

WILLIAM R. HUTCHISON, Ph.D., P.E., P.G.

Independent Groundwater Consultant

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billhutch@texasgw.com**EDUCATION**

University of Texas at El Paso: Ph.D., Environmental Science and Engineering, 2004-2006

University of Arizona: M.S., Hydrology, 1980-1981, 1982-1983

University of California, Davis: B.S., Soil and Water Science, 1976-1980

PROFESSIONAL LICENSES

Professional Engineer (Geological and Civil) No. 96287 (Texas)

Engineering Firm Registration No. 14526 (Texas)

Professional Geoscientist (Geology) No. 286 (Texas)

Geoscience Firm Registration No. 50445 (Texas)

Registered Professional Geologist No. 779 (Mississippi)

PROFESSIONAL HISTORY

Organization and Location(s)	Position	Dates
Independent Groundwater Consultant Austin, TX		2012 – pres.
LBG-Guyton Associates Austin, TX	Associate	2011 – 2012
Texas Water Development Board Austin, TX	Director, Groundwater Resources Division	2009 – 2011
El Paso Water Utilities El Paso, TX	Water Resources Manager	2006 – 2009
	Hydrogeology Manager	2003 – 2006
	Hydrogeologist	2001 – 2003
TEAM Engineering and Management, Inc. Bishop, CA and Phoenix, AZ	Senior Hydrologist	1998 – 2001
Woodward-Clyde Consultants Santa Ana, CA and Phoenix, AZ	Associate	1996 – 1998
	Sr. Project Hydrologist	1993 – 1996
Luhdorff & Scalmanini Consulting Engineers Woodland, CA	Principal Hydrologist	1991 – 1993
	Senior Hydrologist	1988 – 1991
Inyo County Water Department Bishop, CA (now in Independence, CA)	County Hydrologist	1985 – 1988
Geothermal Surveys, Inc. South Pasadena, CA	Hydrologist	1983 – 1985
University of Arizona Tucson, AZ	Research Assistant	1982 – 1983
Mobil Oil Corporation Denver, CO and Glendive, MT	Hydrologist	1981
Metropolitan Water District of Southern California Yorba Linda, CA	Intern	1979 (summer)

PEER REVIEWED PUBLICATIONS

- Druhan, Jennifer L., Hogan, James F., Eastoe, Christopher J., Hibbs, Barry J., and Hutchison William R., 2008. Hydrogeologic Controls on Groundwater Recharge and Salinization: A Geochemical Analysis of the Northern Hueco Bolson Aquifer, El Paso, Texas, USA. *Hydrogeology Journal*, Vol. 16, No. 2, pp. 281-296.
- Eastoe, Christopher J., Hibbs, Barry J., Granados-Olivas, Alfredo, Hogan, James F., Hawley, John, and Hutchison, William R., 2008. Isotopes in the Hueco Bolson Aquifer, Texas (USA) and Chihuahua (Mexico): Local and General Implications for Recharge Sources in Alluvial Basins. *Hydrogeology Journal*, Vol. 16 No. 4, pp.737-747.
- Eastoe, Christopher J., Hutchison, William R., Hibbs, Barry J., Hawley, John, and Hogan, James F., 2010 Interaction of a River with an Alluvial Basin Aquifer: Stable Isotopes, Salinity and Water Budgets. *J. Hydrol.* doi:10.1016/j.jhydrol.2010.10.012.
- Hutchison, William R., 2006. Groundwater Management in El Paso, Texas. Ph.D. Dissertation, The University of Texas at El Paso. Obtainable at <http://www.dissertation.com/book.php?method=ISBN&book=1581123280>
- Hutchison, William R. and Hibbs, Barry J., 2008. Ground Water Budget Analysis and Cross-Formational Leakage in an Arid Basin. *Ground Water*, Vol. 46, No. 3, pp. 384-395.

