STATISTICAL EVALUATION OF CHINLE AQUIFER QUALITY AT THE HOMESTAKE SITE NEAR GRANTS, NM

URANIUM
SELENIUM
MOLYBDENUM
SULFATE
NITRATE
CHLORIDE
VANADIUM
THORIUM-230
TOTAL RADIUM

Prepared for:

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Executive Summary

Natural uranium, selenium, molybdenum, TDS, sulfates, nitrates, chloride, vanadium, thorium-230, and radium are key contaminants introduced into the shallow groundwater as a result of the processing of uranium ore at the Homestake site, located near Grants, New Mexico. However, a natural source of these same constituents exists in the region which influences natural background groundwater quality. The purpose of this report is to statistically characterize the concentrations of the aforementioned constituents in the three Chinle aquifers and the area known as the Chinle aquifer 'mixing zone'.

There are three Chinle aquifers from which groundwater data have been collected. The data from wells in the Upper Chinle, Middle Chinle and Lower Chinle aquifers have been sorted based upon whether or not they have been affected by the alluvial groundwater inflow. Data from the non-affected wells have been segregated into the Upper Chinle Non-Mixing Zone, Middle Chinle Non-Mixing Zone, and Lower Chinle Non-Mixing Zone datasets. The datasets were then used in defining natural background levels for the constituents of concern for these zones. The data from the affected wells have been grouped together and labeled as "Chinle Mixing Zone" data, and used to define the natural background levels for this mixing zone. The term "affected" is not meant to convey that a well has been impacted by tailings seepage, only alluvial groundwater inflow.

Samples were collected at wells in the Chinle aquifers from 1979 to 2003. A total of 31 wells provided the data to construct the datasets. Close examination of the groundwater database provided justification for elimination of select samples. Samples were eliminated based upon high detection limits, reported zero concentrations, no reported values, and extreme maximum and minimum concentrations (outliers). Only a minor percentage of samples were eliminated; the completeness of the dataset was not compromised.

Statistical analyses were performed on the individual datasets (constituent and zone specific) to determine distribution, statistical similarities between data, and upper tolerance limits. Results of the distribution analysis indicated that all but one dataset were nonparametrically distributed. The Upper Chinle Non-Mixing Zone sulfate dataset was determined to be parametrically distributed.

The 95th percentile was calculated as the nonparametric upper tolerance limit for nonparametric datasets and the Parametric Upper Tolerance Limit at a 95% confidence level was calculated for the parametric dataset. These results are used to define the natural background levels of the Chinle aquifers. If sample concentrations are greater than their respective upper tolerance limit (UTL), contamination may be indicated. However, it should be noted that since the 95th percentile and confidence level was calculated as the upper tolerance limit, statistically 5% of the time one would expect the upper tolerance limit to be exceeded. A summary table of the parameter, dataset, distribution, 95th percentile, range, arithmetic mean and number of samples is provided for all constituents except total radium as Table ES-1. The summary table for total radium, which includes results for dissolved Ra-226 and Ra-228, is provided as Table ES-2.

Table ES-1. Chinle Aquifer Statistical Analyses Summary Table

Parameter	Dataset	Distribution	95th Percentile or PUTL	Range		Arithmetic Mean	Number of Samples
				From	To		
U-nat	Upper	Nonparametric	0.09	0.0007	0.3610	0.031	166
	Middle	Nonparametric	0.07	0.0034	0.1357	0.019	190
	Lower	Nonparametric	0.02	0.0010	0.0260	0.012	60
	Mixing	Nonparametric	0.18	0.0020	0.2312	0.065	96
Selenium	Upper	Nonparametric	0.06	< 0.001	0.244	0.017	165
	Middle	Nonparametric	0.07	< 0.001	0.222	0.016	192
	Lower	Nonparametric	0.32	< 0.005	0.362	0.066	59
	Mixing	Nonparametric	0.14	< 0.001	0.520	0.048	96
Molybdenum	Upper	Nonparametric	0.08	< 0.01	0.235	0.027	143
	Middle	Nonparametric	0.05	< 0.01	0.150	0.022	166
	Lower	Nonparametric	0.03	< 0.01	< 0.03	0.015	32
	Mixing	Nonparametric	0.10	< 0.01	0.13	0.030	67
TDS	Upper	Nonparametric	2010	920	2160	1613	166
	Middle	Nonparametric	1557	560	1970	1273	187
	Lower	Nonparametric	4141	805	4180	2181	58
	Mixing	Nonparametric	3137	976	3217	1935	94
Sulfate	Upper	Parametric	914	535	998	747	167
	Middle	Nonparametric	857	319	1430	654	192
	Lower	Nonparametric	2002	284	2140	991	60
	Mixing	Nonparametric	1750	409	1880	1028	96
Nitrate	Upper	Nonparametric	4.89	< 0.01	7.9	1.21	124
	Middle	Nonparametric	4.00	0.04	5.02	1.08	138
	Lower	Nonparametric	2.99	< 0.1	3.2	0.87	27
	Mixing	Nonparametric	15.31	< 0.1	21.8	3.87	58
Chloride	Upper	Nonparametric	412	21	540	142	127
	Middle	Nonparametric	63	< 0.01	85	40	143
	Lower	Nonparametric	634	46	657	204	28
	Mixing	Nonparametric	96	8.5	114	62	60
Vanadium	Upper	Nonparametric	0.02	< 0.01	< 0.1	0.007	39
	Middle	Nonparametric	0.02	< 0.01	< 0.1	0.080	41
	Lower	Nonparametric	0.01	< 0.01	0.01	0.005	16
	Mixing	Nonparametric	0.08	< 0.01	< 0.1	0.008	26
Thorium 230	Upper	Nonparametric	0.55	< 0.1	0.90	0.150	35
	Middle	Nonparametric	0.86	< 0.1	1.10	0.219	35
	Lower	Nonparametric	0.72	< 0.02	0.80	0.229	17
	Mixing	Nonparametric	0.97	< 0.02	0.80	0.213	24

Notes:

1 Results are in mg/L for all constituents except Th-230. Th-230 results in pCi/L.

2 Upper: Upper Chinle Non-Mixing Zone
Middle: Middle Chinle Non-Mixing Zone
Lower: Lower Chinle Non-Mixing Zone
Mixing: Chinle Mixing Zone

Table ES-2. Chinle Aquifer Statistical Analyses Summary Table for Radium

Parameter	Dataset	Distribution	95th Percentile or PUTL	Range		Arithmetic Mean	Number of Samples
				From	To		
Total Radium	Upper	Nonparametric	3.66	< 0.6	4.7	1.77	17
	Middle	Nonparametric	2.20	< 0.2	2.8	1.46	33
	Lower	Nonparametric	3.24	0.3	4.3	1.46	35
	Mixing	Nonparametric	3.53	< 0.6	4.3	1.86	24
Ra-226	Upper	Nonparametric	1.00	< 0.2	1.4	0.506	17
	Middle	Nonparametric	0.46	0.1	0.9	0.424	33
	Lower	Nonparametric	0.63	0.1	1.0	0.267	35
	Mixing	Nonparametric	1.34	0.2	2.3	0.567	24
Ra-228	Upper	Nonparametric	2.66	< 1.0	4.1	1.265	17
	Middle	Nonparametric	1.74	< 0.1	2.5	1.033	33
	Lower	Nonparametric	2.61	0.1	4.0	1.189	35
	Mixing	Nonparametric	2.19	< 1.0	3.9	1.296	24

Notes:

1 Results are in pCi/L.

2 Upper: Upper Chinle Non-Mixing Zone
Middle: Middle Chinle Non-Mixing Zone
Lower: Lower Chinle Non-Mixing Zone
Mixing: Chinle Mixing Zone

1.0 Introduction

Natural uranium, selenium, molybdenum, TDS, sulfates, nitrates, chloride, vanadium, thorium and radium are key contaminants introduced into the shallow groundwater as a result of the processing of uranium ore at the Homestake site, located near Grants, New Mexico. Because of their mobility, these constituents are used to track contaminant plume migration downgradient of the site. However, extensive mineralized areas upgradient of the site serve as a natural source of these same constituents in the alluvial groundwater. The purpose of this report is to statistically characterize concentrations of the aforementioned contaminants in the Upper Chinle Non-Mixing Zone, Middle Chinle Non-Mixing Zone, Lower Chinle Non-Mixing Zone and the Chinle Mixing Zone.

This report was prepared at the request of Homestake Mining Company. Homestake Mining Company provided the chemical analysis data, and George Hoffman from Hydro-Engineering, a contractor for the Homestake site, provided the well location maps presented in this report as well as other valuable information, both printed and verbal, used in this assessment.

1.1 Monitor Well Network

The monitor well locations are shown on three figures. The locations of the Upper Chinle Non-Mixing Zone are shown on Figure 1-1. The Middle Chinle Non-Mixing Zone well locations are shown on Figure 1-2. The Lower Chinle Non-Mixing Zone well locations are shown on Figure 1-3. All wells are located within two miles of the site and are found on all sides of the site. The Chinle Mixing Zone wells are shown throughout the three figures. The well sampling frequency varied by well and year, but generally most wells were sampled at least twice per year through 2003.

Figure 1-1 shows the location of the five Upper Chinle aquifer monitor wells for which groundwater quality data were provided. Upper Chinle Non-Mixing Zone wells 0931, 0934, CW3, CW13 and CW18 are located within approximately one mile of the site. Data are available for water samples collected at well 931 from 1982 to 2000. Data at well 934 are available for water samples collected from 1982 to 2003. Data from well CW3 are available for water samples collected from 1984 through 2001. Well CW3 samples collected after 2001 were not used. The constituent concentrations are elevated due to continuous pumping at that well. Data at wells CW13 and CW18 are available for water samples collected from 1994 and 1995, respectively, to 2003.

Figure 1-2 shows the locations of the six Middle Chinle aquifer monitor wells for which groundwater quality data were provided. The Middle Chinle Non-Mixing Zone wells ACW, CW1, CW2, CW14, CW28 and WCW are all located within approximately one mile of the site. Sample data for well ACW are available for water samples collected for the period from 1979 to 1994. Data for wells CW1 and CW2 are available for water samples collected from 1982 to 2003. Water sample data from well CW14 consists of results from three sample dates, all in early 1995. Well CW28 data consists of water sample results from 1995 to 2003. Data for well WCW are available for water samples collected from 1980 to 2000.

Figure 1-3 shows the six Lower Chinle Non-Mixing Zone monitor wells. These six Lower Chinle wells are CW26, CW29, CW31, CW32, CW33 and CW41. All of these wells are located approximately one to two miles southwest of the site. All of the data from these wells are from water samples collected from 1995 to 2002, with the exception of CW41. CW41 data are from water samples collected from 1996 to 1998.

The thirteen Chinle Mixing Zone wells from which water sample data are provided are shown throughout Figures 1-1, 1-2, and 1-3. The wells are CW9, CW10, CW15, CW17 CW24, CW35, CW36, CW37, CW39, CW43, CW50, CW52 and WR25. Data are available from water samples collected at well CW9 from 1987 to 2000. Data for well CW10 are available for water samples collected from 1987 to 1994. Data are available for water samples collected from wells CW15, CW17 and CW35 from 1995 to 2002. Data are available for water samples collected at wells CW24 and WR25 for the period 1995 to 2000. Data for water samples collected from wells CW36 and CW39 are available for the period from 1995 to 1998. The data from well CW37 are available for water samples collected from 1996 to 2002. The data from water samples collected at well CW43 were collected from 1997 to 2002. Water sampling of wells CW50 and CW52 began in mid 2003.

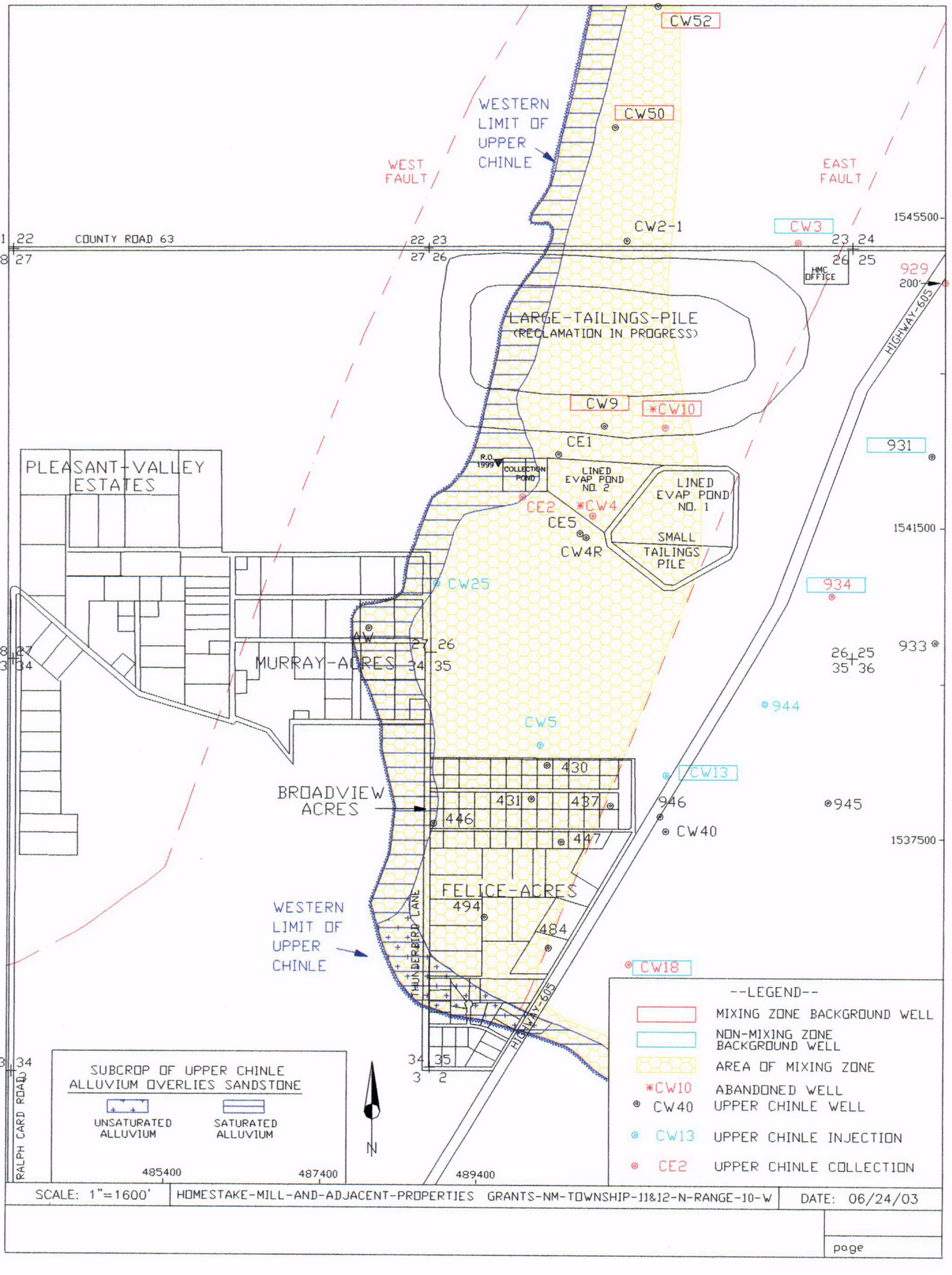

Figure 1-1 Upper Chinle Non-Mixing and Mixing Zone Well Locations

C01

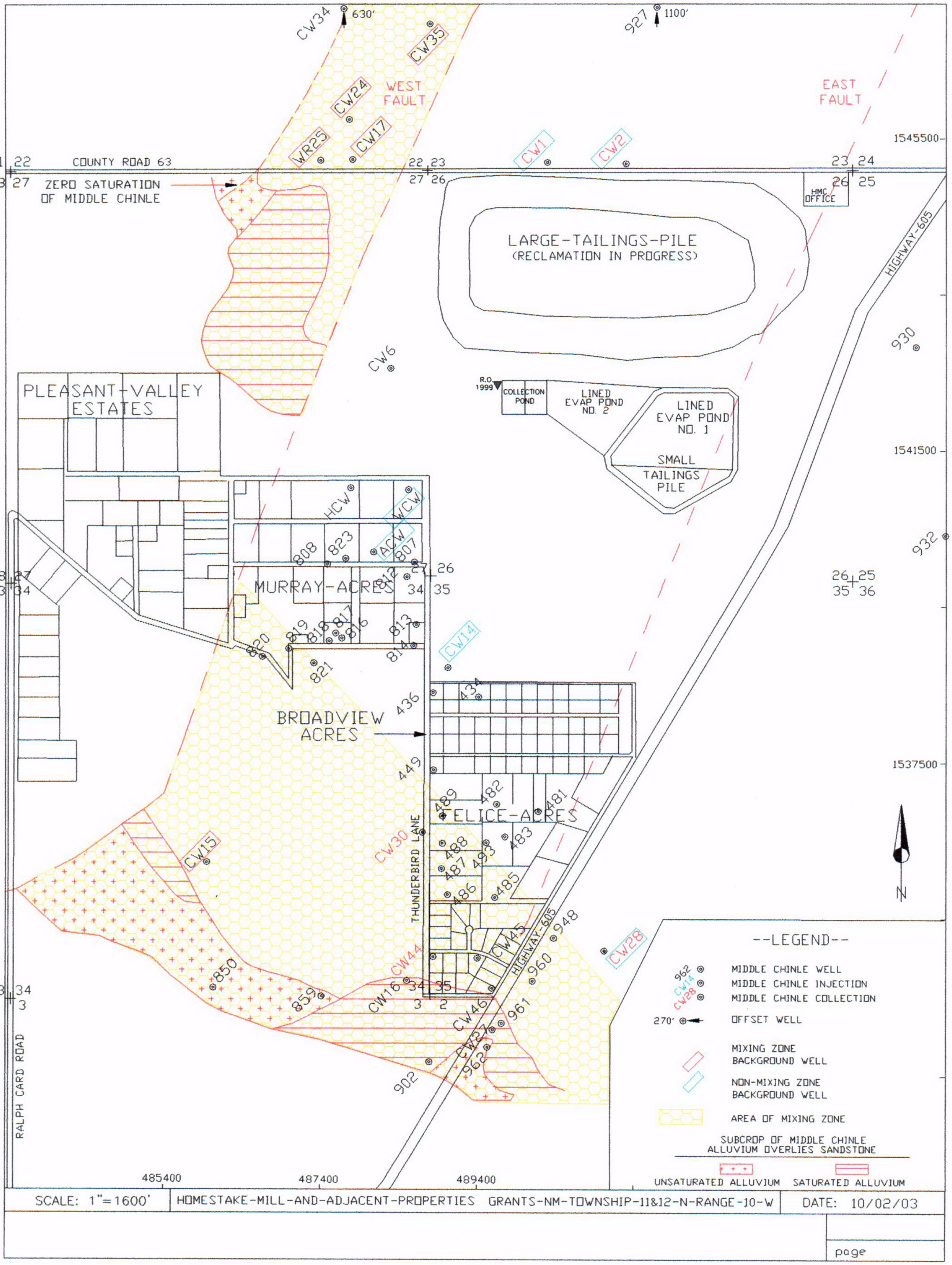

Figure 1-2 Middle Chinle Non-Mixing and Mixing Zone Well Locations

C02

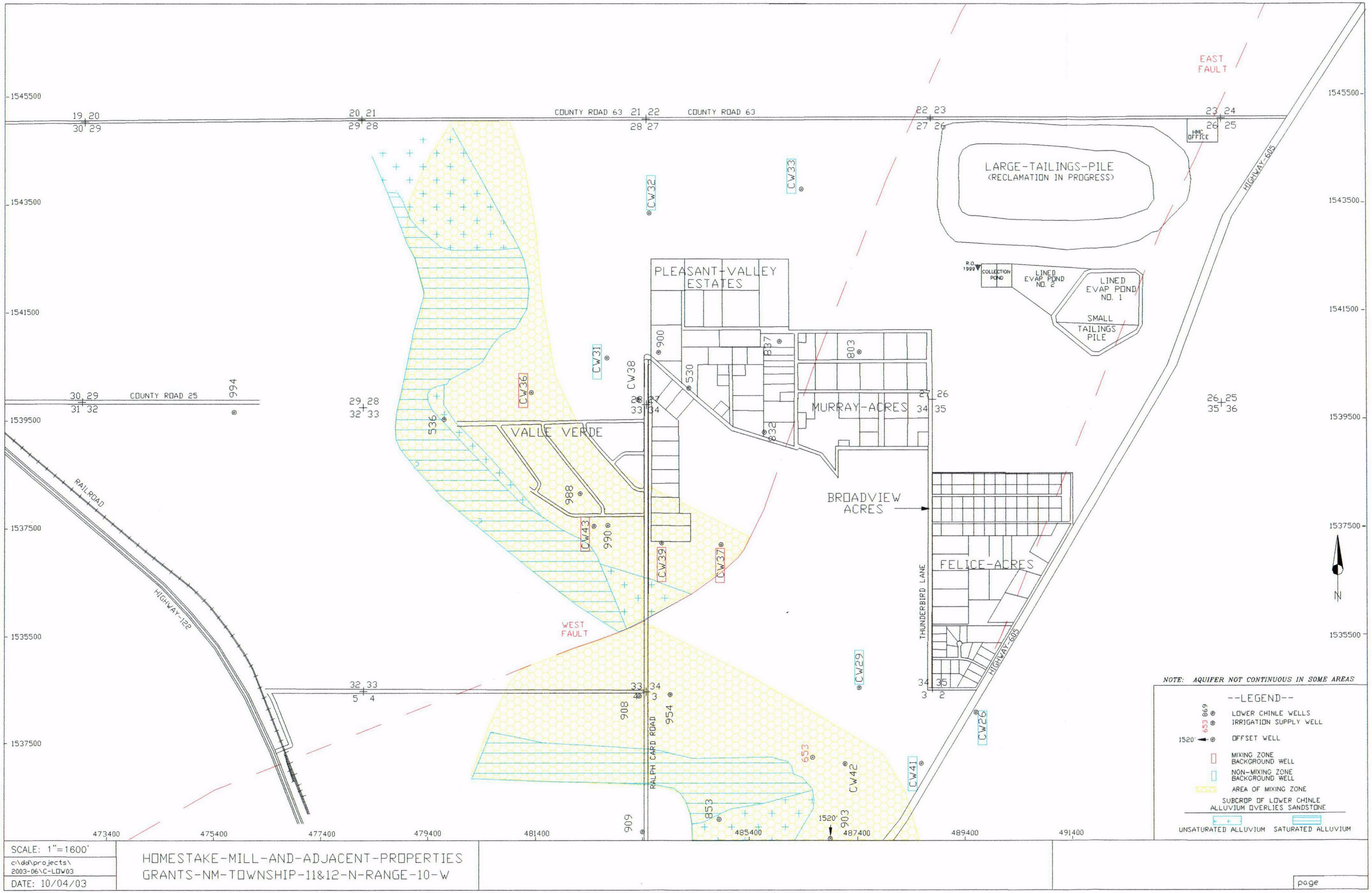

Figure 1-3 Lower Chinle Non-Mixing and Mixing Zone Well Locations

C03

1.2 Data Preparation

The database consists of analytical results with descriptive information in seven fields of: well identification number, sample date, measured parameter, laboratory identification where the sample was processed, remark code (qualifiers), lab code, and concentration (mg/L and pCi/L). There is one deviation from this format. Total radium analytical results consist of both Ra-226 and Ra-228 results.

Examination of the database revealed isolated problems with individual data values. For example, Th-230 data for Upper Chinle Wells 931 (9/18/89), 934 (9/18/89) and CW3 (9/15/89 and 11/29/98) were omitted as uninformative because zero concentrations were reported. The same was true for Middle Chinle Wells 930 (9/15/89), WCW (10/20/89), CW2 (12/1/89), ACW (12/19/89) and CW2 (8/7/90). Total Radium data for Upper Chinle Well CW3 (8/7/1990) was omitted due to a zero concentration reported for Ra-226. Duplicate Middle Chinle Well sample results for ACW (12/19/1989) were also omitted as uninformative due to a zero concentration reported for Ra-228.

The data used for statistical evaluation, including those data that were subsequently excluded, are presented for each constituent in tabular form in Appendix C.

2.0 Methods

2.1 Distribution Analyses

A distribution analysis was performed to determine if a particular dataset was parametric or nonparametric. The data first were subjected to an *a priori* screen (Section 2.1.1). The number of non-detects was then evaluated for the dataset (Section 2.1.2). If greater than 15% non-detects existed, the dataset was considered nonparametric and the distribution analysis was concluded. If fewer than 15% non-detects existed, the data were subjected to six numerical and two graphical procedures to determine the distribution type. The numerical procedures included the coefficient of variation (Section 2.1.3), the Studentized range test (Section 2.1.4), Geary's test (Section 2.1.5), the coefficient of skewness (Section 2.1.6), the Shapiro-Wilk Test of Normality if the sample size was less than or equal to 50 or the Shapiro-Francia test if the sample size was greater than 50 (Section 2.1.7), and Filliben's statistic (Section 2.1.8). The graphical procedures used were the histogram (Section 2.1.9) and the probability plot (Section 2.1.10). The results of the procedures were compared and the distribution was determined (Section 2.1.11). The T_n statistic was then calculated for the datasets that were normally, or near normally, distributed as a second screening mechanism for outliers (Section 2.1.12). If a dataset contained fewer than 15% non-detects but failed the numerical and graphical procedures for a parametric distribution, the dataset was often carried through to the T_n statistic procedure to determine if outliers were present. In some instances, outliers are identified and removed during the T_n statistic procedure causing a dataset that had initially failed to pass the parametric numerical and graphical tests. If outliers were identified during the T_n statistical test, the outliers were removed and the mean and standard deviation were recalculated for the dataset, and the distribution analysis was performed again.

2.1.1 Rejection of Outliers: *A Priori* Test

The *a priori* test is a screening test used to eliminate outliers before the distribution analysis is performed. This test is applied to all data whether parametric or nonparametric. An observation that is 4 or 5 times as large as the rest of the data is generally considered suspect (EPA 1989). Conservatively, for this *a priori* test, outliers are defined as maximum values greater than three times the next highest value. Non-transformed data are used for this screening test. If a data value fails the *a priori* test, it is removed from the dataset for all following statistical analyses. The data point, however, must be explained as potential sampling error, laboratory error, an anomalously high value, or some other factor contributing to an unexpectedly "high concentration".

2.1.2 Determination of Percent Non-detects

If the percentage of non-detects was less than 15%, the non-detect was replaced by the detection limit divided by two. A parametric distribution analyses was then performed on the modified dataset. If the percentage of non-detects was greater than 15%, the distribution was considered nonparametric and a distribution analysis was not performed (EPA 1989, 1992).

2.1.3 Coefficient of Variation

The coefficient of variation (CV) is a unitless measure that determines dispersion for a set of data. The CV is commonly used in environmental statistical analyses because variability (expressed as a standard deviation) is often proportional to the mean. The CV may be used to determine whether or not the data follow a normal curve by comparing the sample CV to 1. EPA guidance (EPA 1998) suggests that the use of the CV is most valid for non-negative data. If the CV is greater than 1, the normality of the data is considered suspect. However, this method cannot be used to conclude the opposite, i.e. the distribution is normal if the CV is less than 1 (EPA 1998). This test was used as a preliminary screening test in conjunction with other more powerful distribution determining tests. The CV was calculated by dividing the standard deviation by the mean. Further information is provided in Guidance for Data Quality Assessment, Practical Methods for Data Analysis (EPA 1998).

The following formula is used to calculate CV:

$$CV = \frac{s}{\overline{X}}$$

where,

CV = coefficient of variation
s = standard deviation, and
$\overline{X}$ = sample mean

2.1.4 Studentized Range Test

Almost 100% of the area of a normal curve lies within ± 5 standard deviations from the mean. The Studentized range test for normality was developed based on this fact. This test compares the range of the sample (w) divided by the sample standard deviation (s) to a critical value range. If (w/s) exists outside of the critical value range, the dataset fails the test. The Studentized range test does not perform well if the data are asymmetric. If the data appear to be lognormally distributed the test should not be applied (EPA 1998).

The following formula is used to perform the Studentized Range Test:

$$\frac{w}{s} = \frac{X_n - X_1}{s}$$

where,

w/s = sample range divided by the sample standard deviation
X_n = the maximum value of the dataset
X_1 = the minimum value of the dataset, and
s = the sample standard deviation

2.1.5 Geary's Test

Another numerical test utilized for normality testing was Geary's test. Geary's test uses the ratio of the mean deviation of the sample to the sample standard deviation. This ratio is then adjusted to approximate a standard normal distribution (EPA 1998). A "Z" value is calculated from the sample mean, the sample sum of squares, and the sum of absolute deviations. The "Z" value is then compared to a critical value such that if the absolute value of "Z" is greater than the critical value, the test indicates that the data do not follow a normal distribution.

The following formulas are used in Geary's Test. The first procedure is to calculate the sample mean:

$$\overline{X} = \frac{1}{n}\sum_{i=1}^{n} X_i$$

where,

$\overline{X}$ = the sample mean
X_i = the individual sample within the dataset, and
n = the number of samples within the dataset

The second procedure is to calculate the sample sum of squares:

$$SSS = \sum_{i=1}^{n} X_i^2 - \frac{\left(\sum_{i=1}^{n} X_i\right)^2}{n}$$

where,

SSS = sample sum of squares
X_i = the individual sample within the dataset, and
n = the number of samples within the dataset

The third procedure is to calculate the sum of absolute deviations:

$$SAD = \sum_{i=1}^{n} \left| X_i - \bar{X} \right|$$

where,

SAD = sum of the absolute deviations
$\bar{X}$ = the sample mean
X_i = the individual sample within the dataset, and
n = the number of samples within the dataset

The fourth procedure is to calculate Geary's test statistic:

$$a = \frac{SAD}{\sqrt{n(SSS)}}$$

where,

a = Geary's test statistic
SAD = sum of the absolute deviations
SSS = sample sum of squares, and
n = the number of samples within the dataset

The final step in performing Geary's test is to test "a" for significance by computing:

$$Z = \frac{a - 0.7979}{0.2123/\sqrt{n}}$$

where,

Z = test of "a" for significance
a = Geary's test statistic, and
n = the number of samples within the dataset

2.1.6 Coefficient of Skewness

The coefficient of skewness indicates to what degree a dataset is skewed or asymmetric with respect to the mean. Data from a perfectly shaped normal distribution have a coefficient of skewness of zero, while asymmetric data have either positive or negative skewness depending on whether the right- or left-hand tail of the distribution is longer and "skinnier" than the opposite tail. A small degree of skewness (between -1 and +1) is not likely to affect the results of statistical tests based on an assumption of normality. However, if the coefficient of skewness is larger than 1 (in absolute value) and the sample size is small (e.g., n<25), statistical research has shown that standard normal theory-based tests are much less powerful than when the absolute skewness is less than 1 (Gayen, 1949). Therefore, it is considered a failure of the test for normality if the coefficient of skewness exceeds 1. The formula for the coefficient of skewness γ_i is shown below, where n is the number of data points, x_i is an individual sample observation, $\bar{x}$ is the mean of the dataset, and σ is the standard deviation.

$$\gamma_i = \frac{\frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^3}{\left(\frac{n-1}{n}\right)^{\frac{3}{2}}(\sigma)^3}$$

The Coefficient of Skewness can also be used to evaluate whether the distribution of a dataset is more normal or lognormal, based on the closeness of γ_i to zero.

When performing this test using the EPA statistical analysis software application, Data Quality Evaluation Statistical Toolbox (DataQUEST), calculates the coefficient of skewness at the same time as the coefficient of kurtosis. Due to the coefficient of skewness being calculated with an additional test, the value generated is not comparable with the individually calculated coefficient of skewness. The absolute value of the coefficient of skewness calculated with DataQUEST is compared to 2.576. If the absolute value of the coefficient is greater than 2.576 then the dataset fails the test. It the absolute value of the calculated coefficient falls below 2.576 then further testing is warranted.

Because the DataQUEST application has a maximum population limit of 150, datasets with a population of greater than 150 were calculated using a spreadsheet.

2.1.7 Shapiro-Wilk ($n \leq 50$) or Shapiro-Francia ($n > 50$) Test of Normality

The Shapiro-Wilk Test of Normality is based on the premise that, if a set of data is normally distributed, the ordered values should be highly correlative with corresponding quantiles taken from a normal distribution (Shapiro and Wilk, 1965). In particular, the Shapiro-Wilk Test of Normality gives substantial weight to evidence of non-normality in the tails of a distribution, where the robustness of statistical tests based on the normality assumption is the most severely affected (EPA, 1992).

The Shapiro-Wilk test statistic (W) will tend to be large (close to 1) when the data are normally distributed. Only when the plotted data show significant bends or curves will the test statistic be small. The Shapiro-Wilk Test of Normality is considered to be one of the best available tests of normality (Miller, 1986; Madansky, 1988).

The following formula is used to calculate W:

$$W = \left[\frac{b}{\sigma\sqrt{n-1}}\right]^2$$

where,

$$b = \sum_{i=1}^{k} b_i = \sum_{i=1}^{k} a_{n-i+1}\left(x_{(n-i+1)} - x_i\right)$$

and σ = standard deviation,
n = number of data points,
a_{n-i+1} = coefficients determined from Table A-1in EPA (1992) for $3 \leq n \leq 50$
k = greatest integer less than or equal to n/2

Normality of the data should be rejected if the Shapiro-Wilk statistic is too low when compared to the critical values provided in Table A-2 (EPA, 1992). Otherwise, the data are assumed to be approximately normal for purposes of further statistical analysis.

The Shapiro-Francia Test of Normality is also based on the premise that, if a set of data is normally distributed, the ordered values should be highly correlative with corresponding quantiles taken from a normal distribution (Shapiro and Francia 1972).

The Shapiro-Francia test statistic (W') will tend to be large (close to 1) when the data is normally distributed. Only when the plotted data show significant bends or curves will the test statistic be small. Normality of the data should be rejected if the Shapiro-Francia statistic is below calculated critical values (EPA 1992). Otherwise, the data are assumed to be approximately normal for purposes of further statistical analysis.

The following formula is used to calculate W':

$$W' = \frac{\left[\Sigma_i m_i x_i\right]^2}{(n-1)SD^2 \Sigma_i m_i^2}$$

where,

W' = test statistic

x_i = represents the ith ordered value of the sample

n = the number of samples within the dataset

SD = the sample standard deviation

m_i = the approximated expected value of the ith ordered Normal quantile.

The values for m_i can be approximately computed as

$$m_i = \Phi^{-1}\left(\frac{i}{n+1}\right)$$

where,

m_i = the approximated expected value of the ith ordered Normal quantile

Φ^{-1} = the inverse of the standard Normal distribution with zero mean and unit variance

n = the number of samples within the dataset

2.1.8 Filliben's Statistic

Filliben's statistic is approximately equivalent to the Shapiro-Wilk and Shapiro-Francia tests as described by Filliben (1975). This test correlates well with the use of probability plots, because the essence of the test is to compute the common correlation coefficient for points on a probability plot (EPA 1992). Since the correlation coefficient is a measure of the linearity of the points on a scatterplot, Filliben's statistic will be high when the plotted points fall along a straight line and low when there are significant bends and curves in the probability plot. Comparison of the Shapiro-Wilk and Filliben's statistic has indicated very similar statistical power for detecting non-normality (Ryan and Joiner, 1976). Critical values for the correlation coefficient have been derived in EPA 1992. If the calculated value is less than the critical value, there is significant evidence of non-normality.

Filliben's statistic may be computed as:

$$r = \frac{\Sigma_{i=1}^{n} X_i M_i}{\left(\sqrt{\Sigma_i M_i^2}\right)(SD)\left(\sqrt{n-1}\right)}$$

where,

r = Filliben's statistic

X_i = represents the ith smallest ordered concentration value

n = the number of samples within the dataset

SD = the sample standard deviation

M_i = the median of the ith order statistic from a standard Normal distribution.

The ith Normal order statistic median may be approximated as $M_i = \Phi^{-1}(m_i)$, where as before Φ^{-1} is the inverse of the standard Normal cumulative distribution and m_i can be can be computed as follows (given sample size n):

$$m_i = 1 - (0.5^{1/n}) \quad \text{for } i = 1$$

$$m_i = (i - 0.3175)/(n + 0.365) \quad \text{for } 1 < i < n$$

$$m_i = 0.5^{1/n} \quad \text{for } i = n$$

2.1.9 Histograms

Histograms are useful for visually determining whether the datasets are skewed, and if so, in what direction. Histograms are created by determining the range of sample concentrations, then dividing the concentration range into equal intervals. Samples are then placed into the appropriate concentration intervals. The concentration range forms the x-axis. Calculating the percentage of samples per concentration interval compared to the total number of samples, or simply plotting the number of data values that fall within an interval, provides the y-axis in terms of percent frequency or frequency, respectively, of a particular concentration interval.

2.1.10 Probability Plots

Another simple and useful graphical test for determining normality is to plot the data on probability paper. The y-axis is scaled to represent probabilities according to the normal distribution, and the data are arranged in increasing order. An observed value is plotted on the x-axis, and the proportion of observations less than or equal to each observed value is plotted as the y-coordinate. The scale is constructed so that, if the data are normal, the points when plotted will approximate a straight line. Visually apparent curves or bends indicate that the data do not follow a normal distribution (EPA, 1992).

Probability plots are particularly useful for spotting irregularities within the data when compared to a specific distributional model such as the normal distribution. It is easy to determine whether departures from normality are occurring more or less in the middle ranges of the data or in the extreme tails. Probability plots can also indicate the presence of possible outlier values that do not follow the basic pattern of the data and can show the presence of significant positive or negative skewness.

The probability for a particular data value x is calculated as

$$\text{Probability} = 100*((i-3/8)/(n+1/4))$$

where,

i = ranked order of x_i from i to n
n = number of samples

2.2. Determination of Distribution

Upon completion of the *a priori* screen, percent non-detect determination, and graphical and numerical distribution analysis, a determination of the distribution was made (EPA, 1992).

2.2.1 The T_n Statistic Test

The T_n Statistic test was performed on each dataset after the *a priori* screen and initial distribution analysis had been completed. The test was run iteratively until the largest remaining value in the dataset passed. If a particular dataset had fewer than 15% non-detects but failed the parametric distribution tests, it was often carried over to the T_n Statistic and

analyzed using the parametric distribution that it most closely resembled. In some instances, identification and removal of outliers during the T_n Statistic procedure allows for the previously failed dataset to pass the parametric numerical and graphical tests. If failures were reported during the T_n statistical test, the failing values were removed, the mean and standard deviation recalculated on the censored dataset, and all distributional analyses performed again. Failures of the T_n Statistic are defined as T_n calculated values that exceed the critical value (EPA, 1989). The censored dataset was then used for all additional statistical tests. (Removed data points are considered potential sampling error, laboratory error, an anomalously high value, or some other factor contributing to an unexpectedly large concentration).

To calculate the T_n statistic, the following formula is used:

$$T_n = \frac{(x_n - \bar{x})}{\sigma}$$

where

T_n = T_n statistic,
x_n = individual sample,
$\bar{x}$ = mean of sample set, and
σ = standard deviation.

2.3 Determination of Upper Tolerance Limit

This section describes two methods, one for parametric data and the other for nonparametric data that establish the maximum expected background concentration using a 95 percent confidence limit. A parametric upper tolerance limit (Section 2.1.13.1) is calculated for parametric datasets, while a 95th percentile (considered a nonparametric upper tolerance limit) (Section 2.1.13.2) is calculated for nonparametric datasets.

2.3.1 Parametric Upper Tolerance Limit

A tolerance interval establishes a concentration range that is constructed to contain a specified proportion (P%) of the population with a specified confidence coefficient, Y. The proportion of the population included, P, is referred to as the coverage. The probability with which the tolerance interval includes the proportion P% of the population is referred to as the tolerance coefficient.

Coverage of 95% was used as recommended by EPA (1989). By using this coverage, random observations from the same distribution would exceed the upper tolerance limit less than 5% of the time. Similarly, a tolerance coefficient of 95% was used. This means that there is a confidence level of 95% that the upper 95% tolerance limit would contain at least 95% of the distribution of observations from background groundwater data. These values were chosen to be consistent with the performance standards described in Section 2 of EPA 1989.

Tolerance intervals were constructed assuming that the data or the transformed data were normally distributed.

The formula for the UTL is as follows:

$$UTL = \bar{x} + t_{.05(n-1)} \cdot \sigma$$

where

$\bar{x}$ = the mean of the population,
$t_{.05(n-1)}$ is one-sided tolerance factor for n (Table 5, Appendix B, EPA 1989), and
σ = the standard deviation

2.3.2 95th Percentile

For nonparametric datasets, the 95th percentile value is used for expressing the upper range of background. The 95th percentile indicates that 95 percent of the data would be expected to be below that value, while 5 percent would be above the value. The calculated background is therefore insensitive to the magnitude of the largest 5 percent of the data points.

Percentiles can be calculated in several similar manners. EPA 1998 provides one method of calculating percentiles. The 95th percentile presented in this report was calculated electronically by the Microsoft Excel software program (Microsoft 1992).

3.0 Constituent Background Concentrations in Chinle Non-Mixing and Mixing Zone Aquifers

The data provided in Appendix C were processed using the test sequence and the methods presented in Section 2 of this report. The various test results for the Upper Chinle Non-Mixing Zone aquifer are discussed in detail in Section 3.1 with the results also shown in Tables A-1 through A-9 of Appendix A and Figures B-1 through B-12 of Appendix B. A summary of the Hypothesis testing is also presented in Table A-9, "Cumulative Test Results for Upper Chinle Non-Mixing Zone". This table shows the logic flow as leading to the results of the distribution analysis.

The results for the other aquifers have been abbreviated by discussing only the interesting aspects of the analyses and relying on the reader to find the values in the corresponding tables in Appendix A and corresponding charts in Appendix B. The results of the upper 95-percentile confidence level for nonparametric datasets, or the parametric upper tolerance limit for the parametric dataset, for all analyses of all constituents except total radium, are given in Table 3-1. The results for total radium, including Ra-226 and Ra-228, are given in Table 3-2.

3.1 Upper Chinle Non-Mixing Zone

3.1.1 Uranium

Uranium concentration data for the Upper Chinle wells were characterized by over 15 percent non-detects at laboratory detection limits of 0.00848 and 0.01 mg/L. The Upper Chinle uranium dataset consists of 166 sample results.

3.1.1.1 Distribution Analysis Results

No outliers were identified or eliminated from the dataset. The *a priori* test compares the two highest sample results for closeness. An *a priori* test ratio of 2.4 was calculated indicating the highest test result was not at least three times higher than the second highest test result, and therefore elimination of the highest test result was not warranted based solely on this test. Results of the *a priori* test are presented in Table A-1 of Appendix A.

Because the Upper Chinle dataset had greater than 15% non-detects, the data were considered to be nonparametric (EPA 1989). Thus, no distribution tests were applied to these data. The data were assumed nonparametric and the 95th percentile was calculated. The results for the Percent Non-detects test are shown in Table A-2, found in Appendix A.

3.1.1.2 Determination of Upper Tolerance Limit

3.1.1.2.1 95th Percentile

The Upper Chinle 95th percentile was determined to be 0.09 mg/L. The table summarizing all upper tolerance limit test results is presented as Table 3-1.

3.1.2 Selenium

Selenium concentration data for the Upper Chinle wells were characterized by 45 percent non-detects at laboratory detection limits of 0.001, 0.002, 0.005, 0.0075, 0.01, and 0.0125 mg/L. The Upper Chinle selenium dataset consists of 165 sample results.

3.1.2.1 Distribution Analysis Results

No outliers were identified or eliminated from the dataset. The *a priori* test compares the two highest sample results for closeness. An *a priori* test ratio of 1.3 was calculated indicating the highest test result was not at least three times higher than the second highest test result, and therefore elimination of the highest test result was not warranted based solely on this test. Results of the *a priori* test are presented in Table A-1 of Appendix A.

