i>Audubon Society Watch List</i>	<i>NV PIF Priority*</i>	<i>NV WAP Priority?</i>	<i>US Shorebird Conservation Plan</i>	<i>Natl Colonial Waterbird Cons Plan</i>	<i>Waterbird Cons Plan Intermtn West</i>	<i>N. American Waterfowl Management Plan Trend</i>
Waterbirds													
Eared Grebe	<i>Podiceps nigricollis</i>	BCC	G5	S4B					X		MC	HC	
Western Grebe	<i>Aechmophorus occidentalis</i>		G5	S4B					X		MC	HC	
American White Pelican	<i>Pelecanus erythrorhynchos</i>		G3	S2B				X	X		MC	HC	
Black-crowned Night-heron	<i>Nycticorax nycticorax</i>		G5	S5B							MC	MC	
Franklin's Gull	<i>Larus pipixcan</i>		G4G5	S3B					X		MC	HC	
California Gull	<i>Larus californicus</i>		G5	S5B							MC	MC	
Forster's Tern	<i>Sterna forsteri</i>		G5	S3B					X		MC	MC	
Black Tern	<i>Chlidonias niger</i>		G4	S2S3B				X	X		MC	HC	
Clark's Grebe	<i>Aechmophorus clarkii</i>		G5	S4B			R	X	X		LC		
White-faced Ibis	<i>Plegadis chihi</i>		G5	S3B				X	X		LC	HC	
Snowy Egret	<i>Egretta thula</i>		G5	S4B					X		HC	HC	
Shorebirds													
Marbled Godwit	<i>Limosa fedoa</i>	BCC	G5	S3M							HC		
Western Sandpiper	<i>Calidris mauri</i>		G5	S5M							HC		
Dunlin	<i>Calidris alpina</i>		G5	S4N							HC		
Wilson's Phalarope	<i>Phalaropus tricolor</i>		G5	S2S3B							HC		
Snowy Plover	<i>Charadrius alexandrinus</i>	BCC	G4	S3B				D	X	X	HI		
Long-billed Curlew	<i>Numenius americanus</i>	BCC	G5	S2S3B				D	X	X	HI		
Waterfowl													
American Wigeon	<i>Anas americana</i>		G5	S4B									none
Canada Goose	<i>Branta canadensis</i>		G5	S5									↑
Canvasback	<i>Aythya valisineria</i>		G5	S3					X				none
Cinnamon Teal	<i>Anas cyanoptera</i>		G5	S5B					X				none

Table 4. Desert NWR Complex Priority Bird Species

<i>Common Name</i>	<i>Scientific Name</i>	<i>FWS</i>	<i>Global Rank</i>	<i>State Rank</i>	<i>Continental PIF Pop Objective</i>	<i>Continental PIF Status</i>	<i>Audubon Society Watch List</i>	<i>NV PIF Priority*</i>	<i>NV WAP Priority?</i>	<i>US Shorebird Conservation Plan</i>	<i>Natl Colonial Waterbird Cons Plan</i>	<i>Waterbird Cons Plan Intermtn West</i>	<i>N. American Waterfowl Management Plan Trend</i>
Gadwall	<i>Anas strepera</i>		G5	S4BS5N									↑
Greater White-fronted Goose	<i>Anser albifrons</i>		G5	S4N									↑
Green-winged Teal	<i>Anas crecca</i>		G5	S4BS5N									↑
Lesser Scaup	<i>Anas crecca</i>		G5	S4NS4B									↓
Lesser snow goose	<i>Chen caerulescens</i>		G5	S4N									none
Mallard	<i>Anas platyrhynchos</i>		G5	S5									none
Northern Pintail	<i>Anas acuta</i>		G5	S5					X				↓
Northern Shoveler	<i>Anas clypeata</i>		G5	S4BS4N									↑
Redhead	<i>Aythya americana</i>		G5	S4B					X				none
Ring-necked Duck	<i>Aythya collaris</i>		G5	S4									↑
Tundra Swan	<i>Cygnus columbianus</i>		G5	S4B									↑
Wood Duck	<i>Axi sponsa</i>		G5	S4B									↑
Landbirds													
Bendire's Thrasher	<i>Toxostoma bendirei</i>	BCC	G4G5	S1	↑ 100%	WL	HC		X				
White-throated Swift	<i>Aeronautes saxatalis</i>		G5	S4B	↑ 100%	WL			X				
Pinyon Jay	<i>Gymnorhinus cyanocephalus</i>	BCC	G5	S3S4	↑ 100%	WL	D	X	X				
Arizona Bell's Vireo	<i>Vireo bellii arizonae</i>		G5T4	S2B	↑ 100%	WL	HC		X				
Southwestern Willow Flycatcher	<i>Empidonax traillii extimus</i>	BCC/E	G5T1T2	S1B	↑ 50%	WL	D	X	X				
Black-chinned Sparrow	<i>Spizella atrogularis</i>	BCC	G5	S3B	↑ 50%	WL	HC		X				
Virginia's Warbler	<i>Vermivora virginiae</i>	BCC	G5	S4B	Maint./ ↑	WL	R	X	X				
Costa's Hummingbird	<i>Calypte costae</i>	BCC	G5	S3B	Maint./ ↑	WL	R		X				
Le Conte's Thrasher	<i>Toxostoma lecontei</i>	BCC	G3	S2	Maint./ ↑	WL	R	X	X				
Lucy's Warbler	<i>Vermivora luciae</i>	BCC	G5	S2S3B	Maint./ ↑	WL	R	X	X				
Abert's Towhee	<i>Pipilo aberti</i>		G3G4	S3	Maint./ ↑	WL	R		X				

Table 4. Desert NWR Complex Priority Bird Species

<i>Common Name</i>	<i>Scientific Name</i>	<i>FWS</i>	<i>Global Rank</i>	<i>State Rank</i>	<i>Continental PIF Pop Objective</i>	<i>Continental PIF Status</i>	<i>Audubon Society Watch List</i>	<i>NV PIF Priority*</i>	<i>NV WAP Priority?</i>	<i>US Shorebird Conservation Plan</i>	<i>Natl Colonial Waterbird Cons Plan</i>	<i>Waterbird Cons Plan Intermtn West</i>	<i>N. American Waterfowl Management Plan Trend</i>
Lewis's Woodpecker	<i>Melanerpes lewis</i>	BCC	G4	S3	Maint./ ↑	WL		X	X				
Flammulated Owl	<i>Otus flammeolus</i>	BCC	G4	S4B	Maint./ ↑	WL	R	X	X				
Gray Vireo	<i>Vireo vicinior</i>	BCC	G4	S3B	Maintain	WL	R	X	X				
Gambel's Quail	<i>Callipepla gambelii</i>		G5	S5	Maintain	S							
Red-naped Sapsucker	<i>Sphyrapicus nuchalis</i>		G5	S4S5B	Maintain	S		X					
Dusky Flycatcher	<i>Empidonax oberholseri</i>		G5	S4B	Maintain	S							
Gray Flycatcher	<i>Empidonax wrightii</i>		G5	S4B	Maintain	S		X					
Verdin	<i>Auriparus flaviceps</i>		G5	S3	Maintain	S			X				
Cactus Wren	<i>Campylorhynchus brunneicapillus</i>		G5	S4	Maintain	S							
Black-tailed Gnatcatcher	<i>Polioptila melanura</i>		G5	S4	Maintain	S							
Mountain Bluebird	<i>Sialia currucoides</i>		G5	S4	Maintain	S							
Crissal Thrasher	<i>Toxostoma crissale</i>		G5	S3	Maintain	S			X				
Phainopepla	<i>Phainopepla nitens</i>		G5	S2B	Maintain	S		X	X				
Black-throated Gray Warbler	<i>Dendroica nigrescens</i>		G5	S5B	Maintain	S		X					
Green-tailed Towhee	<i>Pipilo chlorurus</i>	BCC	G5	S5B	Maintain	S							
Black-throated Sparrow	<i>Amphispiza bilineata</i>		G5	S5B	Maintain	S							
Sage Sparrow	<i>Amphispiza belli</i>	BCC	G5	S4B	Maintain	S	D	X	X				
Yellow-headed Blackbird	<i>Xanthocephalus xanthocephalus</i>		G5	S4B	Maintain	S							
Scott's Oriole	<i>Icterus parisorum</i>		G5	S4B	Maintain	S		X	X				
Peregrine Falcon	<i>Falco peregrinus</i>	BCC	G4	S2		S			X				
Western Yellow-billed Cuckoo	<i>Coccyzus americanus occidentalis</i>	BCC/C	G5T3Q	S1B									
Western Burrowing Owl	<i>Athene cunicularia hypugaea</i>		G4T4	S3B									

Table 4. Desert NWR Complex Priority Bird Species

<i>Common Name</i>	<i>Scientific Name</i>	<i>FWS</i>	<i>Global Rank</i>	<i>State Rank</i>	<i>Continental PIF Pop Objective</i>	<i>Continental PIF Status</i>	<i>Audubon Society Watch List</i>	<i>NV PIF Priority*</i>	<i>NV WAP Priority?</i>	<i>US Shorebird Conservation Plan</i>	<i>Natl Colonial Waterbird Cons Plan</i>	<i>Waterbird Cons Plan Intermtn West</i>	<i>N. American Waterfowl Management Plan Trend</i>
Code Definitions													
G1	Critically Imperiled—At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.												
G2	Imperiled—At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.												
G3	Vulnerable—At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors.												
G4	Apparently Secure—Uncommon but not rare; some cause for long-term concern due to declines or other factors.												
G5	Secure—Common; widespread and abundant.												
S1	Critically Imperiled—Critically imperiled in the nation or state/province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.												
S2	Imperiled—Imperiled in the nation or state/province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province.												
S3	Vulnerable—Vulnerable in the nation or state/province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.												
S4	Apparently Secure—Uncommon but not rare; some cause for long-term concern due to declines or other factors.												
Bold	= highest priority	↑ = increase/increasing	↓ - decrease/decreasing	WL = watch list	S = stewardship	HC = high concern	MC = moderate concern						
LC	= low concern	D = declining	R = rare										

Table 5. Priority Bird Species Benefiting from Proposed Restoration and Management Actions

Common Name	Ash Meadows NWR						Desert NWR				Moapa Valley NWR					Pahranagat NWR				
	Wet Mead ¹	Upl	Mes Bos/ Rip	Em Mar	Spr/ Chan	Des Scr	P-J	Pine	Spr/ Chan	Mes Bos/ Rip	Spr/ Chan	Rip	Mes Bos	Em Mar	Des Scr	Open Water	Em Mar	Wet Mead	Alkali Flat	Rip
Waterbirds																				
Eared Grebe				x											x	x	x			
Western Grebe				x										x	x	x				
American White Pelican															x					
Black-crowned Night-heron			x	x	x			x	x	x	x	x	x	x			x			x
Franklin's Gull				x										x			x			
California Gull				x										x	x	x				
Forster's Tern				x										x	x	x				
Black Tern				x										x	x	x				
Clark's Grebe				x										x	x	x				
White-faced Ibis	x			x										x		x	x			
Snowy Egret	x		x	x	x			x	x	x	x	x	x	x			x	x		x
Shorebirds																				
Marbled Godwit	x																			x
Western Sandpiper	x																			
Dunlin	x																			
Wilson's Phalarope	x			x											x	x	x			
Snowy Plover																				x
Long-billed curlew	x																			x
Waterfowl																				
American Wigeon	x			x	x			x		x				x			x	x		
Canada Goose	x			x										x			x	x		
Canvasback	x			x											x		x	x		
Cinnamon Teal	x			x	x			x		x				x			x	x		
Gadwall	x			x										x			x	x		
Greater White-fronted Goose	x			x													x	x		
Green-winged Teal	x			x										x			x	x		
Lesser Scaup				x											x		x			
Lesser snow goose	x			x													x	x		

Table 5. Priority Bird Species Benefiting from Proposed Restoration and Management Actions

Common Name	Ash Meadows NWR						Desert NWR				Moapa Valley NWR				Pahrnagat NWR					
	Wet Mead ¹	Upl	Mes Bos/ Rip	Em Mar	Spr/ Chan	Des Scr	P-J	Pon Pine	Spr/ Chan	Mes Bos/ Rip	Spr/ Chan	Rip	Mes Bos	Em Mar	Des Scr	Open Water	Em Mar	Wet Mead	Alkali Flat	Rip
Mallard	x			x	x				x		x			x				x	x	
Northern Pintail	x			x										x				x	x	
Northern Shoveler	x			x														x	x	
Redhead	x			x												x		x	x	
Ring-necked Duck	x			x												x		x	x	
Wood Duck			x	x	x				x		x							x		x
Landbirds																				
White-throated Swift		x					x													x
Pinyon Jay								x												
Arizona Bell's Vireo			x							x		x	x							x
Southwestern Willow Flycatcher			x							x		x	x							x
Black-chinned Sparrow							x													
Virginia's Warbler			x							x		x	x							x
Costa's Hummingbird		x	x			x				x		x	x		x					x
LeConte's Thrasher		x				x									x					
Lucy's Warbler			x							x		x	x							x
Abert's Towhee			x							x		x								x
Lewis's Woodpecker								x												x
Flammulated Owl								x												
Gray Vireo			x				x			x		x								x
Gambel's Quail		x	x			x				x		x			x				x	x
Red-naped Sapsucker			x					x		x		x								x
Dusky Flycatcher			x							x		x								x
Gray Flycatcher			x				x			x		x								x
Verdin		x	x			x				x		x	x		x					x
Cactus Wren		x				x									x					
Black-tailed Gnatcatcher		x	x			x				x		x	x		x					x
Mountain Bluebird			x				x			x										x
Crissal Thrasher			x			x									x					
Phainopepla			x							x		x	x							x

Table 5. Priority Bird Species Benefiting from Proposed Restoration and Management Actions

Common Name	Ash Meadows NWR						Desert NWR				Moapa Valley NWR				Pahranagat NWR					
	Wet Mead ¹	Upl	Mes Bos/ Rip	Em Mar	Spr/ Chan	Des Scr	P-J	Pon Pine	Spr/ Chan	Mes Bos/ Rip	Spr/ Chan	Rip	Mes Bos	Em Mar	Des Scr	Open Water	Em Mar	Wet Mead	Alkali Flat	Rip
Black-throated Gray Warbler			x				x	x		x		x	x							x
Green-tailed Towhee			x				x			x		x	x							x
Black-throated Sparrow		x				x									x					
Sage Sparrow		x				x									x					
Yellow-headed Blackbird				x										x				x		
Scott's Oriole		x	x			x	x			x		x	x		x					x
Peregrine Falcon	x	x	x	x	x	x			x	x	x	x	x	x	x			x	x	x
Western Yellow-billed Cuckoo			x							x		x	x							x
Western Burrowing Owl		x				x				x		x			x					

Sources: Rich et al. 2004, Ivey and Herziger 2005, Service 1986, Brown et al. 2001, Kushlan et al. 2002, Nevada Partners in Flight 1999, and NDOW 2005.

¹Habitats: Wet Mead=Alkali wet meadow or montane wet meadow, Upl=Native upland, Mes Bos=Mesquite bosque, Rip=Lowland riparian or riparian, Em Mar=Emergent marsh, Spr/Chan=Spring/Channel, Des Scr=Desert scrub, P-J=Pinyon-juniper woodland (prescribed burns), Pon Pine=Ponderosa pine forest (prescribed burn),

Desert NWR Big Game Species Accounts

Desert bighorn sheep are a subspecies of the bighorn sheep (*Ovis canadensis*). *O. canadensis* is a large, herbivorous ungulate that lives in open grasslands or shrub-steppe communities in mountains, foothills, or river canyons (Shackleton 1985). Escape terrain, such as cliffs and talus slopes, are a necessary habitat requirement for the bighorn sheep. During winter months, as much as 86 percent of their time is spent near escape terrain. In southern Nevada, *O. canadensis nelsoni* lives at higher elevations and moves to lower elevations during the cold winter months (Air Warfare Center 1999). This vertical migration coincides with the increasing abundance of new growth and presence of snow at higher elevations. During spring and summer, new growth begins to appear and provides food for the bighorn sheep as they return to the higher elevations.

Desert bighorn sheep are adapted to survival in the desert by being able to withstand 10 days without water (Warrick and Krausman 1989). They will eat barrel cactus to satisfy their water requirements. The mating season for desert bighorns is in the fall and may encompass several months (Shackleton 1985). Lambs are born in early spring, usually March, and are weaned in 4 to 6 months. Females live with their young, and males live apart from both during most of the year.

Desert bighorn sheep utilize habitat within the Desert NWR along all of the major mountain ranges: Pintwater, Sheep, Spotted, Desert, and Las Vegas (BLM 2001). They forage, breed, and raise young on barren cliffs along these mountain ranges. The Desert NWR is one of the largest intact blocks of habitat for the bighorn sheep in the southwestern United States. Water is a limiting resource, so 30 springs and 26 “guzzlers,” or catchments, have been improved to maintain a permanent water source. Hunting is permitted for three weeks in late fall to winter in the Spotted and Pintwater Ranges depending on the current population estimate of the herd (Air Warfare Center 1999).

Mule deer (*Odocoileus hemionus*) are herbivorous ungulates that browse on a wide variety of woody plants and graze on grasses and forbs (Anderson and Wallmo 1984). Feeding on agricultural crops and eating mushrooms in the fall are also common forage habits for mule deer. Preferred habitat types for the mule deer include coniferous forest, desert shrub, chaparral, and grasslands with shrubs. They are often associated with successional growth near agricultural fields. Precipitation patterns tend to trigger migration in mule deer.

Mating occurs in late November to mid-December, and young are born the following spring or as late as July or August in some cases (Anderson and Wallmo 1984). Litter size is 1 to 2 young and varies with the age and condition of the female. Young are usually weaned by their fourth month and depend heavily on sufficient cover to survive to adulthood. Predation by mountain lions and coyotes is a major threat to fawns.

Mule deer utilize habitat on the Desert NWR along the Pintwater Range, the Sheep Range, and the Desert Mountain Range, as well as other areas outside the Desert NWR (BLM 2001).

Sensitive Species Accounts

Arizona Bell's vireo (*Vireo bellii arizonae*) is considered a Bird of Conservation Concern by the Service. In southern Nevada, the Arizona Bell's vireo occurs along rivers and streams, in desert washes, and in mesquite bosques (NDOW 2005). The vireo's preferred habitat consists of dense undergrowth with low, shrubby vegetation. It occupies riparian areas, brushy fields, young second-growth forest or woodland, scrub oak, and mesquite woodlands. Nests are built on branches in dense bushes and small trees and occasionally in herbaceous vegetation. This bird's diet consists primarily of insects and spiders.

The **Ash Meadows Amargosa pupfish** (*Cyprinodon nevadensis mionectes*) was federally listed as endangered with critical habitat on September 2, 1983 (48 FR 40178). It is only found in ten spring areas within Ash Meadows, all of which have been designated as critical habitat (Service 1990). The pupfish's habitat ranges from large, deep springs (Crystal Pool) to small spring pools with no overflow discharge (Five Springs complex). Streamflow from several of the springs joins at some point on the Ash Meadows NWR, but many do not as a result agricultural diversions; thus habitat fragmentation has occurred. Other threats to this pupfish have included drying of springs due to pumping of groundwater, elimination of riparian vegetation, and the introduction of non-native species (e.g., crayfish, bullfrog).

The **Ash Meadows naucorid** (*Ambrysus relictus*) is an aquatic beetle that was listed as threatened with critical habitat on May 20, 1985 (50 FR 20777). The naucorid is known to exist at Point of Rocks Springs within the Ash Meadows NWR, where it occupies an extremely restricted habitat where flowing water passes over rock and pebble substrates (Service 1990). It can also be found on stones and rocky substrates in thermal swift currents (Hershler and Sada 1987). If factors threaten the naucorid, such as non-native species, the naucorid is more susceptible to extirpation given its limited distribution.

The **Ash Meadows speckled dace** (*Rhinichthys osculus nevadensis*) was federally listed as endangered with critical habitat on September 2, 1983 (48 FR 40178). It is only found in four springs on the Ash Meadows NWR: Bradford, Big, Tubbs, and Jackrabbit Springs (Service 1990). Flowing streams are the preferred habitat for the dace because they like to feed on drifting insects. Females lay eggs over stream riffles, and males fertilize them as they drift to the substrate. The dace's naturally limited range and presence of introduced species are the main threats to this species' population.

The **bald eagle** (*Haliaeetus leucocephalus*) was adopted as the United States national emblem in 1782 (Service 1999). Bald eagles are large brown raptors with wingspans up to 8 feet across. As adults, they have white heads and yellow beaks. Juveniles are brown with some white spots on their bodies and black beaks. Habitat for bald eagles consists of streams, rivers, lakes, and ponds with tall trees nearby for perching and nesting (Service 1999).

The bald eagle's range is from Alaska and southern Canada to Florida (Alaska Department of Natural Resources 2001). It is only found on the North American continent. The bald eagle was listed as endangered in most of the lower 48 states in 1973. Since then, populations have increased, and it was downlisted to threatened status in 1995. In 1999, the Service proposed that the bald eagle be de-listed, and on August 8, 2007, the bald eagle was officially de-listed (72 FR 37345-37372). Populations are considered stable in the lower 48 states with an estimate of 6,000 nesting pairs.

The **desert tortoise** (*Gopherus agassizii*) occurs in the Mojave, Colorado, and Sonoran Deserts in North America and is listed as threatened in the Mojave Desert (Berry 1997). It is most commonly found in creosote bush scrub communities in the Upper Sonoran life zones. Habitat often consists of well-drained sandy loam soils, suitable for burrowing. Tortoise burrows are typically found in washes and arroyos in the Mojave Desert.

Tortoises burrow into the ground to escape the heat in summer, rest, and find warmth in winter. They often use multiple burrows within a short time frame (about 1 week) (Berry 1997). Tortoises also have separate burrows for the winter and summer months and can be found under bushes at night. Eggs are laid in shallow depressions near or inside a burrow. Eggs are often laid in late spring/early summer and are relatively large in size, with a diameter of 30 to 40 millimeters and weight of 20 to 40 grams. Clutch size can be up to 15 eggs, but averages 3 to 7. Incubation period and size and sex of the hatchlings depend on the temperature; cooler temperatures yield longer periods and mostly larger, male hatchlings.

Desert tortoises can live more than 50 years, with juveniles reaching sexual maturity between 13 and 16 years of age (Berry 1997). Juveniles have distinct growth rings on their carapaces, and their growth rate is much higher than an adult's growth rate. At about 20 to 25 years of age, these rings begin to fade and wear out. Tortoise age can be easily determined up to this point when the vegetation growth season is known for the area. Rings are grown annually when there is only one growth season and multiple times a year for more than one season. Adult tortoises have a 20- to 36-centimeter-long carapace, and males are larger than females. Males can also be distinguished by their longer gular shield and larger chin glands on both sides of the lower jaw.

The desert tortoise's range on the North American continent is in the southwestern United States and northwestern Mexico at elevations typically lower than 4,000 feet above msl. Populations are generally stable in Arizona, but they are declining in other areas. Destruction of habitat is the main reason for their decline, but other factors such as disease and mortality caused by humans also contribute to the decrease in tortoise populations in the Southwest.

The final rule for critical habitat for the Mojave Desert population was made in 1994, but it is subject to change if the need arises from future management plans. This ruling used 14 Desert Wildlife Management Areas determined by the Desert Tortoise Recovery Plan as the basis for critical habitat units and designated approximately 10,000 square miles of critical habitat (Berry 1997). These areas contain ideal habitat for the desert tortoise and help divide the populations into smaller areas, so they can be monitored more easily. The desert tortoise population on the Desert NWR is part of the Northeastern Mojave Desert Recovery Unit. All of the Desert NWR is located within the Coyote Spring Desert Wildlife Management Area. The desert tortoise has also been detected in the Pahranaagat Valley foothills and likely occurs on Pahranaagat NWR (Manville 2007).

The **Devils Hole pupfish** (*Cyprinodon diabolis*) was listed as endangered by the Service on March 11, 1967 (32 FR 4001). It was also listed as critically endangered by the State of Nevada on January 1, 1969 (Service 1980). Devils Hole is the only natural habitat for this species, so it was designated as a detached part of Death Valley National Monument on January 17, 1952, in order to protect the fish.

Devils Hole is the opening to a deep, water-filled limestone cavern, and it is the smallest habitat in the world containing the entire population of a vertebrate species (Service 1980). The segment of the water table that is exposed to sunlight measures approximately 10 by 70 feet, and it is this area that the pupfish use for feeding and reproduction. As water level declined in the late 1960s and early 1970s due to groundwater pumping for irrigation, less area was exposed to sunlight, limiting habitat for the pupfish. A minimum water level was established in the late 1970s to ensure the survival of this species by maintaining its only natural habitat.

Two refugia were established in the 1970s and 1980s to support additional populations of Devils Hole pupfish (Service 1980). One of the refugia was located at Hoover Dam and was constructed by the U.S. Bureau of Reclamation. The second alternate population was started at Amargosa Pupfish Station on Ash Meadows NWR. The objective of the pupfish's recovery plan is to down-list the fish from endangered to threatened and manage it as such in its natural habitat. Nearby groundwater pumping has been halted, but more recent threats to the pupfish in its natural habitat include habitat degradation from surface runoff, vandalism, accidents, and impacts associated with major land use changes in the surrounding area.

The **ferruginous hawk** (*Buteo regalis*) is considered a Bird of Conservation Concern by the Service. It occurs throughout Nevada and is a year-round resident in southern Nevada (NDOW 2005). Ferruginous hawks occur in montane shrublands, open land, and lower montane woodlands. Nests are

primarily built in live Utah juniper trees, but some nests have been observed on hills, banks, tall trees, or other tall structures. The breeding and nesting period is generally late February to early October.

The **Moapa dace** (*Moapa coriacea*) was federally listed as endangered under the Endangered Species Preservation Act of 1966 on March 11, 1967 (32 FR 4001), and has been protected under the ESA since its inception in 1973.

The Moapa dace is unique because it is the only representative of the genus *Moapa* (Service 1983). Its habitat is restricted to the headwaters of the Muddy River where water temperatures occur in the narrow range between 82° and 90°F. The dace does not extend beyond the headwater springs because further from the spring orifice, the water becomes cooler and more silty. Currently, the dace's distribution is even more restricted to portions of three springs and less than 2 miles of streams in the Warm Springs area. The remainder of the spring system has been invaded by tilapia (*Oreochromis aurea*), a non-native fish, and made unsuitable for the dace by other habitat modifications (Service 1996).

Moapa dace habitat is managed under the Moapa Dace Recovery Plan (Service 1983) and the Recovery Plan for the Rare Aquatic Species of the Muddy River Ecosystem (Service 1996). Attempts to transplant this species into waters of two other habitats failed. During a snorkel survey conducted in January 2001, 935 Moapa dace were recorded in the Muddy River and its tributaries (Heinrich 2001). Of those observed during the survey, 580 dace were on the Pedersen Unit and 59 were on the Plummer Unit. The population of this species was estimated at 1,000 individuals in 2002, which declined from 4,000 in 1995 after the invasion of the tilapia (*Oreochromis aureus*) (Scoppettone 2002). More recent snorkel surveys in 2007 reported 1,172 Moapa dace in the Muddy River and its tributaries. Of those observed during the 2007 surveys, 565 Moapa dace were located at the Moapa Valley NWR (Goodchild 2007). Reasons for decline in dace populations include competition with shortfin molly and other introduced species and destruction and modification of habitat; efforts to remove introduced species and improve habitat have allowed the dace population to increase.

The **Pahranagat roundtail chub** (*Gila robusta jordani*) is a subspecies of the roundtail chub (*G. robusta*) in the Colorado River system (Service 1998). The Pahranagat roundtail chub is greenish in color with black blotches and reaches a total length of approximately 10 inches. Historically, the Pahranagat roundtail chub was found in streams, creeks, and ditches throughout the Pahranagat Valley. In 1997, the population was estimated to contain 150 to 260 adults. It is restricted to the Ash Spring outflow, including a portion of Pahranagat Creek and an irrigation ditch, in the Pahranagat Valley (NDOW 2005).

The Pahranagat roundtail chub was listed as endangered in October 1970 (35 FR 16047). Recovery criteria for the Pahranagat roundtail chub include improved habitat within the Pahranagat Creek and Ditch and along the outflow stream of Crystal Spring, reduced impacts to the species such that they no longer threaten the fish, and establishment of a self-sustaining population in the Crystal Spring outflow stream and Pahranagat Creek/Ditch (Service 1998).

The **Pahrump poolfish** (*Empetrichthys latos*), also known as the Pahrump killifish, is a small, slender, omnivorous fish about 2 inches long (Service 1993). It spawns in spring, but may spawn during any time of the year under proper conditions. The poolfish is a thermal species that can be found in warm springs with little fluctuation in temperature. Their tolerant range is between 74 and 77 degrees Fahrenheit. The Pahrump poolfish is native to Manse Springs in Pahrump Valley. In 1975 its habitat was dessicated due to groundwater pumping.

The Pahrump poolfish was listed as endangered in March 1967, but in 1993, it was proposed for reclassification as threatened (Service 1993). As of 1993, it was found in Nevada at only three sites where the populations had to be introduced. Two were outside of Las Vegas: one in the Spring Mountains and one on the Desert NWR. The third was in Shoshone Springs outside of Ely. Corn Creek Springs on the Desert NWR was home to one of the populations that was introduced in the 1970s. The Spring Mountain Ranch State Park population was established in an irrigation reservoir after the species became extirpated from its natural home. Non-native species forced the poolfish out of the population in Corn Creek Springs during the last 10 years. Bullfrogs and crayfish out-competed the poolfish, but in June 2003, it was reintroduced to a refugium at Corn Creek.

The **peregrine falcon** (*Falco peregrinus*) is considered a Bird of Conservation Concern by the Service. It occurs throughout Nevada as a permanent resident (NDOW 2005). Peregrine falcons occur in open areas, developed areas, marsh habitat, and in or near cliffs and canyons. This species nests on rocky cliff faces or ledges and forages in farmland, developed areas, along rivers, and in marshes. Nests are typically found on ledges with a sheltering overhang. The breeding and nesting period is generally late April to early September.

The **southwestern willow flycatcher** (*Empidonax traillii extimus*) was listed as endangered on February 27, 1995 (60 FR 10693), and critical habitat was designated on October 19, 2005 (70 FR 60885). The critical habitat designation includes 120,824 acres or 737 miles of suitable habitat along several streams and rivers in California, Arizona, Nevada, Utah, and New Mexico (Service 1997). This flycatcher subspecies nests in dense, riparian woodlands with trees averaging 13 to 23 feet tall. Common species associated with flycatcher habitat include willow, seep willow, boxelder (*Acer negundo*), stinging nettle (*Urtica* spp.), blackberry (*Rubus* spp.), cottonwood, and arrowweed (*Tessaria sericea*) (Service 2002b). Riparian habitat in the Southwest has, however, declined dramatically over the past 100 years, and this loss of habitat has been a major threat to flycatcher populations.

The southwestern willow flycatcher is only found in six states in the southwestern U.S. (Finch and Stoleson 2000). During winter months it can be found in Central America. A survey of flycatcher populations between 1993 and 1996 estimated less than 1,000 individuals in the U.S. New Mexico had the most abundant population with around 300 individuals. Only three individuals were estimated to occur in Nevada according to surveys conducted between 1993 and 1996 (Finch and Stoleson 2000). The flycatcher is known to occur at Ash Meadows NWR, and resident and/or breeding individuals have been reported on the Refuge since 1999 (NDOW 2007). It may also occur at Moapa Valley NWR because it has been observed along the Muddy River, near its confluence with the Colorado River. Surveys are conducted annually at Pahrangat NWR. In 2005, 37 adult southwestern willow flycatchers were detected in the riparian habitats on the refuge with 11 breeding individuals, and 21 nestlings were observed at 7 nest sites (Koronkiewicz et.al 2006). Preliminary data for 2006 surveys estimate 34 adult flycatchers with 15 breeding pairs (McLeod 2006).

Habitat loss and brood parasitism are the common causes of the decline of this subspecies (Finch and Stoleson 2000). The brown-headed cowbird (*Molothrus ater*) often lays its eggs in flycatcher nests and reduces the survival rate of young flycatchers.

The **Virgin River chub** (*Gila seminuda*, Muddy River population) is a silvery colored fish with olive shading on the back (Service 1995). It can reach a maximum length of 18 inches and has a streamlined body with a deeply forked tail. Virgin River chub occur in two distinct populations in the Muddy and Virgin Rivers. These populations were historically connected prior to establishment of Lake Mead; however, since Lake Mead filled, there has been no movement between the two populations. In the mid-1990s, the Muddy River population in the main stem was estimated at more than 20,000

individuals. Muddy River chub are monitored annually by NDOW using hoop nets and other methods (NDOW 2005).

The **Warm Springs pupfish** (*Cyprinodon nevadensis pectoralis*) was federally listed as endangered on October 13, 1970 (35 FR 16047). It occupies six small, isolated springs less than 1 mile west of Devils Hole (Service 1990). These springs encompass an area less than 0.77 square mile. Alteration of the springs has decreased the available water, reduced the quality of the habitat, and threatened the survival of the Warm Springs pupfish. Since this pupfish's habitat is located within the area surrounding Devils Hole that is protected from groundwater withdrawal, its ability to survive is similar to the Devils Hole pupfish. The introduction of predatory and/or competing species has also threatened the pupfish's small population. Factors threatening the Warm Springs pupfish, such as alteration of springs and non-native fish, can make the species more susceptible to extirpation given its limited distribution.

The **western burrowing owl** (*Athene cunicularia hypugea*) is considered a Bird of Conservation Concern by the Service (NDOW 2005). It migrates to Nevada in the spring, and some individuals may spend most of the year in Nevada. Preferred habitat for western burrowing owl consists of short vegetation with fresh small mammal burrows. Because this species is a ground-nesting bird, burrow use is influenced by availability, soils, and dynamics of the small mammals population. This species often uses rodent burrows to nest in and may use satellite burrows to relocate young and avoid predation.

The **yellow-billed cuckoo** (*Coccyzus americanus*) is a federal candidate species in the western continental U.S.. The most recent review of this species categorizes it as a lower priority species for listing although evidence shows that its populations are declining as suitable habitat continues to decline in the West (Service 2002c). The main cause for this species' decline is habitat loss, degradation, and fragmentation. The loss of riparian habitats in Arizona is estimated at 90 to 95 percent.

The preferred breeding habitat for cuckoos in the western U.S. includes large blocks of riparian woodland habitat consisting of cottonwoods, willows, and tamarisk. Nests are built in trees with dense understory foliage, and breeding occurs from mid-June to August, which overlaps with the emergence of large insects. Foraging occurs in the same habitat as nesting, and typical prey species include caterpillars, katydids, and cicadas.

The **Yuma clapper rail** (*Rallus longirostris yumanensis*) was listed as endangered without critical habitat on March 11, 1967 (32 FR 4001). The clapper rail utilizes freshwater or brackish stream sides and marshlands at elevations less than 4,500 feet (Service 2002d). It is known to occur in Arizona, and its current range is along portions of the Colorado, Gila, and Salt Rivers; Picacho Reservoir; and Tonto Creek. In Nevada, the clapper rail occurs along the Colorado River (south of Lake Mead toward Mexico), Las Vegas Wash, Virgin River, Muddy River, Pahrnagat Valley, and Amargosa Valley. Loss of habitat is the main reason for the decline of this species. The clapper rail has been documented to nest in the Muddy River drainage adjacent to Moapa Valley NWR and along the Colorado and Virgin Rivers in Nevada. It has also been reported at Ash Meadows NWR and in the Pahrnagat Valley and likely occurs at Pahrnagat NWR (Manville 2007). Habitat restoration at all refuges, but especially at Moapa Valley NWR, could result in additional breeding pairs and expansion of their range within Nevada.