OTHER PUBLICATIONS (e.g. Conference Proceedings, Magazine Articles)

- Hibbs, Barry J. and Hutchison William R., 2006. Environmental Isotopes and Numerical Models Estimate Induced Recharge in the El Paso/Juarez Area. In: *Increasing Freshwater Supplies, 2006 UCOWR/NIWR Annual Conference Proceedings*, Santa Fe, New Mexico.
- Hibbs, B., Phillips, F., Hogan, J., Eastoe, C., Hawley, J., Granados, A., and Hutchison, B., 2003. Hydrogeologic and Isotopic Study of the Groundwater Resources of the Hueco Bolson Aquifer. El Paso Texas/Juarez, Mexico Area. *Hydrological Science and Technology*. Volume 19. No. 1-4, pp 109-119.
- Hutchison, William R., 2006. Desalination of Brackish Groundwater and Deep Well Injection of Concentrate in El Paso, Texas. In: *Stars of the Future, Reuse & Desalination, 2006 WateReuse Association Annual Symposium Proceedings*.
- Hutchison, William R., 2006. Integrated Water Management Strategies for the City and County of El Paso. In: *Increasing Freshwater Supplies, 2006 UCOWR/NIWR Annual Conference Proceedings*, Santa Fe, New Mexico.
- Hutchison, William R., 2007. El Paso Groundwater Desalination Project: Initial Operation. *Water Reuse and Desalination, As Bright as the Florida Sun, 2007 WateReuse Association Annual Symposium Proceedings*.
- Hutchison, William R., 2008. Deep Well Injection of Desalination Concentrate in El Paso, Texas. *Southwest Hydrology*, Vol. 7, No. 2, March/April 2008, pp. 28-30.
- Hutchison, William R., 2008. Desalination of Brackish Groundwater and Deep Well Injection of Concentrate in El Paso, Texas. *Texas WET*, Vol. 25, No. 5, September 2008, pp. 5-8.

AGENCY REPORTS (2002-2011)

- Hutchison, William R. and Hill, Melissa E., 2011. Recalibration of the Edwards BFZ (Barton Springs Segment) Aquifer Groundwater Flow Model. Texas Water Development Board, Unnumbered report.
- Hutchison, William R.; Hill, Melissa E.; Anaya, Roberto, Hassan, Mohammed M.; Oliver, Wade; Jigmond, Marius; Wade, Shirley, 2011. Groundwater Management Area 16 Groundwater Flow Model. Texas Water Development Board, Unnumbered report.
- Hutchison, William R.; Jones, Ian C.; Anaya, Roberto; and Jigmond, Marius, 2011. Update of the Groundwater Availability Model for the Edwards-Trinity (Plateau) and Pecos Valley Aquifers. Texas Water Development Board, Unnumbered report.
- Hutchison, William R.; Shi, Jerry; and Jigmond, Marius, 2011. Groundwater Flow Model of the Kinney County Area. Texas Water Development Board, Unnumbered report.
- Hutchison, William R., Davidson, Sarah C., Brown, Brenner J., and Mace, Robert E. (editors), 2009. Aquifers of the Upper Coastal Plains of Texas. Texas Water Development Board, Report 374.
- Hutchison, William R., 2008. Conceptual Evaluation of Surface Water Storage in El Paso County. El Paso Water Utilities Hydrogeology Report 08-02. Prepared for the Far West Texas Regional Planning Group.
- Hutchison, William R., 2008. Preliminary Groundwater Flow Model, Dell City Area, Hudspeth and Culberson Counties, Texas. El Paso Water Utilities Hydrogeology Report 08-01.
- Hutchison, William R., 2004. Documentation of Files for Canutillo Wellfield Groundwater Flow Model. El Paso Water Utilities Hydrogeology Report 04-03.
- Hutchison, William R. and Granillo, Jose A., 2004. Preliminary Analysis of Impacts of Joint Desalination Facility Injection Wells. El Paso Water Utilities Hydrogeology Report 04-02.
- Hutchison, William R., 2004. Hueco Bolson Groundwater Conditions and Management in the El Paso Area. El Paso Water Utilities Hydrogeology Report 04-01
- Hutchison, William R., 2003. Lower Valley Desalination Well Analysis. El Paso Water Utilities Hydrogeology Report 03-03.
- Hutchison, William R., Pease, R. Eric and Hess, Suzanne, 2003. Joint Desalination Facility Blend Well Analysis. El Paso Water Utilities Hydrogeology Report 03-02.
- Hutchison, William R., 2003. Hueco Bolson Groundwater Model Update. El Paso Water Utilities Hydrogeology Report 03-01. Available at:
- Hutchison, William R., 2002. Conceptual Model of the Groundwater Flow System, Bone Spring-Victorio Peak Aquifer, Salt Basin and Diablo Plateau, Hudspeth and Culberson Counties, Texas. El Paso Water Utilities Hydrogeology Report 02-02.
- Hutchison, William R., 2002. Documentation of Files for Steady State and Annual Versions of Groundwater Flow Model of Hueco Bolson. El Paso Water Utilities Hydrogeology Report 02-01.
- Oliver, Wade and Hutchison, William R., 2010. Modification and Recalibration of the Groundwater Availability Model of the Dockum Aquifer. Texas Water Development Board, Unnumbered report.

