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SERVING CLIENTS SINCE 1957

Via Federal Express

June 30, 2011

Mr. Jason King, P.E.
State Engineer
Nevada Division of Water Resources
901 S. Stewart Street, Suite 2002
Carson City, Nevada 89701

Re: Evidentiary Exchange Regarding Southern Nevada Water Authority Water Right Applications in Spring, Cave, Dry Lake, and Delmar Valleys

Dear Mr. King:

The Long Now Foundation respectfully submits the enclosed witness list, exhibit list, and exhibits (July 1, 2011 Evidentiary Exchange) in support of its protest to Southern Nevada Water Authority Water Right Applications in Spring, Cave, Dry Lake, and Delmar Valleys. Copies of the July 1, 2011 Evidentiary Exchange have also been provided to the individuals on the attached Service List.

Sincerely,

Stephen B. Reich, P.E.
Senior Supervising Engineer

Enclosures

Service List

Dana Walsh
Southern Nevada Water Authority
1001 S. Valley View Blvd. MS#485
Las Vegas, Nevada 89153

Great Basin Water Network and Protestants
2nd Big Springs Irrigation Company, et al.
Simeon Herskovits
Advocates for Community and Environment
P.O. Box 1075
El Prado, New Mexico 87529

Richard W. and Lesley Ann Sears
1963 South 17th East HC 10
Ely, Nevada 89301
(Electronic)

Juab County and Millard County, Utah
J. Mark Ward
Utah Association of Counties
5397 Vine Street
Murray, Utah 84107

EskDale Center
Jerald Anderson
1100 Circle Drive
EskDale, Utah 84728

U.S. Department of Agriculture
Forest Service
Jeanne A. Evenden
324 25th Street
Ogden, Utah 84401

Henry C. Vogler IV
HC 33 Box 33920
Ely, Nevada 89301

Nye County
George Benesch
190 W. Huffaker Lane, Suite 408
Reno, Nevada 89511-2092

Confederated Tribes of the Goshute Reservation, Duckwater Shoshone Tribe and Ely Shoshone Tribe
Mark Echohawk and V. Aaron Contreras
505 Pershing Ave., Suite 100
Pocatello, Idaho 83205

Corporation of the Presiding Bishop of the Church of Jesus Christ of Latter-day Saints
Severin A. Carlson
Kaempher Crowell, Renshaw, Gronauer & Fiorentino
510 W. Fourth Street
Carson City, Nevada 89703

LONG NOW FOUNDATION WITNESS LIST

SOUTHERN NEVADA WATER AUTHORITY
WATER RIGHT APPLICATIONS IN
SPRING, CAVE, DRY LAKE AND DELAMAR VALLEYS

In the Matter of Protested Applications 53987, 53988 (Cave Valley - Basin 180), 53989, 53990 (Dry Lake Valley - Basin 181), 53991, 53992 (Delamar Valley - Basin 182), and 54003 through 54021 (Spring Valley - Basin 184)

The following individuals will provide testimony during the hearing in the above referenced matter.

Expert Witness: Mr. Cliff Landers
Expert Witness: Mr. Clay Robinson, PhD.
Witness: Mr. Scott Thomas, PhD.
Witness: Mr. Stephen Reich

Mr. Cliff Landers will provide expert witness testimony provided in the attached June 30, 2011 report entitled: "EXPERT REPORT Nevada State Engineer Water Rights Hearing Spring Valley, Nevada – Soils"

Mr. Clay Robinson will provide expert witness testimony provided in the attached June 30, 2011 report entitled: "EXPERT REPORT Nevada State Engineer Water Rights Hearing Spring Valley, Nevada – Soils"

Mr. Scott Thomas's will provide testimony as outlined in the attached report entitled: "Report: Cost of Mitigation at Owens Lake, California"

Mr. Reich will provide testimony regarding the requirement for monitoring and mitigation as outlined in the 1990 Green Book that addresses the Long-Term Groundwater Management Plan for the Owens Valley and Inyo County. The relationship between vegetation, soil management, and aquifer management and how it relates to long-term pumping will be addressed. The history of developing management goals in Owens Valley and Inyo County for various vegetation classifications will be discussed as it pertained to Mr. Reich's experience as the arbitrator regarding the determination of groundwater pumping by LADWP.

Name & Title: **Cliff Landers, Senior Soil Scientist**	**Project Assignment:**
Years of Experience with Firm: 1	**Years of Experience With Other Firms:** 41
Education: Degree(s) / Year / Specialization: B.S./ 1969 / Soil Science, Texas Tech University Soils Course 105 / 1972 / University of California at Davis	**Registrations / Certifications**: Licensed Professional Geoscientist (Soil Science) by the state of Texas (License #606) Certified Professional Soil Scientist (Soil Classifier) by the American Registry of Certified Professionals in Agronomy, Crops, and Soils (ARCPACS)

Experience Record

2010 to Present: STETSON ENGINEERS INC.-Albuquerque, NM

Mr. Landers is a Supervisory Soil Scientist for Stetson Engineers, Inc. and is the manager of Stetson's office in Albuquerque. He supervises all personnel assigned to the Albuquerque office and provides technical direction and oversight for all soil-related projects. These include (1) irrigation suitability studies on projects in New Mexico, Nevada, Arizona, Montana, and Idaho; (2) soil salinity studies on irrigated lands and native vegetation habitat restoration projects; (3) soil surveys; and other projects involving the evaluation and inventory of soil physical and chemical properties.

1988 to 2010: SOIL AND WATER WEST, INC.-Rio Rancho, NM; Corpus Christi, TX

Mr. Landers was the founder and President of Soil and Water West, Inc. He served as Principal Investigator for various irrigation suitability studies, soil surveys, and soil quality studies in the states of Arizona, Alabama, California, Idaho, Montana, New Mexico, Nevada, Oregon and Texas, and in the countries of Ghana, Eritrea, and Ethiopia. He has also been involved with several projects involving environmental concerns and in the preparation of Environmental Assessments.

Mr. Landers directed and conducted numerous studies to determine the suitability of land for irrigation. These projects involved the examination and mapping of the physical and chemical characteristics of soils, topography and ecological aspects to determine the suitability of the land for irrigation. Approximately 20 components of land were systematically mapped and evaluated to aid in the assessment of the cost of land development, the productive capacity of the land, and the management requirements to achieve the targeted production. These data were usually used by inter-disciplinary teams consisting of economists, engineers, hydrologists, agronomists and others, to determine the feasibility of the project development. Since 1988, Mr. Landers supervised the following irrigation suitability studies:

- Little Colorado River Project Area (Recon.); Arizona
- Little Colorado River Project Area (Semi-detailed); Arizona
- Soboba Indian Res. (Recon.); California
- Soboba Indian Res. (Semi-detailed); California
- Duck Valley Indian Res. (Recon.); Nevada/Idaho
- Duck Valley Indian Res. (Semi-detailed); Nevada/Idaho
- Tule River Water Development Plan (Recon.); California
- Salton Sea Area (Recon.); California
- Umatilla Indian Res. (Recon.)
- Ruby Valley Area (Semi-detailed); Nevada
- Fort Mojave Indian Res. (Recon.); Arizona/California
- Globe Equities 59 Project; Arizona
- San Juan Watershed Project Area (Recon.); New Mexico
- Nez Perce Indian Reservation (Semi-detailed); Idaho
- Gila River Indian Reservation (Semi-detailed); Arizona
- San Xavier Area (Recon.); Arizona
- Fort Independence Area (Recon.); California
- Fort Independence Area (Semi-detailed); California
- Crow Indian Res. (Recon.); Montana
- Crow Indian Res. (Semi-detailed); Montana
- Tohono O'Odham Irrigation Project; Arizona
- Ghedem Irrigation Project (Recon and Semi-detailed); Eritrea (Africa)
- Rio Jemez (Semi-detailed); Jemez, Zia, Santa Ana Pueblos; New Mexico
- Ghana Irrigation Project (Semi-detailed); Accra, Ghana (Africa)
- Flathead Indian Reservation (Semi-detailed); Montana

Cliff Landers, Project Contact / Coordinator
(Continued)

Mr. Landers has extensive experience in conducting soil surveys. Since 1988 he has conducted soil surveys and terrestrial ecosystem (soil-plant community) surveys for the USDA Forest Service, the National Park Service, Indian Pueblos on the Rio Grande, and private businesses. These total well over 100,000 acres in extent. Mr. Landers supervises the irrigated lands Salinity Assessment Program of Soil and Water West, Inc. This program consists of conducting soil salinity surveys on irrigated lands and lands under planning for habitat restoration, and advising the land operators of causes and solutions to soil salinity problems. Assessments have been conducted on the Palo Verde Irrigation District near Blythe, Ca; on the Welton-Mohawk Irrigation District near Yuma, Az; on Isleta Pueblo irrigated lands near Albuquerque, NM; on Isleta Pueblo lands along the Rio Grande River bosque); and on the Colorado River Indian Reservation in Arizona.