References

- Air Warfare Center. 1999. Integrated Natural Resource Management Plan. Nellis Air Force Base.
- Alaska Department of Natural Resources, Division of Parks and Recreation. 2001. Alaska Chilkat Bald Eagle Preserve. Available on the internet: <http://www.dnr.state.ak.us/parks/units/eagleprv.htm>. Accessed 6/03.
- Anderson, A.E., and O.C. Wallmo. 1984. *Odocoileus hemionus*. Mammalian Species. Published by the American Society of Mammalogists. 219:1–9.
- Berry, Kristin H. 1997. The desert tortoise recovery plan: an ambitious effort to conserve biodiversity in the Mojave and Colorado Deserts of the United States. Conservation, Restoration, and Management of Tortoises and Turtles—An International Conference. pp. 430–440.
- Brown, Stephen, Catherine Hickey, Brian Harrington, and Robert Gill, editors. 2001. *United States Shorebird Conservation Plan*. Second Edition. May.
- Carpenter, A.T. and T.A. Murray. 1998. Element stewardship abstract for *Acroptilon repens*. The Nature Conservancy. Available on the Internet: <http://tncweeds.ucdavis.edu/esadocs/documnts/acrorep.html>. 1/19/99.
- Carpinelli, Michael. 2003. Spotted knapweed. Plant Conservation Alliance, U.S. Department of Agriculture, Agricultural Research Service. Available on the internet: <http://www.nps.gov/plants/alien/fact/cebi1.htm>. Accessed 6/03.
- Goodchild, Shawn. 2007. Moapa dace 2007 survey results. Comments on the Administrative Draft Environmental Impact Statement. U.S. Fish and Wildlife Service, Nevada Fish and Wildlife Office. August 2007.
- Finch, Deborah M. and Scott H. Stoleson (editors). 2000. Status, Ecology, and Conservation of the Southwestern Willow Flycatcher. Gen. Tech. Rep. RMRS-GTR-60. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 131 pp.
- Heinrich, Jim E. 2001. Muddy River dive counts- January 2001. E-mail to Shawn Goodchild, Cynthia Martinez, Gary Scopettone, Bruce Lund, J.C. Sjoberg, and James Harvey. February 7, 2001.
- Hershler, R. and D. Sada. 1987. Springsnails (Gastropoda: Hydrobiidae) of Ash Meadows, Amargosa Basin, California-Nevada. Proceedings of the Biological Society of Washington. 100(4), 1987, pp. 776-843.
- Ivey, G. L., and C. P. Herziger, compilers. 2005. *Intermountain West Waterbird Conservation Plan—A plan associated with the Waterbird Conservation for the Americas initiative*. Version 1.0. Intermountain West Joint Venture, West Valley City, Utah.
- Koronkiewicz, T.J., McLeod, M.A., Brown, B.T., and S.W. Carothers. 2006. Southwestern willow flycatcher surveys, demography, and ecology along the lower Colorado River and tributaries, 2005. Annual report submitted to U.S. Bureau of Reclamation, Boulder City, NV by SWCA Environmental Consultants, Flagstaff, AZ. 176 pp.

- Kushlan, James A., Melanie J. Steinkamp, Katharine C. Parsons, Jack Capp, Martin Acosta Cruz, Malcolm Coulter, Ian Davidson, Loney Dickson, Naomi Edelson, Richard Elliot, R. Michael Erwin, Scott Hatch, Stephen Kress, Robert Milko, Steve Miller, Kyra Mills, Richard Paul, Roberto Phillips, Jorge E. Saliva, Bill Sydeman, John Trapp, Jennifer Wheeler, and Kent Wohl. 2002. *Waterbird Conservation for the Americas: The North American Waterbird Conservation Plan, Version 1*. Waterbird Conservation for the Americas, Washington, D.C., 78 pp.
- Manville, Christiana. 2007. Sensitive species occurrences at Desert Complex. Comments on the Administrative Draft Environmental Impact Statement. U.S. Fish and Wildlife Service, Nevada Fish and Wildlife Office. August 2007.
- McLeod, M.A. 2006. Southwestern willow flycatcher population estimate. Personal communication with Leslie Wagner, SWCA. Biologist, SWCA Environmental Consultants. October 10, 2006.
- Morefield, James D. 2001. Nevada Rare Plant Atlas. Compiled by the Nevada Natural Heritage Program for the U.S. Fish and Wildlife Service. June. Available on the Internet: <http://heritage.nv.gov/atlas/atlas.html>.
- Nevada Department of Wildlife. 2005. State of Nevada Comprehensive Wildlife Conservation Strategy. Nevada Department of Wildlife, Reno, NV. 605 p. Available on the Internet: <http://www.ndow.org/wild/conservation/cwcs/index.shtm#plan>.
- Nevada Department of Wildlife. 2007. Southwestern willow flycatcher occurrences in Nevada. Comments on the Administrative Draft Environmental Impact Statement. August 2007.
- Nevada Natural Heritage Program. 2005. Detailed Rare Plant and Lichen List. Nevada Department of Conservation and Natural Resources. List dated April 1, 2005. Available on the Internet: <http://heritage.nv.gov/plantbig.htm>.
- Nevada Natural Heritage Program. 2004. Detailed Rare Animal List. Nevada Department of Conservation and Natural Resources. List dated March 18, 2004. Available on the Internet: <http://heritage.nv.gov/animlbig.htm>.
- Nevada Partners in Flight. 1999. *Nevada Partners in Flight Bird Conservation Plan*. Edited by Larry A. Neel. November 29, 1999.
- Otis Bay, Inc. and Stevens Ecological Consulting, LLC. 2006. Ash Meadows Geomorphic and Biological Assessment: Draft Final Report.
- Parker, K. F. 1990. *An Illustrated Guide to Arizona Weeds*. The University of Arizona Press, Tucson.
- Rich, T. D., C. J. Beardmore, H. Berlanga, P. J. Blancher, M. S. W. Bradstreet, G. S. Butcher, D. W. Demarest, E. H., Dunn, W. C. Hunter, E. E. Iñigo-Elias, J. A. Kennedy, A. M. Martell, A. O. Panjabi, D. N. Pashley, K. V. Rosenberg, C., M. Rustay, J. S. Wendt, T. C. Will. 2004. *Partners in Flight North American Landbird Conservation Plan*. Cornell Lab of Ornithology. Ithaca, NY.
- Reveal, J. L., Broome, C. R., and J. C. Beatley. 1973. A new Centaurium (Gentianaceae) from Death Valley region of Nevada and California. *Bulletin of the Torrey Botanical Club* 100: 353-356.

- Scoppettone, Gary. 2002. Moapa dace. Presented at the Upper Muddy River Integrated Science Workshop, July 17-19.
- Shackleton, D.M. 1985. *Ovis canadensis*. Mammalian Species. Published by The American Society of Mammalogists. 230: 1-9.
- Thunhorst, G., and J.M. Swearingen. 1999. Leafy spurge. Plant Conservation Alliance, The Nature Conservancy and U.S. National Park Service. Available on the internet: <http://www.nps.gov/plants/alien/fact/eues1.htm>. Accessed 6/03.
- U.S. Bureau of Land Management. 2001. Draft Nevada Test and Training Range Resource Management Plan and Environmental Impact Statement. U.S. Department of the Interior, U.S. Bureau of Land Management, Las Vegas Field Office, Nevada.
- U.S. Bureau of Land Management. 1999. Partners against weeds. Available on the Internet: http://www.nv.blm.gov/Resources/noxious_weeds.htm. Accessed 6/03.
- U.S. Fish and Wildlife Service. 2006a. Integrated Pest Management Plan for Ash Meadows National Wildlife Refuge. U.S. Fish and Wildlife Service, Southern Nevada Field Office. May.
- U.S. Fish and Wildlife Service. 2006b. Memorandum regarding species lists for the Comprehensive Conservation Plans for the Desert National Wildlife Refuge Complex in Clark, Lincoln, and Nye Counties, Nevada. Ecological Services, U.S. Fish and Wildlife Service, Department of the Interior. November 6.
- U.S. Fish and Wildlife Service. 2002a. Birds of conservation concern 2002. Division of Migratory Bird Management, Arlington, Virginia. Available on the Internet: <http://migratorybirds.fws.gov/>.
- U.S. Fish and Wildlife Service. 2002b. Southwestern willow flycatcher recovery plan. U.S. Fish and Wildlife Service, Albuquerque, New Mexico.
- U.S. Fish and Wildlife Service. 2002c. Yellow-billed cuckoo (*Coccyzus americanus*) general species information. Arizona Ecological Services Field Office, Phoenix, Arizona. 1 p.
- U.S. Fish and Wildlife Service. 2002d. Yuma clapper rail (*Rallus longirostris yumanensis*) general species information. Arizona Ecological Services Field Office, Phoenix, Arizona. 1 p.
- U.S. Fish and Wildlife Service. 1999. Proposed rule to remove the bald eagle in the lower 48 states from the list of endangered and threatened wildlife. Federal Register. Vol. 64: 36454–36464.
- U.S. Fish and Wildlife Service. 1998. Recovery Plan for the Aquatic and Riparian Species of Pahranaagat Valley. Portland, Oregon. 82 pp.
- U.S. Fish and Wildlife Service. 1997. Final determination of critical habitat for the southwestern willow flycatcher. Federal Register. Vol. 62, No. 140: 39129–39147.
- U.S. Fish and Wildlife Service. 1996. Recovery Plan for the Rare Aquatic Species of the Muddy River Ecosystem. Portland, Oregon. 60 pp.
- U.S. Fish and Wildlife Service. 1995. Proposed determination of critical habitat for woundfin, Virgin River chub, and virgin spinedace and notice of public hearing. *Federal Register*. Vol. 60, No. 65: 17296-17311.

- U.S. Fish and Wildlife Service. 1993. Proposed reclassification of the Pahrump poolfish (*Empetrichthys latos latos*) from endangered to threatened status. Federal Register. Vol. 58: 49279–49283.
- U.S. Fish and Wildlife Service. 1990. Recovery plan for the endangered and threatened species of Ash Meadows, Nevada. U.S. Fish and Wildlife Service, Portland Oregon.
- U.S. Fish and Wildlife Service. 1986. *North American Waterfowl Management Plan: A Strategy for Cooperation*. Original version May.
- U.S. Fish and Wildlife Service. 1985. Endangered and threatened wildlife and plants: determination of threatened status with critical habitat for six plants and one insect in Ash Meadows, Nevada and California; and endangered status with critical habitat for one plant in Ash Meadows, Nevada and California. Federal Register 50(97):20777-20794.
- U.S. Fish and Wildlife Service. 1983. Moapa Dace Recovery Plan. February 14.
- U.S. Fish and Wildlife Service. 1980. Devil's Hole Pupfish Recovery Plan. Prepared in cooperation with the Devil's Hole Pupfish Recovery Team. July 15.
- Warrick, G.D. and P.R. Krausman. 1989. Barrel cacti consumption by desert bighorn sheep. The Southwestern Naturalist. 34:483–486.
- Young, James A., Blank, Robert R., and Charlie D. Clements. 2005. Tall whitetop (*Lepidium latifolium*). In Resource Notes, Number 76, January 19, 2005. U.S. Department of Agriculture, Agricultural Research Service. Available on the Internet: <http://www.blm.gov/nstc/resourcenotes/resnotes.html>.

Species Lists: Ash Meadows NWR

Birds

Loons

Common loon	<i>Gavia immer</i>
Pacific loon	<i>Gavia pacifica</i>

Grebes

Clark's grebe	<i>Aechmophorus clarkii</i>
Western grebe	<i>Aechmophorus occidentalis</i>
Horned grebe	<i>Podiceps auritus</i>
Eared grebe	<i>Podiceps nigricollis</i>
Pied-billed grebe	<i>Podilymbus podiceps</i>

Pelicans and Cormorants

American white pelican	<i>Pelecanus erythrorhynchos</i>
Double-crested cormorant	<i>Phalacrocorax auritus</i>

Bitterns, Herons, and Ibis

Great egret	<i>Ardea alba</i>
Great blue heron	<i>Ardea herodias</i>
American bittern	<i>Botaurus lentiginosus</i>
Cattle egret	<i>Bubulcus ibis</i>
Green heron	<i>Butorides virescens</i>
Snowy egret	<i>Egretta thula</i>
Least bittern	<i>Ixobrychus exilis</i>
Black-crowned night-heron	<i>Nycticorax nycticorax</i>
White-faced ibis	<i>Plegadis chihi</i>

Waterfowl

Wood duck	<i>Aix sponsa</i>
Northern pintail	<i>Anas acuta</i>
American wigeon	<i>Anas americana</i>
Northern shoveler	<i>Anas clypeata</i>
Green-winged teal	<i>Anas crecca</i>
Cinnamon teal	<i>Anas cyanoptera</i>
Blue-winged teal	<i>Anas discors</i>
Mallard	<i>Anas platyrhynchos</i>

Waterfowl, continued

Gadwall	<i>Anas strepera</i>
Greater white-fronted goose	<i>Anser albifrons</i>
Lesser scaup	<i>Aythya affinis</i>
Redhead	<i>Aythya americana</i>
Ring-necked duck	<i>Aythya collaris</i>
Greater scaup	<i>Aythya marila</i>
Canvasback	<i>Aythya valisineria</i>
Canada goose	<i>Branta canadensis</i>
Bufflehead	<i>Bucephala albeola</i>
Common goldeneye	<i>Bucephala clangula</i>
Snow goose	<i>Chen caerulescens</i>
Tundra swan	<i>Cygnus columbianus</i>
Hooded merganser	<i>Lophodytes cucullatus</i>
Common merganser	<i>Mergus merganser</i>
Red-breasted merganser	<i>Mergus serrator</i>
Ruddy duck	<i>Oxyura jamaicensis</i>

Vultures

Turkey vulture	<i>Cathartes aura</i>
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Raptors

Cooper's hawk	<i>Accipiter cooperii</i>
Sharp-shinned hawk	<i>Accipiter striatus</i>
Golden eagle	<i>Aquila chrysaetos</i>
Red-tailed hawk	<i>Buteo jamaicensis</i>
Rough-legged hawk	<i>Buteo lagopus</i>
Red-shouldered hawk	<i>Buteo lineatus</i>
Ferruginous hawk	<i>Buteo regalis</i>
Swainson's hawk	<i>Buteo swainsoni</i>
Northern harrier	<i>Circus cyaneus</i>
White-tailed kite	<i>Elanus caeruleus</i>
Merlin	<i>Falco columbarius</i>
Prairie falcon	<i>Falco mexicanus</i>
Peregrine falcon	<i>Falco peregrinus</i>
American kestrel	<i>Falco sparverius</i>
Bald eagle	<i>Haliaeetus leucocephalus</i>
Osprey	<i>Pandion haliaetus</i>

Gallinaceous Birds

Chuckar	<i>Alectoris chukkar</i>
Gambel's quail	<i>Callipepla gambelii</i>

Rails

American coot	<i>Fulica americana</i>
Common moorhen	<i>Gallinula chloropus</i>
Sora	<i>Porzana carolina</i>
Virginia rail	<i>Rallus limicola</i>

Shorebirds

Spotted sandpiper
Ruddy turnstone
Sanderling
Western sandpiper
Least sandpiper

Actitis macularia
Arenaria interpres
Calidris alba
Calidris mauri
Calidris minutilla

Shorebirds, continued

Willet
Snowy plover
Semipalmated plover
Killdeer
Dunlin
Common snipe
Black-necked stilt
Long-billed dowitcher
Marbled godwit
Long-billed curlew
Red-necked phalarope
Wilson's phalarope
Black-bellied plover
American avocet
Lesser yellowlegs
Greater yellowlegs
Solitary sandpiper

Catoptrophorus semipalmatus
Charadrius alexandrinus
Charadrius semipalmatus
Charadrius vociferus
Clidris alpina
Gallinago gallinago
Himantopus mexicanus
Limnodromus scolopaceus
Limosa fedoa
Numenius americanus
Phalaropus lobatus
Phalaropus tricolor
Pluvialis squatarola
Recurvirostra americana
Tringa flavipes
Tringa melanoleuca
Tringa solitaria

Gulls and Terns

Black tern
California gull
Ring-billed gull
Bonaparte's gull
Forster's tern
Common tern

Chlidonias niger
Larus californicus
Larus delawarensis
Larus philadelphia
Sterna forsteri
Sterna hirundo

Doves

Rock dove
Mourning dove

Columba livia
Zenaida macroura

Cuckoos

Greater roadrunner

Geococcyx californianus

Owls

Long-eared owl
Burrowing owl
Great horned owl
Common barn owl

Asio otus
Athene cunicularia
Bubo virginianus
Tyto alba

Goatsuckers

Lesser nighthawk
Common poorwill

Chordeiles acutipennis
Phalaenoptilus nuttallii

Swifts

White-throated swift

Aeronautes saxatalis

Hummingbirds

Black-chinned hummingbird
Costa's hummingbird
Broad-tailed hummingbird
Rufous hummingbird

Archilochus alexandri
Calypte costae
Selasphorus platycercus
Selasphorus rufus

Kingfishers

Belted kingfisher

Ceryle alcyon

Woodpeckers

Northern flicker
Ladder-backed woodpecker
Red-naped sapsucker

Colaptes auratus
Picoides scalaris
Sphyrapicus nuchalis

Flycatchers

Olive-sided flycatcher
Wood-pewee
Dusky flycatcher
Cordilleran flycatcher
Willow flycatcher
Gray flycatcher
Ash-throated flycatcher
Brown-crested flycatcher
Black phoebe
Say's phoebe
Western kingbird

Contopus borealis
Contopus sordidulus
Empidonax oberholseri
Empidonax occidentalis
Empidonax traillii
Empidonax wrightii
Myiarchus cinerascens
Myiarchus tyrannulus
Sayornis nigricans
Sayornis saya
Tyrannus verticalis

Shrikes

Northern shrike
Loggerhead shrike

Lanius excubitor
Lanius ludovicianus

Vireos

Bell's vireo
Plumbeousvireo
Warbling vireo

Vireo bellii
Vireo solitarius
Vireo gilvus

Jays and Crows

Western scrub jay
Common raven

Aphelocoma californica
Corvus corax

Larks

Horned lark *Eremophila alpestris*

Swallows

Cliff swallow *Hirundo pyrrhonota*
 Barn swallow *Hirundo rustica*
 Bank swallow *Riparia riparia*
 Northern rough-winged swallow *Stelgidopteryx serripennis*
 Tree swallow *Tachycineta bicolor*
 Violet-green swallow *Tachycineta thalassina*

Verdins and Bushtits

Bushtit *Psaltriparus minimus*
 Verdin *Auriparus flaviceps*

Wrens

Marsh wren *Cistothorus palustris*
 Rock wren *Salpinctes obsoletus*
 Bewick's wren *Thryomanes bewickii*
 House wren *Troglodytes aedon*

Kinglets and Gnatcatchers

Golden-crowned kinglet *Regulus satrapa*
 Ruby-crowned kinglet *Regulus calendula*
 Blue-gray gnatcatcher *Polioptila caerulea*

Thrushes

Hermit thrush *Catharus guttatus*
 Swainson's thrush *Catharus ustulatus*
 Townsend's solitaire *Myadestes townsendi*
 Mountain bluebird *Sialia currucoides*
 American robin *Turdus migratorius*

Mockingbirds and Thrashers

Northern mockingbird *Mimus polyglottos*
 Sage thrasher *Oreoscoptes montanus*
 Crissal thrasher *Toxostoma crissale*
 Le Conte's thrasher *Toxostoma lecontei*

Pipits

American pipit *Anthus spinoletta*

Starlings

European starling *Sturnus vulgaris*

Waxwings

Cedar waxwing *Bombycilla cedrorum*

Silky Flycatchers

Phainopepla *Phainopepla nitens*

Warblers

Yellow-rumped warbler *Dendroica coronata*
 Black-throated gray warbler *Dendroica nigrescens*
 Yellow warbler *Dendroica petechia*
 Townsend's warbler *Dendroica townsendi*
 Common yellowthroat *Geothlypis trichas*
 Yellow-breasted chat *Icteria virens*
 Macgillivray's warbler *Oporornis tolmiei*
 Orange-crowned warbler *Vermivora celata*
 Lucy's warbler *Vermivora luciae*

Warblers, continued

Virginia's warbler *Vermivora virginiae*
 Wilson's warbler *Wilsonia pusilla*

Tanagers

Western tanager *Piranga ludoviciana*

Grosbeaks, Buntings, and Sparrows

Sage sparrow *Amphispiza belli*
 Black-throated sparrow *Amphispiza bilineata*
 Lark sparrow *Chondestes grammacus*
 Dark-eyed junco *Junco hyemalis*
 Song sparrow *Melospiza melodia*
 Lincoln's sparrow *Melospiza lincolni*
 Savannah sparrow *Passerculus sandwichensis*
 Blue grosbeak *Passerina caerulea*
 Lazuli bunting *Passerina amoena*
 Indigo bunting *Passerina cyanea*
 Black-headed grosbeak *Pheucticus melanocephalus*
 Green-tailed towhee *Pipilo chlorurus*
 Spotted towhee *Pipilo maculatus*
 American tree sparrow *Spizella arborea*
 Brewer's sparrow *Spizella breweri*
 Chipping sparrow *Spizella passerina*
 White-crowned sparrow *Zonotrichia leucophrys*

Meadowlarks, Blackbirds, and Orioles

Red-winged blackbird *Agelaius phoeniceus*
 Brewer's blackbird *Euphagus cyanocephalus*
 Bullock's oriole *Icterus bullockii*
 Hooded oriole *Icterus cucullatus*
 Brown-headed cowbird *Molothrus ater*
 Great-tailed grackle *Quiscalus mexicanus*

Meadowlarks, Blackbirds, and Orioles, continued

Western meadowlark

Sturnella neglecta

Yellow-headed blackbird

Xanthocephalus xanthocephalus

Finches

Pine siskin

Carduelis pinus

Lesser goldfinch

Carduelis psaltria

American goldfinch

Carduelis tristis

House finch

Carpodacus mexicanus

Weaver Finches

House sparrow

Passer domesticus

Mammals

Pallid bat	<i>Antrozous pallidus</i>
Spotted bat	<i>Euderma maculatum</i>
Greater western mastiff-bat	<i>Eumops perotis californicus</i>
Allen's big-eared bat	<i>Idionycteris phyllotis</i>
Hoary bat	<i>Lasiurus cinereus</i>
California leaf-nosed bat	<i>Macrotus californicus</i>
California myotis	<i>Myotis californicus</i>
Long-eared myotis	<i>Myotis evotis</i>
Small-footed myotis	<i>Myotis leibii</i>
Fringed myotis	<i>Myotis thysanodes</i>
Cave myotis	<i>Myotis velifer</i>
Long-legged myotis	<i>Myotis volans</i>
Yuma myotis	<i>Myotis yumanensis</i>
Big free-tailed bat	<i>Nyctinomops macrotis</i>
Townshend's big eared bat	<i>Plecotus townsendii</i>
Western pipistrelle	<i>Pipistrellus hesperus</i>
Blacktail jackrabbits	<i>Lepus alleni</i>
Desert cottontail	<i>Sylvilagus auduboni</i>
White-tailed antelope squirrel	<i>Ammospermophilus leucurus</i>
Long-tailed pocket mouse	<i>Chaetodipus formosus</i>
Desert pocket mouse	<i>Chaetodipus penicillatus</i>
Desert kangaroo rat	<i>Dipodomys deserti</i>
Merriam's kangaroo rat	<i>Dipodomys merriami</i>
Ash Meadows montane vole	<i>Microtus montanus nevadensis</i>
House mouse	<i>Mus musculus</i>
Desert wood rat	<i>Neotoma lepida</i>
Southern grasshopper mouse	<i>Onychomys torridus</i>
Little pocket mouse	<i>Perognathus longimembris</i>
Canyon mouse	<i>Peromyscus crinitus</i>
Deer mouse	<i>Peromyscus maniculatus</i>
Western harvest mouse	<i>Reithrodontomys megalotis</i>
Round-tailed ground squirrel	<i>Spermophilus tereticaudus</i>
Botta's pocket gopher	<i>Thomomys bottae</i>
Ringtail	<i>Bassariscus astutus</i>
Coyotes	<i>Canis latrans</i>
Mountain lion	<i>Felis concolor</i>
Bobcat	<i>Felis rufus</i>
American badger	<i>Taxidea taxus</i>
Kit fox	<i>Vulpes macrotis</i>
Mule deer	<i>Odocoileus hemionus</i>
Desert bighorn sheep	<i>Ovis canadensis</i>

Reptiles and Amphibians

Reptiles

Zebra-tailed lizard	<i>Callisaurus draconoides</i>
Western whiptail	<i>Cnemidophorus tigris</i>
Western banded gecko	<i>Coleonyx variegatus</i>
Great Basin collared lizard	<i>Crotaphytus bicinctores</i>
Desert iguana	<i>Dipsosaurus dorsalis</i>
Long-nosed leopard lizard	<i>Gambelia wislizenii</i>
Banded Gila monster	<i>Heloderma suspectum cinctum</i>
Desert horned lizard	<i>Phrynosoma platyrhinos</i>
Chuckwalla	<i>Sauromalus ater</i>
Desert spiny lizard	<i>Sceloporus magister</i>
Long-tailed brush lizard	<i>Urosaurus graciosus</i>
Side-blotched lizard	<i>Uta stansburiana</i>
Desert night lizard	<i>Xantusia vigilis vigilis</i>
Sidewinder	<i>Crotalus cerastes</i>
Speckled rattlesnake	<i>Crotalus mitchellii</i>
Mojave green rattlesnake	<i>Crotalus scutulatus scutulatus</i>
Common kingsnake	<i>Lampropeltis getula</i>
Western threadsnake	<i>Leptotyphlops humilis</i>
Coachwhip snake	<i>Masticophis flagellum</i>
Red coachwhip	<i>Masticophis flagellum piceus</i>
Spotted leaf-nosed snake	<i>Phyllorhynchus decurtatus</i>
Gopher snake	<i>Pituophis catenifer</i>
Great Basin gopher snake	<i>Pituophis catenifer deserticola</i>
Gopher snake	<i>Pituophis melanoleuces</i>
Ground snake	<i>Sonora semiannulata</i>
Western terrestrial garter snake	<i>Thamnophis elegans</i>

Amphibians

Western toad	<i>Bufo boreas</i>
Red-spotted toad	<i>Bufo punctatus</i>
Woodhouse toad	<i>Bufo woodhousii</i>
Bullfrog	<i>Rana catesbeiana</i>
Western chorus frog	<i>Pseudacris regilla</i>

Fish and Invertebrates

Fish

Brown bullhead
 Convict cichlid
 Devil's Hole pupfish
 Ash Meadows Amargosa pupfish
 Warm Springs pupfish
 Mosquito fish
 Green sunfish
 Largemouth bass
 Black bass
 Sailfin molly
 Ash Meadows speckled dace

Ameiurus nebulosus
Cichlasoma nigrofasciatum
Cyprinodon diabolis
Cyprinodon nevadensis mionectes
Cyprinodon nevadensis pectoralis
Gambusia affinis
Lepomis cyanellus
Micropterus salmoides
Micropterus salmoides floridanus
Poecelia latipinna
Rhinichthys osculus nevadensis

Invertebrates

Warm Springs naucorid
 Death Valley agabus diving beetle
 Ash Meadows alkali skipper
 Unnamed riffle beetle
 Death Valley june beetle
 Amargosa naucorid
 Devil's Hole Warm Spring riffle beetle
 Ash Meadows pebble snail
 Crystal Springs snail
 Distal-gland springsnail
 Elongate gland springsnail
 Fairbanks Spring snail
 Ash Meadows naucorid
 Median-gland Nevada spring snail
 Oasis Valley springsnail
 Amargosa tryonia
 Minute tryonia
 Point of Rocks tryonia
 Sportinggoods tryonia
 Virile Amargosa snail
 Ash Meadows blazing star
 Red-rimmed melania
 Louisiana crayfish
 Honeybee
 American rubyspot
 Ground beetle
 Great Basin tiger beetle
 Tiger beetle
 Salt Creek tiger beetle
 Oblique tiger beetle
 Lady beetle
 Kiowa dancer

Ambrysus relictus
Agabus rumppi
Pseudocopaeodes eunus alinea
Microcylloepus similis
Polyphylla erratica
Pelocoris shoshone amargosus
Stenelmis calida calida
Pyrgulopsis erythropoma
Pyrgulopsis crystalis
Pyrgulopsis nanus
Pyrgulopsis isolatus
Pyrgulopsis fairbanksensis
Ambrysus amargosus
Pyrgulopsis pisteri
Pyrgulopsis micrococcus
Tryonia variegata
Tryonia ericae
Tryonia elata
Tryonia angulata
 Unknown
Mentzelia leucophylla
Melanoides tuberculata
Procambarus clarkii
Apis mellifera
Hetaerina americana
Bembidion sp.
Cicindela amargosae
Cicindela hemorrhagica
Cicindela nevadica
Cicindela tranquebarica
Hippodamia convergens
Argia immunda

Invertebrates, continued

Aztec dancer	<i>Argia nahuana</i>
Blue-ringed dancer	<i>Argia sedula</i>
Damsel fly	<i>Argia sp.</i>
Vivid dancer	<i>Argia vivida</i>
Familiar bluet	<i>Enallagma civile</i>
Bluet	<i>Enallagma sp.</i>
Pacific forktail	<i>Ischnura cervula</i>
Desert forktail	<i>Ishnura Barberi</i>
Black-fronted forktail	<i>Ishnura denticollis</i>
California dancer	<i>Argia agrioides</i>
Paiute dancer	<i>Argia alberta</i>
Large water boatmen	<i>Hesperocorixa laevigata</i>
Western malaria mosquito	<i>Anopheles freeborni</i>
Western encephalitis mosquito	<i>Culex tarsalis</i>
Cool-weather mosquito	<i>Culiseta incidens</i>
Winter marsh mosquito	<i>Culiseta inornata</i>
Unnamed riffle beetle	<i>Microcylloepus similis</i>
Carpenter ant	<i>Campanotus sp.</i>
Bicolored pyramid ant,	<i>Dorymyrmex bicolor</i>
Toad bug	<i>Gelastocoris oculatus</i>
Water striders	<i>Gerris gillettei</i>
White-belted ringtail	<i>Erpetogomphus compositus</i>
Gray sanddragon	<i>Progomphus borealis</i>
Field crickets	<i>Gryllus sp.</i>
Sweat bee	<i>Halictus ligatus</i>
Water scavenger family	<i>Tropisternus sublaevis</i>
Microcaddisfly	<i>Hydroptila ajax</i>
Western pondhawk	<i>Erythemis collocata</i>
Comanche skimmer	<i>Libellula comanche</i>
Bleached skimmer	<i>Libellula composita</i>
Widow skimmer	<i>Libellula luctuosa</i>
Flame skimmer	<i>Libellula saturata</i>
Marl pennant	<i>Macrodiplax balteata</i>
Wandering glider	<i>Pachydiplax flavescens</i>
Blue dasher	<i>Pachydiplax longipennis</i>
Variegated meadowhawk	<i>Sympetrum corruptum</i>
Striped meadowhawk	<i>Sympetrum pallipes</i>
Black saddlebags	<i>Tramea lacerata</i>
Red saddlebags	<i>Tramea onusta</i>
Caddisfly	<i>Limnephilus assimilis</i>
Western pigmy blue	<i>Brephidium exile</i>
Ceraunus blue	<i>Hemiargus ceraunus</i>
Reakirt's blue	<i>Hemiargus isola</i>
Marine blue	<i>Leptotes marina</i>
Mantis	<i>Stagmomantis sp.</i>
Water treaders	<i>Mesovelia amoena</i>
Wasp	<i>Chyphotes melaniceps</i>
Velvet ant	<i>Dasymutilla sp.</i>

Invertebrates, continued

Ant	<i>Odontophotopsis melicausa</i>
Velvet ant	<i>Sphaerophthalma blakeii</i>
Velvet ant	<i>Sphaerophthalma helicaon</i>
Creeping water bug	<i>Ambrysus mormon</i>
Warm Springs naucorid	<i>Limnocoris moapensis</i>
Moth	<i>Bulia deducta</i>
Arizona bird-dropping moth	<i>Conochoares arizonae</i>
Moth	<i>Heliothis paradoxus</i>
Corn earworm	<i>Heliothis zea</i>
Melipotis moth	<i>Melipotis jucunda</i>
Beet armyworm	<i>Spodoptera exigua</i>
Cabbage looper	<i>Trichoplusia ni</i>
Noctuid moths	<i>Catocala sp.</i>
Sagebrush checkerspot	<i>Chlosyne acastus</i>
Monarch butterfly	<i>Danaus plexippus</i>
Buckeye	<i>Junonia coenia</i>
Damselfly	<i>Coenagrionidae</i>
Stink bug	<i>Chlorocoris sp.</i>
Caddisfly	<i>Chimarra sp.</i>
Desert orangetip	<i>Anthocharis cethura</i>
White butterfly	<i>Pontia sp.</i>
Western white	<i>Pontia occidentalis</i>
Checkered white	<i>Pontia protodice</i>
Arenivaga	<i>sand cockroaches</i>
Spider hunter	<i>Pepsis pallidolimbata</i>
Threadlegged bug	<i>Emesaya brevipennis</i>
Assassin bug	<i>Zelus sp.</i>
Palmer's metalmark	<i>Apodemia palmerii</i>
Sand wasps	<i>Bembix</i>
Blue mud wasp	<i>Chalybion californicum</i>
Wasp	<i>Chlorion</i>
Hornworm	<i>Hyles lineata</i>
Deer flies	<i>Chrysops</i>
Horse flies	<i>Tabanus sp.</i>
Sand obligate beetle	<i>Edrotes ventricosus</i>
Darkling beetle	<i>Eleodes armata</i>
Sooty longwing	<i>Capnobotes fuliginosus</i>
Wasp	<i>Brachycistis timberlakei</i>
Veliid	<i>Microvelia americana</i>
Broad-shouldered water striders	<i>Rhagovelia sp.</i>
Veliid	<i>Rhagovelia distincta</i>
Wasp	<i>Odynerus cinnabarinus</i>
Paper wasp	<i>Polistes sp.</i>
Potter wasp	<i>Eumenes sp.</i>
Giant darner	<i>Anax walsinghami</i>
Blue-eyed darner	<i>Rhionaeshna multicolor</i>
American rubyspot	<i>Heptaerina sp.</i>

Invertebrates, continued

Giant water bugs,
Bird grasshoppers
Grasshopper
Green darner
Giant darner

Belostoma sp.
Schistocerca sp.
Trimerotropis sp.
Anax junius sp.
Anax walsinghami

Species Lists: Desert NWR

Birds

Grebes

Western grebe
Eared grebe
Pied-billed grebe

Aechmophorus occidentalis
Podiceps nigricollis
Podilymbus podiceps

Cormorant

Double-crested cormorant

Phalacrocorax auritus

Bitterns, Herons, Egrets and Ibis

Great egret
Great blue heron
American bittern
Green heron
Snowy egret
Black-crowned night-heron
White-faced ibis

Ardea alba
Ardea herodias
Botaurus lentiginosus
Butorides virescens
Egretta thula
Nycticorax nycticorax
Plegadis chihi

Waterfowl

Wood duck
Northern pintail
American wigeon
Northern shoveler
Green-winged teal
Cinnamon teal
Blue-winged teal
Mallard
Gadwall
Greater white-fronted goose
Lesser scaup
Redhead
Ring-necked duck
Canvasback
Canada goose
Bufflehead
Common goldeneye
Ruddy duck

Aix sponsa
Anas acuta
Anas americana
Anas clypeata
Anas crecca
Anas cyanoptera
Anas discors
Anas platyrhynchos
Anas strepera
Anser albifrons
Aythya affinis
Aythya americana
Aythya collaris
Aythya valisineria
Branta canadensis
Bucephala albeola
Bucephala clangula
Oxyura jamaicensis

Vultures

Turkey vulture

Cathartes aura

Raptors

Cooper's hawk

Accipiter cooperii

Northern goshawk

Accipiter gentilis

Sharp-shinned hawk

Accipiter striatus

Golden eagle

Aquila chrysaetos

Red-tailed hawk

Buteo jamaicensis

Rough-legged hawk

Buteo lagopus

Ferruginous hawk

Buteo regalis

Swainson's hawk

Buteo swainsoni

Northern harrier

Circus cyaneus

Merlin

Falco columbarius

Prairie falcon

Falco mexicanus

Peregrine falcon

Falco peregrinus

American kestrel

Falco sparverius

Bald eagle

Haliaeetus leucocephalus

Osprey

Pandion haliaetus

Gallinaceous Birds

Gambel's quail

Callipepla gambelii

Rails

American coot

Fulica americana

Common moorhen

Gallinula chloropus

Sora

Porzana carolina

Virginia rail

Rallus limicola

Shorebirds

Spotted sandpiper

Actitis macularia

Western sandpiper

Calidris mauri

Least sandpiper

Calidris minutilla

Killdeer

Charadrius vociferus

Common snipe

Gallinago gallinago

Black-necked stilt

Himantopus mexicanus

Long-billed dowitcher

Limnodromus scolopaceus

Marbled godwit

Limosa fedoa

Long-billed curlew

Numenius americanus

Red phalarope

Phalaropus fulicaria

Wilson's phalarope

Phalaropus tricolor

American avocet

Recurvirostra americana

Lesser yellowlegs

Tringa flavipes

Greater yellowlegs

Tringa melanoleuca

Solitary sandpiper

Tringa solitaria

Gulls and Terns

Black tern
California gull
Ring-billed gull
Bonaparte's gull

Chlidonias niger
Larus californicus
Larus delawarensis
Larus philadelphia

Doves

Rock dove
Band-tailed pigeon
Common ground-dove
White-winged dove
Mourning dove

Columba livia
Columba fasciata
Columbina passerina
Zenaida asiatica
Zenaida macroura