Table 3-1 Chinle Aquifer Statistical Analyses Summary Table

Parameter	Dataset	Distribution	95th Percentile or PUTL	Range		Arithmetic Mean	Number of Samples
				From	To		
U-nat	Upper	Nonparametric	0.09	0.0007	0.3610	0.031	166
	Middle	Nonparametric	0.07	0.0034	0.1357	0.019	190
	Lower	Nonparametric	0.02	0.0010	0.0260	0.012	60
	Mixing	Nonparametric	0.18	0.0020	0.2312	0.065	96
Selenium	Upper	Nonparametric	0.06	< 0.001	0.244	0.017	165
	Middle	Nonparametric	0.07	< 0.001	0.222	0.016	192
	Lower	Nonparametric	0.32	< 0.005	0.362	0.066	59
	Mixing	Nonparametric	0.14	< 0.001	0.520	0.048	96
Molybdenum	Upper	Nonparametric	0.08	< 0.01	0.235	0.027	143
	Middle	Nonparametric	0.05	< 0.01	0.150	0.022	166
	Lower	Nonparametric	0.03	< 0.01	< 0.03	0.015	32
	Mixing	Nonparametric	0.10	< 0.01	0.13	0.030	67
TDS	Upper	Nonparametric	2010	920	2160	1613	166
	Middle	Nonparametric	1557	560	1970	1273	187
	Lower	Nonparametric	4141	805	4180	2181	58
	Mixing	Nonparametric	3137	976	3217	1935	94
Sulfate	Upper	Parametric	914	535	998	747	167
	Middle	Nonparametric	857	319	1430	654	192
	Lower	Nonparametric	2002	284	2140	991	60
	Mixing	Nonparametric	1750	409	1880	1028	96
Nitrate	Upper	Nonparametric	4.89	< 0.01	7.9	1.21	124
	Middle	Nonparametric	4.00	0.04	5.02	1.08	138
	Lower	Nonparametric	2.99	< 0.1	3.2	0.87	27
	Mixing	Nonparametric	15.31	< 0.1	21.8	3.87	58
Chlorine	Upper	Nonparametric	412	21	540	142	127
	Middle	Nonparametric	63	< 0.01	85	40	143
	Lower	Nonparametric	634	46	657	204	28
	Mixing	Nonparametric	96	8.5	114	62	60
Vanadium	Upper	Nonparametric	0.02	< 0.01	< 0.1	0.007	39
	Middle	Nonparametric	0.02	< 0.01	< 0.1	0.080	41
	Lower	Nonparametric	0.01	< 0.01	0.01	0.005	16
	Mixing	Nonparametric	0.08	< 0.01	< 0.1	0.008	26
Thorium 230	Upper	Nonparametric	0.55	< 0.1	0.90	0.150	35
	Middle	Nonparametric	0.86	< 0.1	1.10	0.219	35
	Lower	Nonparametric	0.72	< 0.02	0.80	0.229	17
	Mixing	Nonparametric	0.97	< 0.02	0.80	0.213	24

Notes:

1 Results are in mg/L for all constituents except Th-230. Th-230 results in pCi/L.

2 Upper: Upper Chinle Non-Mixing Zone
Middle: Middle Chinle Non-Mixing Zone
Lower: Lower Chinle Non-Mixing Zone
Mixing: Chinle Mixing Zone

Table 3-2 Chinle Aquifer Statistical Analyses Summary Table for Radium

Parameter	Dataset	Distribution	95th Percentile or PUTL	Range		Arithmetic Mean	Number of Samples
				From	To		
Total Radium	Upper	Nonparametric	3.66	< 0.6	4.7	1.77	17
	Middle	Nonparametric	2.20	< 0.2	2.8	1.46	33
	Lower	Nonparametric	3.24	0.3	4.3	1.46	35
	Mixing	Nonparametric	3.53	< 0.6	4.3	1.86	24
Ra-226	Upper	Nonparametric	1.00	< 0.2	1.4	0.506	17
	Middle	Nonparametric	0.46	0.1	0.9	0.424	33
	Lower	Nonparametric	0.63	0.1	1.0	0.267	35
	Mixing	Nonparametric	1.34	0.2	2.3	0.567	24
Ra-228	Upper	Nonparametric	2.66	< 1.0	4.1	1.265	17
	Middle	Nonparametric	1.74	< 0.1	2.5	1.033	33
	Lower	Nonparametric	2.61	0.1	4.0	1.189	35
	Mixing	Nonparametric	2.19	< 1.0	3.9	1.296	24

Notes:

1 Results are in pCi/L.

2 Upper: Upper Chinle Non-Mixing Zone
Middle: Middle Chinle Non-Mixing Zone
Lower: Lower Chinle Non-Mixing Zone
Mixing: Chinle Mixing Zone

Because the Upper Chinle dataset had greater than 15% non-detects, the data were considered to be nonparametric (EPA 1989). Thus, no distribution tests were applied to these data. The data were assumed nonparametric and the 95th percentile was calculated. The results for the Percent Non-detects test are shown in Table A-2 in Appendix A.

3.1.2.2 Determination of Upper Tolerance Limit

3.1.2.2.1 95th Percentile

The Upper Chinle 95th percentile was determined to be 0.06 mg/L. The table summarizing all upper tolerance limit test results is presented as Table 3-1.

3.1.3 Molybdenum

Molybdenum concentration data for the Upper Chinle wells were characterized by over 40 percent non-detects at laboratory detection limits of 0.01, 0.03, 0.05, and 0.1 mg/L. The Upper Chinle molybdenum dataset consists of 143 sample results.

3.1.3.1 Distribution Analysis Results

No outliers were identified or eliminated from the dataset. The *a priori* test compares the two highest sample results for closeness. An *a priori* test ratio of 1.0 was calculated indicating the highest test result was not at least three times higher than the second highest test result, and therefore elimination of the highest test result was not warranted based solely on this test. Results of the *a priori* test are presented in Table A-1 of Appendix A.

Because the Upper Chinle dataset had greater than 15% non-detects, the data were considered to be nonparametric (EPA 1989). Thus, no distribution tests were applied to these data. The data were assumed nonparametric and the 95th percentile was calculated. The results for the Percent Non-detects test are shown in Table A-2 in Appendix A.

3.1.3.2 Determination of Upper Tolerance Limit

3.1.3.2.1 95th Percentile

The Upper Chinle 95th percentile was determined to be 0.08 mg/L. The table summarizing all upper tolerance limit test results is presented as Table 3-1.

3.1.4 Total Dissolved Solids (TDS)

TDS concentration data for the Upper Chinle wells were characterized by zero percent non-detects. The Upper Chinle TDS dataset consists of 166 sample results.

3.1.4.1 Distribution Analysis Results

No outliers were identified or eliminated from the dataset. The *a priori* test compares the two highest sample results for closeness. An *a priori* test ratio of 1.0 was calculated indicating the highest test result was not at least three times higher than the second highest test result, and therefore elimination of the highest test result was not warranted based solely on this test. Results of the *a priori* test are presented in Table A-1 of Appendix A.

There were zero non-detects in the Upper Chinle TDS dataset. Because the dataset had less than 15 percent non-detects distribution tests were applied. The results for the Percent Non-detects test are shown in Table A-2 in Appendix A.

3.1.4.1.1 Coefficient of Variation

The regular and log-transformed datasets passed the CV screen. The CV value was 0.14 for the regular data, and 0.02 for the log-transformed data, compared to a critical value of 1. According to EPA 1998, if the CV is less than 1, the data

may be normal and warrants further analysis. The coefficient of variation results are presented in Table A-3 in Appendix A.

3.1.4.1.2 Studentized Range Test

The regular dataset passed the Studentized range test. The calculated range (w) for the regular dataset divided by its standard deviation (s) produced a result of 5.59. The critical value range for a 95 percent confidence level and a population size of 166 is 4.65 to 6.25. When (w/s) falls inside the critical range it implies that the data may possibly be modeled by a normal curve (EPA 1998).

The log-transformed dataset failed the Studentized range test. The calculated range (w) for the log-transformed dataset divided by its standard deviation (s) produced a result of 6.29. When (w/s) falls outside the critical range, it implies that the data are not well modeled by a normal curve (EPA 1998). The Studentized range test results are shown in Table A-6 of Appendix A.

3.1.4.1.3 Geary's Test

The Geary's test on the Upper Chinle well data for TDS was not performed. This test is run on the EPA statistical application DataQUEST. DataQUEST has a dataset population limit of 150 sample results and the TDS dataset consists of 166 sample results.

3.1.4.1.4 Coefficient of Skewness

The regular and log-transformed datasets both passed the coefficient of skewness test. The calculated coefficient of skewness was 0.53 for the regular dataset and 0.08 for the log-transformed dataset. An acceptable value for a coefficient of skewness would fall in the range of -1 to 1. Both coefficients of skewness were within the acceptable range therefore a normal distribution may accurately approximate both datasets (EPA 1992). The calculated coefficients of skewness are shown in Table A-6 in Appendix A.

3.1.4.1.5 Shapiro-Francia (n >50) Test of Normality

The regular and log-transformed datasets failed the Shapiro-Francia test for normality. The calculated W' value was 0.937 for the regular dataset and 0.944 for the log-transformed dataset. The critical value for a 95 percent confidence level and a population size of 166 is 0.985. With both calculated W' values falling below the critical value, normality for both datasets was rejected (EPA 1992). These results are presented in Table A-7 in Appendix A.

3.1.4.1.6 Filliben's Statistic

The Filliben's Statistic test on the Upper Chinle well data for TDS was not performed. This test is run on the EPA statistical application DataQUEST. DataQUEST has a dataset population limit of 100 sample results for this test and the TDS dataset consists of 166 sample results.

3.1.4.1.7 Histograms

Figure B-1 shows the histogram of the Upper Chinle TDS regular dataset. The histogram shows an uneven distribution of data with a right skew. This histogram implies that the data may not follow a normal distribution and the assumption of normality could provide a poor approximation of the dataset.

Figure B-2 depicts the histogram for the log-transformed dataset. This figure also depicts a right skewness implying that the log-transformed data may not follow a normal distribution and the assumption of normality could also provide a poor approximation of the dataset.

3.1.4.1.8 Probability Plots

Figure B-3 shows the probability plot for the Upper Chinle TDS regular dataset. The plot depicts a line of data points with a bend. There are also a number of breaks in the line as the concentration approaches the lower range of results. This implies that the dataset may not follow a normal distribution.

Figure B-4 shows the probability plot for the log-transformed data. This plot also depicts a line with a bend and a number of breaks in it as the concentration approaches the lower range of results. This implies that the log-transformed data may not follow a normal distribution.

3.1.4.2 Determination of Distribution

The distribution analysis results for both the regular and log-transformed datasets were determined to be nonparametric. A summary of the distributional analyses results is shown in Table A-13 in Appendix A. In an attempt to remove outliers and possibly show that the distribution is normal, the regular dataset was chosen for application of the T_n statistic test.

3.1.4.2.1 The T_n Statistic Test

Though the Upper Chinle datasets were determined to be nonparametric, the T_n statistic outlier test was applied to the regular dataset in an attempt to remove any outliers. No outliers were identified using the T_n statistic. The table summarizing the T_n statistic results is presented as Table A-9 in Appendix A.

3.1.4.3 Determination of Upper Tolerance Limit

3.1.4.3.1 95th Percentile

The Upper Chinle 95th percentile was determined to be 2010 mg/L. The table summarizing all upper tolerance limit test results is presented as Table 3-1.

3.1.5 Sulfate

The sulfate concentration data for the Upper Chinle wells were characterized by zero percent non-detects. The Upper Chinle sulfate dataset consists of 167 sample results.

3.1.5.1 Distribution Analysis Results

No outliers were identified or eliminated from the dataset. The *a priori* test compares the two highest sample results for closeness. An *a priori* test ratio of 1.0 was calculated indicating the highest test result was not at least three times higher than the second highest test result, and therefore elimination of the highest test result was not warranted based solely on this test. Results of the *a priori* test are presented in Table A-1 of Appendix A.

Since the dataset had fewer than 15 percent non-detects, distribution tests were applied. The results for the Percent Non-detects test are shown in Table A-2 in Appendix A.

3.1.5.1.1 Coefficient of Variation

The regular and log-transformed datasets passed the CV screen. The CV value was 0.11 for the regular data, and 0.02 for the log-transformed data, compared to a critical value of 1. According to EPA 1998, if the CV is less than 1, the data may be normal and warrant further analysis. The coefficient of variation results are presented in Table A-3 in Appendix A.

3.1.5.1.2 Studentized Range Test

The regular and log-normal datasets passed the Studentized range test. The calculated range (w) for the regular dataset divided by its standard deviation (s) produced a result of 5.49. The calculated range (w) for the log-transformed dataset divided by its standard deviation (s) produced a result of 5.45. The critical value range for a 95 percent confidence level and a population size of 167 is 4.65 to 6.25. When (w/s) falls inside the critical range it implies that the data may possibly be modeled by a normal curve (EPA 1998). The Studentized range test results are shown in Table A-4 of Appendix A.

3.1.5.1.3 Geary's Test

The Geary's test on the Upper Chinle well data for sulfate was not performed. This test is run on the EPA statistical application DataQUEST. DataQUEST has a dataset population limit of 150 sample results and the sulfate dataset consists of 167 sample results.

3.1.5.1.4 Coefficient of Skewness

The regular and log-transformed datasets passed the coefficient of skewness test. The calculated coefficient of skewness was 0.09 for the regular dataset and -0.31 for the log-transformed dataset. An acceptable value for a coefficient of skewness falls in the range of -1 to 1. Both coefficients of skewness were within the acceptable range therefore a normal distribution may accurately approximate both datasets (EPA 1992). The calculated coefficients of skewness are shown in Table A-6 in Appendix A.

3.1.5.1.5 Shapiro-Francia (n >50) Test of Normality

The regular dataset passed the Shapiro-Francia test for normality. The calculated W' value was 0.989. The critical value for a 95 percent confidence level and a population size of 167 is 0.985. With the calculated W' value above the critical value, normality for the regular dataset can not be rejected (EPA 1992). These results are presented in Table A-7 in Appendix A.

The log-transformed dataset failed the Shapiro-Francia test for normality. The calculated W' value was 0.984 for the log-transformed dataset. The critical value for a 95 percent confidence level and a population size of 167 is 0.985. With the calculated W' value falling below the critical value, normality for the log-normal dataset was rejected (EPA 1992). These results are presented in Table A-7 in Appendix A.

3.1.5.1.6 Filliben's Statistic

The Filliben's Statistic test on the Upper Chinle well data for sulfate was not performed. This test is run on the EPA statistical application DataQUEST. DataQUEST has a dataset population limit of 100 sample results for this test and the sulfate dataset consists of 167 sample results.

3.1.5.1.7 Histograms

Figure B-5 shows the histogram of the Upper Chinle sulfate regular dataset. The histogram shows a symmetrical distribution of data with no skew. This histogram implies that the data may follow a normal distribution.

Figure B-6 depicts the histogram for the log-transformed dataset. This figure also depicts a slight right skewness implying a normal distribution may provide a poor approximation of the dataset

3.1.5.1.8 Probability Plots

Figure B-7 shows the probability plot for the Upper Chinle sulfate regular dataset. The plot depicts a line of data points with a slight bend and a few breaks at the upper and lower range of the results. This probability plot is not the ideal

example of what a perfectly normal dataset would look like but it isn't necessarily a failure either. The plot implies that the dataset may or may not follow a normal distribution.

Figure B-8 shows the probability plot for the log-transformed data. This plot also depicts a line with a slight bend and a few breaks in it as the concentration approaches the upper and lower range of results. This plot implies that the log-transformed data, like the regular data, may or may not follow a normal distribution.

3.1.5.1.9 Determination of Distribution

Based on the distribution analysis results of both the regular and log-transformed datasets, the regular dataset is considered to be parametric. The log-transformed data is considered to be nonparametric. A summary of the distributional analyses results is shown in Table A-9 in Appendix A. Since the regular dataset was found to be parametric, no T_n statistic test was performed.

3.1.5.2. Determination of Upper Tolerance Limit

3.1.5.2.1 Parametric Upper Tolerance Limit

The Upper Chinle parametric upper tolerance limit was determined to be 914 mg/L. The table summarizing all upper tolerance limit test results is presented as Table 3-1.

3.1.6 Nitrate

Nitrate concentration data for the Upper Chinle wells were characterized by over 30 percent non-detects at laboratory detection limits of 0.01, 0.1 and 1.0 mg/L. The Upper Chinle nitrate dataset consists of 124 sample results.

3.1.6.1 Distribution Analysis Results

No outliers were identified or eliminated from the dataset. The *a priori* test compares the two highest sample results for closeness. An *a priori* test ratio of 1.2 was calculated indicating the highest test result was not at least three times higher than the second highest test result, and therefore elimination of the highest test result was not warranted based solely on this test. Results of the *a priori* test are presented in Table A-1 of Appendix A.

Because the Upper Chinle dataset had greater than 15% non-detects, the data were considered to be nonparametric (EPA 1989). Thus, no distribution tests were applied to these data. The data were assumed nonparametric and the 95th percentile was calculated. The results for the Percent Non-detects test are shown in Table A-2, found in Appendix A.

3.1.6.2 Determination of Upper Tolerance Limit

3.1.6.2.1 95th Percentile

The Upper Chinle 95th percentile was determined to be 4.89 mg/L. The table summarizing all upper tolerance limit test results is presented as Table 3-1.

3.1.7 Chloride

Chloride concentration data for the Upper Chinle wells were characterized by zero percent non-detects The Upper Chinle chloride dataset consists of 127 sample results

3.1.7.1 Distribution Analysis Results

No outliers were identified or eliminated from the dataset. The *a priori* test compares the two highest sample results for closeness. An *a priori* test ratio of 1.0 was calculated indicating the highest test result was not at least three times higher

than the second highest test result, and therefore elimination of the highest test result was not warranted based solely on this test. Results of the *a priori* test are presented in Table A-1 of Appendix A.

There were zero non-detects in the Upper Chinle chloride dataset. Because the dataset had less than 15 percent non-detects distribution tests were applied. The results for the Percent Non-detects test are shown in Table A-2 in Appendix A.

3.1.7.1.1 Coefficient of Variation

The regular and log-transformed datasets passed the CV screen. The CV value was 0.94 for the regular data, and 0.20 for the log-transformed data, compared to a critical value of 1. According to EPA 1998, if the CV is less than 1, the data may be normal and warrants further analysis. The coefficient of variation results are presented in Table A-3 in Appendix A.

3.1.7.1.2 Studentized Range Test

The regular and log-transformed datasets failed the Studentized range test. The calculated range (w) for the regular dataset divided by its standard deviation (s) produced a result of 3.88 for the regular dataset and 3.52 for the log-transformed dataset. The critical value range for a 95 percent confidence level and a population size of 127 is 4.42 to 6.05. When (w/s) falls outside the critical range, it implies that the data are not well modeled by a normal curve (EPA 1998). The Studentized range test results are shown in Table A-4 of Appendix A.

3.1.7.1.3 Geary's Test

The Geary's test on the Upper Chinle well data for chloride was performed using the EPA statistical application DataQUEST. For the regular dataset DataQUEST returned a sample value of 1.27 compared to a table value of 1.65. With the sample value less than the table value, there was not enough evidence to reject the assumption of normality with a 5 percent significance level. The results of Geary's test are presented in Table A-5 of Appendix A.

For the log-transformed dataset DataQUEST returned a sample value of 6.23 compared to a table value of 1.65. With the sample value greater than the table value, non-lognormality was detected at a 5 percent significance level.

3.1.7.1.4 Coefficient of Skewness

The regular dataset failed the coefficient of skewness test. The calculated coefficient of skewness was 1.22 for the regular dataset. An acceptable value for a coefficient of skewness would fall in the range of -1 to 1. Since the coefficient of skewness does not fall within the acceptable range, a normal distribution will not accurately approximate the dataset (EPA 1992).

The log-transformed dataset passed the coefficient of skewness test. The calculated coefficient of skewness was 0.37 for the log-transformed dataset. Since the coefficient of skewness was within the acceptable range a normal distribution may accurately approximate the log-transformed dataset (EPA 1992). The calculated coefficients of skewness are shown in Table A-6 in Appendix A.

3.1.7.1.5 Shapiro-Francia (n >50) Test of Normality

The regular and log-transformed datasets failed the Shapiro-Francia test for normality. The calculated W' value was 0.80 for the regular dataset and 0.90 for the log-transformed dataset. The critical value for a 95 percent confidence level and a population size of 127 is 0.985. With both calculated W' values falling below the critical value, normality for both datasets was rejected (EPA 1992). These results are presented in Table A-7 in Appendix A.

3.1.7.1.6 Filliben's Statistic

The Filliben's Statistic test was not performed on the Upper Chinle well data for chloride. This test is run on the EPA statistical application DataQUEST. DataQUEST has a dataset population limit of 100 sample results for this test and the chloride dataset consists of 127 sample results.

3.1.7.1.7 Histograms

Figure B-9 shows the histogram of the Upper Chinle chloride regular dataset. The histogram shows an uneven distribution of data with strong left skew. This histogram implies that the data may not follow a normal distribution and the assumption of normality could provide a poor approximation of the dataset.

Figure B-10 depicts the histogram for the log-transformed dataset. This figure also depicts a strong left skewness implying that the log-transformed data may not follow a normal distribution and the assumption of normality could also provide a poor approximation of the dataset

3.1.7.1.8 Probability Plots

Figure B-11 shows the probability plot for the Upper Chinle chloride regular dataset. The plot depicts a line of data points with a dramatic bend. There are also several breaks in the line throughout the entire range of results. This implies that the dataset may not follow a normal distribution.

Figure B-12 shows the probability plot for the log-transformed data. This plot also depicts a line with a bend and several breaks in it throughout the entire range of results. This implies that the log-transformed data may not follow a normal distribution.

3.1.7.2 Determination of Distribution

Based on the distribution analysis results for both the regular and log-transformed datasets, both are considered to be nonparametric. A summary of the distributional analyses results is shown in Table A-9 in Appendix A. For the purpose of selecting the dataset to further analyze for distribution using the T_n statistic and performing an upper tolerance limit calculation, a choice of which dataset best approximates normality must be made even though both datasets show poor approximation of normality. Based on the previous distributional analyses results, the log-transformed dataset is found to most closely follow a normal distribution.

3.1.7.2.1 The T_n Statistic Test

Though the Upper Chinle datasets were determined to be nonparametric, the T_n statistic outlier test was applied to the regular dataset in an attempt to remove any outliers. No outliers were identified using the T_n statistic. The table summarizing the T_n statistic results is presented as Table A-13 in Appendix A.

3.1.7.3 Determination of Upper Tolerance Limit

3.1.7.3.1 95th Percentile

The Upper Chinle 95th percentile was determined to be 412 mg/L. The table summarizing all upper tolerance limit test results is presented as Table 3-1.

3.1.8 Vanadium

Vanadium concentration data for the Upper Chinle wells were characterized by 100 percent non-detects at laboratory detection limits of 0.1 and 1.0 mg/L. The Upper Chinle selenium dataset consists of 39 sample results.

3.1.8.1 Distribution Analysis Results

No outliers were identified or eliminated from the dataset. The *a priori* test compares the two highest sample results for closeness. For this reason, neither result was omitted as an outlier even though a non-detect result of 0.1 mg/L is a factor of ten higher than the rest of the data values below the non-detect limit of 0.01 mg/L. Results of the *a priori* test are presented in Table A-1 of Appendix A.

Because the Upper Chinle dataset had greater than 15% non-detects, the data were considered to be nonparametric (EPA 1989). Thus, no distribution tests were applied to these data. The data were assumed nonparametric and the 95th percentile was calculated. The results for the Percent Non-detects test are shown in Table A-2 in Appendix A.

3.1.8.2 Determination of Upper Tolerance Limit

3.1.8.2.1 95th Percentile

The Upper Chinle 95th percentile was determined to be 0.02 mg/L. This result is the 95th percentile of the combined 37 "< 0.01" non-detect values and the two "< 0.10" non-detect values. The table summarizing all upper tolerance limit test results is presented as Table 3-1.

3.1.9 Thorium-230

Four sample results were removed from the thorium-230 dataset due to reported values of zero. These four samples are listed in Table A-13 in Appendix A.

Thorium-230 concentration data for the Upper Chinle wells were characterized by over 85 percent non-detects at laboratory detection limits of 0.1, 0.2, 0.3, 0.4 and 1.0 pCi/L. The Upper Chinle thorium-230 dataset consists of 35 sample results after the four outliers are removed.

3.1.9.1 Distribution Analysis Results

No outliers were identified or eliminated from the dataset. The *a priori* test compares the two highest sample results for closeness. An *a priori* test ratio of 1.8 was calculated indicating the highest test result was not at least three times higher than the second highest test result, and therefore elimination of the highest test result was not warranted based solely on this test. Results of the *a priori* test are presented in Table A-1 of Appendix A.

Because the Upper Chinle dataset had greater than 15% non-detects, the data were considered to be nonparametric (EPA 1989). Thus, no distribution tests were applied to these data. The data were assumed nonparametric and the 95th percentile was calculated. The results for the Percent Non-detects test are shown in Table A-2 in Appendix A.

3.1.9.2 Determination of Upper Tolerance Limit

3.1.9.2.1 95th Percentile

The Upper Chinle 95th percentile was determined to be 0.55 pCi/L. The table summarizing all upper tolerance limit test results is presented as Table 3-1.

3.1.10 Total Radium

Total radium refers to the dissolved concentrations of both Ra-226 and Ra-228.

One sample result was removed from the Upper Chinle total radium dataset due to a reported value of zero. This sample is listed in Table A-13 in Appendix A.

Total radium concentration data for the Upper Chinle wells were characterized by over 15 percent non-detects for both Ra-226 and Ra-228 at laboratory detection limits of 0.2 pCi/L (Ra-226) and 0.1, 0.9 and 1.0 pCi/L (Ra-228). The Upper Chinle total radium dataset consists of 35 sample results.

3.1.10.1 Distribution Analysis Results

One outlier was identified and eliminated due to failure of the *a priori* test. The *a priori* test compares the two highest sample results for closeness and was performed on each individual radium dataset (Ra-226 and Ra-228) and the combined total radium dataset. If a sample failed either individual or the combined test the entire sample result was removed to ensure no suspect data would be included in the analyses. An *a priori* test ratio of 11.7 (Ra-226) was calculated indicating the highest test result was at least three times higher than the second highest test result, and therefore elimination of the highest test result was warranted based solely on this test. The sample result was removed and the test performed again and the maximum ratio calculated was 1.4. Results of the *a priori* test are presented in Table A-1 of Appendix A.

The Percent Non-detects Test was performed on both the individual data sets (Ra-226 and Ra-228) and the combined total radium dataset. All three test results for the Upper Chinle radium datasets had greater than 15% non-detects, the data were considered to be nonparametric (EPA 1989). Thus, no distribution tests were applied to these data. The data were assumed nonparametric and the 95th percentile was calculated. The results for the Percent Non-detects test are shown in Table A-2, found in Appendix A.

3.1.10.2 Determination of Upper Tolerance Limit

3.1.10.2.1 95th Percentile

The Upper Chinle 95th percentile for total radium is 3.66 pCi/L. This value was calculated by summing the Ra-226 95th percentile and the Ra-228 95th percentile. The table summarizing all upper tolerance limit test results for radium is presented as Table 3-2.

3.2 Middle Chinle Non-Mixing Zone

There were no unusual findings in the distributional analyses of the Middle Chinle datasets. TDS, sulfate and chloride were the only constituents to pass the Determination of Percent Non-detects test. Further distributional analyses were performed on these constituents. The results of all individual tests are shown in Tables A-1 through A-8 in Appendix A. The table of cumulative test results is given in Table A-10.

There were two outliers identified in the TDS dataset. These outliers were identified by the T_n Statistic test, removed from the dataset, and the distributional analyses continued on the updated dataset.

There were ten outliers identified in the nitrate regular dataset. These outliers were identified using the T_1 statistic test. Upon removal of these ten outliers the dataset failed the Determination of Percent Non-detects test and was immediately classified as nonparametric. No further distributional tests were applied to the nitrate dataset.

There were four outliers identified in the chloride dataset. These outliers were identified by the T_n Statistic test, removed from the dataset, and the distributional analyses continued on the updated dataset.

Five sample results were removed from the thorium-230 dataset due to reported values of zero.

Two sample results were removed from the total radium dataset due to reported values of zero (Ra-228) and one outlier was identified by the a priori test and removed from the dataset prior to calculating the 95th percentile (Ra-226).

The aforementioned outliers and zero values are listed in Table A-13 in Appendix A.

3.3 Lower Chinle Non-Mixing Zone

There were no unusual findings in the distributional analyses of the Lower Chinle datasets. Uranium, TDS, sulfate and chloride were the only constituents to pass the Determination of Percent Non-detects test. Further distributional analyses were performed on these constituents. The results of all individual tests are shown in Tables A-1 through A-8 in Appendix A. The table of cumulative test results is given in Table A-11.

There was one outlier identified in the molybdenum dataset. This outlier was identified by the *a priori* test and removed from the dataset prior to calculating the 95th percentile.

There were two outliers identified in the TDS dataset. One outlier was identified by the *a priori* test and removed from the dataset prior to distributional analyses. The second outlier was identified by the T_n Statistic test, removed from the dataset, and the distributional analyses continued on the updated dataset.

There was one outlier identified in the selenium dataset. This outlier was identified by the *a priori* test and removed from the dataset prior to calculating the 95th percentile.

The aforementioned outliers are listed in Table A-13 in Appendix A

3.4 Chinle Mixing Zone

There were no unusual findings in the distributional analyses of the Chinle Mixing Zone datasets. Uranium, selenium, TDS, sulfate and chloride were the only constituents to pass the Determination of Percent Non-detects test. Further distributional analyses were performed on these constituents. The results of all individual tests are shown in Tables A-1 through A-8 in Appendix A. The table of cumulative test results is given in Table A-12.

There was one outlier identified in the TDS dataset. This outlier was identified by the T_n Statistic test, removed from the dataset, and the distributional analyses continued on the updated dataset.

There were two outliers identified in the chloride dataset. The outliers were identified by the T_n Statistic test, removed from the dataset, and the distributional analyses continued on the updated dataset.

There was one outlier identified in the total radium dataset (Ra-226). This outlier was identified by the *a priori* test and removed from the dataset prior to calculating the 95th percentile.

The aforementioned outliers are listed in A-13 in Appendix A

4.0 Summary

Samples were collected at the Chinle Upper, Middle and Lower Non-Mixing Zone wells, and the Chinle Mixing Zone wells, from 1979 to 2003. Five wells provided the Upper Chinle well data. Six wells provided the Middle Chinle data. Six wells provided the Lower Chinle well data. Thirteen wells provided the Chinle Mixing Zone data. Close examination of the groundwater database provided justification for elimination of select samples. Samples were eliminated based upon high detection limits, reported zero concentrations, and extreme maximum concentrations.

Statistical analyses were performed on the individual datasets to determine distribution and upper tolerance limits. Results of the distribution analysis indicated that all datasets were nonparametrically distributed, with the exception of the Upper Chinle sulfate dataset.

The 95th percentile was calculated as the nonparametric upper tolerance limit for all analyzed datasets. For the Upper Chinle sulfate dataset the parametric upper tolerance limit was calculated for a 95 percent confidence level. It should be noted that since the 95th percentile, and 95th percent confidence level, were calculated as the upper tolerance limits, statistically, one would expect the upper tolerance limit to be exceeded 5% of the time. Two summary tables of the parameter, dataset, distribution, 95th percentile, range, and sample number are provided in Section 3 as Tables 3-1 and 3-2.

5.0 References

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Appendix A

Statistical Analyses Tables

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Appendix A - Statistical Analyses Tables

Table A-1 ***A Priori*** **Test Results**

	Upper Chinle Non-Mixing Zone	Middle Chinle Non-Mixing Zone	Lower Chinle Non-Mixing Zone	Chinle Mixing Zone
U-nat	2.4	1.2	1.0	1.0
Se	1.3	2.2	1.1	2.2
Mo	1.0	1.4	1.0	1.0
TDS	1.0	1.1	1.0	1.0
SO_4	1.0	1.0	1.0	1.0
NO_3	1.2	1.0	1.0	1.3
Cl	1.0	1.0	1.0	1.1
V	1.0	1.0	2.0	1.0
Th-230	1.8	1.1	1.1	1.1
Total Radium	1.1	1.5	1.57	1.0
Ra-226	*1.4*	*1.3*	*1.56*	*1.6*
Ra-228	*1.3*	*1.4*	*1.78*	*1.8*

Note:

1. The a priori test results are the ratio of the highest to second highest sample analysis results. A ratio of 3.0, or greater indicates outlier status. The high analysis result is removed and the test run again. The results above are of the final dataset used for distributional analyses. If a sample failed the a priori test it will be listed in Table A-13 as an outlier.

2. The total radium results are calculated by dividing the maximum combined Ra-226 and Ra-228 analytical results by the second highest combined Ra-226 and Ra-228 analytical results. The individual Ra-226 and Ra-228 results are for those individual isotopes exclusively.

Table A-2 Percentage of Non-detects Test Results

	Upper Chinle Non-Mixing Zone	Middle Chinle Non-Mixing Zone	Lower Chinle Non-Mixing Zone	Chinle Mixing Zone
U-nat	0.16	0.32	0.05	0.02
Se	0.45	0.36	0.27	0.14
Mo	0.43	0.31	1.00	0.66
TDS	0.00	0.00	0.00	0.00
SO_4	0.00	0.00	0.00	0.00
NO_3	0.34	0.15	0.33	0.21
Cl	0.00	0.01	0.00	0.00
V	1.00	0.93	0.94	1.00
Th-230	0.89	0.71	0.77	0.88

Note:

1. The total radium results are calculated by counting as non-detect only the samples that had non-detects for both Ra-226 and Ra-228. The individual Ra-226 and Ra-228 results are for those individual isotopes exclusively.

Table A-3 Coefficient of Variation Test Results

	Upper Chinle Non-Mixing Zone		Middle Chinle Non-Mixing Zone		Lower Chinle Non-Mixing Zone		Chinle Mixing Zone	
	Regular	Ln	Regular	Ln	Regular	Ln	Regular	Ln
U-nat	×	×	×	×	-0.57	-0.18	0.97	-0.35
Se	×	×	×	×	×	×	1.34	-0.35
TDS	0.14	0.02	0.18	0.03	0.58	0.08	0.35	0.05
SO_4	0.11	0.02	0.25	0.04	0.58	0.09	0.39	0.06
Cl	0.94	0.20	0.33	0.23	1.06	0.19	0.30	0.07

Notes:

1. The × symbol indicates test not applicable.

Table A-4 Studentized Range Test Results

			Upper Chinle Non-Mixing Zone		Middle Chinle Non-Mixing Zone		Lower Chinle Non-Mixing Zone		Chinle Mixing Zone	
			Regular	Ln	Regular	Ln	Regular	Ln	Regular	Ln
U-nat	w/s		×	×	×	×	3.71	3.83	3.65	4.12
	Range	From	×	×	×	×	3.96	3.96	4.28	4.28
		To	×	×	×	×	5.51	5.51	5.87	5.87
Se	w/s		×	×	×	×	×	×	8.04	5.27
	Range	From	×	×	×	×	×	×	4.28	4.28
		To	×	×	×	×	×	×	5.87	5.87
TDS	w/s		5.59	6.29	6.25	6.62	2.66	2.85	3.28	3.40
	Range	From	4.65	4.65	4.77	4.77	3.93	3.93	4.27	4.27
		To	6.25	6.25	6.39	6.39	5.48	5.48	5.86	5.86
SO_4	w/s		5.49	5.45	6.85	5.86	3.21	3.35	3.65	3.81
	Range	From	4.65	4.65	4.77	4.77	3.96	3.96	4.28	4.28
		To	6.25	6.25	6.39	6.39	5.51	5.51	5.87	5.87
Cl	w/s		3.88	3.52	6.42	12.04	2.84	2.87	5.57	4.48
	Range	From	4.46	4.46	4.59	4.59	3.40	3.40	3.96	3.96
		To	6.05	6.05	6.18	6.18	4.80	4.80	5.51	5.51

Notes:

1. The × symbol indicates test not applicable.

Table A-5 Geary's Test Results

		Upper Chinle Non-Mixing Zone		Middle Chinle Non-Mixing Zone		Lower Chinle Non-Mixing Zone		Chinle Mixing Zone	
		Regular	Ln	Regular	Ln	Regular	Ln	Regular	Ln
U-nat	Test Statistic	×	×	×	×	2.14	-0.55	2.91	0.86
	Table Value	×	×	×	×	1.65	1.65	1.65	1.65
Se	Test Statistic	×	×	×	×	×	×	-0.49	-0.06
	Table Value	×	×	×	×	×	×	1.65	1.65
TDS	Test Statistic	×	×	×	×	4.32	3.57	2.20	2.70
	Table Value	×	×	×	×	1.65	1.65	1.65	1.65
SO_4	Test Statistic	×	×	×	×	3.54	2.66	1.76	1.77
	Table Value	×	×	×	×	1.65	1.65	1.65	1.65
Cl	Test Statistic	1.27	6.23	-3.41	-1.71	0.79	1.02	-0.35	0.32
	Table Value	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65

Notes:

1. The × symbol indicates test not applicable.

Table A-6 Coefficient of Skewness Test Results

		Upper Chinle Non-Mixing Zone		Middle Chinle Non-Mixing Zone		Lower Chinle Non-Mixing Zone		Chinle Mixing Zone	
		Regular	Ln	Regular	Ln	Regular	Ln	Regular	Ln
U-nat	Test Statistic	×	×	×	×	0.198	-3.942	3.984	-1.154
	Table Value	×	×	×	×	2.576	2.576	2.576	2.576
Se	Test Statistic	×	×	×	×	×	×	6.197	-1.706
	Table Value	×	×	×	×	×	×	2.576	2.576
TDS	Test Statistic	0.53	0.08	-0.22	-0.98	1.781	0.840	2.119	0.449
	Table Value	-1 to 1	-1 to 1	-1 to 1	-1 to 1	2.576	2.576	2.576	2.576
SO_4	Test Statistic	0.09	-0.31	0.33	-0.45	1.876	0.050	2.117	0.437
	Table Value	-1 to 1	-1 to 1	-1 to 1	-1 to 1	2.576	2.576	2.576	2.575
Cl	Test Statistic	1.22	0.37	2.75	0.29	×	×	0.198	0.997
	Table Value	-1 to 1	-1 to 1	2.58	2.58	×	×	2.576	2.575

Notes:

1. The × symbol indicates test not applicable.

Table A-7 Shapiro-Wilk (n ≤ 50) and Shapiro-Francia (n >50) Test Results

		Upper Chinle Non-Mixing Zone		Middle Chinle Non-Mixing Zone		Lower Chinle Non-Mixing Zone		Chinle Mixing Zone	
		Regular	Ln	Regular	Ln	Regular	Ln	Regular	Ln
U-nat	Test Statistic	×	×	×	×	0.980	0.870	0.825	1.974
	Table Value	×	×	×	×	0.963	0.963	0.975	0.975
Se	Test Statistic	×	×	×	×	×	×	0.578	1.896
	Table Value	×	×	×	×	×	×	0.962	0.962
TDS	Test Statistic	0.937	0.944	0.979	0.943	0.823	0.891	0.926	0.962
	Table Value	0.985	0.985	0.985	0.985	0.962	0.962	0.975	0.975
SO_4	Test Statistic	0.989	0.984	0.950	0.961	0.886	0.943	0.946	0.978
	Table Value	0.985	0.985	0.985	0.985	0.962	0.962	0.975	0.975
Cl	Test Statistic	0.804	0.896	0.925	0.387	0.696	0.838	0.977	0.980
	Table Value	0.985	0.985	0.985	0.985	0.924	0.924	0.962	0.962

Notes:

1. The × symbol indicates test not applicable.

Table A-8 Filliben's Statistic Test Results

		Upper Chinle Non-Mixing Zone		Middle Chinle Non-Mixing Zone		Lower Chinle Non-Mixing Zone		Chinle Mixing Zone	
		Regular	Ln	Regular	Ln	Regular	Ln	Regular	Ln
U-nat	Test Statistic	×	×	×	×	0.988	0.928	0.907	0.928
	Table Value	×	×	×	×	0.981	0.981	0.986	0.986
Se	Test Statistic	×	×	×	×	×	×	0.911	0.974
	Table Value	×	×	×	×	×	×	0.981	0.981
TDS	Test Statistic	×	×	×	×	0.903	0.940	0.960	0.978
	Table Value	×	×	×	×	0.981	0.981	0.986	0.986
SO_4	Test Statistic	×	×	×	×	0.938	0.968	0.971	0.987
	Table Value	×	×	×	×	0.981	0.981	0.986	0.981
Cl	Test Statistic	×	×	×	×	0.843	0.928	0.990	0.990
	Table Value	×	×	×	×	0.962	0.962	0.981	0.981

Notes:

1. The × symbol indicates test not applicable.

Table A-9 Cumulative Test Results for Upper Chinle Non-Mixing Zone

	U-nat		Selenium		Molybdenum		TDS		SO_4		NO_3		Cl		Vanadium		Th-230		Total Radium	
	Regular	Ln	Regular	Ln	Regular	Ln	Regular	Ln	Regular	Ln	Regular	Ln	Regular	Ln	Regular	Ln	Regular	Ln	Regular	Ln
A Priori Ratio	Pass	×	Pass	×	Pass	×	Pass	×	Pass	×	Pass	×	Pass	×	Pass	×	Pass	×	Pass	×
Percentage of Non-Detects	Fail		Fail		Fail		Pass		Pass		Fail		Pass		Fail		Fail		Fail	
Coefficient of Variation	×		×		×		TF	TF	TF	TF	×		TF	TF	×		×		×	
Studentized Range Test	×		×		×		TF	Fail	TF	TF	×		Fail	Fail	×		×		×	
Geary's Test	×		×		×		See note 3.		See note 3.		×		TF	Fail	×		×		×	
Coefficient of Skewness	×		×		×		TF	TF	TF	TF	×		Fail	TF	×		×		×	
Shapiro-Wilk or Shapiro-Francia	×		×		×		Fail	Fail	TF	Fail	×		Fail	Fail	×		×		×	
Filliben's Statistic	×		×		×		See note 3.		See note 3.		×		See note 3.		×		×		×	
Histograms	×		×		×		Fail	Fail	TF	Fail	×		Fail	Fail	×		×		×	
Probability Plots	×		×		×		Fail	Fail	TF	TF	×		Fail	Fail	×		×		×	
Dataset Chosen	□		□		□		□		□		□			□	□		□		□	

Notes:

1. A priori and Percentage of Non-detects tests either pass or fail based upon their ratio or percentage. A pass indicates dataset can be forwarded to next step of distributional analyses testing. A failure for the Percent Non-detects test indicates the dataset is nonparametric.
2. The × symbol indicates test not applicable.
3. Test not performed due to DataQUEST population limit.
4. TF indicates not enough evidence to fail the dataset and further testing is warranted.
5. The 'Dataset Chosen' row indicates whether the regular or log-transformed dataset has been chosen to perform the Upper Tolerance Limit testing on. The choice of dataset is based on which dataset is most near normally distributed, which is decided upon review of distibutional analyses results.

Table A-10 Cumulative Test Results for Middle Chinle Non-Mixing Zone

	U-nat		Selenium		Molybdenum		TDS		SO_4		NO_3		Cl		Vanadium		Th-230		Total Radium	
	Regular	Ln	Regular	Ln	Regular	Ln	Regular	Ln	Regular	Ln	Regular	Ln	Regular	Ln	Regular	Ln	Regular	Ln	Regular	Ln
A Priori Ratio	Pass	×	Pass	×	Pass	×	Pass	×	Pass	×	Pass	×	Pass	×	Pass	×	Pass	×	Pass	×
Percentage of Non-Detects	Fail		Fail		Fail		Pass		Pass		Fail		Pass		Fail		Fail		Fail	
Coefficient of Variation	×		×		×		TF	TF	TF	TF	×		TF	TF	×		×		×	
Studentized Range Test	×		×		×		TF	Fail	Fail	TF	×		Fail	Fail	×		×		×	
Geary's Test	×		×		×		See note 3.		See note 3.		×		Fail	Fail	×		×		×	
Coefficient of Skewness	×		×		×		TF	TF	TF	TF	×		Fail	TF	×		×		×	
Shapiro-Wilk or Shapiro-Francia	×		×		×		Fail	Fail	Fail	Fail	×		Fail	Fail	×		×		×	
Filliben's Statistic	×		×		×		See note 3.		See note 3.		×		See note 3.		×		×		×	
Histograms	×		×		×		Fail	Fail	Fail	Fail	×		TF	Fail	×		×		×	
Probability Plots	×		×		×		TF	TF	Fail	Fail	×		Fail	Fail	×		×		×	
Dataset Chosen	□		□		□		□			□	□		□		□		□		□	

Notes:

1. A priori and Percentage of Non-detects tests either pass or fail based upon their ratio or percentage. A pass indicates dataset can be forwarded to next step of distributional analyses testing. A failure for the Percent Non-detects test indicates the dataset is nonparametric.

2. The x symbol indicates test not applicable.

3. Test not performed due to DataQUEST population limit.

4. TF indicates not enough evidence to fail the dataset and further testing is warranted.

5. The 'Dataset Chosen' row indicates whether the regular or log-transformed dataset has been chosen to perform the Upper Tolerance Limit testing on. The choice of dataset is based on which dataset is most near normally distributed, which is decided upon review of distibutional analyses results.

Table A-11 Cumulative Test Results for Lower Chinle Non-Mixing Zone

	U-nat		Selenium		Molybdenum		TDS		SO_4		NO_3		Cl		Vanadium		Th-230		Total Radium	
	Regular	Ln	Regular	Ln	Regular	Ln	Regular	Ln	Regular	Ln	Regular	Ln	Regular	Ln	Regular	Ln	Regular	Ln	Regular	Ln
A Priori Ratio	Pass	x	Pass	x	Pass	x	Pass	x	Pass	x	Pass	x	Pass	x	Pass	x	Pass	x	Pass	x
Percentage of Non-Detects	Pass		Fail		Fail		Pass		Pass		Fail		Pass		Fail		Fail		Fail	
Coefficient of Variation	TF	TF	x		x		TF	TF	TF	TF	x		Fail	TF	x		x		x	
Studentized Range Test	Fail	Fail	x		x		Fail	Fail	Fail	Fail	x		Fail	Fail	x		x		x	
Geary's Test	Fail	TF	x		x		Fail	Fail	Fail	Fail	x		TF	TF	x		x		x	
Coefficient of Skewness	TF	Fail	x		x		TF	TF	TF	TF	x		x		x		x		x	
Shapiro-Wilk or Shapiro-Francia	TF	Fail	x		x		Fail	Fail	Fail	Fail	x		Fail	Fail	x		x		x	
Filliben's Statistic	TF	Fail	x		x		Fail	Fail	Fail	Fail	x		Fail	Fail	x		x		x	
Histograms	Fail	Fail	x		x		Fail	Fail	Fail	Fail	x		TF	Fail	x		x		x	
Probability Plots	Fail	Fail	x		x		Fail	Fail	Fail	Fail	x		Fail	Fail	x		x		x	
Dataset Chosen	0		0		0			0		0	0			0	0		0		0	

Notes:

1. A priori and Percentage of Non-detects tests either pass or fail based upon their ratio or percentage. A pass indicates dataset can be forwarded to next step of distributional analyses testing. A failure for the Percent Non-detects test indicates the dataset is nonparametric.
2. The x symbol indicates test not applicable.
3. Test not performed due to DataQUEST population limit.
4. TF indicates not enough evidence to fail the dataset and further testing is warranted.
5. The 'Dataset Chosen' row indicates whether the regular or log-transformed dataset has been chosen to perform the Upper Tolerance Limit testing on. The choice of dataset is based on which dataset is most near normally distributed, which is decided upon review of distibutional analyses results.

