MEMORANDUM

New Mexico Office of the State Engineer
Hydrology Bureau

June 24, 2003

TO: Brian Wilson, Chief, Water Use and Reports Bureau

THROUGH: Tom Morrison, Chief, Hydrology Bureau

FROM: Douglas Rappuhn, Hydrology Bureau

SUBJECT: Second Sufficiency Review of Second Application, Water Supply Plan for Rainmakers Subdivision, Units One through Five, Lincoln County

Since the last review by the NMOSE of applicant submittals (October 2002), three new wells have been drilled (one experienced problems, and is reported to have been plugged), and aquifer tests were performed on both completed wells. Cooperation by the applicant in performance of the tests is appreciated, as valuable information regarding local aquifer response has been gained.

Short-term testing of the new wells indicates initial pumping rates between 161 (S-7) and 185 (S-6) gpm, adding capacity to the water system, although at present, Wells S-6 and S-7 exist under exploratory permits, therefore the ability to permanently provide water from S-6 and S-7 has not yet been authorized. Forty-year simulation of project pumpage indicates the potential for wellfield drawdown and possible reduction in yield, yet 40-year diversion of existing water rights from the seven wells, including S-6 and S-7, appears possible with adequate proportioning of pumpage and well maintenance.

New Information Received Since Previous Submittal

New Well H-1122-S-6:

NMOSE Well Record (H-3409, "1st Well"; drilling problems noted / well to be abandoned)
NMOSE Well Record (H-3409, "2nd Well")
Water level data collected during the 72-hour test-pumping of S-6 and subsequent recovery period, and a curve-match analysis of a portion of the data
A 4/1/03 statement noting production of the seven wells associated with the CDS Rainmakers Utilities, L.L.C. (formerly Rancho Ruidoso Village Water Company)
A 4/1/03 analytical report from Hall Environmental Analysis Laboratory regarding a water sample collected from Well H-3409 during test-pumping on 3/23/03
A two-page, 4/8/03 letter-report from Atkins Engineering Associates, Inc., providing additional information and analysis of S-6 test-pumping
Geologic Map for CDS Investments / Rainmakers Utilities by Atkins Engineering Associates, Inc., updated April 8, 2003

New Well H-1122-S-7:

NMOSE Well Record (H-3408)
Water level data collected during the 25-hour test-pumping of S-7 and subsequent recovery period, and a curve-match analysis of a portion of the data

A two-page, 5/13/03 letter-report from Atkins Engineering Associates, Inc., providing additional information and analysis of S-7 test-pumping, and revised estimates of Well S-7 and total wellfield capacity

Previously submitted *"Geohydrologic Analysis of Ground Water Supplies Within the Vicinity of Section 16 Through 22, Township 10 South, Range 14 East, N.M.P.M."*, prepared by Atkins Engineering Associates, Inc., May 2002 ("*Geohydrologic Analysis*"), and earlier submittals were not updated by the applicant, and were therefore referred to as necessary.

Water Rights; Project and Service Area Demand

The Rancho Ruidoso Village Water Company / CDS Rainmakers Utilities, L.L.C. presently includes seven wells (H-1122-S through H-1122-S-7), which are described in part in attached Appendix 1. At present, Wells S-6 and S-7 exist under exploratory permits (H-3409 and –3408, respectively), and although the applicant has been granted temporary emergency authorization to pump both of these newer wells, the applications to use the wells to supplement their water right have been protested and been forwarded to the NMOSE Administrative Litigation Unit for scheduling of hearing(s). The ability to permanently provide water from S-6 and S-7 has therefore not yet been authorized.

Currently, water rights associated with Rancho Ruidoso Village Water Company / CDS Rainmakers Utilities, L.L.C. Permit H-1122 et al consist of a total consumptive use water right of 176.1875 AFY. The diversion of water can be increased to a total of 349.375 AFY upon submittal of measurement of return flow to Little Creek and measurement of irrigated water to the associated golf course. Of the 176.1875 AFY consumptive use water right, 48.75 AFY (97.5 AFY of diversionary right, with approved return flow credit) is under a temporary permit scheduled for expiration May 31, 2010.

"Rancho Ruidoso Village Water Company Service Area Total Water Requirement", as presented in *Exhibit 8* of applicant's *Geohydrologic Analysis*, has been calculated at 229.92 AFY under the assumptions and terms therein. This total includes components for existing utility commitments to local subdivisions (663 lots) and the Spencer Theater (assumes 18.73 AFY upon full development), as well as subject 236 lot-equivalent subdivision.