Cuckoos

Yellow-billed cuckoo
Greater roadrunner

Coccyzus americanus
Geococcyx californianus

Owls

Northern saw-whet owl
Short-eared owl
Long-eared owl
Burrowing owl
Great horned owl
Northern pygmy-owl
Flammulated owl
Western screech-owl
Barn owl

Aegolius acadicus
Asio flammeus
Asio otus
Athene cunicularia
Bubo virginianus
Glaucidium gnoma
Otus flammeolus
Otus kennicottii
Tyto alba

Goatsuckers

Whip-poor-will
Lesser nighthawk
Common nighthawk
Common poorwill

Caprimulgus vociferus
Chordeiles acutipennis
Chordeiles minor
Phalaenoptilus nuttallii

Swifts

White-throated swift
Vaux's Swift

Aeronautes saxatalis
Chaetura vauxi

Hummingbirds

Black-chinned hummingbird
Anna's hummingbird
Costa's hummingbird
Broad-tailed hummingbird
Rufous hummingbird
Allen's hummingbird
Calliope hummingbird

Archilochus alexandri
Calypte anna
Calypte costae
Selasphorus platycercus
Selasphorus rufus
Selasphorus sasin
Stellula calliope

Kingfisher

Belted kingfisher

*Ceryle alcyon***Woodpeckers**

Northern flicker

Colaptes auratus

Lewis' woodpecker

Melanerpes lewis

Ladder-backed woodpecker

Picoides scalaris

Hairy woodpecker

*Picoides villosus***Woodpeckers, continued**

Red-breasted sapsucker

Sphyrapicus ruber

Williamson's sapsucker

Sphyrapicus thyroideus

Yellow-bellied sapsucker

*Sphyrapicus varius***Flycatchers**

Olive-sided flycatcher

Contopus cooperi

Western wood-pewee

Contopus sordidulus

Western flycatcher

Empidonax difficilis

Hammond's flycatcher

Empidonax hammondi

Dusky flycatcher

Empidonax oberholseri

Willow flycatcher

Empidonax traillii

Gray flycatcher

Empidonax wrightii

Ash-throated flycatcher

Myiarchus cinerascens

Vermilion flycatcher

Pyrocephalus rubinus

Black phoebe

Sayornis nigricans

Say's phoebe

Sayornis saya

Eastern kingbird

Tyrannus tyrannus

Western kingbird

Tyrannus verticalis

Cassin's kingbird

*Tyrannus vociferans***Shrikes**

Loggerhead shrike

*Lanius ludovicianus***Vireos**

Bell's vireo

Vireo bellii

Warbling vireo

Vireo gilvus

Hutton's vireo

Vireo huttoni

Red-eyed vireo

Vireo olivaceus

Solitary vireo

Vireo solitarius

Gray vireo

*Vireo vicinior***Jays, Magpies, and Crows**

Scrub jay

Aphelocoma californica

American crow

Corvus brachyrhynchos

Common raven

Corvus corax

Steller's jay

Cyanocitta stelleri

Pinyon jay

Gymnorhinus cyanocephalus

Clark's nutcracker

Nucifraga columbiana

Larks

Horned lark *Eremophila alpestris*

Swallows

Barn swallow *Hirundo rustica*
 Cliff swallow *Petrochelidon pyrrhonota*
 Bank swallow *Riparia riparia*
 Northern rough-winged swallow *Stelgidopteryx serripennis*
 Tree swallow *Tachycineta bicolor*
 Violet-green swallow *Tachycineta thalassina*

Chickadees and Titmouse

Plain titmouse *Parus inornatus*
 Mountain chickadee *Poecile gambeli*

Verdins

Verdin *Auriparus flaviceps*

Bushtits

Bushtit *Psaltriparus minimus*

Nuthatches

Red-breasted nuthatch *Sitta canadensis*
 White-breasted nuthatch *Sitta carolinensis*
 Pygmy nuthatch *Sitta pygmaea*

Creepers

Brown creeper *Certhia americana*

Wrens

Cactus wren *Campylorhynchus brunneicapillus*
 Canyon wren *Catherpes mexicanus*
 Marsh wren *Cistothorus palustris*
 Rock wren *Salpinctes obsoletus*
 Bewick's wren *Thryomanes bewickii*
 House wren *Troglodytes aedon*
 Winter wren *Troglodytes troglodytes*

Kinglets and Gnatcatchers

Blue-gray gnatcatcher *Polioptila caerulea*
 Black-tailed gnatcatcher *Polioptila melanura*
 Ruby-crowned kinglet *Regulus calendula*
 Golden-crowned kinglet *Regulus satrapa*

Thrushes

Hermit thrush	<i>Catharus guttatus</i>
Swainson's thrush	<i>Catharus ustulatus</i>
Varied thrush	<i>Ixoreus naevius</i>
Townsend's solitaire	<i>Myadestes townsendi</i>
Mountain bluebird	<i>Sialia currucoides</i>
Western bluebird	<i>Sialia mexicana</i>
American robin	<i>Turdus migratorius</i>

Mockingbirds and Thrashers

Northern mockingbird	<i>Mimus polyglottos</i>
Sage thrasher	<i>Oreoscoptes montanus</i>
Bendire's thrasher	<i>Toxostoma bendirei</i>
Crissal thrasher	<i>Toxostoma crissale</i>
Le conte's thrasher	<i>Toxostoma lecontei</i>

Wagtails and Pipits

American pipit	<i>Anthus rubescens</i>
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Waxwings

Cedar waxwing	<i>Bombycilla cedrorum</i>
Bohemian waxwing	<i>Bombycilla garrulus</i>

Phainopepla

Phainopepla	<i>Phainopepla nitens</i>
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Starlings

European starling	<i>Sturnus vulgaris</i>
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Warblers

Blue warbler	<i>Dendroica caerulescens</i>
Yellow-rumped warbler	<i>Dendroica coronata</i>
Grace's warbler	<i>Dendroica graciae</i>
Black-throated gray warbler	<i>Dendroica nigrescens</i>
Hermit warbler	<i>Dendroica occidentalis</i>
Yellow warbler	<i>Dendroica petechia</i>
Townsend's warbler	<i>Dendroica townsendi</i>
Black-throated	<i>Dendroica virens</i>
Common yellowthroat	<i>Geothlypis trichas</i>
Yellow-breasted chat	<i>Icteria virens</i>
Black-and-white warbler	<i>Mniotilta varia</i>
Painted redstart	<i>Myioborus pictus</i>
Macgillivray's warbler	<i>Oporornis tolmiei</i>
Northern parula	<i>Parula americana</i>
Northern waterthrush	<i>Seiurus noveboracensis</i>
American redstart	<i>Setophaga ruticilla</i>
Orange-crowned warbler	<i>Vermivora celata</i>
Lucy's warbler	<i>Vermivora luciae</i>

Warblers, continued

Tennessee warbler	<i>Vermivora peregrina</i>
Nashville warbler	<i>Vermivora ruficapilla</i>
Virginia's warbler	<i>Vermivora virginiae</i>
Wilson's warbler	<i>Wilsonia pusilla</i>

Tanagers

Western tanager	<i>Piranga ludoviciana</i>
Summer tanager	<i>Piranga rubra</i>

Grosbeaks and Buntings

Blue grosbeak	<i>Guiraca caerulea</i>
Lazuli bunting	<i>Passerina amoena</i>
Indigo bunting	<i>Passerina cyanea</i>
Rose-breasted grosbeak	<i>Pheucticus ludovicianus</i>
Black-headed grosbeak	<i>Pheucticus melanocephalus</i>

Towhees and Sparrows

Sage sparrow	<i>Amphispiza belli</i>
Black-throated sparrow	<i>Amphispiza bilineata</i>

Towhees and Sparrows, continued

Lark bunting	<i>Calamospiza melanocorys</i>
Lapland longspur	<i>Calcarius lapponicus</i>
Chestnut-collared longspur	<i>Calcarius ornatus</i>
Lark sparrow	<i>Chondestes grammacus</i>
Dark-eyed junco	<i>Junco hyemalis</i>
Swamp sparrow	<i>Melospiza georgiana</i>
Lincoln's sparrow	<i>Melospiza lincolni</i>
Song sparrow	<i>Melospiza melodia</i>
Savannah sparrow	<i>Passerculus sandwichensis</i>
Fox sparrow	<i>Passerella iliaca</i>
Abert's towhee	<i>Pipilo aberti</i>
Green-tailed towhee	<i>Pipilo chlorurus</i>
Rufous-sided towhee	<i>Pipilo erythrophthalmus</i>
Vesper sparrow	<i>Poocetes gramineus</i>
American tree sparrow	<i>Spizella arborea</i>
Black-chinned sparrow	<i>Spizella atrogularis</i>
Brewer's sparrow	<i>Spizella breweri</i>
Chipping sparrow	<i>Spizella passerina</i>
White-throated sparrow	<i>Zonotrichia albicollis</i>
Golden-crowned sparrow	<i>Zonotrichia atricapilla</i>
White-crowned sparrow	<i>Zonotrichia leucophrys</i>

Blackbirds, Meadowlarks, and Orioles

Red-winged blackbird	<i>Agelaius phoeniceus</i>
Brewer's blackbird	<i>Euphagus cyanocephalus</i>
Bullock's oriole	<i>Icterus bullockii</i>

Blackbirds, Meadowlarks, and Orioles, continued

Hooded oriole	<i>Icterus cucullatus</i>
Scott's oriole	<i>Icterus parisorum</i>
Brown-headed cowbird	<i>Molothrus ater</i>
Great-tailed grackle	<i>Quiscalus mexicanus</i>
Western meadowlark	<i>Sturnella neglecta</i>
Yellow-headed blackbird	<i>Xanthocephalus xanthocephalus</i>

Finches

Pine siskin	<i>Carduelis pinus</i>
Lesser goldfinch	<i>Carduelis psaltria</i>
American goldfinch	<i>Carduelis tristis</i>
Cassin's finch	<i>Carpodacus cassinii</i>
House finch	<i>Carpodacus mexicanus</i>
Evening grosbeak	<i>Coccothraustes vespertinus</i>
Red crossbill	<i>Loxia curvirostra</i>

Weaver Finches

House sparrow	<i>Passer domesticus</i>
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Mammals

Spotted bat	<i>Euderma maculatum</i>
Greater western mastiff-bat	<i>Eumops perotis californicus</i>
Allen's big-eared bat	<i>Idionycteris phyllotis</i>
California leaf-nosed bat	<i>Macrotus californicus</i>
Western small-footed myotis	<i>Myotis ciliolabrum</i>
Long-eared myotis	<i>Myotis evotis</i>
Small-footed myotis	<i>Myotis Leibii</i>
Fringed myotis	<i>Myotis thysanodes</i>
Cave myotis	<i>Myotis velifer</i>
Long-legged Myotis	<i>Myotis volans</i>
Long-legged myotis	<i>Myotis volans</i>
Yuma myotis	<i>Myotis yumanensis</i>
Big free-tailed bat	<i>Nyctinomops macrotis</i>
Townsend's big-eared bat	<i>Plecotus townsendii</i>
Blacktail jackrabbit	<i>Lepus alleni</i>
Desert cottontail	<i>Sylvilagus auduboni</i>
Whitetail antelope squirrel	<i>Ammospermophilus leucurus</i>
Merriam kangaroo rat	<i>Dipodomys merriami</i>
Cliff chipmunk	<i>Neotamias dorsalis</i>
Hidden Forest Uinta chipmunk	<i>Neotamias umbrinus nevadensis</i>
Desert woodrat	<i>Neotoma lepida</i>
Deer mouse	<i>Peromyscus maniculatus</i>
Valley pocket gopher	<i>Thomomys bottae</i>
Coyote	<i>Canis lutrans</i>
Mountain lion	<i>Felis concolor</i>
Bobcat	<i>Felis rufus</i>
Badger	<i>Taxidea taxus</i>
Gray fox	<i>Urocyon cinereoargenteus</i>
Kit fox	<i>Vulpes macrotis</i>
Pronghorn antelope	<i>Antilocapra americanus</i>
Mule deer	<i>Odocoileus hemionus</i>
Desert bighorn sheep	<i>Ovis canadensis</i>

Reptiles and Amphibians

Reptiles

Desert tortoise
Red-eared turtle

Gopherus agassizii
Trachemys scripta

Zebra-tailed lizard
Western whiptail lizard
Collared lizard
Leopard lizard
Desert horned lizard
Banded gila monster
Chuckwalla
Desert spiny lizard
Side-blotched lizard

Callisaurus draconoides
Cnemidophorus tigris
Crotaphytus collaris
Gambelia wislizenii
Genus *Phrynosoma*
Heloderma suspectum suspectum
Sauromalus obesus
Sceloporus magister
Uta stansburiana

Coachwhip
Red racer
Gopher snake

Masticophis flagellum
Masticophis flagellum piceus
Pituophis melanoleucus

Amphibians

Bullfrog
Pacific tree frog

Rana catesbeiana
Hyla regilla

Fish and Invertebrates

Fish

Carp
Goldfish
Pahrump poolfish

Cyprinus carpio
Carassius auratus
Empetrichthys latos

Invertebrates

Nevada admiral
Louisiana crayfish
Corn Creek springsnail
Southeastern Nevada springsnail

Limenitis weidemeyerii nevadae
Procambarus clarkii
Pyrgulopsis fausta
Pyrgulopsis turbatrix

Species Lists: Moapa Valley NWR

Birds

Bitterns and Ibis

Least bittern
White-faced ibis

Ixobrychus exilis
Plegadis chihi

Vultures

Turkey vulture

Cathartes aura

Raptors

Cooper's hawk
Sharp-shinned hawk
Red-tailed hawk
Red-shouldered hawk
Ferruginous hawk
Common black-hawk
American kestrel
Mississippi kite

Accipiter cooperii
Accipiter striatus
Buteo jamaicensis
Buteo lineatus
Buteo regalis
Buteogallus anthracinus
Falco sparverius
Ictinia mississippiensis

Rails

Sandhill crane
Yuma clapper rail

Grus canadensis
Rallus longirostris yumanensis

Gulls and Terns

Black tern

Chlidonias niger

Cuckoos

Western yellow-billed cuckoo

Coccyzus americanus

Owls

Western burrowing owl

Athene cunicularia hypugea

Hummingbirds

Black-chinned hummingbird

Archilochus alexandri

Flycatchers

Olive-sided flycatcher
Southwestern willow flycatcher
Gray flycatcher
Ash-throated flycatcher

Contopus cooperi
Empidonax traillii extimus
Empidonax wrightii
Myiarchus cinerascens

Flycatchers, continued

Vermilion flycatcher
Black phoebe
Western kingbird

Pyrocephalus rubinus
Sayornis nigricans
Tyrannus verticalis

Shrikes

Loggerhead shrike

Lanius ludovicianus

Vireos

Arizona Bell's vireo

Vireo bellii arizone

Wrens

Marsh wren

Cistothorus palustris

Thrashers

Crissal thrasher

Toxostoma crissale

Pipits

American pipit

Anthus rubescens

Phainopepla

Phainopepla

Phainopepla nitens

Warblers

Yellow warbler
Yellow-breasted chat
Lucy's warbler
Orange-crowned warbler

Dendroica petechia
Icteria virens
Vermivora luciae
Vermivora celata

Tanagers

Summer tanager

Piranga rubra

Grosbeaks and Buntings

Blue grosbeak
Indigo bunting

Guiraca caerulea
Passerina cyanea

Blackbirds, Meadowlarks, and Orioles

Bullock's oriole
Hooded oriole

Icterus bullockii
Icterus cucullatus

Finches

House finch

Carpodacus mexicanus

Mammals

Pallid bat	<i>Antrozous pallidus</i>
Townsend's big-eared bat	<i>Corynorhinus townsendii</i>
Big brown bat	<i>Eptesicus fuscus</i>
Spotted bat	<i>Euderma maculatum</i>
Greater western mastiff-bat	<i>Eumops perotis californicus</i>
Allen's big-eared bat	<i>Idionycteris phyllotis</i>
Yellow bat	<i>Lasiurus xanthinus</i>
California leaf-nosed bat	<i>Macrotus californicus</i>
Long-eared myotis	<i>Myotis evotis</i>
Small-footed myotis	<i>Myotis leibii</i>
Fringed myotis	<i>Myotis thysanodes</i>
Cave myotis	<i>Myotis velifer</i>
Long-legged myotis	<i>Myotis volans</i>
Yuma myotis	<i>Myotis yumanensis</i>
Big free-tailed bat	<i>Nyctinomops macrotis</i>
Western pipistrelle	<i>Pipistrellus hesperus</i>
Desert cottontail	<i>Sylvilagus audubonii</i>
Desert pocket mouse	<i>Chaetodipus penicillatus</i>
Ringtail	<i>Bassariscus astutus</i>
Spotted skunk	<i>Spilogale gracilis</i>
Kit fox	<i>Vulpes macrotis</i>

Reptiles and Amphibians

Reptiles

Soft-shelled turtle

Apalone spinifera

Desert tortoise

Gopherus agassizii

Desert collard lizard

Crotaphytus collaris

Desert iguana

Dipsosaurus dorsalis

Banded Gila monster

Heloderma suspectum cinctum

Chuckwalla

Sauromalus ater

Amphibians

Southwestern toad

Bufo microscaphus

Red-spotted toad

Bufo punctatus

Fowler's toad

Bufo woodhousii

Tree frog

Hyla regilla

Bullfrog

Rana catesbeiana

Fish and Invertebrates

Fish

Moapa White River springfish
Mosquitofish
Virgin River chub
Moapa dace
Tilapia
Shortfin mollies
Moapa speckled dace

Crenichthys baileyi moapae
Gambusia affinis
Gila seminuda
Moapa coriacea
Oreochromis aurea
Poecilia mexicana
Rhinichthys osculus moapae

Invertebrates

Creeping water bug
MacNeil sootywing skipper
Warm Springs naucorid
Moapa riffle beetle
Amargosa naucorid
Shoshone naucorid
Moapa pebblesnail
Moapa Valley springsnail
Moapa water strider
Moapa Warm Spring riffle beetle
Grated tryponia
Moapa naucorid

Ambrysus mormon
Hesperopsis graciellae
Limnocoris moapensis
Microcyllloepus moapus
Pelocoris shoshone amargosus
Pelocoris shoshone shoshone
Pyrgulopsis avernalis
Pyrgulopsis carinifera
Rhagovelia becki
Stenelmis moapa
Tryponia clathrata
Usingerina moapensis

Species Lists: Pahranaagat NWR

Birds

Loons

Common loon	<i>Gavia immer</i>
Pacific loon	<i>Gavia pacifica</i>
Red-throated loon	<i>Gavia stellata</i>

Grebes

Clark's grebe	<i>Aechmophorus clarkii</i>
Western grebe	<i>Aechmophorus occidentalis</i>
Horned grebe	<i>Podiceps auritus</i>
Red-necked grebe	<i>Podiceps grisegena</i>
Eared grebe	<i>Podiceps nigricollis</i>
Pied-billed grebe	<i>Podilymbus podiceps</i>

Pelicans and Cormorants

American white pelican	<i>Pelecanus erythrorhynchos</i>
Double-crested cormorant	<i>Phalacrocorax auritus</i>

Bitterns, Herons, and Ibises

Great blue heron	<i>Ardea herodias</i>
Great egret	<i>Ardea alba</i>
American bittern	<i>Botaurus lentiginosus</i>
Cattle egret	<i>Bubulcus ibis</i>
Green heron	<i>Butorides virescens</i>
Little blue heron	<i>Egretta caerulea</i>
Reddish egret	<i>Egretta rufescens</i>
Snowy egret	<i>Egretta thula</i>
Least bittern	<i>Ixobrychus exilis</i>
Wood stork	<i>Mycteria americana</i>
Black-crowned night-heron	<i>Nycticorax nycticorax</i>
Roseate spoonbill	<i>Platalea ajaja</i>
White-faced ibis	<i>Plegadis chihi</i>

Waterfowl

Wood duck	<i>Aix sponsa</i>
Northern pintail	<i>Anas acuta</i>
American wigeon	<i>Anas americana</i>

Waterfowl, continued

Northern shoveler	<i>Anas clypeata</i>
Green-winged teal	<i>Anas crecca</i>
Cinnamon teal	<i>Anas cyanoptera</i>

Waterfowl, continued

Blue-winged teal	<i>Anas discors</i>
Eurasian wigeon	<i>Anas penelope</i>
Mallard	<i>Anas platyrhynchos</i>
Gadwall	<i>Anas strepera</i>
Greater white-fronted goose	<i>Anser albifrons</i>
Lesser scaup	<i>Aythya affinis</i>
Redhead	<i>Aythya americana</i>
Ring-necked duck	<i>Aythya collaris</i>
Canvasback	<i>Aythya valisineria</i>
Canada goose	<i>Branta canadensis</i>
Cackling goose	<i>Branta hutchinsii</i>
Bufflehead	<i>Bucephala albeola</i>
Common goldeneye	<i>Bucephala clangula</i>
Snow goose	<i>Chen caerulescens</i>
Ross' goose	<i>Chen rossii</i>
Tundra swan	<i>Cygnus columbianus</i>
Fulvous whistling-duck	<i>Dendrocygna bicolor</i>
Hooded merganser	<i>Lophodytes cucullatus</i>
Surf scoter	<i>Melanitta perspicillata</i>
Common merganser	<i>Mergus merganser</i>
Red-breasted merganser	<i>Mergus serrator</i>
Ruddy duck	<i>Oxyura jamaicensis</i>

Vulture

Turkey vulture	<i>Cathartes aura</i>
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Raptors

Cooper's hawk	<i>Accipiter cooperii</i>
Sharp-shinned hawk	<i>Accipiter striatus</i>
Golden eagle	<i>Aquila chrysaetos</i>
Zone-tailed hawk	<i>Buteo albonotatus</i>
Red-tailed hawk	<i>Buteo jamaicensis</i>
Rough-legged hawk	<i>Buteo lagopus</i>
Red-shouldered hawk	<i>Buteo lineatus</i>
Ferruginous hawk	<i>Buteo regalis</i>
Swainson's hawk	<i>Buteo swainsoni</i>
Common black hawk	<i>Buteogallus anthracinus</i>
Crested caracara	<i>Caracara cheriway</i>
Northern harrier	<i>Circus cyaneus</i>
White-tailed kite	<i>Elanus leucurus</i>

Raptors, continued

Merlin	<i>Falco columbarius</i>
Prairie falcon	<i>Falco mexicanus</i>
Peregrine falcon	<i>Falco peregrinus</i>
American kestrel	<i>Falco sparverius</i>
Bald eagle	<i>Haliaeetus leucocephalus</i>
Osprey	<i>Pandion haliaetus</i>
Harris hawk	<i>Parabuteo unicinctus</i>

Gallinaceous Birds

Gambel's quail	<i>Callipepla gambelii</i>
Ring-necked pheasant	<i>Phasianus colchicus</i>

Rails

American coot	<i>Fulica americana</i>
Common moorhen	<i>Gallinula chloropus</i>
Sandhill crane	<i>Grus canadensis</i>
Sora	<i>Porzana carolina</i>
Virginia rail	<i>Rallus limicola</i>

Shorebirds

Spotted sandpiper	<i>Actitis macularia</i>
Sanderling	<i>Calidris alba</i>
Baird's sandpiper	<i>Calidris bairdii</i>
Western sandpiper	<i>Calidris mauri</i>
Pectoral sandpiper	<i>Calidris melanotos</i>
Least sandpiper	<i>Calidris minutilla</i>
Semipalmated sandpiper	<i>Calidris pusilla</i>
Willet	<i>Catoptrophorus semipalmatus</i>
Semipalmated plover	<i>Charadrius semipalmatus</i>
Killdeer	<i>Charadrius vociferus</i>
Wilson's snipe	<i>Gallinago gallinago</i>
Black-necked stilt	<i>Himantopus mexicanus</i>
Short-billed dowitcher	<i>Limnodromus griseus</i>
Long-billed dowitcher	<i>Limnodromus scolopaceus</i>
Marbled godwit	<i>Limosa fedoa</i>
Long-billed curlew	<i>Numenius americanus</i>
Red-necked phalarope	<i>Phalaropus lobatus</i>
Wilson's phalarope	<i>Phalaropus tricolor</i>
Black-bellied plover	<i>Pluvialis squatarola</i>
American avocet	<i>Recurvirostra americana</i>
Lesser yellowlegs	<i>Tringa flavipes</i>
Greater yellowlegs	<i>Tringa melanoleuca</i>
Solitary sandpiper	<i>Tringa solitaria</i>

Gulls and Terns

Black tern	<i>Chlidonias niger</i>
Caspian tern	<i>Hydroprogne caspia</i>
Herring gull	<i>Larus argentatus</i>
California gull	<i>Larus californicus</i>
Mew gull	<i>Larus canus</i>
Ring-billed gull	<i>Larus delawarensis</i>
Bonaparte's gull	<i>Larus philadelphia</i>
Franklin's gull	<i>Larus pipixcan</i>
Forster's tern	<i>Sterna forsteri</i>
Common tern	<i>Sterna hirundo</i>
Sabine's gull	<i>Xema sabini</i>

Doves

Band-tailed pigeon	<i>Columba fasciata</i>
Rock dove	<i>Columba livia</i>
Common ground-dove	<i>Columbina passerina</i>
Eurasian collared-dove	<i>Streptopelia decaocto</i>
White-winged dove	<i>Zenaida asiatica</i>
Mourning dove	<i>Zenaida macroura</i>

Cuckoos

Yellow-billed cuckoo	<i>Coccyzus americanus</i>
Greater roadrunner	<i>Geococcyx californianus</i>

Owls

Short-eared owl	<i>Asio flammeus</i>
Long-eared owl	<i>Asio otus</i>
Burrowing owl	<i>Athene cunicularia</i>
Great horned owl	<i>Bubo virginianus</i>
Western screech-owl	<i>Otus kennicottii</i>
Barn owl	<i>Tyto alba</i>

Goatsuckers

Lesser nighthawk	<i>Chordeiles acutipennis</i>
Common nighthawk	<i>Chordeiles minor</i>
Common poorwill	<i>Phalaenoptilus nuttallii</i>

Kingfisher

Belted kingfisher	<i>Ceryle alcyon</i>
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Swift

White-throated swift	<i>Aeronautes saxatalis</i>
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Hummingbirds

Black-chinned hummingbird	<i>Archilochus alexandri</i>
Anna's hummingbird	<i>Calypte anna</i>
Costa's hummingbird	<i>Calypte costae</i>

Hummingbirds, continued

Broad-tailed hummingbird	<i>Selasphorus platycercus</i>
Rufous hummingbird	<i>Selasphorus rufus</i>
Calliope hummingbird	<i>Stellula calliope</i>

Woodpeckers

Northern flicker	<i>Colaptes auratus</i>
Acorn woodpecker	<i>Melanerpes formicivorus</i>
Lewis' woodpecker	<i>Melanerpes lewis</i>
Downy woodpecker	<i>Picoides pubescens</i>
Ladder-backed woodpecker	<i>Picoides scalaris</i>
Hairy woodpecker	<i>Picoides villosus</i>
Red-naped sapsucker	<i>Sphyrapicus nuchalis</i>

Flycatchers

Northern beardless tyrannulet	<i>Camptostoma imberbe</i>
Olive-sided flycatcher	<i>Contopus cooperi</i>
Western wood-pewee	<i>Contopus sordidulus</i>
Western flycatcher	<i>Empidonax difficilis</i>
Yellow-bellied flycatcher	<i>Empidonax flaviventris</i>
Hammond's flycatcher	<i>Empidonax hammondi</i>
Dusky flycatcher	<i>Empidonax oberholseri</i>
Cordilleran flycatcher	<i>Empidonax occidentalis</i>
Traill's willow flycatcher	<i>Empidonax traillii</i>
Southwestern willow flycatcher	<i>Empidonax traillii extimus</i>
Gray flycatcher	<i>Empidonax wrightii</i>
Ash-throated flycatcher	<i>Myiarchus cinerascens</i>
Brown-crested flycatcher	<i>Myiarchus tyrannulus</i>
Phainopepla	<i>Phainopepla nitens</i>
Vermilion flycatcher	<i>Pyrocephalus rubinus</i>
Black phoebe	<i>Sayornis nigricans</i>
Say's phoebe	<i>Sayornis saya</i>
Tropical kingbird	<i>Tyrannus melancholicus</i>
Eastern kingbird	<i>Tyrannus tyrannus</i>
Western kingbird	<i>Tyrannus verticalis</i>
Cassin's kingbird	<i>Tyrannus vociferans</i>

Shrikes

Northern Shrike	<i>Lanius excubitor</i>
Loggerhead Shrike	<i>Lanius ludovicianus</i>

Vireos

Bell's vireo	<i>Vireo bellii</i>
Cassin's vireo	<i>Vireo cassinii</i>
Warbling vireo	<i>Vireo gilvus</i>
White-eyed vireo	<i>Vireo griseus</i>
Plumbeous vireo	<i>Vireo plumbeus</i>

Jays and Crows

Scrub jay	<i>Aphelocoma californica</i>
American crow	<i>Corvus brachyrhynchos</i>
Steller's jay	<i>Cyanocitta stelleri</i>
Pinyon jay	<i>Gymnorhinus cyanocephalus</i>
Common raven	<i>Corvus Corax</i>

Lark

Horned lark	<i>Eremophila alpestris</i>
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Swallows

Cliff swallow	<i>Hirundo pyrrhonota</i>
Barn swallow	<i>Hirundo rustica</i>
Bank swallow	<i>Riparia riparia</i>
Northern rough-winged swallow	<i>Stelgidopteryx serripennis</i>
Tree swallow	<i>Tachycineta bicolor</i>
Violet-green swallow	<i>Tachycineta thalassina</i>

Chickadees

Black capped chickadee	<i>Poecile atricapillus</i>
Mountain chickadee	<i>Poecile gambeli</i>

Verdins

Verdin	<i>Auriparus flaviceps</i>
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Bushtit

Common bushtit	<i>Psaltriparus minimus</i>
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Creepers

Brown creeper	<i>Certhia americana</i>
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Wrens

Cactus wren	<i>Campylorhynchus brunneicapillus</i>
Canyon wren	<i>Catherpes mexicanus</i>
Marsh wren	<i>Cistothorus palustris</i>
Rock wren	<i>Salpinctes obsoletus</i>
Bewick's wren	<i>Thryomanes bewickii</i>
House wren	<i>Troglodytes aedon</i>
Winter wren	<i>Troglodytes troglodytes</i>

Kinglets and Gnatcatchers

Blue-gray gnatcatcher	<i>Poliophtila caerulea</i>
Ruby-crowned kinglet	<i>Regulus calendula</i>
Golden-crowned kinglet	<i>Regulus satrapa</i>

Thrushes

Wood thrush	<i>Hylocichla mustelina</i>
Varied thrush	<i>Ixoreus naevius</i>
Mountain bluebird	<i>Sialia currucoides</i>
Western bluebird	<i>Sialia mexicana</i>
American robin	<i>Turdus migratorius</i>

Mockingbirds and Thrashers

Gray catbird	<i>Dumetella carolinensis</i>
Northern mockingbird	<i>Mimus polyglottos</i>
Sage thrasher	<i>Oreoscoptes montanus</i>
Crissal thrasher	<i>Toxostroma crissale</i>
Le conte's thrasher	<i>Toxostroma lecontei</i>

Pipits

American pipit	<i>Anthus rubescens</i>
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Waxwings

Cedar waxwing	<i>Bombycilla cedrorum</i>
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Starlings

European starling	<i>Sturnus vulgaris</i>
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Warblers

Common yellowthroat	<i>Ceothlypis trichas</i>
Bay-breasted warbler	<i>Dendroica castanea</i>
Yellow-rumped warbler	<i>Dendroica coronata</i>
Black-throated gray warbler	<i>Dendroica nigrescens</i>
Yellow warbler	<i>Dendroica petechia</i>
Worm-eating warbler	<i>Helmitheros vermivora</i>
Yellow-breasted chat	<i>Icteria virens</i>
Macgillivrays warbler	<i>Oporornis tolmiei</i>
Northern parula	<i>Parula americana</i>
Prothonotary warbler	<i>Protonotaria citrea</i>
Northern waterthrush	<i>Seiurus noveboracensis</i>
Orange-crowned warbler	<i>Vermivora celata</i>
Hooded warbler	<i>Wilsonia citrina</i>
Willsons warbler	<i>Wilsonia pusilla</i>

Tanagers

Western tanager	<i>Piranga ludoviciana</i>
Summer tanager	<i>Piranga rubra</i>

Grosbeaks and Buntings

Blue grosbeak	<i>Buiranca caerulea</i>
Lazuli bunting	<i>Passerina amoena</i>
Indigo bunting	<i>Passerina cyanea</i>

Grosbeaks and Buntings, continued

Black-headed grosbeak *Pheucticus melanocephalus*

Towhees and Sparrows

Rufus-crowned sparrow *Aimophila ruficeps*
 Sage sparrow *Amphispiza belli*
 Black-throated sparrow *Amphispiza bilineata*
 Lark sparrow *Chondestes grammacus*
 Dark-eyed junco *Junco hyemalis*
 Lincoln's sparrow *Melospiza lincolni*
 Song sparrow *Melospiza melodia*
 Savannah sparrow *Passerculus sandwichensis*
 Fox sparrow *Passerelia iliaca*
 Green-tailed towhee *Pipilo chlorurus*
 Spotted towhee *Pipilo maculatus*
 Vesper sparrow *Poocetes gramineus*
 Brewer's sparrow *Spizella breweri*
 Chipping sparrow *Spizella passerina*
 Golden-crowned sparrow *Zonotrichia atricapilla*
 White crown sparrow *Zonotrichia leucophrys*
 Harris's sparrow *Zonotrichia querula*

Blackbirds, Meadowlarks, and Orioles

Red-winged blackbird *Agelaius phoeniceus*
 Rusty blackbird *Euphagus carolinus*

Blackbirds, Meadowlarks, and Orioles, continued

Brewer's blackbird *Euphagus cyanocephalus*
 Bullock's oriole *Icterus bullockii*
 Hooded oriole *Icterus cucullatus*
 Scott's oriole *Icterus parisorum*
 Brown-headed cowbird *Molothrus ater*
 Great-tailed grackle *Quiscalus mexicanus*
 Western meadowlark *Sturnella neglecta*
 Yellow-headed blackbird *Xanthocephalus xanthocephalus*

Finches

Pine siskin *Carduelis pinus*
 Lesser goldfinch *Carduelis psaltria*
 American goldfinch *Carduelis tristis*
 Cassin's finch *Carpodacus cassinii*
 House finch *Carpodacus mexicanus*