REPRESENTATIVE EXPERIENCE - TEXAS

Joint Groundwater Planning in Texas

In 2005, the Texas Legislature adopted HB 1763, which required that groundwater conservation districts within each groundwater management area adopt desired future conditions by September 1, 2010. The Texas Water Development Board provided technical assistance to this process. As Director of the Groundwater Resources Division, Dr. Hutchison was responsible for coordinating the effort of division staff, and took the lead in 9 of the 15 Groundwater Management Areas. Technical support included developing and running groundwater models to estimate impacts of alternative pumping scenarios, and attending meeting to discuss and interpret the results of these analyses. Partly as a result of the technical support provided by the Groundwater Resources Division staff, all desired future conditions were adopted prior to the statutory deadline. (2009 to 2010)

Challenges to the Reasonableness of Desired Future Conditions in Texas

Prepared technical reports related to petitions challenging the reasonableness of desired future conditions for Groundwater Management Area 1 (Ogallala Aquifer) and Groundwater Management Area 9 (Edwards Group of the Edwards-Trinity (Plateau) Aquifer). These petitions were filed with the Texas Water Development Board in accordance with statute and agency rules. The technical analysis was submitted to the Board for consideration in their deliberations as to the reasonableness of the adopted desired future condition. (2009 to 2010)

Modeled Available Groundwater Development in Texas

Managed development of modeled available groundwater estimates that were based on the desired future conditions adopted by the groundwater conservation districts. These estimates, required by statute, include estimating the total pumping that will achieve the desired future condition and estimating the exempt use of the area. Prior to the 2011 legislative session, these estimates were termed Managed Available Groundwater, and represented the amount of groundwater available for permitting, and were calculated as the total pumping minus the exempt use. (2010-2011)

Evaluation of a Proposed Groundwater Development Project in East Texas

Completed an evaluation of potential effects of a proposed groundwater development project located in Anderson, Cherokee, and Houston counties in east Texas for the Neches & Trinity Valleys Groundwater Conservation District. Consultants for the project proponents and the Texas Water Development Board (TWDB) had previously completed simulations of the proposed pumping using the Groundwater Availability Model (GAM) of the Northern Carrizo-Wilcox Aquifer. Neches & Trinity Valleys Groundwater Conservation District asked for the completion of three tasks: 1) review TWDB GAM run reports, including the GAM run model run that was used to establish Desired Future Conditions, and the GAM run that was used to evaluate the regional effects of the proposed project, 2) extend the previous analyses of the project proponent's consultant and the TWDB by evaluating the effects of the proposed pumping on specific wells, and 3) recommend and monitoring network. The analysis was presented to the Neches & Trinity Valleys Groundwater Conservation District and is now part of the information that they are using to consider permitting the proposed project. (2011 to 2012)