Table A-12 Cumulative Test Results for Chinle Mixing Zone

	U-nat		Selenium		Molybdenum		TDS		SO_4		NO_3		Cl		Vanadium		Th-230		Total Radium	
	Regular	Ln	Regular	Ln	Regular	Ln	Regular	Ln	Regular	Ln	Regular	Ln	Regular	Ln	Regular	Ln	Regular	Ln	Regular	Ln
A Priori Ratio	Pass	×	Pass	×	Pass	×	Pass	×	Pass	×	Pass	×	Pass	×	Pass	×	Pass	×	Pass	×
Percentage of Non-Detects	Pass		Pass		Fail		Pass		Pass		Fail		Pass		Fail		Fail		Fail	
Coefficient of Variation	TF	TF	Fail	TF	×		TF	TF	TF	TF	×		TF	TF	×		×		×	
Studentized Range Test	Fail	Fail	Fail	TF	×		Fail	Fail	Fail	Fail	×		Fail	TF	×		×		×	
Geary's Test	Fail	TF	TF	TF	×		Fail	Fail	Fail	Fail	×		TF	TF	×		×		×	
Coefficient of Skewness	Fail	TF	Fail	TF	×		TF	TF	TF	TF	×		TF	TF	×		×		×	
Shapiro-Wilk or Shapiro-Francia	Fail	TF	Fail	TF	×		Fail	Fail	Fail	TF	×		TF	TF	×		×		×	
Filliben's Statistic	Fail	Fail	Fail	Fail	×		Fail	Fail	Fail	TF	×		TF	TF	×		×		×	
Histograms	Fail	Fail	Fail	Fail	×		Fail	Fail	Fail	Fail	×		Fail	Fail	×		×		×	
Probability Plots	Fail	TF	Fail	TF	×		Fail	Fail	Fail	Fail	×		Fail	Fail	×		×		×	
Dataset Chosen		□		□	□			□		□	□			□	□		□		□	

Notes:

1. A priori and Percentage of Non-detects tests either pass or fail based upon their ratio or percentage. A pass indicates dataset can be forwarded to next step of distributional analyses testing. A failure for the Percent Non-detects test indicates the dataset is nonparametric.
2. The × symbol indicates test not applicable.
3. Test not performed due to DataQUEST population limit.
4. TF indicates not enough evidence to fail the dataset and further testing is warranted.
5. The 'Dataset Chosen' row indicates whether the regular or log-transformed dataset has been chosen to perform the Upper Tolerance Limit testing on. The choice of dataset is based on which dataset is most near normally distributed, which is decided upon review of distibutional analyses results.

Table A-13 Outliers and Zero Values Removed from Datasets

	Constituent	Well	Sample Date	Reason Removed
Upper Chinle Non-Mixing Zone	Th-230	931	09/18/1989	Reported value of zero
	Th-230	934	09/18/1989	Reported value of zero
	Th-230	CW3	09/15/1989	Reported value of zero
	Th-230	CW3	11/29/1989	Reported value of zero
	Total Radium	CW3	02/02/1994	Failed A Priori Test (Ra-228)
	Total Radium	CW3	08/07/1990	Reported value of zero (Ra-226)
Middle Chinle Non-Mixing Zone	NO_3	ACW	07/09/1986	Failed T_n Statistic Test
	NO_3	ACW	12/31/1986	Failed T_n Statistic Test
	NO_3	WCW	07/18/1984	Failed T_n Statistic Test
	NO_3	WCW	11/01/1984	Failed T_n Statistic Test
	NO_3	ACW	11/02/1984	Failed T_n Statistic Test
	NO_3	ACW	05/20/1986	Failed T_n Statistic Test
	NO_3	ACW	03/19/1986	Failed T_n Statistic Test
	NO_3	CW2	10/13/1986	Failed T_n Statistic Test
	NO_3	CW2	01/08/1987	Failed T_n Statistic Test
	NO_3	CW2	06/15/1984	Failed T_n Statistic Test
	TDS	WCW	07/07/1980	Failed T_n Statistic Test
	TDS	CW2	11/04/1996	Failed T_n Statistic Test
	Cl	ACW	07/09/1986	Failed T_n Statistic Test
	Cl	CW28	11/21/1995	Failed T_n Statistic Test
	Cl	CW28	04/13/1995	Failed T_n Statistic Test
	Cl	CW28	04/05/1995	Failed T_n Statistic Test
	Th-230	930	09/15/1989	Reported value of zero
	Th-230	WCW	10/20/1989	Reported value of zero
	Th-230	CW2	12/01/1989	Reported value of zero
	Th-230	ACW	12/19/1989	Reported value of zero
	Th-230	CW2	08/07/1990	Reported value of zero
	Total Radium	ACW	12/19/1989	Reported value of zero (Ra-228)
	Total Radium	ACW	12/19/1989	Reported value of zero (Ra-228)
	Total Radium	CW2	2/3//1995	Failed *A Priori* Test (Ra-226)
Lower Chinle Non-Mixing Zone	Mo	CW26	05/20/1998	Failed *A Priori* Test
	TDS	CW26	11/19/1997	Failed *A* Priori Test
	TDS	CW32	06/02/1999	Failed T_n Statistic Test
	Se	CW32	09/13/1995	Failed *A Priori* Test
Chinle Mixing Zone	TDS	CW35	06/01/1999	Failed T_n Statistic Test
	Cl	WR25	11/28/1995	Failed T_n Statistic Test

Appendix B

Histograms and Probability Plots

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Appendix B - Histograms and Probability Plots

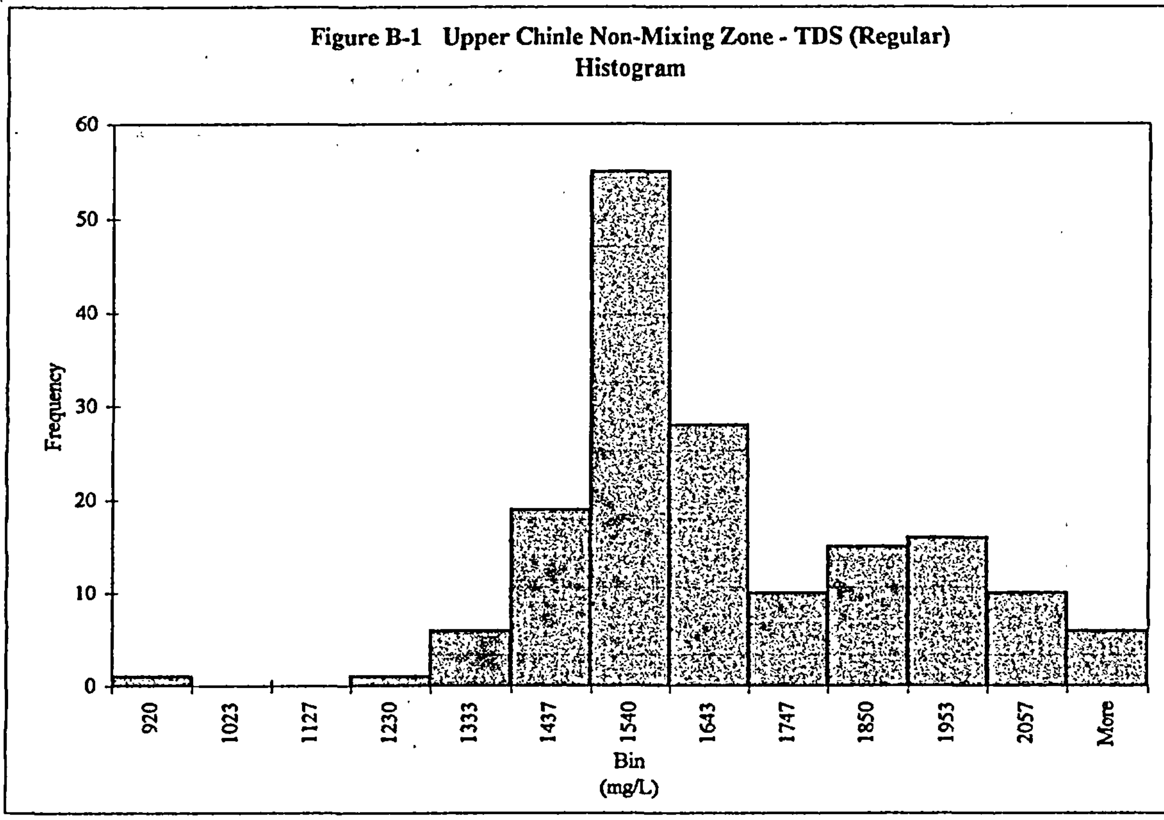


Figure B-1 Upper Chinle Non-Mixing Zone - TDS (Regular)
Histogram
Frequency
0
10
20
30
40
50
60
920
1023
1127
1230
1333
1437
1540
1643
1747
1850
1953
2057
More
Bin
(mg/L)

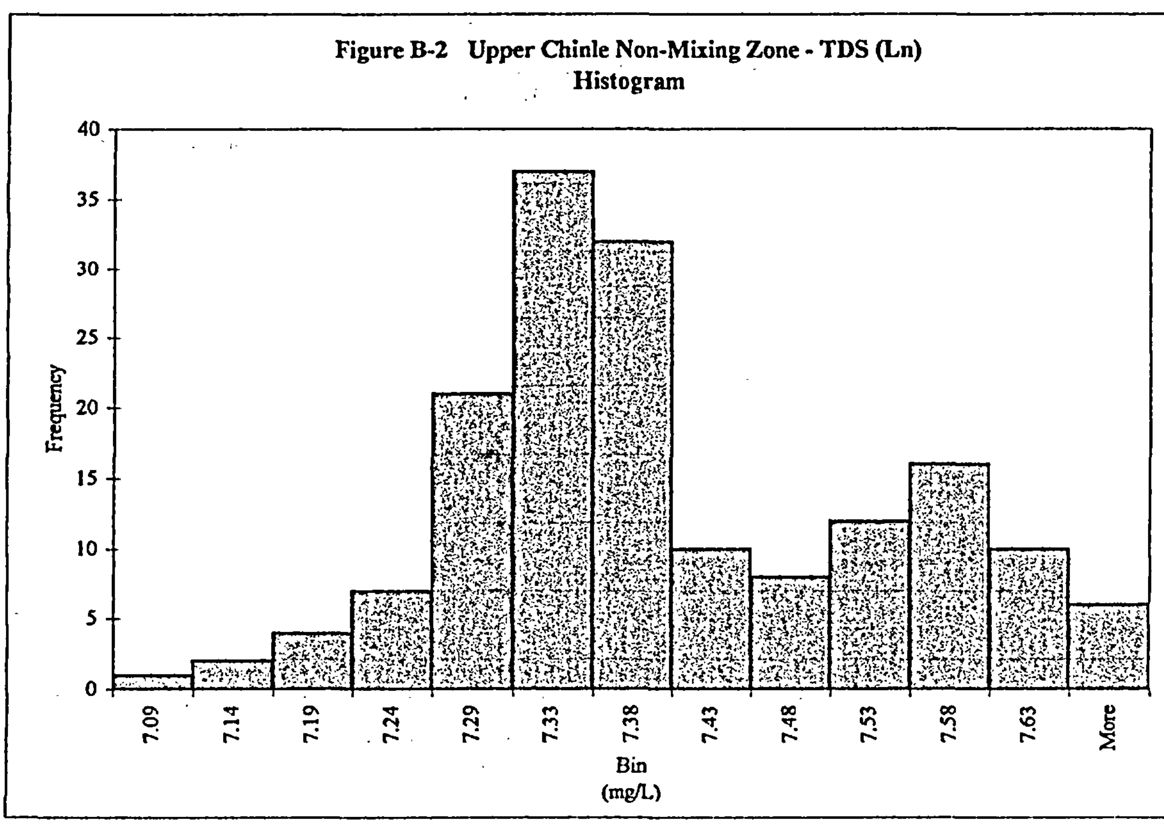


Figure B-2 Upper Chinle Non-Mixing Zone - TDS (Ln)
Histogram
Frequency
0
5
10
15
20
25
30
35
40
7.09
7.14
7.19
7.24
7.29
7.33
7.38
7.43
7.48
7.53
7.58
7.63
More
Bin
(mg/L)

Figure B-3 Upper Chinle Non-Mixing Zone - TDS (Regular)
Probability Plot

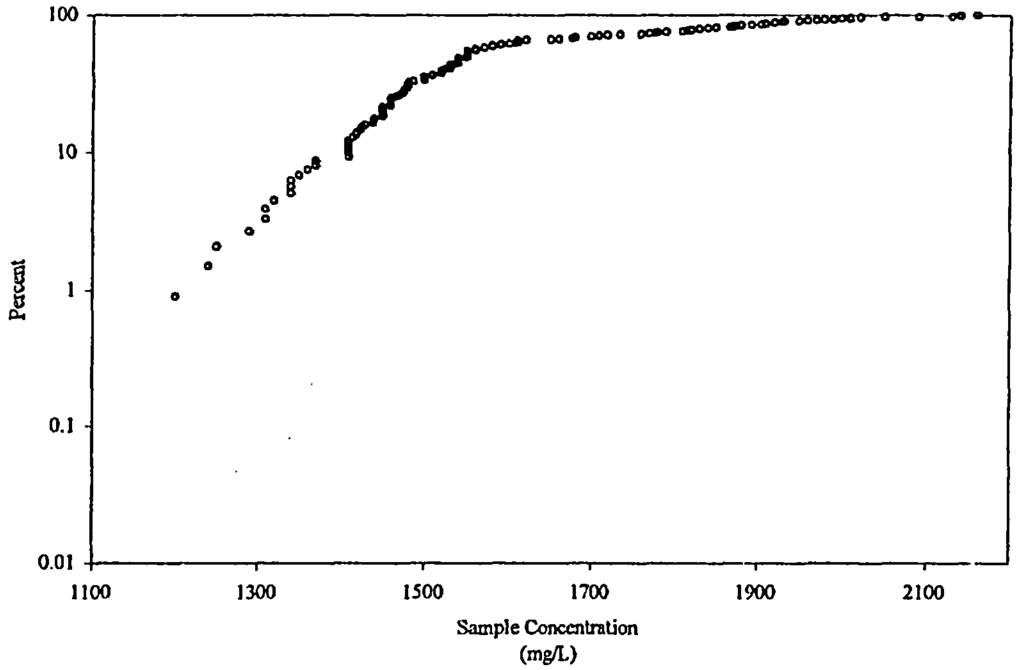


Figure B-4 Upper Chinle Non-Mixing Zone - TDS (Ln)
Probability Plot

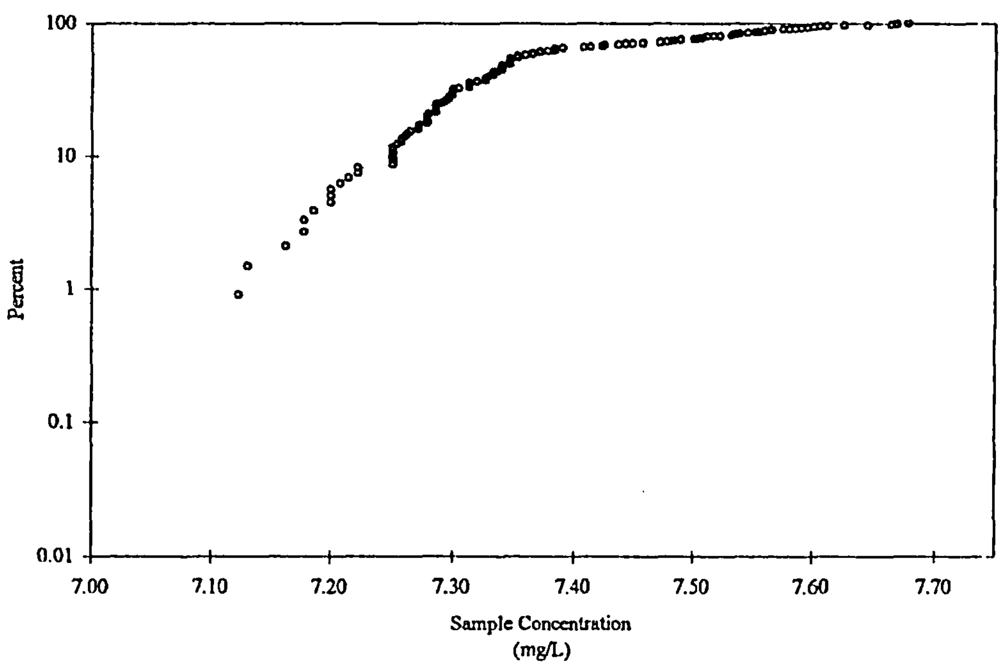


Figure B-5 Upper Chinle Non-Mixing Zone - SO4 (Regular) Histogram

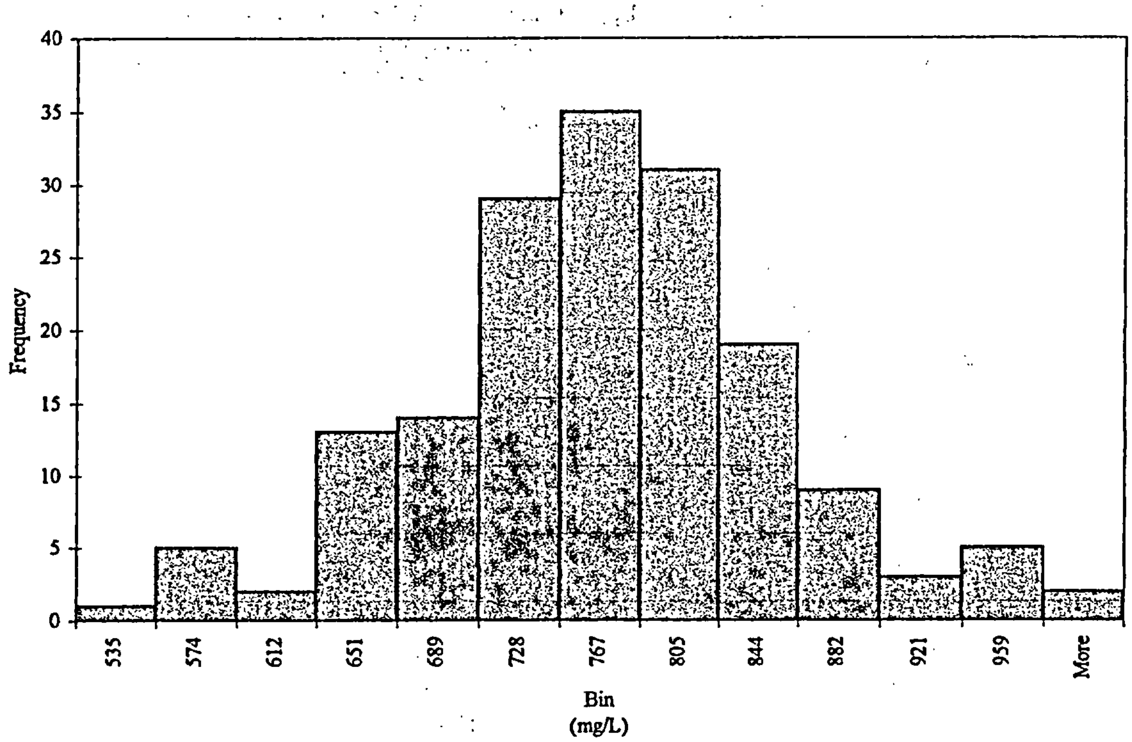
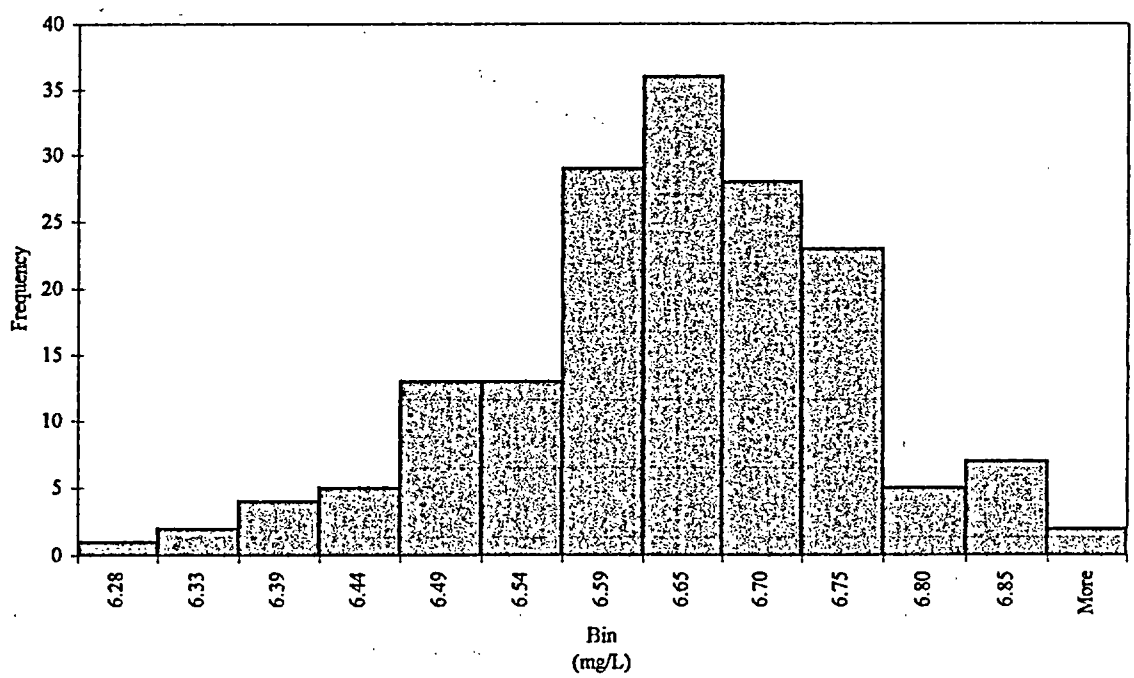


Figure B-6 Upper Chinle Non-Mixing Zone - SO4 (Ln) Histogram



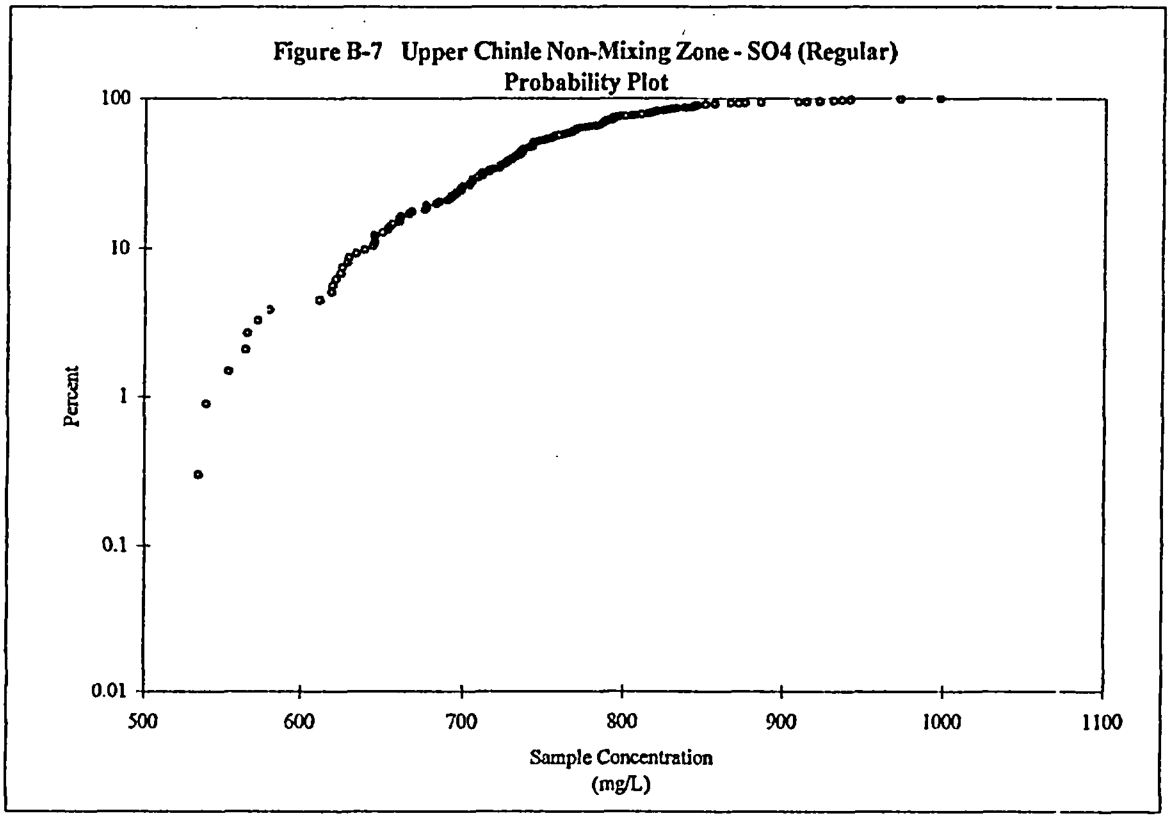


Figure B-7 Upper Chinle Non-Mixing Zone - SO4 (Regular)
Probability Plot
100
10
1
0.1
0.01
Percent
500
600
700
800
900
1000
1100
Sample Concentration
(mg/L)

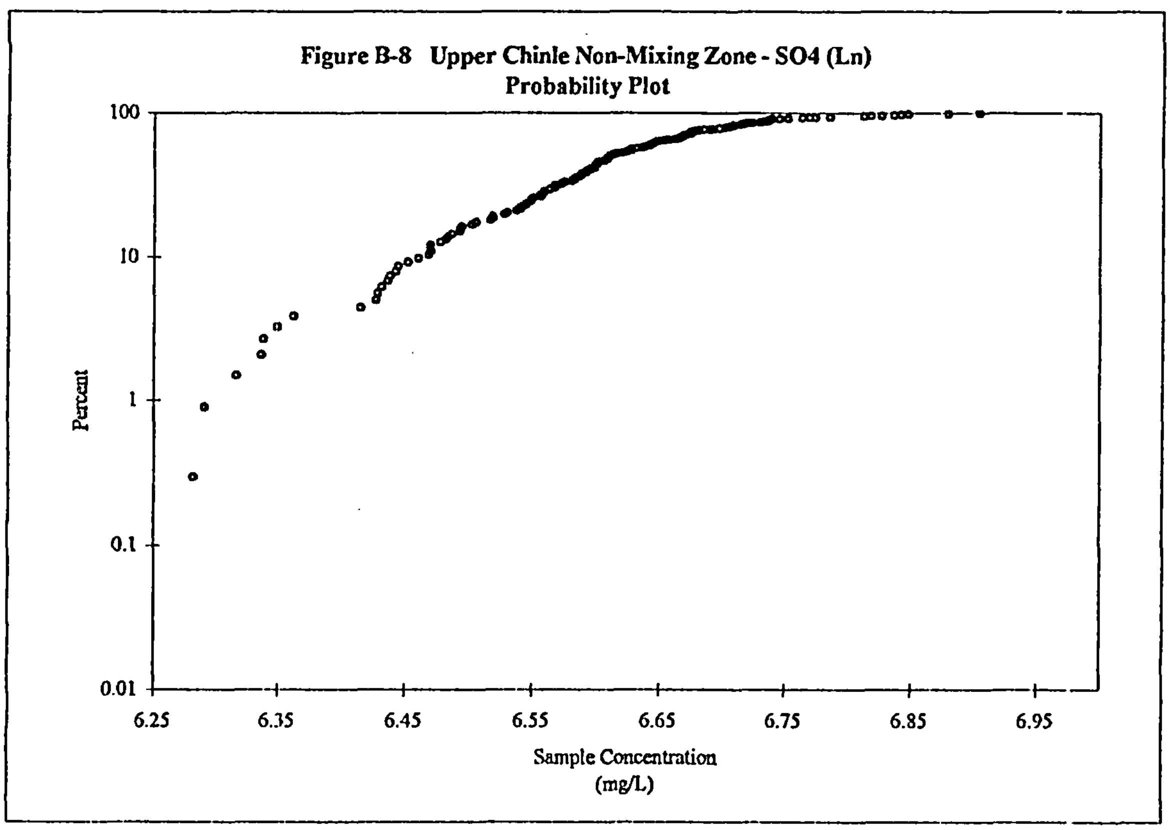


Figure B-8 Upper Chinle Non-Mixing Zone - SO4 (Ln)
Probability Plot
100
10
1
0.1
0.01
Percent
6.25
6.35
6.45
6.55
6.65
6.75
6.85
6.95
Sample Concentration
(mg/L)

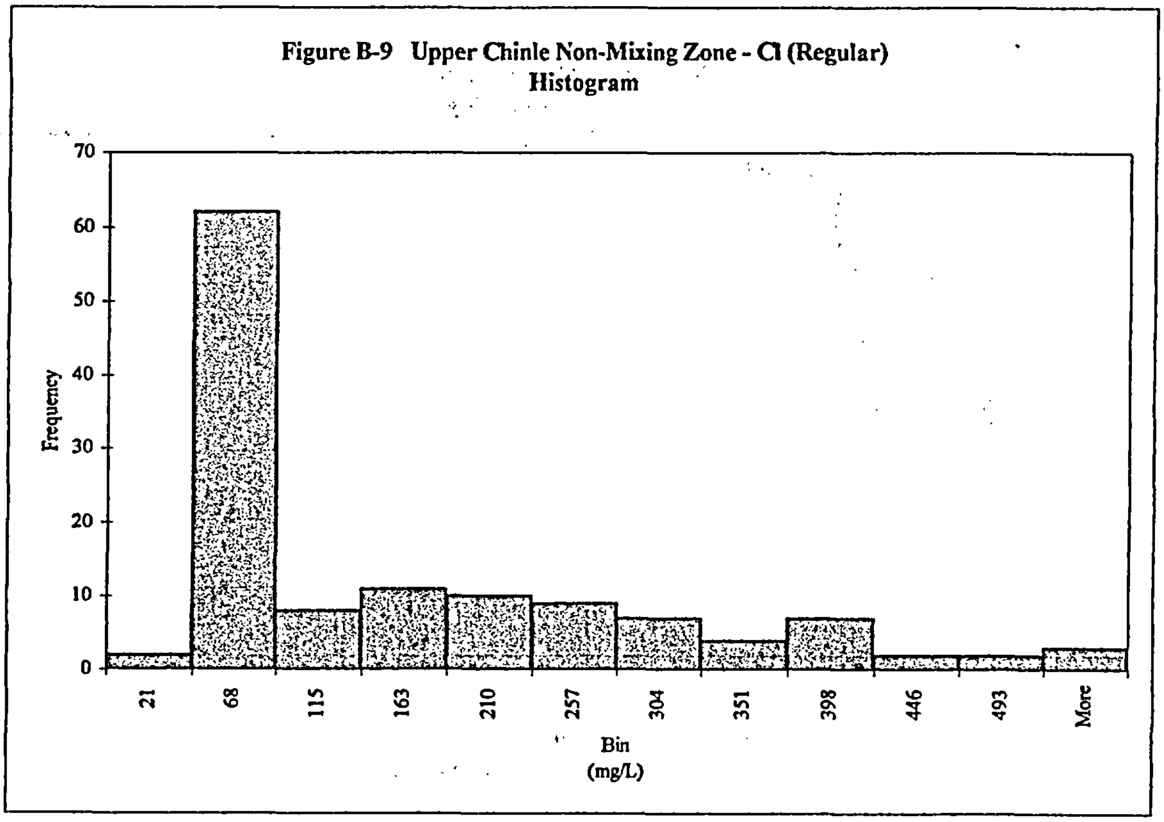


Figure B-9 Upper Chinle Non-Mixing Zone - Cl (Regular)
Histogram
Frequency
70
60
50
40
30
20
10
0
21
68
115
163
210
257
304
351
398
446
493
More
Bin
(mg/L)

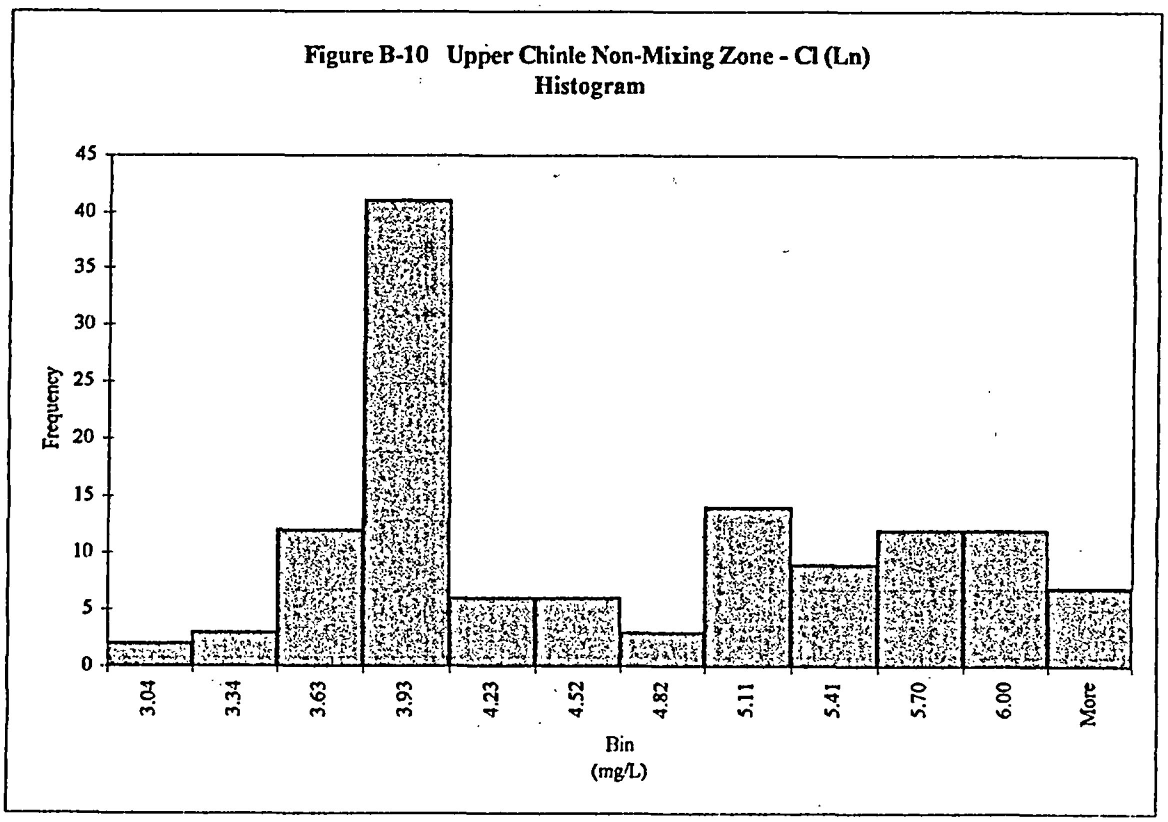


Figure B-10 Upper Chinle Non-Mixing Zone - Cl (Ln)
Histogram
Frequency
45
40
35
30
25
20
15
10
5
0
3.04
3.34
3.63
3.93
4.23
4.52
4.82
5.11
5.41
5.70
6.00
More
Bin
(mg/L)

Figure B-11 Upper Chinle Non-Mixing Zone - Cl (Regular)
Probability Plot

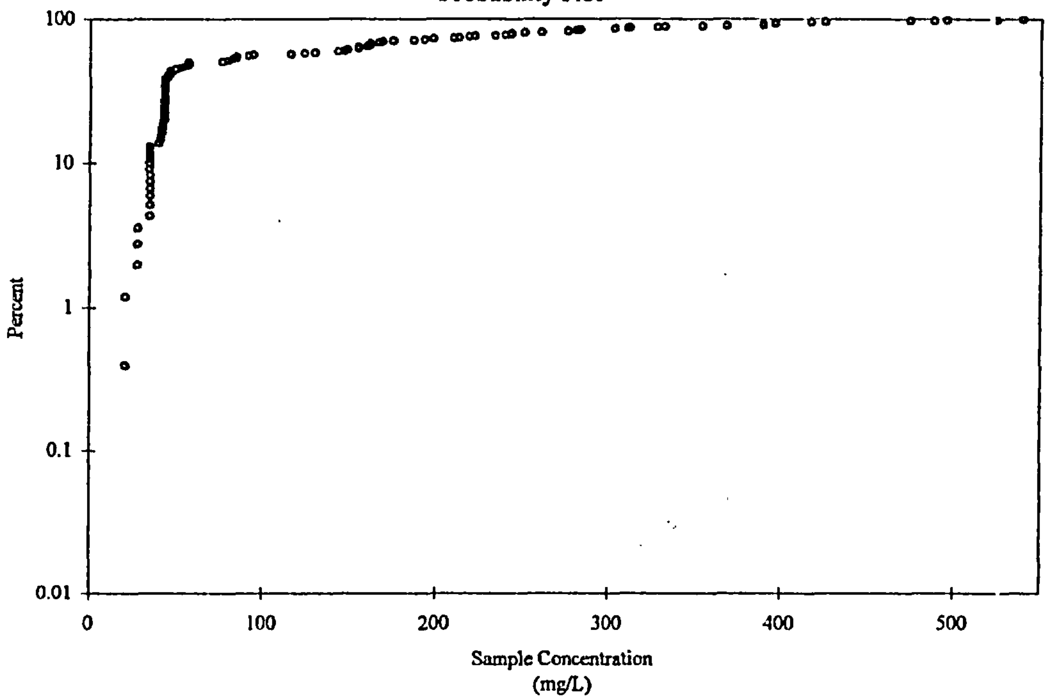
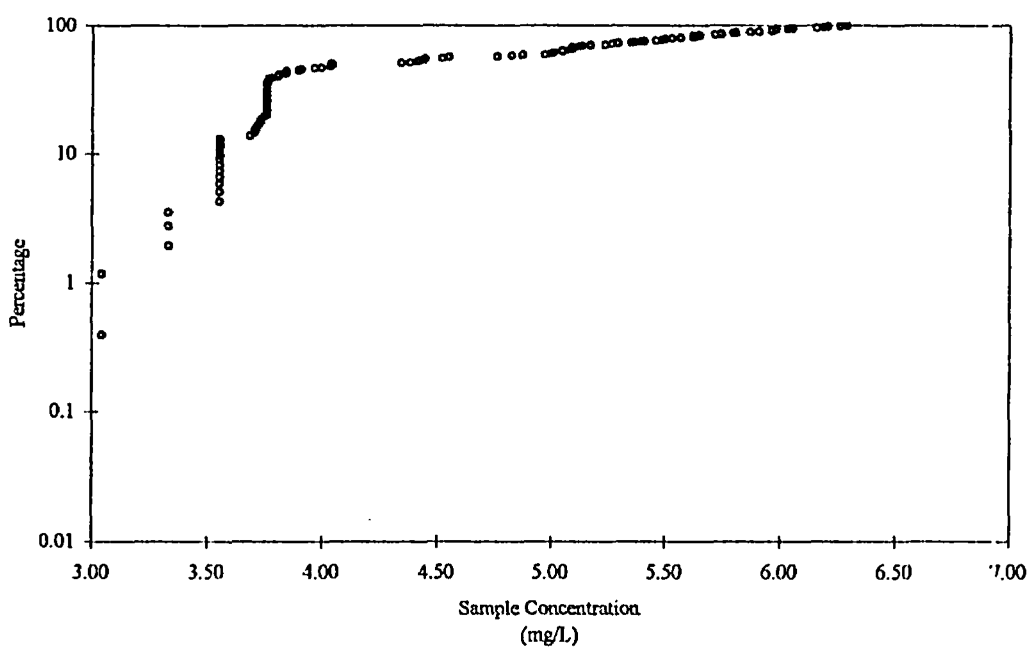


Figure B-12 Upper Chinle Non-Mixing Zone - Cl (Ln)
Probability Plot



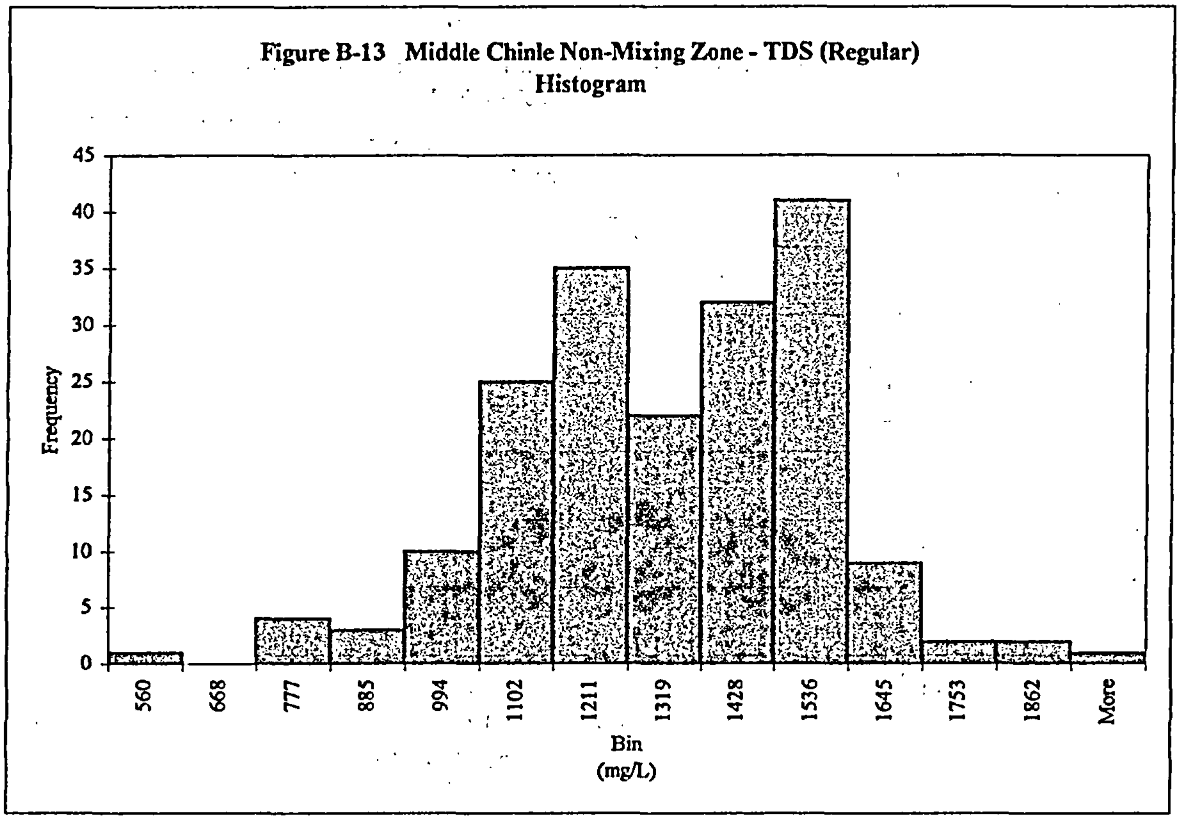


Figure B-13 Middle Chinle Non-Mixing Zone - TDS (Regular)
Histogram
Frequency
0
5
10
15
20
25
30
35
40
45
560
668
777
885
994
1102
1211
1319
1428
1536
1645
1753
1862
More
Bin
(mg/L)

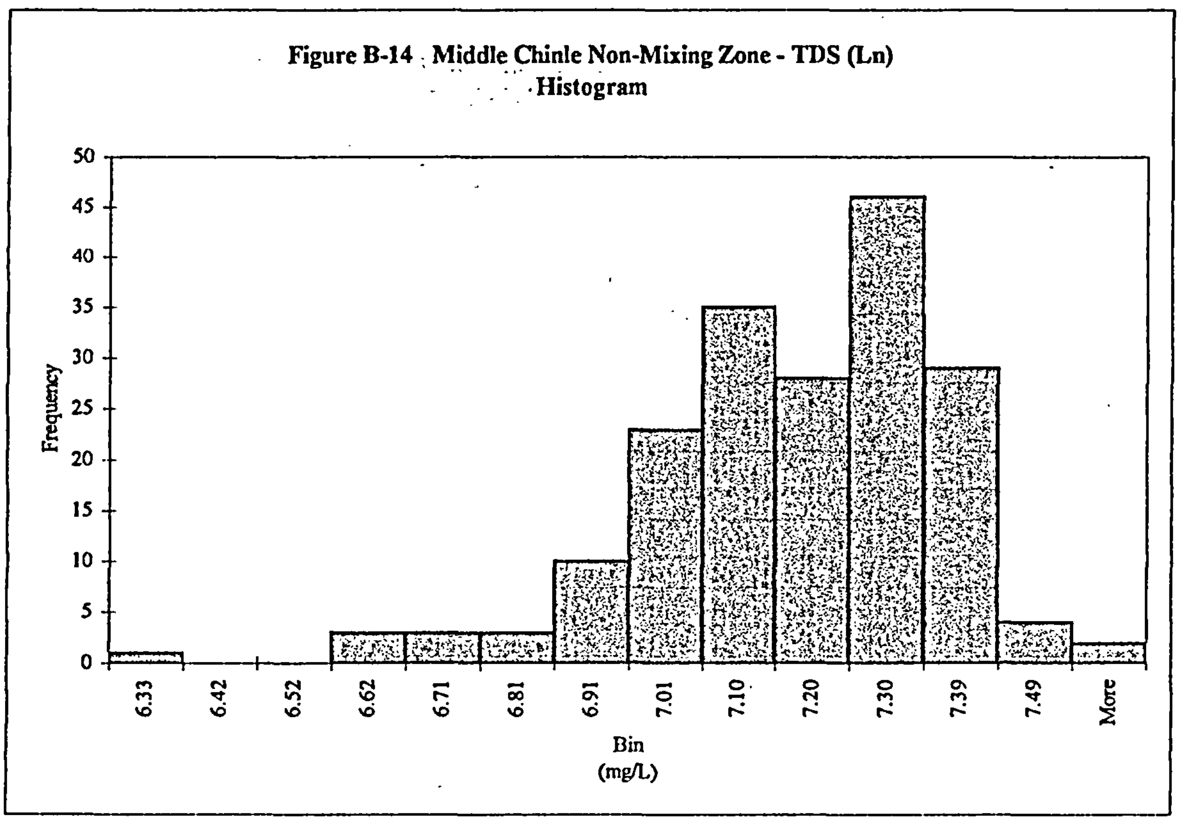


Figure B-14 Middle Chinle Non-Mixing Zone - TDS (Ln)
Histogram
Frequency
0
5
10
15
20
25
30
35
40
45
50
6.33
6.42
6.52
6.62
6.71
6.81
6.91
7.01
7.10
7.20
7.30
7.39
7.49
More
Bin
(mg/L)