Weaver Finch

House sparrow *Passer domesticus*

Mammals

Gray shrew	<i>Notiosorex crawfordi</i>
Pallid bat	<i>Antrozous pallidus</i>
Big brown bat	<i>Eptesicus fuscus</i>
Spotted bat	<i>Euderma maculatum</i>
Greater western mastiff-bat	<i>Eumops perotis californicus</i>
Allen's big-eared bat	<i>Idionycteris phyllotis</i>
Silver-haired bat	<i>Lasionycteris noctivagans</i>
Western red bat	<i>Lasiurus blossevillii</i>
Big brown bat	<i>Lasiurus borealis</i>
Hoary bat	<i>Lasiurus cinereus</i>
California leaf-nosed bat	<i>Macrotus californicus</i>
California myotis	<i>Myotis californicus</i>
Western small-footed myotis	<i>Myotis ciliolabrum</i>
Long-eared myotis	<i>Myotis evotis</i>
Small-footed myotis	<i>Myotis leibii</i>
Fringed myotis	<i>Myotis thysanodes</i>
Cave myotis	<i>Myotis velifer</i>
Long-legged myotis	<i>Myotis volans</i>
Yuma myotis	<i>Myotis yumanensis</i>
Big free-tailed bat	<i>Nyctinomops macrotis</i>
Western pipistrel	<i>Pipistrellus hesperus</i>
Townsend big-eared bat	<i>Plecotus townsendii</i>
Brazilian free-tailed bat	<i>Tadarida brasiliensis</i>
Pygmy rabbit	<i>Brachylagus idahoensis</i>
Black-tailed jackrabbit	<i>Lepus californicus</i>
Desert cottontail rabbit	<i>Sylvilagus audubonii</i>
White-tailed antelope squirrel	<i>Ammospermophilus leucurus</i>
Desert kangaroo rat	<i>Caloprymnus campestris</i>
Desert pocket mouse	<i>Chaetodipus penicillatus</i>
Merriam kangaroo rat	<i>Dipodomys merriami</i>
Desert Valley kangaroo mouse	<i>Microdipodops megacephalus albiventer</i>
Pahranagat Valley montane vole	<i>Microtus montanus fucosus</i>
House mouse	<i>Mus musculus</i>
Desert woodrat	<i>Neotoma lepida</i>
Muskrat	<i>Ondatra zibethicus</i>
Southern grasshopper mouse	<i>Onychomys torridus</i>
Deer mouse	<i>Peromyscus maniculatus</i>
Western harvest mouse	<i>Reithrodontomys megalotis</i>
Rock squirrel	<i>Spermophilus variegatus</i>
Valley pocket gopher	<i>Thomomys bottae</i>
Ringtail	<i>Bassariscus astutus</i>
Coyote	<i>Canis latrans</i>
Mountain lion	<i>Felis concolor</i>
Bobcat	<i>Felis rufus</i>

Mammals, continued

Striped skunk
Long tailed weasel
Raccoon
Badger
Gray fox
Kit fox

Mephitis mephitis
Mustela frenata
Procyon lotor
Taxidea taxus
Urocyon cinereoargenteus
Vulpes macrotis

Pronghorned antelope
Elk
Mule deer

Antilocapra americana
Cervus elaphus
Odocoileus hemionus

Reptiles and Amphibians

Reptiles

Desert tortoise	<i>Gopherus agassizii</i>
Zebra-tailed lizard	<i>Callisaurus draconoides</i>
Western whiptail lizard	<i>Cnemidophorus tigris</i>
Western banded gecko	<i>Coleonyx variegatus</i>
Desert collard lizard	<i>Crotaphytus collaris</i>
Desert iguana	<i>Dispsosaurus dorsalis</i>
Western skink	<i>Eumeces skiltonianus</i>
Long-nosed leopard lizard	<i>Gambelia wislizenii</i>
Banded Gila monster	<i>Heloderma suspectum cinctum</i>
Desert horned lizard	<i>Phrynosoma platyrhinos</i>
Chuckwalla	<i>Sauromalus ater</i>
Desert spiny lizard	<i>Sceloporus magister</i>
Side-blotched lizard	<i>Uta stansburiana</i>
Desert night lizard	<i>Xantusia vigilis</i>
Night snake	<i>Hypsiglena torquata</i>
Common kingsnake	<i>Lampropeltis getula</i>
Coachwhip	<i>Masticophis flagellum</i>
Striped whipsnake	<i>Masticophis taeniatus</i>
Gophersnake	<i>Pituophis catenifer</i>
Long-nosed snake	<i>Rhinocheilus lecontei</i>
Western patch-nosed snake	<i>Salvadora hexalepis</i>
Sidewinder	<i>Crotalus cerastes</i>
Great basin rattlesnake	<i>Crotalus oreganus lutosus</i>
Mojave rattlesnake	<i>Crotalus scutulatus</i>
Ground snake	<i>Sonora semiannulata</i>

Amphibians

Western toad	<i>Bufo boreas</i>
Great plains toad	<i>Bufo cognatus</i>
Red-spotted toad	<i>Bufo punctatus</i>
Woodhouse toad	<i>Bufo woodhousii</i>
Pacific tree frog	<i>Hyla regilla</i>
Bullfrog	<i>Rana catesbeiana</i>
Northern leopard frog	<i>Rana pipiens</i>
Tiger salamander	<i>Ambystoma tigrinum</i>

Fish and Invertebrates

Fish

Bullhead catfish	<i>Ameiurus</i> spp.
Grass carp	<i>Ctenopharyngodon idella</i>
Pahrnagat spinedace	<i>Lepidomeda altivelis</i>
Large-mouthed bass	<i>Micropterus salmoides</i>
Crappie	<i>Pomoxis</i> spp.
Pahrnagat speckled dace	<i>Rhinichthys osculus velifer</i>

Invertebrates

Shoshone naucorid	<i>Pelocoris shoshone shoshone</i>
Pahrnagat pebblesnail	<i>Pyrgulopsis merriami</i>
Moapa Warm Spring riffle beetle	<i>Stenelmis moapa</i>
Grated tyronia	<i>Tryonia clathrata</i>

Appendix I.
Wilderness Review

This appendix contains the wilderness inventory conducted for the Ash Meadows, Moapa Valley, and Pahrangat National Wildlife Refuges (NWRs) as part of the Comprehensive Conservation Plan (CCP) development process. The wilderness inventory concluded that none of the lands within Ash Meadows and Moapa Valley NWRs meet the criteria for wilderness designation. However, three small units of Pahrangat NWR along the western side of the Refuge and adjacent to the proposed Desert Wilderness on Desert NWR do meet the criteria for wilderness designation.

This appendix also contains a copy of the proposal to designate approximately 1.3 million acres of land within the Desert NWR as wilderness. This wilderness proposal was submitted to Congress in 1974 but Congress has yet to act on the proposal. However the Service continues to manage this area to protect its wilderness values. As part of the CCP implementation, the Service plans to prepare a revised proposal which includes technical corrections to the existing proposed wilderness such as: correcting overlap with US Air Force's bombing range; allowing repair/relocation of hazardous sections of roads; and allowing the use of helicopters to repair/maintain water developments and access remote areas for wildlife surveys. Details of these revisions will be provided in a revised proposal.

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APPENDIX I-1

Wilderness Inventory: Ash Meadows, Moapa Valley, and Pahrnagat NWRs

**Desert National Wildlife Refuge Complex
Clark County, Nevada**

The purpose of a wilderness review is to identify and recommend for Congressional designation National Wildlife Refuge System (System) lands and waters that merit inclusion in the National Wilderness Preservation System (NWPS). Wilderness reviews are a required element of comprehensive conservation plans (CCPs) and conducted in accordance with the refuge planning process outlined in 602 FW 1 and 3, including public involvement and the National Environmental Policy Act (NEPA) compliance.

There are three phases to the wilderness review: 1) inventory, 2) study; and 3) recommendation. Lands and waters that meet the minimum criteria for wilderness are identified in the inventory phase. These areas are called wilderness study areas (WSAs). WSAs are evaluated through the CCP process to determine their suitability for wilderness designation. In the study phase, a range of management alternatives are evaluated to determine if a WSA is suitable for wilderness designation or management under an alternate set of goals and objectives that do not involve wilderness designation. The recommendation phase consists of forwarding or reporting recommendations for wilderness designation from the Director through the Secretary and the President to Congress in a wilderness study report.

If the inventory does not identify any areas that meet the WSA criteria, we document our findings in the administrative record for the CCP, fulfilling the planning requirement for a wilderness review. We inventoried Service lands and waters within Ash Meadows, Moapa Valley, and Pahranaagat NWRs and found no areas that meet the eligibility criteria for a WSA as defined by the Wilderness Act. This appendix summarizes the wilderness inventory for these three refuges.

Inventory Criteria

The wilderness inventory is a broad look at the planning area to identify WSAs. These are roadless areas that meet the minimum criteria for wilderness identified in Section 2(c) of the Wilderness Act.

“A wilderness, in contrast with those areas where man and his works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this Act an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions, and which: (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man’s work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological or other features of scientific, educational, scenic, or historical value.”

A WSA must be a roadless area or island, meet the size criteria, appear natural, and provide outstanding opportunities for solitude or primitive recreation. The process for identification of roadless areas and application of the wilderness criteria are described in the following sections.

Identification of Roadless Areas and Roadless Islands

Identification of roadless areas and roadless islands required gathering and evaluating land status maps, land use and road inventory data, and aerial and satellite imagery for the refuges. “Roadless” refers to the absence of improved roads suitable and maintained for public travel by means of motorized vehicles primarily intended for highway use. Only lands currently owned by the Service in fee title or BLM lands managed under a cooperative agreement were evaluated.

Evaluation of the Size Criteria

Roadless areas or roadless islands meet the size criteria if any one of the following standards applies:

- An area with over 5,000 contiguous acres. State and private lands are not included in making this acreage determination.
- A roadless island of any size. A roadless island is defined as an area surrounded by permanent waters or that is markedly distinguished from the surrounding lands by topographical or ecological features.
- An area of less than 5,000 contiguous Federal acres that is of sufficient size as to make practicable its preservation and use in an unimpaired condition, and of a size suitable for wilderness management.
- An area of less than 5,000 contiguous Federal acres that is contiguous with a designated wilderness, recommended wilderness, or area under wilderness review by another Federal wilderness managing agency such as the Forest Service, National Park Service, or Bureau of Land Management.

Evaluation of the Naturalness Criteria

In addition to being roadless, a WSA must meet the naturalness criteria. Section 2(c) defines wilderness as an area that "... generally appears to have been affected primarily by the forces of nature with the imprint of man's work substantially unnoticeable." The area must appear natural to the average visitor rather than "pristine." The presence of historic landscape conditions is not required. An area may include some human impacts provided they are substantially unnoticeable in the unit as a whole. Significant human-caused hazards, such as the presence of unexploded ordnance from military activity, and the physical impacts of refuge management facilities and activities are also considered in evaluation of the naturalness criteria. An area may not be considered unnatural in appearance solely on the basis of the "sights and sounds" of human impacts and activities outside the boundary of the unit.

Evaluation of Outstanding Opportunities for Solitude or Primitive and Unconfined Recreation

In addition to meeting the size and naturalness criteria, a WSA must provide outstanding opportunities for solitude or primitive recreation. The area does not have to possess outstanding opportunities for both solitude and primitive and unconfined recreation, and does not need to have outstanding opportunities on every acre. Further, an area does not have to be open to public use and access to qualify under this criteria; Congress has designated a number of wilderness areas in the Refuge System that are closed to public access to protect resource values.

Opportunities for solitude refer to the ability of a visitor to be alone and secluded from other visitors in the area. Primitive and unconfined recreation means non-motorized, dispersed outdoor recreation activities that are compatible and do not require developed facilities or mechanical transport. These primitive recreation activities may provide opportunities to experience challenge and risk; self reliance; and adventure.

These two "opportunity elements" are not well defined by the Wilderness Act but, in most cases, can be expected to occur together. However, an outstanding opportunity for solitude may be present in an area offering only limited primitive recreation potential. Conversely, an area may be so attractive for recreation use that experiencing solitude is not an option.

Evaluation of Supplemental Values

Supplemental values are defined by the Wilderness Act as “...ecological, geological, or other features of scientific, educational, scenic, or historic value.” These values are not required for wilderness but their presence should be documented.

Inventory Findings:

Ash Meadows NWR

As documented below, none of the lands within Ash Meadows NWR meet the criteria necessary for a WSA. Figure 1 shows the units, and Table 1 summarizes the inventory findings for each unit.

Roadless Areas and Roadless Islands/ Size Criteria

Ash Meadows NWR is a total of approximately 23,488 acres. There are approximately 32 miles of public roads on the Refuge, and these roads divide the refuge into ten units. These units can be classified by their size. Only one unit is greater than 5,000 acres (Area A), and there are numerous unimproved roads within the unit. Three other units are relatively large, consisting of 4,561, 4,058, and 4,461 acres (Areas F, G, & A).

Naturalness Criteria

The land within Ash Meadows NWR was intensively farmed in the 1960s and 1970s, prior to its establishment as a Refuge. As a result, many of the visual qualities associated with that use are still evident. Agricultural fields, fences, utility lines, fences, levees, roads (maintained and not), ditches, and a reservoir are examples of some of the remains of this agricultural legacy. The Refuge is currently in the habitat restoration stage and will likely remain so for years to come.

Of the four sections that are close to being large enough for wilderness management;

- Area A consists of 4,461 acres, includes several levees, the Peterson Reservoir, the Longstreet cabin, approximately 24 miles of unimproved roads, and extensive agricultural fields.
- Area D consists of 5,092 acres, contains Crystal Springs Reservoir and dam, several levees, approximately 23 miles of unimproved roads and old agricultural fields.
- Area F is 4,561 acres, contains the Point of Rocks interpretive site, has approximately 28 miles of unimproved roads, and old agricultural fields.
- Area G consists of 4,058 acres, contains several structures, irrigation or well infrastructure, old agricultural fields, and approximately 17 miles of unimproved roads.

Outstanding Opportunities for Solitude or Primitive and Unconfined Recreation

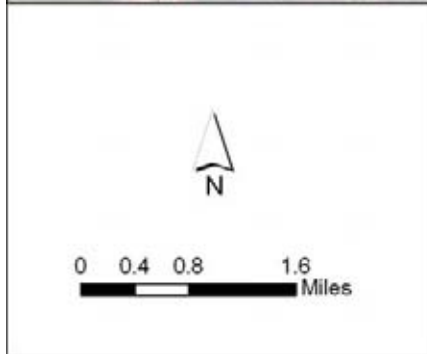
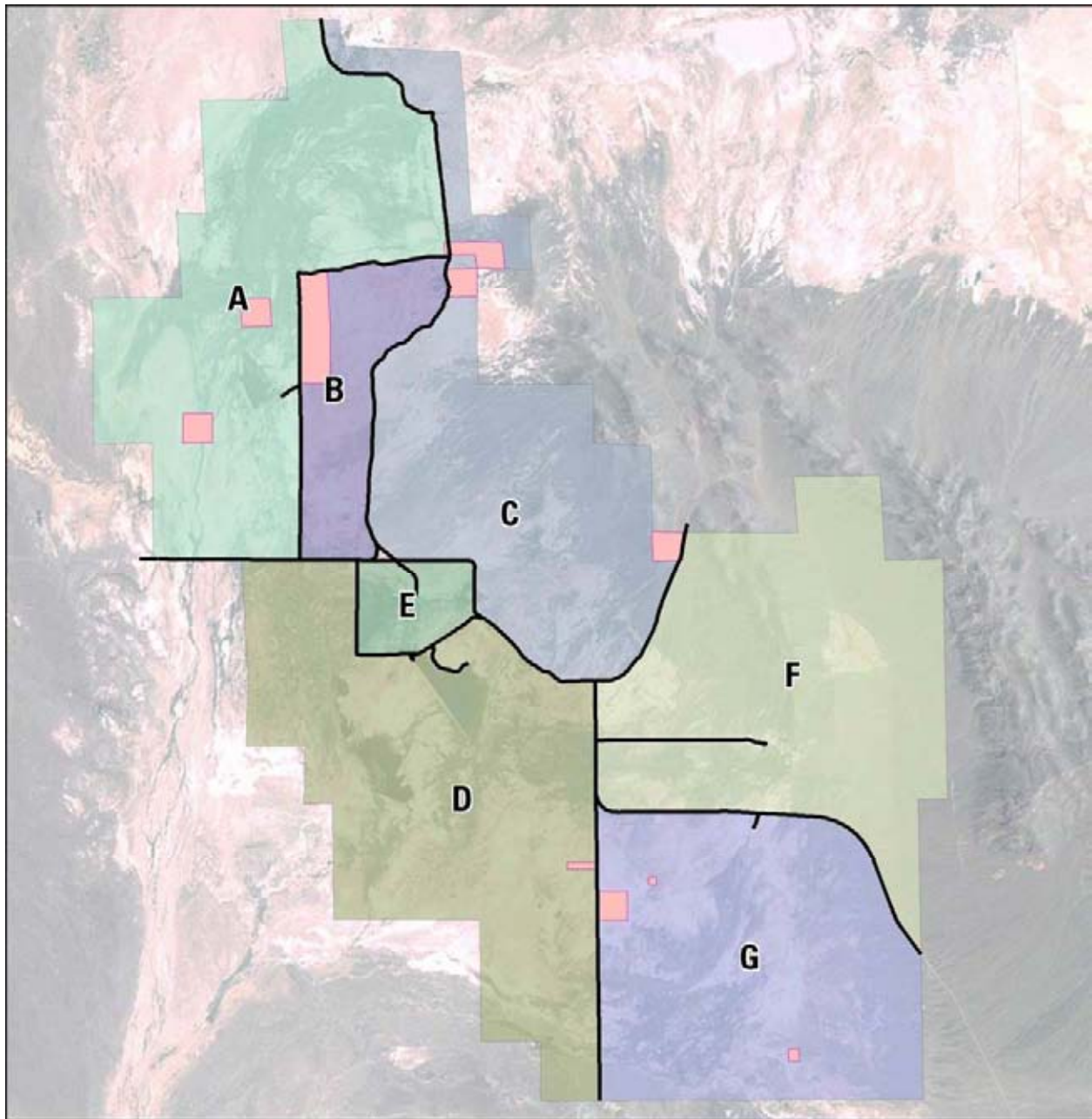
There are opportunities for solitude or primitive and unconfined recreation; however, sights and sounds from visitors, refuge personnel, or over flights from the military may interfere with solitude.

Supplemental Values

Ash Meadows NWR consists of more than 23,000 acres of spring-fed wetlands and alkaline desert uplands and is a major discharge point for a large underground aquifer system stretching 100 miles to the northeast. Water-bearing strata reach the surface in more than 30 seeps and springs, providing a rich and complex variety of habitats. Wetlands, springs, and springbrook channels are scattered throughout the Refuge. Sandy dunes, rising up to 50 feet above the landscape, appear in the central portions of the Refuge. The Refuge provides habitat for at least 25 plants and animals found nowhere else in the world and provides a unique visual opportunity.

Mesquite and ash groves flourish near wetlands and stream channels and saltbush dominates large portions of the Refuge in dry areas adjacent to wetlands. Creosote bush habitat occurs in the drier elevated areas along the east and southeastern portions of the Refuge. Cacti occur along the outer eastern edge of the Refuge with a variety at Point of Rocks.

The Refuge provides excellent views of the night sky for stargazers due to the lack of light sources in the vicinity.



A, 4545 ac	E, 475 ac
B, 1257 ac	F, 4562 ac
C, 4039 ac	G, 4105 ac
D, 5103 ac	Refuge Roads
	Inholdings

Figure 1
Wilderness Inventory
 Ash Meadows NWR

Table 1 Ash Meadows NWR Roadless Units

Refuge unit and acreage	Yes/no and Comments					Unit qualifies as a wilderness study area (meets criteria 1, 2, and 3a or 3b)
	(1) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition;	(2) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable;	(3a) has outstanding opportunities for solitude;	or (3b) has outstanding opportunities for a primitive and unconfined type of recreation;	(5) contains ecological, geological or other features of scientific, educational, scenic, or historical value.	
A	No, 4,461 acres	Includes several levees, the Peterson Reservoir, the Longstreet cabin, approximately 24 miles of dirt roads, and extensive agricultural fields.	Yes	Yes	Yes, Longstreet cabin and ecological, educational, and scenic values.	No, insufficient size and management as wilderness would conflict with restoration plans.
D	Yes, 5,092 acres	Crystal Springs Res. & dam, several levees, approximately 23 miles of dirt roads and old agricultural fields.	Yes	Yes	Yes, ecological, educational, and scenic values.	No, the human imprint on the environment is substantially noticeable.
F	No, 4,561 acres	Contains Point of Rocks interpretive site, has approx. 28 miles of dirt roads, and old agricultural fields.	Yes	Yes	Yes, ecological, educational, and scenic values.,	No, insufficient size and management as wilderness would conflict with restoration plans.

Refuge unit and acreage	Yes/no and Comments					Unit qualifies as a wilderness study area (meets criteria 1, 2, and 3a or 3b)
	(1) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition;	(2) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable;	(3a) has outstanding opportunities for solitude;	or (3b) has outstanding opportunities for a primitive and unconfined type of recreation;	(5) contains ecological, geological or other features of scientific, educational, scenic, or historical value.	
G	No, 4,058 acres	Contains several structures, irrigation or well infrastructure, old agricultural fields, and approximately 17 miles of dirt roads.	Yes	Yes	Yes, ecological, educational, and scenic values.	No, insufficient size and management as wilderness would conflict with restoration plans.

Moapa Valley NWR

As documented below, none of the parcels in the Moapa Valley NWR meet the criteria necessary for a WSA.

Roadless Areas and Roadless Islands

The Moapa Valley NWR is a total of approximately 116 acres. Warm Springs Road (Hwy 168) parallels the eastern border to the Refuge, and from Warm Springs Road there are Refuge roads leading to the stream viewing chamber, and to the Pederson Unit, which leads to the Pederson residence and outbuildings. The Apcar Unit is also bisected by unimproved roads used by both Refuge staff and by the Moapa Valley Water District to access the capped spring head. The Moapa Valley NWR does not meet the size criteria for a wilderness study area.

Naturalness Criteria

The 116-acres Refuge contains a stream viewing chamber, with parking for visitors. The Refuge is comprised of four adjacent, but visually distinct units. The Pedersen Unit, to the west, is 30 acres in size. The Plummer Unit, to the east, is 28 acres in size. The Apcar Unit is 48 acres in size. The Pederson #2 Unit is 11 acres in size. Each unit has a separate stream system supported by the steady and uninterrupted flow of several springs that come to the surface at various places throughout the Refuge. The Pederson Unit #2 includes a residence and outbuildings. The Apcar Unit has a spring house, and the Plummer Unit contains the stream viewing chamber and parking lot.

With an active restoration program, native riparian species have begun to return, including ash trees, honey mesquite, and screw bean mesquite. Plant species on the drier, upland areas of the Refuge are fourwing saltbush and creosote bush. Removal of non-native species, such as Canadian thistle and salt cedar is an on-going task. A visitor on the Refuge may see either see houses or roads and could hear cars driving on these roads.

Outstanding Opportunities for Solitude or Primitive and Unconfined Recreation

There are no opportunities for solitude or primitive and unconfined recreation due to the size of the Refuge; sights and sounds from Warm Springs Road may interfere with solitude, depending on the amount of traffic on the road.

Supplemental Values

The desert landscape combined with the springs can provide the visitor with an interest in geology and ecology and glimpse into an area where the Moapa Dace is uniquely adapted to life in this harsh landscape. The Refuge was created because of the Moapa Dace, as it is found no where except this valley.

Pahranagat NWR

As documented below, three units within Pahranagat NWR meet the criteria necessary for a WSA. Figure 2 shows the units, and Table 2 summarizes the inventory findings for each unit.

Roadless Areas and Roadless Islands/Size Criteria

Pahranagat NWR consists of 5,382 acres. The Refuge is long and narrow in shape, and varies from 0.5 to 2 miles in width (1.5 mile average), with US Highway 93 paralleling the eastern boundary along the Refuge's approximate 10-mile length. The north half of the Refuge, including Upper Pahranagat Lake is well visited because of a campground located on the east side of the lake and a county road (Old Corn Creek Road) which bisects the Refuge about 1 mile south of Upper Pahranagat Lake. This road continues on to Bureau of Land Management lands, and is used as a boundary for the Proposed Desert Wilderness. There are five levees positioned east-west that are used to cross the lake and wetlands for administrative purposes. By using roads to divide the Refuge into units, and eliminating units less than 100 acres results in 14 units in which to evaluate the refuge for wilderness values.

The middle section of the Refuge includes (immediately west of current US Highway 93) a section of old US Highway 93, currently used by vehicles accessing the Refuge. The lower section of the Refuge contains larger units, none larger than 730 acres.

The Refuge is adjacent to the Proposed Desert Wilderness, on Desert NWR. In 1974, approximately 1.3 million acres of land within the Desert National Wildlife Refuge were proposed for wilderness designation under the Wilderness Act of 1964. In the President's message to Congress accompanying the proposal, he recommended that Congress defer action on the proposal until a mineral survey is completed. The Final EIS for the proposal was released on August of 1975. A mineral assessment of the Refuge was completed in 1993 as part of the mineral withdrawal which was later completed in 1999. However, Congress has yet to act on the wilderness proposal, and the area continues to be managed to protect its wilderness values. The proposed wilderness is directly adjacent to the eastern boundary of Refuge units, 1, 4, 11, and 14. Unit 6 is separated by an administrative road from this proposed wilderness.

Naturalness Criteria

The Refuge encompasses a ten mile stretch of Pahranagat Valley and associated desert uplands at an elevation of slightly less than 4,000 feet above sea level. The White River, an ancient perennial stream which was a tributary of the Colorado River, flowed through the Pahranagat Valley from the north. It established a well-defined, but relatively narrow flood plain. The river bed is dry for many miles upstream and downstream from Pahranagat Valley, but there is water in the valley that comes from large, thermal springs along the flood plain. This spring water is stored in the Refuge's Upper Lake and North Marsh and is released to create conditions which will enhance the growth of wildlife food plants and to supplement lakes, marshes, and grasslands south of the Refuge headquarters. Water from the springs rarely flows past Maynard Lake at the southern end of the Refuge. The inlet to the upper lake is concrete lined for approximately 20 feet on either side of a stop log control structure. There are five levees which are used for water management, and administrative roads on the levees. There is a concrete lined ditch that is used to transfer water. There is a campground with fourteen camp sites, and numerous dirt roads, with three of these roads continuing through the Refuge to the west. Roads created in this desert environment tend to remain as scars on the desert floor for a very long time. Refuge buildings consist of an office/shop, equipment shelter, manager residence, bunkhouse, and fire cache.

Outstanding Opportunities for Solitude or Primitive and Unconfined Recreation

The eastern portion of the Refuge does have opportunities for solitude. The section south of Lower Pahranagat Lake contains the only remaining naturally occurring lake and the only part of the Refuge not accessible by automobile. The section includes an abandoned section of the historic Corn Creek Road that is washed out and can no longer be traveled by auto. Sights and sounds from Highway 93 may interfere with solitude, depending on the amount of traffic on the road.

Supplemental Values

The lower section of the Refuge includes historic dry lake beds, upland desert habitat, a historic (late 1800) home site, naturally occurring springs, petroglyphs, native American artifacts and geological formations including volcanic tuff and other upland areas. The desert landscape, wildlife, and wetland, open water, and riparian habitats on Pahrnagat NWR provide significant scenic value to visitors of the Refuge. The Refuge's managed water also provides regionally significant ecological value for migratory birds and other wildlife.

Map and Table

The following map (Fig. 2) and accompanying table (Table 2) show Pahrnagat National Wildlife Refuge segmented by roads, and grouped into units greater than 100 acres. Refuge units lesser than 100 acres were deemed too small to be suitable for wilderness management. Adjacent to the Refuge to the west is the Desert Proposed Wilderness.

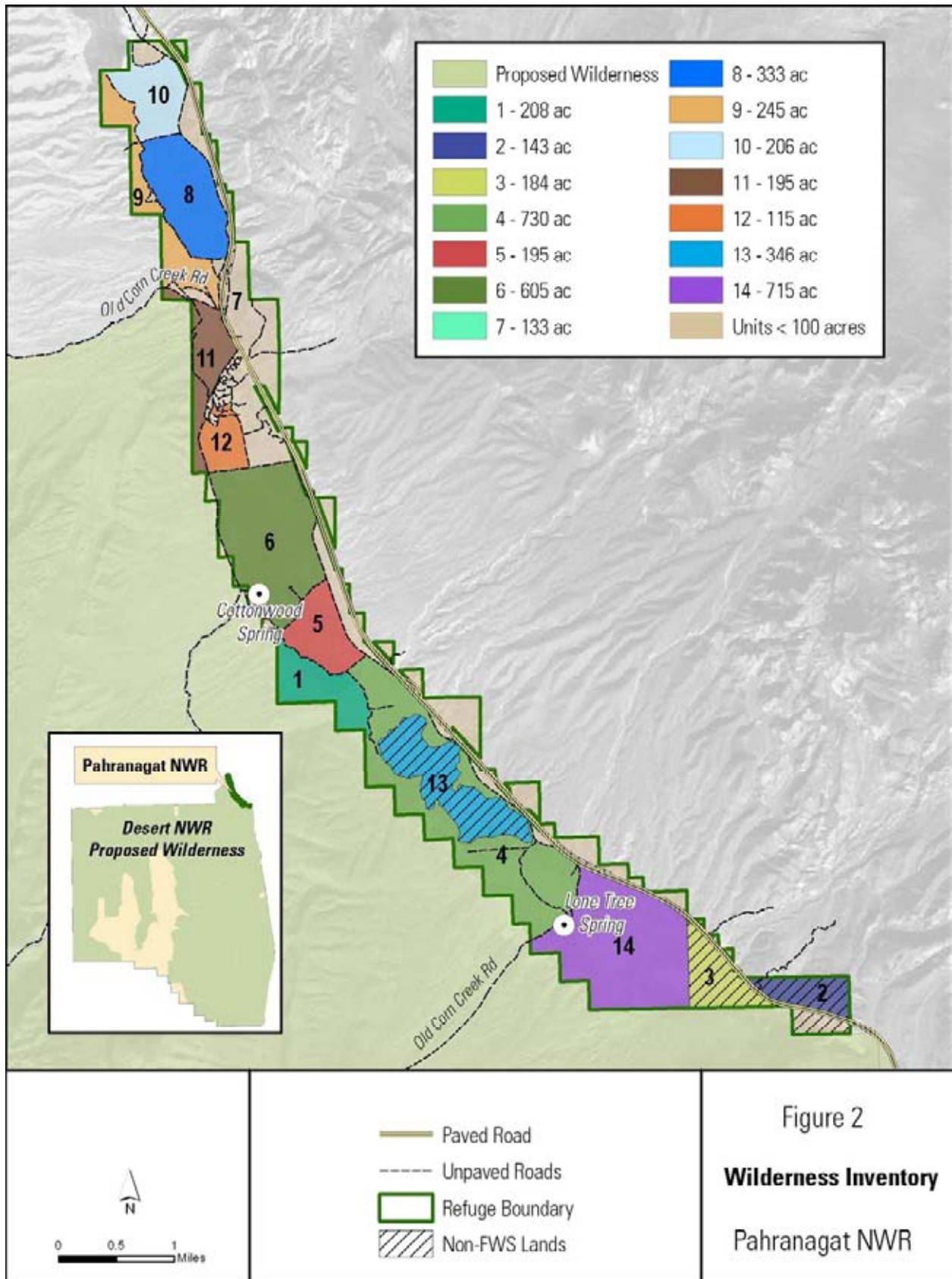


Figure 2
Wilderness Inventory
 Pahranagat NWR

Table 2 Pahrana gat NWR Roadless Units

Refuge unit and acreage	■ Yes/no and Comments					Unit qualifies as a wilderness study area (meets criteria 1, 2, and 3a or 3b)
	(1) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition;	(2) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable;	(3a) has outstanding opportunities for solitude;	or (3b) has outstanding opportunities for a primitive and unconfined type of recreation;	(5) contains ecological, geological or other features of scientific, educational, scenic, or historical value.	
1	Yes, 208 acres and Contiguous with Desert Proposed Wilderness.	Yes, unpaved road on east boundary.	Yes, on west boundary.	Yes, if combined with Desert Proposed Wilderness.	Scenic	Yes
2	No, 143 acres	Inholding	No, bordered by highway	No	Yes, contains historic road bed, petroglyphs, geological features, historical rock corrals, rock rings, ecologically important to the area because of shear fault zone, old lake bed, ancient river bed	No, inholding.

Refuge unit and acreage	■ Yes/no and Comments					Unit qualifies as a wilderness study area (meets criteria 1, 2, and 3a or 3b)
	(1) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition;	(2) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable;	(3a) has outstanding opportunities for solitude;	or (3b) has outstanding opportunities for a primitive and unconfined type of recreation;	(5) contains ecological, geological or other features of scientific, educational, scenic, or historical value.	
3	No, 184 acres	Inholding	No, bordered by highway	No	Yes, Contains historic road bed, petroglyphs, geological features, historical rock corrals, rock rings, ecologically important to the area because of shear fault zone, old lake bed, ancient river bed	No, inholding.
4	Yes, 730 acres and Contiguous with Desert Proposed Wilderness.	No, highway and dirt roads evident, water control structure, water ditch, power lines parallel hwy.	Yes, on the w. boundary.	Yes, if combined with Desert Proposed Wilderness.	Yes, ecological, scenic, historical river channel, historical lake bed, historical home site, spring.	No

Refuge unit and acreage	■ Yes/no and Comments					Unit qualifies as a wilderness study area (meets criteria 1, 2, and 3a or 3b)
	(1) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition;	(2) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable;	(3a) has outstanding opportunities for solitude;	or (3b) has outstanding opportunities for a primitive and unconfined type of recreation;	(5) contains ecological, geological or other features of scientific, educational, scenic, or historical value.	
5	No, 195 acres	No, levees on n. & s. boundary, roads on e. & w. boundary, channelized stream.	Yes, on the w. boundary.	No, too small an area.	Yes, ecological, scenic.	No, insufficient size.
6	No, 605 acres	No, roads on e. and w. boundary, levee on the s. boundary, check dams in stream.	Yes	Yes	Yes, ecological, and Cottonwood Spring.	No, insufficient size.
7	No, 133 acres	Highway, petroglyphs, old agricultural fields, abandoned portion of highway.	No, too close to hwy.	No, too small an area.	Yes, petroglyphs.	No, insufficient size.
8	No, 333 acres	Highway, levee to s. & n., road on e. & w. shore, campsites, levee overlook.	No, lake used for fishing, campers nearby	No, too small an area.	Yes, scenic Upper Pahrnagat Lake.	No, insufficient size.
9	No, 245 acres	Eastside road defines boundary.	Yes	No, too small an area.	Yes, scenic desert.	No, insufficient size.