Groundwater Management Plan for Red River Groundwater Conservation District

Consultant to the Red River Groundwater Conservation District in Fannin and Grayson Counties in the preparation of their initial management plan. This assignment required compiling and organizing the goals, objectives and performance measures from management plans of neighboring districts, preparing a handout for Board members and reviewing the various approaches with the Board in an open workshop session. Based on the discussion, a draft plan was prepared and approved by the Board. The review draft was subsequently approved by the Texas Water Development Board with no changes. The public hearing and final approval were completed by District personnel as a means of reducing costs. (2012)

Groundwater Availability Model Updates in Texas

Completed updates to groundwater availability models in support of the Joint Groundwater Planning Process in Texas. Updated models included: Dockum Aquifer, Edwards-Trinity (Plateau) Aquifer and Pecos Valley Aquifer, Barton Springs Segment of the Edwards (Balcones Fault Zone) Aquifer, Kinney County portions of the Edwards (Balcones Fault Zone) Aquifer and Edwards-Trinity (Plateau) Aquifer, and Southern Gulf Coast Aquifer (GMA 16 portion). These models were updated because the existing models proved to be inadequate for assisting the groundwater conservation districts in developing desired future conditions. (2009 to 2010)

Groundwater Model of the Dell City, Texas Area

Developed a regional groundwater flow model covering a large area in Hudspeth and Culberson Counties, Texas and Otero County, New Mexico. This objective of this groundwater model was to develop a more complete understanding of the hydrogeology of the karstic aquifer in the region, and develop data and information related to acquiring property and water rights for a potential groundwater importation project for the City of El Paso. (2001 to 2008)

Update of the Hueco Bolson Model in Chihuahua, New Mexico and Texas

Completed an update of the USGS model of the Hueco Bolson (Texas, New Mexico and Chihuahua) by extending the model period to 2002. The model was used to complete simulations of alternative groundwater management strategies. Based on the results of this work, recommendations were developed regarding long-term groundwater management strategies for the Hueco Bolson. (2001-2003)

Hueco Bolson Evaluation, Texas

Completed analyses of groundwater flow and groundwater quality of the Hueco Bolson covering west Texas, southern New Mexico and northern Chihuahua. These analyses included evaluating historic groundwater flow patterns, mapping current groundwater quality in three dimensions, evaluating historic groundwater quality changes caused by pumping, and changes in the groundwater budget including induced inflow from the Rio Grande. Prepared comprehensive report of findings that was peer reviewed by a 5-member panel. Results included the finding that the reduction in groundwater pumping from 1989 to 2002 had fundamentally changed conditions in the Hueco Bolson. Moreover, the assumptions that were the foundation of a conclusion made in a 1979 analysis (depletion of fresh groundwater by 2030) were no longer applicable. (2001-2004)

Mesilla Bolson Groundwater Management, El Paso, Texas

Completed analyses of groundwater flow and groundwater quality of the Mesilla Bolson in west Texas and southern New Mexico. These analyses included evaluating previous groundwater models developed for a variety of objectives, and analyzing the role of the Rio Grande in the recharge of the Mesilla. As a result of the analyses a series of piezometers were constructed to improve data coverage and long term monitoring of the area. In addition, limitations to previous models were identified, and work is currently underway to better incorporate the known hydrostratigraphy in an updated and improved model of the area. (2001-2009)

Model Documentation of Groundwater Availability Models in Texas

Completed documentation of the Hueco Bolson and Mesilla Bolson groundwater flow models (Texas, New Mexico and Chihuahua). These models had been previously developed, and were designated as official Groundwater Availability Models (GAM) for the Hueco-Mesilla Aquifer by the Texas Water Development Board. Documentation was needed to fully satisfy the requirements of the Texas Water Development Board. (2001-2004)