In performing the subject evaluation, submitted documents and maps were reviewed, and several references to an associated golf course were noted, including passages in the *Disclosure Statement & Restrictive Covenants*. An applicant simulation provided by Atkins Engineering Associates, Inc., included rights associated with supplying the golf course as well as existing and proposed domestic and commercial use. The subject evaluation includes drawdown simulations based on a diversion of 349.375 AFY, consistent with the maximum diversion considered in the applicant's *Geohydrologic Analysis*, and the maximum diversion currently allowable under Permit H-1122 et al.

Evaluation of Ground Water Availability

Discussion of project wells

Lincoln County regulations require that the subdivider demonstrate a 40-year water supply and the ability to be ready, willing, and able to provide that water. For the subject project, that supply will be dependent upon the amount of sustainable well production from the CDS Rainmakers Utilities, L.L.C. wells, which in turn is dependent on the interrelation of well design / construction, long-term drawdown, and resultant decreased well yield. Design information on the seven existing applicant wells is presented in Appendix 1. Well locations are presented on Figure 1.

Wells S-3, S-4, and S-7 are located in western portions of the project area, and appear to tap the stratified aquifer found in the Triassic-age Santa Rosa Formation. Wells S-3, S-4, and recently

drilled S-7 are characterized by relatively shallow static water levels, sandstone production beds, and unconfined to confined aquifer response.

Wells S, S-2, S-5, and S-6 tap the aquifer found in the Permian-age San Andres Formation. Wells S, S-2 and S-5 are located in eastern portions of the project area, and are characterized by limestone production beds, deep static water levels, and unconfined to semi-confined aquifer response. Recently drilled Well S-6 is located in the western portion of the project area, and taps a confined portion of the San Andres aquifer, also characterized by deep static water levels. The Santa Rosa unit was penetrated, but cased and cemented-off, in the construction of Well S-6.

The Santa Rosa aquifer is situated at a shallower depth than the San Andres aquifer in western portions of the project area. The Santa Rosa unit pinches-out to the east, and does not appear to exist in the vicinity of Wells S, S-2, and S-5. It is unlikely that the confining beds that separate the two zones in the western project area provide perfect hydraulic separation, and leakage across confining units likely occurs and may permit a related degree of drawdown over longer periods of pumping as head differentials respond to long-term pumping.

Due to the significant increase in depth to shallowest ground water from west to east across the project site, many local wells drilled near western portions of the site are relatively shallow and tap production beds of upper Permian through Cretaceous units, while eastern wells are necessarily deeper, tapping the San Andres and Glorieta Formations. Wells in both areas are often characterized by short water columns, due typically to cessation of the drilling process once initial establishment of required well yield occurs.

Onsite aquifer tests

Atkins Engineering Associates, Inc. has conducted three onsite aquifer tests for the applicant since initiation of the subdivision review process, and has provided the NMOSE with test data and their analyses. Table 1 presents information relative to the tests conducted.

Table 1. Aquifer tests conducted on H-1122 et al wells.

Well (H-1122-)	Aquifer pumped	Dates	Discharge rate (gpm)	Pumping duration (hours)	Maximum drawdown in pumped well (feet)	NMOSE-estimated transmissivity (gpd/ft)
S-5	San Andres	4/17 – 4/21/02	70.2	72	141.5	550
S-6	San Andres	3/21 – 3/27/03	230→185	72	88	1650
S-7	Santa Rosa	5/9 – 5/10/03	161	25	63.5	4000

Simulation of 40-year diversion

Theis simulations were conducted by the NMOSE to estimate the self-induced 40-year drawdown effects of diversion of the H-1122 water right (349.375 AFY). Separate simulations were conducted for wells completed into the Santa Rosa aquifer (S-4 and S-7) and wells completed into the San Andres aquifer (S-5 and S-6). Simulated pumpage was proportioned only to Wells S-4, S-5, S-6, and S-7, rather than all seven existing wells, as the yield and configuration of these four wells and aquifer transmissivity suggested potential for 40-year longevity, whereas several of the older wells appeared to lack viability to sustain long-term, high yield pumping.

Aquifer properties used in the simulations are provided in Appendix 1. Additional assumptions in the simulations included no aquifer boundaries, use of a semi-confined storage coefficient (0.005), no regional drawdown effects, and no overlapping or superimposed effects between wells producing from the Santa Rosa and San Andres aquifers. The calculation procedure was selected for evaluating

the ability of the wells to produce a 40-year supply, and may not be appropriate for assessing impacts to other wells.

Simulation results
Establishing project 40-year water availability was considered based on the ability of the existing wellfield to sustain pumpage relative to applicant well design, well interference, and geometry of production beds tapped by the wells. In each case, all project wells involved were simulated to pump at rates less than that claimed possible in the applicant-submitted 4/1/03 affidavit and 5/13/03 revision specifying production rates. Results of the simulations are presented as part of Appendix 1.

