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

FILED
APR 21 2006
STATE ENGINEER'S OFFICE

IN THE MATTER OF APPLICATION NUMBER 73197,
FILED BY STEWART-NEVADA ENTERPRISES, LLC.,
ON 31 AUGUST 2005, TO APPROPRIATE THE WATERS OF BASIN
209, PAHRANAGAT VALLEY

} PROTEST

Comes now Nevada Rock and Sand Company, a Nevada corporation, whose post office address is 6600 Amelia Earhardt Court, Suite C, Las Vegas, Nevada 89119, whose occupation is farming and ranching, as the owner and user of the right to five-twelfths of the flow of Crystal Springs, Pahranagat Valley, Lincoln County, Nevada, and supports, by way of this protest, the granting of Application Number 73197 filed on 31 August 2005 (with corrected application filed 27 January 2006) by Stewart-Nevada Enterprises, LLC, to appropriate underground waters situated in Lincoln County, State of Nevada, for the following reasons and on the following grounds, to wit:

**See the attached documents, including (but not limited to) the document entitled "Reasons and Grounds" and also the letter-report of Greg L. Bushner, R.G., dated 17 February 2006. The attached documents are incorporated here by reference.**

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THEREFORE the Protestant requests that the application be granted and that an order be entered for such relief, consistent with the granting of the application, as the State Engineer deems just and proper.

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STATE ENGINEER

Signed .....
By: Brent D. Stewart, President, Nevada Rock and Sand Company
Address: 6600 Amelia Earhardt Court, Suite C
Las Vegas, Nevada 89119

Subscribed and sworn to before me this 13th day of April, 2006.

.....
Notary Public

BARBARA CLARK
NOTARY PUBLIC - STATE OF NEVADA
Date Appointment Exp: 7-27-2007
Certificate No: 95-0371-1

State of Nevada

County of Clark

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

DCNR/DWR
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# REASONS AND GROUNDS

1. The Protestant Nevada Rock and Sand Company (hereafter "NRS") respectfully requests that you grant the application that is the subject of this Protest (hereafter "the application"), for the reasons and on the grounds given below.

2. NRS owns Crystal Springs Ranch in Pahranagat Valley, Lincoln County, Nevada. The Ranch is situated just south of Crystal Springs and just west of Highway 93. As the owner of the Ranch, NRS has the right to use and in fact uses five-twelfths of the flow of Crystal Springs. The family that owns NRS has been farming and ranching at Crystal Springs Ranch for over 40 years, has extensive experience with the Crystal Springs water flow, and also has been continually aware of the pumping of ground water at Stewart's Hiko Ranch (the site of the application).

3. (Relative to the information set forth in paragraphs 4 through 6, please see the attached letter-report of Greg L. Bushner, R.G., of URS Corporation.) The irrigable portion of Hiko Ranch sits on the alluvium filling the old White River water course. All the wells ever operating on the Ranch have drawn water from that alluvial fill, as demonstrated by all the well logs. It is cold water, no more than 60° F.

4. The three springs in Pahranagat Valley – Hiko, Crystal, and Ash – flow from a deep carbonate aquifer, that is, a portion of the bedrock called Paleozoic carbonate rock. This is very warm water, between about 82° and 88° F.

5. No geologic or other phenomenon exists between Hiko Ranch and the three springs that can or does emit the huge amount of energy that would be necessary to elevate the temperature of the water in the alluvial fill some 25° F. so as to cause that water's temperature to approximate the spring-water temperature. Moreover, all indications are that the chemistry of the Hiko Ranch well water is different from the spring-water chemistry.

6. In the fifty-five plus years that the Stewarts have been pumping the Hiko Ranch wells, no one has detected a diminution in the flow of Crystal Springs (or Hiko or Ash Springs, for that matter). Accordingly, no one has previously suggested the possibility of an adverse impact on spring flow resulting from pumping the Hiko Ranch wells. Moreover, not one holder of any water right in any of the three springs and not one user of any of the spring water protested the application or earlier applications of which the application is an amendment. (The only protest came from the United States National Park Service; that protest said in essence that additional pumping at Hiko Ranch will cause the ruination of the Lake Mead National Recreation area, of which the closest point to Hiko Ranch is well more than 100 miles away.)

7. NRS understands that the State Engineer is showing some hostility to additional pumping at Hiko Ranch. That hostility, as NRS understands it, rests on one fundamental premise – that the source of the Hiko Ranch well water and the source of the water

flowing from the three springs are one and the same ("the single-source premise"). This single-source premise then apparently leads the State Engineer to "find" that additional pumping on Hiko Ranch would interfere with existing rights (including NRS's) in Hiko, Ash and Crystal Springs.