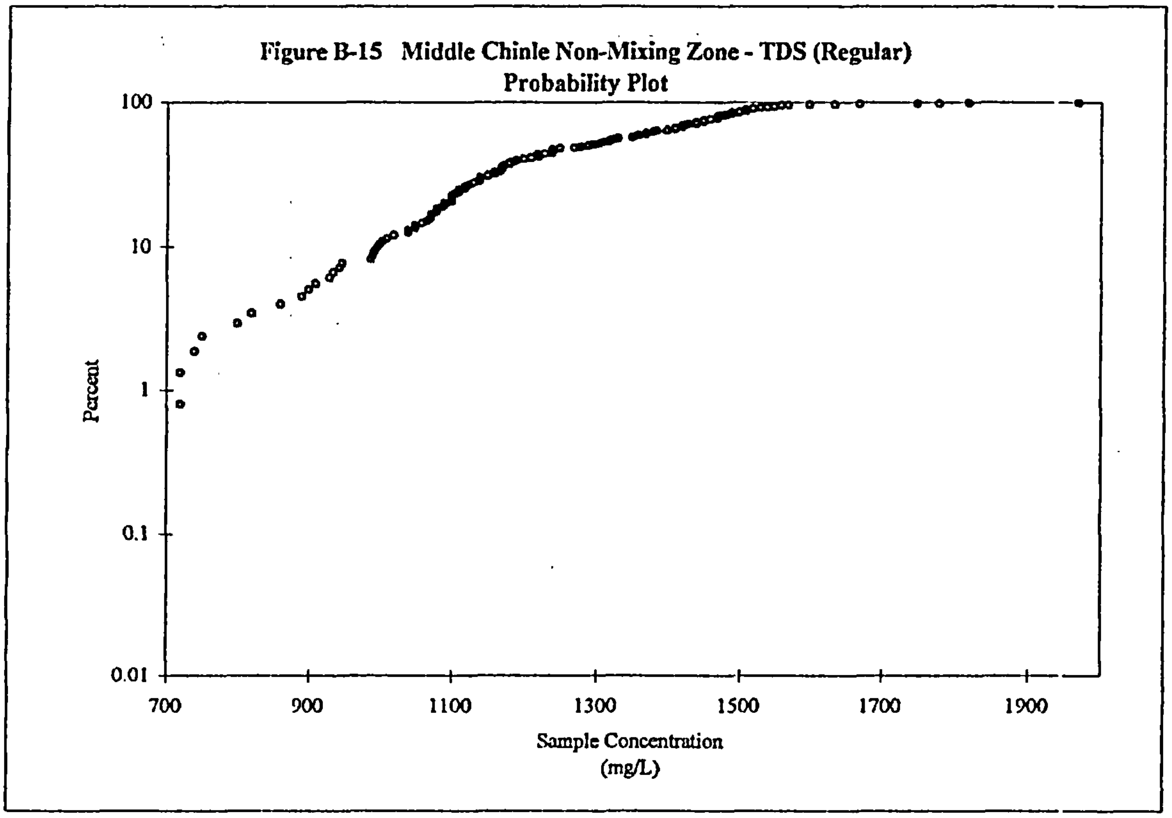


Figure B-15 Middle Chinle Non-Mixing Zone - TDS (Regular)
Probability Plot
100
10
1
0.1
0.01
Percent
700
900
1100
1300
1500
1700
1900
Sample Concentration
(mg/L)

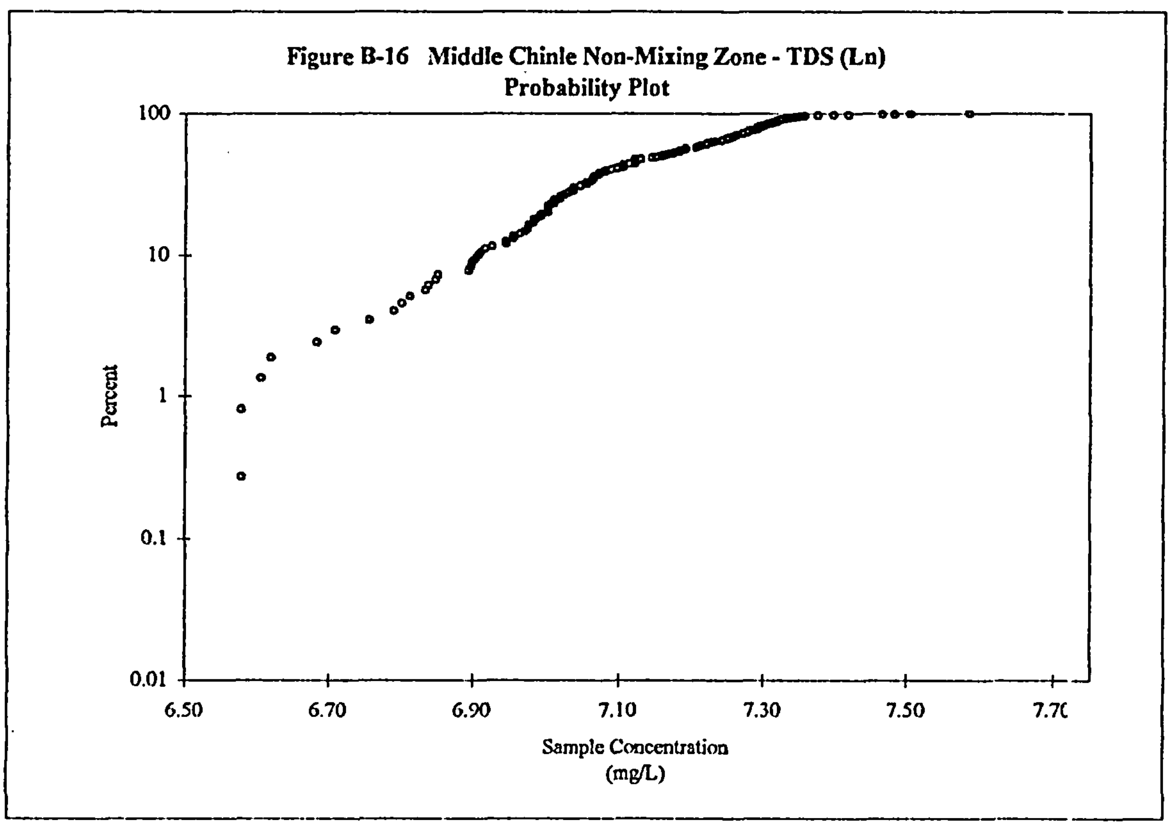


Figure B-16 Middle Chinle Non-Mixing Zone - TDS (Ln)
Probability Plot
100
10
1
0.1
0.01
Percent
6.50
6.70
6.90
7.10
7.30
7.50
7.7(
Sample Concentration
(mg/L)

Figure B-17 Middle Chinle Non-Mixing Zone - SO4 (Regular)
Histogram

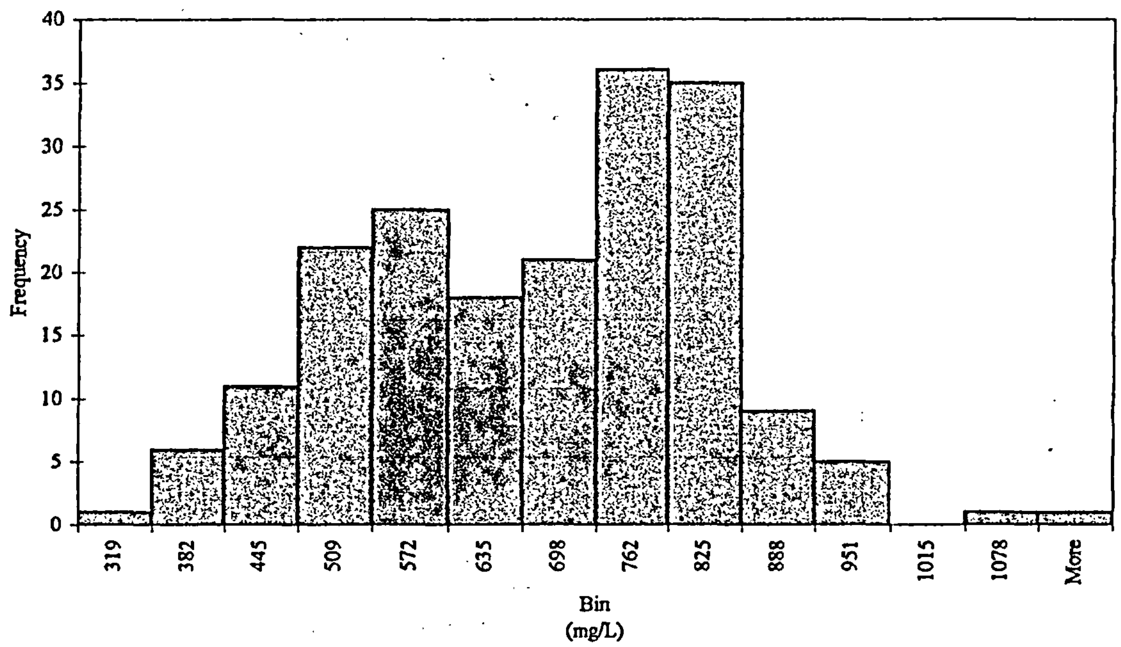


Figure B-18 Middle Chinle Non-Mixing Zone - SO4 (Ln)
Histogram

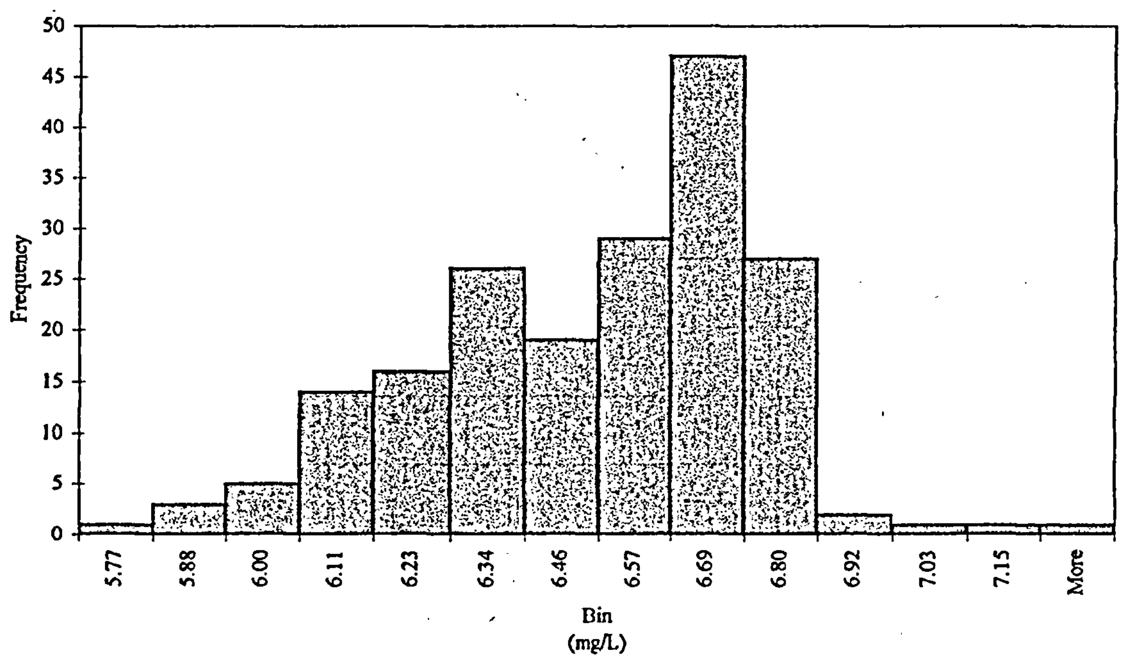


Figure B-19 Middle Chinle Non-Mixing Zone - SO4 (Regular)
Probability Plot

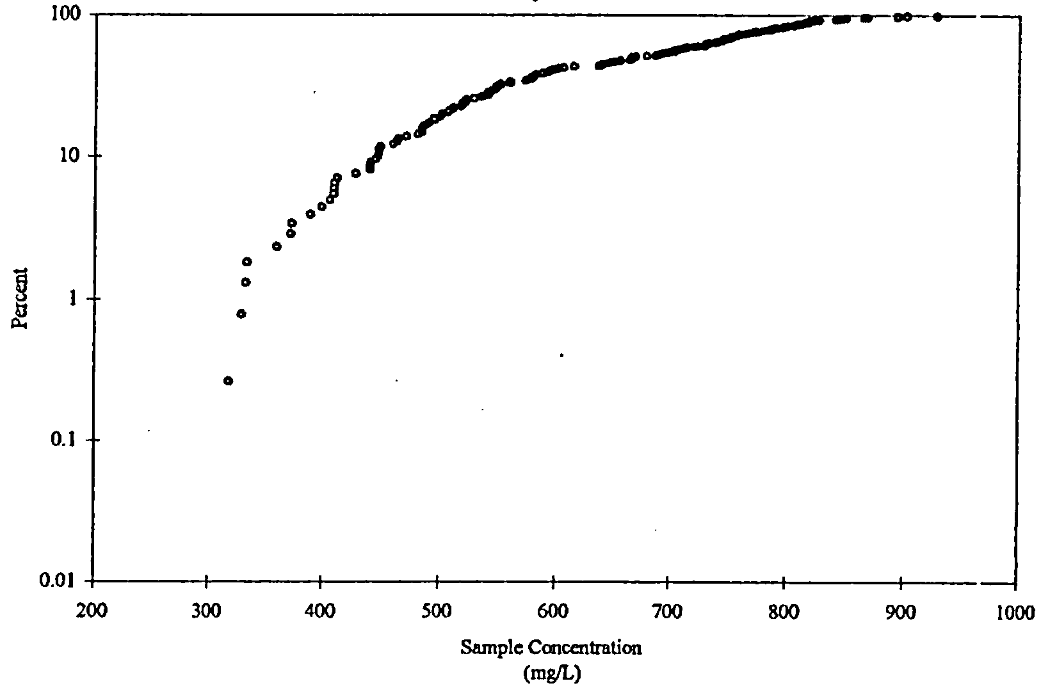


Figure B-20 Middle Chinle Non-Mixing Zone - SO4 (Ln)
Probability Plot

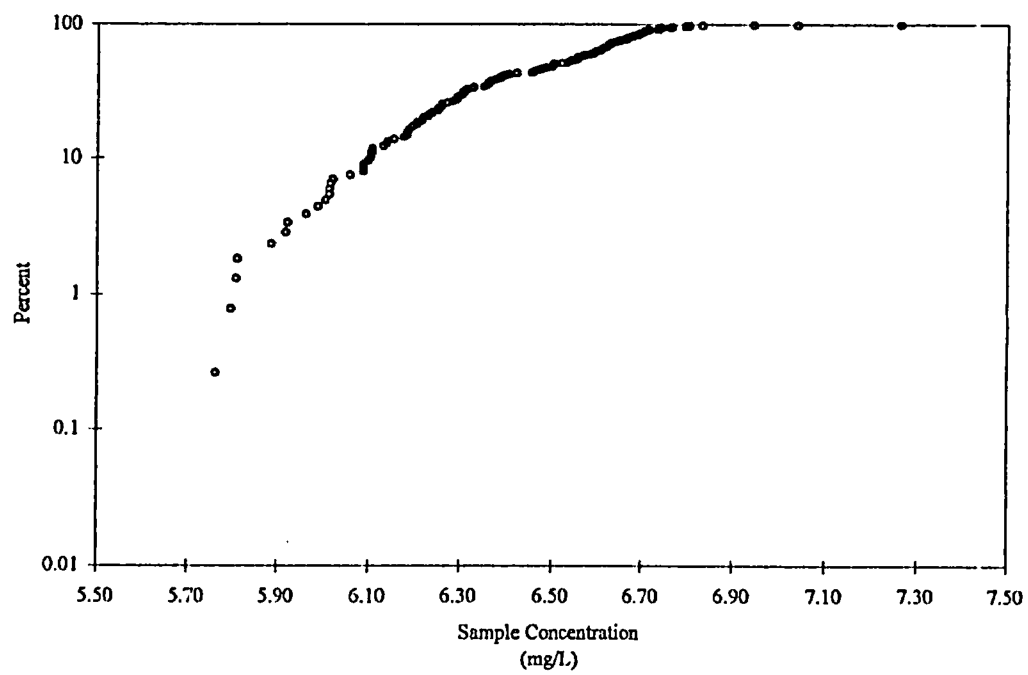


Figure B-21 Middle Chinle Non-Mixing Zone - NO3 (Regular) Histogram

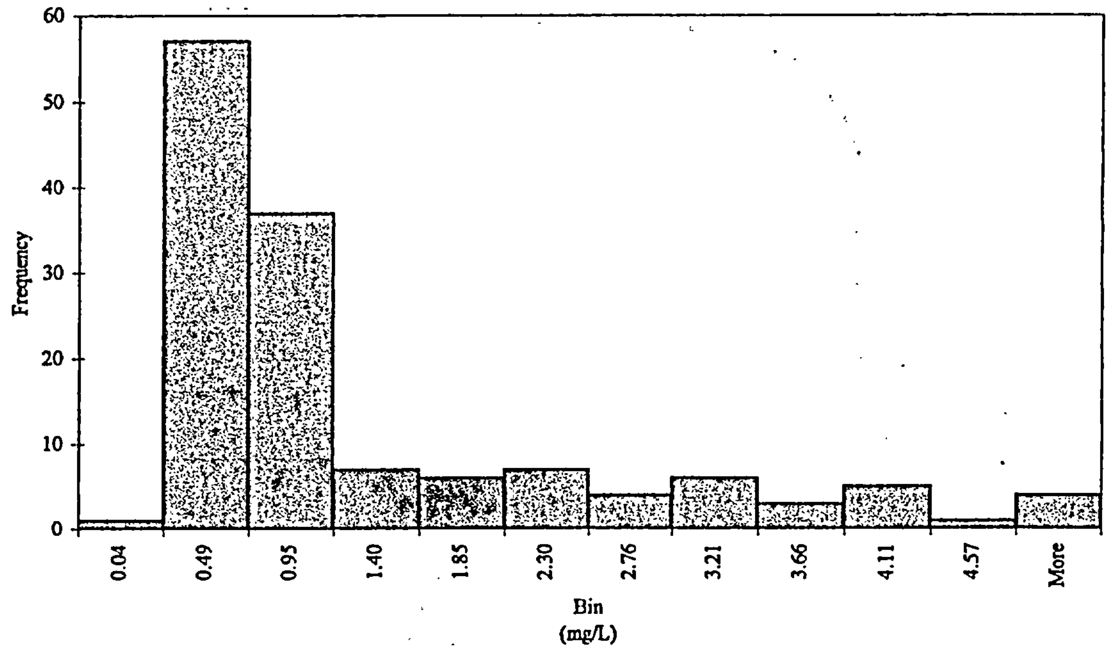


Figure B-22 Middle Chinle Non-Mixing Zone - NO3 (Ln) Histogram

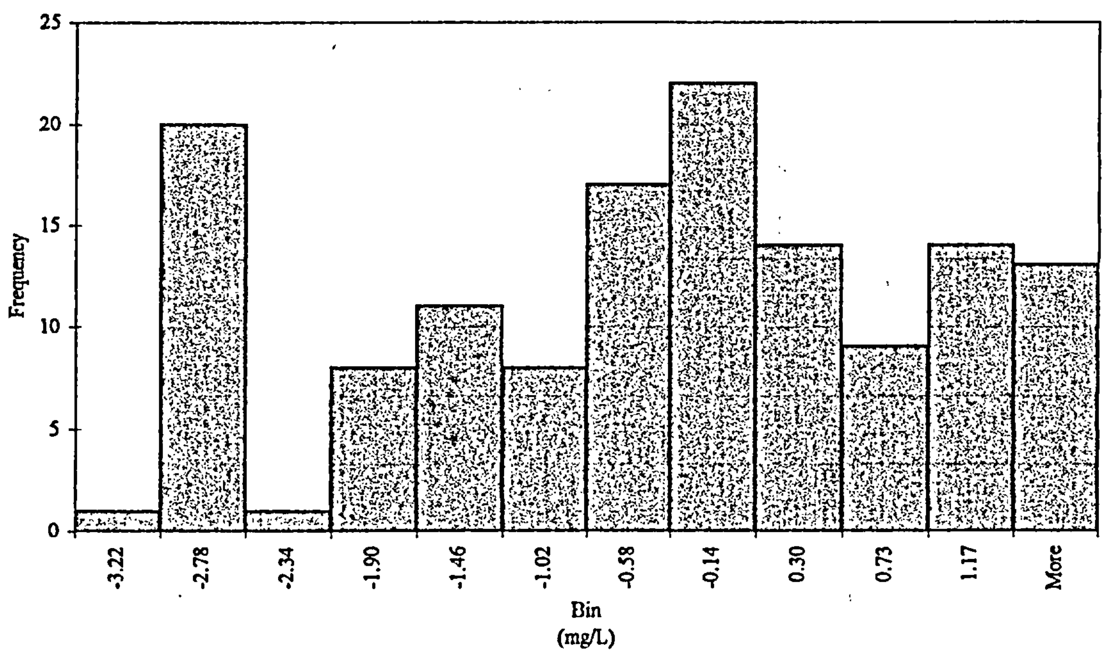


Figure B-23 Middle Chinle Non-Mixing Zone - NO3 (Regular)
Probability Plot

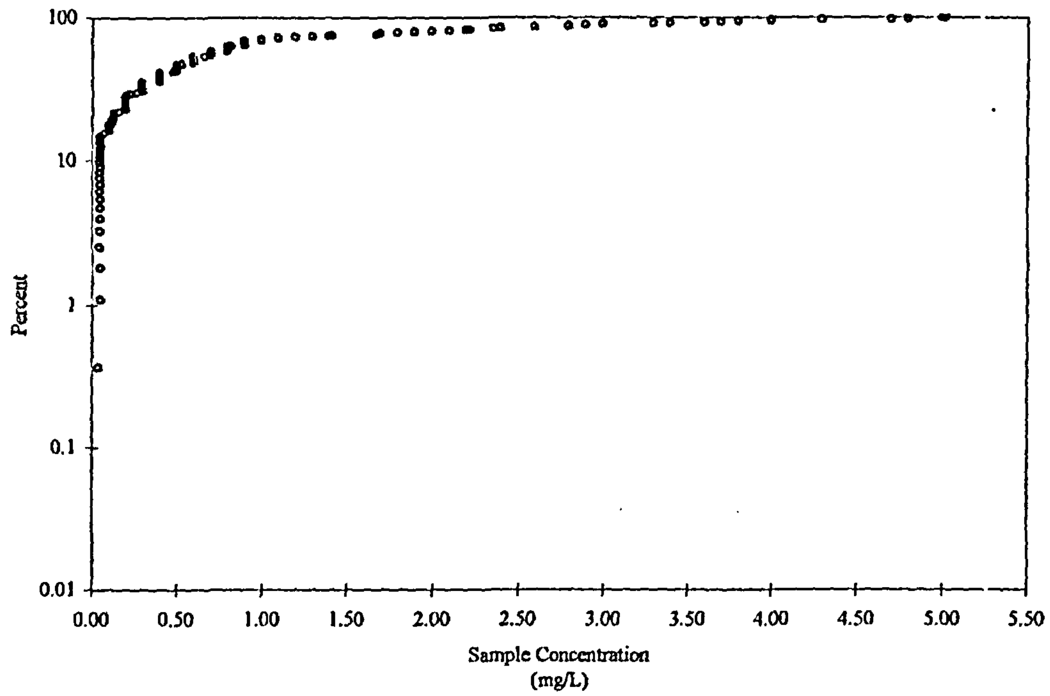


Figure B-24 Middle Chinle Non-Mixing Zone - NO3 (Ln)
Probability Plot

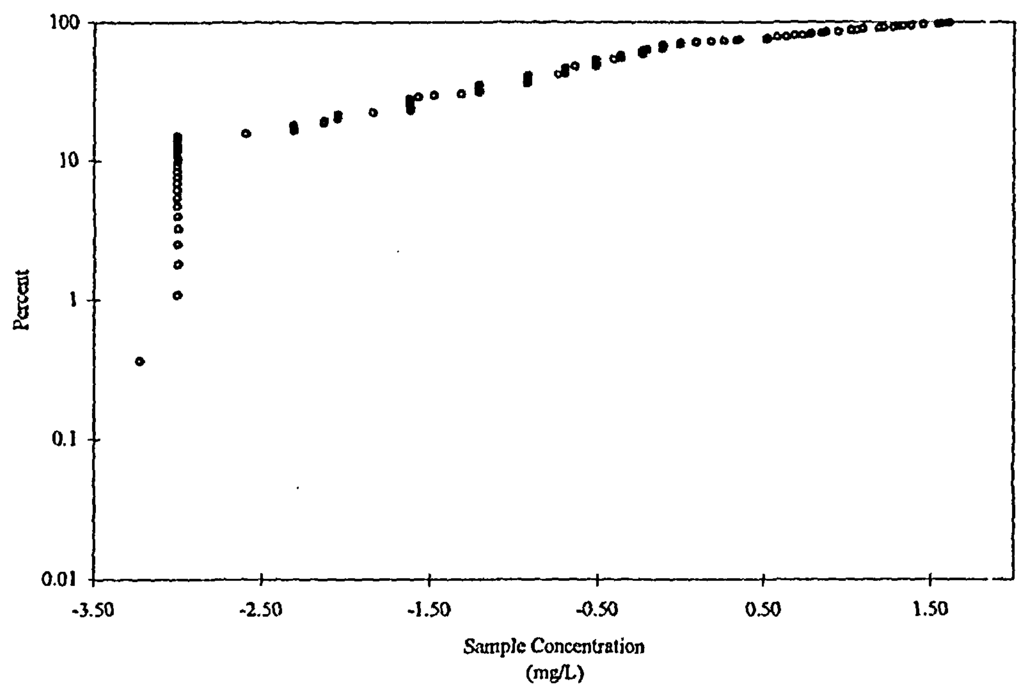


Figure B-25 Middle Chinle Non-Mixing Zone - Cl (Regular)
Histogram

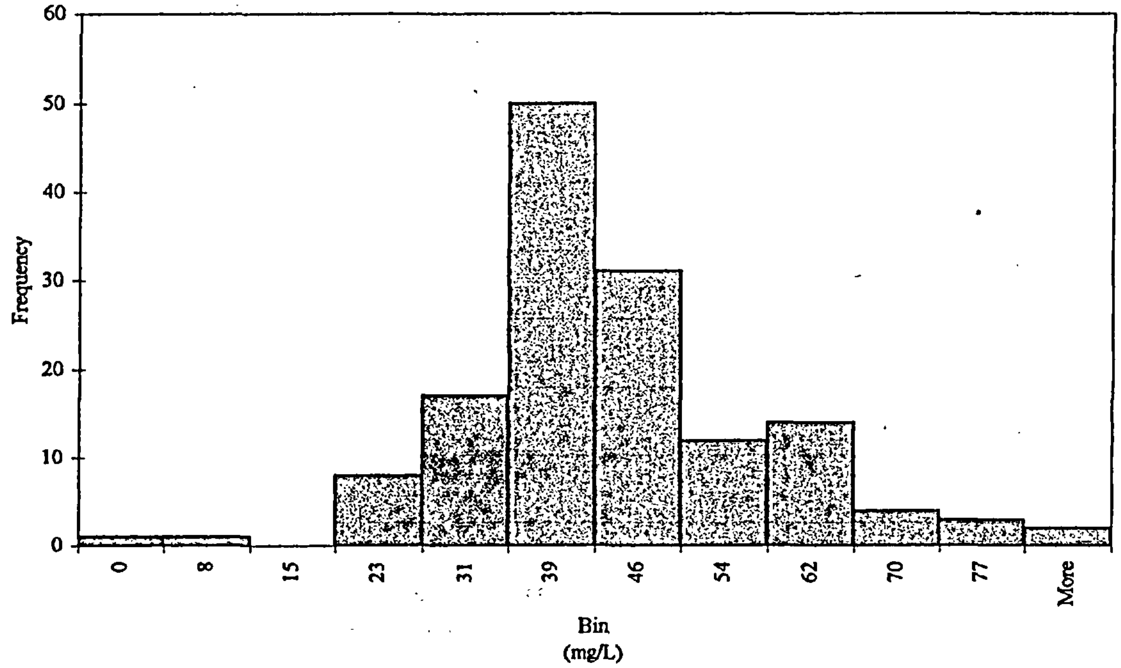


Figure B-26 Middle Chinle Non-Mixing Zone - Cl (Ln)
Histogram

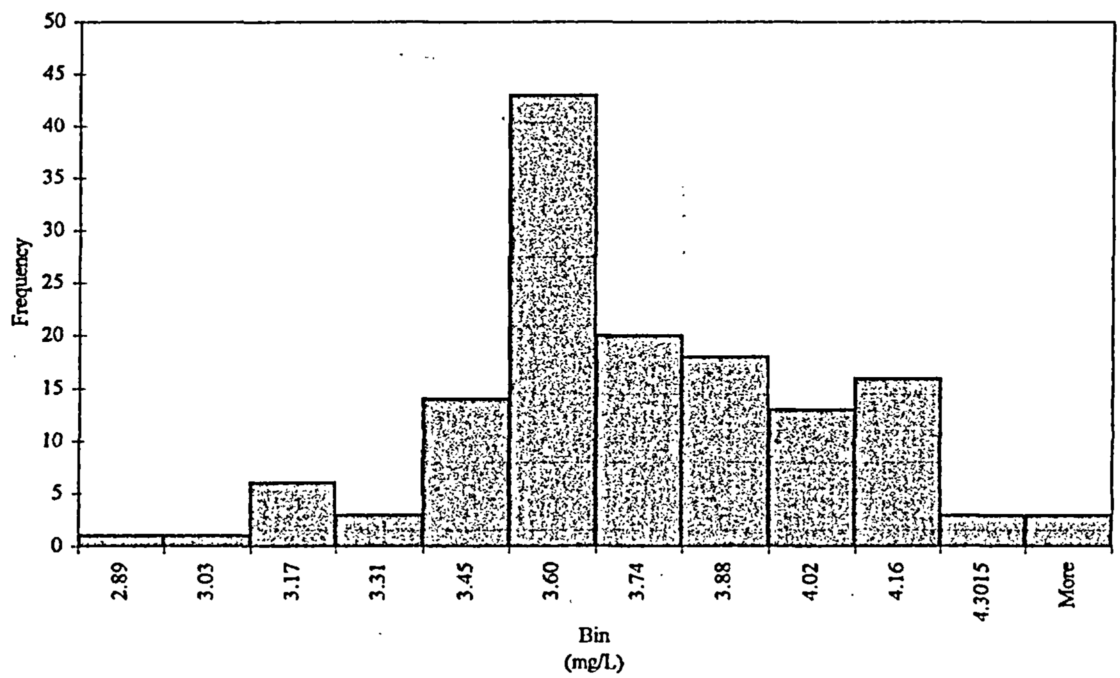


Figure B-27 Middle Chinle Non-Mixing Zone - Cl (Regular)
Probability Plot

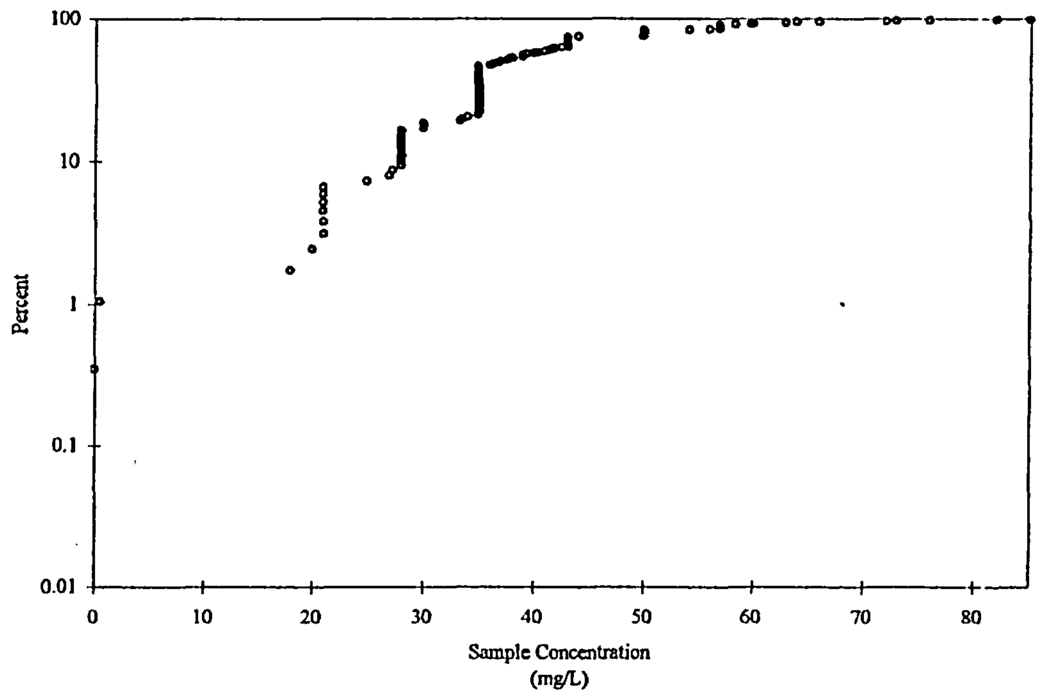


Figure B-28 Middle Chinle Non-Mixing Zone - Cl (Ln)
Probability Plot

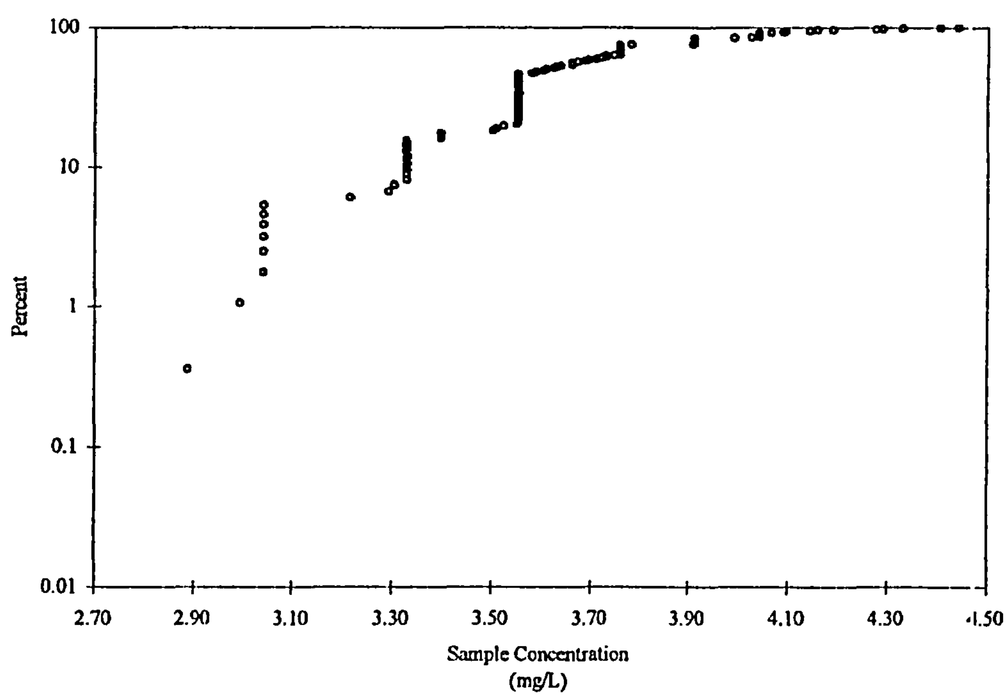


Figure B-29 Lower Chinle Non Mixing Zone - U-nat (Regular)
Histogram

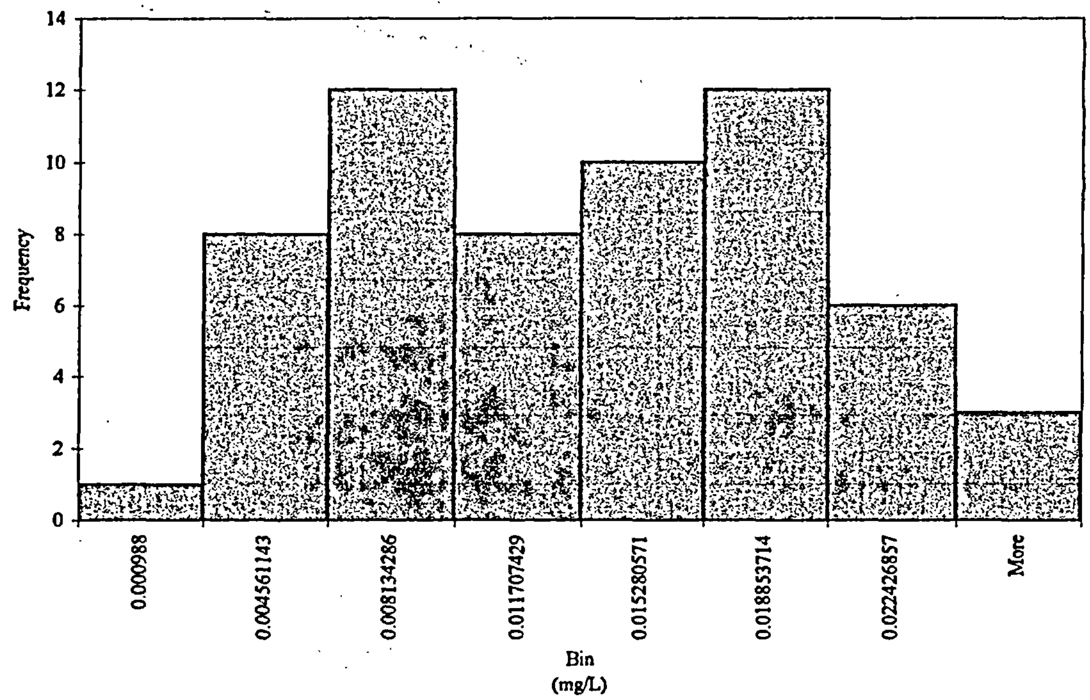
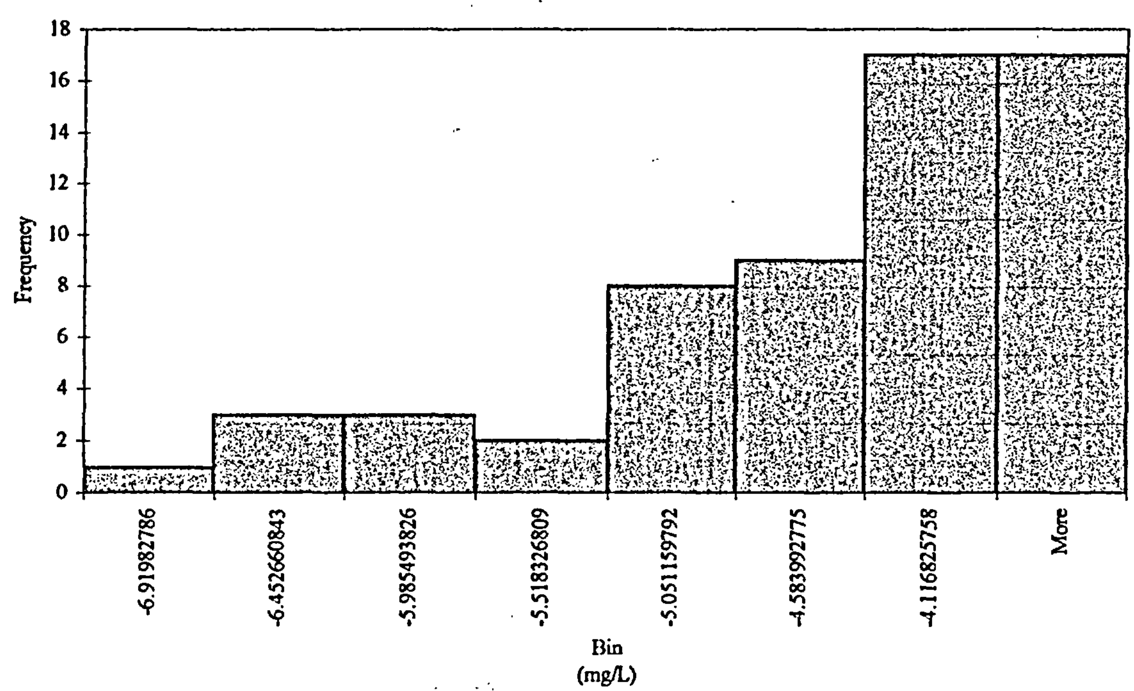


Figure B-30 Lower Chinle Non-Mixing Zone - U-nat (Ln)
Histogram



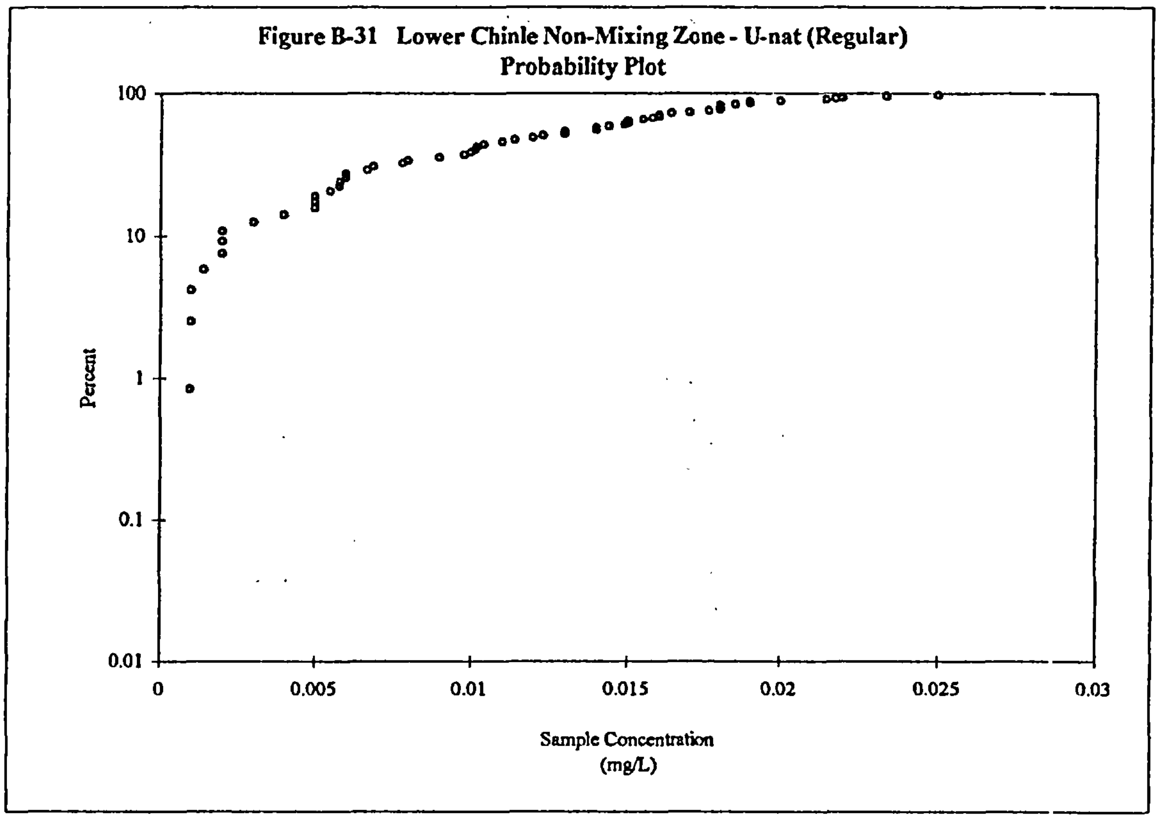


Figure B-31 Lower Chinle Non-Mixing Zone - U-nat (Regular)
Probability Plot
100
10
1
0.1
0.01
Percent
0
0.005
0.01
0.015
0.02
0.025
0.03
Sample Concentration
(mg/L)

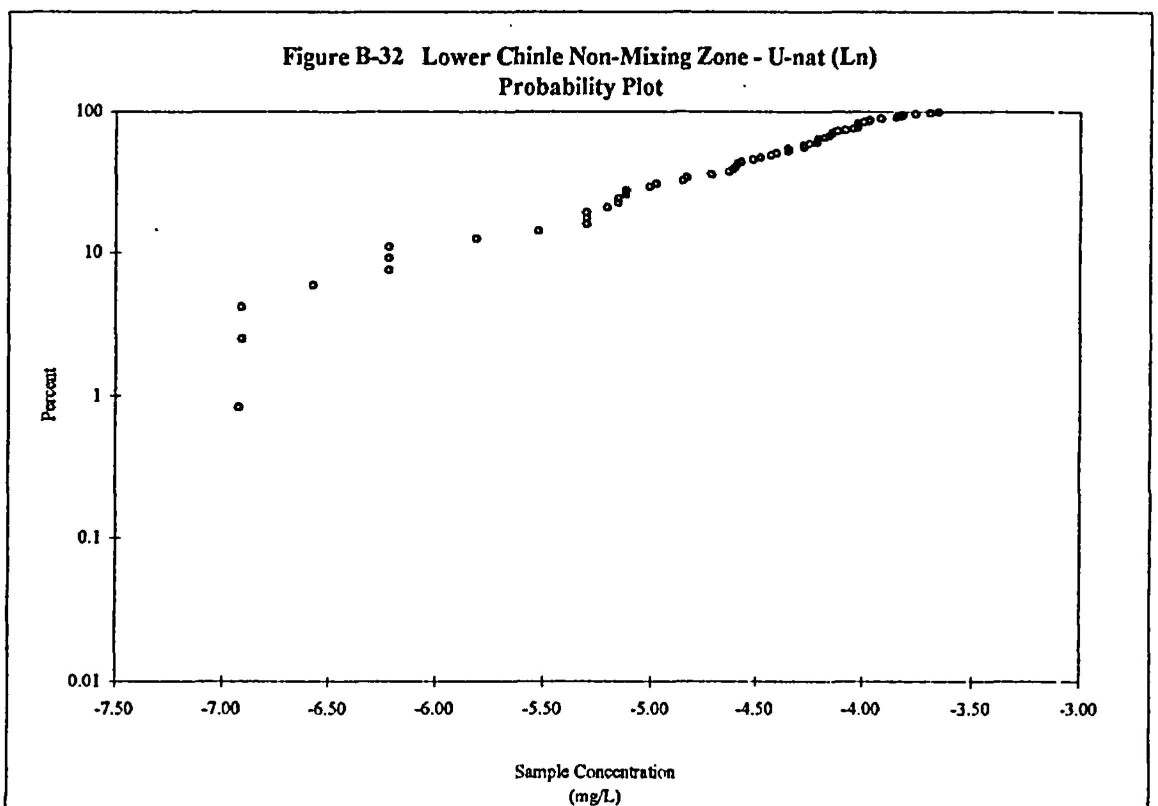


Figure B-32 Lower Chinle Non-Mixing Zone - U-nat (Ln)
Probability Plot
100
10
1
0.1
0.01
Percent
-7.50
-7.00
-6.50
-6.00
-5.50
-5.00
-4.50
-4.00
-3.50
-3.00
Sample Concentration
(mg/L)