Mr. Landers served as Principal Investigator for various environmental projects. Recently, Mr. Landers was project manager and lead soil scientist for a 5-year project at Owens Lake near Lone Pine, California. This project involved the propagation of salt grass on highly saline and sodic soils. Mr. Landers provided the lead in monitoring soil chemical and physical conditions on various research plots on the dry lakebed and recommending management alternatives to the client.

Mr. Landers has testified as an expert witness in court or deposition on numerous occasions. His clients have included the U.S. Department of Justice as well as private law firms.

1985 to 1988: BUREAU OF INDIAN AFFAIRS-Albuquerque, NM

Supervisory Soil Scientist:
Mr. Landers served as the head of the Soils Section in the Branch of Rights Protection, Albuquerque Area Office. He was responsible for providing guidelines and technical direction for soil studies conducted by the BIA, both in-house and under contract. He was the final technical authority concerning these studies. During this time, Mr. Landers provided direction on the classification of about 30,000 acres on the Jemez, Zia, and Santa Ana Indian Reservations in New Mexico. He did much of the field work himself and testified in various depositions and in court as an expert witness for the Department of Justice concerning this work. Also during this time, Mr. Landers provided technical support regarding the environmental impacts of various activities on Indian Reservations. He assisted Los Alamos National Laboratories in the investigation of radionucleide soil contamination on San Ildefonso Pueblo. He collaborated with BIA Geohydrologists to determine the impacts of land spreading of animal wastes on Isleta Pueblo lands. Mr. Landers received an outstanding rating and a cash award for sustained outstanding performance while in this position.

1981 to 1985: STONEMAN-LANDERS, INC.-Albuquerque, NM

Mr. Landers was co-founder and principal in the firm. He served as co-director of soil investigation activities. His duties ranged from project leader on certain projects to soil classifier on others. Additionally he was responsible for preparing or reviewing reports prepared by the firm.

During this time, Mr. Landers was involved with projects concerning Irrigation Suitability Land Classification for several Indian tribes; Mescalero, Southern Ute and Ute Mountain Indian reservations, Acoma-Laguna, Jemez, Zia, Santa Ana, Taos, San Juan, and Santa Clara Pueblos. Other large projects Mr. Landers was actively involved in include: An Ecological Soil Survey of the Mescalero Apache Indian Reservation (460,000 acres); Environmental Impact Studies for the Acoma-Leguna Indian tribe to determine the land damage due to waste disposal activities; Environmental Contamination Studies for Artesia Oil Refinery and review of the refinery's environmental mitigation.

1980 to 1981: FOREST SERVICE, USDA - Albuquerque, NM

Soil Correlator:
In this position, Mr. Landers served on the Soil and Water Staff Unit in the Southwestern Regional Office of the Forest Service. His primary duty was to provide technical guidance to the Forest Soil Scientists in Arizona and New Mexico regarding the preparation of ecological soil surveys and to conduct field reviews of these surveys to determine their accuracy and quality. He developed regional guidelines and methodology for Terrestrial Ecosystem Studies and assisted in the preparation of the technical manual concerning these criteria. In addition, Mr. Landers developed procedures for evaluating watershed conditions for forest service planning. He served as a member of an Interdisciplinary Team to assess the environmental impacts of selected projects.

Cliff Landers, Project Contact / Coordinator
(Continued)

1978 to 1980: FOREST SERVICE, USDA - Alamogordo, NM

Soil Scientist:
Mr. Landers primary duty was to provide technical advice to the Lincoln National Forest Supervisor and his staff concerning the soil resource in regard to lumber, crop, and watershed management as well as the environmental impact of various forestry activities. Mr. Landers performed ecological soil surveys on the Lincoln National Forest for use in planning of Forest activities and management. He was responsible for reviewing and assessing all forest projects and activities that had significant environmental impacts within his area of expertise. A project of special interest that Mr. Landers worked on as a member of the Forest Interdisciplinary team was determining the ecological factors involved with restoring the natural resource to a functional condition in the aftermath of an ecological disaster. Mr. Landers also participated in range allotment analyses and in the preparation of various Environmental Impact statements.

1974 to 1978: SOIL CONSERVATION SERVICE, USDA – Capitan, NM

Soil Survey Party Leader:
Mr. Landers directed soil survey activities of the SCS in Lincoln County and supervised the soil scientists assigned to his office. These survey activities included studies for soil and wind erosion, cropland suitability, rangeland planning and productivity potentials, and soil and vegetation studies. He provided assistance to five SCS Field Offices on projects dealing with engineering recommendations and irrigated cropland management. Mr. Landers worked on the conservation Needs Inventory Program and assisted in the preparation of subdivision regulations for Lincoln County.

1973 to 1974: SOIL CONSERVATION SERVICE, USDA – Palmetto, FL

Area Soil Scientist:
Mr. Landers was Area Soil Scientist on the Staff of the Area Conservationist in west-central Florida. His duty was to provide soil surveys in the area (10 counties) as needed for farm, ranch, and urban planning. He conducted site evaluations to determine flood zones, and surface and subsurface drainage. Mr. Landers participated in several workshops to teach city planners, engineers, developers, and other land users to extract and apply the information contained in soil survey reports. Mr. Landers was involved in the reclamation of land strip-mined for phosphates. He characterized the mine spoils and provided recommendations for the reclamation. This work was one of the first efforts to classify these areas using standard soil taxonomy criteria. Mr. Landers classified extensive areas of hydric soils (wetlands) throughout west central Florida.

1970 to 1973: SOIL CONSERVATION SERVICE, USDA – San Francisco Bay Area, CA

Soil Scientist:
In this position, Mr. Landers performed soil surveys in the heavily populated San Francisco Bay Area. The surveys were designed for land suitability engineering interpretations in the more populated areas and for irrigated cropland and rangeland in the more rural areas. Mr. Landers assisted in the writing of the Contra Costa County Soil Survey Report, the Western Alameda County Soil Survey Report, and a long-range development plan for the city of Hayward, California, and is named as a contributor on each of these reports. He classified thousands of acres of hydric soils (wetlands) on the east side of San Francisco bay and in the delta area of the Sacramento and San Joaquin rivers.

1969 to 1970: SOIL CONSERVATION SERVICE, USDA – Lubbock, TX

Soil Scientist:
In this position, Mr. Landers performed soil surveys in Lubbock County. Federal funds were provided for soil conservation measures installed on irrigated cropland and the soil survey was the basis for determining the eligibility of local farmers for those funds.

- Responsible for collecting scientifically defensible aquifer characterization information in active Indian Water Right Adjudications. Well site geologist for the Karavas Tract, Tract "A", Buffalo Pasture and Tract "C" investigations in Taos, NM. I developed a Mod Flo ground water model based upon structure of the basement rock below the Taos Plateau.
- Well site geologist on 10 exploratory test wells of 300' to 2000' on the Pueblo of Taos. At each site drill cuttings were collected, subsequent analytical characterization of same by examination and description, and cataloged in chip trays for long term preservation. Geophysical well logs were obtained at all locations. Aquifer Pump Testing Investigations were performed and analyzed to estimate parameters of transmissivity and determine coefficients of storage.

Cliff Landers, Project Contact / Coordinator
(Continued)

Other Experiences, Qualifications, and Affiliations

Texas Association of Professional Geoscientists
American Society of Agronomy
Soil Science Society of America
Professional Soil Scientists Association of Texas

Curriculum Vitae: **CLAY ROBINSON,** Ph.D., CPSS, PG June, 2011

Address: 6240 Riverside Plaza Ln NW
Phone: (505) 890-4099 Email: c.drdirt.robinson@gmail.com

Education and Certification:

P.G.	2003	1416, Licenced Professional Geoscientist: Soils, Texas Board of Professional Geoscientists
CPSSc	1999	28054, Certified Professional Soil Scientist, ARCPACS Federation of Certifying Boards
Ph.D.	1993	Iowa State University, Ames, Iowa, Soil Science (Soil Management)
M.S.	1988	West Texas State University, Canyon, Texas, Agriculture
B.S.	1984	West Texas State University, Canyon, Texas, Magna cum Laude
H.S.	1980	Booker High School, Booker, Texas

Employment:

June 2011 - present	Senior Soil Scientist, Stetson Engineers, Inc.
Sep. 2007 - May 2011	Professor of Soil Science, West Texas A&M University
Sep. 1, 2000 - 2007	Associate Professor of Soil Science, West Texas A&M University
Sep. 1, 2000	Tenured, West Texas A&M University
Sep., 1994 - 2000	Assistant Professor of Soil Science, West Texas A&M University
Sep., 1992 - 1994	Instructor, Farm Mgr., Asst. Prof. of Agriculture, Eastern New Mexico Univ.
Sep., 1988 - 1992	Teaching Assistant (88-90), Research Assistant (90-92), Iowa State University
Jan., 1986 - 1988	Research and Teaching Assistant, West Texas State University
May, 1984 - 1986	Research Technician, ARCO Seed Company, Triticale Division

Teaching and Related Activities:

Taught soils, soil fertility, soil and water conservation, soil profile evaluation, soil morphology and classification, irrigation, field crops, horticulture, undergraduate statistics, environmental issues and ethics.