Brackish Groundwater Well Location, El Paso, Texas

Completed analyses of the Hueco Bolson related to locations of new wells for use in the Kay Bailey Hutchison Desalination Plant, a joint project between El Paso Water Utilities and Fort Bliss. After initial concerns were raised by Fort Bliss, an investigation was completed in cooperation with the US Army Corps of Engineers to evaluate five alternative well field locations that would produce brackish groundwater to be treated in the planned reverse osmosis plant. Based on this analysis, an alternative was selected and agreed upon. (2003)

Desalination Concentrate Injection Wells in El Paso, Texas

Completed preliminary analyses of impacts from injection wells that were proposed for use as part of the Kay Bailey Hutchison Desalination Plant in El Paso, Texas. The analyses included the development of a simple numerical flow model based on a subsurface geologic model developed by researchers at UTEP from gravity data and on the results from slug tests completed during a test hole drilling project funded and managed by the US Army Corps of Engineers. These analyses were incorporated into the Environmental Impact Statement (EIS) for the overall project. Based on the results of the analysis, a full-size injection well was constructed and tested to obtain better data to support authorization from the Texas Commission on Environmental Quality (TCEQ) under the Underground Injection Control (UIC) program. Once authorization was obtained, two additional wells were constructed and all three wells were equipped and tested. Issues related to the potential for mineral precipitation in the well bores and reservoir were evaluated with a combination of geochemical modeling, experiments with formation samples, formation water and concentrate, and monitoring of initial operation (2004 to 2009)

Simulations of Potential Desalination Plant in Mission Valley, El Paso, Texas

Completed a preliminary analysis of a proposed desalination plant in the Mission Valley area of El Paso. This analysis consisted of simulating three potential configurations of well fields to assess impacts to groundwater elevations and gradients, and to estimate potential impacts to the groundwater budget of the area. Based on this analysis, and a companion engineering analysis completed by a consultant, future pre-design work was recommended. (2003)

Impacts of Climate Variability and Climate Change in El Paso, Texas

Analyzed the reliability of El Paso's municipal water supplies under a wide range of climate scenarios, including integration of the Intergovernmental Panel on Climate Change (IPCC) projections for the region. Because El Paso practices conjunctive use management, the analysis included evaluation of impacts to both surface water (Rio Grande) and groundwater impacts. The analysis included developing simulated Rio Grande flows entering Elephant Butte reservoir based on a published 1000-yr tree ring record, developing a simple reservoir operations model to estimate Elephant Butte outflows and El Paso municipal diversions, estimating groundwater pumping, and simulating groundwater storage changes using a groundwater model. A total of 60 climatic scenarios were developed. Each scenario was simulated under 958 50-year simulations for a total of 57,480 simulations. The results demonstrated the effectiveness of the investments in water infrastructure and the efficacy of the management approach that has been developed over the last several decades in meeting municipal water demands over a wide range of climatic conditions. (2007-2008)

Region E Water Planning, Far West Texas

Developed the conceptual approach of an Integrated Water Management Strategy for El Paso County that was used in the 2005 Regional Water Plan for Far West Texas. Working with Far West Texas Regional Planning Group and their consultants, the conceptual plan was used to develop six specific alternatives designed to meet expected increased water demands in El Paso County through 2060. Alternatives ranged from reliance on single existing sources to a balanced approach that relied on numerous sources, including importation from Hudspeth, Culberson, Jeff Davis, and Presidio Counties. (2004-2005)

Well Construction

Managed a well construction and equipping program while employed by El Paso Water Utilities that resulted in:

- Drilling of 50 test holes
- Construction of 14 monitoring wells
- Construction of 3 multi-zone piezometers
- Construction and equipping of 16 fresh groundwater production wells
- Construction and equipping of 32 brackish groundwater production wells