Figure B-33 Lower Chinle Non-Mixing Zone - TDS (Regular) Histogram

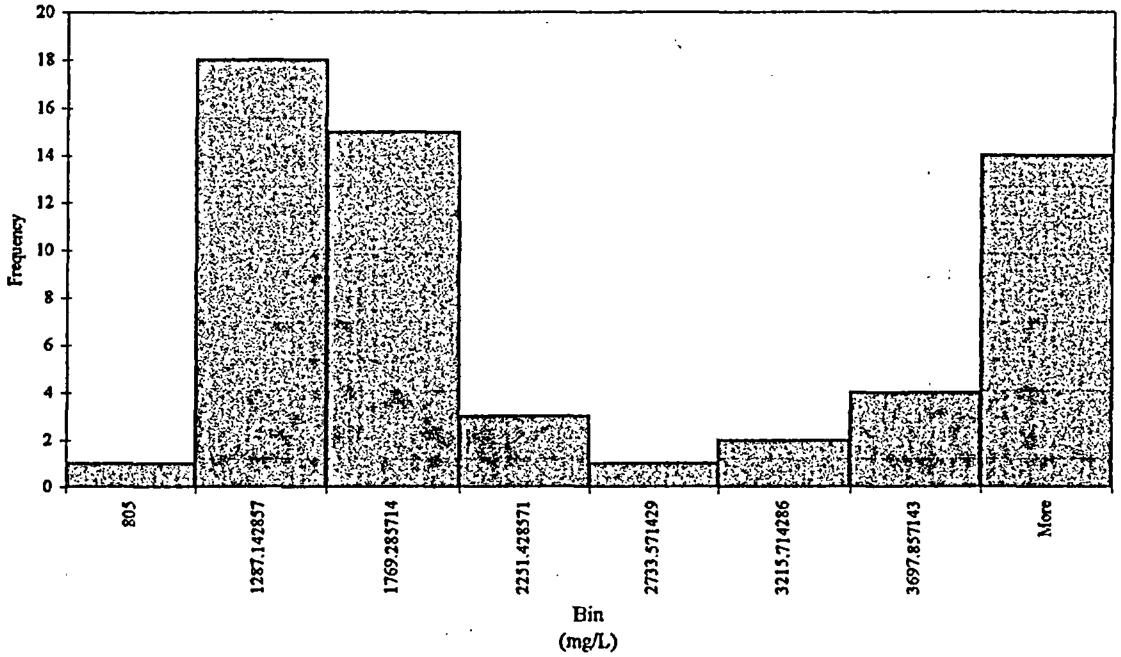


Figure B-34 Lower Chinle Non-Mixing Zone - TDS (Ln) Histogram

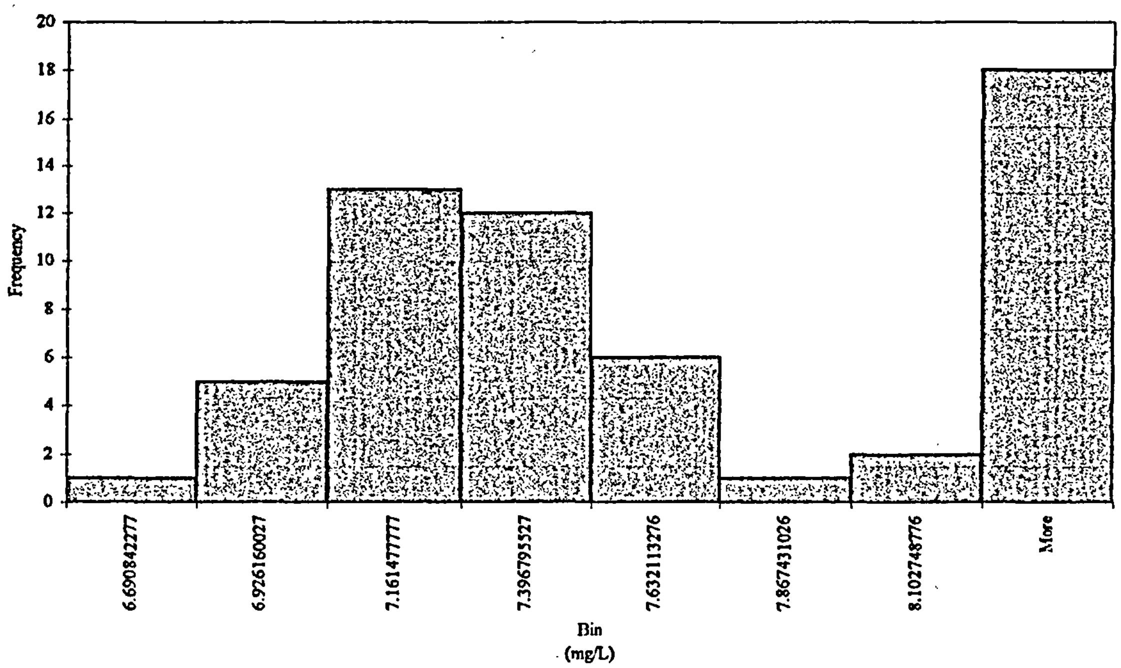


Figure B-35 Lower Chinle Non-Mixing Zone - TDS (Regular)
Probability Plot

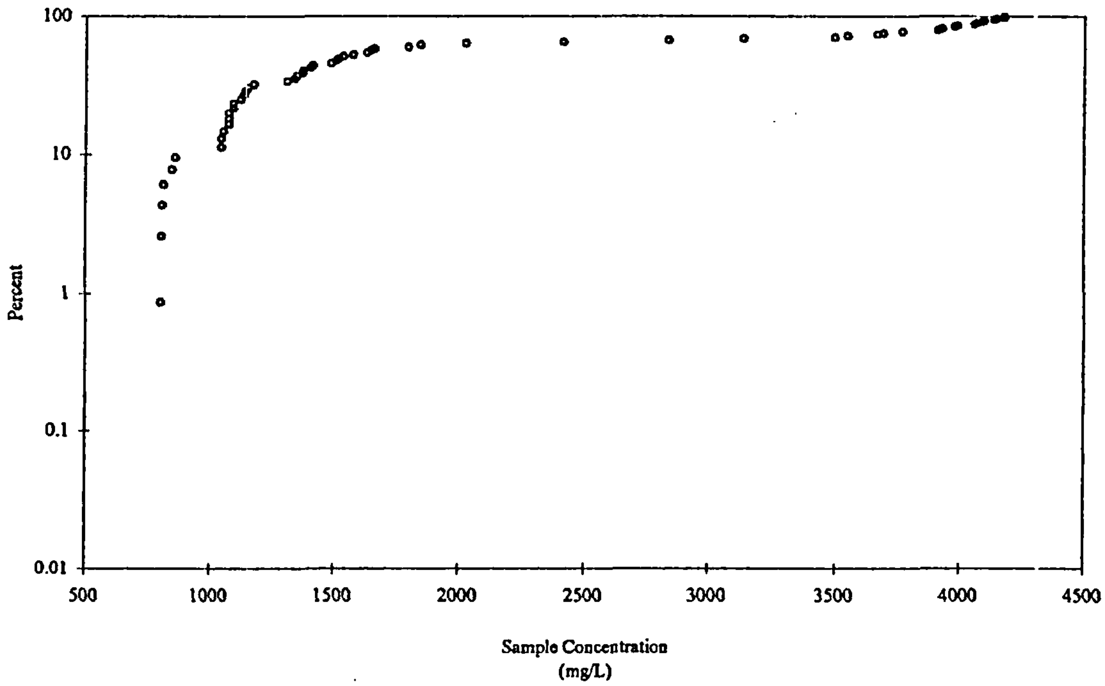


Figure B-36 Lower Chinle Non-Mixing Zone - TDS (Ln)
Probability Plot

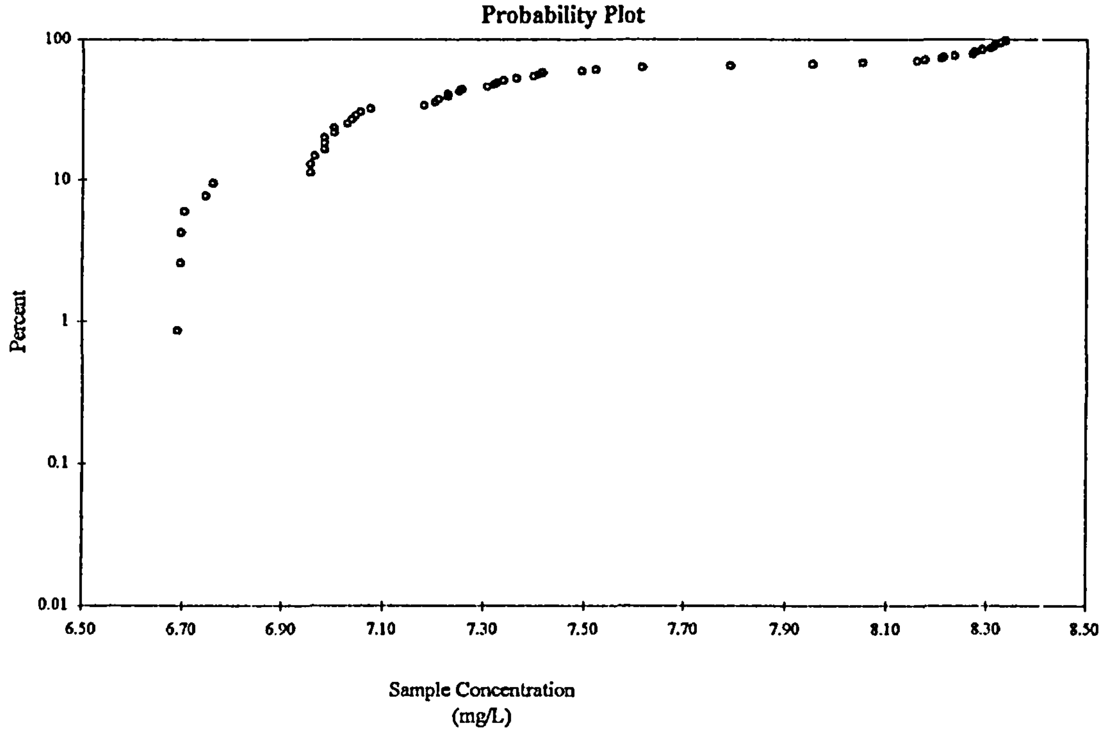


Figure B-37 Lower Chinle Non-Mixing Zone - SO4 (Regular) Histogram

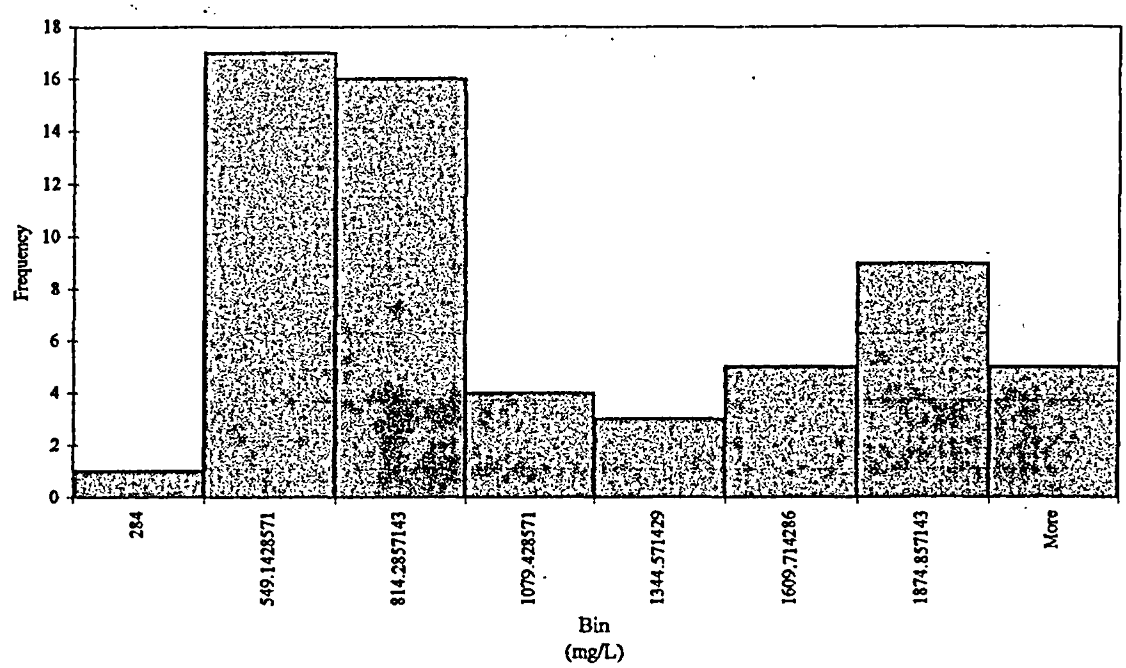


Figure B-38 Lower Chinle Non-Mixing Zone - SO4 (Ln) Histogram

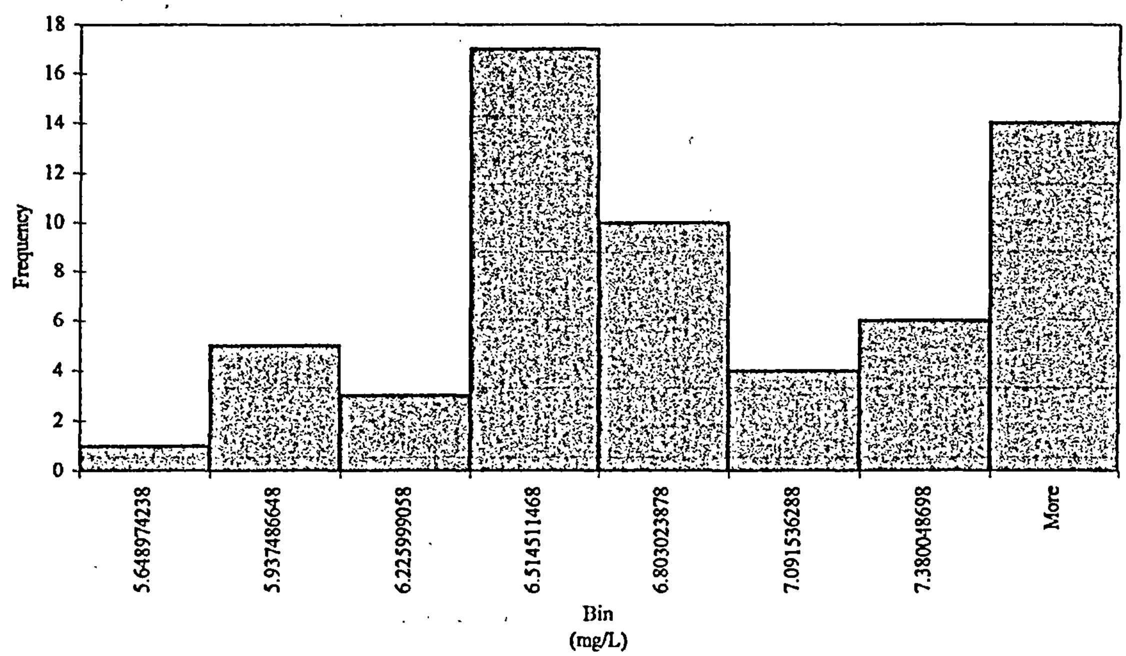


Figure B-39 Lower Chinle Non-Mixing Zone - SO4 (Regular) Probability Plot

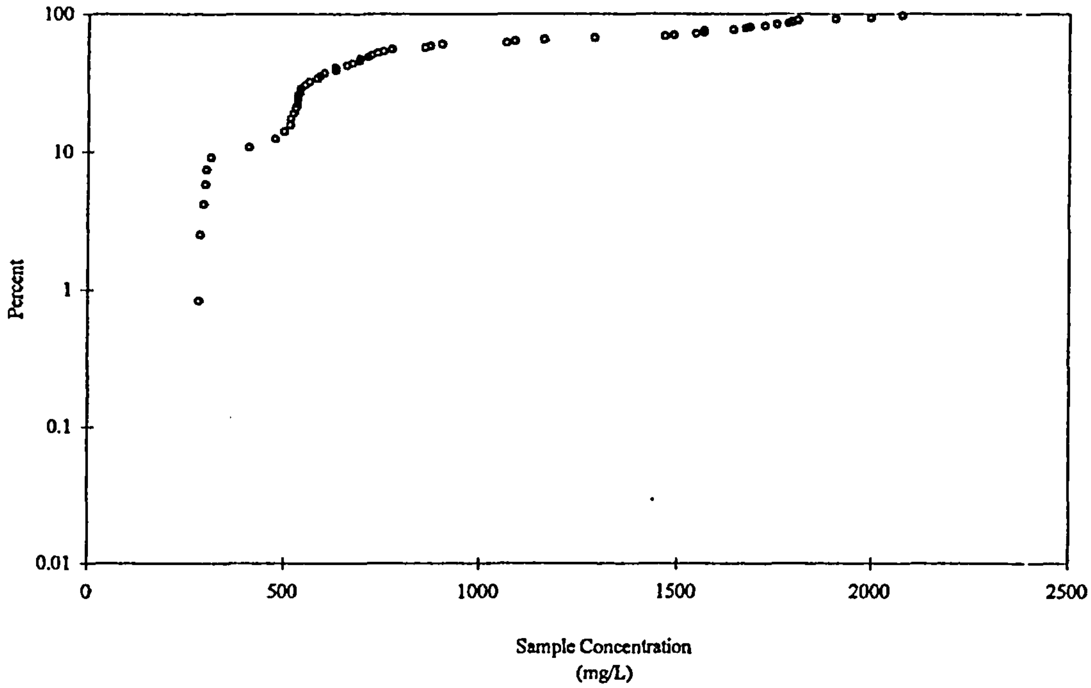


Figure B-40 Lower Chinle Non-Mixing Zone - SO4 (Ln) Probability Plot

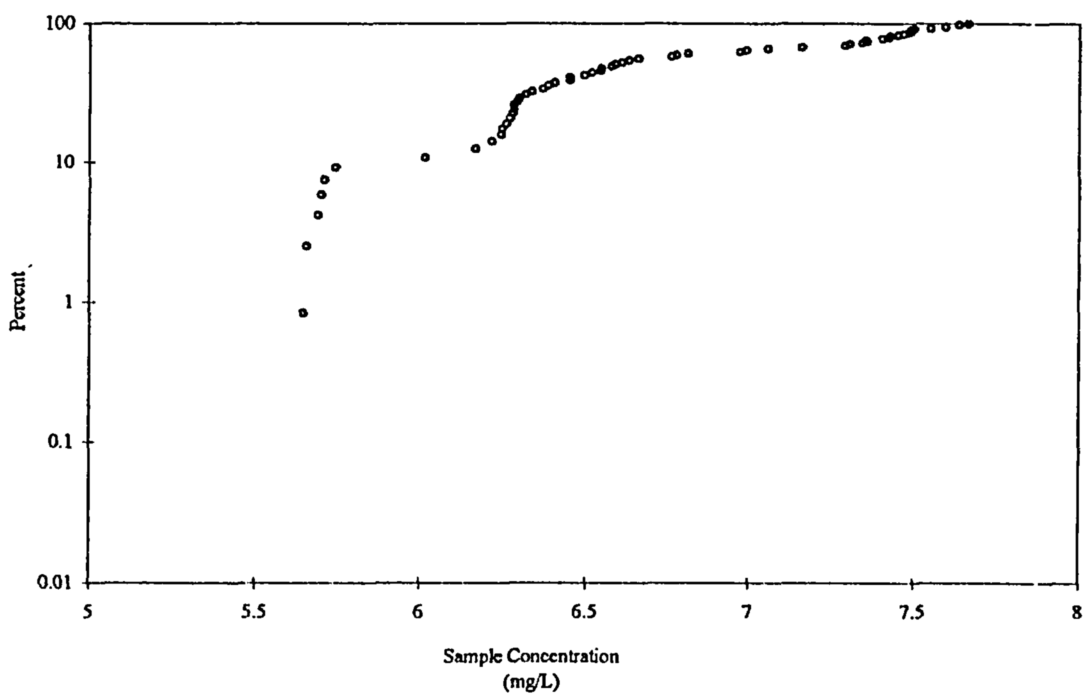


Figure B-41 Lower Chinle Non-Mixing Zone - Cl (Regular)
Histogram

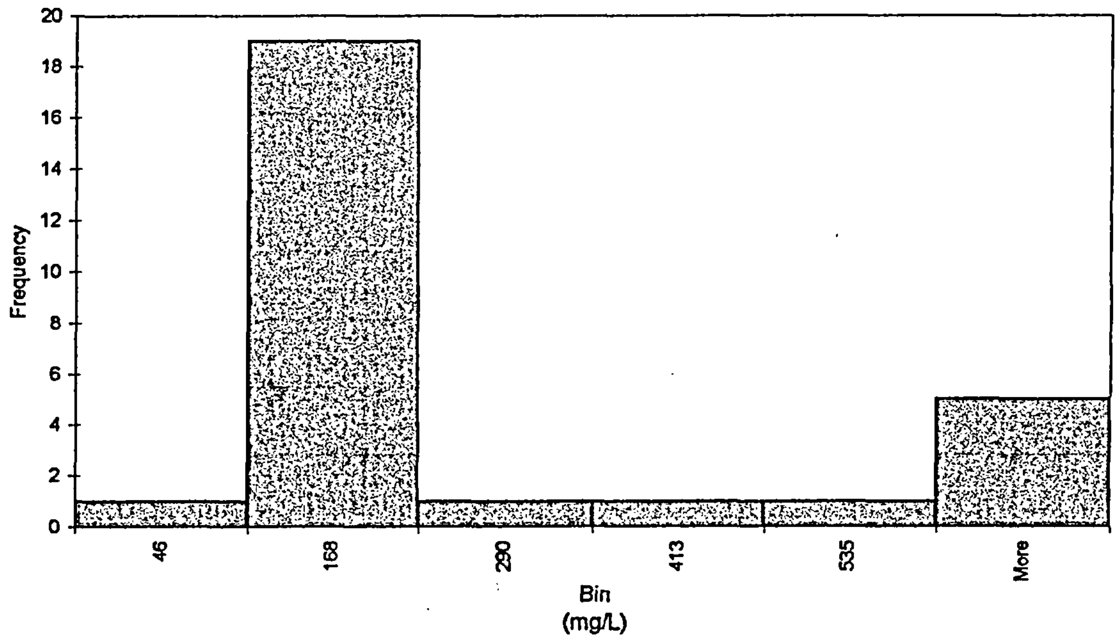
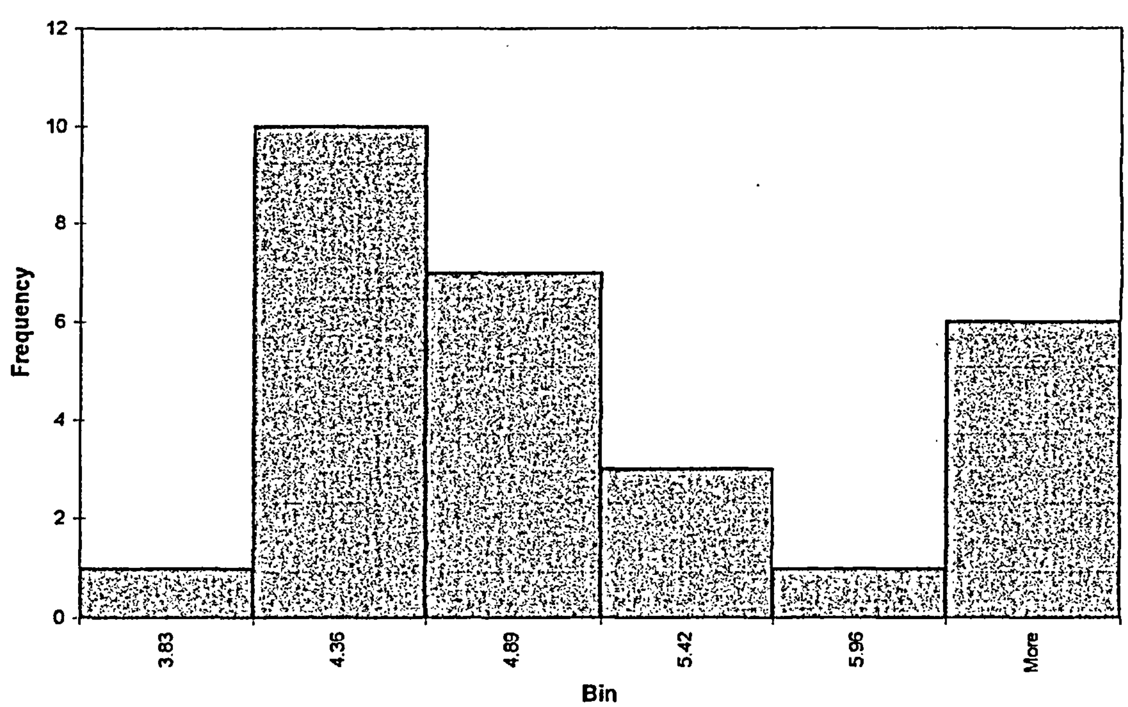


Figure B-42 Lower Chinle Non-Mixing Zone - Cl (Ln)
Histogram



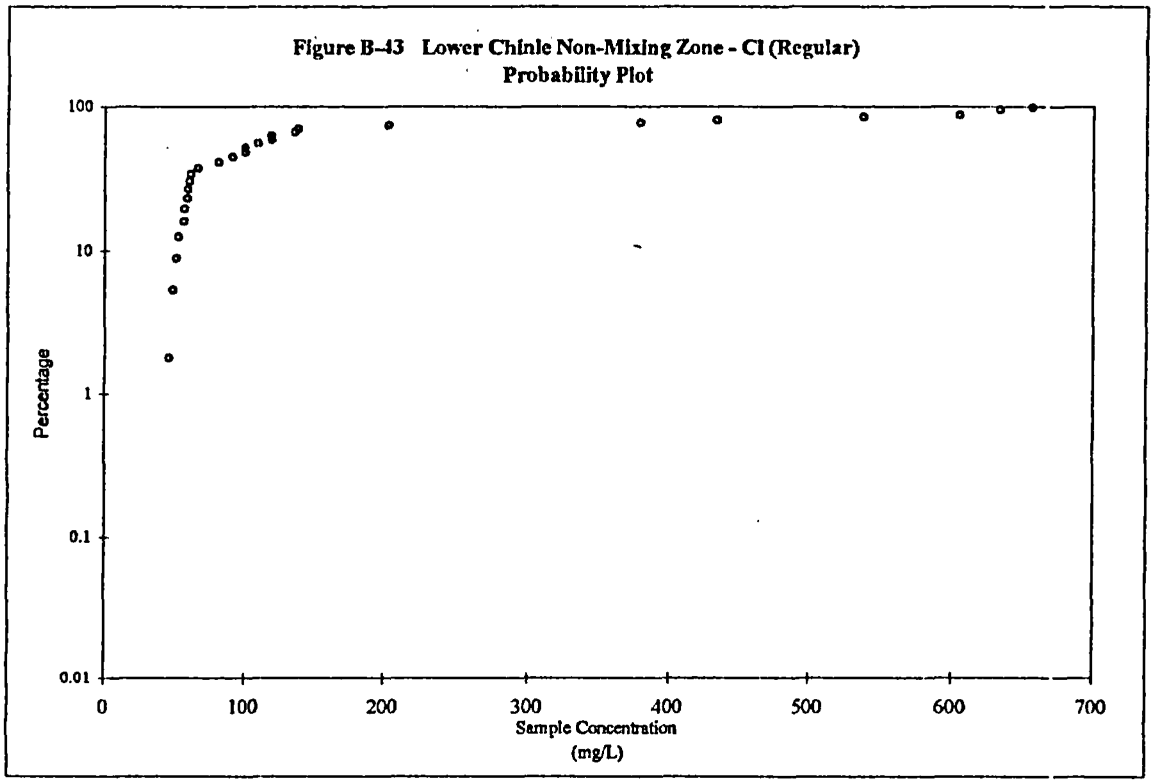


Figure B-43 Lower Chinle Non-Mixing Zone - Cl (Regular)
Probability Plot
Percentage
100
10
1
0.1
0.01
0
100
200
300
400
500
600
700
Sample Concentration
(mg/L)

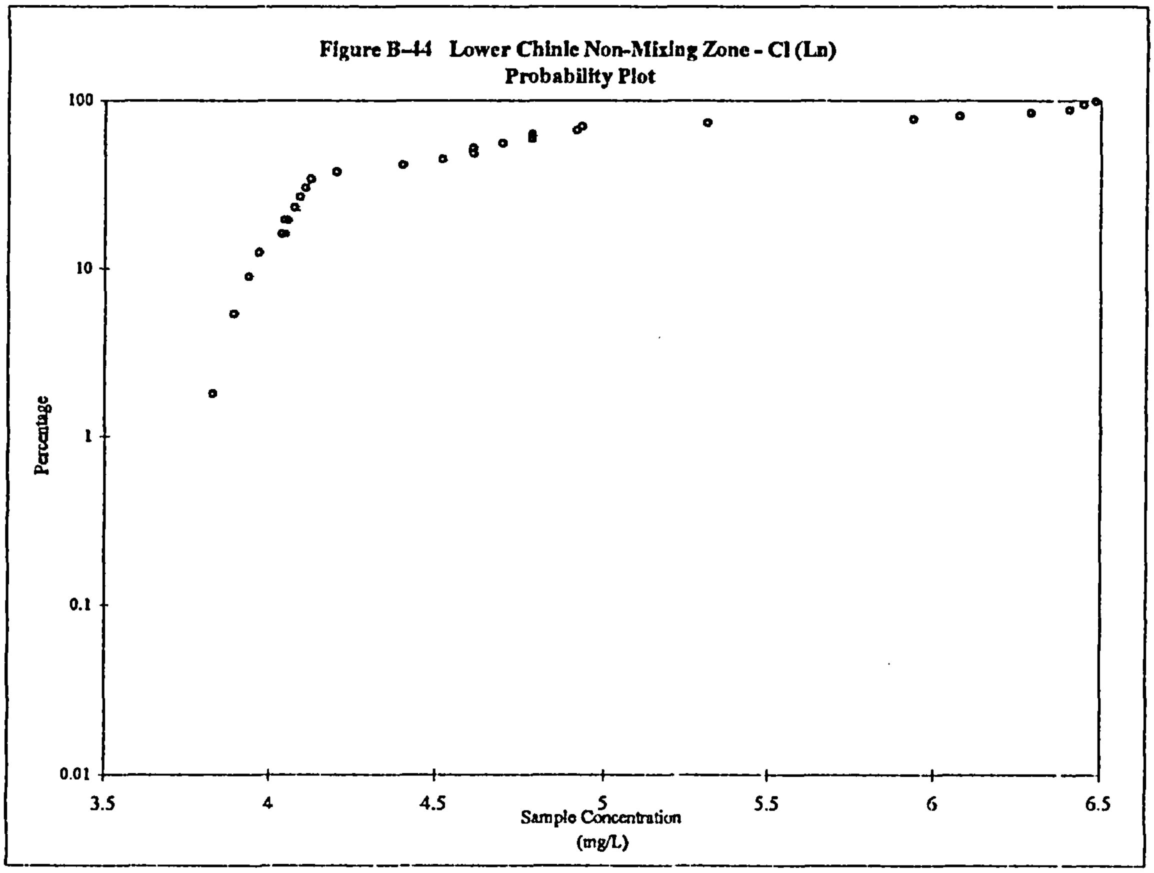


Figure B-44 Lower Chinle Non-Mixing Zone - Cl (Ln)
Probability Plot
Percentage
100
10
1
0.1
0.01
3.5
4
4.5
5
5.5
6
6.5
Sample Concentration
(mg/L)

Figure B-45 Chinle Mixing Zone - U-nat (Regular)
Histogram

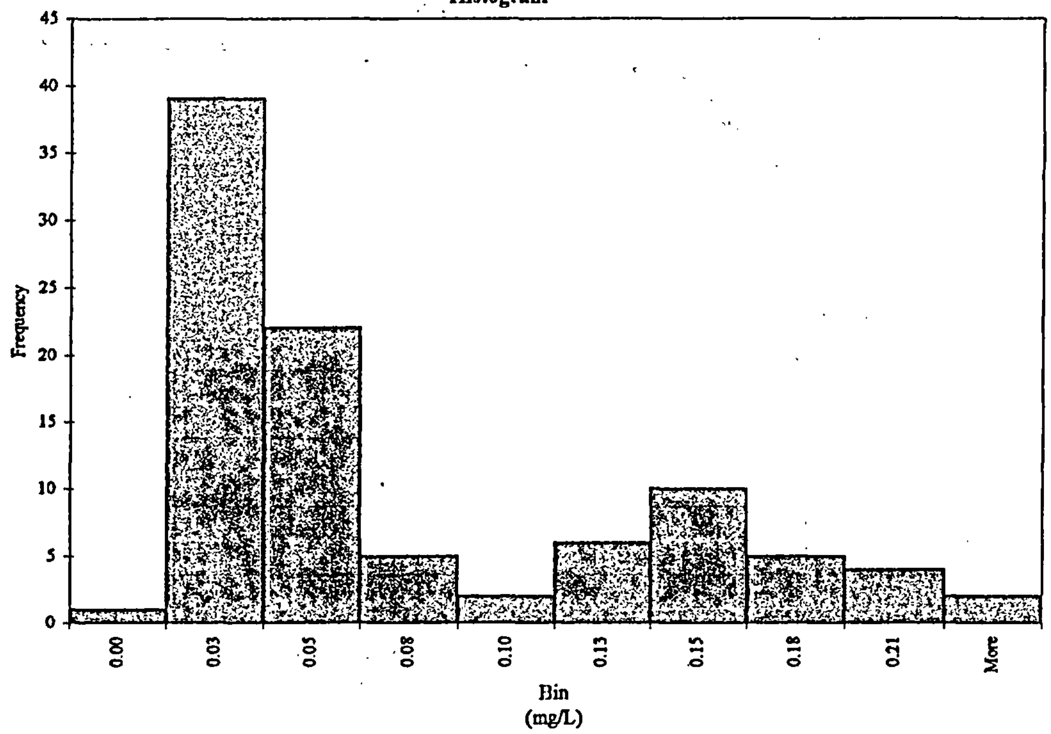
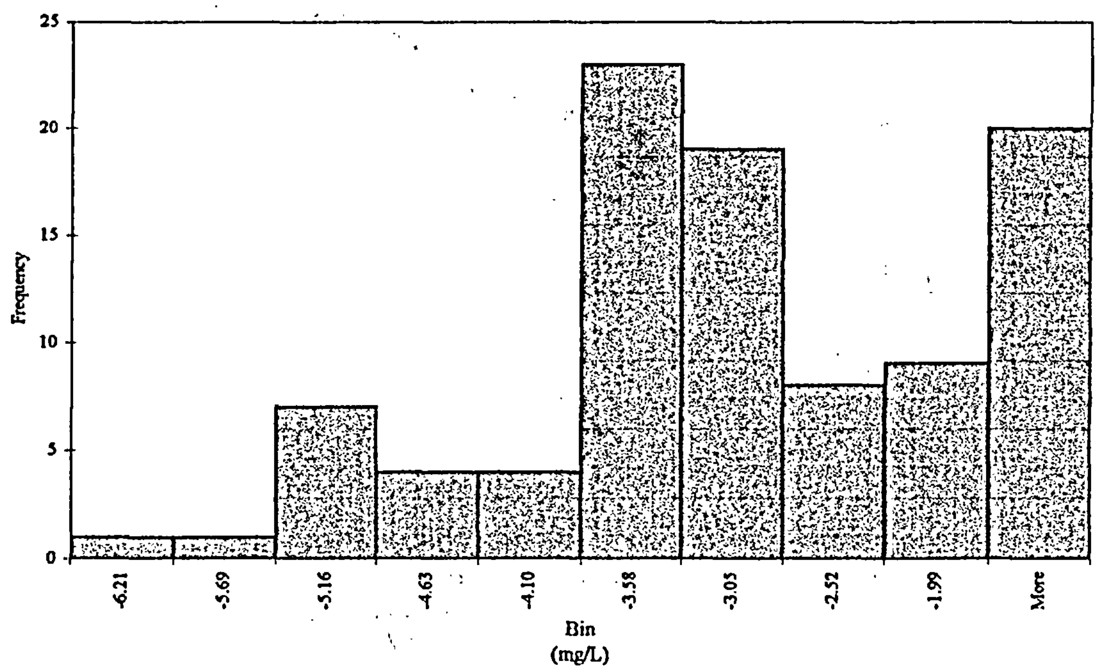


Figure B-46 Chinle Mixing Zone - U-nat (Ln)
Histogram



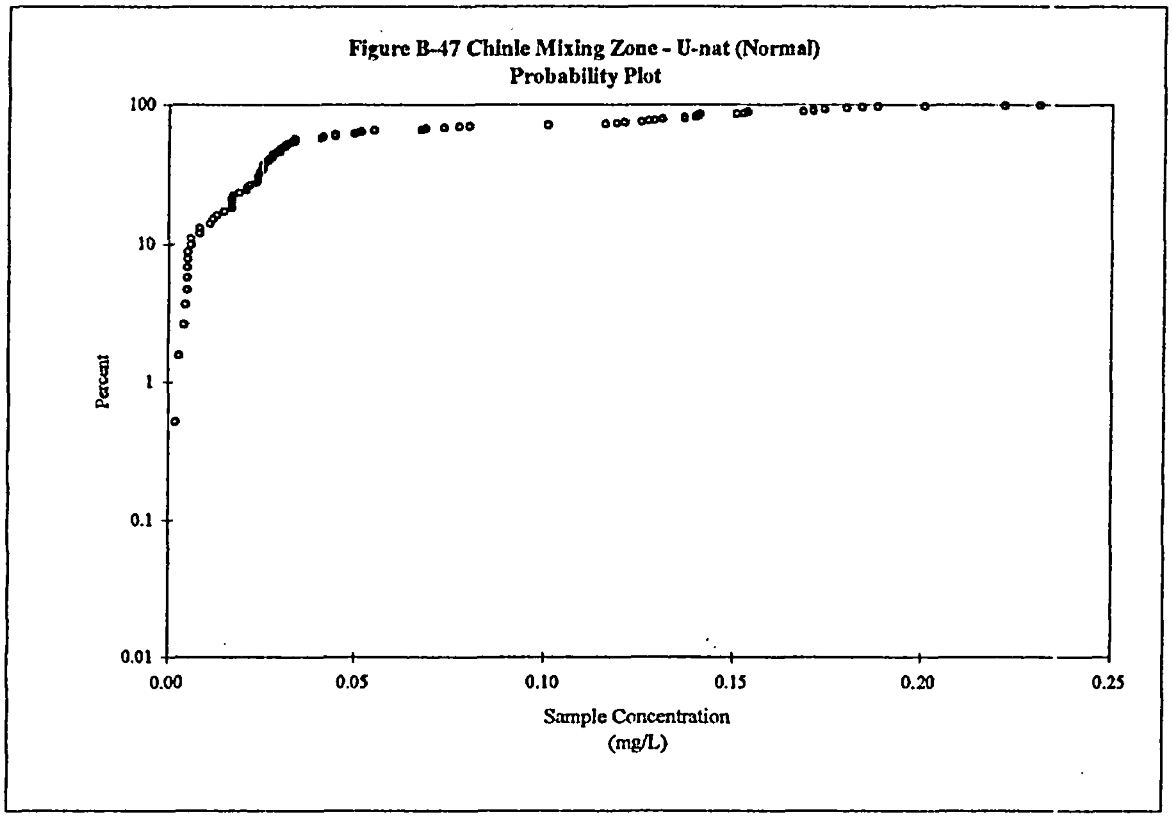


Figure B-47 Chinle Mixing Zone - U-nat (Normal)
Probability Plot
100
10
1
0.1
0.01
Percent
0.00
0.05
0.10
0.15
0.20
0.25
Sample Concentration
(mg/L)

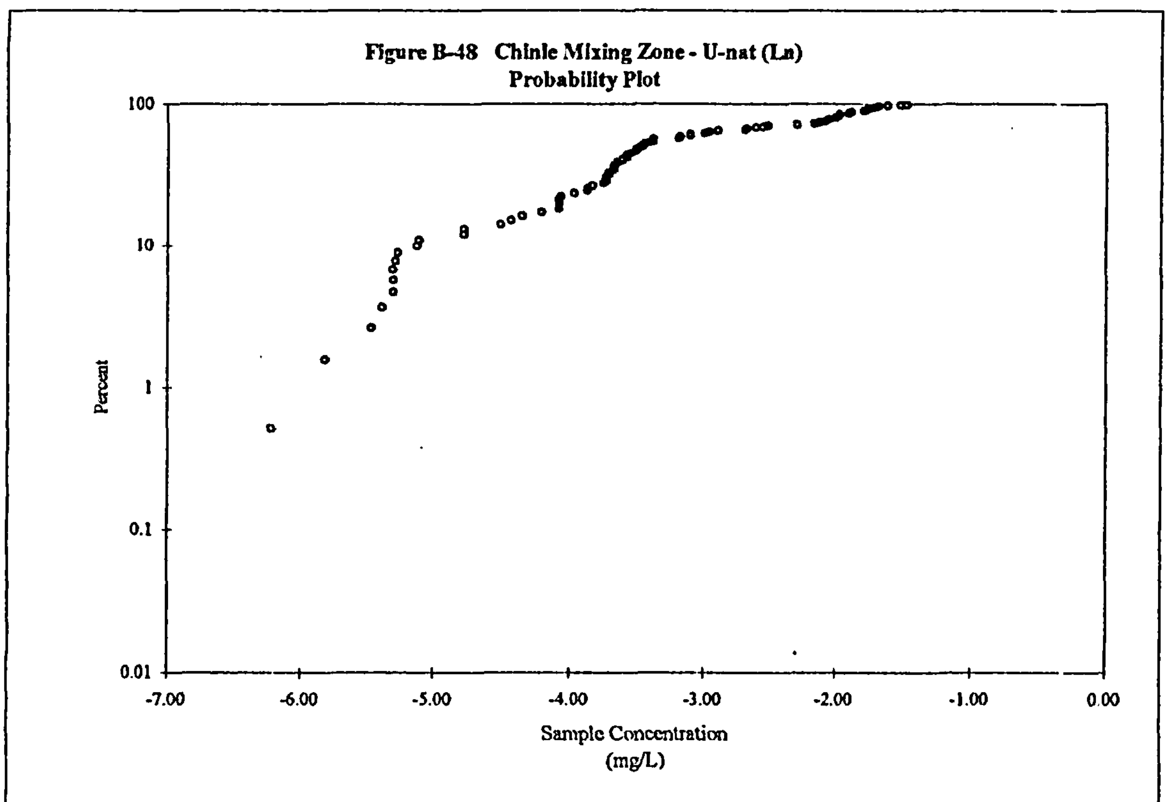


Figure B-48 Chinle Mixing Zone - U-nat (Ln)
Probability Plot
100
10
1
0.1
0.01
Percent
-7.00
-6.00
-5.00
-4.00
-3.00
-2.00
-1.00
0.00
Sample Concentration
(mg/L)