Refuge unit and acreage	■ Yes/no and Comments					Unit qualifies as a wilderness study area (meets criteria 1, 2, and 3a or 3b)
	(1) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition;	(2) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable;	(3a) has outstanding opportunities for solitude;	or (3b) has outstanding opportunities for a primitive and unconfined type of recreation;	(5) contains ecological, geological or other features of scientific, educational, scenic, or historical value.	
10	No, 206 acres	Water control structure, refuge boundary fence, hwy, levee on south boundary.	No, lake used for fishing, road nearby.	No, too small an area.	Yes, scenic Upper Pahrnagat Lake.	No, insufficient size.
11	Yes, 195 acres and Contiguous with Desert Proposed Wilderness.	Unmaintained road, and hwy.	Yes, if combined with Desert Proposed Wilderness.	Yes, if combined with Desert Proposed Wilderness.	Yes, scenic desert.	Yes
12	No, 115 acres	Abandoned agricultural fields, concrete ditch, levee on s. boundary, roads on e. & w. boundary.	No, too close to refuge headquarters.	No, too close to headquarters.	No	No, insufficient size.
13	No, 346 acres	Inholding	No, too small an area.	No	Scenic, ecological.	No, inholding.
14	Yes, 715 acres and Contiguous with Desert Proposed Wilderness.	Highway on the e. boundary.	Yes, on the w. boundary.	Yes, if combined with Desert Proposed Wilderness.	Old farmstead foundation and Lone Tree Spring.	Yes

APPENDIX I-2

1971 Desert NWR Wilderness Proposal

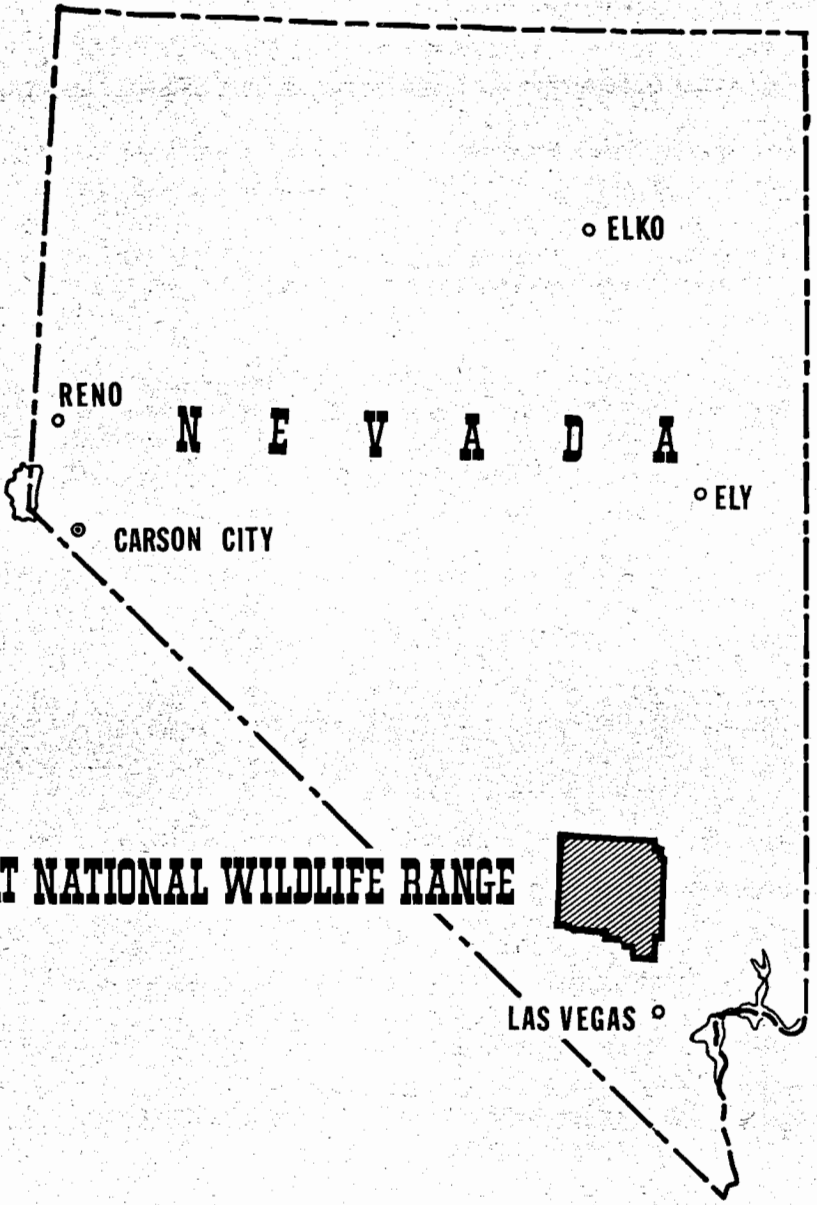
**Desert National Wildlife Refuge Complex
Clark County, Nevada**

United States Department of the Interior
Fish and Wildlife Service

DESERT WILDERNESS PROPOSAL
DESERT NATIONAL WILDLIFE RANGE



NEVADA



DESERT NATIONAL WILDLIFE RANGE

◦ ELKO

◦ RENO

◦ CARSON CITY

◦ ELY

LAS VEGAS ◦

PREFACE

The Wilderness Act of September 3, 1964 (Public Law 88-577) requires that the Secretary of the Interior review every roadless area of 5,000 contiguous acres or more and every roadless island, regardless of size, within the National Wildlife Refuge System within ten years after the effective date of the Act and report to the President of the United States his recommendations as to the suitability or nonsuitability of each area or island for preservation as wilderness. A recommendation of the President for designation as wilderness does not become effective unless provided by an Act of Congress.

In defining wilderness, the Act also included areas of less than 5,000 acres that are of sufficient size to make preservation and use in an unimpaired condition practicable.

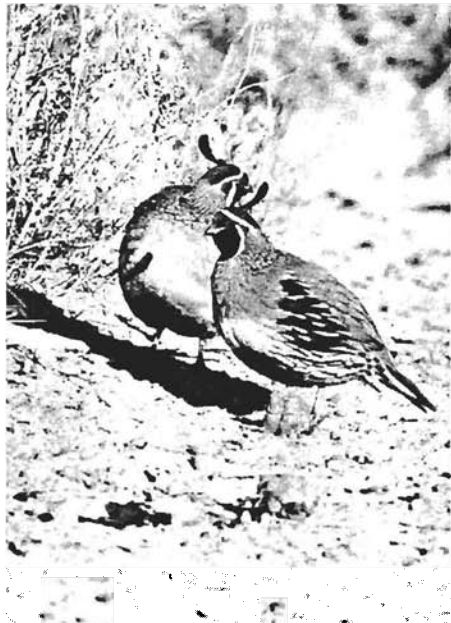
The National Wildlife Refuge System is a National network of lands and water managed and safeguarded for preservation and enhancement of the human benefits associated with wildlife and their environments. It presently consists of over 320 units embracing nearly 30 million acres in 46 states and is administered by the Bureau of Sport Fisheries and Wildlife. About 90 of those units, containing over 25 million acres in 32 states, qualify for study under the Wilderness Act.

Sections 4(a) and (b) of the Wilderness Act provide that: (1) The Act is to be within and supplemental to the purposes for which units of the Refuge System are established; and (2) Wilderness areas shall be administered so as to preserve their wilderness character and shall be devoted to the public purposes of recreational, scenic, scientific, educational, conservation and historical use insofar as primary Refuge System objectives permit. Wilderness designation does not remove or alter an area's status as a unit of the National Wildlife Refuge System.

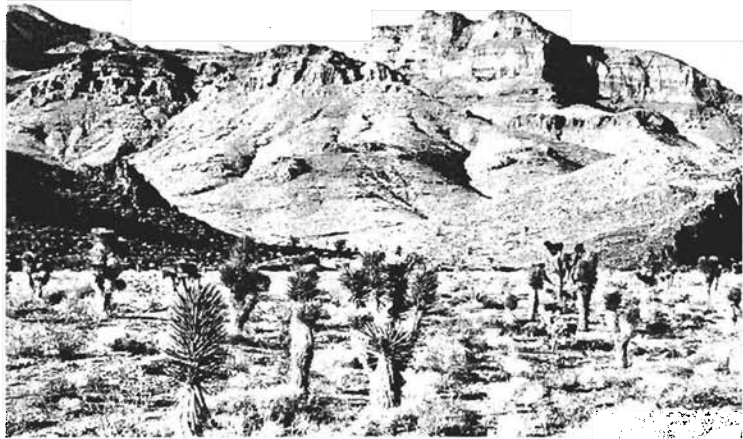
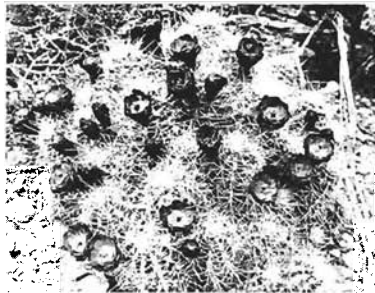
This brochure concerns a National Wildlife Range that has been studied by the Bureau of Sport Fisheries and Wildlife at the direction of the Secretary of the Interior. Its purpose is to summarize the wilderness study in sufficient detail to enable the reader to form an opinion regarding study conclusions concerning the suitability and desirability of including all or part of the Range within the National Wilderness Preservation System.



Desert tortoise.



Gambel's quail—
common below the pinyon belt.



Typical bighorn lambing area.
Yucca Peak in background. Sheep Range unit.

INTRODUCTION

Lying at the very edge of metropolitan Las Vegas, Nevada is the largest unit of the National Wildlife Refuge System outside of Alaska—the Desert National Wildlife Range. Established in 1936 by Executive Order of President Franklin D. Roosevelt, this vast 1,588,000-acre area was set aside for the protection of a remnant population of the desert bighorn sheep—a species believed native to this harsh region for over 300,000 years.

Sensitively intolerant of human settlement and development, the desert bighorn is now largely confined to small, isolated areas within its former range in the Southwestern United States and Mexico. Within the protective confines of the Desert Wildlife Range, its numbers have gradually recovered until there are now an estimated 1,000 animals. This is the largest known population of desert bighorn sheep.

The Range is situated in the northeastern portion of the Mohave Desert in Clark and Lincoln Counties, southern Nevada. The administrative headquarters is in Las Vegas, with a field station at Corn Creek, 23 miles northwest. The southernmost boundary is about one-half mile from the Las Vegas city limits.

The western portion of the Range is used by the U. S. Air Force as an aerial bombing and gunnery range for training purposes. Public access to these lands is restricted.

The wilderness study area comprised the entire Desert National Wildlife Range and 58,000 acres of adjacent public domain lands, included because they are logical ecological and topographical extensions of the Range. The study area was divided into several study units on the basis of Wildlife Range management and development programs and plans, Air Force use, and the status of private inholdings. Permanent road and vehicle trails, contour lines, and legal subdivisions all served as unit boundaries. Approximately 88 percent of the study area, or 1,443,100 acres, were judged suitable for further consideration as wilderness within seven separate units.



Petroglyphs remain as visual reminders of a rich part of America's cultural heritage.

HISTORY

Petroglyphs on canyon walls and in caves attest to the existence of an aboriginal people in southern Nevada. Their primitive way of securing food is also evidenced by the presence of "mescal" pits, a number of which are located on the Wildlife Range.

Paiute Indians were found living near the watering places in the 1770's when Europeans first visited the region. These were Spanish pioneers searching for a more northerly route for the Spanish Trail between their settlements in present-day New Mexico and California.

The white man's culture was first introduced in the mid-1880's when Mormon settlers moved into the Las Vegas Valley and settled near the springs. By 1900, a wagon trail linked the gold fields of central Nevada with the railroad in Las Vegas.

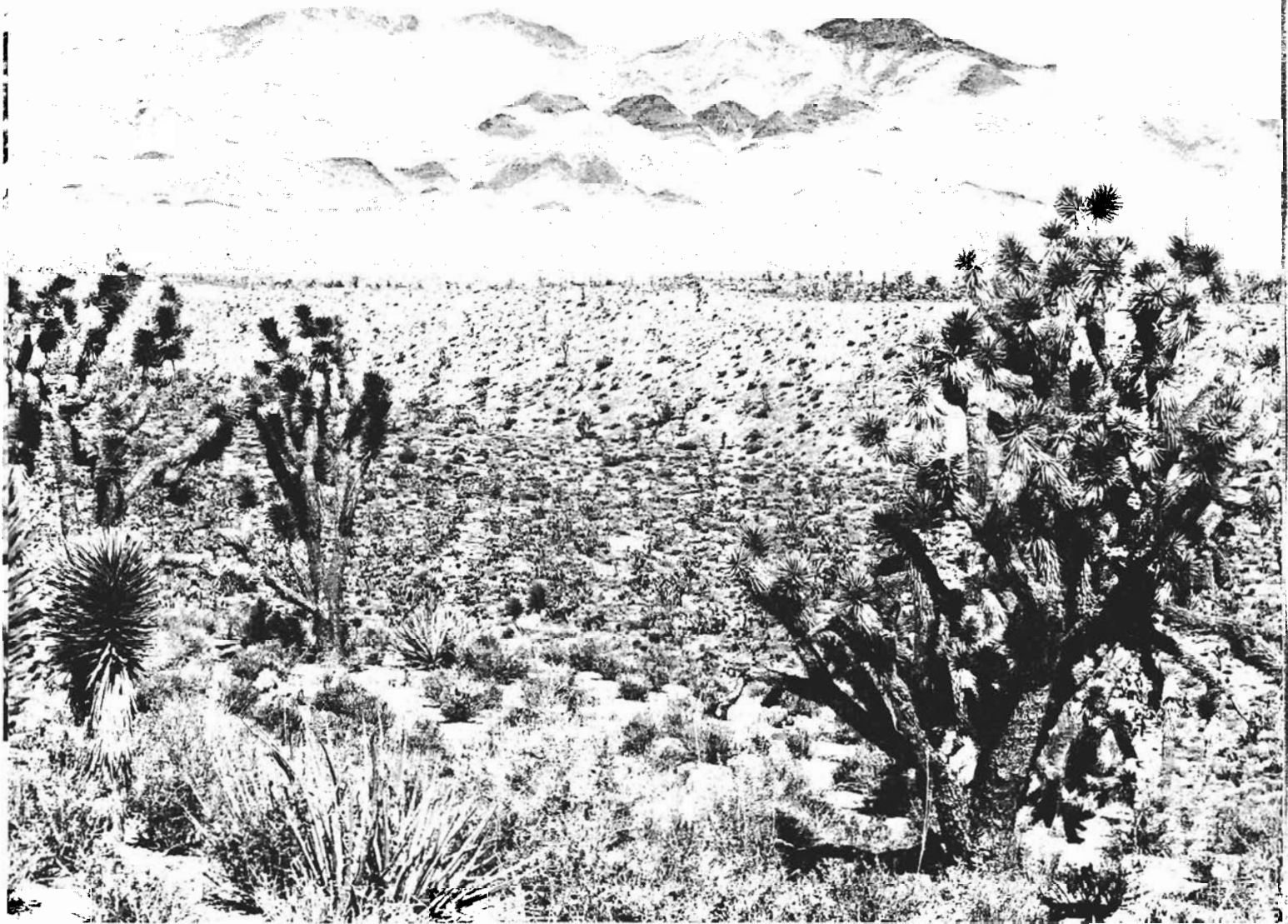
Freight teams traveled north over the Alamo and Mormon Wells Road through what is now the Wildlife Range, hauling supplies and lumber to the mining camps. Corn Creek Springs, purchased in 1939 by the Federal Government, was originally an old ranch site and stagecoach stop. Up until that time, the Range was used by a growing number of prospectors, cattlemen, poachers, bootleggers and lumbermen. Shacks and corrals were built near the best springs. Livestock competed for meager supplies of forage and water. The desert sheep was a ready source of fresh meat, and had little resistance to diseases introduced by domestic animals. Its numbers began to decline.

When originally established, the Wildlife Range comprised over two million acres and was jointly managed with the Bureau of Land Management. Joint administration was terminated in 1966, when a division in administrative responsibility between the two agencies was made. Range boundaries were adjusted accordingly, and the Bureau of Sport Fisheries and Wildlife was granted primary jurisdiction over all lands within the present-day Desert National Wildlife Range, except for about 3,200 acres subject to a primary withdrawal by the Air Force in the southeast corner of the Range.

During the early stages of World War II, an aerial bombing and gunnery training range was superimposed on the western portion of the Wildlife Range, encompassing an area of about 819,000 acres. U. S. Air Force use of this area continues under a Memorandum of Understanding between the respective Secretaries of Interior and the Air Force. Under this agreement, ground operations have been authorized on designated target areas which collectively total about 139,000 acres. Considerable physical disturbance has occurred in these areas. Use of the remaining portion of the bombing and gunnery range is limited by agreement to air space. The land remains essentially undisturbed.



Prospector's shelter from another era.



Rug Mountain, from vicinity of Mule Deer Ridge. Rug Mountain unit.

PHYSICAL DESCRIPTION

For long periods of early geological time, southern Nevada was submerged under a shallow sea. It was during this period that the material that now forms the seven distinct mountain ranges found within the study area accumulated. This was followed by constricting, folding and erosion which wore off the tops of the folds, leaving the lower as well as the upper strata in various degrees of exposure.

The steep and generally bare mountain sides are cut by deep ravines and canyons composed almost entirely of bedrock. Remnants of young alluvial aprons found high in the ranges indicate that portions of the mountains were once buried and have only recently been exposed.

Many of the basins are now sites of deposits of alluvial material transported down slope during occasional cloudbursts. The higher parts of the alluvial aprons are composed of coarse debris deposited in the geologically recent past. They are now being gradually eroded and cut by deep gullies. The lowlands or dry lake beds are underlain by fine-grained lake and stream deposits with some windblown materials.

The period of geological rejuvenation is still continuing, but at a slower rate—due to the arid conditions that have developed in this region.

With elevations ranging from 2,600 feet to nearly 10,000 feet, the climate varies widely. The mean temperature is approximately 60°F, with occasional extremes of 117°F in the valleys to below zero in the higher mountains. Summertime temperatures regularly exceed 100°F, broken occasionally by torrential thunderstorms which form quickly and deliver rain in sudden showers. These often cause flash flooding and erosion. Snow occurs almost every year in the Sheep Range, which contains the highest peaks on the area.

The diverse topography, differences in soils, and variations in precipitation and temperature have resulted in the development of several well-defined plant communities. Vegetation varies from low-growing, widely-scattered desert shrubs at lower elevations to a well-developed coniferous forest at the upper elevations. Animal occurrence and distribution also tend to correspond to the different vegetative zones with each species associated with those areas which best fulfill their seasonal requirements.

The study area embraces a veritable mosaic of nearly every ecological type that occurs in Southern Nevada. It exists as a largely pristine, strikingly beautiful example of a unique kind of American wilderness.

RESOURCES

The wide range of elevation and rainfall has created a diverse habitat suited to a wide variety of wildlife species—the most notable, of course, being the desert bighorn sheep.

The overall range of the desert bighorn has not changed markedly since white man's arrival; but the animal has disappeared from many areas within its original range, and its numbers are dangerously low in others. Conversely, available information suggests that their numbers may be as great as they ever were in some parts of their range. The desert bighorn on the Wildlife Range recovered from an estimated low of 300 in the late 1930's to around 1,000 presently. It is estimated that there are about 10,000 desert bighorns in the United States (in Arizona, California, Nevada, New Mexico and Utah—traces in Colorado, Texas and Wyoming); and 4,000 in Mexico (in Baja California and Baja California Sur, Coahuila and Sonora).

Typical desert bighorn habitat cannot support more than a few animals, due to limitations imposed by food and water availability. Further, psychological make-up of the animal seems to inhibit its population size. Because of the typically low population densities, the bighorns' sensitive psychology, and their delicate adjustment to a harsh environment, human interference—even on a small scale—could have disastrous results for the animal. The evidence that desert bighorns cannot successfully co-exist with humans and their development is overwhelming.

Bighorns in Southern Nevada commonly use the range of elevations between 3,500 and 8,500 feet. The Desert National Wildlife Range contains the essential requirements of the species within this elevational range—a wide variety of food, available water, mountainous terrain, comparative isolation from disturbance, and space. It is, therefore, imperative that all these requirements be preserved to help assure the desert bighorns' continued existence.

Peek-a-boo Canyon along Mormon Well Road is spring range for bighorn rams.
Las Vegas Range unit.



Collared lizard



Ewe and lamb



Water improvement at Rye Patch Spring.





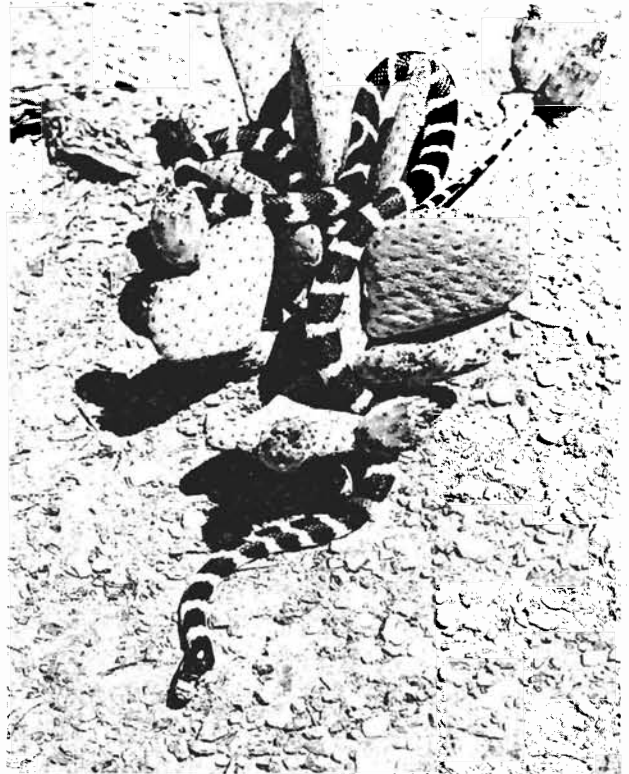
It is doubtful that any part of the State of Nevada offers a greater diversity of animal life than the Desert National Wildlife Range.

The study area supports a total of 53 species of native mammals, including the threatened kit fox, and mule deer at higher elevations. Over 250 species of birds have been recorded, including the rare prairie falcon during migration. The desert tortoise and gila monster are two of the most interesting of the 30 species of amphibians and reptiles that occur on the area.

Water is scarce throughout the study area. There are no free-flowing streams, ponds or marshes, except at Corn Creek. The dry

lakes occasionally collect run-off water during wet years, but only remain wet for a few weeks. All known springs and seeps have been improved to enhance the supply of water for wildlife. These are the only natural sources of water.

The vegetative zones change markedly with elevation, and seven distinct plant communities are easily recognized by the casual observer. Over 500 species of plants have been identified in plant communities varying from creosote bush on valley floors to pine-fir and bristlecone pine communities at upper elevations. The Sheep Range mountains contain the only well-developed coniferous forest—one of only four bristlecone pine forests occurring in the entire state.



The docile king snake.

The rare mountain lion occurs at higher elevations in Sheep Range.

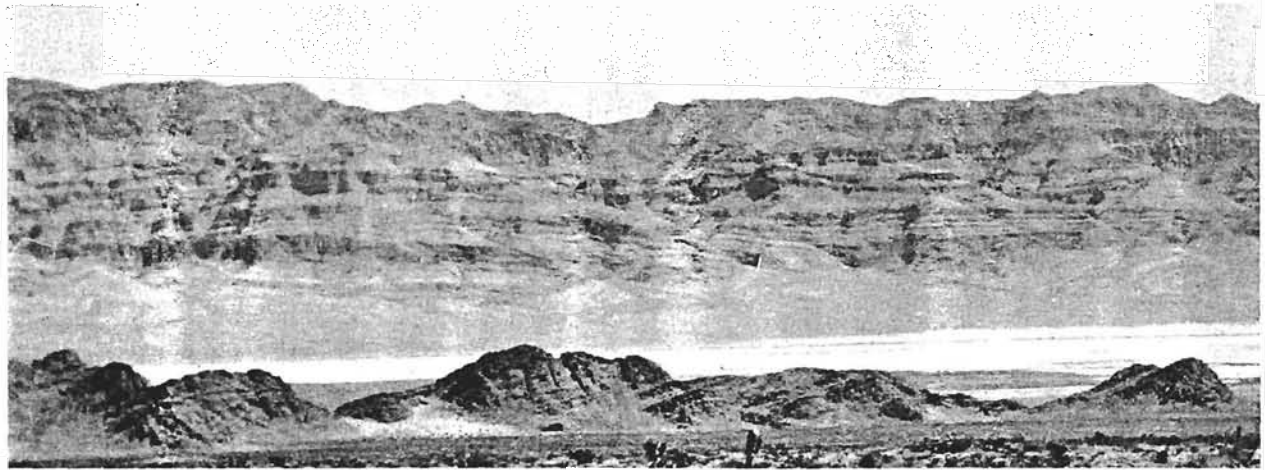


The inimitable roadrunner.





Recent mineral prospect site in Gass Peak unit.



Desert Lake, with north end of Sheep Range in background.



Creosote bush zone typical of low valleys. Corn Creek visible in background—Sheep Range beyond.

The western portion of the Wildlife Range used by the Air Force is closed to location under the mining laws. The remaining lands within the study area are largely open to mineral entry.

No information was found that would indicate that important ore-bearing zones exist within the boundaries of the study area. In fact, peripheral mineral surveys suggest that these lands are probably the least mineralized in Nevada.

No patented mining claims existed within the area at the time of the study. Visual examination of the study area also failed to reveal any valid unpatented mining claims. Prospect sites located were concentrated in the extreme southern portion of the Wildlife Range, and few showed signs of recent activity.

In order to protect the desert bighorn on the Wildlife Range, it is necessary that large areas of undisturbed natural habitat be maintained. It is important, therefore, that the entire Range ultimately be excluded from mineral exploration and development. Plans to accomplish this have been initiated by the Bureau of Sport Fisheries and Wildlife.

Areas considered to be the most critical bighorn sheep habitat have already been excluded from application of the oil and gas leasing laws. Operations associated with oil and gas exploration and development would not be compatible with wilderness.



Solitude high in the Sheep Range.

PUBLIC USE

There are many opportunities on the Wildlife Range for public recreation which is compatible with the requirements of desert bighorn sheep and related natural values. However, the number of people engaged in any one recreational activity at any given time must remain relatively limited to avoid conflict with wildlife and preserve the element of solitude and freedom from human presence that the area possesses. Herein lies one of the very special values of the Desert National Wildlife Range—the opportunity preserved for a truly unique desert wilderness experience.

Public use presently totals about 15,000 visits annually, with the greatest visitation occurring at the Corn Creek subheadquarters. Most of the area is managed as a wild area, with recreation generally limited to day use only. Hiking, wildlife observation, scenic driving, and photography are popular uses of the area. The areas of most interest to visitors are Hidden Forest within the Sheep Range Mountains, Mormon Pass, and Fossil Ridge within the Las Vegas Range Mountains. The Alamo and Mormon Pass Roads provide year-round access for conventional highway vehicles, while a few primitive "spur" roads permit seasonal access to areas which would otherwise seldom be visited because of water scarcity and the rigors of foot travel in the hot temperatures. Public access within the bombing and gunnery range is limited by military restrictions.

Recreational uses near springs and other sources of water are closely regulated to avoid conflicts with wildlife. The hunting program is coordinated with the Nevada State Fish and Game Department, with hunting limited to the taking of a few mature bighorn rams. The qualitative aspects of the hunting experience are emphasized.

Unauthorized cross-country travel by four-wheel drive and so-called "dune buggy" vehicles is an increasing problem and often difficult to control—particularly, along the southern perimeter of the Range. Wilderness designation could be highly beneficial in this respect, in terms of providing additional legislative protection.

One Research Natural Area has been officially designated and two proposed in the Sheep Range, primarily for research and educational purposes. All would be compatible with wilderness designation.

The Wildlife Range's value as outdoor laboratory for educational purposes will increase with passage of time.



MANAGEMENT

The primary management objectives within the Wildlife Range are to preserve and protect natural environmental qualities required for the survival of an optimum population of desert bighorn sheep and other native wildlife. To assure that these objectives will be fulfilled, there is a continuing need for periodic resource inventories, applied research to provide information for management and maintenance, fire suppression, and routine patrol for protection of Wildlife Range values. When vehicles are required, their use will normally be restricted to established roads and trails excluded from the wilderness proposal. Exceptions involve six primitive vehicle trails included in the wilderness for administrative use only. Use of aircraft, including fixed-wing aircraft and helicopters, will continue to be required; however, landings within the proposed wilderness will not be necessary—except in emergencies. Wildlife management requirements within the

proposed wilderness are considered entirely compatible with wilderness designation.

Management and use of lands within that portion of the study area used by the Air Force is governed by the Memorandum of Understanding between the respective Secretaries of the Interior and the Air Force. Essentially, this agreement authorizes exclusive use of the area by the Air Force for training purposes, with provision for access during certain specified periods by Range personnel for wildlife and public use management purposes.

The public domain lands included in the study are managed by the Bureau of Land Management, primarily for livestock grazing as part of much larger grazing districts. However, livestock seldom graze these areas since water is generally unavailable. The lands lack developments of any kind and are wholly natural. With wilderness designation, grazing would be eliminated.



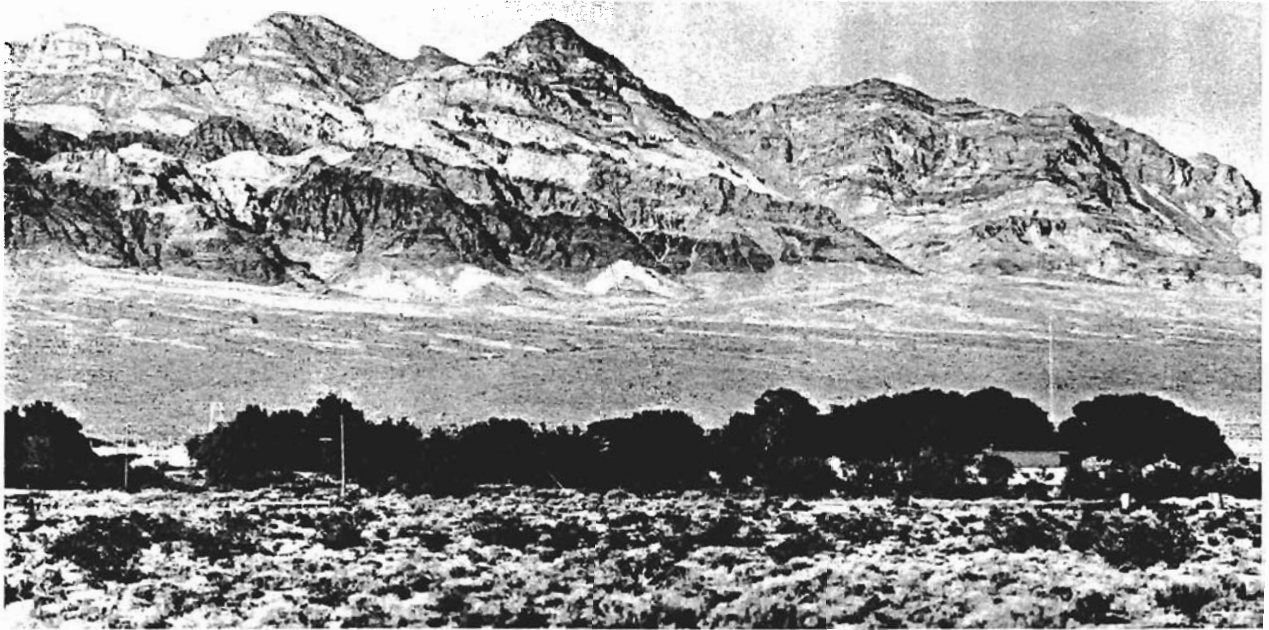
Picnic area at Mormon Pass. Mormon Well Road visible at left.



Bighorns captured in permanent trap near Wamp Spring are used to re-establish populations in areas where species formerly occurred.

View from Angel Peak area south of Wildlife Range. From left to right in background: Indian Springs Valley; Pintwater Range; Three Lakes Valley; and the Desert Range.





Corn Creek Subheadquarters, with Sheep Range in background.

DEVELOPMENT

Although the study area is remarkably free of human disturbance, a variety of existing and planned developments have a bearing on wilderness considerations. Many are not compatible with wilderness, while others are minor and will not detract from the natural quality of the area in which they are located.

Developments excluded from the wilderness proposal include lands within the bombing and gunnery range where target facilities are located; permanent roads; Corn Creek subheadquarters; and private inholdings.

Developments included in the proposal are the primitive Nye Canyon, White Sage Gap, Pine Spring, Mormon Well Spring, Wamp Spring, and Quail Spring Trails, which are required for administration of the Range; several abandoned vehicle trails which will gradually revert to their natural condition; the bighorn sheep trap at Wamp Spring; a well used for monitoring purposes by the

Atomic Energy Commission; the June Bug Mine, authorized for use as a National Radiation Shelter; water improvements, necessary for proper management of desert bighorn sheep; and mineral prospect sites.

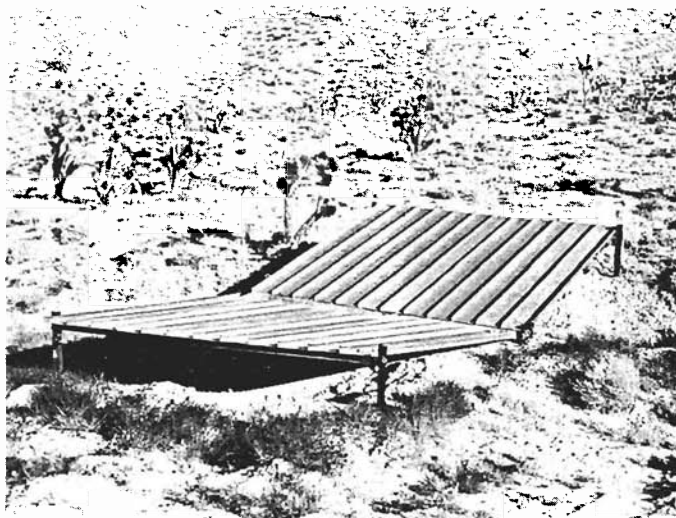
When the June Bug Mine site in the Gass Peak Unit is no longer required for local civil defense purposes, the site and access trail would be suitable for inclusion in the proposed wilderness. The old mine involves a minimum of surface disturbance and represents the type of early-day mining activity which is now very much a part of the American West. The access trail would gradually revert to a natural condition with a minimum of restorative assistance.

At such time as the test well in the Spotted Range Unit is no longer required by AEC in conjunction with their monitoring program, the site and access trail would be suitable for inclusion in the proposed wilderness with a minimum of restoration.



Looking north along Alamo Road toward Sheep Pass.

Water is a primary requirement of desert bighorns and is in short supply on a large portion of the Wildlife Range. For this reason, 28 springs have been improved and six "guzzlers" have been developed to enhance water availability. The water developments do not significantly detract from the wilderness character of the areas within which they occur. Future "guzzler" installations will be developed in a manner that will minimize their impact on natural values.

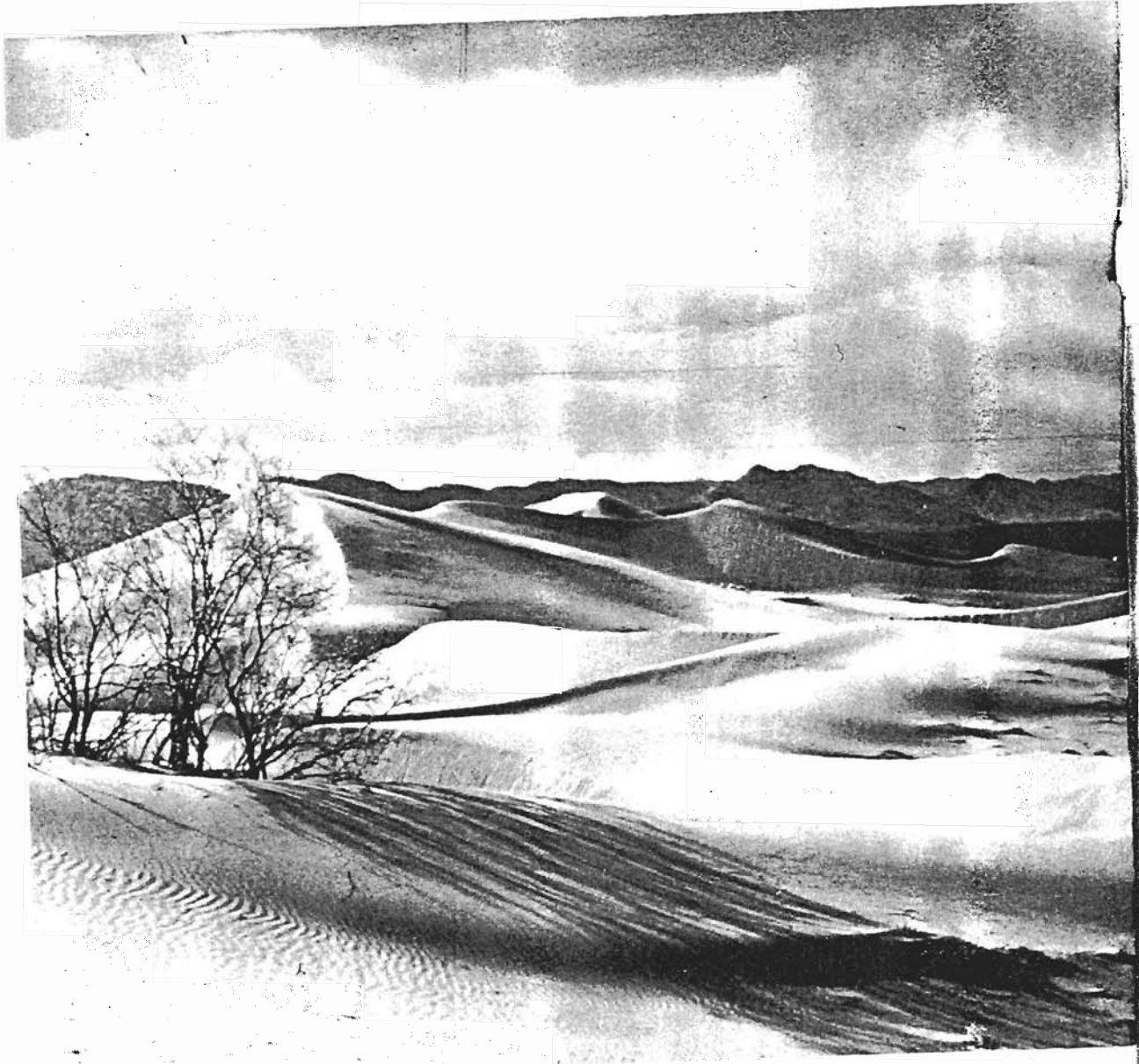


"Guzzler" collects precipitation and delivers it to underground storage tank and small drinking trough.