Present soils topics to more than 1000 farmers/consultants, 500 homeowners, and >20000 K-12 students

Consulting:

Lonestar vs Ratjen. 2011. Literature review and interviews on part of Lonestar to evaluate whether damage to Ratjen's wheat could have been caused by negligence on Lonestar's part.

Hamilton vs. El Paso Natural Gas. 2010. Evaluated soil conditions for EPNG to determine if soil and potential crop productivity were damaged by work done by EPNG to lower a pipeline. Arbiters responded in favor of EPNG.

Stetson Engineers, Summer 2010. On-site irrigated land suitability classification per Navajo irrigation water rights to the San Juan River, Shiprock, NM.

Rendered opinion for case related to damage associated with pipeline construction and revegetation: Were soils replaced in correct order? Wright vs. Gorman Phillips, Hemphill County, TX, 2009.

Rendered opinion about soil/crop salinity documentation for application of oilfield brine wastes to rangeland in Hemphill County, TX for report to Texas Railroad Commission. J&L Oilfield Services, Summer 2009.

Evaluation of irrigation water availability, land requirements, and nutrient management plans for a beef backing plant in Texas County, OK. 2007. HDR Engineering. Evaluated nitrogen and phosphorus fate in alternative cropping systems. Developed water balance spreadsheets according to regulatory requirements relative to soil hydrologic groupings, crop evapotranspiration requirements, effluent/freshwater requirements, and whether current well yields would provide enough fresh water to offset salinity of effluent.

December, 2001 to 2005, Soil background research for Fulbright & Jaworski, L.L.P., in reference to questions related to BWXT-Pantex TLAP proposal for subsurface drip irrigation system to dispose treated wastewater on cropland

Soils background research for Walker & Twenhafel, L.L.P., in reference to Civil Action No. H-02-3098;

Wills v. State Farm Lloyds, Inc.; In the U.S. District Court, Southern District of Texas-Houston Division
Renewable Resources Program review, College of Applied Life Sciences, University of Louisiana-Lafayette (Curriculum, Auxiliary Units, Visits with faculty, administrators, students, alumni, and industry board), Provided written report with recommendations.
Spring, 2000, Morton Homes, Soil and landscape assessment for problems with tree growth
Fall, 1997, Enviro-Ag Engineering, Inc., Soil characterization/classification of a potential playa

Professional Society Memberships and recent activities:
American Society of Agronomy
Resident Education Division Chair for planning Annual Meetings, Long Beach CA, 2010
Associate Editor, J. Natural Resources and Life Sciences Education
Soil Science Society of America
Member, S591 Committee, K-12 Soils Outreach
Council of Soil Science Examiners
Soil and Water Conservation Society

Achievements:
2005-2006 WTAMU Provost's Appreciation Award for Outstanding Contributions
2005-2006 WTAMU Curriculum Innovation Award for role in "Forensic Science" Course Development
2002 American Society of Agronomy Educational Materials Awards Program Certificate of Excellence, Internet Web Page Category for "K-12 Teaching Resources and Activities (by Dr. Dirt)"
NACTA Teaching Award, WTAMU, 1999-2000
2000 SSSA S-6 (Soil and Water Conservation Division) Young Scholar Award
Alpha Zeta WTAMU Outstanding Professor in Agriculture, 1998-1999.

Bibliographical list of publications - Author or contributing co-author for 37 refereed publications including journals, proceedings, books chapters, international journal, and encyclopedia entries, and for 30 non-refereed abstracts and proceedings. Developed 7 pedagogical publications. Maintain Dr. Dirt's K-12 Teaching Resources and Activities, and Dr. Dirt's Homeowner Q&A web pages.

Name & Title:	**Project Assignment:**
Scott Thomas, Senior Scientist	Project Manager; Water Resource Planning & Water Quality
Years of Experience with Firm:	**Years of Experience With Other Firms:**
5	22
Education: Degree(s) / Year / Specialization:	**Registrations / Certifications:**
PhD Environmental Biology and Public Policy, George Mason University 2005 MA Business and Management, Webster University 1990 BA History, Hampden-Sydney College 1984	Facilitator, Franklin-Covey

Experience Record

2006 – Present, Stetson Engineers, Inc.

Dr. Thomas is a Senior Scientist specializing in watershed planning, surface water quality, and environmental planning and permitting.

Water Quality

- Project Manager, Salt & Nutrient Management Plan for Lower Santa Margarita River and Las Flores Creek Basins.
- Project Manager, Hydrologic and Biologic Assessment of Lower Santa Margarita River Watershed.
- Project Manager, Support to Nutrient Numeric Endpoint (NNE) study of the Santa Margarita River Watershed.
- Developed comparative analysis of water quality monitoring programs for the Santa Margarita River Watershed, with recommendations for a consolidated, integrated program for the middle and lower watershed.
- Analyzed water quality implications of toll road construction upon San Mateo Creek.

Management Plans

- Project Manager for Water Resource Plan for Marine Corps Base Camp Pendleton.
- Developed Urban Water Management Plan for Marine Corps Base Camp Pendleton.
- Developed analysis of water reuse opportunities for 125,000 acre Camp Pendleton.
- Developed Water Resource Education and Outreach Plan for Camp Pendleton.
- Supported development of Strategic Water Plan for Camp Pendleton.

Watershed Management

- Facilitator for the Santa Margarita River Water Quality Monitoring Group. Developed Strategic Plan for the Group.
- Facilitator for the Santa Margarita River Executive Management Team for the U.S. Bureau of Reclamation.
- Facilitator for the Santa Margarita River Stakeholder Advisory Group for Reclamation.
- Assisted Elsinore-Murrieta-Anza Resource Conservation District in grant proposal development and meeting facilitation. Developed plan of work for establishing a Watershed Council for the Santa Margarita River.
- Developed Threats Analysis for the Santa Margarita River for Reclamation.

Water Rights

- Negotiation support to U.S. Marine Corps in Federal Case 1247 (United States v. Fallbrook Public Utility District et al.).

1994-2006, Marine Corps Base Camp Pendleton, California

Director of Water Resources, 2002-2006

- Supervised Department that develops water policies, plans and programs including those relating to surface and groundwater supply, monitoring and modeling for water quality, quantity, and flood protection, water conservation and recycling, optimal use of aquifers, and watershed planning.
- Marine Corps Project Leader for planning and developing $100 million conjunctive use water project.
- Represented Camp Pendleton in regional forums including Santa Margarita River Watermaster Steering Committee, Leader, Santa Margarita River Watershed Monitoring Group, Santa Margarita River Executive Management Team and San Diego County Water Authority Agency Managers.
- Chair of Base Water Steering Committee.
- Marine Corps lead negotiator in Federal Water Rights Case 1247: U.S. v. Fallbrook Public Utility District et al.

Environmental Officer, 1998-2002

- Head of the Environmental Department, MCAS Camp Pendleton
- Responsible for numerous functions including water quality, stormwater management, environmental planning and permitting, HAZMAT and HAZWASTE management, air quality, natural and cultural resource conservation.

Environmental Protection Specialist, 1994-1998

- Project Manager – Multi-disciplinary Team developing Uplands Programmatic Biological Assessment.
- Head, Environmental Training Division – Supervised staff of instructors and managed curriculum content. Trained staff of Mountain Warfare Training Center at Bridgeport, CA.
- Head, Environmental Planning Branch – Coordinated NEPA environmental analyses and permitting for water projects. Lead Negotiator for Programmatic Riparian Biological Assessment consultation with USFWS.

1993-1994, Marine Corps Air Ground Combat Center, California

Air Quality Specialist.

- Managed air quality programs, including criteria pollutant and toxics inventories, inspections, permitting, and training.

1984-2004, U.S. Marine Corps (Active Duty 1984-1993, 2001-2003)

Lieutenant Colonel

- Led Marines in various capacities including: Executive Officer and Operations Officer of 3d Civil Affairs Group, Operations Officer of Humanitarian Assistance Coordination Center (Operation Iraqi Freedom), Operations Planner at Central Command (Operation Enduring Freedom), Logistics Officer, and Administrative Officer.