Figure B-49 Chinle Mixing Zone - Se (Regular)
Histogram

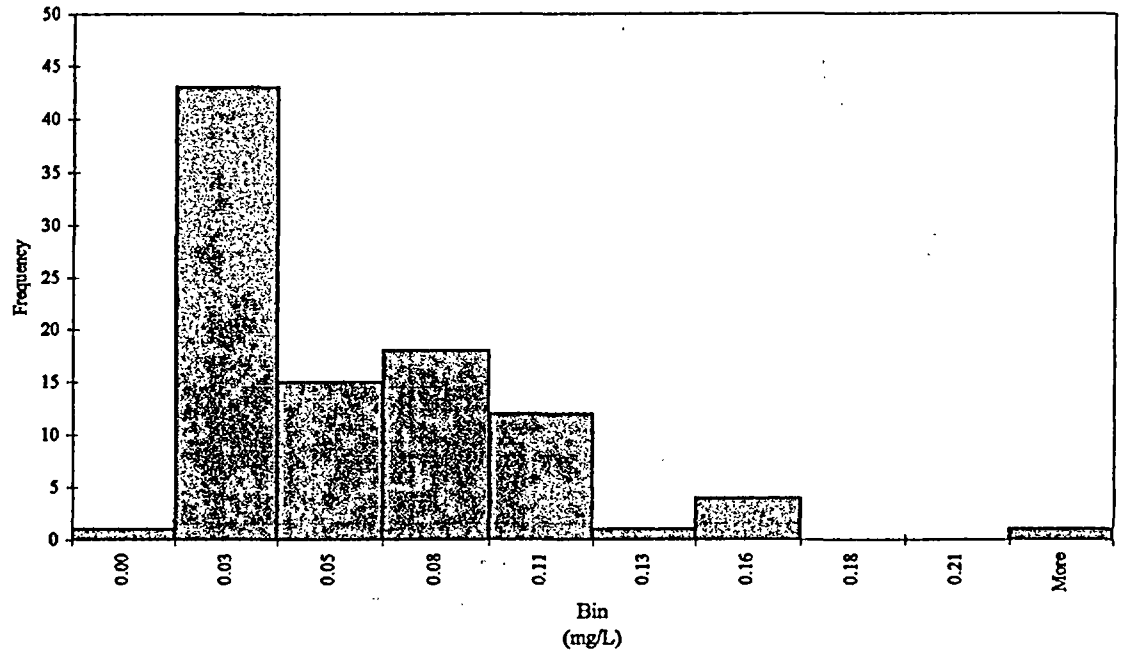


Figure B-50 Chinle Mixing Zone -Se (Ln)
Histogram

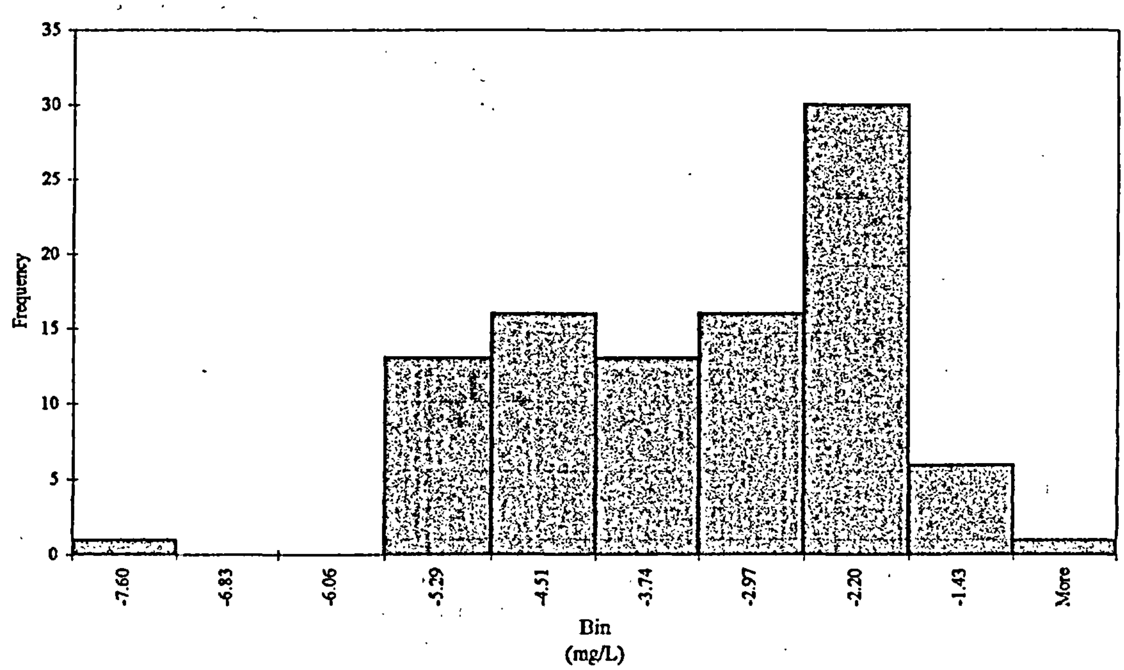


Figure B-51 Chinle Mixing Zone - Se (Normal) Probability Plot

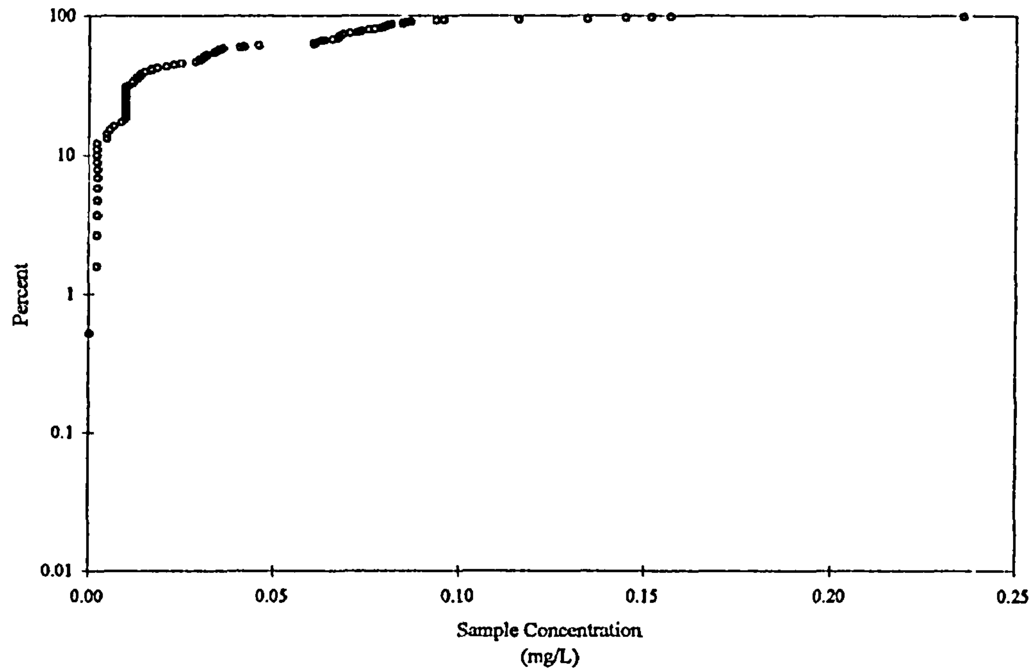


Figure B-52 Chinle Mixing Zone - Se (Ln) Probability Plot

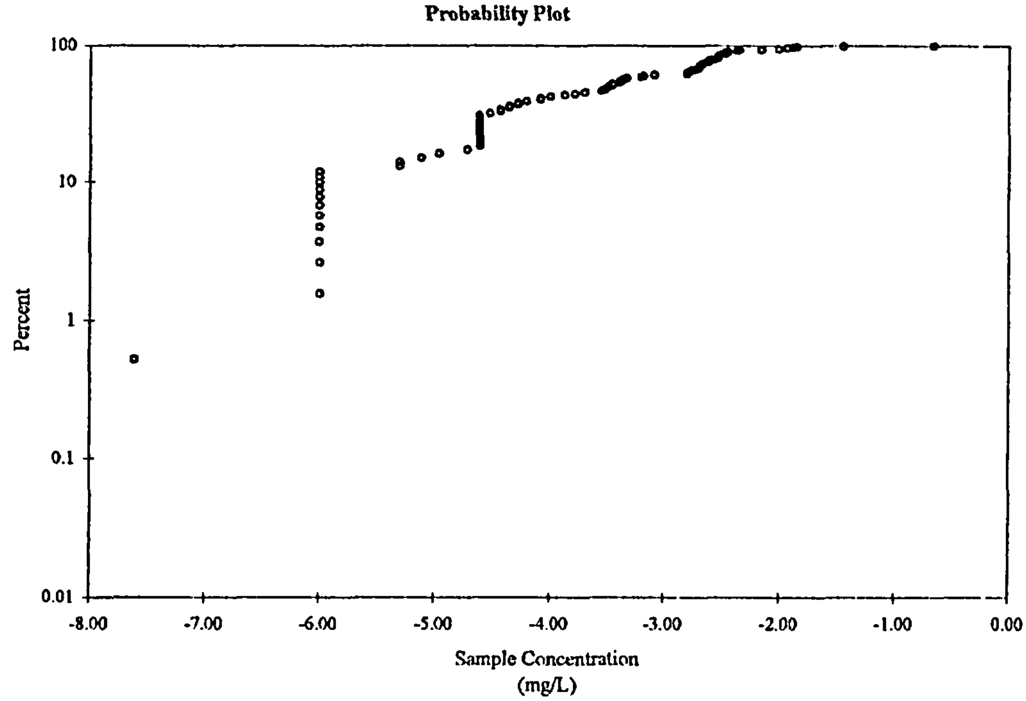


Figure B-53 Chinle Mixing Zone -TDS (Regular)
Histogram

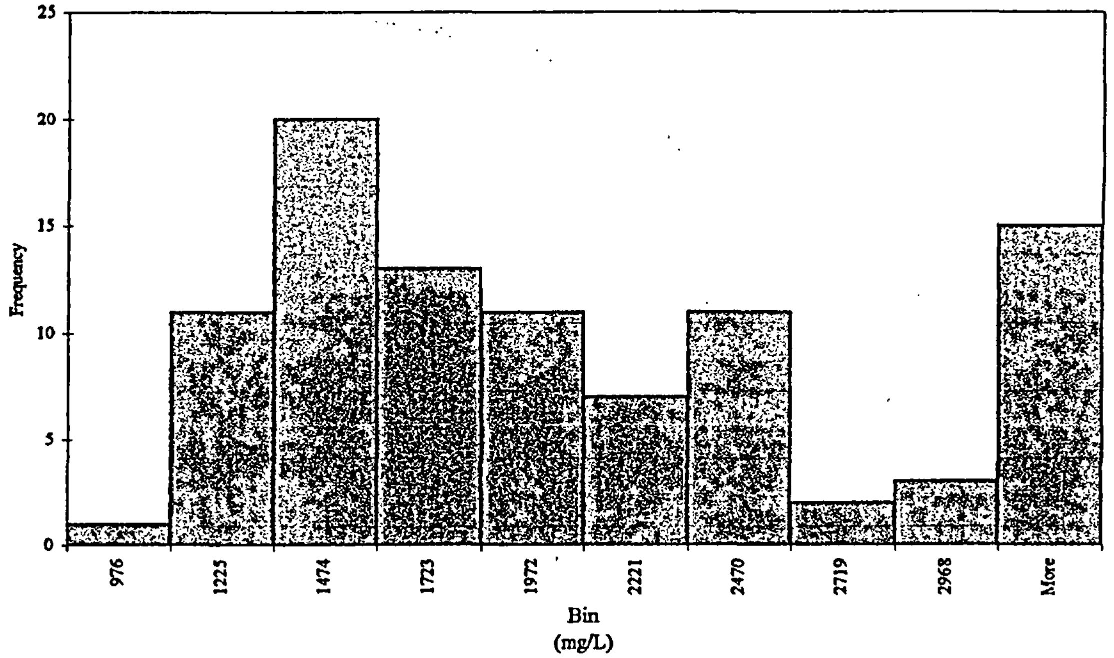


Figure B-54 Chinle Mixing Zone -TDS (Ln)
Histogram

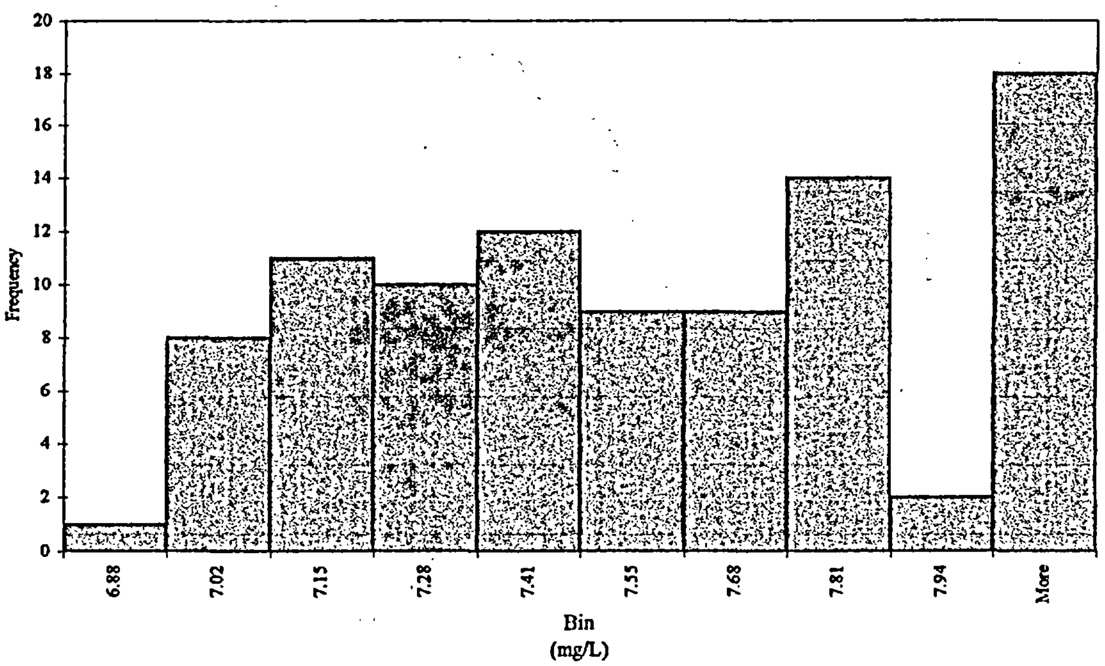


Figure B-55 Chinle Mixing Zone - TDS (Normal)
Probability Plot

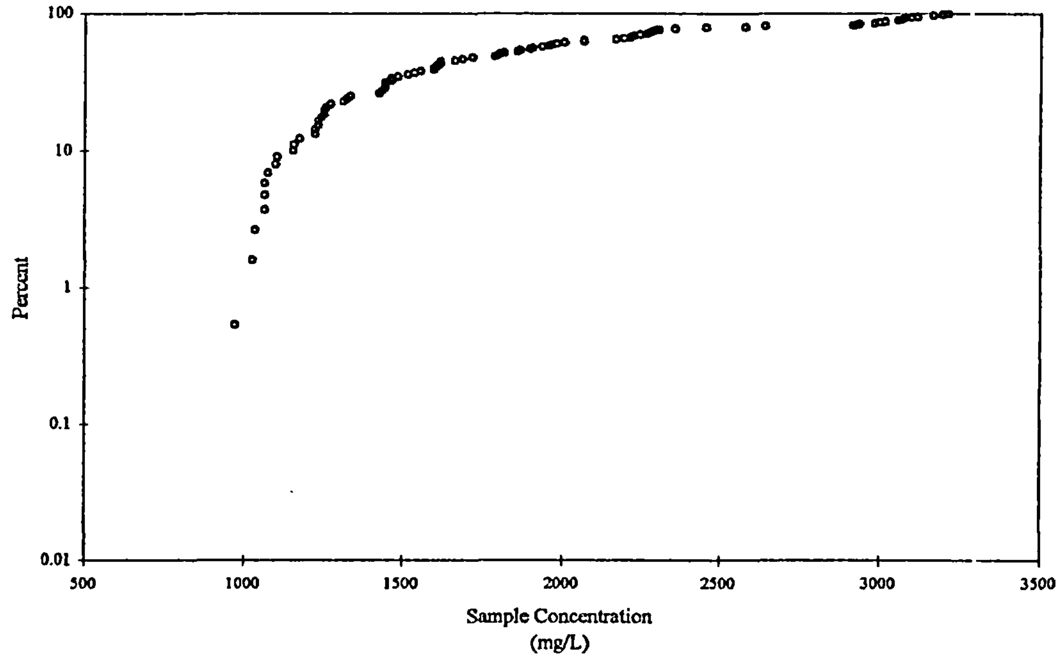
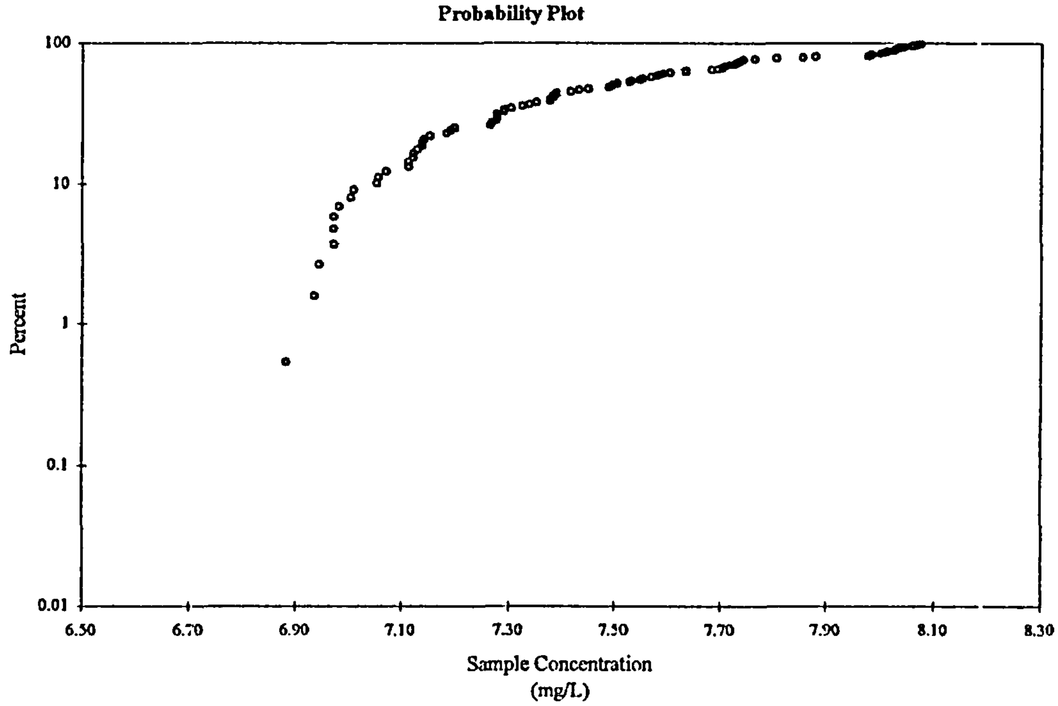


Figure B-56 Chinle Mixing Zone - TDS (Ln)
Probability Plot



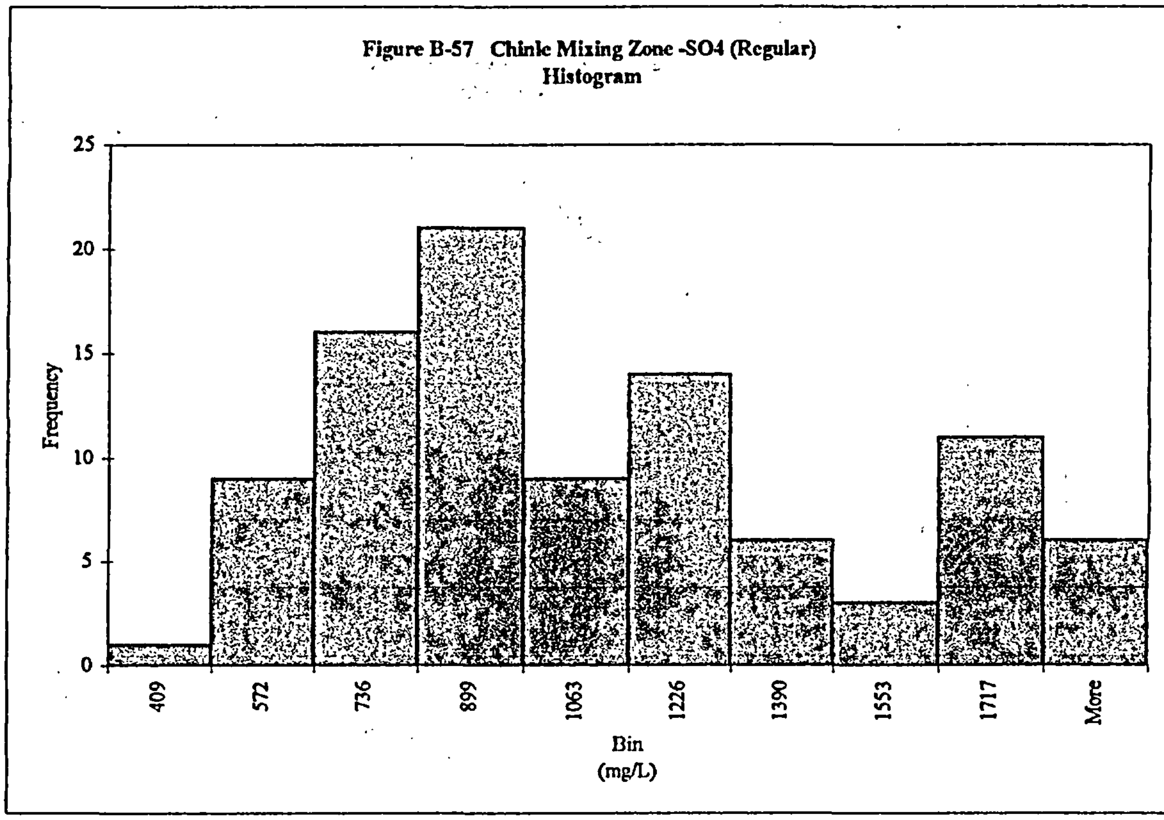


Figure B-57 Chinle Mixing Zone -SO4 (Regular)
Histogram
Frequency
0
5
10
15
20
25
409
572
736
899
1063
1226
1390
1553
1717
More
Bin
(mg/L)

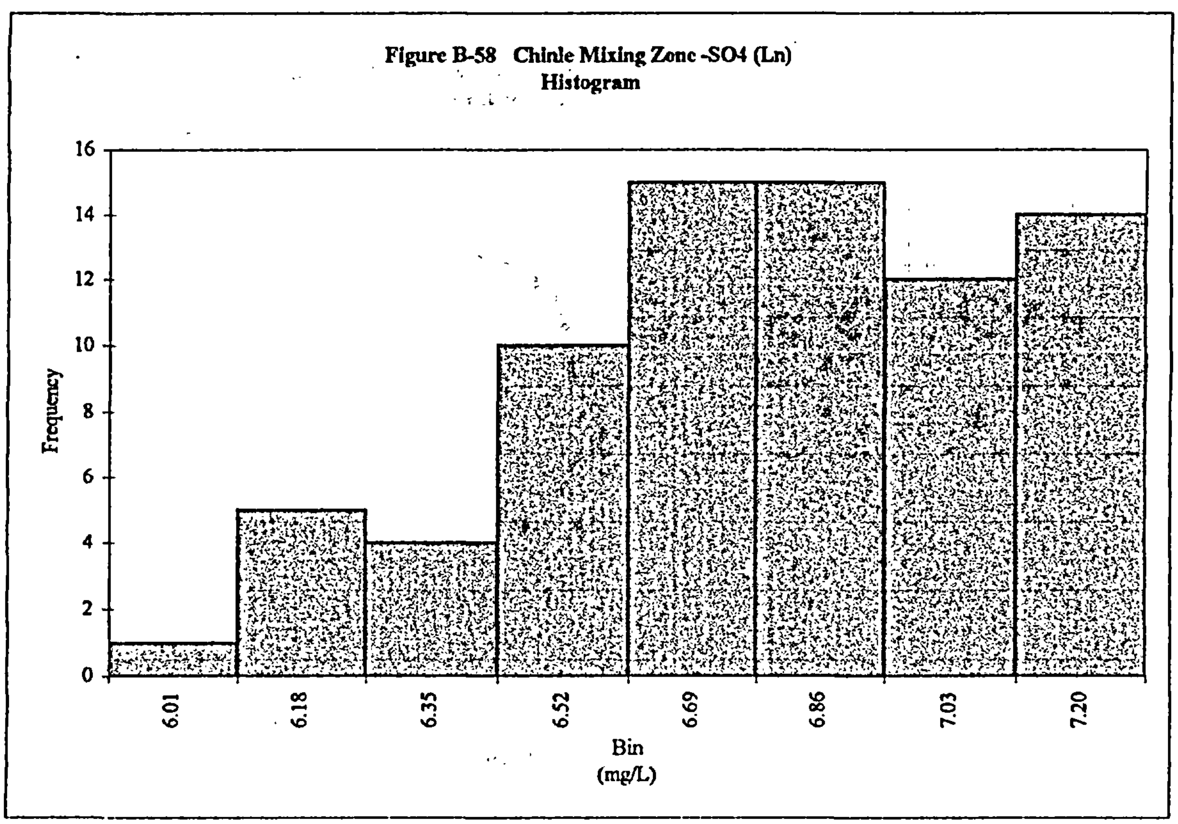


Figure B-58 Chinle Mixing Zone -SO4 (Ln)
Histogram
Frequency
0
2
4
6
8
10
12
14
16
6.01
6.18
6.35
6.52
6.69
6.86
7.03
7.20
Bin
(mg/L)

Figure B-59 Chinle Mixing Zone - SO4 (Normal)
Probability Plot

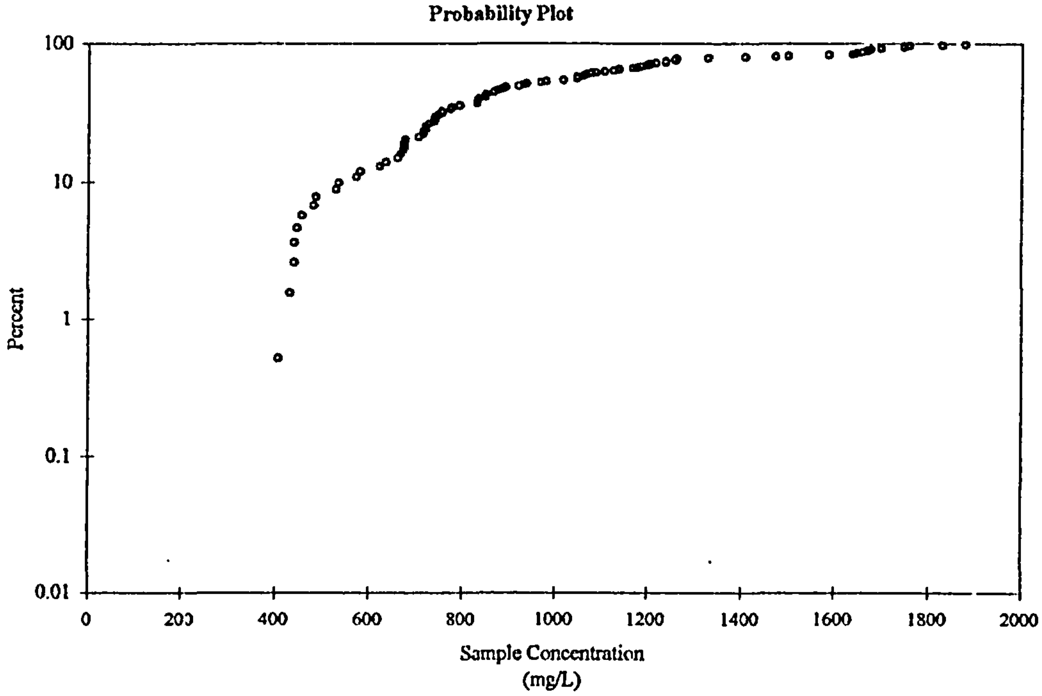
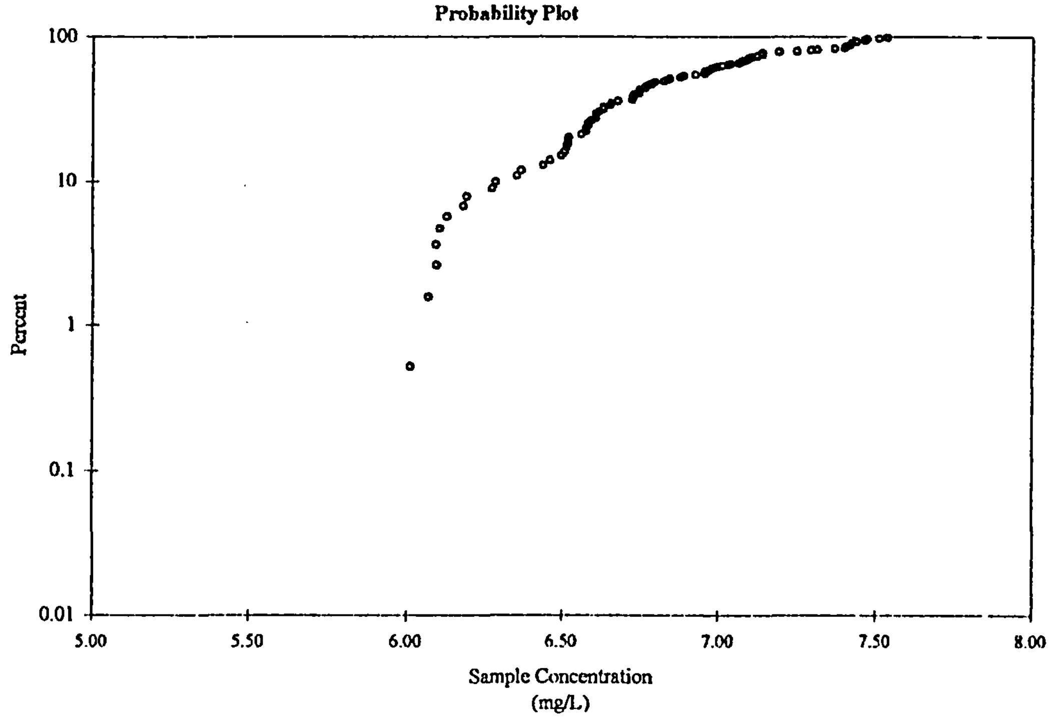


Figure B-60 Chinle Mixing Zone - SO4 (Ln)
Probability Plot



Appendix C

Analytical Data

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Appendix C - Analytical Data

TABLE C-1. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS.

Ca THROUGH ION_BAL

Sample Point Name	Date	Lab	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Na (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	TDS (mg/l)	Cond(calc.) (µmhos/cm)	Ion_B (ratio)
0931	3/26/1982	HMC	—	—	—	—	—	—	—	—	—	—	—
	3/26/1982	HMC	—	—	—	—	—	—	—	—	—	—	—
	3/26/1982	HMC	—	—	—	—	—	—	540	630	2140	—	—
	7/28/1982	HMC	—	—	—	—	—	—	—	—	—	3056	—
	7/28/1982	HMC	—	—	—	—	—	—	—	—	—	3197	—
	7/28/1982	HMC	96.0	—	16.0	658	306	24.0	156	667	2140	—	—
	1/10/1983	HMC	—	—	—	—	—	—	—	—	—	3046	—
	1/10/1983	HMC	—	—	—	—	—	—	—	—	—	3140	—
	1/10/1983	HMC	16.0	—	12.0	655	6.00	44.0	496	640	1920	3037	—
	8/30/1983	HMC	48.0	0	2.00	684	378	0	397	712	2160	2895	—
	1/10/1984	HMC	—	—	—	—	—	—	—	—	—	3102	—
	1/10/1984	HMC	—	—	—	—	—	—	—	—	—	3028	—
	1/10/1984	HMC	—	—	—	—	—	—	489	625	1710	3028	—
	7/24/1984	HMC	—	—	—	—	—	—	—	—	—	2259	—
	7/24/1984	HMC	—	—	—	—	—	—	—	—	—	2174	—
	7/24/1984	HMC	—	—	—	—	—	—	—	—	—	2115	—
	7/24/1984	HMC	—	—	—	—	—	—	—	—	—	2468	—
	7/24/1984	HMC	23.0	22.0	3.00	686	371	0	418	735	2130	2468	0.990
	1/18/1985	HMC	—	—	—	—	—	—	—	—	—	2911	—
	1/18/1985	HMC	—	—	—	—	—	—	—	—	—	2980	—
	1/18/1985	HMC	—	—	—	—	—	—	525	651	1290	3053	—
	7/19/1985	HMC	—	—	—	—	—	—	—	—	—	2900	—
	7/19/1985	HMC	—	—	—	—	—	—	—	—	—	2943	—
	7/19/1985	HMC	—	—	—	—	—	—	—	—	—	2947	—
	7/19/1985	HMC	21.0	2.00	1.000	634	73.0	10.00	475	677	1530	2947	0.990
	1/13/1986	HMC	—	—	—	—	—	—	—	—	—	3046	—
	1/13/1986	HMC	—	—	—	—	—	—	—	—	—	3149	—
	1/13/1986	HMC	—	—	—	—	—	—	390	693	1410	3164	—
	7/23/1986	HMC	32.0	1.000	2.00	690	382	< 0.0010	390	722	2090	3143	0.983

TABLE C-1. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

Ca THROUGH ION_BAL

Sample Point Name	Date	Lab	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Na (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	TDS (mg/l)	Cond(calc.) (µmhos/cm)	Ion_B (ratio)
0931	1/29/1987	HMC	—	—	—	—	—	—	—	—	—	2880	—
	1/29/1987	HMC	—	—	—	—	—	—	—	—	—	2876	—
	1/29/1987	HMC	—	—	—	—	—	—	426	699	1610	2908	—
	7/22/1987	HMC	—	—	—	—	—	—	—	—	—	2800	—
	7/22/1987	HMC	22.0	1.000	2.00	677	383	< 10.00	355	765	1460	3101	0.940
	2/10/1988	HMC	—	—	—	—	—	—	—	—	—	2713	—
	2/10/1988	HMC	—	—	—	—	—	—	369	737	1760	3065	—
	7/28/1988	HMC	—	—	—	—	—	—	—	—	—	2587	—
	7/28/1988	HMC	21.0	1.000	2.00	580	66.0	28.0	390	686	1770	26.0	0.970
	1/18/1989	HMC	—	—	—	—	—	—	277	724	1990	3092	—
	9/18/1989	HMC	22.0	4.00	2.00	703	370	35.0	262	779	1870	3130	1.04
	7/3/1990	HMC	—	—	—	—	—	—	—	—	—	3335	—
	7/3/1990	HMC	—	—	—	—	—	—	—	—	—	3104	—
	7/3/1990	HMC	22.0	1.000	2.00	754	410	6.00	312	704	2140	3104	1.12
	8/20/1991	HMC	—	—	—	—	—	—	—	—	—	2913	—
	8/20/1991	HMC	—	—	—	—	—	—	—	—	—	3068	—
	8/20/1991	HMC	17.0	2.00	1.000	673	405	< 0.100	277	723	1960	3032	1.03
	8/12/1992	HMC	—	—	—	—	—	—	—	—	—	2599	—
	8/12/1992	HMC	—	—	—	—	—	—	—	—	—	2826	—
	8/12/1992	HMC	37.0	1.000	2.00	633	371	12.0	277	751	1950	3031	0.986
	3/4/1993	HMC	33.0	2.00	2.00	637	406	< 0.100	284	737	1990	2887	0.985
	9/1/1993	ENER	8.00	1.30	< 0.100	676	369	7.70	329	622	1905	* 2935	1.05
	3/28/1994	ENER	8.20	1.10	0.400	669	370	< 0.100	333	657	1893	* 2870	1.02
	8/17/1994	ENER	8.90	1.10	< 0.100	668	392	6.70	304	706	1874	* 2938	0.989
	6/14/1995	ENER	9.00	1.40	1.000	617	402	5.60	313	646	1867	—	0.944
	6/14/1995	HMC	—	—	—	—	—	—	—	—	—	3113	—
	8/16/1995	ENER	12.0	1.50	1.10	695	406	< 0.100	397	704	1932	* 3173	0.953
	7/31/1996	ENER	9.10	1.40	1.000	614	397	5.30	252	709	1815	* 2956	0.956
	4/14/1997	ENER	3.50	< 1.000	< 1.000	552	221	36.8	235	626	1550	* 2714	0.991

* Signifies Specific Conductivity from HMC

TABLE C-1. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

Ca THROUGH ION_BAL

Sample Point Name	Date	Lab	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Na (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	TDS (mg/l)	Cond(calc.) (µmhos/cm)	Ion_B (ratio)
0931	9/3/1997	ENER	3.30	< 1.000	< 1.000	503	177	16.9	244	619	1530	* 2523	0.954
	4/1/1998	ENER	# 3.00	# < 1.000	# < 1.000	# 483	# 153	# 9.10	# 238	# 608	# 1420	*# 2365	# 0.959
	4/1/1998	ENER	3.00	< 1.000	< 1.000	473	151	9.40	251	615	1410	* 2365	0.919
	9/16/1998	ENER	2.80	< 1.000	< 1.000	432	140	4.00	223	540	1370	* 2178	0.954
	4/20/1999	ENER	2.90	< 1.000	< 1.000	439	128	10.0	211	554	1340	* 2815	0.972
	9/14/1999	ENER	3.60	< 1.000	3.90	454	253	< 1.000	220	535	1340	* 2698	0.934
	4/6/2000	ENER	—	1.10	1.30	—	399	< 1.000	132	711	1750	* 3133	—
	4/6/2000	ENER	7.80	# 1.000	# 1.80	559	# 397	# < 1.000	# 150	# 708	# 1720	—	0.973
	8/30/2000	ENER	2.80	< 1.000	< 1.000	438	164	10.00	144	571	1410	* 2712	1.02
	8/30/2000	ENER	# 2.80	# < 1.000	# < 1.000	# 437	# 172	# 6.00	# 145	# 574	# 1410	—	# 1.01
0934	2/25/1982	HMC	51.0	6.00	—	620	401	< 10.00	241	768	1910	—	—
	9/18/1989	HMC	22.0	2.00	1.000	633	399	30.0	156	786	1710	2686	1.02
	7/3/1990	HMC	—	—	—	—	—	—	—	—	—	2587	—
	7/3/1990	HMC	22.0	1.000	2.00	616	415	7.00	170	732	1840	2587	1.04
	8/19/1991	HMC	17.0	1.000	1.000	617	418	< 0.100	163	748	1790	2586	1.03
	8/19/1991	HMC	—	—	—	—	—	—	—	—	—	2587	—
	8/12/1992	HMC	—	—	—	—	—	—	—	—	—	2568	—
	8/12/1992	HMC	—	—	—	—	—	—	—	—	—	2611	—
	8/12/1992	HMC	53.0	1.000	1.000	560	379	12.0	156	774	1760	2617	1.000
	3/4/1993	HMC	29.0	2.00	2.00	583	406	< 0.100	163	821	1830	2525	0.953
	8/31/1993	ENER	8.00	1.000	< 0.100	611	375	5.60	163	678	1777	* 2497	1.08
	3/28/1994	ENER	7.10	0.900	0.300	577	412	< 0.100	194	654	1676	* 2523	0.988
	8/17/1994	ENER	7.80	0.900	< 0.100	572	397	5.60	161	662	1549	* 2556	1.01
	8/17/1995	ENER	7.80	1.000	1.000	571	422	< 0.100	176	727	1589	* 2618	0.938
	7/31/1996	ENER	7.10	1.10	< 1.000	567	402	4.80	163	706	1678	* 2707	0.965
	4/14/1997	ENER	7.30	1.000	1.000	573	385	6.30	131	727	1650	* 2779	1.00
	9/3/1997	ENER	7.70	1.10	1.000	567	392	9.60	149	733	1720	* 2776	0.960
	4/1/1998	ENER	8.00	1.000	1.000	557	380	5.20	148	801	1680	* 2538	0.908
	9/24/1998	ENER	6.80	< 1.000	< 1.000	529	386	6.60	125	696	1700	* 2405	0.955

Signifies Quality Control Sample

* Signifies Specific Conductivity from HMC

TABLE C-1. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

Ca THROUGH ION_BAL

Sample Point Name	Date	Lab	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Na (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	TDS (mg/l)	Cond(calc.) (µmhos/cm)	Ion_B (ratio)
0934	4/20/1999	ENER	6.60	1.000	1.000	543	380	12.1	117	705	1660	* 3113	0.978
	9/14/1999	ENER	6.50	< 1.000	< 1.000	563	395	< 1.000	82.5	730	1590	* 2901	1.04
	4/6/2000	ENER	6.70	< 1.000	1.30	519	392	< 1.000	83.3	700	1610	* 2935	0.985
	8/30/2000	ENER	5.50	< 1.000	1.07	493	394	5.30	77.1	645	1580	* 2925	0.982
	7/25/2001	ENER	—	—	—	—	—	—	—	620	1560	* 2902	—
	2/26/2002	ENER	—	—	—	—	—	—	—	629	1830	* 3407	—
	7/22/2002	ENER	25.9	—	—	—	—	—	—	691	1780	* 3037	—
	4/28/2003	ENER	11.7	—	—	—	—	—	—	635	1880	* 3518	—
	7/7/2003	ENER	12.3	1.90	1.30	623	619	7.50	220	632	1930	* 2850	0.938
ACW	12/7/1979	UNK	—	—	1.37	472	295	—	41.8	759	—	—	—
	12/2/1980	HMC	—	—	—	490	331	—	—	799	—	1619	—
	8/18/1981	HMC	—	—	—	460	358	—	—	929	1470	—	—
	10/8/1981	HMC	—	—	—	310	348	—	30.0	704	1490	—	—
	11/19/1981	HMC	—	—	—	530	342	—	43.0	787	1500	—	—
	2/1/1982	HMC	—	—	—	470	285	—	41.0	866	1490	—	—
	2/15/1982	HMC	—	—	—	485	307	—	50.0	844	1520	—	—
	3/2/1982	HMC	—	—	—	495	303	—	50.0	797	1470	—	—
	5/21/1982	HMC	27.0	13.0	16.0	458	359	8.00	57.0	752	1420	1514	0.970
	11/16/1982	HMC	—	—	—	—	—	—	—	—	—	1996	—
	11/16/1982	HMC	—	—	—	—	—	—	—	—	—	1992	—
	11/16/1982	HMC	—	—	—	—	—	—	—	—	—	1977	—
	11/16/1982	HMC	—	—	—	—	—	—	43.0	691	1430	1992	—
	2/14/1983	HMC	—	—	—	—	—	—	—	—	—	1997	—
	2/14/1983	HMC	—	—	—	—	—	—	35.0	746	1490	1900	—
	4/15/1983	HMC	25.0	3.00	2.00	484	323	0	43.0	750	1460	1971	1.02
	6/27/1983	HMC	—	—	—	—	—	—	—	—	—	1784	—
	6/27/1983	HMC	—	—	—	—	—	—	—	—	—	1766	—
	6/27/1983	EID	9.60	0	1.56	456	340	11.8	34.9	730	* 1410	* 1792	* 0.990
	8/31/1983	HMC	—	—	—	—	—	—	28.0	746	1370	1956	—

* Signifies Specific Conductivity from HMC

TABLE C-1. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

Ca THROUGH ION_BAL

Sample Point Name	Date	Lab	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Na (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	TDS (mg/l)	Cond(calc.) (µmhos/cm)	Ion_B (ratio)
ACW	12/19/1983	HMC	—	—	—	—	—	—	—	—	—	2057	—
	12/19/1983	HMC	—	—	—	—	—	—	—	—	—	2090	—
	12/19/1983	HMC	—	—	—	—	—	—	—	—	—	2099	—
	12/19/1983	HMC	—	—	—	—	—	—	43.0	746	1370	2076	—
	1/1/1984	HMC	—	—	—	—	—	—	—	—	—	2046	—
	1/1/1984	HMC	—	—	—	—	—	—	—	—	—	2070	—
	1/1/1984	HMC	—	—	—	—	—	—	28.0	759	1470	2044	—
	7/19/1984	HMC	—	—	—	—	—	—	—	—	—	1672	—
	7/19/1984	HMC	—	—	—	—	—	—	—	—	—	1640	—
	7/19/1984	HMC	—	—	—	—	—	—	35.0	814	1220	1668	—
	11/2/1984	HMC	—	—	—	—	—	—	—	—	—	1874	—
	11/2/1984	HMC	—	—	—	—	—	—	—	—	—	1986	—
	11/2/1984	HMC	—	—	—	—	—	—	28.0	688	1440	1874	—
	3/19/1986	HMC	—	—	—	—	—	—	—	—	—	1133	—
	3/19/1986	HMC	—	—	—	—	—	—	—	—	—	10.00	—
	3/19/1986	HMC	—	—	—	—	—	—	—	—	—	1038	—
	3/19/1986	HMC	—	—	—	—	—	—	35.0	374	560	1038	—
	5/20/1986	HMC	—	—	—	—	—	—	—	—	—	1087	—
	5/20/1986	HMC	—	—	—	—	—	—	—	—	—	1101	—
	5/20/1986	HMC	205	19.0	4.00	57.0	346	< 10.00	37.0	330	740	1020	1.03
	7/9/1986	HMC	—	—	—	—	—	—	99.0	334	820	1293	—
	12/31/1986	HMC	—	—	—	—	—	—	—	—	—	1124	—
	12/31/1986	HMC	—	—	—	—	—	—	—	—	—	1064	—
	12/31/1986	HMC	—	—	—	—	—	—	35.0	335	720	1064	—
	12/19/1989	HMC	22.0	1.000	1.000	437	279	29.0	43.0	667	1240	1986	0.979
	6/26/1990	HMC	19.0	4.00	1.000	473	334	20.0	35.0	667	1400	1993	1.04
	6/27/1991	HMC	27.0	1.000	1.000	430	325	< 0.100	35.0	640	1570	1939	1.03
	12/10/1992	HMC	—	—	—	—	—	—	—	—	—	1880	—
	12/10/1992	HMC	—	—	—	—	—	—	—	—	—	2068	—

TABLE C-1. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

Ca THROUGH ION_BAL

Sample Point Name	Date	Lab	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Na (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	TDS (mg/l)	Cond(calc.) (µmhos/cm)	Ion_B (ratio)
ACW	12/10/1992	HMC	16.0	4.00	1.000	453	196	37.0	50.0	692	1470	2068	1.03
	7/12/1994	ENER	3.40	0.600	0.200	448	302	9.10	34.0	643	1173	* 1865	1.01
	7/12/1994	ENER	3.30	0.600	0.100	445	304	8.20	33.3	640	1172	* 1865	1.00
CW1	1/21/1982	HMC	—	—	—	590	285	—	30.0	1039	1780	—	—
	1/28/1982	HMC	—	—	—	550	309	—	35.0	903	1600	—	—
	3/9/1994	ENER	7.80	1.10	0.400	437	292	4.30	36.3	724	1326	* 2020	0.927
	2/26/2002	ENER	—	—	—	—	—	—	—	552	1240	* 2327	—
	8/21/2002	ENER	—	—	—	—	—	—	—	616	1320	* 2448	—
	4/23/2003	ENER	—	—	—	—	—	—	—	597	1320	* 2514	—
	7/10/2003	ENER	7.50	1.10	1.30	478	354	4.70	45.4	632	1350	* 2030	1.04
CW2	1/22/1982	HMC	—	—	—	590	325	—	60.0	1141	1970	—	—
	2/2/1982	HMC	51.0	2.00	25.0	525	374	< 0.0100	50.0	847	1670	—	1.04
	7/15/1982	HMC	128	—	13.0	415	318	10.00	21.0	607	1210	1723	—
	1/20/1983	HMC	—	—	—	—	—	—	35.0	492	1150	—	—
	4/14/1983	HMC	—	—	—	—	—	—	—	—	—	1892	—
	4/14/1983	HMC	—	—	—	—	—	—	—	—	—	1745	—
	4/14/1983	HMC	—	—	—	—	—	—	—	—	—	1621	—
	4/14/1983	HMC	—	—	—	—	—	—	50.0	549	1180	1640	—
	6/27/1983	EID	4.40	0	0.780	354	298	15.4	39.4	464	992	—	0.970
	6/27/1983	HMC	21.0	2.00	2.00	330	329	6.00	27.0	441	1100	1457	1.01
	9/12/1983	HMC	—	—	—	—	—	—	—	—	—	1665	—
	9/12/1983	HMC	—	—	—	—	—	—	—	—	—	1694	—
	9/12/1983	HMC	31.0	2.00	2.00	363	300	12.0	35.0	560	1090	1694	0.980
	10/26/1983	HMC	—	—	—	—	—	—	—	—	—	1035	—
	10/26/1983	HMC	—	—	—	—	—	—	—	—	—	997	—
	10/26/1983	HMC	—	—	—	—	—	—	35.0	593	1160	1009	—
	1/5/1984	HMC	—	—	—	—	—	—	—	—	—	2126	—
	1/5/1984	HMC	—	—	—	—	—	—	—	—	—	1979	—