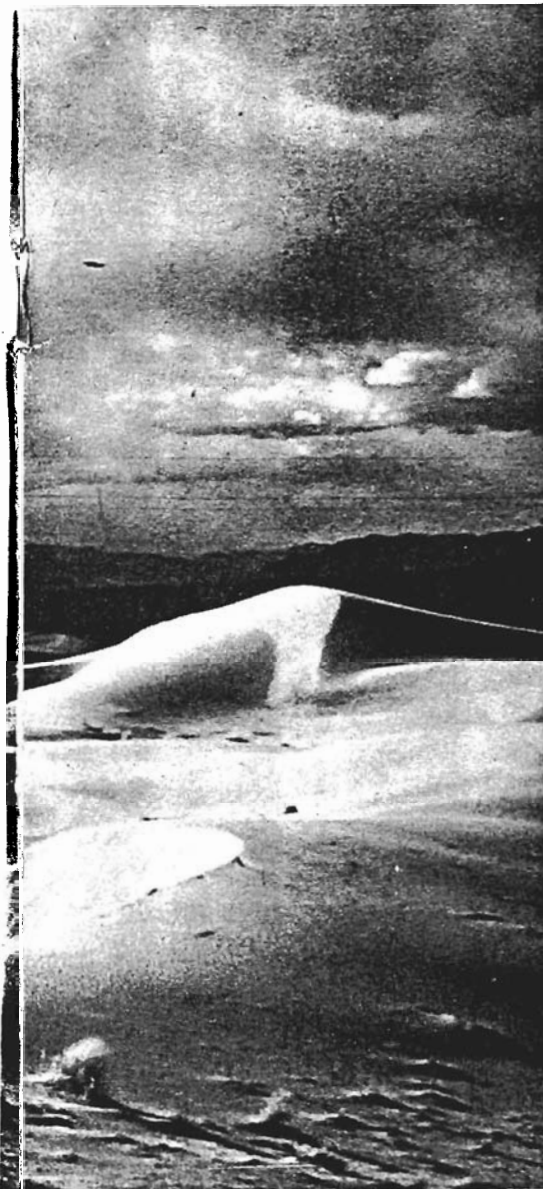


Air Force target area west of Spotted Range in Indian Springs—Gunnery Range unit.

Recreational development is planned for certain areas excluded from the proposed wilderness to facilitate public use and enjoyment of the Range. These will generally be rather minimal, with emphasis on environmental interpretation and preservation of the primitive character of the area. The most extensive development will occur at Corn Creek, where facilities planned will include a visitor center complex complete with desert bighorn sheep display areas, photographic blinds, interpretive foot trails, and a ten-mile interpretive automobile loop route.



SOCIO-ECONOMIC CONSIDERATIONS



Sand dunes near Desert Lake.

Las Vegas is one of the fastest growing metropolitan areas in the United States. The resident population of Clark County has increased by more than 157 percent since 1958, from 105,000 to nearly 300,000 at present. It also attracts around 14.5 million annual visitors. Projections made by the Las Vegas City Planning Department indicate that by 1980 the area will contain 700,000 people. The area is also well under a six-hour drive via auto from Southern California metropolitan complexes, with populations collectively in excess of eight million.

The desert is an important part of the recreation environment of southern California. In **THE CALIFORNIA DESERT, A CRITICAL ENVIRONMENTAL CHALLENGE**, the recent report released by the California State Office of the Bureau of Land Management, it is noted that annual visitor use on public lands of the California desert is increasing at about four times the national average. In the same report, a 1968 survey recorded nearly 5,000,000 visitor days for the area. By the year 2000, the report predicts that use may reach as high as 50 million visitor days.

The above illustrates the expanding use of the desert as a recreation resource by the growing population of southern California. This uncontrolled use of the fragile desert environment for recreation and other purposes has resulted in a widespread deterioration of the resource. Huge areas that no more than a few years ago were *de facto* wilderness are now visibly scarred by indiscriminate and uncontrolled use.



Desert patriarch

The Desert National Wildlife Range's accessibility by highway to the huge Los Angeles metropolitan complex and its proximity to the rapidly expanding Las Vegas metropolitan area make it a prime candidate for desert recreation uses which can adversely affect natural values. The regional recreation picture shown by the data indicates a little more than two percent of the total Class V (primitive) recreation lands now protected by the Wilderness Act. Thus, wilderness designation for the Desert National Wildlife Range would help to balance the regional recreation supply and, at the same time, protect the ecological integrity of at least a portion of the diminishing southwestern American desert.

To date, the economic values derived from mining operations have been negligible. Where there is an intermittent interest in locating claims, the damaging impact on the landscape greatly exceeds the apparent potential economic value of mineral devel-

opment. Prospecting for minerals and mining operations would not be compatible with wilderness designation.

Since competition for forage and water by domestic livestock is not compatible with wildlife management objectives, grazing is not allowed on the Wildlife Range. As indicated earlier, livestock grazing subject to provisions of the Taylor Grazing Act is permitted on the public domain lands adjacent to the Range. The lands included within the wilderness study are portions of four large allotments which are grazed intermittently when conditions are suitable. Grazing in the desert is quite variable and relies to a great extent on short-lived vegetation. Distribution is difficult to obtain, since animals tend to remain near the limited sources of water and, as a result, seldom drift west of the highway onto the study area. Termination of grazing on these lands would, therefore, have little effect on the economic stability of the area.

Looking northwest from above Cow Camp Spring. Alamo Road visible in near foreground—
Desert Range Mountains beyond.



Hiking in year-round bighorn habitat—Sheep Range unit.



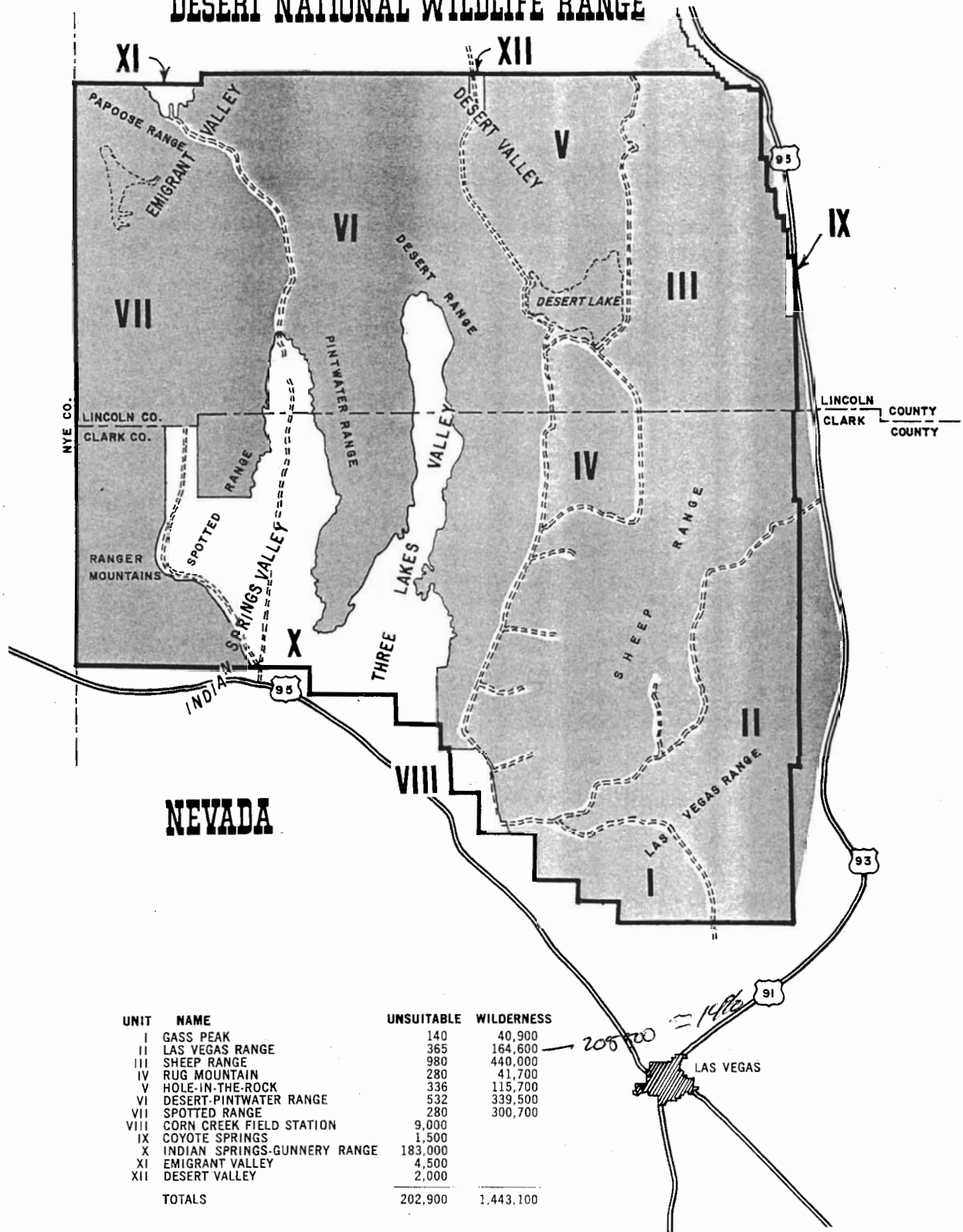
Coyote



Winter scene along Alamo Road. Sheep Range in background.

DESERT WILDERNESS PROPOSAL

DESERT NATIONAL WILDLIFE RANGE



CONCLUSIONS

THE PROPOSAL

A total of about 1,443,100 acres within the Desert National Wildlife Range wilderness study area were found suitable for further consideration as wilderness, and are proposed for designation as a unit of the National Wilderness Preservation System. The proposed Desert Wilderness consists of seven individual wilderness units varying from 40,900 to 440,000 acres in size, with the following proposed stipulations:

- Permanent roads and primitive vehicle trails which serve as wilderness unit boundaries shall be 16 feet in width, with a total right-of-way 116 feet in width, measuring 58 feet on either side of the center line of the existing road or trail. This will provide a suitable area for roadside parking and a buffer for future road maintenance.

- The primitive terminal access vehicle trails excluded from the proposed wilderness shall be 10 feet in width, with a total right-of-way of 110 feet, measuring 55 feet on either side of the center line of the existing trails. The vehicle parking and turn-around area at the end of these trails shall be an area two acres in size.
- Use of vehicles on the Nye Canyon, White Sage Gap, Pine Spring, Mormon Well Spring, Wamp Spring and Quail Spring Trails will be authorized for administrative purposes only.
- Surface exploration for minerals within proposed wilderness units would not be permitted.
- Use of the Wamp Spring sheep trap will be authorized for the trapping and transplanting of desert bighorns.

Caliente Power Line right-of-way forms southeastern boundary of proposed Las Vegas Range Wilderness Unit, at left.



THE EXCLUSIONS

Approximately 202,900 acres of the study area are proposed for exclusion from wilderness, because the lands no longer possess the character of wilderness or have existing or planned uses occurring on them which are currently inconsistent with wilderness.

Specific developments in Unit VIII include the Corn Creek administrative subheadquarters, 360 acres of private inholdings involving eight individual owners, and numerous roads.

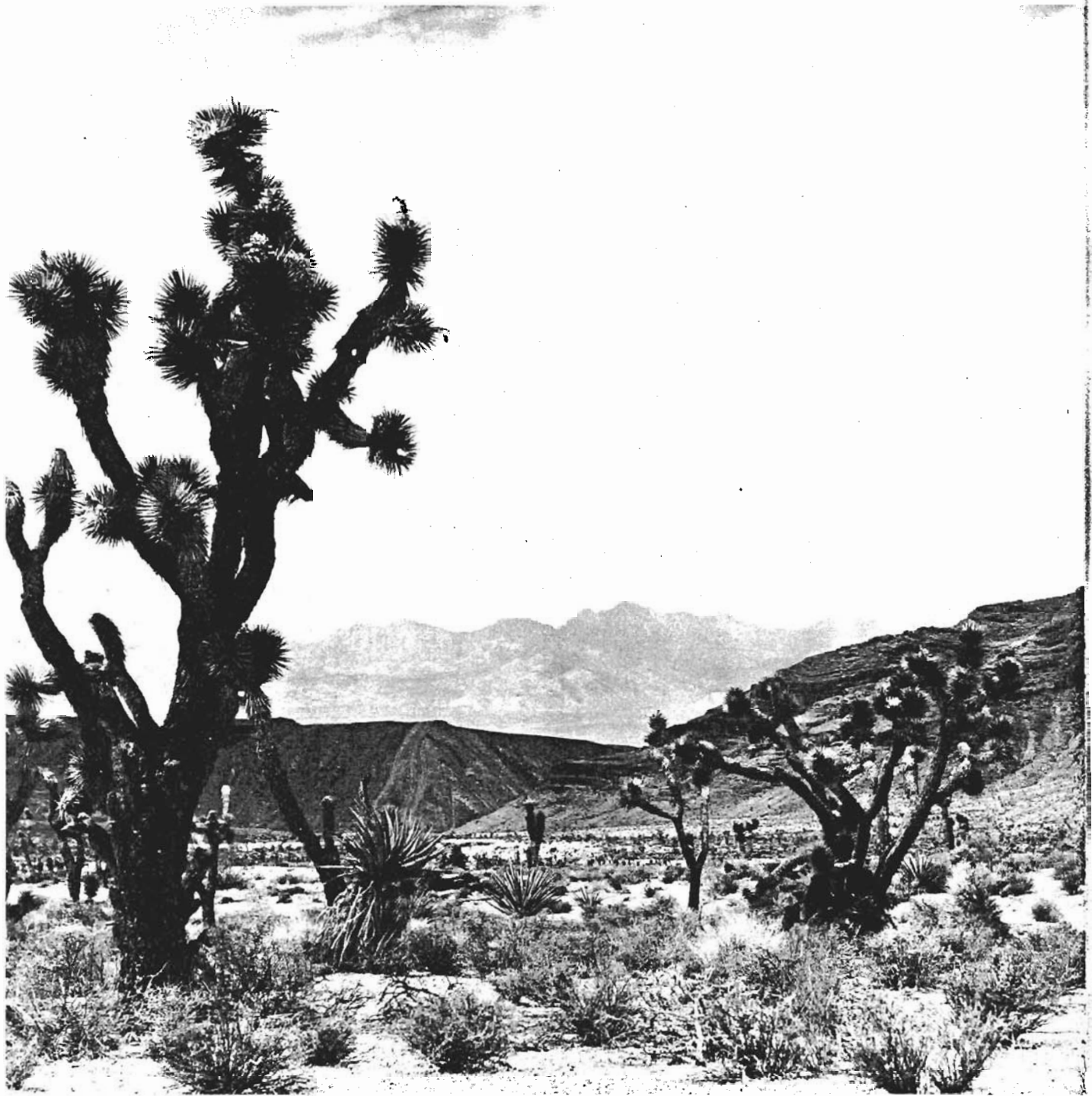
Unit IX is located along the northeast boundary of the Wildlife Range and contains 600 acres of private inholdings with two individual owners. Both tracts have extensive developments, as well as all-weather access roads from Highway 93.

Unit X includes the lands used for target areas by the Air Force as provided by the agreement which authorizes their use. The

areas subject to physical disturbances are located in the valleys below 3,600 feet elevation and were so delineated, as contour lines provide the only practical basis for establishing a wilderness management boundary in the absence of a legal land survey.

Units XI and XII are located along the north boundary of the Wildlife Range within the bombing and gunnery range and contain target facilities used by the Air Force. Much physical disturbance has occurred in conjunction with these activities.

Should military use of lands now proposed for exclusion be discontinued, much of this area would be suitable for addition to the proposed Desert Wilderness. However, rather extensive cleanup and restoration work would be required in some of the practice target areas.



Scenic diversity is outstanding quality of the Desert National Wildlife Range.

PHOTO CREDITS:

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As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

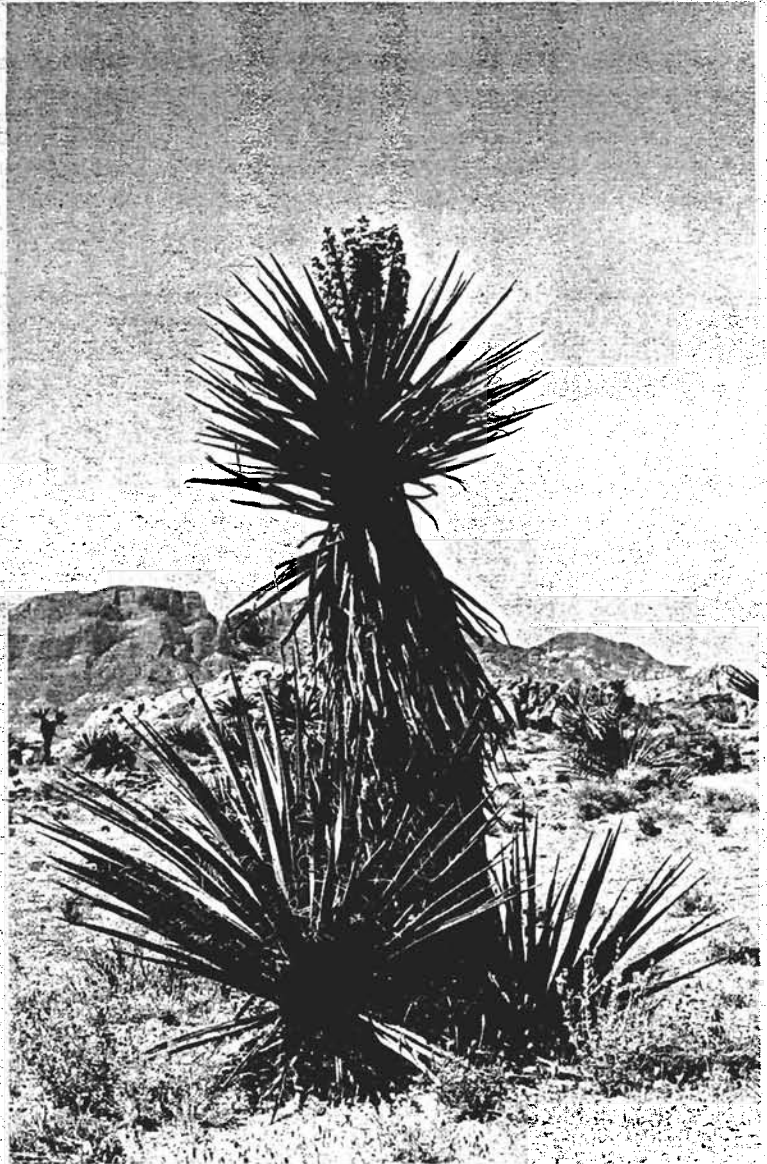
The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.



INSPECTION

Anyone interested in this proposal is urged to personally inspect the Desert National Wildlife Range wilderness study area. Additional information may be obtained from the Refuge Manager, Desert National Wildlife Range, 1500 North Decatur Boulevard, Las Vegas, Nevada 89108, or the Regional Director, Bureau of Sport Fisheries and Wildlife, Box 3737, Portland, Oregon 97208.

October 1971



UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE

Appendix J.
Desert NWR
Bighorn Sheep Discussion

Desert Bighorn Sheep Population Objectives

Prepared by Bruce Zeller

The refuge-wide desert bighorn sheep population objective, as listed in the Refuge Management Plan, Part II (1987) and draft Sheep Management Plan (1990), is 2000. Based on helicopter survey data gathered during the fifteen year period between 1974 and 1988, the refuge-wide desert bighorn population was at or very near the objective level (see Table 1.).

During the last fifteen years, 1989-2003, the refuge-wide desert bighorn population is approximately 1000 individuals below the objective level (see Table 2.). Therefore, a 100% increase or doubling of the population is required to reach the objective level. Most of the shortfall is accounted for by declines in the Sheep Mountains sub-population and the smaller, more transitory sub-population of the adjunct East Desert Mountains.

Table 1. Fall helicopter survey results by mountain range on DNWR, 1974-1988.

Year	No. of Bighorn Recorded Per Mountain Range					
	Las Vegas	Sheep*	E. Desert	Desert	Pintwater	
1974	111	172	97	70	50	
1975	89	183	83	17		
1976						
1977	79	331	91	102	114	
1978	73	239	41	30	82	
1979	21	403	29	10	75	
1980		436			28	
1981	46	297	65	37	37	
1982	27	146			68	
1983	45	346	49	17	120	
1984		205				
1985	38	436	87	38	94	
1986	34	361	73	29	75	
1987	39	280	19	85	104	
1988	11	215	54	48	104	
<u>Total:</u>	613	4050	688	483	951	
<u>Average:</u>	51.1	289.3	62.5	43.9	79.3	
(1)						
<u>Ave. Est. Pop:</u>	194	1096	174	220	300	<u>Grand Total:</u> 1984

*Smaller sample sizes during 1974, 1975, 1978, 1982 & 1984 are directly correlated to reductions in survey hours. Because no adjustment was made for those years when survey hours were reduced, the average estimated population is skewed downward.

Table 2. Fall helicopter survey results by mountain range on DNWR, 1989-2003

Year	No. Bighorn Recorded Per Mountain Range				
	Las Vegas	Sheep*	E. Desert	Desert	Pintwater
1989	46	146	15	28	51
1990	53	146	10	62	67
1991	33	78	31	46	72
1992	55	66	25	57	60
1993	87	61	21	47	92
1994	39	38	20	28	76
1995	65	60	19	35	56
1996	41	37	29	34	67
1997	34	39	4	26	57
1998	65	42	14	28	47
1999	43	70	10	27	64
2000	70	59	25	8	63
2001		16	17	72	68
2002	51	50	13	41	46
2003	53	57	6	48	67
<u>Total:</u>	735	965	259	587	953
<u>Average:</u>	49.0	64.3	17.3	39.1	63.5
(1)					
<u>Ave. Est. Pop.:</u>	186	244	48	196	241
					<u>Grand Total: 915</u>

*Smaller sample sizes during 1996, 1997, 2001 & 2002 may be partially correlated to reductions in survey hours. Because no adjustment was made for those years when survey hours were reduced, the average population estimate may be skewed slightly downward.

(1)Footnote: Population estimates derived by dividing the average no. of sheep recorded by the observation rate or visibility factor (all ranges = 40%) and the percentage of habitat surveyed (Las Vegas, Sheep & Pintwater Ranges = 66%; Desert Range = 50%; East Desert Range = 90%)

As a result of the biological review conducted in April, 2003, there was a recommendation to establish a population objective for each mountain range/sub-population. It was further recommended that a threshold level (minimum sub-population size) be set for each mountain range. Decline below the threshold level would trigger an “all-out”, immediate strategy(s) to reverse the trend.

The suggested objectives and thresholds are presented in the following table. All objectives are based on data presented in Table 1., except the Spotted Mountains. The Spotted Mountains resident herd is a relative young sub-population, established by trans-locations in 1993 and 1996, with only three years of helicopter data. Empirical evidence indicates that small desert bighorn populations, those with fewer than 50 individuals, may be susceptible to extinction (Berger 1990, 1991, Krausman et al. 1993, Krausman et al. 1999). This was the basis for using 50 as the threshold level for all ranges except the Sheep Mountains. Fifty desert bighorn in the expansive habitat of the Sheep Mountains would represent an extremely low/unacceptable density; thus, its threshold was set at a higher level.

Table 3. Population objectives and thresholds by mountain range on DNWR.

Mountain Range	Objective	Threshold
Las Vegas	200	50
Sheep	1000	150
East Desert	100*	50
Desert	250	50
Pintwater	300	50
Spotted	150	50
<u>Total:</u>	2000	

*The average population for the East Desert Mountains in Table 1. is believed to be inflated by high numbers of migrants from the Sheep Mountains. The East Desert Range is relative small with only two man-made water developments; therefore, a more realistic resident, bighorn population objective is 100.

Literature Cited

Berger, J. 1990. Persistence of different sized populations: an empirical assessment of rapid extinctions in bighorn sheep. *Conservation Biology* 4:91-98.

Berger, J. 1999. Intervention and persistence in small populations of bighorn sheep. *Conservation Biology* 13:432-435.

Desert National Wildlife Range, Refuge Management Plan, Part II. 1987. U.S. Fish and Wildlife Service. Las Vegas, Nevada.

Desert National Wildlife Range, Draft Sheep Management Plan. 1990. U.S. Fish and Wildlife Service. Las Vegas, Nevada.

Krausman, P. R., Etchberger, R. C., and R. M. Lee. 1993. Mountain sheep population persistence in Arizona. *Conservation Biology* 7:219.

Krausman, P. R., Sandoval, A. V., and R.C. Etchberger. 1999. Natural history of desert bighorn sheep. Page 139-179 in R. Valdez and P. R. Krausman, eds. *Mountain sheep of North America*. University of Arizona Press, Tucson.

Appendix K.
CCP Implementation

The Comprehensive Conservation Plan (CCP) for the Desert National Wildlife Refuge Complex will be prepared following approval of the Final EIS and issuance of the Record of Decision (ROD), which will identify the selected plan. This appendix combined with Chapters 1 and 4, portions of Chapter 2, and Appendix E of the Final EIS will form the basis for the Final CCP. Implementation of the CCP can begin following the issuance of the ROD. Although it is our intent to implement the proposed strategies (projects) by the established deadlines, the timing of implementation may vary depending upon a variety of factors, including funding, staffing, compliance with Federal regulations, partnerships, and the results of monitoring and evaluation. Some strategies, such as those related to habitat restoration, will require the completion of step-down plans and appropriate environmental compliance documents before they can be implemented. This appendix defines how the preferred alternative for each refuge in the Desert NWR Complex (described in Chapter 3) would be implemented if they are identified as the selected plan in the ROD.

During the 15 years following CCP approval, the CCP will serve as the primary reference document for all refuge planning, operations, and management. Appendix E lists the various wildlife and habitat management and visitor services goals, objectives, and strategies for the preferred alternative for each refuge. Completion of any of these actions would however be dependent upon the various factors. These strategies would be implemented with assistance from new and existing partners, including public agencies, tribes, non-governmental organizations, and the public. Consistent public outreach and continued coordination with refuge constituents are essential components of this implementation process. Some of the partnership opportunities to be explored during the 15-year life of this CCP are described below, as are the stepdown plans, monitoring responsibilities, and staffing and funding requirements needed to successfully implement the CCP.

CCPs are intended to evolve with each Refuge, and the Improvement Act specifically requires that these plans be formally revised and updated at least every 15 years. The formal revision process will follow the same steps as those implemented for the initial CCP development process, with a major emphasis placed on public involvement. Until a formal revision is initiated, the Service will periodically review and update the CCP (at least as often as every five years) to address needs identified as a result of monitoring or in response to adaptive management procedures. This CCP will also be informally reviewed by refuge staff while preparing annual work plans and updating the refuge databases. It may also be reviewed during routine inspections or programmatic evaluations. Results of any or all of these reviews may indicate a need to modify the plan. The goals described in this CCP will not change until they are reevaluated as part of the formal CCP revision process. However, the objectives and strategies may be revised to better address changing circumstances or to take advantage of increased knowledge of refuge resources. If revisions to the CCP are required prior to the initiation of formal revisions, the level of public involvement and associated NEPA documentation will be determined by the Refuge Manager.

Monitoring

Monitoring the effects of management actions on the Refuges' trust resources is an important component of the CCP, as is the documentation of the Refuges' baseline conditions. By completing baseline inventories and monitoring specific management actions, Refuge staff can better understand the species, habitats, and physical processes that occur on the Refuges and the ecological interactions that occur between species. Monitoring is an ongoing management activity at each refuge in the Desert NWR Complex and will continue per available funding. Appendix E identifies several new and/or expanded inventories and monitoring actions for each refuge.

Adaptive Management

Adaptive management involves sequential decision making, integrating project design, management, and monitoring to systematically test assumptions. Based on the data and lessons learned, subsequent phases of an ongoing restoration project or a new restoration project with similar objectives can be revised as necessary to maximize project objectives over time. Adequate baseline data, clearly defined and measurable project objectives, a monitoring plan focused on measurable results, and a process for refining and improving current and future management actions are all essential components of a successful adaptive management approach to restoration. Each of these components would be addressed during step down planning, and the details of the adaptive management approach would be integrated into final restoration plans

Step-Down Plans

Some projects such as public use programs and habitat restoration proposals require more in-depth planning than the CCP process is designed to provide. For these projects, the Service prepares step-down plans. Step-down plans provide additional planning and design details necessary to implement the strategies (projects or programs) identified in the CCP. Several step-down plans are proposed for completion following the approval of the CCP. Table 1 lists the step-down plans proposed for each refuge along with the target date for completion.

Compliance Requirements of Plan Implementation

All projects and step-down plans described in the CCP will be required to comply with NEPA and the Improvement Act, as well as a variety of other Federal regulations, executive orders, and legislative acts, which are described in greater detail in Chapter 6 of this document. The EIS is intended to address all proposed actions at the program level; however, some actions once defined in greater detail may require additional analysis and review under NEPA.

Anticipated Costs and Staffing Needs to Fully Implement the CCP

The estimated costs for the various projects described for the preferred alternatives for each refuge are presented in Table 2. These costs are rough estimates and will be refined as more details are available. To fully implement the proposed actions and achieve the goals and objectives of the CCP for the four Refuges, additional staff will be necessary. Table 3 presents the current and future (proposed) staff needs for management of the each refuge.

Potential Funding Sources for Implementing CCP Projects

Many projects included in the CCP may be implemented in full or in part by sources other than the Refuge annual budget. These projects could be funded through partnerships with other local, state, or federal agencies, special legislative appropriations, or grants (i.e., Southern Nevada Public Lands Management Act, National Fish and Wildlife Foundation, Transportation Enhancement Funds). Other potential sources of funding for restoration projects include: the North American Wetlands Conservation Act Grants Program; and the Cooperative Endangered Species Conservation Fund.

Partnership Opportunities

Many programs on the refuges, both existing and planned, are made possible through a variety of public/private, interagency, and tribal partnerships. Chapter 1 of the EIS includes a brief description the existing partnerships at each refuge.

Table 1. Step-down plans proposed for the Desert NWR Complex

<i>Plan</i>	<i>Target for Completion</i>
Ash Meadows NWR	
Restoration plan for Crystal Management Unit	2011
Restoration plan for Carson Slough Management Unit	2011
Site restoration plans for Upper Point of Rocks, Jackrabbit Spring, the Warm Springs Unit (North and South Indian Springs and School Springs), Lower Point of Rocks, Lower Kings Pool, Marsh, Big, Fairbanks, Tubbs, Bradford, Crystal, Forest, and North and South Scruggs Springs	Within 15 years
Transportation Plan	2010
Resurfacing plan for main roads	2012
Plan to remove dikes in uplands	2011
Plan for Modification and/or removal of Crystal Reservoir	2011
Data management plan	2008
Environmental Education Plan	2010
Visitor Services Plan	2008
Hunting step-down	Within 3 yrs
Cultural Resources Management Plan	Within 15 yrs
Desert NWR	
Sheep Management Plan	2009
Inventory and Monitoring Plan	Within 15 yrs
Restoration Plan for areas along the s. & e. boundaries	Within 15 yrs
Moapa Valley NWR	
Long-term Water Resources Management Plan	2008
Integrated Pest Management Plan	Within 15 yrs
Inventory and Monitoring Plan	Within 5 yrs
Habitat Management Plan	Within 3 yrs
Pahranagat NWR	
Fisheries Management Plan	Within 3 yrs
Habitat Management Plan	Within 3 yrs
Inventory and Monitoring plan	Within 5 yrs
Water Resources Management Plan	2012
Integrated Pest Management Plan	2009
Spring Restoration Plan	2012
Refugium for endangered and native fish	2012
Interpretive plan	Within 5 yrs

Table 2. Estimated One-Time Project Costs to Implement CCP

<i>Expenditure (Related Strategy)</i>	<i>Estimated Cost (1000s)¹</i>
Ash Meadows NWR	
Conduct baseline inventories on vegetation communities, small mammals, herps, and pollinators (1.1.1)	1,400
Complete a four year baseline inventory and monitoring for endemic fish species and a three year baseline inventory and monitoring for the southwest willow flycatcher (1.1.2)	710
Continue and improve inventory of native species diversity and distribution (1.1.3)	50
Continue and improve inventory of non-native species diversity and distribution (1.1.4)	50
Conduct baseline and periodic monitoring of endangered or threatened bird species (1.1.11)	25
Conduct periodic monitoring of secretive marsh birds and sensitive species of waterfowl (1.1.12)	25
Develop and implement habitat restoration and translocation protocols for target species, including consideration of timing of habitat restoration and genetics (1.3.1)	55
Develop life history and habitat conservation models of target species (1.3.3)	156
Complete and implement Restoration Plans for Upper Point of Rocks, Jackrabbit Spring , and the Warm Springs Unit (North and South Indian Springs and School Springs) (1.3.6)	1,000
Complete and implement the restoration plans for Lower Point of Rocks, Lower Kings Pool, Marsh, Big, and Fairbanks Springs (1.3.6)	1,250
Develop and implement restoration plans for Tubbs, Bradford, Crystal, Forest, and North and South Scruggs Springs (1.3.10)	1,500
Based on outcome of Carson Slough Restoration Plan, develop and implement restorations plans for Longstreet and Rogers Springs (1.3.11)	1,000
Restore Point of Rocks spring outflow channel habitat to known suitability and monitor parameters (ex. temperature, flow, depth, etc.) to inform adaptive management (1.4.1)	175
Perform experimental planting and monitoring on test sites, representative of Refuge habitat (1.5.2)	22
Conduct habitat suitability study for listed plants (ex. Niterwort) (1.5.6)	45
Complete a feasibility study for construction of an on-site greenhouse to supply plants for restoration on the Refuge (1.5.7)	35
Within 15 years of CCP construct a refugium for the Ash Meadows speckled dace if feasible (1.6.3)	335
Within 5 years, complete a feasibility assessment of on-site and off-site refugia for all other Ash Meadows NWR endemic species (1.6.4)	25
Obtain normal color aerial photography on a decadal scale or more frequently if necessary (2.1.1)	
Improve Refuge-wide vegetation map through ground surveys and updating of GIS layers (2.1.2)	380
Obtain 1-2 foot contour data for Refuge to aid in restoration and planning activities (2.1.5)	65
Within 10 years obtain baseline data on spring discharge, flood frequency, and groundwater elevation for seventeen springs identified in the Refuge Biological Assessment (2.2.4)	85
Conduct an assessment of berms, ditches, dams, impoundments, and reservoir basins (2.3.1)	45
After assessment initiate removal of dams, impoundments, and unnecessary roads within the Warm Springs, Jackrabbit/Big Springs, Upper Carson Slough, and Crystal Springs units to restore natural hydrology on a landscape scale (2.3.2)	3,000
Restore natural average and range of variability, flood frequency, water quality and water table elevation for open water at Peterson Reservoir and Horseshoe Reservoir (2.3.4)	22
Restore Crystal Spring outflow to historic channel, through the administrative area, when the	500

¹ A variety of funding sources could be used to pay for project costs, including appropriated funds (annual refuge budget), Southern Nevada Public Lands Management Act, National Fish and Wildlife Foundation, and Transportation Enhancement Funds