Professional Affiliations:

Desert Research Institute (Reno, NV) Adjunct Research Professor

Ecological Society of America

American Water Resources Association

Water Reuse Association

Society of Wetland Scientists

Military Fish and Wildlife Society

Name & Title:	**Project Assignment:**
Stephen Reich, Supervising Engineer / Hydrogeologist	Supervising Engineer
Years of Experience with Firm:	**Years of Experience With Other Firms:**
23	1
Education: Degree(s) / Year / Specialization:	**Registrations / Certifications:**
M.S. / 1989 / Geophysical Engineering, Colorado School of Mines, Golden, Colorado B.S. / 1985 / Geophysical Engineering, Colorado School of Mines, Golden, Colorado	Civil Engineer No.C58713, California

Experience Record

Stetson Engineers Inc.

Arbitrator

Currently serving as the sole arbitrator of a ground-water pumping dispute between the Los Angeles Department of Water and Power and Inyo county. The dispute is based on the interpretation of legal and technical agreements between the two parties regarding the amount of ground water that may be pumped from the Owens Valley, California. Review of complicated reports that discuss the impact of pumping on ground-water hydrology and ecological and biological maintenance.

Feasibility Analysis

As author and project manager, directed all engineering, hydrologic, hydrogeologic, environmental tasks involved in the completion of the Santa Margarita River Recharge and Recovery Enhancement Program. This project combined the complex engineering and environmental studies required to maximize the ground-water production from a ground-water basin without harming the 16 endangered species that live within the riparian corridor and associated estuary of the Santa Margarita River. Currently participating in the completion of the environmental documentation associated with this project.

Municipal Water Systems

- Participating as a member of a Technical Committee, worked directly with private developers and the Contra Costa Water District in analyzing the buy-in charges for new customers. As an expert witness, contributed to the review of the Contra Costa Water District's raw and treated water infrastructure including their pipe network system, reservoir, pumping plant, and canal structures. In order to determine the District's value, coordinated data acquisition and analysis of available documents and maps in order to complete a thorough final report relating to the applicability of the District's charges.
  (Private client, Contra Costa Rate Study, 1993-1998)
- Acting for the San Francisco Bay Area Water Users Association, oversaw the monitoring of water supply and delivery of water to numerous entities that purchase Hetch Hetchy water from the City of San Francisco.
  (BAWUA Water Delivery Monitoring Program, 1992-1996).
- As a member of the Stetson technical team consulting the Ute Indian Tribe in Utah, responsible for the gathering and interpreting geological data relevant to determining the location of a future dam site. Responsibilities included identifying and describing geologic hazards at thirteen potential dam sites both on and off the Reservation.
  (Dam Site Feasibility Study, Ute Indian Tribe, Uintah Indian Tribe, 1994).

Water Quality Oversight

Working together with The Nature Conservancy and San Diego State University riparian ecologists, biologists, and hydrologists, led efforts in monitoring the "ecological health" of a river. The purpose of these efforts has been to monitor the health of river while at the same time meeting the municipal water demands of downstream water rights holders. Other studies involved with this task include the oversight of geomorphology and hydraulic studies associated with the characterization of a river.

Water Rights Negotiations

Technical lead for the United States and the Marine Corps Camp Pendleton in the settlement of one of the longest running (76 years) water rights disputes in California. Using technical studies prepared by experts in numerous fields, developed the technical portion of a settlement agreement that allowed for the restoration of streamflow to satisfy both ecological demands and municipal demands. A MODFLOW ground-water model, a hydrologic model, and the classification of the riparian and biological habitat were just a few of the numerous studies that were used to establish the basis for settlement of a complex river system. The negotiated agreement acknowledges the beneficial use of water not only for human consumption, but also for ecological demands.

Steve Reich, Supervising Engineer / Hydrogeologist
(Continued)

Watershed Studies

- As project manager, oversee all hydrologic and hydrogeologic tasks relating to the adjudication of the Santa Margarita River Watershed. As the lead engineering firm for the U.S. Department of Justice, work directly with the U.S. Marine Corps Base Camp Pendleton, various Indian Reservations, the federal Watermaster, the U.S. Geological Survey, and Rancho California Water District personnel to develop solutions relating to all water resources in the Santa Margarita River Watershed.
  (U.S. Department of Justice, Santa Margarita River Watershed, 1993 - ongoing).
- Analyzed numerous well logs in Riverside and San Diego Counties. Analysis of these data sets was used to delineate between underflow and percolating ground water under unconfined or confined conditions as well as determining hydrogeologic characteristics of the aquifers
  (U.S. Department of Justice, Southern California Ground-water Studies, 1993).
- Designed an integrated geophysical survey in the San Pedro River Basin in Arizona to delineate between underflow and percolating ground water. Using various DC electrical techniques as well as bore hole data, defined the lateral boundaries of the San Pedro River stream system
  (U.S. Department of Justice, San Pedro River Basin, 1994).

Water Rights Studies

As a member of the Stetson technical team consulting the Pyramid Lake Paiute Tribe, prepared documents on irrigation and land use status using aerial photographs and historic documents. Additionally involved with a cooperative effort between the Tribe, the U.S. Department of Justice, and the U.S. Bureau of Reclamation in identifying the transfer of water rights. Coordinated GIS data and other databases with relevance to legal and illegal irrigated lands.
(Pyramid Lake Paiute Tribe, Pyramid Lake Land Use Study, 1992 - present).

Water Wells/Drilling Expertise

- Responsible for the drilling and completion of a 1,300-foot water well on the Pechanga Indian Reservation, CA including the geological and geophysical logging of the well, determination of the screened interval, and pump testing of the well.
  (U.S. Department of Justice, Pechanga Reservation Ground-water Study, 1996).
- Responsible for the design, acquisition and interpretation of a seismic refraction survey to determine the suitability of a shallow ground-water supply on the Shivwitz Indian Reservation in Southwestern Utah. Additionally, five shallow bore-holes were drilled and incorporated in the interpretation of the final results.
  (U.S. Department of Justice, Shivwitz Reservation Ground-water Study, 1995).
- Designed and implemented both geophysical and hydrogeologic studies for the Southern California Water Company (SCWC). Working directly with their chief hydrogeologist, coordinated both field and office studies concerned with the design and location of new water wells within numerous ground-water basins throughout California. Additionally, analyzed some of SCWC's existing water wells in Edna Valley and Barstow for the determination of surface water influences and their pertinence to drinking water standards.
  (SCWC Water Well Studies, 1993-94)
- Worked as the on-site geologist during the drilling of a ground-water well in the City of Burlingame, California. Responsible for the collection and analysis of geologic samples, analysis of geophysical data, completion depth, and general field supervision. Completion of this well resulted in a dependable supply of irrigation water with a yield of 200 gpm.
  (City of Burlingame, Washington Park Irrigation Well Drilling, 1992)

Prior Experience

As an independent consultant, specialized in electrical methods applied to oil fields. Responsibilities included the design, implementation, processing, interpretation and presentation of transient electromagnetic data, as well as recommendations to the personnel responsible for choosing well site locations. While with the Western Geophysical Company of Houston, Texas, supervised 120-person field crews in Turkey for the acquisition of reflection and refraction seismic data. During this time in Turkey, drilled and logged over 200 shallow exploration holes. In London, England, processed and interpreted a three-dimensional survey used for the development of an existing oil field. Applied electromagnetic techniques to define alluvial and bedrock structures outside both Ely and Carlin, Nevada. Performed studies for theoretical modeling of electromagnetic data and its applications and supervised data acquisition for deep structural gas studies. Also worked as an on-site geologist for Exlog Inc. during the exploration of a 13,000-foot well in the Bering Sea.