8. The single-source premise is both procedurally and substantively flawed. It's procedural flaws are these: The State Engineer's Office adopted the single-source premise (a) after having implicitly rejected that premise relative to Hiko Ranch on three prior occasions; (b) without holding a hearing on that novel, unprecedented premise; (c) without calling for a study to verify or falsify that premise; (d) without calling for additional information relative to it; and (e) without otherwise providing any opportunity to the Stewarts or to anyone else (including NRS) to be heard on the single-source premise. Yet no protester raised the single-source premise, and (as seen below) no document available to the State Engineer and the general public supports that premise.

9. (Relative to the information set forth in paragraphs 9 and 10, please see the attached letter-report of Greg L. Bushner, R.G., of URS Corporation.) Regarding its substantive defects, the single-source premise has no supporting evidence (as shown by the very two authorities on which the Ruling purports to rely) and is in fact false.

10. The two authorities on which the State Engineer apparently purports to rely are Thomas Eakin's 1963 Reconnaissance Series Report ("the Eakin report" or "the report") and the State Engineer's Ruling # 3225 denying applications to drill wells very close to Crystal Springs ("the 1985 Ruling").

A. The State Engineer plainly misreads and distorts the Eakin report. Contrary to the single-source premise, the Eakin report:

i. identifies two, not one, groundwater systems in Pahranagat Valley: (a) the regional groundwater system in the deep Paleozoic carbonate rock, with that water flowing from Hiko, Crystal, and Ash Springs, and (b) the local alluvial system in the much younger and overlying valley fill;

ii. does not indicate anywhere a direct hydrological connection between the two different systems that the report identifies;

iii. does suggest that the two systems are indeed separate;

iv. expressly states that "[m]oderate pumping of groundwater from the fill [such as that occurring at Hiko Ranch over these many years] would have little effect on the discharge of the principal springs [Ash, Crystal, and Hiko] whose flow is adjudicated.";

v. provides no basis for explaining away (as required to sustain the single-source premise) the vastly different temperature and chemistry between, on one hand, the Hiko Ranch well water and, on the other hand, the spring water; and

vi. provides no basis for explaining away the fact that fifty-five plus years of pumping at Hiko Ranch has resulted in no adverse impact on the three springs.

B. The State Engineer's 1985 Ruling actually undercuts the State Engineer's apparent present position. The 1985 Ruling addressed a proposed well just 500 feet from Crystal Springs and another one just 2400 feet away. An existing domestic well in that very same area allowed testing of water chemistry. Thus: "Chemical analysis [was]

performed … on water samples from both Crystal Springs and the existing domestic well …. The results of the analysis indicate that the well is drawing from the same source as Crystal Springs." On this basis, the 1985 Ruling concluded that the proposed wells "could result in the interception of source water to Crystal Springs, a fully appropriated source, and therefore conflict with existing rights." By stark contrast, both water temperature and water chemistry demonstrate, directly contrary to the 2006 Ruling's single-source premise, that the Hiko Ranch wells are ***not*** "drawing from the same source as Crystal[, Hiko, and Ash] Springs." Whereas in the 1985 Ruling the State Engineer acted rationally in relying on similar water chemistry between the one spring and the nearby well, in the 2006 Ruling the State Engineer acted irrationally exactly because he has refused to consider dissimilarity (including of temperature) between the three springs, on one hand, and, on the other hand, the distant wells – or even the possibility of dissimilarity when such is highly indicated (or, in the case of the temperature, proven).

11. In sum, the indisputable and undisputed facts establish that the application should be granted because (a) more than sufficient water is available in the source (the alluvial fill groundwater system); (b) the proposed pumping and irrigating pursuant to the application will have no adverse impact on existing rights; and (c) it is in the public interest to grant the Applications, in that the State of Nevada (and Lincoln County in particular) will be substantially benefited by the proposed agricultural development, both by the large expenditure of funds required initially and over the long term for that development and by the increase in the tax base resulting from that development.

12 . NRS respectfully requests that the State Engineer approve the application.