<i>Expenditure (Related Strategy)</i>	<i>Estimated Cost (1000s)¹</i>
office/visitor center is relocated (2.3.5)	
Conduct a study to evaluate nutrient input to streams from roads (2.3.9)	55
Implement the plan for the modification or removal of Crystal Reservoir (2.3.10)	
Install temporary fish barriers until bass eradication is complete at Big and Jackrabbit springs (2.3.12)	80
Inventory, assess, and mitigate landscape disturbances including graded lands, mines, fences and other disturbances (2.3.13)	145
Within ten years, reduce salt cedar and Russian knapweed distribution by 75 to 95% of the 2006 distribution on 4,000 acres of Refuge land of salt cedar (2.4.2)	
Replace or add gates on service or fire roads and sign them (2.6.12)	2.5
Add 11 to 15 road gates to prevent unauthorized use of roads and resource damage (2.6.15)	7.5
Develop a Resurfacing Plan for main roads through and on the Refuge that considers the restoration of slough hydrology (2.6.16)	85
Complete the Refuge Transportation Plan (2.6.19)	213
Conduct a study to obtain historic plant distribution through pollen analysis (2.7.4)	175
Restore historic hydrology and revegetate mesquite bosques and dunes along spring channels and in former agricultural fields (2.8.2)	11,000
Rehabilitate 30-45% of old agricultural fields by controlling invasive species and installing native plants (2.8.7)	1,500
Develop and implement plan to remove dikes in uplands	100
Complete a study to obtain biological and geomorphic data to inform demolition and restoration plan for Crystal Reservoir (2.11.1)	254
Establish conservation agreements or acquire in-holdings from willing sellers (2.12.2)	9,000
Conduct a literature review of aquatic invasive species ecology, trophic interactions and eradication treatments, for detrimental species (3.1.1)	3
Conduct experiments on Refuge habitat and species impacts and trophic interactions due to aquatic invasive species (3.1.2)	33
Conduct a study of crayfish ecology on Refuge (3.1.4)	34
Conduct laboratory and field experiments on eradication/control techniques (3.1.5)	33
Study exclusion methods to restrict movement of non-native fish (ex. large mouth bass, green sunfish, etc.) into native fish habitat (3.1.6)	12
Complete studies and analysis of historic data to link uplands, alkali meadows, and springs habitats (3.3.2)	35
Conduct studies to obtain basic life history information for endemic and listed plant species (3.3.3)	60
Conduct taxonomic studies of Refuge plant species (3.3.4)	384
Install a weather station within each of the three major drainage basins (3.4.1)	135
Complete a study to obtain core samples from old spring mounds, Carson Slough, etc. (3.4.2)	45
Conduct tree ring studies to determine growth patterns over long periods of time (3.4.3)	207
Conduct studies of past pollen and spore distribution (palynology studies) (3.4.4)	176
Conduct a comprehensive Refuge terrestrial species inventory (3.5.2)	1,200
Conduct bat studies (3.5.3)	96
Complete a study to obtain baseline information on reptiles and amphibians (3.5.4)	381
Conduct a one-year assessment on the relationship between coarse woody debris and terrestrial invertebrates and continue monitoring if feasible (3.5.5)	33
Conduct a study to assess contribution of invertebrates associated with coarse woody debris to terrestrial macrofauna diet (3.5.6)	25

<i>Expenditure (Related Strategy)</i>	<i>Estimated Cost (1000s)¹</i>
Evaluate dust impacts to listed plants through two-year studies (lab and field) and generate recommendations for road management (3.6.2)	45
Complete a study to determine the historic fire regime for Ash Meadows prior to broad establishment of invasive species (3.7.6)	100
Identify and archive existing datasets, including hard copy only data (ex. maps, photos, diaries, etc.) (3.8.3)	75
Contract a feasibility study for location and design of an on-site research facility (3.9.2)	65
Complete an assessment of visitor education needs and opportunities (4.1.3)	3
Develop an outreach Plan to support the Carson Slough Restoration Plan (4.1.12)	8
Develop an educational video on the endemic fish and other wildlife of Ash Meadows NWR (4.1.13)	45
Design and construct boardwalks to follow Kings Pool Stream from parking lot to Kings Pool, with a pool overlook (4.2.1)	700
Design and construct interpretative displays for new boardwalks to be installed at Point of Rocks (4.2.2)	144
Design and construct boardwalk to the Longstreet Cabin and an overlook for the Longstreet Spring pool (4.2.3)	132
Improve Point of Rocks and Longstreet Cabin parking areas (4.2.5)	91
Conduct a study of Refuge visitation to determine the number and purpose of visits (4.2.7)	35
Improve signs on Refuge boundary (4.2.8)	360
Develop multi-lingual interpretative materials and construct new interpretive facilities at Fairbanks Springs (4.2.11)	35
Design and construct other interpretive facilities identified in the Interpretive Plan (4.2.12)	4,500
Develop and implement a comprehensive Visitor Services Plan by 2009	25
Improve existing roadways and parking areas to good condition as described in the Ash Meadows Refuge Roads Inventory (2004) (4.2.15)	2,500
Contract for a feasibility study for location and design of new headquarters/visitor contact station building (4.6.2)	145
Contract for construction of the new facility (4.6.3)	3,600
Compile all existing baseline data on cultural resources sites, surveys, and reports within, and near, the Ash Meadows NWR. And create digital, GIS, and hard copy databases, maps, and a library (5.1.5)	15
Prepare evaluation criteria and conduct a cultural resource inventory at all public use areas, roads, impacted areas, and other destinations on Ash Meadows NWR and areas that would be affected by Refuge projects (5.2.1)	544
Inventory, evaluate, mitigate adverse effects and stabilize samples of cultural resources on Ash Meadows NWR using a research design prepared in consultation with appropriate tribes and the scientific community (5.2.3)	65
Conduct a study of ethnobotany and traditional plant use locations on Ash Meadows NWR in consultation with appropriate tribes (5.2.4)	80
Update Refuge brochures and interpretive signs with appropriate cultural resources information (5.3.8)	20
Identify and evaluate cultural resources subject to looting/vandalism, erosion, or deterioration and implement steps, including barriers and signs to reduce these threats and preserve the resources (5.4.1)	35
Total	38,596
Desert NWR	
Determine connectivity between sub-populations and their habitats on- and off-Refuge using	50

<i>Expenditure (Related Strategy)</i>	<i>Estimated Cost (1000s)¹</i>
historical records, random sightings, and radio-tracking data. (1.1.9)	
Remove highly flammable vegetation around catchments as needed to protect from wildfires. (1.1.11)	50
Evaluate and adjust as necessary the current population monitoring methodology to determine adequacy for trend analyses. (1.1.12)	25
Construct additional rainwater catchments if existing sources are determined to be inadequate. (1.1.13)	50
Conduct a radio telemetry study to assess bighorn sheep mortality factors, particularly mountain lion predation, home ranges and habitat utilization/abandonment, and other research priorities. Coordinate radio telemetry with Air Force so that an appropriate band can be assigned to prevent transmission problems or equipment failure. (1.1.15)	100
Collect blood and fecal samples to determine general health of herd, diet composition and nutrient uptake, and genetic diversity. (1.1.16)	50
Develop and implement a Sheep Management Plan in cooperation with NDOW. The Plan would be flexible and address a number of issues such as management of water developments, herd health, predator management, habitat management (prescribed fire) and population management (translocations). (1.1.18)	100
Develop survey and mapping data using GIS tools and following the standards provided in the USFWS WH8 Promises Team report regarding biotic and abiotic data layers. (2.1.4)	50
Develop and implement an inventory and monitoring plan in coordination with FWS Endangered Species Program, NDOW, DOD and academic institutions. (2.1.5)	50
Establish permanent, representative sample plots in each major plant community on the refuge. At each site, conduct baseline inventory of plant and animal species composition and abundance. Repeat inventories every five years. (2.1.6)	250
Construct and maintain a steel post and cable fence along the southern boundary. (2.2.9)	2,000
Where necessary, fence and maintain the eastern boundary using a steel post and cable construction method. (2.2.12)	2,000
Develop and implement plan to close illegal trails and rehabilitate damaged habitat along the southern boundary. (2.2.14)	500
Use prescribed fire and naturally ignited fires to restore vegetation characteristics representative of a natural fire regime (assume helicopter ignition, 2,000 ac/year for five years) (2.3.2)	100
Work with partners to fill data gaps in fire ecology of Desert NWR plant communities. (2.3.4)	50
Work with the Air Force to update the MOU as required by Public Law 106-65. (3.1.1)	50
Survey and rectify the RNA boundaries with accurate legal descriptions and ground markers. (3.2.1)	50
Conduct photographic reconnaissance and documentation of all RNAs. (3.2.2)	25
Develop cultural resources interpretive and environmental education materials in coordination with the Native American tribes. (4.1.7)	25
Develop live “sheep cam” at water development and stream video through website and to visitor contact station/center. Apply for SNPLMA funds, or other appropriate sources to develop the webcam. (4.1.8)	50
Develop and install interpretive panels and signs at designated entry point(s). (4.1.9)	50
Develop and install a permanent environmental education/interpretive display at a prominent public venue such as McCarran International Airport. (4.2.1)	25
Develop and distribute a Desert Refuge video in the community. (4.2.3)	45
Evaluate potential sites and construct blinds for wildlife observation and photography. (4.3.3)	10
Improve and maintain Mormon Well and Alamo Roads to fair condition based on the 2002 Refuge Road Inventory. (4.3.4)	10,000
Map existing trails using GPS and develop trail guide. (4.3.5)	5

<i>Expenditure (Related Strategy)</i>	<i>Estimated Cost (1000s)¹</i>
Use post and cable fencing to designate specific parking turnouts along Alamo, Mormon Well and Gass Peak Roads. (4.3.6)	5
Construct an entrance sign and information kiosk at the east end of Mormon Well Road. (4.3.7)	35
Compile all existing baseline data on cultural resources sites, surveys, and reports within, and near Desert NWR and create secure digital, GIS, and hard copy databases, maps, and library. (5.1.2)	30
Prepare evaluation criteria and conduct a cultural resource inventory at all public use facilities and areas that would be affected by Refuge projects. (5.2.1)	500
Inventory, evaluate, and nominate Traditional Cultural Properties and sacred sites to the National Register, in consultation with culturally affiliated Tribes. (5.2.2)	150
Inventory, evaluate and mitigate adverse effects and stabilize samples of cultural resources on Desert NWR using a research design prepared in consultation with culturally affiliated Tribes and the scientific community. (5.2.3)	65
Conduct a study of ethnobotany and traditional plant use at locations on Desert NWR in consultation with culturally affiliated Tribes. (5.2.4)	80
Create a cultural resource layer in a NWR complex GIS database that aids in the identification, planning, monitoring, and interpretation of cultural sites. (5.2.5)	25
Coordinate with the Consolidated Group of Tribal Organizations to identify potential critical/priority cultural sites on the non-military overlay of the Desert Refuge. Develop a cooperative program to survey and record these sites. (5.3.3)	50
Work with culturally affiliated Tribes on projects to restore habitats of important native plants and to harvest (for traditional non-commercial purposes) native plant foods. (5.3.4)	25
Consult with culturally affiliated Tribes and other stakeholders to design and implement educational materials, programs and activities that would be used to address traditional or sacred resources, and to increase awareness on- and off-Refuge about the sensitivity of cultural resources to visitor impacts and the penalties for vandalism. (5.3.6)	50
Identify and evaluate cultural resources subject to looting/vandalism, erosion, or deterioration and implement steps, including barriers and signs to reduce these threats and preserve the resources. (5.4.1)	35
Create and implement a cultural resources site stewardship volunteer program. (5.4.4)	25
Total	16,835
Moapa Valley NWR	
Continue channel restoration on the Pedersen Unit by planting native species. (1.1.1)	2
Complete restoration of the spring heads and channels on Apear Unit. (1.1.2)	450
Restore native overstory, mid-level and understory vegetation (using local seed and/or seedlings) to riparian corridors, transitional upland sites and any disturbed or newly exposed areas. (1.1.3)	2
Develop strategies to remove non-native fish species, including mollies and mosquito fish, from Refuge streams in coordination with the USFWS Endangered Species program and NDOW. (1.1.15)	2
Inventory Refuge habitat consistent with the Moapa Dace Recovery Plan. (1.2.2)	5
Develop a GIS-enabled species inventory program, beginning with Moapa dace inventory data. (1.2.3)	10
Develop a long-term water resources management plan for the Refuge by 2009. (1.3.5)	50
Purchase and install water monitoring equipment. (1.3.7)	10
Develop and implement an Integrated Pest Management Plan to control and eradicate invasive species encroachment. (1.4.9)	50
Monitor habitat changes, maintain and continue improvements for restoration efforts and other landscape improvements, and provide adequate level of monitoring and maintenance for invasive species control and fire management. (1.4.13)	50

<i>Expenditure (Related Strategy)</i>	<i>Estimated Cost (1000s)¹</i>
Conduct baseline inventories of federally listed, proposed, candidate and species of concern on the refuge; conduct baseline inventories of aquatic habitat for invertebrates and amphibians to determine species composition and abundance; and inventory existing upland habitat for migratory birds, mammals, and reptiles. (1.5.1)	50
Develop a long-term inventory and monitoring plan for federally listed, proposed, candidate and species of concern on the Refuge. (1.5.5)	50
Prepare step down habitat management plan for lands acquired within the proposed expansion area. (1.6.1)	100
Complete volunteer needs assessment, create position descriptions, and coordinate with outdoor recreation planner to recruit, hire, and train volunteers. (2.1.1)	10
Develop interpretive and environmental education materials. (2.1.6)	50
Erect a Refuge entrance sign near Warm Springs Road. (2.1.8)	2
Develop regionally focused cultural resources environmental education and interpretation materials for self guided tours. (2.1.15)	25
Confer with the Moapa Band of Paiutes to incorporate their history and native plant and animal species knowledge as part of the interpretive program at the Refuge. (2.1.16)	5
Coordinate the installation of a permanent environmental education display at the Moapa Valley Community Center or other suitable public venue. (2.1.17)	3
Construct an overlook trail with interpretive panels and shade structure on top of the hill on the Plummer unit for viewing the Refuge and the Moapa Valley. (2.1.18)	100
Design and install new interpretive panels. (2.1.19)	100
Total	1,126
Pahranagat NWR	
Assess the effectiveness of rotenone treatments to control carp and encourage growth of submerged aquatic vegetation. (1.1.6)	2
Implement a geotechnical engineering study of Upper Pahranagat Lake to evaluate levee integrity and water loss through the lake bottom. (1.1.10)	25
Develop a rainfall-runoff analysis for Upper Pahranagat. (1.1.12)	40
Develop and implement a habitat management plan to improve quality of existing open water habitat for waterfowl, waterbirds, shorebirds and other migratory birds. (1.1.14)	318
Control spread of bulrush at Middle marsh by chemical and mechanical means using the Integrated Pest Management (IPM) Plan protocol. (1.2.5)	100
Investigate methods to increase efficiency of water delivery from Upper Lake. (1.3.2)	318
Continue limited IPM efforts in existing 112-acre grassland habitat to contain spread by knapweed and reduce its extent. (1.3.6)	331
Determine population status, distribution and demography of Pahranagat Valley montane vole on the Refuge. (1.3.7)	10
Control salt cedar and other invasive species on 215 acres near Lower Pahranagat Lake and the Pahranagat Wash/Lower Lake area and restore Lower Pahranagat Lake edge with native plant species. (1.4.1)	331
Develop and implement a species inventory and monitoring plan to identify species composition, relative abundance, seasonality, health and distribution of waterfowl, waterbirds and shorebirds. (1.4.1)	469
Survey existing groundwater wells and repair or cap as appropriate. (1.5.3)	97
Install a new pump in Well No. 3 and monitor for flow to document beneficial use of allocation and support the water right. (1.5.4)	10
Install a flume or weir at the outflow of Lower Pahranagat Lake to assist in development of the water budget. (1.5.5)	10

<i>Expenditure (Related Strategy)</i>	<i>Estimated Cost (1000s)¹</i>
Install and monitor flow meters and data loggers on each of the three ground water wells located on the Refuge. (1.5.6)	6
Develop a Refuge-wide water budget (1.5.7)	164
Install gages and data logging equipment at springs adjacent to Middle Marsh. (1.5.8)	6
Determine the status of ground water wells of record, and repair and/or abandon as appropriate, and apply for change(s) in point of use with Nevada Division of Water Resources by 2006. (1.5.11)	164
Determine the appropriate water restoration delivery system changes, prioritize restoration and develop an implementation strategy. (1.5.12)	212
Investigate the feasibility of planting native grasses between Upper Pahranaagat Lake and Middle Marsh, to control invasives such as knapweed and provide forage for sandhill cranes, waterfowl and geese. (1.6.3)	10
Complete and implement an IPM Plan. (1.7.2)	10
Use mechanical methods and prescribed fire to reduce fuels in the cottonwood/willow areas of Upper Pahranaagat Lake and north Marsh. (2.1.1)	7
Secure (apply for, re-apply for) additional water rights to provide necessary water for establishment of new willow wetland habitat. (2.1.2)	4
Conduct wetland habitat vegetation surveys that include percent cover, density, age, and structure. (2.1.7)	4
Monitor the response of migratory birds, the southwestern willow flycatcher in particular, to the wetland establishment efforts. (2.1.9)	4
Restore wetland habitat on the east side of Upper Pahranaagat Lake and North of the North Marsh. (2.1.10)	10
Conduct fish, invertebrate, bird, mammal and plant inventories of each spring head. (2.2.2)	40
Investigate historic photos and other records to determine pre-development characteristics of springs. (2.2.3)	10
Prepare a springhead and channel restoration plan in coordination with NDOW and USFWS Endangered Species Program. (2.2.4)	50
Implement springhead and channel restoration. (2.2.5)	500
Install physical barriers to prevent vehicle traffic in closed areas. (2.3.4)	6
Plan and design a refugium on the Refuge in coordination with NDOW and FWS-ES (2.4.1)	106
Construct a refugium for the roundtail chub on the refuge (2.4.2)	100
Post and maintain designated hunting area signs on Refuge and provide hunting information to the public through brochures, fact sheets and maps. (3.1.4)	4
Update the Fisheries Management Plan for the Refuge in coordination with NDOW. (3.2.2)	10
Improve and maintain existing restroom facilities for visitor use at Upper Pahranaagat Lake. (3.2.9)	10
Assess the effects of increased water withdrawals from Upper Pahranaagat Lake and North Marsh for wetlands management in Middle Marsh and Lower Pahranaagat Lake on sport fisheries. (3.2.10)	6
Design and construct a wildlife viewing trail system possibly along historic farming and ranching roads and trails. (3.3.3)	10
Construct photography and observation blinds along the trail route. (3.3.4)	20
Develop and implement an interpretive plan for the Refuge by working with partners. (3.4.3)	20
Develop Refuge-specific environmental education materials. (3.4.4)	20
Develop signs, such as "least-wanted" posters, for invasive plant species. (3.4.5)	4
Construct a new visitor contact station and office space at refuge headquarters unit. (3.4.8)	2,000
Construct interpretive walking trail that connects Upper Pahranaagat Lake with the Headquarters Unit. (3.4.9)	10
Focus outreach effort on six major Refuge System events: International Migratory Bird Day, the	3

<i>Expenditure (Related Strategy)</i>	<i>Estimated Cost (1000s)¹</i>
Junior Duck Stamp Program, and the National Wildlife Refuge Week, Public Lands Day, Earth Day, National Fishing Day. (3.5.2)	
Compile all existing baseline data on cultural resources sites, surveys, and reports within, and near, Pahrnagat NWR and create secure digital, GIS, and hard copy databases, maps, and library. (4.1.2)	20
Prepare evaluation criteria and conduct a cultural resource inventory at all public use facilities and Areas that would be affected by Refuge projects. (4.2.1)	50
Inventory, evaluate, and nominate Traditional Cultural Properties and sacred sites to the National Register, in consultation with culturally affiliated Tribes. (4.2.2)	150
Inventory, evaluate, mitigate adverse effects on and stabilize samples of cultural resources on Pahrnagat NWR using a research design prepared in consultation with culturally affiliated Tribes and the scientific community. (4.2.3)	200
Conduct a study of ethnobotany and traditional plants use locations on Pahrnagat NWR in consultation with culturally affiliated Tribes. (4.2.4)	60
Create a cultural resource layer in the NWR complex GIS that aids in the identification, planning and monitoring, and interpretation of cultural sites. (4.2.5)	25
Identify and evaluate cultural resources subject to looting/vandalism, erosion, or deterioration and implement steps, including barriers and signs to reduce these threats and preserve the resources. (4.4.1)	150
Create and implement a site stewardship volunteer program to assist in site monitoring, delivery of educational and interpretive literature and programs, and to promote cultural resources conservation in neighboring communities. (4.4.4)	25
Total	6,271

Table 3. Estimated Annual Salary and Non-Salary Operation and Maintenance Costs to Fully Implement CCP²

Position (grade)	Quantity	Unit	Unit Cost ³	Total Cost
Desert NWR Complex				
Project Leader (GS-14)	1	FTE	\$140,424	\$140,424
Deputy Project Leader (GS-13)	1	FTE	\$118,838	\$118,838
ORP/Volunteer Coordinator (GS-11/12)	1	FTE	\$99,934	\$99,934
Supervisory Fish and Wildlife Biologist (GS-12/13)	1	FTE	\$118,838	\$118,838
<i>Fisheries Biologist (GS-9/11)</i>	1	FTE	\$83,376	\$83,376
Wildlife Biologist (GS-9/11)	1	FTE	\$83,376	\$83,376
Botanist (GS-9/11)	1	FTE	\$83,376	\$83,376
<i>Fish Facility Manager (GS-11/12)</i>	1	FTE	\$99,934	\$99,934
<i>Archeologist/Tribal Coordinator (GS-11)</i>	1	FTE	\$83,376	\$83,376
<i>SNPLMA Coordinator (GS-13)</i>	1	FTE	\$99,934	\$99,934
Administrative Officer (GS-9/11)	1	FTE	\$83,376	\$83,376
Administrative Assistant (GS-5/7)	1	FTE	\$56,334	\$56,334
<i>Administrative/Office Assistant (GS-5)</i>	1	FTE	\$45,477	\$45,477
Fire Management Officer (GS-11/12)	1	FTE	\$99,934	\$99,934
Assistant FMO (GS-9/11)	1	FTE	\$83,376	\$83,376
Seasonal Range Technician (GS-06)	0.5	FTE	\$50,697	\$25,349
Engine Captain (GS-6/7)	1	FTE	\$56,334	\$56,334
Forestry Technician (GS-5/6)	3	FTE	\$50,697	\$152,091
Supervisory Law Enforcement Officer (GS-11/12)	1	FTE	\$99,934	\$99,934
<i>Refuge Law Enforcement Officer (GS-5/7/9)</i>	4	FTE	\$68,915	\$275,659
Refuge Law Enforcement Officer (GS-5/7/9)	1	FTE	\$68,915	\$68,915
Information and Education Specialist (GS-11/12)	1	FTE	\$99,934	\$99,934
<i>Environmental Education Specialist (GS-9/11)</i>	1	FTE	\$83,376	\$83,376
Ash Meadows NWR				
Refuge Manager (GS-12)	1	FTE	\$99,934	\$99,934
Fish and Wildlife Biologist (GS-9/11)	1	FTE	\$83,376	\$83,376
Engineering Equipment Operator (WG-8)	1	FTE	\$65,651	\$65,651
<i>Fish and Wildlife Biologist (GS-9/11)</i>	1	FTE	\$83,376	\$83,376
<i>Park Ranger (Visitor Services) (GS-9)</i>	1	FTE	\$68,915	\$68,915
<i>Laborer (WG-5)</i>	1	FTE	\$55,795	\$55,795
Wildlife Refuge Specialist (GS-9/11)	1	FTE	\$83,376	\$83,376
<i>Biological Technician (GS-5/7)</i>	3	FTE	\$56,334	\$169,002
<i>Administrative/Office Assistant (GS-5)</i>	1	FTE	\$45,477	\$45,477
Desert NWR				
Refuge Manager (GS-12)	1	FTE	\$99,934	\$99,934
Wildlife Refuge Specialist (GS-9/11)	1	FTE	\$83,376	\$83,376
Engineering Equipment Operator (WG-8)	1	FTE	\$65,651	\$65,651

² Note: Costs could be funded through both appropriated (annual refuge budget) and non-appropriated sources (see end of table for key)

³ Note: Salary costs based on OPM's FY2008 salary table for "Rest of US" (at step 5 of highest grade) and includes 25% for benefits and 10% for overhead (awards, travel, equipment, etc)

<i>Environmental Education Specialist (GS-9/11)</i>	1	FTE	\$83,376	\$83,376
<i>Visual Information Specialist (GS-11)</i>	1	FTE	\$83,376	\$83,376
<i>Biological Technician (GS-5/7)</i>	2	FTE	\$56,334	\$56,334
<i>Laborer (WG-5)</i>	1	FTE	\$55,795	\$55,795
<i>Administrative/Office Assistant (GS-5)</i>	1	FTE	\$45,477	\$45,477
Moapa Valley NWR				
Refuge Manager (GS-11)	1	FTE	\$83,376	\$83,376
Engineering Equipment Operator (WG-8)	1	FTE	\$65,651	\$65,651
<i>Fish & Wildlife Biologist (GS-7/9)</i>	1	FTE	\$68,915	\$68,915
Pahranagat NWR				
Refuge Manager (GS-11)	1	FTE	\$83,376	\$83,376
Engineering Equipment Operator (WG-8)	1	FTE	\$65,651	\$65,651
<i>Wildlife Refuge Specialist (GS-9/11)</i>	1	FTE	\$83,376	\$83,376
Youth Conservation Corps Team Leader (GS-5)	1	FTE	\$9,620	\$9,620
Youth Conservation Corps Team Members	4	PTE	\$2,026	\$8,104
<i>Biological technician (GS-5/7)</i>	2	FTE	\$56,334	\$56,334
<i>Environmental Education Specialist (GS-9/11)</i>	1	FTE	\$83,376	\$83,376
<i>Administrative/Office Assistant (GS-5)</i>	1	FTE	\$45,477	\$45,477
Total (current positions)				
	36.5			\$3,388,871
Total Proposed (all positions)				
	57.5			\$4,222,972
Estimated Non-Salary Operation and Maintenance Need				\$1,386,669
Normal font = paid with appropriated funds				
<i>Italic font</i> = paid with non-appropriated funds				
indented = new position				

*Appendix L.
Land Protection Plan and
Conceptual Management Plan
for Moapa Valley NWR*

APPENDIX L-1

LAND PROTECTION PLAN

**Proposed Moapa Valley
National Wildlife Refuge Expansion
Clark County, Nevada**

United States Department of the Interior
Fish and Wildlife Service

**Land Protection Plan
Proposed Moapa Valley
National Wildlife Refuge Expansion**

Clark County, Nevada

Prepared by
**U.S. Fish and Wildlife Service
Region 8**

January 2008

Recommended By:

Approved By:

Director, Region 8
Sacramento, California

Date

Director
Washington, D.C.

Date

APPENDIX L-1

LAND PROTECTION PLAN

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LAND PROTECTION PLAN

Proposed Moapa Valley National Wildlife Refuge Expansion Clark County, Nevada

Introduction

This draft land protection plan outlines resource protection needs, priorities, and habitat protection methods the U.S. Fish and Wildlife Service (Service) would use for the proposed Moapa Valley National Wildlife Refuge (Refuge) expansion in Clark County, Nevada. This plan proposes fee-title acquisition as the primary level of protection needed to meet habitat and wildlife management goals for the project area. The Environmental Assessment (EA) evaluated the environmental effects of expanding the approved refuge acquisition boundary to conserve and where appropriate, restore approximately 1,472 additional acres, which includes warm springs and their outflows, riparian corridors and adjacent lands where land use directly affects water quality and associated vegetation.

Nothing in this plan constitutes an offer to purchase private property, or a usurpation of the authority of the State of Nevada, Clark County, or any other jurisdiction to regulate land use within the proposed refuge boundary. This plan is intended to guide the Service's proposed land protection activities subject to the availability of funds and other constraints. To complement this plan, the Service has prepared a conceptual management plan (Appendix L-2) that describes the general management approaches for the Refuge.

Project Description

The Service proposes to establish an approved refuge land acquisition boundary and provide protection and management within the proposed expanded boundary of the Refuge. The Service's proposed action encompasses approximately 1,472 acres, which includes of warm springs and their outflows, riparian corridors and adjacent lands where land use directly affects water quality and associated vegetation. The refuge study area adjoins the existing Refuge in northeast Clark County (see Tract Map).

Purpose and Goals of Moapa Valley NWR

The Refuge was established on September 10, 1979, to secure and protect habitat for the endangered Moapa dace (*Moapa coriacea*). The purpose of the Refuge comes from the Endangered Species Act of 1973, as amended (Act):

“...to conserve (A) fish or wildlife which are listed as endangered species or threatened species...or (B) plants...” (16 USC §1534).

The Service developed two goals for management of Moapa Valley NWR. These goals were used to identify appropriate objectives and strategies and develop alternatives.

Endemic and Special Status Species (Goal 1). Protect and restore, when possible, healthy populations of endemic and special status species, such as the endangered Moapa dace, within the Muddy River headwaters.

Visitor Services (Goal 2). Local communities and others enjoy and learn about the resources of Moapa Valley NWR and participate in its restoration.

The authorities for the acquisition are the Endangered Species Act of 1973, as amended (16 U.S.C. 1532-1544, 87 Stat. 884), Fish and Wildlife Act of 1956, as amended (16 U.S.C. 742(a)-754), Migratory Bird Conservation Act of 1929 (16 U.S.C. 715-715d) and Refuge Recreation Act of 1962, as amended (16 U.S.C. 460k-460k-4). The Endangered Species Act of 1973, Fish and Wildlife Act of 1956, and Refuge Recreation Act of 1962 authorize the Service to use funds made available under the Land and Water Conservation Fund Act of 1965 (16 U.S.C. 4601-4601-11) to acquire lands, waters, or interests therein for fish and wildlife conservation purposes. Federal monies used to acquire private lands through the Land and Water Conservation Fund are derived primarily from oil and gas leases on the outer continental shelf, excess motorboat fuel tax revenues, and the sale of surplus Federal property.

Objectives of the Proposed Action

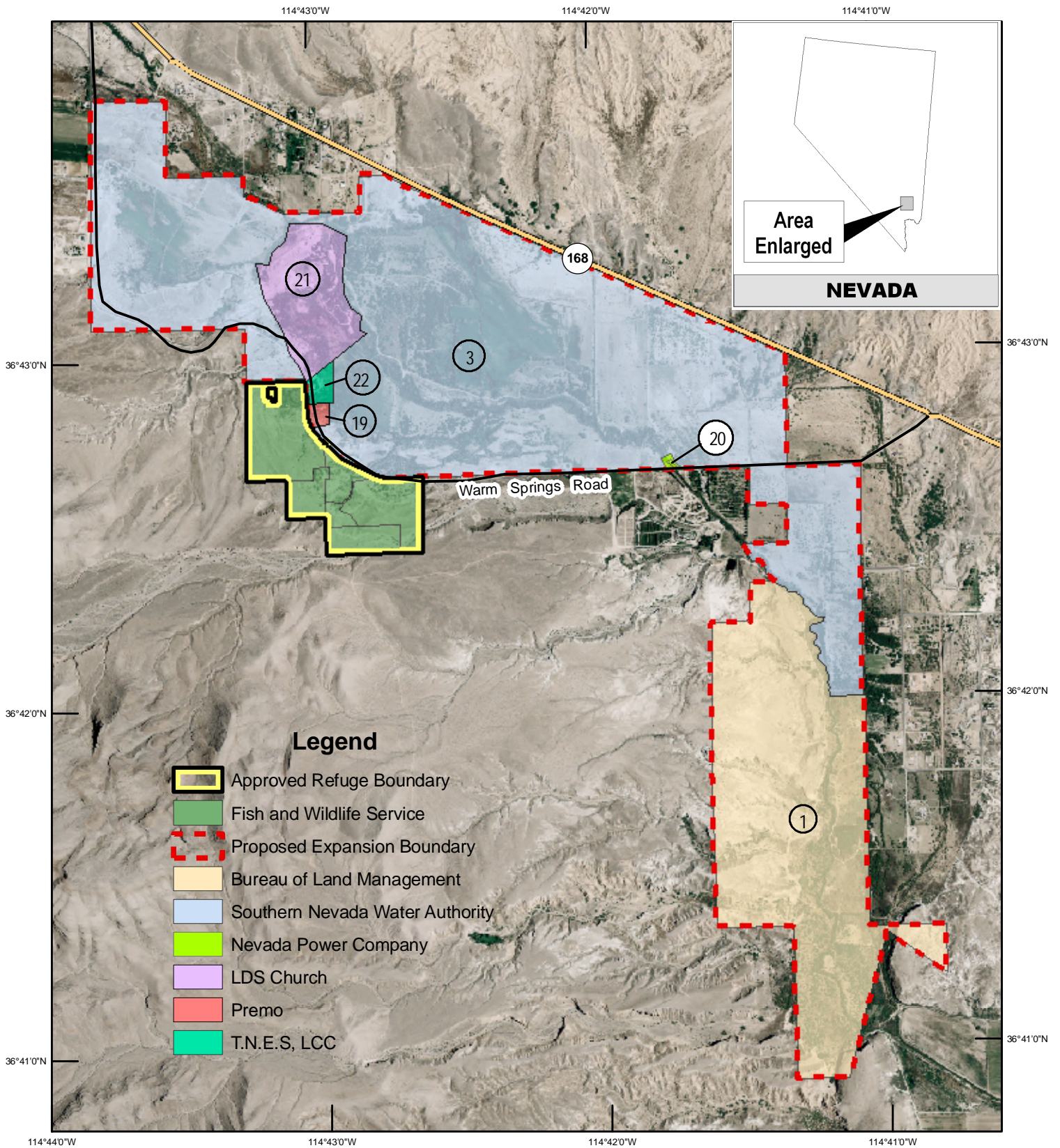
The primary objectives of this proposal are to ensure the conservation and perpetuation of aquatic, wetland, and mesquite bosque habitats needed for the recovery of Moapa dace and other endemic wildlife species in the upper Moapa Valley. Our areas of emphasis are twofold: (1) the warm springs and their outflows, which provide the only habitat of the Moapa dace, and (2) riparian corridors and adjacent lands where land use directly affects water quality. Also important is the opportunity to improve riparian habitat conditions for the yellow-billed cuckoo, the southwestern willow flycatcher, and other species. The expansion of the Refuge is a crucial step toward recovery of the Moapa dace and would advance and expand habitat restoration actions other important recovery actions.



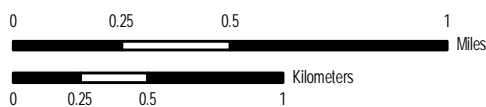
U.S. Fish & Wildlife Service

Moapa Valley National Wildlife Refuge Proposed Expansion Clark County, NV

Tract Map



Produced by the Region 8 Realty Office
 Sacramento, CA
 1/16/2008
 Boundaries follow 2008 Clark County
 parcel data except where survey data was used.



Additionally, protection of this habitat could preclude the need to list other rare aquatic species in the future. The proposed project provides opportunities for Federal, Tribal, State, and local government partnerships with private property owners. These partnerships are the basis for achieving mutual conservation goals while maintaining the rural lifestyle and economic vitality of the Moapa Valley.

Protection of the lands considered would fulfill the habitat criterion of the Recovery Plan for the Rare Aquatic Species of the Muddy River Ecosystem (Recovery Plan) (USFWS 1995). The proposed expansion area includes about 1,472 acres of land adjacent to the Refuge that are occupied by species listed as threatened or endangered under the Endangered Species Act of 1973, as amended (Act). The proposed expansion area also contains other listed and species of concern, has restorable habitat, and potential to contribute significantly to species recovery.

Threats to and Status of the Resource to be Protected

Threats to the upper Moapa Valley and its species include incompatible land use, decline in quantity and quality of the regional aquifer, introduction of exotic aquatic species, and spread of invasive plant species.

Clark County is one of the fastest growing counties in the United States, with a population forecasted to grow to approximately 2.5 million people by 2030 (Clark County 2000a). Residential development may include risks such as increased contaminants, human disturbance, risk of wildfire, exotic species establishment, increased draw on the aquifer, and increased agriculture or ranching. Historically, ranching activities such as water diversion, ditching and draining of wetlands, grazing, haying, burning, and clearing have adversely affected habitats in the upper Moapa Valley. Many of these activities continue to contribute to the decline of native wildlife populations.

Groundwater pumping may draw down the aquifer and reduce spring flow. Pumping of groundwater in the immediate vicinity of the springs is probably causing declines in the flow in the upper Muddy River. The reduction in stream flow is caused by the interception of water discharging from the carbonate aquifer to the stream through the alluvium.

Water discharging at Pedersen and other nearby springs on the Refuge, is probably isolated from the alluvium, but has a more direct connection with the carbonate aquifer. Small declines in the spring pool elevation have occurred at Pedersen spring, and it is presently unclear if the discharge rate is declining because of other factors that affect the relationship between pool level and discharge-rate measurements (Waddell, pers. comm.).