EXHIBIT LIST

IN THE MATTER OF APPLICATIONS 53987 THROUGH 53992 AND 54003 THROUGH 54021 FILED BY THE SOUTHERN NEVADA WATER AUTHORITY TO APPROPRIATE GROUNDWATER IN SPRING VALLY, CAVE VALLEY, DRY LAKE VALLEY AND DELAMAR VALLEY

HEARING DATE: Scheduled for September 26, 2011 through October 14, 2011, and October 31, 2011, through November 18, 2011

		OFF.	AD.
LONG_Exh_001	Table of Contents and Introduction of the June 1990 Green Book addressing theLong-Term Groundwater Management Plan for the Owens Valley and Inyo County		
LONG_Exh_002	Report Cost of Mitigation at Owens Lake by Mr. Scott Thomas, PhD.		
LONG_Exh_002	Example - Long Now Protest to Water Rights Application 540003		
LONG_Exh_004	EXPERT REPORT Nevada State Engineer Water Rights Hearing, Spring Valley, Nevada - Soils		
LONG_Exh_005			

LONG_Exh_001

GREEN BOOK
FOR THE
LONG-TERM GROUNDWATER MANAGEMENT PLAN
FOR THE
OWENS VALLEY AND INYO COUNTY

JUNE 1990

PREPARED BY

INYO COUNTY

GREG JAMES
WATER DIRECTOR
DR. DAVID GROENEVELD
PLANT ECOLOGIST
BILL HUTCHISON
HYDROLOGIST

CITY OF LOS ANGELES

DENNIS.C. WILLIAMS
ENGINEER IN CHARGE,
LOS ANGELES AQUEDUCT DIVISION
RUSSELL H. RAWSON
ENGINEER,
LAND & RESOURCES MANAGEMENT
EUGENE L. COUFAL
HYDROLOGIC ENGINEER

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INTRODUCTION

The Agreement between the County of Inyo and the City of Los Angeles and its Department of Water and Power on a Long-term Groundwater Management Plan for the Owens Valley and Inyo County (Agreement) in Section I.E provides:

> "The location of each management area, vegetation monitoring site, and each monitoring well; the wells linked to each vegetation monitoring site; the method for locating additional monitoring sites and monitoring wells; the type of monitoring to be conducted at each site; and the standardized procedures for analysis and interpretation of monitoring results, including the determination of available soil water and the amount of soil water required by vegetation, are set forth in a technical document called a 'Green Book.' This 'Green Book' will be attached as a technical appendix to the final long-term Agreement and its accompanying environmental impact report (EIR)."

This document is the "Green Book."

The Green Book consists of five primary sections. The sections are:

I. Vegetation Management

II. Vegetation Inventory and Development of Vegetation Management Maps

III. Vegetation Monitoring

IV. Hydrologic Management

V. Further Studies

Section I on Vegetation Management describes the goals and principles of the Agreement that pertain to management of the vegetation types. This section sets forth the procedures and methods for achieving these goals and principles.

Section II describes the process of compiling the vegetation inventories and the development of the management maps that are to be used in achieving the goals of the Agreement.

Section III describes the techniques and methods to monitor the vegetation and calculate soil-plant water requirements.

Section IV outlines the criteria and procedures to be used in monitoring and evaluating hydrologic data. Also, the section sets forth the procedures for locating and operating the new wells, and the methods of avoiding groundwater mining.

Section V of the Green Book outlines further studies that are being considered to more effectively achieve the goals and principles of the Agreement over the long term or needed to refine monitoring procedures based on new technology.

Section VI, the Appendix, contains various supporting technical vegetation information.

Provisions for revising and updating the Green Book are specified in Section III.E of the Agreement, which states:

> "...modifying the provisions of the 'Green Book' as a result of information gained from ongoing research and cooperative studies or for other reasons, as may be necessary to improve the effectiveness of the monitoring and the evaluation activities."

LONG_Exh_002

REPORT

COST OF MITIGATION AT OWENS LAKE, CALIFORNIA

TASK ORDER: 2066

PREPARED FOR
THE LONG NOW FOUNDATION

PREPARED BY:
SCOTT THOMAS, PHD.
RENO, NEVADA
STETSON ENGINEERS, INC.

JUNE 26, 2011

2171 E. Francisco Blvd., Suite K | San Rafael, California | 94901
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INTRODUCTION

This report documents the magnitude of the mitigation costs associated with suppressing fugitive dust emissions at Owens Lake, California. These mitigation costs were not foreseen in the early years of the Los Angeles Department of Water and Power (LADWP) water project. Lessons learned at other water development projects may aid in the development of potential mitigation requirements associated with groundwater development and exportation in eastern Nevada. These requirements and costs should be factored into decisions relating to the feasibility, value, and potential economic costs of any proposed project.

CONDITIONS AT OWENS LAKE

Anderson (2006) provides a historical overview of the water production activities dating back approximately 100 years, the periodic legal and regulatory entanglements, and changing environmental conditions in the Owens River Valley. He writes of Owens Lake near Olancha, "On a bad day, the dust rises off the lake's skeleton in vicious, tornado-like plumes, forcing children and the elderly to stay indoors. It is the largest source of coarse-particle air pollution in the country — second in the world only to the Sahara Desert" (Anderson, 2006). Since 2006, progress has continued and conditions have evidently improved, as the LADWP states that the PM-10 dust is being 90% controlled as of 2010 (LADWP, 2010b).

MITIGATION REQUIREMENTS

The LADWP operates its groundwater production program in accordance with a 1997 Owens Valley Memorandum of Understanding between LADWP and Inyo County (LADWP, 2010a). Under this MOU, LADWP must prepare an annual report documenting hydrologic conditions for the Valley, operation of the groundwater production program, and status of the mitigation program. This mitigation is set in accordance with the Environmental Impact Report of 1991 (LADWP, 2010a). This mitigation includes extensive monitoring of hydrology, condition of vegetation and dust generation. The mitigation also includes a series of projects such as revegetation with native flora, reinstatement of river flows, water augmentation for ponds, surface spreading of water, pasture irrigation, maintenance of waterfowl habitat, and measures to suppress fugitive dust (PM-10) generation (LADWP, 2010a).

The California Air Resources Board and the Great Basin Unified Air Pollution Control District require that LADWP control the fugitive dust. Techniques tested include sand fences, chemicals, covering the lake with old tires, as well as a proposal to pump treated sewage from Los Angeles. The methods that worked best were shallow flooding, vegetation, and gravel (Anderson, 2006). As of June 2011, the mitigation program continues. Most mitigation projects are underway, however some are still in the planning stage (LADWP, 2010a) and new techniques continue to be tested (Piper, 2006; LADWP, 2010b).

MITIGATION EXPENDITURES

In the mid-1990s, as the Owens Lake dust mitigation project matured, City of Los Angeles officials and taxpayers' representatives began to grow concerned over the size of the costs associated with the project. At a meeting on February 15, 2006, the Los Angeles City Council ordered that an independent audit be conducted to quantify the expenditures to date on the Owens Lake dust mitigation project (City of Los Angeles, 2006). The Council stated that while the Department of Water and Power had originally stated that the project would cost "no more than $120 million," the cost had in fact escalated to over three times than much. Meanwhile, one of the City's contractors on the project, CH2M HILL, submitted a letter stating that "Many agencies and other entities involved with the Owens Lake project have known and reported for almost a decade now that the project, as defined, would cost in the range of $400 million" (CH2M HILL, 2006). The letter continued: "Specifically, initial estimates, provided to the [LADWP] in May 1997, anticipated that the Owens Lake project would cost between $313 million and $440 million. These early estimates were validated by Parsons Engineering, an independent engineering firm and competitor to CH2M HILL, before our company began serving the city on the project." The letter provides a tabulation of costs accrued to date (as of January 2006) which totals $446 million.

A recent online article quotes LADWP as having spent $540 million for the first 43 square miles of dust control on the lake bed (Piper, 2011). LADWP confirms that it is over $500 million as of 2010 (LADWP, 2010b). In addition, this capital expenditure (and consulting fees) does not include the average $17.5 million for annual maintenance as well as the average $24 million annually (which varies depending upon precipitation) for water applied to the lake for a yearly total of $41.5 million (GBUAPCD, 2008). However LADWP quotes much higher annual costs:

$25 million annually for maintenance and $41 million for water use annually, for a yearly total of $66 million (LADWP, 2010b).

SUMMARY

Based on a review of publically available references, capital expenditures for the project as of 2011 are approximately $540 million and yearly recurring costs range between $41-66 million.

REFERENCES

Anderson, Jeffrey. 2006. THE ETERNAL DUSTBOWL: Paying for the sins of L.A.'s water barons has created a half-billion-dollar boondoggle. LA Weekly dated March 22, 2006. Los Angeles, California.

CH2M HILL. 2006. Owens Valley – Corrections for the Record. Letter dated January 13, 2006 to Mary D. Nichols, President, Board of Water and Power Commissioners, City of Los Angeles. Los Angeles, California.