URS

February 17, 2006

Mr. Dan H. Stewart
Stewart-Nevada Enterprises
6600 Amelia Earhart Court, Suite C
Las Vegas, Nevada 89119

Re: **Applications 64326, 64327, 69085, and 69086 to Appropriate Underground Sources of Water Within the Pahranagat Valley Hydrographic Basin (209), Lincoln County, Nevada**

Dear Mr. Stewart:

In an effort to understand Nevada State Engineer Ruling #5547 ("the 2006 Ruling"), which denied the above-mentioned applications ("the Applications"), I have reviewed the following documents:

- U.S. Geological Survey Report entitled "Ground-Water Resources – Reconnaissance Series Report 21: Ground-Water Appraisal of Pahranagat and Pahroc Valleys, Lincoln and Nye Counties, Nevada," by Thomas Eakin (1963) ("the Eakin report" or "the report")
- State of Nevada Engineer's Office Ruling #3225 regarding applications to appropriate public waters of an underground source in Pahranagat Valley filed by Davis and Hafen ("the 1985 Ruling")
- The 2006 Ruling

The reasons given in the 2006 Ruling are based on the assumption that water withdrawn by the wells proposed in the Applications will be the same water that discharges from Crystal, Ash, and Hiko Springs ("the single-source premise"). The 2006 Ruling relies almost entirely upon the Eakin report; that report is effectively presented as the foundation to deny the Applications to appropriate groundwater from Pahranagat Valley.

I conclude that the Eakin report does not support but rather undercuts the 2006 Ruling and its single-source premise based on a lack of hydrologic data that demonstrates the connection between the valley fill aquifer and the springs.

URS Corporation
7720 North 16th Street, Suite 100
Phoenix, AZ 85020
Tel: 602.371.1100
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The Eakin report states that flows from Crystal, Ash and Hiko Springs are supported by groundwater from the Paleozoic carbonate rock aquifer. The report does not, however, state that the alluvial aquifer system that occurs in both Pahroc and Pahranagat Valleys also supports this spring flow. In fact the report identifies two major "rock" groups that include (1) hard rock and (2) valley fill. The first group includes Paleozoic carbonate rocks and other non-carbonate rocks. The significance of the second group of "rocks" identified by the Eakin report is that the older and younger valley fill is water bearing and can yield economic quantities of water to wells. It is hypothesized that the older and younger valley fill overlie the Paleozoic carbonate rocks in both Pahranagat and Pahroc Valleys.

The Eakin report postulates "that ground-water movement though carbonate rocks in this region [Pahranagat and Pahroc Valleys] occurs through both fractures and solution openings." Further, that "the large quantity of ground water issuing from fractures and solution openings, such as those at Ash, Crystal, and Hiko Springs in Pahranagat Valley, is a dramatic demonstration that ground water moves through Paleozoic carbonate rocks in this region of Nevada."

For the valley fill materials, the Eakin report states: "Most of the unconsolidated sand and gravel of the younger valley fill is capable of transmitting ground water freely, as is demonstrated by several large-capacity wells in northern Pahranagat Valley." The wells that are referred to here are wells that the Stewart family has used for irrigation purposes. In fact, several of these wells[1] are identified in Table 8 of the Eakin report. The well logs to which the report makes reference indicate highly permeable materials including boulders, gravels, and sands that could yield large volumes of water to wells in this area.

Thus, the Eakin report has identified *two* groundwater systems: a local alluvial system (valley fill materials) and a regional hard rock carbonate system. The local alluvial aquifer system is made up of sediments eroded from nearby mountains creating older and younger valley fill materials that can store and transmit significant volumes of water, as demonstrated by existing production wells in the area owned by the Stewart family. It should be noted that the Eakin report does not indicate anywhere that there is a direct hydraulic connection between the Ash, Crystal, and Hiko Springs of the Paleozoic carbonate aquifer system and the alluvial aquifer system. In fact, the Eakin report postulates that, due to the magnitude of the combined discharge of the springs, the magnitude of the source of recharge needed "is far in excess of the amount that might be supplied by recharge from precipitation within the defined surficial area of the valley." He further states that "the hydrologic system, of which Pahranagat and Pahroc Valleys are a part, may be considered an open system – that is, it extends beyond the limits of the valleys." Thus the report is saying in effect that, based on the magnitude of the discharge alone and the consistency of the discharge over time, the flow of the Ash, Crystal, and Hiko Springs hydrologic system is separate from the alluvial valley fill aquifer system. The Eakin report further supports this understanding with this statement: "Thus, based on the potential hydraulic gradients, ground water probably moves [in the

[1] These wells include 3S/60-24a1, 3S/60-24d1, 4S/60-2a1, 4S/60-2a2, and 4S/60-2d2.

carbonate rocks] from the northwest, north and northeast toward the principal carbonate springs in Pahranagat Valley."