Continued pumping from the carbonate aquifer will likely further decrease the water levels in the carbonate aquifer beneath the Refuge, and cause a measurable, and possibly significant reduction in discharge rate at Pedersen and nearby springs. Computer modeling of the groundwater system predicts that groundwater production from the carbonate aquifer beneath California Wash and

Coyote Springs Valley will reduce groundwater discharge rates in the upper Muddy River area. This reduction will be in addition to the reduction caused by more local pumping. Because Pederson and nearby springs are located at higher elevation than the springs located in the center of the valley, they will probably be more affected by pumping than the other springs (Waddell, pers. comm.).

The introduction, both intentional and accidental, of nonnative species has adversely affected endemic species through predation, competition, and infestation by parasites. Predation by tilapia and bullfrogs is of particular concern, and these species, as well as shortfin mollies and mosquitofish, also compete with native species for resources. Crayfish (*Procambarus clarkii*), already present in the lower Muddy River, could spread upriver and create additional pressures on endemic species in the Warm Springs area.

The spread of California fan palms continues to have deleterious effects on the hydrology of the Warm Springs area. Young palms are growing and increasing in numbers along the stream channels. As a result, the streams have narrowed and channelized creating higher velocities unsuitable for the Moapa dace. The presence of these palms also increases the risk of wild fire. A fire in 1994 virtually eliminated Moapa dace on the Refuge (USFWS 1995). To lessen the probability of fire occurring again over Moapa dace habitat, Refuge staff developed a management plan for both wild and prescribed fires.

The invasion of weeds poses a threat to the integrity of habitats supporting listed species and other species of concern in the Moapa Valley. Nonnative shrubs, such as tamarisk (*Tamarix*) and Russian olive (*Eleagnus angustifolius*), are increasing in numbers in the study area, competing with native riparian species, and potentially lowering the water table. Eel grass (*Valisneria*) is flourishing in many portions of the streams and threatens to alter stream hydrology further. Upland weeds, such as Russian thistle (*Salsola tragus*) and knapweed (*Centaurea* spp.), have affected habitat quality of the upland areas and will continue to proliferate in disturbed areas.

Protection Methods

A variety of habitat protection methods can be used to conserve the natural resources of the area within the boundary of the proposed Refuge expansion. Service policy is to adopt habitat protection measures and strategies that involve acquiring the minimum possible interest or rights in lands and waters. The goal is to leave as large a proportion of these rights as possible in private ownership and still meet the defined resource objectives.

The Service first considered the likelihood of the land/habitat in question being protected under local government action (e.g., zoning, ordinances) designating specific geographic areas where particular uses are either permitted or prohibited; such as residential, business, or open space for the parks. The Service also considered the likelihood of the land/habitat in question being protected under a Federal/State/local permit, license or other program. Since the above

protection methods are not available or not being used at the local and State level to protect these lands, the Service examined the degree of land acquisition which may be needed to protect habitat resources.

These acquisition options range from the acquisition of land by the Service in fee-title, conservation and agricultural easements, cooperative agreements, or memorandum of understanding. Since habitat protection by means of local or State regulatory controls appears unlikely, the Service believes fee title acquisition represent the minimum possible interest or rights in lands and waters which would need to be acquired to meet the habitat protection objectives for the Warm Springs Ranch. Expansion of the Refuge would provide a coordinated effort to protect native habitats and assist recovery of declining fish and wildlife populations of the Muddy River Ecosystem.

The term “conservation” is defined to include a wide variety of habitat protection methods. On lands owned and managed by public agencies, cooperative agreements and coordinated planning/management efforts, including shared resources, could be used to conserve natural resources within the proposed refuge boundary. “Conservation” also includes acquisition of land or interest therein by the Service for inclusion in the National Wildlife Refuge System. The Service could acquire fee-title, conservation or agricultural easements, long-term leases, and/or cooperative agreements with willing public agencies and willing landowners through purchase, donation, transfer, exchange, or written agreement.

While the Service Proposed Action is fee-title acquisition of the lands considered, habitat protection methods that could be used by the Service to protect habitats within the proposed expansion area are described below:

Conservation Easements. Conservation easements provide the Service the opportunity to manage lands for their fish and wildlife habitat values. The easement would preclude uses inconsistent with the Service’s management objectives as outlined in the CMP. In effect, the landowner transfers certain development and property rights to the Service for restrictive uses, as specified in the easement. Property taxes would remain the responsibility of the landowner.

Easements would likely be useful when (1) most, but not all, of a private landowner’s uses are compatible with the Service’s management objectives, and (2) the current owner desires to retain ownership of the land and continue compatible uses under the terms mutually agreed to in the easement. Land uses that are normally restricted under the terms of a conservation easement include, but are not limited to:

- Development rights (residential, industrial, etc.)
- Alteration of the area’s natural topography
- Uses which adversely effect the area’s flora and fauna
- Crop type (cereal grains, corn, etc.)
- Alteration of natural water regimes.

Fee-Title Acquisition. The Service acquires land by outright purchase (fee-title) when (1) the land's fish and wildlife resources require permanent protection that is not otherwise available, (2) the land is needed for development associated with public use, (3) a pending land use could otherwise harm fish and wildlife resources, or (4) purchase is the most practical and economical way to assemble small tracts into a manageable unit. Fee-title acquisition often transfers all property rights owned by the landowner, including mineral and water rights, to the federal government. A fee title interest may be acquired by purchase, donation, exchange, or transfer. The Service proposes fee-title acquisition for the project study area, for the reasons listed above, as the best way to permanently protect and restore all the lands considered in this expansion proposal

Management Considerations

The Southern Nevada Water Authority (SNWA) has title to the Warm Springs Ranch and acquired it through funding from the Southern Nevada Public Lands Management Act (SNPLMA). The Bureau of Land Management has title to the 400 acre riparian area south of the Refuge, and Mary Premo owns three acres situated between the Refuge and the Warm Springs Ranch. The Warm Springs Ranch has no water rights associated with it and there is an inholding within the Ranch that the Church of Latter Day Saints owns, consisting of approximately 72 acres, and another inholding consisting of six acres owned by TNES, LLC.

The Service, Moapa Band of Paiutes, Southern Nevada Water Agency (SNWA), MVWD, and Coyote Springs Investments, LLC (CSI) are signatories in a Memorandum of Agreement (MOA). In this MOA, the parties have identified certain conservation measures for the conservation and recovery of the Moapa dace, and have agreed to coordinate the monitoring, management and mitigation measures in their monitoring plans.

The MOA establishes a Recovery Implementation Program (RIP) to outline and implement necessary protection and recovery activities for the Moapa dace. The MOA also provides for funding to develop the RIP, dedication of certain water rights to preserve in-stream flows, pumping restrictions whereby the parties agree to curtail pumping in the event spring flows in the Warm Springs area decline to specified "trigger levels." Any future production of groundwater by the parties would be subject to the terms of the MOA, including pumping that may occur after the two-year pump test or as a result of other groundwater development projects. Other conservation measures in the MOA include:

- Dedication of the Jones water right (Apcar spring) to provide in-stream flows.
- Dedication of a portion of CSI's water rights from the Coyote Spring Valley.

- Habitat restoration and recovery measures, including funding for; restoration of Moapa dace habitat, development of an ecological model for the Moapa dace, construction of fish barriers, eradication of non-native fish species, and cultivation of native vegetation.
- Protection of in-stream flows through the establishment of minimum in-stream flow levels that would trigger a range of conservation actions including restriction of groundwater pumping.
- Establishment of a Hydrologic Review Team to coordinate data collection, analyses of impacts, and assessments of pumping restrictions.
- Acquisition of additional land and water rights to assist in the recovery of the Moapa dace.
- Operational coordination among the Service, SNWA, CSI, and MVWD.
- Adaptive management measures, including additional conservation measures for the conservation and recovery of the Moapa dace.

On January 30, 2006, the USFWS issued a final programmatic biological opinion (BO) on the MOA (Service File 1-5-05-FW-536). The Service determined that the cumulative groundwater withdrawal of 16,100 afy from two hydrographic basins, Coyote Spring Valley and California Wash is likely to adversely affect the Moapa dace. The Service concluded that the proposed action, combined with the conservation measures outlined in the MOA would not jeopardize the Moapa dace. Future Section 7 consultations for federal actions under the MOA, including the Coyote Spring Project, would be tiered from this programmatic BO.

Summary of Planning and Land Acquisition Processes

The Director of the Service, in consultation with the Region 8 Director, would approve the designation of the project boundary upon completion of the planning and environmental coordination process. This process includes compliance with the National Environmental Policy Act (NEPA), the Endangered Species Act, and other federal regulations and executive orders. Based on NEPA and other compliance documents, the Regional Director, in consultation with the Regional Chief of the National Wildlife Refuge System will decide whether to select an expanded project boundary or not. If the decision is to expand the Refuge project boundary, the Regional Director will determine if an expanded Refuge project boundary would have a significant impact upon the quality of the human environment, and make a formal recommendation to the Director for approval. If the selected alternative is determined not to have a significant impact, a Finding of No Significant Impact (FONSI) will be issued. If the selected alternative is determined to have a significant impact, a Notice of Intent to prepare an Environmental Impact Statement (EIS) will be issued.

With the selection of an approved boundary and successful completion of the NEPA process, the selected project alternative can be implemented as described in this Land Protection Plan and Conceptual Management Plan.

The Service's planning process includes the following steps:

- Preliminary agency planning
- Concept plan issued
- Public involvement
- Environmental assessment and other planning documents released
- Public review period of planning documents
- Notice of Decision (whether to expand the Refuge or complete an EIS)

Public Scoping and Involvement. This expansion is being conducted concurrently with the development of the Desert Complex Comprehensive Conservation Plan (CCP). Public meetings have been held and some members of the public have advocated the expansion of the Moapa Valley NWR. Future public meetings for the CCP are scheduled for 2008.

Throughout the scoping process, the Service has consulted with a number of federal, state, and local elected officials and agencies and private organizations to solicit their views of the proposal. Parties contacted have included: the Southern Nevada Water Authority, Moapa Valley Water District, Nevada Division of Wildlife, Bureau of Land Management, Clark Co. Comprehensive Planning, U.S. Geological Survey-Biological Resources Division, As the result of the above public involvement, the Service selected the preferred alternative represented in this Land Protection Plan.

The selection and approval of a project boundary only allows the Service to acquire lands or interest in lands from willing sellers at fair-market value or to enter into management agreements with interested landowners. An approved project boundary does not grant the Service jurisdiction or control over lands within the boundary, and it does not automatically make lands within the project boundary part of the National Wildlife Refuge System. Lands do not become part of the National Wildlife Refuge System unless they are acquired by the Service or are placed under an agreement that provides for management as part of the refuge system.

No new or additional zoning laws would be imposed by the Service within the approved project boundary. Any landowner within an approved project boundary retains all existing rights, privileges, and responsibilities of private-land ownership as determined by local, city, or county jurisdictions. Again, lands remain under the control of the owner until management rights or title to the property has been transferred to or has been acquired by the Service.

The Service land protection policy is to acquire land only when other protective means are not appropriate, available, or effective. The Service strives to obtain the minimum interest necessary to reach management objectives, once land is acquired or retained.

The acquisition and habitat protection program is expected to take several years. Initial acquisition efforts would focus primarily on protecting blocks of land having the highest biological values. The Service recognizes that some lands identified within the approved project boundary may never become part of the National Wildlife Refuge System.

Willing Seller Policy

Service policy is to acquire lands or interest in lands only from willing participants under general authorities such as the Endangered Species Act, Fish and Wildlife Act of 1956, the Migratory Bird Conservation Act, and the Refuge Recreation Act. Landowners within the project boundary who do not wish to sell their property or any other interest in their property are under no obligation to enter into negotiations or to sell to the Service.

The Service, like other federal agencies, has been given the power of eminent domain, which allows the use of condemnation to acquire lands and other interest in land for the public good. This power, however, is seldom used and is not expected to be used in this project. The Service usually acquires land from willing participants and is not often compelled to buy specific habitats within a specific time frame.

In all cases the Service is required by law to offer 100 percent of fair-market value for lands to be purchased as determined by an approved appraisal that meets professional standards and federal requirements.

Under the Uniform Relocation Assistance and Real Property Acquisition Policies Act, landowners who sell their property to the Service are eligible for certain benefits and payments which include:

1. Reimbursement of reasonable moving and related expenses or certain substitute payments.
2. Replacement housing payments under certain conditions.
3. Relocation assistance services to help locate replacement housing/farm/or business.
4. Reimbursement of certain necessary and reasonable expenses incurred in selling real property to the federal government.

Land Protection Priorities within the Planning Area Boundary

The Service would seek fee title acquisition of all or part of the lands within the proposed Refuge boundary. The Service has prepared a table (Table 1) that lists assessor parcel numbers, acreages and priority for acquisition should the property owner be willing to sell and funding become available. Prioritizing the lands within the proposed boundary can be difficult to calculate, as land uses and conditions can change rapidly. The Service has placed a priority on Moapa dace habitat, springheads and streams, including the Muddy River, and associated riparian habitat. Second in priority would be desert uplands retaining their characteristic vegetation.

In selecting the priorities for Table 1, it was determined that the first priority would be the Warm Springs Ranch, because it contains 90 percent of Moapa dace habitat. Equal in priority is the BLM property, as it contains a large portion of the Muddy River. Second in priority are the Premo, Nevada Power Company, LDS Church, and TNES, LLC properties. Final determination of priority lands would occur when final negotiations are made for the purchase of lands.

Social and Cultural Impacts

The current quality of life communities and individuals around the proposed refuge is expected to remain the same or improve slightly as a result of the expansion of the Refuge. The expansion of the Refuge is not expected to change most land use activities or public use patterns in the vicinity of the project area.

Under provisions of the Refuge Revenue Sharing Act (Public Law 95-469), the Service would make an annual payment to the county to help offset revenue lost as a result of Federal acquisition. This law states that the Secretary of the Interior (Secretary) shall pay to each county in which any area acquired in fee title is situated, the greater of the following amounts:

§ An amount equal to 75 cents per acre for the total acreage of that portion of the fee area which is located within each county.

§ An amount equal to three-fourths of 1 percent of the fair market value, as determined by the Secretary, for that portion of the fee area which is located within each county.

§ An amount equal to 25 percent of the net receipts collected by the Secretary in connection with the operation and management of such fee area during each fiscal year.

There have been occasions when payments to the counties have been less than the legislated amounts because of funding deficits. Congress may appropriate, through the budget process, supplemental funds to compensate local governments for any shortfall in revenue sharing payments. The Refuge Revenue Sharing Act also requires that Service lands be reappraised every five years to ensure that payments to local governments remain equitable. Payments under

this Act would be made only on lands the Service acquires in fee title. On lands where the Service acquires only partial interest through easement, all taxes would remain the responsibility of the individual landowner. From 1993 through 2002 (the last ten years for which there is complete data) payments averaged 63 percent of the legislated amounts.

Coordination and Consultation

The Service has worked with a variety of interested parties to identify issues and concerns associated with the proposed Refuge expansion. These interested parties include members of the public, interested private groups, elected officials, and federal, state and local government agencies. The Service's public involvement activities included hosting meetings, developing a mailing list, requesting information, undertaking consultations, and responding to inquiries. The Service has provided information about the proposal to the media and other interested or affected parties throughout the public scoping period.

The Service has invited and continues to encourage public participation through the public involvement program consisting of public notices, meetings with potential affected landowners, government agencies, and private organizations. The proposed acquisition is being presented in conjunction with the Desert Complex Comprehensive Conservation Plan (CCP). Planning updates have been prepared and sent to landowners and other interested parties. Additionally, public scoping meetings have been held.

Summary of Proposed Action

In light of the valuable resources in the Warm Springs area and continuing threats to these resources, the Service proposes to expand the Refuge boundary from 116 acres up to 1,588 acres. This proposed expansion would allow the Service to conserve, protect, and restore thermal springs, riparian corridors and desert uplands through fee-title acquisition. Protection of the lands considered would fulfill the habitat criterion of the Recovery Plan for the Rare Aquatic Species of the Muddy River Ecosystem (Recovery Plan) (USFWS 1995).

Our areas of emphasis are twofold: (1) the warm springs and their outflows, which provide the only habitat of the Moapa dace, and (2) riparian corridors and adjacent lands where land use directly affects water quality. Also important is the opportunity to improve riparian and mesquite bosque habitat conditions for the yellow-billed cuckoo, the southwestern willow flycatcher, and other bird and bat species. The expansion of the Refuge is a crucial step toward recovery of the Moapa dace and would allow the Service to initiate habitat restoration and other important recovery actions on this land.

The Refuge is located about 60 miles northeast of Las Vegas in Clark County. The Refuge is part of a unique system of thermal springs that are part of the headwaters of the Muddy River, which eventually flows into Lake Mead east of Las Vegas. The Refuge is located on the southern side of State Highway 168 and the Muddy River, between I-15 and Hwy 93. The entire

Refuge lies within the Moapa Valley. It is bounded on the north by Warm Springs Road, on the south and west by BLM, and on the east by private property.

The Service has encouraged input from landowners, agencies, and conservation organizations, other Federal agencies, State and local governments, and individuals in the community to identify concerns and issues and to explore the alternatives. Additional public input was sought through the use of mailings, personal contacts, and news releases.

The EA analyzes the potential effects to the human environment resulting from expanding the Refuge and managing the area under the Conceptual Management Plan (CMP). The EA describes various alternatives that the Service could take to protect and manage an expanded refuge. Copies of the EA, LPP, and CMP were distributed to Federal and State delegations, agencies, landowners, private groups, and interested individuals. The documents are also available on the Service’s Division of Refuge Planning website at the following URL: <http://www.fws.gov/cno/refuges/planning.html>.

TABLE 1
Land Tracts and Acquisition Priorities for the Proposed Action:

Proposed Moapa Valley NWR Expansion – Tract Table

Tract #	Owner	APN	Acres	Priority
1	BLM	03023201002	11.34	1
1	BLM	03023401001	136.0	1
1	BLM	03026101001	160.0	1
1	BLM	03026701003	8.32	1
1	BLM	03026301003	75.75	1
3	SNWA	03016101001	239.22	1
3	SNWA	03014401001	67.73	1
3	SNWA	03015301001	318.58	1
3	SNWA	03009401001	39.09	1
3	SNWA	03016701008	65.89	1

3	SNWA	03023101003	92.91	1
3	SNWA	03015201001	140.61	1
3	SNWA	03023301001	23.09	1
4	MVWD	03016701002	0.65	1
19	Premo	03016801009	3.3	2
20	NPC	03015801002	0.3	2
20	NPC	03015801001	0.9	2
21	LDS	03016601002	72	2
22	TNES	03016701005	6	2

References

Clark County. 2000a. *Comprehensive Planning News*. Clark County Department of Comprehensive Planning, summer 2000.

U. S. Fish and Wildlife Service. 1995. Recovery Plan for the Rare Aquatic Species of the Muddy River Ecosystem. Portland, Oregon. 60pp.

Waddell, R. 2002. Personal communication from Richard Waddell, hydrologist with GeoTrans, Inc., Westminster, Colorado.

APPENDIX L-2

CONCEPTUAL MANAGEMENT PLAN

Moapa Valley National Wildlife Refuge Proposed Expansion

Clark County, Nevada

United States Department of the Interior

U.S. Fish and Wildlife Service

CONCEPTUAL MANAGEMENT PLAN

Moapa Valley National Wildlife Refuge Proposed Expansion

Clark County, Nevada

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**CONCEPTUAL MANAGEMENT PLAN
MOAPA VALLEY NATIONAL WILDLIFE REFUGE
PROPOSED EXPANSION
Clark County, Nevada**

INTRODUCTION

This draft conceptual management plan outlines resource protection needs, priorities, and habitat protection methods the U.S. Fish and Wildlife Service (Service) would use for the proposed Moapa Valley National Wildlife Refuge (Refuge) expansion in Clark County, Nevada. This plan proposes fee-title acquisition as the primary level of protection needed to meet habitat and wildlife management goals for the project area. The Environmental Assessment (EA) evaluated the effects of expanding the approved refuge acquisition boundary to protect, conserve, and where appropriate, restore, thermal springs, riparian corridors, mesquite bosques and associated uplands totaling approximately 1,503 additional acres. Habitat management practices will be directed towards improving stream habitat and water quality for the endangered Moapa dace; these efforts will also have a direct and positive effect on use of the area by terrestrial and migratory wildlife.

This Conceptual Management Plan (CMP) is for the Service's proposed acquisition and management of the expanded Refuge and presents a general outline on how these new lands would be managed. As a conceptual plan, this CMP does not provide extensive detail or pinpoint exactly where long-term habitat improvements could be made or exactly where, if any, public use facilities would be ultimately constructed. Those details would normally be included in the Refuge's Comprehensive Conservation Plan (CCP), a long-term formal planning effort which is running concurrently with this land acquisition effort. During the CCP planning effort, goals, objectives, and strategies for public use as well as resource management are being developed for the existing 116-acre Refuge with input from the public, and in accordance with the National Environmental Policy Act. This CMP however, is for the proposed expansion acreage and presents a broad overview of the Service's proposed management approaches to wildlife, habitats, public uses, wildlife-dependent recreational activities, wildfire suppression, rights-of-way, easements, law enforcement, and facilities.

As part of the acquisition process, an environmental assessment (EA) evaluated the effects of expanding the approved refuge acquisition boundary to protect, conserve, and where appropriate, restore thermal springs, riparian corridors, mesquite bosques and associated uplands, totaling approximately 1,503 additional acres. Habitat management practices will be directed towards improving stream habitat and water quality for the endangered Moapa dace; these efforts will also have a direct and positive effect on use of the area by terrestrial and migratory wildlife.

Our areas of emphasis are twofold: (1) the warm springs and their outflows, which provide the essential habitat for the Moapa dace, and (2) riparian corridors and adjacent lands where land use directly affects water quality. Also important is the opportunity to improve riparian habitat conditions for the Yuma clapper rail, yellow-billed cuckoo, the southwestern willow flycatcher,

phainopepla and other migratory bird species. The Refuge expansion is a critical step toward recovery of the Moapa dace and would allow the Service to expand habitat restoration efforts and other important recovery actions. Additionally, habitat improvements and protection of this area could preclude the need to list other species in the future.

NATIONAL WILDLIFE REFUGE SYSTEM

The proposed expansion area would become part of the National Wildlife Refuge System (Refuge System) and would be managed to fulfill the Refuge System's mission and the specific purpose for which the Refuge was established. The mission of the Refuge System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans (National Wildlife Refuge System Improvement Act of 1997). The Refuge System is a network of protected lands and waters dedicated to fish and wildlife. Since the Refuge System's inception in 1903, with the establishment of the Pelican Island National Wildlife Refuge in Florida, the System has grown to 545 refuges, with at least one refuge in every state. The Desert National Wildlife Refuge complex consists of four refuges with a combined total of 1,634,306 acres.

Goals of the National Wildlife Refuge System

- To fulfill our statutory duty to achieve refuge purpose(s) and further the System mission.
- Conserve, restore where appropriate, and enhance all species of fish, wildlife, and plants that are endangered or threatened with becoming endangered.
- Perpetuate migratory bird, interjurisdictional fish, and marine mammal populations.
- Conserve a diversity of fish, wildlife, and plants.
- Conserve and restore, where appropriate, representative ecosystems of the United States, including the ecological processes characteristic of those ecosystems.
- To foster understanding and instill appreciation of fish, wildlife, and plants, and their conservation, by providing the public with safe, high-quality, and compatible wildlife-dependent public use. Such use includes hunting, fishing, wildlife observation and photography, and environmental education and interpretation.

Purpose of the Moapa Valley National Wildlife Refuge

The Refuge was established on September 10, 1979, to secure and protect habitat for the endangered Moapa dace (*Moapa coriacea*). The purpose of the Refuge comes from the Endangered Species Act of 1973, as amended (Act):

“...to conserve (A) fish or wildlife which are listed as endangered species or threatened species...or (B) plants...” (16 USC §1534).

Goals of the Moapa Valley National Wildlife Refuge

The Service developed two goals for management of Moapa Valley NWR. These goals were used to identify appropriate objectives and strategies and develop alternatives.

- **Endemic and Special Status Species.** Protect and restore, when possible, healthy populations of endemic and special status species, such as the endangered Moapa dace, within the Muddy River headwaters.
- **Visitor Services.** Local communities and others enjoy and learn about the resources of Moapa Valley NWR and participate in its restoration.

REFUGE ADMINISTRATION

The Refuge would continue to be administered and supervised by the Desert National Wildlife Refuge Complex (Complex) in Las Vegas, Nevada. Currently, the Desert NWR Manager also serves as the Moapa Valley NWR Manager. However, acquisition of the expansion area would likely allow stand-alone staffing for the Moapa Valley NWR. The 2007 approved staffing chart shows a vacant GS 11 Refuge Manager and GS 7/9 Ecologist position. At present, the Desert NWR Equipment Operator assists, as needed, at the Moapa Valley NWR. This arrangement would be acceptable with supplemental funding provided, or alternatively, maintenance activities could be contracted. Eventually, a full-time maintenance position would be required. Administrative assistance would be provided through the Complex. Temporary or seasonal employees could include biological aides, tractor operators or Youth Conservation Corps (YCC) crews.

Presently existing on the Refuge are two government quarters. It is conceivable that one employee could live in one of the homes, and the second be converted to office space. This satellite office would increase the efficiency of staff time by eliminating the commute from the Desert NWR, a nearly 3-hour round trip.

A small storage building is located on the existing Refuge; however, the Refuge does not have any heavy equipment. A larger building would be necessary in the future, to house and protect these items.

The annual budget for the Refuge is estimated to be \$165,000 to include salaries for 2 permanent FTE's, maintenance contracting or supplementing a current equipment operator's salary, utilities, supplies, materials and equipment. PCS moves for employees are likely to be near \$100,000.

Start-up expenditures would require \$50,000 to purchase two vehicles; \$25,000 for office and computer equipment; \$15,000 for building upgrades and repairs; and \$15,000 for tools and maintenance supplies, totaling \$105,000.

KEY AREAS OF MANAGEMENT FOCUS

The key areas of initial focus for the expanded area would be habitat and wildlife management, research, and wildlife-dependent recreational activities. The proposed new unit would operate under interim management until a formal habitat management plan or Comprehensive Conservation Plan is in place. Interim management would include non-native vegetation control using chemical and mechanical means, habitat restoration with native plant species, endangered species surveys, law enforcement patrols, and limited environmental education and interpretation.

Habitat and Wildlife Management

Native habitats and plant communities would generally be managed for the recovery of endangered, threatened, and rare species. Active modification and manipulation of intact native plant communities would be avoided. In disturbed areas, such as the pastures, along the roads and around buildings, there are non-native plant infestations. Mechanical and chemical means would be used to treat these species, as well as remove non-native trees. Areas that have undergone invasive/non-native species vegetation control would be re-planted with native species. Seeds from native plants would be collected locally and propagated in a greenhouse managed by the Moapa Band of Paiute Indians for future outplanting.

Research that may benefit the Refuge's endangered and threatened species or other natural resources may be permitted. The Service may allow limited access for scientific research and for study groups on a case-by-case basis through a special-use permit process. Research that is nondisruptive to wildlife or archaeological resources, and compatible with refuge purposes and goals, are types that may be allowed.

Population Monitoring

Surveys of listed and sensitive species would occur semi-annually, as well as the continuation of scientific studies carried out within the Refuge through the special use permit program.

PUBLIC USE AND WILDLIFE-DEPENDENT RECREATIONAL ACTIVITIES

Refuges as Primary Use Areas

National wildlife refuges are managed first and foremost for the benefit of fish, wildlife, plants, and their habitats. In addition, refuges are closed to public uses unless specifically and formally opened. Other Federal land management systems are managed under a multiple-use mandate (e.g., national forests administered by the U.S. Forest Service and public lands administered by the U.S. Bureau of Land Management). Hunting, fishing, wildlife observation and photography, and environmental education and interpretation are priority public uses of the Refuge System. These uses must receive enhanced consideration over other general public uses in refuge planning and management.

As part of the National Wildlife Refuge System, the proposed Refuge expansion would provide opportunities for wildlife-dependent recreational uses that are compatible with the Refuge purpose. The Refuge can provide the people of the Las Vegas area and the nation with opportunities to gain better appreciation and understanding of the region's unique wildlife heritage.

The Compatibility Standard

Before any uses are allowed on a national wildlife refuge, Federal law requires a written compatibility determination be completed which states that the use is compatible. A compatible use is defined as a proposed or existing wildlife-dependent recreational use or any other use of a national wildlife refuge that, based on sound professional judgment, will not materially interfere with or detract from the fulfillment of the National Wildlife Refuge System mission or the purposes of the national wildlife refuge. Sound professional judgment is defined as a decision that is consistent with the principles of fish and wildlife management and administration, available science and resources (funding, personnel, facilities, and other infrastructure), and adherence to the requirements of the National Wildlife Refuge System Administration Act of 1966 as amended by the National Wildlife Refuge System Improvement Act of 1997 (16 U.S.C. 668dd-668ee), and other applicable laws. If resources are not available to design, operate, and maintain priority public uses that are otherwise compatible, the refuge manager will take reasonable steps to obtain outside assistance from the state and other conservation interests. If adequate funding or staffing assistance cannot be identified, then the use is not compatible and cannot be allowed. High quality wildlife-dependent recreational opportunities are predicated on healthy habitats and healthy populations of endangered species, migratory birds, and other native species. Therefore, some constraints on public use and recreation are necessary. Unlimited public access and use of refuge lands could easily degrade the resources that make a visit to a national wildlife refuge so special.

Refuge Purpose(s)

The purpose(s) for which a refuge is established has special significance relating to compatible public uses. A refuge purpose may be specified in or derived from a Federal law or proclamation, an executive order, an agreement, a public land order, a donation document, or an administrative memorandum (Fish and Wildlife Service Manual, 602 FW 1.4M.). In addition to providing a basis for making compatibility determinations, a refuge's purpose also serves as a vision or mission statement for refuge managers and the public. It provides a broad, long-term statement of management direction and priorities.

Pre-acquisition Compatibility Determinations

The Service is required to identify, prior to acquisition of new refuges or refuge additions, existing owner-authorized, wildlife-dependent public uses that would be allowed to continue on an interim basis during the time period following Service acquisition to the completion of a Comprehensive Conservation Plan (CCP). This is required by the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd-668ee). The referenced wildlife-dependent public uses are hunting, fishing, wildlife observation and photography, and environmental education and interpretation. These are the priority public uses of the National Wildlife Refuge System.

The Service is not required to complete pre-acquisition compatibility determinations for uses that did not previously exist and were not owner-authorized. Determination of what qualifies as an existing priority public use is a judgment call by the refuge manager. In general, occasional, personal use of property, such as allowing family or friends to hunt or photograph wildlife, would not be considered an existing public use. In contrast, properties that are generally open, such as a private hunt club or a military reservation that allows military personnel and their families to fish, would be considered to have an existing public use. The Warm Springs Ranch does not presently have any public uses. The Warm Springs Ranch is expected to have some public uses since the Southern Nevada Water Authority recently acquired the property, through the Southern Nevada Public Land Management Act (SNPLMA). The SNPLMA funding source is the Parks, Trails, and Natural Areas (PTNA). As a PTNA, the SNWA is expected to provide public use and interpretation on the Warm Springs Ranch, once a management plan is written.

The Service, once they have acquired the Warm Springs Ranch, is likely to continue wildlife dependent public uses that are compatible with the Refuge purpose. A pre-acquisition compatibility determination would have to be made by the Refuge manager. It is likely that some compatible public use opportunities would be available within the capabilities of allocated staff and budget.

Hunting and fishing do not currently occur on the Refuge. There are no game fish in the stream. The site does not provide good hunting opportunities due to the proximity of residences. There is no known demand for hunting on this site.

The Refuge expansion may eventually open to limited staff or volunteer-led public use, providing interpretative and educational opportunities. There would also be the opportunity for the public to enjoy wildlife observation and photography during these on-site visits. In order to protect endangered species and sensitive resources, the area would initially be open to the public only through Refuge staff-led tours and volunteer programs. Group size could be limited and may be supervised by Refuge staff or volunteers to ensure that resources are protected.

The Service may also allow limited access for scientific research and for study groups on a case-by-case basis through a special-use permit process. Research that is nondisruptive to wildlife or archaeological resources and compatible with refuge purposes and goals may be allowed. Any public use allowed would be in strict conformance with applicable Federal and State statutes.

RIGHTS-OF-WAY AND EASEMENTS

Lands for the Refuge would be acquired subject to existing rights-of-way and easements. The Service has an application process for granting new rights-of-way and easements across refuge lands. This process would also be used if holders of existing rights-of-way and easements on refuge lands want to expand or modify the terms and conditions of their rights. New rights-of-way and easements or modifications to existing rights-of-way and easements must be compatible with the purpose for which the Refuge was established.

LAW ENFORCEMENT

Enforcement of Federal, State, and County laws are critical to safeguard Refuge resources, visitors, and facilities. The Refuge Complex staff includes five law enforcement personnel. Refuge officers would work with Las Vegas Metropolitan Police Department, Clark County Sheriff's Office, and Bureau of Land Management Rangers to prevent trespass, vandalism, and violation of wildlife laws.

FACILITIES DEVELOPMENT AND MANAGEMENT

The Service is in the process of constructing visitor facilities on the existing Refuge property. These include a stream viewing chamber, an interpretive trail and kiosk, and an educational/group use shelter. Any additional facilities and management of those facilities cannot be projected at this time.

Boundaries of lands acquired by the Service are posted with refuge signs at regular intervals. Fencing or other types of barriers are often constructed to control trespassing that could damage habitat or endangered species.

FIRE MANAGEMENT

Wildfires are a threat to Refuge structures due to the number and flammability of dead palm tree fronds within the valley. If and when the Refuge is expanded, the Service would update the

Moapa Valley National Wildlife Refuge Wildland Fire Management Plan (FMP) to include the new unit. The FMP addresses initial response, fire crew dispatch, wildfire suppression, cooperative agreements for firefighting support, and prescribed burning. Fire management planning would also include agreements with the Bureau of Land Management, and local fire departments for fire suppression support. The Refuge would maintain certain existing roads and trails as fire breaks and fire roads, and would evaluate needs for additional fire management facilities.

INTERAGENCY AND PUBLIC COORDINATION

The Service, Moapa Band of Paiutes, Southern Nevada Water Agency (SNWA), Moapa Valley Water District (MVWD), and Coyote Springs Investments, LLC (CSI) are signatories in a Memorandum of Agreement (MOA). In this MOA, the parties have identified certain conservation measures for the conservation and recovery of the Moapa dace, and have agreed to coordinate the monitoring, management and mitigation measures in their monitoring plans. The MOA establishes a Recovery Implementation Program (RIP) to outline and implement necessary protection and recovery activities for the Moapa dace. The MOA also provides for funding to develop the RIP, dedication of certain water rights to preserve in-stream flows, pumping restrictions whereby the parties agree to curtail pumping in the event spring flows in the Warm Springs area decline to specified “trigger levels.” Any future production of groundwater by the parties would be subject to the terms of the MOA, including pumping that may occur after the two-year pump test or as a result of other groundwater development projects.

Recovery Implementation Team

The Service has established a Recovery Implementation Team for the Muddy River. The goal of the team is to develop an action plan, identify on-the-ground activities, and implement actions necessary for recovery and management of native and endangered species of the Muddy River watershed. Partners involved with this initiative include the Nevada Division of Wildlife, U. S. Geological Survey, The Nature Conservancy, University of Nevada, Reno, Clark County and the Southern Nevada Water Authority, and the Muddy River Regional Environmental Impact Alleviation Committee (MRREIAC).

Muddy River Regional Environmental Impact Alleviation Committee

The MRREIAC has begun an active program to enhance the Muddy River ecosystem. One aspect of the program is removing tamarisk and other weeds and restoring riparian habitat with native species. The communities of Moapa, Logandale, Glendale, and Overton support these activities. The program has received funding from the U.S. Environmental Protection Agency, the Service, and the Clark County MSHCP. If its conservation measures are determined to be effective, Clark County intends to continue to provide funding to assist MRREIAC.

The Service acknowledges the strong support of the Nevada Department of Wildlife and Clark County. The Service will continue to work with these agencies to maximize resource protection,

enhancement, and public education for the expanded Refuge. The Service would seek partnerships with other agencies and neighboring landowners to meet mutual goals and objectives whenever possible. The Service would also pursue other partnerships to benefit resource management and public use, including interpretation and environmental education.

REFERENCES CITED

U. S. Fish and Wildlife Service. 1995. Recovery Plan for the Rare Aquatic Species of the Muddy River Ecosystem. Portland, Oregon. 60pp.