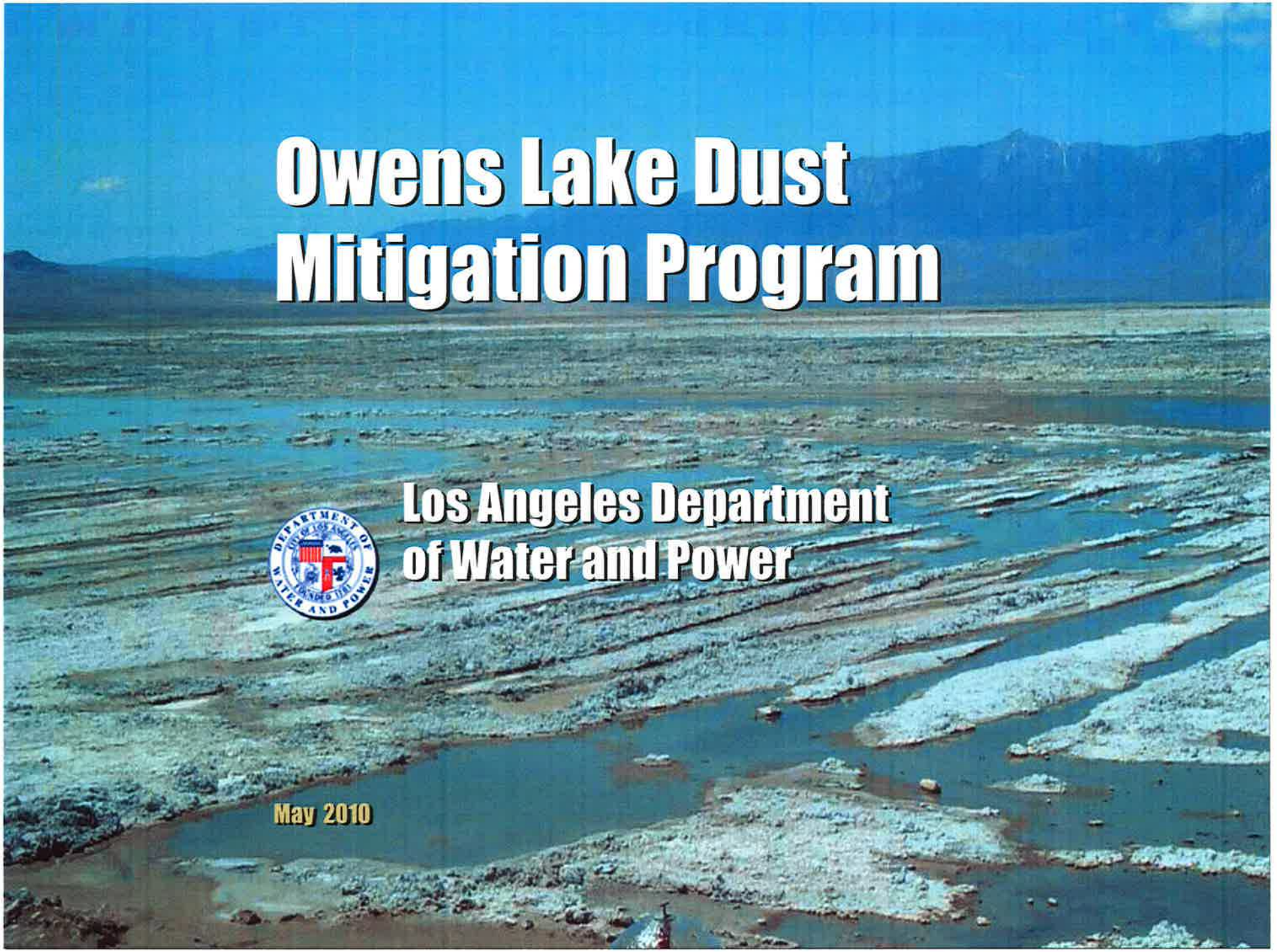
City of Los Angeles. 2006. Motion and Approval for an Independent Audit of the Owens Valley Dust Mitigation Project. Record of City Council Decision dated February 16, 2006. Office of the City Clerk. Los Angeles, California.

Great Basin Unified Air Pollution Control District (GBUAPCD). 2008. Owens Valley PM10 Planning Area Demonstration of Attainment State Implementation Plan. January 28, 2008. 7-6 to 7-13.

Los Angeles Department of Water and Power (LADWP). 2010a. Draft Annual Owens Valley Report. April, 2010. Los Angeles, California.

_____. 2010b. Owens Lake Dust Mitigation Program. Presentation. May 2010. Los Angeles, California.

Piper, Karen. 2011. Dreams, Dust and Birds: The Trashing of Owens Lake. The Design Observer Group. http://places.designobserver.com/feature/dreams-dust-and-birds-the-trashing-of-owens-lake/23328/ viewed on June 26, 2011.


Owens Lake Dust
Mitigation Program
Los Angeles Department
of Water and Power
May 2010

General Statistics - Accomplishments and Costs

- Great Improvement - Owens Lake is no longer in the top 10 list of PM10 emissions
- 39.5 square miles of dust control in operation
  Capital cost = more than a half-billion dollars
- Presently 62 full time staff working on Owens Lake
  Annual operation and maintenance costs = $25-million
- Annual Water Use = 95,000 acre feet per year
  Annual water cost = $46-million*

*(95,000 acre-feet at $484 per acre-foot, MWD tier 1 rate for untreated water)

LONG_Exh_003

IN THE OFFICE OF THE STATE ENGINEER OF THE STATE OF NEVADA

In the Matter of Application Number 54003 Filed on October 17, 1989 held by Southern Nevada Water Authority for Permission to Appropriate the Public Waters of the State of Nevada	**PROTEST**

Comes now The Long Now Foundation, whose post office address is Fort Mason Center, Landmark Building A, San Francisco, California 94123, and protests the granting of Application Number 54003, filed on October 17, 1989. Application No. 54003 is one of 19 applications (App Nos. 54003-54021) held by Southern Nevada Water Authority (SNWA) to appropriate water rights in the Spring Valley Basin. Recently re-noticed by the State Engineer of Nevada in order to reopen the protest period, the Long Now Foundation protests the granting of Application No. 54003 for permission to appropriate the public waters of the State of Nevada, for the following reasons and on the following grounds, to wit:

1. The full extent of the water exportation scheme contemplated by SNWA is unknown at this time and it is uncertain how many additional groundwater and/or surface water appropriations or change applications SNWA will file to supplement the amount of water sought by Application No. 54003. Before acting on the individual applications, the applicant should be required to provide a detailed abstract of the total duty of water sought for exportation including details as to the supplemental nature of the individual groundwater and surface water applications.

2. The applicant's answer to "Question 12" does not provide sufficient details for the proposed project or proposed water usage, to allow the public, interested parties, protestants, and the State Engineer to make a proper evaluation of the potential impacts of approving the application. Based on the scope and magnitude of the water exportation scheme proposed by Application Nos. 54003 et al., the applicant should be required to conduct the Hydrologic and Environmental Studies specified by NRS 533.368, before the State Engineer makes a final determination on the applications.

3. On information and belief, Application Nos. 54003 et al. seek to appropriate more groundwater than the perennial yield of the basin as currently recognized by the State Engineer.

4. On information and belief, Application Nos. 54003 et al. seek to appropriate more groundwater than the safe yield of the basin.

5. The application involves an interbasin transfer and should be rejected pursuant to NRS 533.370(6) for, among other reasons, the applicant's failure to:

A. justify the need to import water to the other basin(s);

B. demonstrate that a conservation plan(s) has been adopted and effectively carried out for the other basin(s);

C. demonstrate that the proposed export of water from the basin is environmentally sound;

D. demonstrate that the proposed action is an appropriate long-term use which will not limit growth and development in the basin; and,

E. identify the specifics of the proposed project, including the basin(s) into which water will be imported.

6. The application for interbasin transfer should also be rejected pursuant to NRS 533.370 for the lack of information regarding:

A. access to the use of public/private lands necessary for the construction of the works of diversion and the means of conveyance;

B. financial ability to construct the works and apply the water to the intended use with reasonable diligence;

C. technical feasibility to construct the works and apply the water to the intended use with reasonable diligence; and,

D. justification for the quantity of water required for the proposed project.

7. Granting the application would threaten to prove detrimental to the public interest.

8. Granting the application would threaten to prove detrimental to the public interest in ways that are not yet known to this Protestant, but which may arise or first become known to this Protestant in the period between the date of filing of the Application and the hearing on the protested Application.

9. Granting the application would threaten to prove detrimental to the public interest and the interests and rights of The Long Now Foundation for the reasons stated above, and because among other things, it would:

A. result in degraded air quality and adverse impacts to visual resources in the region;

B. result in adverse economic impacts due to degraded air quality and visual resources;

C. result in adverse impacts to hydrological, biological, cultural, and environmental resources;

D. result in adverse impacts to the riparian vegetation and natural habitat that support sensitive plant and animal species in the region;

E. result in adverse impacts to the water resources in adjacent basins;

F. result in interference with artesian water sources, springs, and seeps in the region; and,

G. otherwise adversely affect the interests of The Long Now Foundation.

10. This Protestant incorporates in this Protest by reference, as if fully set forth herein, every relevant protest ground set forth in any other Protest filed by any other Protestant regarding this application.