* Signifies Specific Conductivity from HMC

TABLE C-1. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

Ca THROUGH ION_BAL

Sample Point Name	Date	Lab	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Na (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	TDS (mg/l)	Cond(calc.) (µmhos/cm)	Ion_B (ratio)
CW2	1/5/1984	HMC	—	—	—	—	—	—	28.0	648	1330	1915	—
	4/4/1984	HMC	—	—	—	—	—	—	—	—	—	2244	—
	4/4/1984	HMC	—	—	—	—	—	—	—	—	—	2020	—
	4/4/1984	HMC	—	—	—	—	—	—	43.0	769	1270	1983	—
	6/15/1984	HMC	26.0	3.00	2.00	424	303	—	35.0	701	1310	—	0.980
	10/12/1984	HMC	—	—	—	—	—	—	—	—	—	2247	—
	10/12/1984	HMC	—	—	—	—	—	—	—	—	—	2107	—
	10/12/1984	HMC	—	—	—	—	—	—	28.0	713	1370	—	—
	1/16/1985	HMC	—	—	—	—	—	—	—	—	—	2019	—
	1/16/1985	HMC	—	—	—	—	—	—	—	—	—	1357	—
	1/16/1985	HMC	—	—	—	—	—	—	39.0	513	1040	1357	—
	4/10/1985	HMC	—	—	—	—	—	—	—	—	—	2156	—
	4/10/1985	HMC	—	—	—	—	—	—	—	—	—	1624	—
	4/10/1985	HMC	—	—	—	—	—	—	35.0	549	1170	1663	—
	7/22/1985	HMC	—	—	—	—	—	—	—	—	—	1469	—
	7/22/1985	HMC	—	—	—	—	—	—	—	—	—	1554	—
	7/22/1985	HMC	—	—	—	—	—	—	—	—	—	1626	—
	7/22/1985	HMC	26.0	7.00	2.00	370	329	< 0.0010	21.0	542	1200	1626	1.04
	10/3/1985	HMC	—	—	—	—	—	—	—	—	—	2208	—
	10/3/1985	HMC	—	—	—	—	—	—	—	—	—	1665	—
	10/3/1985	HMC	—	—	—	—	—	—	39.0	530	1100	1665	—
	1/9/1986	HMC	—	—	—	—	—	—	35.0	523	1090	1569	—
	4/8/1986	HMC	—	—	—	—	—	—	—	—	—	1646	—
	4/8/1986	HMC	—	—	—	—	—	—	—	—	—	1590	—
	4/8/1986	HMC	—	—	—	—	—	—	39.0	807	1050	1601	—
	7/15/1986	HMC	26.0	2.00	1.000	353	328	< 0.0010	35.0	502	1190	1643	1.000
	10/13/1986	HMC	—	—	—	—	—	—	50.0	487	1110	1913	—
	1/8/1987	HMC	—	—	—	—	—	—	43.0	496	1010	1680	—
	4/9/1987	HMC	—	—	—	—	—	—	—	—	—	1540	—

TABLE C-1. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

Ca THROUGH ION_BAL

Sample Point Name	Date	Lab	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Na (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	TDS (mg/l)	Cond(calc.) (µmhos/cm)	Ion_B (ratio)
CW2	4/9/1987	HMC	—	—	—	—	—	—	28.0	448	860	1577	—
	7/17/1987	HMC	19.0	1.000	11.0	348	381	< 10.00	35.0	472	1100	1589	0.950
	7/17/1987	HMC	—	—	—	—	—	—	—	—	—	1564	—
	10/15/1987	HMC	—	—	—	—	—	—	21.0	536	890	1558	—
	11/19/1987	HMC	—	—	—	—	—	—	—	—	—	1848	—
	11/19/1987	EID	1.60	6.40	1.24	416	311	—	25.0	485	1166	—	1.18
	11/19/1987	HMC	—	—	—	—	—	—	—	—	—	1829	—
	11/19/1987	HMC	22.0	1.000	1.000	393	321	< 10.00	21.0	583	910	1829	1.000
	1/26/1988	HMC	—	—	—	—	—	—	28.0	508	800	1514	—
	4/20/1988	HMC	—	—	—	—	—	—	35.0	519	750	1504	—
	7/20/1988	HMC	21.0	12.0	1.000	370	281	23.0	43.0	548	720	1459	1.01
	12/15/1988	HMC	—	—	—	—	—	—	43.0	579	1140	1532	—
	1/23/1989	HMC	—	—	—	—	—	—	28.0	486	930	1629	—
	4/24/1989	HMC	—	—	—	—	—	—	—	—	—	1601	—
	4/24/1989	HMC	—	—	—	—	—	—	36.0	603	1230	1601	—
	9/20/1989	HMC	32.0	2.00	2.00	373	315	16.0	21.0	524	1110	1528	1.05
	12/1/1989	HMC	—	—	—	—	—	—	—	576	1020	1680	—
	2/15/1990	HMC	—	—	—	—	—	—	—	—	—	1697	—
	2/15/1990	HMC	—	—	—	—	—	—	—	—	—	1669	—
	2/15/1990	HMC	27.0	2.00	1.000	387	338	< 0.100	35.0	550	1080	—	1.02
	5/8/1990	HMC	—	—	—	—	—	—	—	—	—	1640	—
	5/8/1990	HMC	—	—	—	—	—	—	—	—	—	1615	—
	5/8/1990	HMC	—	—	—	—	—	—	—	509	990	1615	—
	8/7/1990	HMC	25.0	1.000	1.000	413	345	< 0.100	57.0	579	1140	1612	1.00
	11/27/1990	HMC	—	—	—	—	—	—	—	—	—	1596	—
	11/27/1990	BARR	—	—	—	—	—	—	—	413	* 900	* 1596	—
	2/19/1991	HMC	32.0	1.000	1.000	388	284	17.0	35.0	574	1220	—	1.02
	2/19/1991	HMC	—	—	—	—	—	—	—	—	—	1680	—
	2/19/1991	HMC	—	—	—	—	—	—	—	—	—	1680	—

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TABLE C-1. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

Ca THROUGH ION_BAL

Sample Point Name	Date	Lab	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Na (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	TDS (mg/l)	Cond(calc.) (µmhos/cm)	Ion_B (ratio)
CW2	2/19/1991	HMC	—	—	—	—	—	—	—	—	—	1784	—
	5/16/1991	HMC	—	—	—	—	—	—	—	—	—	1683	—
	5/16/1991	HMC	—	—	—	—	—	—	—	—	—	1646	—
	5/16/1991	HMC	—	—	—	—	—	—	—	465	1060	1621	—
	8/14/1991	HMC	27.0	2.00	3.00	377	* 282	6.00	* 76.0	* 449	* 996	1515	1.10
	11/26/1991	HMC	—	—	—	—	—	—	—	—	—	1621	—
	11/26/1991	HMC	—	—	—	—	—	—	—	595	1130	1621	—
	2/19/1992	HMC	—	—	—	—	—	—	—	—	—	1691	—
	2/19/1992	HMC	22.0	1.000	2.00	363	315	2.00	35.0	539	1100	1621	0.976
	5/20/1992	HMC	—	—	—	—	—	—	—	—	—	1754	—
	5/20/1992	HMC	—	—	—	—	—	—	—	588	1160	1699	—
	7/30/1992	HMC	22.0	1.000	2.00	340	296	14.0	28.0	503	1150	1619	0.966
	7/30/1992	HMC	—	—	—	—	—	—	—	—	—	1641	—
	7/30/1992	ENER	5.50	0.800	2.10	387	309	6.30	37.7	490	1072	—	1.04
	11/4/1992	HMC	—	—	—	—	—	—	—	—	—	1703	—
	11/4/1992	HMC	—	—	—	—	—	—	—	—	—	1691	—
	11/4/1992	HMC	—	—	—	—	—	—	—	542	1180	1640	—
	2/8/1993	HMC	28.0	2.00	2.00	372	309	13.0	35.0	520	1140	1577	1.03
	5/4/1993	HMC	—	—	—	—	—	—	—	869	1100	1633	—
	8/12/1993	HMC	36.0	1.000	1.000	353	294	13.0	35.0	512	1110	1607	1.02
	11/1/1993	ENER	—	—	—	—	—	—	—	450	1087	* 1608	—
	2/2/1994	ENER	6.60	0.800	< 0.100	346	304	< 0.100	40.3	496	1071	* 1654	0.939
	3/10/1994	ENER	7.20	0.900	0.300	398	295	6.00	37.6	595	1186	* 1745	0.961
	5/3/1994	ENER	7.30	1.000	0.500	400	—	—	—	542	1132	* 1786	—
	8/2/1994	ENER	8.20	1.000	< 0.100	398	299	4.80	36.2	544	1124	* 1665	1.02
	11/2/1994	ENER	—	—	—	—	—	—	—	589	1104	* 1745	—
	2/2/1995	ENER	8.00	1.20	1.20	379	307	7.20	36.9	520	1138	—	0.993
	2/3/1995	HMC	—	—	—	—	—	—	—	—	—	1779	—
	2/3/1995	ENER	7.30	1.10	1.20	373	309	8.30	27.3	501	1118	* 1779	1.01

* Signifies Specific Conductivity from HMC

TABLE C-1. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

Ca THROUGH ION_BAL

Sample Point Name	Date	Lab	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Na (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	TDS (mg/l)	Cond(calc.) (µmhos/cm)	Ion_B (ratio)
CW2	5/5/1995	ENER	—	—	—	—	—	—	—	697	1168	* 1864	—
	8/2/1995	ENER	9.10	1.30	1.000	403	313	7.40	35.0	581	1239	* 1887	0.981
	11/7/1995	HMC	—	—	—	—	—	—	—	—	—	2145	—
	11/15/1995	ENER	—	—	—	—	—	—	—	646	1295	—	—
	2/12/1996	ENER	14.8	2.10	1.20	445	290	5.70	38.1	734	1425	* 2391	0.953
	2/12/1996	ENER	14.1	1.90	1.20	437	296	5.40	39.0	741	1451	* 2391	0.923
	5/14/1996	ENER	—	—	—	—	—	—	—	704	1385	* 2397	—
	7/29/1996	ENER	11.2	1.60	1.10	420	311	< 0.100	36.8	651	1277	* 2208	0.964
	11/4/1996	ENER	—	—	—	—	—	—	—	1430	2280	* 2839	—
	2/3/1997	ENER	12.5	1.70	1.40	405	304	0	41.4	670	1280	* 2082	0.916
	4/29/1997	ENER	—	—	—	—	—	—	—	666	1360	* 2145	—
	7/28/1997	ENER	—	—	—	—	—	—	—	711	1300	* 2156	—
	10/13/1997	ENER	13.5	1.80	1.50	449	302	4.60	37.8	722	1400	* 2097	0.962
	2/10/1998	ENER	8.60	1.20	1.20	406	303	< 0.100	35.0	546	1220	* 1827	1.05
	5/6/1998	ENER	—	—	—	—	—	—	—	579	1220	* 1931	—
	8/5/1998	ENER	14.8	2.00	1.40	475	279	< 1.000	41.5	782	1450	* 2262	0.979
	10/28/1998	ENER	—	—	—	—	—	—	—	704	1330	* 1971	—
	2/4/1999	ENER	16.2	2.10	1.60	466	256	< 1.000	41.8	850	1750	* 3267	0.922
	5/20/1999	ENER	—	—	—	—	—	—	—	665	1290	* 2434	—
	8/17/1999	ENER	8.70	1.10	1.50	360	293	< 1.000	40.9	561	1240	* 2255	0.918
	11/4/1999	ENER	—	—	—	—	—	—	—	810	1510	* 1962	—
	2/2/2000	ENER	7.50	1.10	3.20	372	289	4.50	42.5	582	1160	* 1751	0.919
	5/2/2000	ENER	—	—	—	—	—	—	—	637	1240	* 2370	—
	8/2/2000	ENER	12.9	1.84	1.22	434	285	< 1.000	40.0	704	1440	* 2636	0.961
	11/28/2000	ENER	—	—	—	—	—	—	—	553	1180	* 2248	—
	5/30/2001	ENER	—	—	—	—	—	—	—	400	935	* 1486	—
	2/26/2002	ENER	—	—	—	—	—	—	—	411	1040	* 1954	—
	8/15/2002	ENER	—	—	—	—	—	—	—	410	947	* 1897	—
	8/21/2002	ENER	—	—	—	—	—	—	—	441	1050	* 1978	—

* Signifies Specific Conductivity from HMC

TABLE C-1. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

Ca THROUGH ION_BAL

Sample Point Name	Date	Lab	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Na (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	TDS (mg/l)	Cond(calc.) (µmhos/cm)	Ion_B (ratio)
CW2	4/23/2003	ENER	—	—	—	—	—	—	—	410	1000	* 1948	—
	7/10/2003	ENER	5.40	< 1.000	< 1.000	367	312	7.50	49.6	430	1020	* 1554	1.04
CW3	1/29/1982	HMC	—	—	—	525	358	—	53.0	886	1600	—	—
	3/9/1982	HMC	32.0	4.00	15.0	495	367	< 10.00	43.0	851	1560	—	0.960
	3/10/1982	HMC	41.0	3.00	15.0	510	353	< 10.00	43.0	857	1560	—	1.000
	7/15/1982	HMC	281	—	17.0	490	359	0	43.0	793	1540	2186	—
	9/15/1982	HMC	34.0	—	17.0	490	359	0	43.0	793	1540	2186	—
	12/23/1982	HMC	—	—	—	—	—	—	50.0	833	1430	2119	—
	2/11/1983	HMC	—	—	—	—	—	—	—	—	—	2145	—
	2/11/1983	HMC	—	—	—	—	—	—	43.0	770	1520	2019	—
	4/14/1983	HMC	—	—	—	—	—	—	—	—	—	2068	—
	4/14/1983	HMC	—	—	—	—	—	—	—	—	—	2043	—
	4/14/1983	HMC	—	—	—	—	—	—	57.0	787	1550	2068	—
	6/28/1983	HMC	—	—	—	—	—	—	—	—	—	1987	—
	6/28/1983	HMC	27.0	* 1.70	* 1.17	473	* 348	5.00	* 54.7	* 844	* 1475	1997	0.970
	9/12/1983	HMC	—	—	—	—	—	—	—	—	—	2132	—
	9/12/1983	HMC	—	—	—	—	—	—	—	—	—	2156	—
	9/12/1983	HMC	36.0	2.00	2.00	483	343	6.00	21.0	838	1500	2156	0.960
	10/27/1983	HMC	—	—	—	—	—	—	—	—	—	1201	—
	10/27/1983	HMC	—	—	—	—	—	—	—	—	—	1201	—
	10/27/1983	HMC	—	—	—	—	—	—	35.0	777	1410	1184	—
	1/6/1984	HMC	—	—	—	—	—	—	—	—	—	2197	—
	1/6/1984	HMC	—	—	—	—	—	—	—	—	—	2197	—
	1/6/1984	HMC	—	—	—	—	—	—	28.0	998	1530	2171	—
	2/14/1984	HMC	—	—	—	—	—	—	—	819	—	2207	—
	4/4/1984	HMC	—	—	—	—	—	—	—	—	—	2244	—
	4/4/1984	HMC	—	—	—	—	—	—	—	—	—	2246	—
	4/4/1984	HMC	—	—	—	—	—	—	43.0	829	1450	[illegible]	—
	7/26/1984	HMC	—	—	—	—	—	—	—	—	—	1765	—

* Signifies Specific Conductivity from HMC

TABLE C-1. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

Ca THROUGH ION_BAL

Sample Point Name	Date	Lab	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Na (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	TDS (mg/l)	Cond(calc.) (µmhos/cm)	Ion_B (ratio)
CW3	7/26/1984	HMC	—	—	—	—	—	—	—	—	—	1564	—
	7/26/1984	HMC	—	—	—	—	—	—	—	—	—	1684	—
	7/26/1984	HMC	48.0	2.00	2.00	488	346	0	43.0	793	1410	1684	1.02
	10/12/1984	HMC	—	—	—	—	—	—	—	—	—	2204	—
	10/12/1984	HMC	—	—	—	—	—	—	—	—	—	2210	—
	10/12/1984	HMC	—	—	—	—	—	—	35.0	788	1580	2210	—
	1/17/1985	HMC	—	—	—	—	—	—	—	—	—	2157	—
	1/17/1985	HMC	—	—	—	—	—	—	—	—	—	2177	—
	1/17/1985	HMC	—	—	—	—	—	—	43.0	763	1550	2203	—
	4/10/1985	HMC	—	—	—	—	—	—	—	—	—	2294	—
	4/10/1985	HMC	—	—	—	—	—	—	—	—	—	2298	—
	4/10/1985	HMC	—	—	—	—	—	—	43.0	795	1460	2226	—
	7/22/1985	HMC	—	—	—	—	—	—	—	—	—	2057	—
	7/22/1985	HMC	—	—	—	—	—	—	—	—	—	2165	—
	7/22/1985	HMC	—	—	—	—	—	—	—	—	—	2140	—
	7/22/1985	HMC	42.0	4.00	2.00	490	361	< 0.0010	28.0	825	1570	2140	1.000
	10/4/1985	HMC	—	—	—	—	—	—	—	—	—	2244	—
	10/4/1985	HMC	—	—	—	—	—	—	—	—	—	2165	—
	10/4/1985	HMC	—	—	—	—	—	—	35.0	807	1200	2165	—
	1/9/1986	HMC	—	—	—	—	—	—	35.0	815	1550	2180	—
	4/8/1986	HMC	—	—	—	—	—	—	—	—	—	2219	—
	4/8/1986	HMC	—	—	—	—	—	—	43.0	937	1250	2193	—
	7/16/1986	HMC	37.0	0.100	2.00	468	357	< 0.0010	35.0	783	1610	1587	0.970
	10/13/1986	HMC	—	—	—	—	—	—	28.0	798	1310	2464	—
	1/8/1987	HMC	—	—	—	—	—	—	43.0	768	1240	2235	—
	4/9/1987	HMC	—	—	—	—	—	—	—	—	—	2208	—
	4/9/1987	HMC	—	—	—	—	—	—	35.0	772	1360	2208	—
	7/22/1987	HMC	—	—	—	—	—	—	—	—	—	2145	—
	7/22/1987	HMC	22.0	1.000	2.00	510	359	< 10.00	35.0	816	1320	2174	0.970

TABLE C-1. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

Ca THROUGH ION_BAL

Sample Point Name	Date	Lab	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Na (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	TDS (mg/l)	Cond(calc.) (µmhos/cm)	Ion_B (ratio)
CW3	10/15/1987	HMC	—	—	—	—	—	—	21.0	790	1540	2271	—
	2/2/1988	HMC	—	—	—	—	—	—	43.0	785	1350	2093	—
	4/20/1988	HMC	—	—	—	—	—	—	43.0	811	1310	2316	—
	7/20/1988	HMC	32.0	3.00	2.00	496	356	—	43.0	846	1410	2155	0.950
	10/12/1988	HMC	31.0	5.00	2.00	498	368	—	43.0	845	1460	2115	0.950
	1/24/1989	HMC	—	—	—	—	—	—	57.0	820	1420	2284	—
	4/25/1989	HMC	—	—	—	—	—	—	—	—	—	2271	—
	4/25/1989	HMC	—	—	—	—	—	—	57.0	867	1620	2271	—
	9/15/1989	HMC	29.0	3.00	1.000	533	331	40.0	35.0	843	920	2207	0.985
	11/29/1989	HMC	—	—	—	—	—	—	—	843	1570	2295	—
	2/15/1990	HMC	—	—	—	—	—	—	—	—	—	2225	—
	2/15/1990	HMC	32.0	1.000	1.000	533	340	< 0.100	35.0	831	1340	2239	1.04
	5/8/1990	HMC	—	—	—	—	—	—	—	—	—	2208	—
	5/8/1990	HMC	—	—	—	—	—	—	—	840	1530	2235	—
	5/20/1990	HMC	—	—	—	—	—	—	—	942	1500	—	—
	5/20/1990	HMC	—	—	—	—	—	—	—	—	—	2231	—
	5/20/1990	HMC	—	—	—	—	—	—	—	—	—	2231	—
	8/7/1990	HMC	28.0	1.000	1.000	533	370	< 0.100	43.0	811	1540	2340	1.02
	11/27/1990	HMC	—	—	—	—	—	—	—	—	—	2197	—
	11/27/1990	HMC	—	—	—	—	—	—	—	743	1450	2197	—
	11/27/1990	BARR	—	—	—	—	—	—	—	767	1450	—	—
	2/19/1991	HMC	32.0	2.00	1.000	467	354	< 0.100	35.0	760	1480	—	0.977
	2/19/1991	HMC	—	—	—	—	—	—	—	—	—	2262	—
	2/19/1991	HMC	—	—	—	—	—	—	—	—	—	2197	—
	2/19/1991	HMC	—	—	—	—	—	—	—	—	—	2197	—
	5/15/1991	HMC	—	—	—	—	—	—	—	—	—	2279	—
	5/15/1991	HMC	—	—	—	—	—	—	—	793	1550	2269	—
	8/13/1991	BARR	15.0	* 3.00	* 3.00	* 500	301	< 1.000	85.0	716	1480	* 2168	1.02
	11/26/1991	HMC	—	—	—	—	—	—	—	—	—	2170	—

* Signifies Specific Conductivity from HMC

TABLE C-1. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

Ca THROUGH ION_BAL

Sample Point Name	Date	Lab	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Na (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	TDS (mg/l)	Cond(calc.) (µmhos/cm)	Ion_B (ratio)
CW3	11/26/1991	HMC	—	—	—	—	—	—	—	805	1550	2144	—
	2/20/1992	HMC	—	—	—	—	—	—	—	—	—	2182	—
	2/20/1992	HMC	38.0	1.000	2.00	487	355	< 0.100	43.0	823	1540	2182	0.960
	5/20/1992	HMC	—	—	—	—	—	—	—	942	1500	—	—
	5/20/1992	HMC	—	—	—	—	—	—	—	—	—	2231	—
	5/20/1992	HMC	—	—	—	—	—	—	—	—	—	2231	—
	7/29/1992	HMC	—	—	—	—	—	—	—	—	—	2162	—
	7/29/1992	HMC	—	—	—	—	—	—	—	—	—	2228	—
	7/29/1992	ENER	14.5	* 1.000	1.60	425	* 353	< 0.100	42.5	* 789	1419	* 2252	0.826
	11/4/1992	HMC	—	—	—	—	—	—	—	—	—	2082	—
	11/4/1992	HMC	—	—	—	—	—	—	—	—	—	2069	—
	11/4/1992	HMC	—	—	—	—	—	—	—	793	1550	2094	—
	2/8/1993	HMC	38.0	1.000	2.00	500	306	< 0.100	43.0	827	1550	2082	1.01
	5/4/1993	HMC	—	—	—	—	—	—	—	876	1520	2182	—
	8/11/1993	HMC	57.0	* 2.80	* 0.300	* 456	349	< 0.100	43.0	769	* 1467	2384	0.999
	11/1/1993	ENER	—	—	—	—	—	—	—	693	1509	* 2170	—
	2/2/1994	HMC	—	—	—	—	—	—	—	—	—	2069	—
	2/2/1994	ENER	14.1	2.70	< 0.100	443	333	< 0.100	43.2	735	1487	—	0.919
	2/2/1994	ENER	15.0	2.70	< 0.100	462	332	< 0.100	46.8	737	1426	* 2069	0.953
	3/9/1994	ENER	12.5	2.40	0.400	475	339	< 0.100	43.2	752	1476	* 2145	0.958
	5/3/1994	ENER	13.5	2.50	0.700	474	—	—	—	744	1441	* 2191	—
	8/1/1994	ENER	13.6	2.70	0.400	509	343	< 0.100	41.9	788	1410	* 2092	0.993
	11/1/1994	ENER	—	—	—	—	—	—	—	789	1439	* 2069	—
	2/2/1995	ENER	14.6	3.20	1.30	480	356	< 0.100	43.4	699	1470	—	1.01
	2/3/1995	HMC	—	—	—	—	—	—	—	—	—	2246	—
	5/5/1995	ENER	—	—	—	—	—	—	—	566	1424	* 2298	—
	8/2/1995	ENER	13.8	2.90	1.10	473	366	< 0.100	40.0	718	1475	* 2276	0.975
	11/7/1995	HMC	—	—	—	—	—	—	—	—	—	2094	—
	11/15/1995	ENER	—	—	—	—	—	—	—	743	1461	—	—

* Signifies Specific Conductivity from HMC

TABLE C-1. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

Ca THROUGH ION_BAL

Sample Point Name	Date	Lab	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Na (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	TDS (mg/l)	Cond(calc.) (µmhos/cm)	Ion_B (ratio)
CW3	11/27/1995	ENER	13.5	2.80	1.10	453	350	4.10	41.0	695	1473	* 2061	0.960
	2/12/1996	ENER	14.5	3.10	1.20	460	353	< 0.100	49.4	712	1479	* 2410	0.955
	5/14/1996	ENER	—	—	—	—	—	—	—	731	1451	* 2363	—
	7/31/1996	ENER	14.2	2.90	1.20	478	355	< 0.100	41.3	741	1481	* 2266	0.971
	11/4/1996	ENER	14.1	2.90	1.20	456	345	4.40	45.2	730	1370	* 2271	0.934
	2/3/1997	ENER	15.1	3.00	1.40	455	349	0	45.4	743	1460	* 2262	0.927
	4/29/1997	ENER	—	—	—	—	—	—	—	712	1500	* 2391	—
	7/28/1997	ENER	—	—	—	—	—	—	—	786	1460	* 2271	—
	10/13/1997	ENER	14.2	2.90	1.40	488	346	< 0.0100	41.5	770	1480	* 2224	0.971
	2/10/1998	ENER	—	3.10	1.40	509	351	< 0.100	42.0	723	1580	* 2281	—
	5/5/1998	ENER	14.9	—	—	—	—	—	—	746	1480	* 2255	—
	8/4/1998	ENER	14.8	3.00	1.20	502	347	< 1.000	44.0	757	1510	* 2220	1.01
	10/28/1998	ENER	—	—	—	—	—	—	—	844	1560	* 2260	—
	2/3/1999	ENER	14.5	2.90	1.40	463	350	< 1.000	46.7	757	1520	* 2795	0.925
	5/11/1999	ENER	—	—	—	—	—	—	—	757	1450	* 2791	—
	8/17/1999	ENER	13.9	2.70	1.80	448	351	< 1.000	45.3	716	1540	* 2777	0.931
	11/9/1999	ENER	—	—	—	—	—	—	—	771	1500	* 2220	—
	2/8/2000	ENER	14.6	3.00	2.90	472	352	< 1.000	47.3	783	1530	* 2205	0.921
	2/8/2000	ENER	# 13.6	# 2.80	# 2.60	# 470	# 350	# < 1.000	# 46.1	# 704	# 1520	—	# 0.986
	4/27/2000	ENER	—	—	—	—	—	—	—	818	1520	* 2785	—
	8/2/2000	ENER	13.4	2.80	1.30	467	349	< 1.000	40.3	700	1550	* 2769	0.990
	8/2/2000	ENER	# 13.3	# 2.90	# < 1.000	# 461	# 345	# < 1.000	# 46.5	# 668	# 1520	—	# 1.00
	11/28/2000	ENER	—	—	—	—	—	—	—	741	1540	* 2787	—
	2/13/2001	ENER	—	—	—	—	—	—	56.8	738	1450	* 2692	—
	6/5/2001	ENER	—	—	—	—	—	—	—	755	1610	* 2752	—
	2/25/2002	ENER	—	—	—	—	—	—	—	949	1960	* 3437	—
	2/25/2002	ENER	—	—	—	—	—	—	—	# 948	# 1950	—	—
	4/29/2002	ENER	—	—	—	—	—	—	—	906	1970	* 3490	—
	8/21/2002	ENER	—	—	—	—	—	—	—	921	1990	* 3432	—

Signifies Quality Control Sample

* Signifies Specific Conductivity from HMC

TABLE C-1. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

Ca THROUGH ION_BAL

Sample Point Name	Date	Lab	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Na (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	TDS (mg/l)	Cond(calc.) (µmhos/cm)	Ion_B (ratio)
CW3	4/22/2003	HMC	—	—	—	—	—	—	—	—	—	3478	—
	4/23/2003	ENER	—	—	—	—	—	—	—	932	1980	—	—
	7/7/2003	ENER	127	33.9	3.30	499	426	< 1.000	144	1050	2130	* 2874	0.939
CW9	4/13/1987	HMC	—	—	—	—	—	—	—	—	—	1968	—
	4/13/1987	HMC	—	—	—	—	—	—	—	—	—	1986	—
	4/13/1987	HMC	56.0	3.00	2.00	400	222	< 0.0010	35.0	797	1320	1920	0.970
	8/2/1988	HMC	—	—	—	—	—	—	—	—	—	1766	—
	8/2/1988	HMC	—	—	—	—	—	—	—	—	—	1820	—
	8/2/1988	HMC	—	—	—	—	—	—	—	—	—	1874	—
	8/2/1988	HMC	54.0	3.00	2.00	378	235	—	57.0	671	1280	1704	1.000
	10/12/1988	HMC	—	—	—	—	—	—	—	—	—	1766	—
	10/12/1988	HMC	—	—	—	—	—	—	—	—	—	1766	—
	10/12/1988	HMC	56.0	5.00	2.00	383	234	—	43.0	750	1110	—	0.960
	10/9/1989	HMC	—	—	—	—	—	—	—	—	—	1724	—
	10/9/1989	HMC	—	—	—	—	—	—	—	—	—	1744	—
	10/9/1989	HMC	—	—	—	—	—	—	57.0	923	1240	1735	—
	8/6/1990	HMC	—	—	—	—	—	—	—	—	—	1920	—
	8/6/1990	HMC	—	—	—	—	—	—	—	—	—	1852	—
	8/6/1990	HMC	55.0	16.0	2.00	426	231	< 0.100	57.0	718	1260	—	1.11
	8/20/1991	HMC	39.0	1.000	2.00	390	196	< 0.100	43.0	664	1330	1805	1.04
	9/2/1992	HMC	—	—	—	—	—	—	—	—	—	1857	—
	9/2/1992	HMC	39.0	2.00	2.00	387	200	< 0.100	35.0	680	1250	1842	1.03
	9/13/1993	ENER	17.1	2.80	0.700	373	195	< 0.100	43.1	584	1163	* 1711	1.05
	9/20/1994	HMC	—	—	—	—	—	—	—	—	—	1839	—
	9/20/1994	ENER	30.2	5.10	1.70	409	184	< 0.100	48.8	731	1241	—	1.01
	9/19/1995	HMC	—	—	—	—	—	—	—	—	—	1880	—
	9/19/1995	ENER	29.2	5.70	2.10	372	172	< 0.100	57.2	676	1266	—	0.981
	9/4/1997	ENER	27.9	5.10	1.80	369	184	< 0.100	55.0	640	1260	* 1925	1.00
	9/29/1998	ENER	31.9	6.80	1.70	291	133	< 1.000	72.1	532	1070	* 1588	0.969

* Signifies Specific Conductivity from HMC

TABLE C-1. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

Ca THROUGH ION_BAL

Sample Point Name	Date	Lab	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Na (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	TDS (mg/l)	Cond(calc.) (µmhos/cm)	Ion_B (ratio)
CW9	9/15/1999	ENER	28.7	6.20	1.80	271	123	< 1.000	73.3	485	976	* 1896	0.969
	8/30/2000	ENER	24.3	4.90	1.92	340	174	< 1.000	48.8	576	1230	* 2286	1.01
	7/8/2003	ENER	24.4	5.70	1.80	156	185	< 1.000	35.0	249	605	* 908	0.922
CW10	4/9/1987	HMC	—	—	—	—	—	—	—	—	—	1939	—
	4/9/1987	HMC	—	—	—	—	—	—	—	—	—	1939	—
	4/9/1987	HMC	—	—	—	—	—	—	—	—	—	1915	—
	4/9/1987	HMC	212	11.0	4.00	252	329	< 10.00	64.0	760	—	1892	0.970
	8/2/1988	HMC	—	—	—	—	—	—	—	—	—	1756	—
	8/2/1988	HMC	—	—	—	—	—	—	—	—	—	1724	—
	8/2/1988	HMC	209	3.00	4.00	255	334	—	64.0	709	1340	1724	0.990
	10/12/1988	HMC	220	7.00	5.00	263	351	—	57.0	719	1450	1855	1.04
	8/17/1989	HMC	—	—	—	—	—	—	—	—	—	1973	—
	8/17/1989	HMC	200	8.00	4.00	283	298	< 10.00	71.0	780	1070	1939	0.983
	8/6/1990	HMC	—	—	—	—	—	—	—	—	—	1956	—
	8/6/1990	HMC	—	—	—	—	—	—	—	—	—	1918	—
	8/6/1990	HMC	216	93.0	4.00	283	343	< 0.100	71.0	741	1470	1918	1.34
	8/20/1991	HMC	—	—	—	—	—	—	—	—	—	1956	—
	8/20/1991	HMC	215	2.00	4.00	267	333	< 0.100	57.0	743	1450	1955	1.00
	9/23/1992	HMC	233	3.00	4.00	283	334	< 0.100	64.0	760	1490	1921	1.05
	9/13/1993	ENER	186	36.7	2.60	254	329	< 0.100	66.2	678	1469	* 1892	1.10
	9/15/1994	ENER	168	44.6	3.60	257	331	< 0.100	68.4	724	1432	* 1890	1.04
	9/15/1994	ENER	166	42.1	3.70	259	328	< 0.100	67.6	724	1437	* 1890	1.03
CW13	12/29/1994	ENER	21.5	3.60	1.80	630	428	< 0.100	94.9	910	2022	* 2675	1.01
	12/29/1994	ENER	19.3	3.00	1.60	628	420	< 0.100	92.2	923	2050	* 2763	0.995
	2/11/1995	ENER	10.4	1.50	1.10	574	325	3.90	80.2	872	1824	* 2767	0.991
	5/28/1996	ENER	10.2	1.50	1.000	589	357	5.30	85.3	915	1921	* 3028	0.956
	6/14/1996	ENER	—	—	—	—	—	—	—	973	1820	—	—
CW14	2/1/1995	ENER	9.40	1.40	1.40	515	266	< 0.100	63.0	754	1636	* 2384	1.05

* Signifies Specific Conductivity from HMC

TABLE C-1. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

Ca THROUGH ION_BAL

Sample Point Name	Date	Lab	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Na (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	TDS (mg/l)	Cond(calc.) (µmhos/cm)	Ion_B (ratio)
CW14	2/1/1995	ENER	9.20	1.40	1.50	472	304	< 0.100	57.0	667	1486	* 2289	1.03
	2/17/1995	ENER	5.60	0.900	1.20	440	259	6.40	56.1	656	1316	* 2002	0.991
	3/2/1995	ENER	5.50	< 1.000	1.30	407	265	3.70	63.0	601	1306	* 2159	0.965
CW15	2/7/1995	ENER	43.0	13.1	2.50	398	262	< 0.100	38.0	777	1446	* 2092	0.956
	11/20/1995	ENER	73.0	21.0	2.40	408	204	< 0.100	49.0	889	1666	* 2520	0.997
	10/15/1996	ENER	45.0	12.2	2.20	464	270	< 0.100	37.0	853	1610	* 2384	1.01
	6/3/1997	ENER	—	—	—	—	—	—	—	880	1620	* 2520	—
	11/8/1997	ENER	88.2	24.8	3.00	441	203	< 0.100	58.2	982	1800	* 2481	1.01
	5/19/1998	ENER	—	—	—	—	—	—	—	870	1540	* 2149	—
	11/5/1998	ENER	30.9	8.70	2.10	468	305	< 1.000	31.5	808	1560	* 2997	0.997
	11/5/1998	ENER	# 30.6	# 8.70	# 2.10	# 472	# 305	# < 1.000	# 30.8	# 805	# 1540	*# 2997	# 1.01
	11/5/1998	ACZ	# 34.3	# 8.00	# 1.80	# 499	# 263	# < 2.00	# 31.0	# 890	# 1580	*# 2997	# 1.01
	6/3/1999	ENER	—	—	—	—	—	—	—	835	1600	* 2983	—
	6/21/2000	ENER	—	—	—	—	—	—	—	854	1520	* 2888	—
	6/6/2001	ENER	—	—	—	—	—	—	—	853	1610	* 3006	—
	6/24/2002	ENER	—	—	—	—	—	—	—	838	1690	* 3070	—
	7/14/2003	ENER	64.0	19.0	2.60	478	250	< 1.000	52.8	941	1710	* 2360	1.02
CW17	2/13/1995	ENER	349	93.0	6.40	344	331	< 0.100	88.0	1503	2584	* 3490	1.03
	11/28/1995	ENER	363	90.0	6.10	374	332	< 0.100	71.0	1675	3103	* 3575	0.991
	8/27/1996	ENER	361	89.8	6.30	395	327	< 0.100	70.5	1650	3070	* 3695	1.02
	6/3/1997	ENER	—	—	—	—	—	—	74.2	1660	3170	* 3619	—
	11/8/1997	ENER	400	98.5	7.50	398	337	< 0.100	74.1	1700	3200	* 3511	1.06
	5/18/1998	ENER	—	—	—	—	—	—	—	1830	3200	* 3360	—
	11/5/1998	ENER	383	98.5	7.20	387	333	< 1.000	76.8	1690	3200	* 4674	1.03
	11/5/1998	ACZ	# 418	# 110	# 7.40	# 410	# 286	# < 2.00	# 58.0	# 1890	# 3250	*# 4674	# 1.05
	11/5/1998	ENER	# 386	# 99.1	# 7.20	# 388	# 330	# < 1.000	# 77.0	# 1700	# 3200	*# 4674	# 1.03
	6/1/1999	ENER	—	—	—	—	—	—	—	1880	1620	* 4599	—
	6/19/2000	ENER	—	—	—	—	—	—	—	1850	3170	* 3469	—

Signifies Quality Control Sample

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TABLE C-1. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

Ca THROUGH ION_BAL

Sample Point Name	Date	Lab	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Na (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	TDS (mg/l)	Cond(calc.) (µmhos/cm)	Ion_B (ratio)
CW17	6/7/2001	ENER	—	—	—	—	—	—	—	1640	3000	* 4227	—
	6/27/2002	ENER	—	—	—	—	—	—	—	1680	3020	* 4428	—
	7/10/2003	ENER	390	100.0	6.80	388	335	< 1.000	80.2	1680	3040	* 3504	1.05
CW18	2/9/1995	ENER	19.7	3.60	1.90	542	379	< 0.100	214	661	1608	* 2650	0.958
	11/22/1995	ENER	11.2	1.80	1.10	499	328	7.20	199	580	1522	* 2585	0.963
	8/27/1996	ENER	—	—	—	—	—	—	—	735	1820	* 2973	—
	10/15/1996	ENER	14.5	2.20	1.30	618	495	< 0.100	150	744	1870	* 2973	0.999
	1/3/1997	ENER	—	—	—	—	—	—	—	728	1850	* 2947	—
	4/17/1997	ENER	—	—	—	—	—	—	—	736	1810	* 3037	—
	11/19/1997	ENER	18.0	2.60	2.10	681	677	< 0.100	168	661	1970	* 3004	1.04
	4/14/1998	ENER	—	—	—	—	—	—	—	726	2000	* 3048	—
	11/4/1998	ENER	17.4	2.70	1.40	642	711	8.58	188	669	2010	* 3909	0.932
	7/22/1999	ENER	—	—	—	—	—	—	—	697	1920	* 3806	—
	7/20/2000	ENER	—	—	—	—	—	—	—	646	2010	* 3838	—
	7/24/2001	ENER	15.7	—	—	—	—	—	—	565	1910	* 3742	—
	7/23/2002	ENER	19.8	—	—	—	—	—	—	678	1930	* 3770	—
	4/28/2003	ENER	—	—	—	—	—	—	—	655	1880	* 3536	—
	7/7/2003	ENER	48.9	9.50	2.90	574	625	< 1.000	212	702	1930	* 2815	0.916
CW24	2/21/1995	ENER	347	100.0	7.00	413	381	< 0.100	95.7	1647	3074	* 3490	1.01
	8/27/1996	ENER	357	94.3	5.90	408	360	< 0.100	8.50	1670	3020	* 3533	1.06
	11/8/1997	ENER	—	—	—	—	—	—	89.5	1750	3060	* 3591	—
	11/24/1998	ENER	—	—	—	—	—	—	—	1750	3120	* 4570	—
	10/3/2000	ENER	—	—	—	—	—	—	—	1410	3080	* 4495	—
	7/10/2003	ENER	407	110	6.70	370	354	< 1.000	79.7	1740	3160	* 3515	1.03
CW26	4/4/1995	ENER	58.0	13.6	3.60	354	251	< 0.100	101	635	1345	* 1979	0.966
	4/4/1995	ENER	53.0	12.4	3.60	365	253	< 0.100	101	635	1356	* 2069	0.971
	11/27/1995	ENER	68.0	15.2	3.70	327	250	< 0.100	92.0	596	1317	* 2033	0.993
	8/28/1996	ENER	—	—	—	—	—	—	—	697	1540	* 2156	—

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TABLE C-1. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

Ca THROUGH ION_BAL

Sample Point Name	Date	Lab	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Na (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	TDS (mg/l)	Cond(calc.) (µmhos/cm)	Ion_B (ratio)
CW26	5/30/1997	ENER	—	—	—	—	—	—	120	720	1510	* 2271	—
	11/19/1997	ENER	83.3	17.7	4.90	417	293	< 0.100	110	679	21400	* 2774	1.08
	5/20/1998	ENER	—	—	—	—	—	—	—	699	1490	* 2155	—
	11/4/1998	ENER	127	28.5	5.60	326	206	< 1.000	139	780	1650	* 2768	0.976
	6/3/1999	ENER	—	—	—	—	—	—	—	754	1610	* 2754	—
	6/3/1999	ENER	—	—	—	—	—	—	—	# 733	# 1660	*# 2754	—
	6/21/2000	ENER	—	—	—	—	—	—	—	664	1380	* 2498	—
	6/6/2001	ENER	—	—	—	—	—	—	—	607	1380	* 2406	—
	6/26/2002	ENER	—	—	—	—	—	—	—	587	1410	* 2493	—
	7/16/2003	ENER	134	29.9	6.30	330	215	< 1.000	161	755	1580	* 2190	0.994
CW28	4/5/1995	ENER	8.60	1.80	1.40	351	334	< 0.100	97.0	373	1066	* 1745	0.994
	4/13/1995	ENER	4.70	< 1.000	1.000	314	259	< 0.100	96.0	361	1004	* 1665	0.968
	11/21/1995	ENER	5.80	1.10	1.10	348	251	4.50	95.0	429	1078	* 1829	0.979
	8/27/1996	ENER	—	—	—	—	—	—	—	319	944	* 1703	—
	11/19/1997	ENER	—	—	—	—	—	—	—	442	1250	* 1945	—
	11/4/1998	ENER	—	—	—	—	—	—	—	482	1350	* 2669	—
	7/26/1999	ENER	—	—	—	—	—	—	—	# 473	# 1330	*# 2644	—
	7/26/1999	ENER	—	—	—	—	—	—	—	458	1380	* 2656	—
	7/20/2000	ENER	—	—	—	—	—	—	—	446	1410	* 2700	—
	7/24/2001	ENER	—	—	—	—	—	—	—	390	1370	* 2722	—
	7/23/2002	ENER	—	—	—	—	—	—	—	461	1360	* 2669	—
	4/28/2003	ENER	—	—	—	—	—	—	—	407	1060	* 2096	—
	7/7/2003	ENER	5.40	< 1.000	1.20	353	292	4.90	97.4	427	1090	* 1665	0.949
CW29	6/5/1995	ENER	88.0	28.0	4.70	298	399	< 0.100	67.0	519	1417	* 1997	1.03
	6/7/1995	ENER	71.0	22.8	4.00	269	291	< 0.100	62.0	535	1059	* 1783	0.975
	6/9/1995	ENER	73.0	22.7	3.90	260	233	< 0.100	57.3	546	1182	* 1808	1.01
	11/13/1995	ENER	60.0	19.0	3.80	282	248	< 0.100	61.0	531	1148	—	1.00
	11/13/1995	HMC	—	—	—	—	—	—	—	—	—	1809	—

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TABLE C-1. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