In the simulations, individual wells were deemed able to sustain 40 years pumping if well screen sections associated with adequate yield were left saturated at the end of the simulation. This was the case in three of the four wells that were simulated, and generally in the forth case as well. Appendix 1 notes that there was a slight infringement of this concept of sustainability regarding Well S-4, as depth to water after 40 years pumping was estimated to be 97 feet bgl, which is 7 feet below the bottom of the uppermost of four well-screen sections (50 – 90 feet bgl).

The S-4 Well Record indicates additional well-screen sections at 110 – 130, 150 – 170, and 250 – 270 feet bgl in the well, with an associated deeper yield of 40 gpm. Therefore it appears that even if the uppermost screened zone in S-4 is dewatered, sufficient yield may exist from deeper production zones penetrated to provide the simulated diversion of 25 gpm.

NMOSE 40-year simulation of project pumpage indicates the potential for wellfield drawdown and possible reduction in well yield in over-stressed wells if diversion of the entire right of 349.375 occurs, although 40-year diversion of the entire right from the existing wellfield appears possible with adequate proportioning of pumpage and well maintenance. The simulation is contingent on the acquisition of approval of permanent use for Wells S-6 and S-7. Other scenarios may exist in which dispersement of pumpage, especially among all existing wells, may offer better results at minimizing well interference.

<u>Water Quality</u>
It was noted that *Geohydrologic Analysis*, page 9 states, "Both aquifer systems meet the water quality requirements of the New Mexico Water Quality Control Commission for public drinking water in the State of New Mexico." Reference is made to aquifer systems the applicant differentiated in earlier pages of the exhibit. *Geohydrologic Analysis, Exhibit 9* presents water quality analysis from Applicant Well 1A (H-1122-S-5), indicating concentration of sulfate in the sample to be 540 mg/L, and concentration of Total Dissolved Solids (TDS) to be 1400 mg/l. It may be worthy of note, that although the New Mexico Ground-water Standards specify threshold values of 600 mg/l sulfate and 1000 mg/l TDS, the U.S. EPA Drinking Water Standards Maximum Contaminant Level for sulfate is 250 mg/l, and for TDS is 500 mg/l.

Additionally, the 4/1/03 analytical report on the water sample taken 3/23/03 from Well H-3409 (H-1122-S-6) indicates sulfate concentration of 530 mg/l, TDS concentration of 1300 mg/l, and manganese concentration of 1.20 mg/l. Similar comments as above are offered regarding sulfate and TDS concentration. Also, New Mexico Ground-water Standards specify threshold value of 0.2 mg/l for manganese (U.S. EPA Drinking Water Standards Maximum Contaminant Level for manganese is 0.05 mg/l).

Appendix 1. Well construction information, yield, and NMOSE-simulated parameters and results for project H-1122 et al wells.

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Well	Depth (feet)	Top of production zone or upper screen (feet bgl)	Bottom of production zone or lower screen (feet bgl)	Aquifer	Static water level (feet bgl)	Productive water column (feet) **[D–F]**	Applicant stated yield (gpm)	NMOSE simulated yield (gpm)	NMOSE simulated transmissivity (gpd/ft)	NMOSE simulated 40-year drawdown (feet)	NMOSE simulated 40-year drawdown at 70% well efficiency (feet) **[K/0.7]**	Depth to water after 40-year simulation at 70% well efficiency (feet bgl) **[F+L]**	Productive water column remaining after 40-year simulation at 70% efficiency (feet) **[D-M]**
S	651	585	651	San Andres	566	85	19	0					
S-2	640	500	640	San Andres	462	178	25	0					
S-3	115	24	105	Santa Rosa	22	83	42	0					
S-4	440	50	255	Santa Rosa	30	230	30	25	4000	47	67	97 (2)	158
S-5	921	700	880	San Andres	552	328	60	20	550 / 1000 (1)	98	140	692	188
S-6	905	830	874	San Andres	733	141	185	40	1650 / 1000 (1)	66	94	827	47
S-7	300	200	300	Santa Rosa	73	227	180 - 200	131.5	4000	89	127	200	100
Totals	-	-	-		-	-	541 - 561	216.5	-	-	-	-	

(1) Self-induced effects were individually calculated at S-5 and S-6 based on test-derived transmissivity (for S-5, T = 550 gpd/ft; for S-6, T = 1650 gpd/ft). The effect of one well's pumping on the other was calculated at an average transmissivity of 1000 gpd/ft. Effects per well were then totaled into column K.

(2) Simulated depth to water after 40 years pumpage is 97 feet, which is below uppermost well screen interval (50 – 90 feet bgl). There remain three other saturated screened intervals in this well (110 – 130 feet bgl, 150 – 170 feet bgl, 250 – 270 feet bgl) after 40 years simulated pumpage. Well Record indicates 62 percent of yield comes from below uppermost screened section.

Figure 1. Rainmakers Project, applicant wells, T10S - R14E, Lincoln County