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THEREFORE this Protestant requests that the above-referenced application be denied and that an order be entered for such relief as the State Engineer deems just and proper.

Alexander Rose, Executive Director
The Long Now Foundation
Fort Mason Center
Landmark Building A
San Francisco, CA 94123
Tel: (415) 561-6582

Subscribed and sworn to before me this ____ day of _____, 2011.

_____
Notary Public

State of _____

County of _____

My Commission Expires: _____

$25 FILING FEE MUST ACCOMPANY PROTEST. PROTEST MUST BE FILED IN DUPLICATE - ALL COPIES MUST CONTAIN ORIGINAL SIGNATURE.

LONG_Exh_004

EXPERT REPORT

Nevada State Engineer Water Rights Hearing
Spring Valley, Nevada

Soils

Table of Contents

Expert Report
Spring Valley, Nevada

Soils

1.0 Opinion

It is our opinion that, according to existing data there are potentially 41,402 acres of playas and/or areas that are ponded during at least part of the year in Spring Valley; and that these areas are potentially prone to wind erosion and generation of dust; and that insufficient data currently exist to adequately characterize the risks of dewatering them, nor to prescribe appropriate mitigation measures in the event the project is implemented as proposed.

2.0 Introduction

This document presents an overview of the existing information regarding the soil-related resources of Spring Valley, Nevada and the potential impacts of a proposed groundwater development project by the Southern Nevada Water Authority (SNWA). The data used in this report were gathered from several sources including the Environmental Impact Statement prepared by the Bureau of Land Management (BLM) in June 2011; the Natural Resources Conservation Service (NRCS) Soil Survey of White Pine Nevada, Eastern Part; and various Baseline Characterization Reports prepared by the SNWA in cooperation with the BLM in January 2008.

The project would convey up to 155,000 acre-feet per year (afy) of water, with up to 122,000 afy of groundwater developed by SNWA and the remaining capacity provided for Lincoln County. The SNWA portion includes pending water rights applications in Spring, Cave, Delamar, Dry Lake and Snake valleys. The proposed facilities associated with this Project are described below:

- Pipelines: approximately 306 miles of buried water pipelines, between 16 and 84 inches in diameter
- Pumping Stations: five pumping station facilities
- Regulating Tanks: six regulating tanks, anticipated to have a capacity of between 3 and 10 million gallons each
- Pressure Reducing Stations: three facilities

- Water Treatment Facility/Buried Storage Reservoir: one facility site with the Water Treatment Facility anticipated to be a 150 million-gallon per day facility and the buried storage reservoir a 40-million gallon buried facility

- Power Lines: approximately 323 miles of 230 kilovolt (kV), 69 kV, and 25 kV overhead power lines

- Electrical Substations: two primary electrical substations (230 kV to 69 kV) and five second

It is not within the scope of this report to predict the environmental results of the proposed action on soils and soil-related factors; rather it is the purpose of this report to discuss those factors that affect the soil environment in the context of the proposed action through consideration of the existing available data; and in this process, perhaps identify areas needing further study and review before implementation.

3.0 Overview of Existing Pre-Development Resources

A large number of studies have been conducted regarding this proposed action. Those that were utilized in this assessment were (1) BLM Baseline Characterization Reports including Geology, Hydrology, Groundwater Resources, and Water Quality; (2) BLM Environmental Impact Statement of June 2011; and (3) Natural Resources Conservation Service Soil Survey of White Pine County, Eastern Part.

Spring Valley is about 120 miles long and 16 miles wide. Spring Valley is bounded by the Schell Creek Range to the west, the Antelope Range to the north, the Snake Range and the Limestone Hills to the east, the Wilson Creek Range to the south, and the Fortification Range to the southwest. Most of Spring Valley is in White Pine County except for the very southern portion located in Lincoln County. U.S. Highway 50 bisects the valley and U.S. Highway 93 runs along the valley's western flank. The predominant uses of water in the valley are for irrigation and stockwater.

There are reportedly 27 perennial streams and 503 springs in Spring Valley. Most water wells are shallow (less than 300 ft.) and about 1/3 are less than 100 ft. deep. Analyses show that the groundwater flows both from the north part of the valley to the central part, and from the south part of the valley to the central part. Salt-crusted playa lakebeds (with varying degrees of wetness) are common in the low areas of the valley.

The chemical composition of Spring Valley groundwater consists mainly of three basic compositions. These are (1) Calcium-Sodium-Bicarbonate-Chloride; (2) Calcium-Magnesium-Sodium-Bicarbonate; and (3) Calcium-Magnesium-Sodium-Bicarbonate-Sulfate. Arsenic is a common constituent in the valley, and reportedly exceeds the maximum allowable EPA limits in

some springs and in places in the valley floor. Isotopic composition analyses of the springs, creeks, and wells in Spring and Snake Valleys implies the existence of a common recharge source for all of them.

Most of the playa lakes in Spring Valley are barren, commonly with a crust layer of salt. The depth to the water table in these areas may be shallow, and in some places these playas are wet to the surface and even ponded for much of the year. Phreatophytic vegetation (plants that receive supplemental moisture from shallow ground water) occurs in the valley, as do wetland and meadow areas.

Based upon a review of the NRCS soil survey for Spring Valley, it was determined that:

1. There are 41,402 acres that are ponded part or most of the year with shallow ground water. Much of these are in playas.

2. There are 26,359 acres that are not ponded, but have groundwater at depths of less than 6 feet for much of the year.

4.0 Overview of Effects of Proposed Project on Water Resource Conditions

Water is the most influential component of the ecosystem in this area. Soil conditions, plant conditions, and air quality are all directly or indirectly affected by soil and surface water. It is projected that groundwater levels will drop by about 10 feet in the aquifers that are pumped (BLM, 2011). If this is the case and groundwater levels drop by 10 feet, the ponded areas in many parts of the valley would no longer be ponded; the shallow groundwater regime under which the phreatopytic plant communities became established would be altered; wetland areas would likely become dry; and meadows would no longer have the water supply needed to maintain their existence. Water is the sustaining resource of all of these areas. Removal of the water from the soil root zones and alteration of the ponding features of the valley may have a dramatic effect on the environmental conditions of Spring Valley.

5.0 Overview of the Potential Impact of Proposed Project on Soil and Related Resources

There are two levels of evaluation that have been done by the BLM regarding the effects of the proposed action. The first level is the effects of site-specific construction and operation activities, such as pipelines and other facilities. The second level is the more regional evaluation of the effects of the drawdown of the ground water on soil, vegetation, and other resources across the project area. It is the more regional effects of withdrawal that is the primary focus of this assessment. Further, it is the focus of this assessment to consider the potential for wind erosion

and associated dust generation in Spring Valley, and the potential effects on vegetation and air quality.

Table 1 lists all of the NRCS soil survey map units that are playas, ponded, or with high water tables and that were delineated in the survey. In the course of conducting the soil survey, the NRCS defined the water features associated with the various soils occurring in the Spring Valley area. These soil data appear to be the most detailed information available regarding the soil conditions in the area. According to these data, there are 41,402 acres within Spring Valley that are playas or ponded during some or most of the year in most years; and there are 26,359 acres with the water table within six feet of the soil surface, allowing plants to benefit from this source of moisture.

Playas

It is been demonstrated on Owens Lakebed in California that soil moisture is a primary binder of salt crusted areas and prevents the generation of dust. Shallow flooding (keeping the soil moist to the surface) is the most extensive dust mitigation measure used on Owens Lakebed. Although it has not been shown that the playa conditions in Spring Valley are comparable to Owens Lakebed, the lesson is clear: drying salt-encrusted playas can only increase dust generation. The soil conditions on Owens Lakebed have been thoroughly studied, and these studies were vital in arriving at the proper prescription to control the dust there. The soil conditions (including the thickness, chemical content, moisture content, etc. of the salt crusts) of the playas in Spring Valley have not been evaluated. The NRCS soil survey simply identifies these areas as "playas" with no further data or information presented. Consequently, data that are essential to evaluating the effects of de-watering of the playas are not available. When one considers that there are 41,402 acres of land that are in playas or ponded in Spring Valley, and that this acreage exceeds that of Owens Lakebed by almost a factor two, the potential risk of adverse impacts is great.