Well designs and construction management are completed in-house. Equipping design and construction management are supervised through a consulting engineer. (2001-2009)

REPRESENTATIVE EXPERIENCE - CALIFORNIA

Owens Valley, California

Hydrology consultant to the Inyo County (California) Board of Supervisors, Water Department, Water Commission and Environmental Health Department from 1985 to 1999 on issues related to water resources management and protection in the Owens Valley and Death Valley regions, including a key role in the development and negotiation of an historic water management agreement between Inyo County and the City of Los Angeles for the Owens Valley and the preparation of the associated environmental documentation. Assignments also included review and analysis of the Anheuser-Busch groundwater export project in the Cartago area, review and analysis of the groundwater pumping proposed by OLSAC in the Cottonwood Creek area, review and analysis of the groundwater export project proposed by Western Water in the Olancho area, and many others. Many of these assignments included the development and application of groundwater models and the development of monitoring networks and environmental triggers and thresholds to manage the pumping operations. (1985-1999)

Owens Valley Indian Reservation Groundwater Modeling

Completed local scale groundwater models of three Indian Reservations in the Owens Valley, California. The regional model developed by the USGS was used as a starting point for these models. The initial phase consisted of using Telescopic Mesh Refinement to define the boundary conditions of the three local scale models. Subsequent phases included enhancing and updating the local scale models. The preliminary model of the Big Pine area was used to evaluate potential increases in pumping that are associated with the Big Pine Ditch System project. (2000-2001)

Los Angeles Aqueduct Simulation Model

Consultant to the California State Water Resources Control Board related to the Mono Basin Water rights decision, a court ordered review of water rights licenses held by the City of Los Angeles. Working in partnership with State Board staff and Board members, hydrologic analyses were completed, and a simulation model (LAAMP) of the Mono Basin and Los Angeles Aqueduct system was developed and applied to evaluate the impacts of alternative water rights decisions. The simulation model was accepted by all parties involved in the process, and was ultimately used in the final water rights decision that resulted in decreased diversions in order to maintain fish flows and restore lake elevation. (1992-1994)

Aggregate Mine Expansion, Ventura County, California

Consultant to Ventura County (California) Resource Management Agency on the analysis of potential hydrologic impacts of the expansion of an aggregate mine. Concerns had been raised about the potential impact of the mine expansion on seawater intrusion and nitrate contamination. The assignment began with the review of a groundwater model prepared by the project proponent's consultant. As a result of the review, the existing analyses was expanded with the development of a site specific groundwater model to enhance the simulation of the potential impacts on nearby spreading facilities, the development of a solute transport model, the completion of a risk assessment of potential groundwater pollution, and the preparation of the water resources and water quality sections of an Environmental Impact Report. (1995-1996)

Evaluation of Impacts of Increased Capacity of Salinas Dam, California

Completed analyses related to the evaluation of potential downstream impacts of increased storage capacity of the Salinas Dam in central California. These analyses included estimates of reduced spills associated with the increased storage, evaluating the relationship of river flows and groundwater levels in the Atascadero area, and estimating potential groundwater level impacts that may result from the reduced spills. The analyses were summarized in an Environmental Impact Report, and in several technical appendices to the EIR. Because the work involved modification of a water right held by the City of San Luis Obispo, expert witness testimony was given at the California State Water Resources Control Board. (1997-1999)

Simulation of Impacts of Tunnel Construction, California

Developed a finite element model for the Metropolitan Water District of Southern California using FRAC3DVS to simulate groundwater inflow during the construction of the Inland Feeder East Tunnel near San Bernardino, California. The model was calibrated under steady-state conditions using groundwater level data from geotechnical boreholes constructed during the design-phase geotechnical investigation. The model was calibrated under transient conditions using tunnel inflow data and groundwater level changes caused by groundwater inflow into the tunnel. Based on the model results, recommendations were made regarding grouting operations for later phases of construction. (1996-2002)