In addition to the physical setting and occurrence of groundwater in Pahranagat Valley, the Eakin report also addresses the difference in water quality of the spring water versus the groundwater that occurs in the alluvial aquifer system. The report states that the spring water has the signature of the carbonate rock aquifer, specifically referring to the low "dissolved-solids content" that was reportedly around 300 ppm [parts per million]. The report also notes that the water type was a calcium-magnesium bicarbonate type. Although it is not fully known yet what type of water quality is pumped from the Stewart's irrigation wells, it is likely of a different type than that of the carbonate rock aquifer due to the alluvial aquifer system. Moreover, it is known that the water temperature of the spring water has been documented at between 82° and 88° F (see Table 5 of the Eakin report). The temperature of the groundwater pumped from the existing irrigation wells of the Stewart family farm is no more than 60° F (personal communication via e-mail, Dan Stewart, February 14, 2006). This temperature difference indicates that water discharged from the springs is different than groundwater that occurs in the alluvial valley fill aquifer system.

There is no physical (geothermal mechanism) that exists, based on the references used for determination in the 2006 Ruling, to heat the groundwater in excess of 22° F within approximately 2½ miles of Hiko Spring. Groundwater temperatures are typically very constant and, based on the data provided, these temperatures provide evidence of different aquifer systems. The regional carbonate rock aquifer system that occurs in eastern Nevada tends to be warmer due to the greater depths at which groundwater occurs and the natural geothermal gradients of approximately 2° to 9° F for every 300 feet in depth (Bouwer[2] 1978).

Additional water chemistry data may be readily collected and analyzed to further verify that the source of the underground water from irrigation wells on the Stewart family farm is different than that of Ash, Crystal, and Hiko Springs. (It appears that such collection and analysis has not occurred before now exactly because the single-source premise was never put forth, let alone seriously entertained, prior to the 2006 Ruling and because all of the previous State Engineer actions relative to the Stewart family farm implicitly rejected that premise.) In this context, I note that in the 1985 Ruling, the State Engineer's Office did rely upon water quality data that demonstrated the pumping well had similar water chemistry to the nearby springs. This well, however, was located in very close proximity (approximately 500 feet) to the springs and obviously diverted flow from Crystal Springs. As a final note relative to the matter of water chemistry, the standard of practice among hydrologists would have called for chemical analysis of the two water sources before advancing the single-source premise, as used in the 2006 Report.

[2] Bouwer, H. 1978. Groundwater hydrology. McGraw-Hill.

Finally, the Eakin report states: "Moderate pumping of groundwater from the [valley] fill probably would have little effect on the discharge of the principal springs whose flow is adjudicated." With this statement, the Eakin report addressed the question of impact to the spring flow by withdrawals from the valley fill aquifer.

Thus, there is ample evidence within the Eakin report to support the conclusions that groundwater pumpage from the alluvial valley fill will not impact spring flow and will rely on the perennial yield of the basin (a renewable water source) rather than on spring flow. In contrast, there is nothing in the Eakin report to support, as a matter of good science, a contrary conclusion.

Should you have any questions or require additional information, please do not hesitate to contact me at 602.861.7478.

Sincerely,

**URS Corporation**

Greg L. Bushner, R.G. (Registered in Arizona, California, and Wyoming)
Professional Hydrogeologist (Registered by the American Institute of Hydrology)
Practice Leader Groundwater Resources

REGISTERED GEOLOGIST
CERTIFICATE NO
30997
GREG L
BUSHNER
Date Signed 2/17/06
ARIZONA U.S.A.

AMERICAN INSTITUTE OF HYDROLOGY
Certificate Number
1125
Greg
Bushner
Professional Hydrogeologist

## EXPERTISE

- Hydrogeology
- Production Well Drilling
- State Permitting Requirements
- Surface Water – Groundwater Interactions
- Groundwater Hydrology

## REGISTRATION

1997 / Registered Geologist / Arizona #30997

1996 / Registered Geologist / California #6552

1992 / Registered Geologist / Wyoming #432

1996 / Hydrogeologist / American Institute of Hydrology No. 96-HG-1125

## EDUCATION

1983 / BS / Geology / Northern Arizona University

## WORK HISTORY

22 total years (4 years with URS / 18 years with others)

## AFFILIATIONS

Arizona Hydrological Society

American Institute of Hydrology

## Representative Experience

Mr. Greg L. Bushner received a B.S. degree in geology from Northern Arizona University, Flagstaff, Arizona, in 1983. Before joining URS Corp as the Practice Leader for Groundwater Resources he was with a HydroSystems, Inc. from 1994 to 2002, where he specialized in hydrogeology, artificial groundwater recharge projects, water well drilling and state permitting requirements. Prior to HydroSystems, Inc., he was with the Arizona Department of Water Resources from 1985 through 1994. His tenure at ADWR culminated in managing the Surface Water/Recharge Section of the Hydrology Division.