Wetlands and Ponded Areas

Wetland areas and meadows potentially are contributors to dust generation if the water is removed from the ecosystem. Virtually no dust is generated from wetland areas in their current natural state. Any action that results in a decrease of plant biomass in a desertic climate should be carefully evaluated as it can only serve to increase the potential for soil erosion and dust generation. If wetland areas are de-watered, it is very likely that they could become salinized. Salinization in areas such as these occurs in two ways. Firstly, the salts in the water of the wetlands will be left behind when the water evaporates. Secondly, as the water table beneath the wetlands and meadows begins to drop, soil moisture will "wick" to the top of the soil from the underlying water table; when the moisture reaches the soil surface it evaporates, leaving a concentration of salt on the soil surface. Over time, as conditions that are unfavorable to plant growth begin to develop, plant cover will diminish and wind erosion potential will increase. The NRCS Soil Survey supports this in a very graphic way. The productivity of a Wet Meadow ecological site is estimated to be 2,000 lbs. of forage per acre per year. If this site is converted to

a Dry Saline Meadow Ecological Site, the forage production drops to 400 lbs. per year. In other words, the productivity of the site drops by 80% as a result of de-watering.

Riparian and Phreatophytic Areas

Riparian areas and areas of phreatophytes are important components to the ecosystem. Their biomass and physical presence acts as buffers to wind movement and protects soil from surface wind erosion. By dropping the water table, many of these areas may be in danger of being eliminated, and replaced with plant communities that are much less effective in preventing soil erosion. The degree of change that these ecosystems will incur is unknown, and it is not certain that sufficient site-specific data are available to make meaningful predictions regarding the environmental impact of the proposed action on these areas.

6.0 Kinds of Data Needed for Appropriate Analyses of the Effects of the Project

Playas

Very little data currently exists for the playa areas of Spring Valley. One of the most readily available sets of data on soil resources is the NRCS soil survey. This survey, however, did not provide any data regarding the properties of the playas as it simply identified them as "playas" (miscellaneous land type).

The nearest similar situation to that of Spring Valley that has occurred recently was at Owens Lakebed in California. Owens Lake was a large saline lake which was dewatered in the early 1900's to provide water to the Los Angeles area. The result was an exposed lakebed of more than 22,000 acres in size. Dust from the lakebed violated federal clean air standards, and the city of Los Angeles was charged with the cost of clean-up. Before cleanup could begin, it was necessary to conduct many studies on the lakebed to determine the best prescriptions for clean-up. One of those studies was an Order 2 Soil Survey, in which the physical and chemical properties of the salt crust and underlying soil were carefully characterized and delineated. Proper mitigation could not move forward without this type of knowledge of the site-specific soil and salt crust conditions.

The playa conditions in Spring Valley are likely to be different than those in Owens Lakebed. Nevertheless, the same type of resource information is needed in order to properly predict the effects of de-watering these areas and to describe mitigation alternatives so that the proposed action will not have disastrous results if implemented. This kind of information can be provided within reasonable time frames with methodologies that have been developed and used across the United States. At the present time, this information does not exist and it is with great uncertainties that this project proceeds forward without it.

Scientific literature notes that soil characteristics, surface condition, use and disturbance have a strong impact on dust and PM10 generation. Dust generation from playas is known to be affected by playa geomorphology and mineralogy, surface conditions, salt or other surface crusting, disturbance, and moisture status. Quick drying and soft crusts contribute to both dust and PM10 emissions. Methodologies for characterizing mineralogy of dust and their health impacts are well-established.

Wetlands and Ponded Areas (Hydric Soils)

Sufficient data may currently exist to evaluate the impact of the proposed action on these areas. However, that analysis has not been made. The BLM, in their Environmental Impact Statement dated June 2011, states that the response of wetlands to drawdown will vary widely across the area, yet they concluded that there would be no change to the susceptibility of these areas for wind erosion as a result of the drawdown and removal of the water.

An appropriate analysis of the impacts of drawdown on these areas can likely be made from the existing NRCS soil survey, coupled with proper techniques used to measure and predict wind erosion. As one example of the effects of local variability of soil conditions, consider the Kolder soil series mapped in the NRCS soil survey. This soil is a hydric soil, supporting wetland vegetation and contributing little if any dust due to wind erosion. This soil is saline throughout the root zone. With these types of soils, as water is removed through evaporation the salt becomes more concentrated through time and these soils become saline. Excessive soil salinity in the absence of moisture is detrimental to the establishment of dense ground cover; consequently, it is likely that bare, salt-crusted areas would occur in this soil as it is de-watered. Obviously, this soil has the potential to contribute significantly to dust through its susceptibility to wind erosion in the de-watered state.

It is reasonable to expect that these kinds of analyses be conducted. The data are generally available; the science is proven; and the methodology is well-known.

Riparian and Phreatophytic Areas

Comments regarding the analysis for Riparian and Phreatophytic Areas are very similar to those for Wetlands and Ponded areas, and will not be repeated here. It is uncertain as to whether sufficient data exists to evaluate these areas appropriately.

Table 1:
Spring Valley NRCS Map Units Identified as Playas, Ponded, or With High Water Table

White Pine Nevada, Eastern Part
NRCS soil survey area 779

Map Unit	Total Acres in MU	Name of MU Component	% of MU	Acres of Component	Wetness Category	Acre Totals
1160	552	Kolda	2	11	2	*Category 1: 41,402*
1326	948	Kolda	4	38	1	*Category 2: 26,359*
1370	1,332	Kolda	5	67	1	
1371	1,753	Kolda	5	88	1	*Combined: 67,761*
3000	476	Playas	5	24	1	
3004	15,638	Playas	15	2,346	1	*Category 1: Ponds/Playas*
3005	4,444	Playas	30	1,333	1	*Category 2: WT <6.0'*
		Kolda	5	222	1	
		Hogum	3	133	1	
3008	4,947	Playas	20	989	1	
3041	1,335	Kolda	2	27	1	
3130	363	Playas	4	15	1	
3132	2,123	Playas	6	127	1	
3180	3,236	Playas	1	32	1	
3189	2,018	Ewelac	25	505	1	
		Biji	20	404	2	
		Kolda	5	101	1	
3191	6,853	Playas	6	411	1	
3193	2,931	Biji	20	586	2	
3195	1,100	Ewelac	50	550	2	
		Biji	15	165	2	
3196	12,868	Benin	40	5,147	1	
		Playas	2	257	1	
3197	1,578	Ewelac	15	237	1	
3290	7,624	Kolda	1	76	1	
3291	2,631	Kolda	2	53	1	
3340	5,963	Playas	5	298	1	
3341	2,877	Playas	6	173	1	
3342	6,459	Playas	2	129	1	
3343	16,763	Kolda	2	335	1	

Table 1 (Continued)

Map Unit	Total Acres In MU	Name of MU Component	% of MU	Acres of Component	Wetness Category
3344	6,877	Kolda	1	69	1
3443	3,423	Kolda	5	171	1
3500	5,983	Ewelac	40	2,393	2
		Biji	30	1,795	2
		Medlaval	15	898	2
		Kolda	6	299	1
3505	1,198	Ewelac	55	659	1
		Biji	30	359	2
		Kolda	2	24	1
3506	563	Biji	35	197	2
		Kolda	4	23	1
3507	7,622	Ewelac, occasionally flooded	35	2,668	1
		Ewelac	30	2,287	2
		Biji	20	1,524	2
		Kolda	6	457	1
3508	1,364	Ewelac	70	955	1
		Hogum	5	68	1
3509	4,103	Ewelac	50	2,052	1
3510	4,876	Biji	60	2,926	2
		Ewelac	30	1,463	1
		Kolda	4	195	1
3512	890	Kolda	1	9	1
3600	1,186	Biji	45	534	2
		Kolda	30	356	1
		Ewelac	15	178	1
3700	8,848	Kolda	55	4,866	1
		Duffer	30	2,654	2
3702	817	Kolda	45	368	1
		Biji	30	245	2
		Kolda	15	123	1

Table 1 (Continued)

Map Unit	Total Acres In MU	Name of MU Component	% of MU	Acres of Component	Wetness Category
3715	1,102	Ewelac	50	551	1
		Kolda	20	220	1
3770	1,294	Ewelac	35	453	1
		Biji	20	259	2
		Kolda	4	52	1
4050	15,555	Playas	5	778	1
4051	3,571	Playas	5	179	1
4052	16,726	Kolda	5	836	1
		Playas	5	836	1
4060	5,650	Ocala	45	2,543	1
		Duffer	25	1,413	2
		Kolda	15	848	1
4112	1,783	Playas	5	89	1
4121	10,525	Biji	15	1,579	2
5000	7,034	Playas	100	7,034	1
5010	6,325	Biji	30	1,898	2
		Hogum	3	190	1
5030	2,715	Biji	30	815	2
		Duffer	30	815	2
		Hogum	25	679	1

7.0 Signatures

Clifford R Landers — 6/20/11

Cliff Landers — Date

Clay Robinson — 6-30-11

Clay Robinson — Date

Attachments: Curriculum Vitae

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