San Benito County Groundwater Evaluation, California

Conducted a countywide evaluation of the groundwater resources of San Benito County, California. This effort included the evaluation of surface water and groundwater quantity and quality, development and calibration of a basin wide numerical model of the groundwater system, and the evaluation of recharge patterns altered by the delivery of supplemental surface water, some of which is used for direct groundwater recharge. At the completion of the model and report, expert witness testimony was given in a groundwater rights lawsuit between a developer and the local water district. Four years after the model was completed, the County requested that the model be updated and enhanced. (1991-1992, 1996)

Tri-Valley Groundwater Evaluation, Mono County, California

Completed a preliminary groundwater model for the Tri-Valley Groundwater Management District in Mono County, California. This model was based on existing data and was used to preliminarily evaluate the potential impacts of a proposed groundwater export project. As a result of the model, additional data requirements were identified and recommended for Phase 2 of the project. (2000-2001)

San Luis Obispo Groundwater Evaluation

Completed analyses related to a proposed increase in groundwater pumping in the San Luis Obispo area of central California. The initial analysis consisted of integrating potential local groundwater pumping increases into the reservoir operations planning model used by the City of San Luis Obispo in order to identify conjunctive use opportunities and limitations. The second phase of the analysis consisted of developing and calibrating a groundwater model of the entire groundwater basin. This model was then used to identify potential impacts of increased pumping on groundwater levels in nearby wells, potential reductions in streamflow, and potential subsidence effects. (2000-2001)

Cadiz Valley Groundwater Exploration and Development

Completed a comprehensive groundwater exploration and development project in the Cadiz Valley in the vicinity of the Fenner Gap in the Mojave Desert region of southeastern California. Exploration work included review of available information and data on groundwater conditions and geology. An extensive geophysical study using shallow ground temperatures was completed and results were used to select drilling sites. Three test holes were drilled and two production wells were constructed and tested. Based on the results of the investigations, a report was prepared and a groundwater budget of the area was estimated. Sixteen years later, assisted the Metropolitan Water District of Southern California in the review of a proposed groundwater storage and recovery project in the Cadiz Valley. As part of this assignment, the groundwater model that had been developed to evaluate the feasibility and potential impacts of the project was modified and enhanced. (1983-1984, 2000-2001)

Los Osos Groundwater Model

Updated and enhanced a groundwater model and developed a groundwater management plan for the three water purveyors in Los Osos, California (Southern California Water Co, S&T Mutual Water Company, and Los Osos Community Services District. The model had been developed in 1987 by the USGS, and the updated version was used to address specific management questions related to construction and operation of a sewer project, seawater intrusion, conjunctive use strategies, and the need to import surface water. (1997-2000)

Groundwater Storage Project Evaluation in Southeastern California

Developed groundwater models for four basins in southeastern California to evaluate the feasibility of storing Colorado River water for the Metropolitan Water District of Southern California. These models were used to simulate the storage of water in wet years, "holding" the water for 5 to 10 years, then extracting after the "hold" period. Models were developed for the Hayfield, Palen, Chuckwalla, and Rice Valleys. On the basis of the initial modeling work, a focused field investigation was completed in the Hayfield Valley are, the site chosen as the most desirable. (1996-2001)

Evaluation of Groundwater Availability using Groundwater Budget Analysis

Completed a groundwater budget analysis in order to provide data and information pertaining to groundwater availability for a private property owner in California. The analysis involved identifying and quantifying individual components of the inflows to and outflows from the defined area. Based on an analysis of precipitation and groundwater elevation changes, a series of historic groundwater budgets were developed for 20-year periods ranging from 1949-1968 to 1991-2010. The analysis was extended to estimate changes to the groundwater budget, generally, and groundwater elevations, specifically under alternative groundwater pumping scenarios from the subject property. (2011 to 2012)