***Vidler Water Company Kane Springs Valley***
Principal in charge of 2,000-foot monitor and production well drilling project in Kane Springs Valley, Nevada. This includes development of technical specifications for both the monitor well and production well, well drilling contractor selection, managing and responsible for well construction oversight, coordination with both client, contractor, and state and federal agencies. Responsible for water quality data collection and analysis, and long-term 7-day aquifer test. Well construction activities will be documented in a well completion report. Data collected will be used in support of hearing before State Engineer of Nevada in order to prove water rights.

***City of Chandler Municipal Well Siting Study***
Collected hydrogeologic data including well logs and water quality information for use in well siting reports, and identified eight potential well locations. Defined well impacts, secured well drilling permits for four sites.

***City of Chandler Municipal Well Construction Project***
Project hydrologist responsible for the siting of three City of Chandler service area production wells located in Shawnee, Amberwood, and Desert Breeze Parks. This work included the development of technical well drilling specifications, well drilling oversight, conducting zonal water quality sampling, well construction oversight, well development and aquifer testing. Involved in all aspects of this work as the project hydrologist. These wells are 18 5/8-inch cased, 1,250 feet deep, and produced approximately 2,000 gpm when drilled.

***City of Chandler Intel Project***
Responsible for the construction and installation of four direct injection wells to recharge and store industrial process treatment water. Project oversight included securing permits, obtaining bid specifications, well logging, drilling, water quality zone sampling, geophysical logging, well construction, well development, aquifer testing, and final report documentation.

***City of Chandler Industrial Process Water Treatment Facility Recharge Site Expansion Project***
Project Manager overseeing the design and construction of one additional aquifer storage and recovery well at this facility. This well was completed with 14-¾ inch casing to a depth of 650 feet. The aquifer test was conducted at 1,150 gpm after the well was

completed. Coordinated well drilling contractor activities, field personnel activities, and interfaced with client regarding status of project.

***North Scottsdale ASR Project, Scottsdale, Arizona***
Provided consulting services to design, permit, and oversee the construction of an ASR project in the Carefree Basin in north Scottsdale. This project entails the transfer of water from Harquahala Valley to the City of Scottsdale that will be recharged in the Carefree Basin. Vadose zone recharge wells will be used to store this water which will be recovered using three high capacity (1,400 gpm each) production wells also located in the Carefree Basins. Managed every phase of this project from conceptual design to underground storage facility permitting, production/recovery well permitting, to well construction oversight. Also, provided management and field oversight of slim-hole exploratory boring located in Harquahala Valley to demonstrate source water quality to facilitate land transfer. A numerical groundwater flow model was developed as part of the permit application to assess impacts from both the groundwater recharge project and well impacts of the three production wells.

***Long Term Aquifer Test, Nevada***
Senior Field Hydrologist in charge of 72 hour long term aquifer test of large diameter, 17½-inch exploration/test well in southern Nevada for a private client. Responsibilities included planning and coordinating test, on-site data collection, data analysis, water quality data collection and monitoring of surrounding domestic wells.

***Ponderosa Domestic Water Improvement District***
Provided consulting services to small water company to analyze current well field conditions and make recommendations for new well sites. This analysis included a site visit, well inventory, aquifer supply determination, and fracture trace analysis for new well locations. Recommendations to client included two new wells sites, and deepening of existing wells.

***Fountain Hills Sanitary District (FHSD)***
Project Manager for the development of an aquifer storage and recovery (ASR) facility to store 3.2 mgd of micro-filtered reclaimed water. This project required construction oversight and testing of four ASR wells (750 feet deep, 14-inch cased), five monitor wells, one production well (900 feet deep, 18-inch cased), and three exploratory borings. Responsible for acquisition of all agency permits required for the drilling and operation of the ASR facility. ASR and production well drilling oversight included development of technical well drilling specifications, well design, lithologic analysis of drill cuttings, analysis of geophysical data with lithology, well construction oversight, well development oversight, aquifer testing protocol development and oversight, and operational well impact analysis.

***City of Phoenix Multi-Use Planning for Effluent Discharge Area***
Project Manager overseeing the drilling of ten soil borings (300 feet deep) and construction of one monitor well (650 feet deep) to determine the lithologic properties of the vadose zone within the planning area. Coordinated well drilling contractor activities, field personnel activities, and interfaced with client regarding status of

project. Drafted consultant report providing outcome of data analysis and recommendations. This report included presentation of the as-built monitor well which will be used as a point of compliance for the effluent discharge.

***City of Scottsdale Westworld Recharge Facility***
Project Manager for development of a recharge facility that included three vadose zone recharge wells and one deep production/recovery well (1,000 feet deep, 12 ¾-inch cased). Responsible for the acquisition of all required permits related to this project for the City of Scottsdale. This included relevant recharge permits, service area well permit, and recovery well permit. Coordinated well drilling contractor activities, field personnel activities, and interfaced with client regarding status of project. Conducted 24-hour aquifer test of production well with well yields to 1,200 gpm.

***City of Phoenix North Gateway Water Reclamation Plant***
Project Manager overseeing the drilling of two soil borings (300 feet deep) and two monitor wells (350 feet deep). This investigation was used to determine the recharge potential of this site. The monitor wells will be used for future points of compliance. Coordinated well drilling contractor activities, field personnel activities, and interfaced with client regarding status of project. Drafted consultant report providing outcome of data analysis and recommendations. This report included presentation of the as-built monitor well.

***Deep Production Well Project***
Project Manager for the siting, construction, and testing of a deep production well (1,200 feet, 18-inch cased) to be used for irrigation purposes. Provided consulting services to determine the existing well capacity and to justify the need for additional capacity. Coordinated well drilling contractor activities, field personnel activities, and interfaced with client regarding status of project.

***Well Inventory Project***
Provided field oversight and inspection of well field for private client. This included identifying all wells on 18,000-acre farm, measuring water levels, collecting well logs, and creating well field database.

***Short Term Aquifer Test***
Assisted in a short term aquifer test of existing well for a private client. Set up transducer and data logging equipment, took sounder measurements, facilitated in the start of the aquifer test.

***Kyrene Recharge Project***
Assisted the City of Tempe in developing a vadose zone recharge well facility to store up to 3MGD of treated effluent. Assisted the City in preparation of its permit application report and determination of the mounding impacts. Field hydrologist responsible for a one month long term recharge test using vadose zone recharge well and associated monitor wells.

***Arizona Department of Water Resources, Surface Water/Recharge Section Hydrology Division***
Manager responsible for the direct supervision of five hydrologists specializing in surface water/groundwater interaction studies.

Oversaw several environmental permitting programs that included:

- *Recharge Program* - evaluated hydrogeologic studies for technical merit as part of the application approval process; developed in-house permitting protocol to facilitate permitting process for applicants and in-house customers; and developed technical and policy interpretations of recharge legislation.
- *Instream Flow Program* - evaluated, reviewed, and approved technical data in applications for instream flow surface water rights; and developed the technical basis for instream flows.
- *Surface Water Rights Program* - provided technical expertise in administering the surface water rights program. Determined whether surface water right permits were needed in cases where appropriable waters were questioned. Made determinations of supplies from Mexico, transmission gains and losses throughout the watershed using water budget analysis and USGS stream gauging records, determination of diminishment to Federal Reserve rights, and determination of appropriable subflow using analytical techniques for the Upper San Pedro Hydrographic Survey Report (HSR). Analyzed and mapped floodplain aquifer for the Upper Salt River watershed and provided a determination of wells. Made determinations of surface water resources of the watershed, provided watershed water budget determination, and supportive figures and appendices for the Upper Salt River Watershed HSR. Characterized the hydrogeology of the San Carlos Indian Reservation; defined aquifer units, provided determinations of well density, water quality, and surface water resources for the San Carlos HSR.

***US Bureau of Reclamation, Yuma, Arizona***

Hydrologic Technician responsible for field data collection, development of groundwater contour maps, lithologic logs, well logging, and aquifer step testing. Pertinent well drilling experience:

- *Well Drilling* – sat wells during drilling of large diameter dewatering wells, participated in data collection during aquifer testing, collected drill cutting samples and developed lithologic logs, assisted in geophysical logging of well.
- *Step Testing* – participated in the data collection during short-term (6 hour) step drawdown tests of existing production wells to determine specific capacity data and well efficiency.