Ca THROUGH ION_BAL

Sample Point Name	Date	Lab	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Na (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	TDS (mg/l)	Cond(calc.) (µmhos/cm)	Ion_B (ratio)
CW29	10/14/1996	ENER	66.0	19.6	3.70	279	251	< 0.100	56.8	568	1160	* 1829	0.977
	5/30/1997	ENER	—	—	—	—	—	—	—	537	1100	* 1809	—
	11/8/1997	ENER	64.7	19.7	4.30	279	253	< 0.100	59.0	537	1130	* 1664	1.01
	5/19/1998	ENER	—	—	—	—	—	—	—	543	1080	* 1624	—
	11/5/1998	ENER	59.3	19.3	4.10	278	250	< 1.000	60.0	517	1080	* 2051	1.01
	6/3/1999	ENER	—	—	—	—	—	—	—	526	1140	* 2044	—
	6/21/2000	ENER	—	—	—	—	—	—	—	557	1100	* 2034	—
	6/6/2001	ENER	—	—	—	—	—	—	—	503	1050	* 1951	—
	6/24/2002	ENER	—	—	—	—	—	—	—	479	1080	* 1952	—
	7/10/2003	ENER	103	28.4	4.50	300	232	< 1.000	79.5	612	1260	* 1828	1.10
CW31	9/15/1995	ENER	181	53.9	11.2	855	432	< 0.100	137	1999	3551	* 4382	0.969
	10/17/1996	ENER	109	33.0	7.70	584	368	< 0.100	82.0	1290	2420	* 3264	0.959
	11/14/1997	ENER	—	—	—	—	—	—	—	759	1520	* 2012	—
	11/19/1998	ENER	—	—	—	—	—	—	—	865	1580	* 2665	—
	6/2/1999	ENER	—	—	—	—	—	—	—	878	3140	* 2612	—
	6/21/2000	ENER	—	—	—	—	—	—	—	1070	1850	* 3160	—
	6/7/2001	ENER	—	—	—	—	—	—	—	1090	2030	* 3291	—
	6/26/2002	ENER	—	—	—	—	—	—	—	908	1800	* 3040	—
	7/21/2003	ENER	122	36.2	5.50	325	206	0	54.2	901	1600	* 2106	0.986
CW32	9/13/1995	ENER	359	72.0	19.1	57.7	358	4.80	204	729	1662	* 2497	0.995
	12/11/1995	ENER	186	64.6	7.30	605	436	< 0.100	380	1164	2842	* 3923	0.976
	12/15/1995	ENER	86.9	31.3	4.10	235	356	< 0.100	120	412	1050	* 1576	0.968
	10/17/1996	ENER	251	89.4	9.40	830	427	< 0.100	634	1680	3930	* 5047	0.939
	6/3/1997	ENER	—	—	—	—	—	—	—	1790	4070	* 5235	—
	11/18/1997	ENER	283	94.1	10.2	899	443	< 0.100	657	1814	4150	* 5558	0.963
	5/20/1998	ENER	—	—	—	—	—	—	—	1800	4090	* 5585	—
	11/19/1998	ENER	245	87.5	9.90	827	448	< 1.000	633	1550	4140	* 6832	0.968
	6/2/1999	ENER	—	—	—	--		—	—	1000	7130	* 6699	—

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TABLE C-1. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

Ca THROUGH ION_BAL

Sample Point Name	Date	Lab	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Na (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	TDS (mg/l)	Cond(calc.) (µmhos/cm)	Ion_B (ratio)
CW32	6/21/2000	ENER	—	—	—	—	—	—	—	1690	3910	* 6726	—
	6/7/2001	ENER	—	—	—	—	—	—	—	1570	4180	* 6608	—
	6/26/2002	ENER	—	—	—	—	—	—	—	1570	4180	* 6784	—
	7/21/2003	ENER	255	95.8	10.3	901	490	< 1.000	679	1810	4090	* 5470	0.925
CW33	9/8/1995	ENER	208	65.0	10.9	906	569	< 0.100	539	1492	3692	* 4807	0.997
	9/12/1995	ENER	187	61.0	10.9	1048	523	< 0.100	606	1649	4059	* 5353	1.00
	10/17/1996	ENER	111	35.6	7.70	934	573	< 0.100	435	1470	3500	* 4920	0.943
	11/18/1997	ENER	—	—	—	—	—	—	—	1760	3670	* 6308	—
	11/24/1998	ENER	—	—	—	—	—	—	—	1910	3920	* 6691	—
	6/2/1999	ENER	—	—	—	—	—	—	—	2070	3980	* 5560	—
	6/21/2000	ENER	—	—	—	—	—	—	—	2140	3990	* 6419	—
	6/7/2001	ENER	—	—	—	—	—	—	—	2080	4100	* 6436	—
	6/26/2002	ENER	—	—	—	—	—	—	—	1730	3770	* 6258	—
	7/21/2003	ENER	102	29.0	9.90	1150	260	< 1.000	367	2060	3990	* 4326	1.00
CW35	10/12/1995	ENER	184	50.2	4.60	323	506	< 0.100	70.0	871	1870	* 2965	0.967
	11/28/1995	ENER	256	68.0	4.90	313	420	< 0.100	53.0	1187	2277	* 2913	0.970
	8/27/1996	ENER	278	68.8	5.00	315	366	< 0.100	52.0	1240	2290	* 2965	1.00
	6/3/1997	ENER	—	—	—	—	—	—	—	1260	2300	* 2973	—
	11/8/1997	ENER	275	69.0	6.30	339	392	< 0.100	56.2	1200	2310	* 2816	1.04
	11/20/1997	HMC	—	—	—	—	—	—	—	—	—	2703	—
	5/18/1998	ENER	—	—	—	—	—	—	—	1220	2270	* 2824	—
	5/18/1998	ENER	—	—	—	—	—	—	—	# 1260	# 2300	*# 2824	—
	11/5/1998	ENER	258	68.7	5.20	323	380	< 1.000	57.4	1170	2270	* 3586	1.01
	6/1/1999	ENER	—	—	—	—	—	—	—	626	6900	* 3494	—
	6/19/2000	ENER	—	—	—	—	—	—	—	1260	2220	* 3421	—
	6/7/2001	ENER	—	—	—	—	—	—	—	1110	2250	* 3425	—
	6/27/2002	ENER	—	—	—	—	—	—	—	1220	2360	* 3591	—
	7/10/2003	ENER	321	84.9	5.60	348	370	< 1.000	101	1230	2370	* 2843	1.11

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TABLE C-1. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

Ca THROUGH ION_BAL

Sample Point Name	Date	Lab	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Na (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	TDS (mg/l)	Cond(calc.) (µmhos/cm)	Ion_B (ratio)
CW36	10/23/1995	ENER	107	36.0	8.00	564	309	< 0.100	54.0	1262	2232	* 2902	1.01
	10/17/1996	ENER	90.5	31.2	7.20	457	290	< 0.100	56.2	1050	1940	* 2713	0.963
	6/3/1997	ENER	—	—	—	—	—	—	—	1070	1910	* 2772	—
	11/14/1997	ENER	126	39.9	7.00	277	231	< 0.100	51.5	742	1450	* 1939	1.05
	5/20/1998	ENER	—	—	—	—	—	—	—	1080	1900	* 2624	—
	11/3/1998	ENER	86.7	30.7	7.30	428	276	< 1.000	56.1	940	1790	* 2447	0.998
	7/17/2003	ENER	92.4	31.3	7.90	450	273	< 1.000	54.8	1030	1820	* 2473	0.981
CW37	10/17/1995	HMC	—	—	—	—	—	—	—	—	—	2847	—
	1/9/1996	ENER	189	71.1	6.50	374	272	< 0.100	78.0	1179	2222	—	1.02
	1/12/1996	ENER	177	68.0	6.20	373	233	< 0.100	81.0	1206	2176	—	0.987
	10/16/1996	ENER	196	72.2	5.90	349	248	< 0.100	76.4	1207	2200	* 2913	0.990
	11/8/1997	ENER	—	—	—	—	—	—	—	1090	2070	* 2695	—
	11/24/1998	ENER	—	—	—	—	—	—	—	1130	2070	* 3403	—
	6/2/1999	ENER	—	—	—	—	—	—	—	1140	2010	* 3274	—
	6/27/2000	ENER	—	—	—	—	—	—	—	1060	1980	* 3238	—
	6/27/2000	ENER	—	—	—	—	—	—	—	# 1070	# 1990	—	—
	6/6/2001	ENER	—	—	—	—	—	—	—	1050	1970	* 3184	—
	7/1/2002	ENER	—	—	—	—	—	—	—	1020	1960	* 3223	—
	7/14/2003	ENER	183	74.0	6.00	339	273	< 1.000	82.4	1020	1920	* 2492	1.07
CW39	11/9/1995	ENER	160	59.0	6.50	306	221	< 0.100	74.0	972	1805	* 2523	1.01
	10/18/1996	ENER	141	57.4	6.30	289	259	< 0.100	64.7	896	1720	* 2391	0.990
	11/24/1998	ENER	—	—	—	—	—	—	—	836	1600	* 2697	—
	7/14/2003	ENER	166	67.1	6.40	300	297	< 1.000	67.6	891	1670	* 2150	1.07
CW41	10/18/1996	ENER	13.9	4.20	2.30	253	278	3.20	49.0	314	811	* 1457	0.962
	1/16/1997	ENER	12.4	3.60	2.30	260	311	0	46.0	297	816	* 1422	0.977
	4/17/1997	ENER	12.5	3.70	2.40	261	326	0	51.4	284	851	* 1448	0.971
	9/29/1997	ENER	—	—	—	—	—	—	—	287	810	* 1388	—
	4/13/1998	ENER	13.0	4.00	2.00	263	306	< 1.000	53.0	300	805	* 1263	0.975

Signifies Quality Control Sample

* Signifies Specific Conductivity from HMC

TABLE C-1. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

Ca THROUGH ION_BAL

Sample Point Name	Date	Lab	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Na (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	TDS (mg/l)	Cond(calc.) (µmhos/cm)	Ion_B (ratio)
CW41	9/28/1998	ENER	—	—	—	—	—	—	—	303	864	* 1335	—
	7/14/2003	ENER	13.2	3.30	2.40	334	401	5.30	110	254	967	* 1545	1.03
CW43	2/7/1997	ENER	132	38.5	5.70	229	437	0	76.4	490	1180	* 1722	1.02
	4/28/1997	ENER	103	29.2	3.10	208	409	0	39.5	444	1080	* 1745	0.977
	9/30/1997	ENER	—	—	—	—	—	—	—	444	1030	* 1577	—
	4/14/1998	ENER	106	29.0	3.00	208	383	< 1.000	34.0	460	1070	* 1539	0.997
	9/29/1999	ENER	—	—	—	—	—	—	—	433	1040	* 1934	—
	8/29/2000	ENER	—	—	—	—	—	—	—	405	1110	* 1986	—
	9/27/2001	ENER	—	—	—	—	—	—	—	450	1160	* 2120	—
	10/2/2002	ENER	—	—	—	—	—	—	—	538	1230	* 2099	—
	7/17/2003	ENER	128	35.2	3.80	242	373	< 1.000	56.8	585	1290	* 1773	0.999
CW50	5/29/2003	ENER	223	57.8	4.70	290	351	< 1.000	83.0	934	1820	* 2338	1.04
	7/1/2003	ENER	203	55.8	4.10	258	343	< 1.000	89.8	855	1790	* 2325	1.00
CW52	6/11/2003	ENER	180	39.9	6.30	509	545	< 1.000	86.0	1050	2460	* 2955	1.04
	7/1/2003	ENER	65.8	11.7	3.10	590	845	< 1.000	80.0	651	2230	* 2754	1.01
WCW	6/16/1980	HMC	77.0	—	—	—	346	16.0	< 1.000	752	1118	—	—
	7/7/1980	HMC	—	—	—	—	—	—	—	—	16.8	—	—
	11/17/1980	HMC	—	—	—	450	329	—	—	775	—	1430	—
	12/2/1980	HMC	—	—	—	475	340	—	—	818	—	1629	—
	8/18/1981	HMC	—	—	—	460	362	—	—	787	1480	—	—
	9/21/1981	HMC	—	—	—	440	350	—	35.0	787	1510	—	—
	10/8/1981	HMC	—	—	—	320	333	—	30.0	733	1450	—	—
	11/19/1981	HMC	—	—	—	460	342	—	< 0.0100	755	1480	—	—
	12/31/1981	HMC	—	—	—	470	340	—	35.0	766	1820	—	—
	2/15/1982	HMC	—	—	—	455	327	—	43.0	772	1470	—	—
	3/2/1982	HMC	—	—	—	495	323	—	43.0	753	1420	—	—
	5/23/1982	HMC	38.0	—	16.0	448	350	11.0	28.0	739	1410	1963	—
	11/18/1982	HMC	—	—	—	—	—	—	—	—	—	1635	—

* Signifies Specific Conductivity from HMC

TABLE C-1. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

Ca THROUGH ION_BAL

Sample Point Name	Date	Lab	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Na (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	TDS (mg/l)	Cond(calc.) (µmhos/cm)	Ion_B (ratio)
WCW	11/18/1982	HMC	—	—	—	—	—	—	—	—	—	1551	—
	11/18/1982	HMC	—	—	—	—	—	—	—	—	—	1680	—
	11/18/1982	HMC	—	—	—	—	—	—	35.0	730	1380	1701	—
	2/14/1983	HMC	—	—	—	—	—	—	—	—	—	1996	—
	2/14/1983	HMC	—	—	—	—	—	—	—	—	—	2017	—
	2/14/1983	HMC	—	—	—	—	—	—	35.0	708	1450	2052	—
	4/15/1983	HMC	25.0	1.000	2.00	484	360	0	43.0	744	1560	2019	0.990
	6/27/1983	HMC	—	—	—	—	—	—	—	—	—	—	—
	6/27/1983	EID	6.20	1.60	1.17	465	335	13.2	33.5	759	1398	—	0.910
	6/27/1983	HMC	21.0	3.00	2.00	446	354	6.00	18.0	694	1500	—	0.990
	8/31/1983	HMC	—	—	—	—	—	—	35.0	731	1350	—	—
	12/19/1983	HMC	—	—	—	—	—	—	—	—	—	2086	—
	12/19/1983	HMC	—	—	—	—	—	—	—	—	—	2086	—
	12/19/1983	HMC	—	—	—	—	—	—	35.0	895	1420	2086	—
	1/20/1984	HMC	—	—	—	—	—	—	—	—	—	2086	—
	1/20/1984	HMC	—	—	—	—	—	—	—	—	—	2086	—
	1/20/1984	HMC	—	—	—	—	—	—	35.0	824	1420	2121	—
	4/26/1984	HMC	—	—	—	—	—	—	—	—	—	2103	—
	4/26/1984	HMC	—	—	—	—	—	—	—	—	—	2103	—
	4/26/1984	HMC	26.0	2.00	2.00	476	333	12.0	35.0	741	1290	2164	1.000
	7/18/1984	HMC	—	—	—	—	—	—	—	—	—	1486	—
	7/18/1984	HMC	—	—	—	—	—	—	—	—	—	1583	—
	7/18/1984	HMC	—	—	—	—	—	—	28.0	895	1240	1583	—
	11/1/1984	HMC	—	—	—	—	—	—	—	—	—	2119	—
	11/1/1984	HMC	—	—	—	—	—	—	—	—	—	2133	—
	11/1/1984	HMC	—	—	—	—	—	—	50.0	842	1530	2068	—
	1/25/1985	HMC	—	—	—	—	—	—	—	—	—	2225	—
	1/25/1985	HMC	—	—	—	—	—	—	—	—	—	2053	—
	1/25/1985	HMC	—	—	—	—	—	—	57.0	807	1170	2053	—

TABLE C-1. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

Ca THROUGH ION_BAL

Sample Point Name	Date	Lab	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Na (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	TDS (mg/l)	Cond(calc.) (µmhos/cm)	Ion_B (ratio)
WCW	4/22/1985	HMC	31.0	1.000	2.00	473	288	< 0.0010	50.0	807	1520	—	0.970
	7/18/1985	HMC	—	—	—	—	—	—	50.0	896	1510	—	—
	10/18/1985	HMC	—	—	—	—	—	—	—	—	—	1991	—
	10/18/1985	HMC	—	—	—	—	—	—	—	—	—	2049	—
	10/18/1985	HMC	—	—	—	—	—	—	35.0	817	1490	2063	—
	1/30/1986	HMC	—	—	—	—	—	—	—	—	—	2061	—
	1/30/1986	HMC	—	—	—	—	—	—	43.0	810	1190	1846	—
	4/29/1986	HMC	—	—	—	—	—	—	—	—	—	2000	—
	4/29/1986	HMC	—	—	—	—	—	—	—	—	—	2132	—
	4/29/1986	HMC	—	—	—	—	—	—	—	—	—	2197	—
	4/29/1986	HMC	—	—	—	—	—	—	35.0	827	1070	2094	—
	7/30/1986	HMC	—	—	—	—	—	—	—	—	—	2115	—
	7/30/1986	HMC	—	—	—	—	—	—	44.0	811	1510	2208	—
	12/3/1986	HMC	—	—	—	—	—	—	—	—	—	2238	—
	12/3/1986	HMC	—	—	—	—	—	—	—	—	—	2238	—
	12/3/1986	HMC	—	—	—	—	—	—	—	—	—	2210	—
	12/3/1986	HMC	—	—	—	—	—	—	43.0	845	1210	2210	—
	3/19/1987	HMC	—	—	—	—	—	—	—	—	—	2185	—
	3/19/1987	HMC	—	—	—	—	—	—	—	—	—	2145	—
	3/19/1987	HMC	—	—	—	—	—	—	—	—	—	2212	—
	3/19/1987	HMC	—	—	—	—	—	—	21.0	792	1410	2212	—
	7/1/1987	HMC	—	—	—	—	—	—	—	—	—	2340	—
	7/1/1987	HMC	—	—	—	—	—	—	—	—	—	2262	—
	7/1/1987	HMC	—	—	—	—	—	—	—	—	—	2262	—
	7/1/1987	HMC	24.0	2.00	2.00	483	284	< 10.00	57.0	818	1530	2271	0.950
	9/30/1987	HMC	—	—	—	—	—	—	—	—	—	2145	—
	9/30/1987	HMC	—	—	—	—	—	—	—	—	—	2197	—
	9/30/1987	HMC	—	—	—	—	—	—	—	—	—	2262	—
	9/30/1987	HMC	—	—	—	—	—	—	35.0	823	1500	2262	—

TABLE C-1. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

Ca THROUGH ION_BAL

Sample Point Name	Date	Lab	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Na (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	TDS (mg/l)	Cond(calc.) (µmhos/cm)	Ion_B (ratio)
WCW	2/29/1988	HMC	—	—	—	—	—	—	—	—	—	2145	—
	2/29/1988	HMC	—	—	—	—	—	—	—	—	—	2145	—
	2/29/1988	HMC	37.0	1.000	2.00	473	279	8.00	57.0	775	1440	2145	1.000
	5/27/1988	HMC	—	—	—	—	—	—	—	—	—	2094	—
	5/27/1988	HMC	57.0	1.000	2.00	473	292	< 10.00	35.0	815	1520	2145	1.02
	8/30/1988	HMC	—	—	—	—	—	—	—	—	—	1971	—
	8/30/1988	HMC	—	—	—	—	—	—	—	—	—	2003	—
	8/30/1988	HMC	—	—	—	—	—	—	43.0	797	1320	2003	—
	10/12/1988	HMC	46.0	2.00	2.00	473	293	—	43.0	798	1170	2055	1.02
	4/7/1989	HMC	—	—	—	—	—	—	—	—	—	2145	—
	4/7/1989	HMC	38.0	3.00	2.00	488	285	16.0	57.0	844	1380	2145	0.960
	7/5/1989	HMC	—	—	—	—	—	—	57.0	818	1550	2340	—
	7/5/1989	HMC	—	—	—	—	—	—	—	—	—	2239	—
	7/5/1989	HMC	—	—	—	—	—	—	—	—	—	2286	—
	10/20/1989	HMC	21.0	3.00	4.00	520	273	12.0	50.0	790	1540	2224	1.06
	6/25/1990	HMC	—	—	—	—	—	—	—	—	—	2246	—
	6/25/1990	HMC	25.0	3.00	2.00	520	264	19.0	85.0	820	1440	2273	0.989
	6/10/1991	HMC	—	—	—	—	—	—	—	—	—	2182	—
	6/10/1991	HMC	38.0	1.000	1.000	470	271	16.0	64.0	780	1510	2197	0.975
	9/17/1992	HMC	28.0	1.000	2.00	487	262	29.0	57.0	802	1550	2162	0.964
	6/8/1993	HMC	28.0	2.00	2.00	500	265	25.0	50.0	757	1550	2223	1.05
	6/15/1994	ENER	10.7	2.00	0.800	483	272	3.10	59.8	786	1508	* 2233	0.961
	6/15/1994	ENER	10.2	1.90	0.800	488	271	4.00	58.4	764	1451	* 2233	0.990
	10/25/1994	ENER	10.8	1.90	1.40	485	294	4.30	54.2	772	1473	* 2094	0.967
	5/22/1996	ENER	11.2	2.20	1.50	463	298	9.00	73.0	760	1470	* 2456	0.907
	5/22/1997	ENER	7.60	1.60	1.60	484	302	17.0	72.1	731	1460	* 2391	0.949
	5/6/1998	ENER	5.00	1.30	1.60	466	291	26.6	66.0	680	1470	* 2228	0.954
	5/11/1999	ACZ	# 229	# 2.00	# 1.50	# 464	# 262	# 10.00	# 49.0	# 740	# 1420	*# 2815	# 1.49
	5/11/1999	ENER	10.9	2.20	1.60	460	312	5.70	50.7	691	1430	* 2815	0.984

Signifies Quality Control Sample

* Signifies Specific Conductivity from HMC

TABLE C-1. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

Ca THROUGH ION_BAL

Sample Point Name	Date	Lab	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Na (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	TDS (mg/l)	Cond(calc.) (µmhos/cm)	Ion_B (ratio)
WCW	5/16/2000	ENER	14.9	3.27	2.44	520	326	< 1.000	82.0	743	1560	* 2933	1.02
	7/17/2003	ENER	16.1	4.00	2.70	648	321	4.60	118	1020	1980	* 2840	0.980
WR25	10/12/1995	ENER	363	89.0	9.40	325	301	< 0.100	100.0	1476	2646	* 3634	1.03
	11/28/1995	ENER	224	62.0	7.80	263	565	< 0.100	186	678	1862	* 3360	0.975
	8/27/1996	ENER	376	92.0	6.20	340	254	< 0.100	96.0	1590	2920	* 3406	1.03
	11/8/1997	ENER	—	—	—	—	—	—	114	1700	2930	* 3381	—
	11/5/1998	ENER	—	—	—	—	—	—	—	1660	2990	* 4370	—
	11/5/1998	ENER	—	—	—	—	—	—	—	# 1640	# 3040	*# 4370	—
	11/5/1998	ACZ	—	—	—	—	—	—	—	# 1710	# 2930	*# 4370	—
	10/3/2000	ENER	—	—	—	—	—	—	—	1330	2940	* 4234	—
	7/10/2003	ENER	561	135	8.50	355	381	< 1.000	111	1950	3660	* 3991	1.09

Signifies Quality Control Sample

* Signifies Specific Conductivity from HMC

TABLE C-2. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS.

pH THROUGH Th-230

Sample Point Name	Date	Lab	pH (std. units)	Unat (mg/l)	Mo (mg/l)	Se (mg/l)	NO3 (mg/l)	Ra226 (pCi/l)	Ra228 (pCi/l)	Cr (mg/l)	V (mg/l)	Th230 (pCi/l)
0931	3/26/1982	HMC	9.40	< 0.0085	0.0500	< 0.0100	1.70	—	—	—	—	—
	7/28/1982	HMC	7.10	< 0.0085	0.0800	0.0300	1.20	1.40	—	—	—	—
	1/10/1983	HMC	10.1	< 0.0085	0.0800	0.0100	2.40	0.800	—	—	—	—
	8/30/1983	HMC	8.00	< 0.0085	0.0500	< 0.0100	1.80	0.300	—	—	—	—
	1/10/1984	HMC	9.40	< 0.0085	0.0800	0.0300	1.80	—	—	—	—	—
	7/24/1984	HMC	7.90	< 0.0100	0.0600	0.0200	3.70	0.600	—	—	—	—
	1/18/1985	HMC	9.20	< 0.0100	0.0700	0.0100	0.200	—	—	—	—	—
	7/19/1985	HMC	8.90	< 0.0100	0.0500	0.0200	4.20	0.200	—	—	—	—
	1/13/1986	HMC	7.70	< 0.0100	0.0300	0.0100	2.60	—	—	—	—	—
	7/23/1986	HMC	8.00	< 0.0100	0.0300	0.0100	5.00	0.200	—	—	—	—
	1/29/1987	HMC	8.90	< 0.0100	0.0300	0.0100	4.40	—	—	—	—	—
	7/22/1987	HMC	7.50	0.0594	0.0200	0.0100	3.60	—	—	—	—	—
	2/10/1988	HMC	8.30	0.144	0.110	0.0200	1.30	—	—	—	—	—
	7/28/1988	HMC	9.20	0.0339	0.0400	0.0200	1.20	0.0300	—	—	—	—
	1/18/1989	HMC	8.30	0.0254	0.0300	0.0100	0.800	—	—	—	—	—
	9/18/1989	HMC	8.60	0.0170	< 0.0100	0.0100	0.400	* 0.200	—	*< 0.0100	< 0.0100	* 0
	7/3/1990	HMC	8.30	0.0085	0.0100	0.0100	1.10	—	—	—	—	—
	8/20/1991	HMC	7.90	0.0339	0.0200	< 0.0100	1.40	* 0.700	—	—	—	—
	8/12/1992	HMC	8.30	0.0254	0.0300	< 0.0100	4.00	*< 0.200	—	—	—	—
	3/4/1993	ENER	—	—	—	—	—	< 0.200	—	—	—	—
	3/4/1993	HMC	7.90	0.0509	0.0200	0.0080	5.00	—	—	—	—	—
	9/1/1993	ENER	8.57	0.0051	0.0300	< 0.0010	0.170	< 0.200	—	—	—	—
	3/28/1994	ENER	7.76	0.0200	0.0800	< 0.0050	< 0.100	< 0.200	< 1.000	< 0.0500	< 0.0100	< 0.200
	8/17/1994	ENER	8.48	0.0060	< 0.0300	< 0.0050	< 0.100	< 0.200	—	—	—	—
	6/14/1995	ENER	8.39	0.0234	0.0300	< 0.0050	< 0.100	< 0.200	< 1.000	< 0.0500	< 0.0100	< 0.200
	8/16/1995	ENER	7.40	0.0160	0.0300	< 0.0050	< 0.100	< 0.200	—	—	—	—
	7/31/1996	ENER	8.37	0.0310	0.0500	0.0140	< 0.100	< 0.200	< 1.000	< 0.0500	< 0.0100	< 0.200
	4/14/1997	ENER	9.47	0.0060	0.0300	< 0.0050	< 1.000	< 0.200	—	—	—	—
	9/3/1997	ENER	9.23	0.0040	< 0.0300	< 0.0050	< 0.100	< 0.200	—	—	—	—

* Signifies Specific Conductivity from HMC

TABLE C-2. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

pH THROUGH Th-230

Sample Point Name	Date	Lab	pH (std. units)	Unat (mg/l)	Mo (mg/l)	Se (mg/l)	NO3 (mg/l)	Ra226 (pCi/l)	Ra228 (pCi/l)	Cr (mg/l)	V (mg/l)	Th230 (pCi/l)
0931	4/1/1998	ENER	# 9.02	# 0.0024	# 0.0500	# < 0.0050	# < 0.100	# < 0.200	—	—	—	—
	4/1/1998	ENER	9.04	0.0309	0.420	0.0100	< 0.100	< 0.200	—	—	—	—
	9/16/1998	ENER	8.70	0.0015	0.0300	< 0.0050	< 0.100	0.200	—	—	—	—
	4/20/1999	ENER	9.14	0.0007	0.0300	< 0.0050	< 0.100	< 0.200	—	—	—	—
	9/14/1999	ENER	8.27	0.0031	0.0300	0.0140	< 0.100	< 0.200	—	—	—	—
	4/6/2000	ENER	8.13	0.0166	< 0.0300	0.0140	< 0.100	< 0.200	—	—	—	—
	4/6/2000	ENER	# 8.19	# 0.0188	# < 0.0300	# 0.0140	# < 0.100	# < 0.200	—	—	—	—
	8/30/2000	ENER	9.04	0.0011	0.0309	< 0.0050	< 0.100	< 0.200	—	—	—	—
	8/30/2000	ENER	# 8.81	# 0.0029	# < 0.0300	# 0.0090	# < 0.100	# < 0.200	—	—	—	—
0934	2/25/1982	HMC	8.10	< 0.0085	0.0600	< 0.0100	0.200	1.10	—	—	—	—
	9/18/1989	HMC	8.70	0.0170	< 0.0100	< 0.0100	0.600	0.900	—	*< 0.0100	< 0.0100	* 0
	7/3/1990	HMC	8.40	0.0085	0.0100	0.0100	1.000	—	—	—	—	—
	8/19/1991	HMC	7.90	0.0424	0.0200	< 0.0100	1.000	—	—	—	—	—
	8/19/1991	BARR	—	—	—	—	—	0.600	—	—	—	—
	8/12/1992	HMC	8.30	0.0339	0.0200	< 0.0100	2.90	*< 0.200	—	—	—	—
	3/4/1993	HMC	8.20	0.0170	0.0200	0.0100	4.20	*< 0.200	—	—	—	—
	8/31/1993	ENER	8.42	0.0144	< 0.0100	< 0.0010	< 0.100	< 0.200	—	—	—	—
	3/28/1994	ENER	7.53	0.0260	0.0400	< 0.0050	< 0.100	0.300	4.00	< 0.0500	< 0.0100	< 0.200
	8/17/1994	ENER	8.40	0.0190	< 0.0300	< 0.0050	1.16	< 0.200	—	—	—	—
	8/17/1995	ENER	7.11	0.0270	0.0300	< 0.0050	< 0.100	< 0.200	—	—	—	—
	7/31/1996	ENER	8.33	0.0173	0.0300	0.0630	0.100	< 0.200	< 1.000	< 0.0500	< 0.0100	< 0.200
	4/14/1997	ENER	8.46	0.0260	< 0.0300	< 0.0050	< 0.0100	< 0.200	—	—	—	—
	9/3/1997	ENER	8.64	0.0140	< 0.0300	< 0.0050	< 0.100	< 0.200	—	—	—	—
	4/1/1998	ENER	8.37	0.0259	0.120	0.0090	< 0.100	< 0.200	—	—	—	—
	9/24/1998	ENER	8.48	0.0160	< 0.0300	< 0.0050	0.110	< 0.200	—	—	—	—
	4/20/1999	ENER	8.75	0.0096	< 0.0300	0.0080	< 0.100	< 0.200	—	—	—	—
	9/14/1999	ENER	8.20	0.0287	< 0.0300	0.0250	0.150	< 0.200	—	—	—	—
	4/6/2000	ENER	8.08	0.0593	< 0.0300	0.0290	3.30	< 0.200	—	—	—	—
	8/30/2000	ENER	8.38	0.0220	< 0.0300	0.0180	< 0.100	< 0.200	—	—	—	—

Signifies Quality Control Sample
* Signifies Specific Conductivity from HMC

TABLE C-2. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

pH THROUGH Th-230

Sample Point Name	Date	Lab	pH (std. units)	Unat (mg/l)	Mo (mg/l)	Se (mg/l)	NO3 (mg/l)	Ra226 (pCi/l)	Ra228 (pCi/l)	Cr (mg/l)	V (mg/l)	Th230 (pCi/l)
0934	7/25/2001	ENER	—	0.0310	< 0.0300	0.0230	—	—	—	—	—	—
	2/26/2002	ENER	—	0.0510	< 0.0300	0.0260	—	—	—	—	—	—
	7/22/2002	ENER	—	0.361	0.230	0.0290	—	—	—	—	—	—
	4/28/2003	ENER	—	0.0931	0.100	0.0170	—	—	—	—	—	—
	7/7/2003	ENER	8.33	0.0745	< 0.0300	0.0200	1.70	< 0.200	< 1.000	—	< 0.0100	0.300
ACW	12/7/1979	UNK	8.39	—	0.0100	0.0140	—	—	—	0.0050	—	—
	12/2/1980	HMC	8.10	< 0.0085	0.0200	< 0.0100	0.480	1.30	—	—	—	—
	8/18/1981	HMC	8.30	< 0.0085	0.0300	< 0.0100	0.800	0.800	—	—	—	—
	10/8/1981	HMC	—	< 0.0085	0.0200	< 0.0100	0.500	1.10	—	—	—	—
	11/19/1981	HMC	—	0.0170	0.0400	< 0.0100	0.200	1.30	—	—	—	—
	2/1/1982	HMC	—	0.0085	0.110	0.0200	0.200	0.500	—	—	—	—
	2/15/1982	HMC	7.80	0.0678	0.0500	0.0300	0.300	1.000	—	—	—	—
	3/2/1982	HMC	—	< 0.0085	0.0700	< 0.0100	0.400	0.500	—	—	—	—
	5/21/1982	HMC	8.40	< 0.0085	0.0400	0.0300	0.400	0.500	—	—	—	—
	11/16/1982	HMC	7.90	< 0.0085	0.0500	0.0500	0.800	—	—	—	—	—
	2/14/1983	HMC	8.00	< 0.0085	0.0300	< 0.0100	0.600	—	—	—	—	—
	4/15/1983	HMC	8.10	< 0.0085	0.0100	0.0100	0.900	0.600	—	—	—	—
	6/27/1983	EID	8.70	—	< 0.0100	0.0060	0.0400	—	—	—	—	—
	6/27/1983	HMC	7.80	0.0678	0.0200	0.0100	1.10	0.900	—	—	—	—
	8/31/1983	HMC	8.00	0.0102	0.0100	0.0200	0.500	—	—	—	—	—
	12/19/1983	HMC	8.00	0.0068	0.0200	0.0200	3.60	—	—	—	—	—
	1/1/1984	HMC	7.90	0.0170	0.0200	0.0200	0.700	—	—	—	—	—
	7/19/1984	HMC	8.70	< 0.0100	0.0100	0.0200	4.00	—	—	—	—	—
	11/2/1984	HMC	8.60	0.0170	0.0200	0.0200	15.4	—	—	—	—	—
	3/19/1986	HMC	7.50	< 0.0100	0.0100	0.0100	6.80	—	—	—	—	—
	5/20/1986	HMC	7.80	< 0.0100	0.0100	0.0100	10.6	0.400	—	—	—	—
	7/9/1986	HMC	7.60	< 0.0100	0.0100	0.0100	11.5	—	—	—	—	—
	12/31/1986	HMC	7.50	< 0.0100	0.0100	0.0100	11.8	—	—	---	---	—
	12/19/1989	HMC	8.80	0.0424	< 0.0100	< 0.0100	0.300	* 0.200	* 0	< 0.0100	< 0.0100	* 0

* Signifies Specific Conductivity from HMC

TABLE C-2. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

pH THROUGH Th-230

Sample Point Name	Date	Lab	pH (std. units)	Unat (mg/l)	Mo (mg/l)	Se (mg/l)	NO3 (mg/l)	Ra226 (pCi/l)	Ra228 (pCi/l)	Cr (mg/l)	V (mg/l)	Th230 (pCi/l)
ACW	6/26/1990	HMC	8.90	0.0254	0.0100	0.0100	3.00	—	—	—	—	—
	6/27/1991	HMC	8.20	0.0085	0.0100	< 0.0100	2.30	* 0.200	—	—	—	—
	12/10/1992	HMC	9.20	< 0.0085	< 0.0100	< 0.0100	4.00	*< 0.200	—	—	—	—
	7/12/1994	ENER	8.73	0.0220	< 0.0300	0.0110	0.210	0.900	< 1.000	< 0.0500	< 0.0100	< 0.200
	7/12/1994	ENER	8.68	0.0190	< 0.0300	0.0100	0.270	0.700	< 1.000	< 0.0500	< 0.0100	< 0.200
CW1	1/21/1982	HMC	—	0.110	0.0400	0.0900	1.90	2.60	—	—	—	—
	1/28/1982	HMC	—	< 0.0085	0.0400	0.0900	0.400	1.30	—	—	—	—
	3/9/1994	ENER	8.42	0.0200	< 0.0300	< 0.0050	0.130	0.200	< 1.000	< 0.0500	< 0.0100	< 0.200
	2/26/2002	ENER	—	0.0340	< 0.0300	0.0110	—	—	—	—	—	—
	8/21/2002	ENER	—	0.0400	< 0.0300	0.0190	—	—	—	—	—	—
	4/23/2003	ENER	—	0.0619	< 0.0300	0.0220	—	—	—	—	—	—
	7/10/2003	ENER	8.37	0.0480	< 0.0300	0.0290	0.700	< 0.200	< 1.000	—	< 0.0100	< 0.200
CW2	1/22/1982	HMC	—	< 0.0085	0.0300	0.0900	1.000	2.00	—	—	—	—
	2/2/1982	HMC	8.10	< 0.0085	0.0300	< 0.0100	0.200	1.30	—	—	—	—
	7/15/1982	HMC	8.40	< 0.0085	0.100	0.0100	2.00	1.30	—	—	—	—
	1/20/1983	HMC	8.25	< 0.0085	0.0100	0.0300	0.600	—	—	—	—	—
	4/14/1983	HMC	8.00	< 0.0085	0.0100	0.0400	0.600	—	—	—	—	—
	6/27/1983	EID	8.83	0.0150	< 0.0100	< 0.0050	0.230	—	—	—	—	—
	6/27/1983	HMC	8.60	< 0.0085	0.0200	0.0300	0.900	0.700	—	—	—	—
	9/12/1983	HMC	8.50	0.0034	0.0300	0.0100	0.700	0.300	—	—	—	—
	10/26/1983	HMC	8.20	0.0034	0.0200	0.0100	0.400	—	—	—	—	—
	1/5/1984	HMC	7.80	0.0170	0.0300	0.0200	0.500	—	—	—	—	—
	4/4/1984	HMC	8.50	0.0034	0.0400	0.0200	3.70	—	—	—	—	—
	6/15/1984	HMC	8.30	0.0170	0.0500	0.0200	6.10	0.500	—	—	—	—
	10/12/1984	HMC	8.20	< 0.0100	0.0100	0.0100	—	—	—	—	—	—
	1/16/1985	HMC	8.30	0.0170	0.0200	0.0100	0.500	—	—	—	—	—
	4/10/1985	HMC	8.30	0.0170	0.0200	0.0200	0.900	—	—	—	—	—
	7/22/1985	HMC	8.30	< 0.0100	0.0300	0.0100	2.40	1.70	—	—	—	—

* Signifies Specific Conductivity from HMC

TABLE C-2. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

pH THROUGH Th-230

Sample Point Name	Date	Lab	pH (std. units)	Unat (mg/l)	Mo (mg/l)	Se (mg/l)	NO3 (mg/l)	Ra226 (pCi/l)	Ra228 (pCi/l)	Cr (mg/l)	V (mg/l)	Th230 (pCi/l)
CW2	10/3/1985	HMC	8.40	0.0170	0.0200	0.0100	2.80	—	—	—	—	—
	1/9/1986	HMC	7.70	< 0.0100	0.0200	0.0100	2.80	—	—	—	—	—
	4/8/1986	HMC	8.10	< 0.0100	0.0200	0.0100	2.10	—	—	—	—	—
	7/15/1986	HMC	7.90	0.0136	0.0200	< 0.0100	4.80	0.700	—	—	—	—
	10/13/1986	HMC	7.80	< 0.0100	0.0100	0.0200	6.30	—	—	—	—	—
	1/8/1987	HMC	8.10	< 0.0100	0.0200	0.0200	6.00	—	—	—	—	—
	4/9/1987	HMC	8.30	0.0170	0.0200	0.0300	0.900	—	—	—	—	—
	7/17/1987	HMC	7.80	0.0509	0.0100	0.0200	0.700	0.600	—	—	—	—
	10/15/1987	HMC	8.00	< 0.0100	0.0200	0.0100	1.30	—	—	—	—	—
	11/19/1987	EID	—	0.0150	< 0.0100	< 0.0050	—	—	—	< 0.100	< 0.100	—
	11/19/1987	HMC	7.90	< 0.0100	0.0100	0.0100	0.900	0.200	—	—	—	—
	1/26/1988	HMC	7.90	< 0.0100	0.0200	0.0100	0.800	—	—	—	—	—
	4/20/1988	HMC	8.40	< 0.0100	0.0200	0.0200	0.500	—	—	—	—	—
	7/20/1988	HMC	8.50	0.0085	0.0200	0.0100	0.600	0.200	—	—	—	—
	12/15/1988	HMC	8.70	0.136	0.150	0.0100	0.400	—	—	—	—	—
	1/23/1989	HMC	8.60	0.0678	0.0200	< 0.0100	0.600	—	—	—	—	—
	4/24/1989	HMC	7.90	< 0.0100	0.0200	< 0.0100	0.400	—	—	—	—	—
	9/20/1989	HMC	8.70	0.0170	0.0100	< 0.0100	0.300	0.100	—	*< 0.0100	< 0.0100	* 0.100
	12/1/1989	HMC	—	0.0254	—	< 0.0100	—	* 0.100	* 0.300	—	—	* 0
	2/15/1990	BARR	—	—	0.0400	—	—	< 0.200	< 0.900	< 0.0100	—	< 0.200
	2/15/1990	HMC	7.90	0.0085	0.0100	< 0.0100	0.300	0.100	—	< 0.0100	< 0.0100	—
	5/8/1990	HMC	—	0.0170	—	0.0100	—	—	—	—	—	—
	8/7/1990	HMC	8.30	0.0678	0.0200	0.0100	1.70	* 0.200	*< 0.200	—	—	*< 0
	11/27/1990	HMC	—	< 0.0085	—	0.0200	—	—	—	—	—	—
	2/19/1991	HMC	8.30	0.0339	0.0200	0.0300	4.00	—	—	< 0.0100	< 0.0100	—
	2/19/1991	BARR	—	—	—	—	—	0.100	1.60	—	—	0.200
	5/16/1991	HMC	—	0.0763	—	< 0.0100	—	—	—	—	—	—
	8/14/1991	BARR	8.13	* 0.0170	0.0200	0.0030	< 0.100	0.100	< 0.100	*< 0.0100	*< 0.0100	< 0.100
	11/20/1991	HMC	—	0.0424	—	< 0.0100	—	—	—	—	—	—

* Signifies Specific Conductivity from HMC

TABLE C-2. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

pH THROUGH Th-230

Sample Point Name	Date	Lab	pH (std. units)	Unat (mg/l)	Mo (mg/l)	Se (mg/l)	NO3 (mg/l)	Ra226 (pCi/l)	Ra228 (pCi/l)	Cr (mg/l)	V (mg/l)	Th230 (pCi/l)
CW2	2/19/1992	HMC	8.50	0.0339	0.0200	< 0.0100	0.700	* 0.300	*< 1.000	< 0.0100	< 0.0100	*< 0.200
	5/20/1992	HMC	—	0.0424	—	< 0.0100	—	—	—	—	—	—
	7/30/1992	HMC	8.50	0.0170	< 0.0100	< 0.0100	2.90	—	—	< 0.0100	< 0.0100	—
	7/30/1992	ENER	8.56	0.0085	< 0.100	< 0.0010	—	< 0.200	< 1.000	< 0.0500	< 0.100	< 0.200
	11/4/1992	HMC	—	0.0085	—	< 0.0100	—	—	—	—	—	—
	2/8/1993	HMC	8.60	0.0254	0.0100	< 0.0100	5.00	—	—	< 0.0100	< 0.0100	—
	5/4/1993	HMC	—	< 0.0085	—	< 0.0100	—	—	—	—	—	—
	8/12/1993	HMC	8.60	< 0.0085	0.0100	< 0.0100	1.40	* 0.500	—	< 0.0100	< 0.0100	—
	11/1/1993	ENER	—	0.0100	—	< 0.0010	—	—	—	—	—	—
	2/2/1994	ENER	8.24	0.0140	< 0.0300	< 0.0050	0.120	< 0.200	< 1.000	< 0.0500	< 0.0100	< 0.200
	3/10/1994	ENER	8.56	0.0180	< 0.0300	< 0.0050	0.100	< 0.200	< 1.000	< 0.0500	< 0.0100	< 0.200
	5/3/1994	ENER	—	0.0200	—	< 0.0100	—	—	—	—	—	—
	8/2/1994	ENER	8.45	0.0170	< 0.0300	0.0070	< 0.100	0.300	< 1.000	< 0.0500	< 0.0100	< 0.200
	11/2/1994	ENER	—	0.0230	—	0.0050	—	—	—	—	—	—
	2/2/1995	ENER	8.62	0.0150	< 0.0300	< 0.0050	< 0.100	0.200	< 1.000	< 0.0500	< 0.0100	< 0.200
	2/3/1995	ENER	8.68	0.0190	< 0.0300	< 0.0100	< 0.100	12.9	< 1.000	< 0.0500	< 0.0100	< 0.200
	5/5/1995	ENER	—	0.0250	—	< 0.0050	—	—	—	—	—	—
	8/2/1995	ENER	8.62	0.0150	< 0.0300	< 0.0050	< 0.100	0.300	2.50	< 0.0500	< 0.0100	< 0.200
	11/15/1995	ENER	—	0.0180	—	< 0.0050	—	—	—	—	—	—
	2/12/1996	ENER	8.54	0.0180	< 0.0300	< 0.0100	< 0.100	< 0.200	< 1.000	—	—	1.10
	2/12/1996	ENER	8.51	0.0160	< 0.0300	< 0.0100	0.130	12.3	1.70	< 0.0500	< 0.0100	0.800
	5/14/1996	ENER	—	0.0200	—	< 0.0100	—	—	—	—	—	—
	7/29/1996	ENER	8.11	0.0121	0.0300	0.0110	0.100	0.200	1.000	0.0500	0.0100	0.200
	11/4/1996	ENER	—	0.0120	0.0300	< 0.0050	—	—	—	—	—	—
	2/3/1997	ENER	7.99	0.0140	0.0500	0.0050	0.100	< 0.200	< 1.000	< 0.0500	0.0200	< 0.200
	4/29/1997	ENER	—	0.0130	—	< 0.0050	—	—	—	—	—	—
	7/28/1997	ENER	—	0.0150	—	< 0.0050	—	—	—	—	—	—
	10/13/1997	ENER	8.43	0.0180	< 0.0300	< 0.0050	< 0.100	< 0.200	< 1.000	< 0.0500	< 0.0100	< 0.200
	2/10/1998	ENER	8.22	0.0146	< 0.0300	0.0050	< 0.100	0.300	< 1.000	—	< 0.0100	0.300

* Signifies Specific Conductivity from HMC

TABLE C-2. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

pH THROUGH Th-230.

Sample Point Name	Date	Lab	pH (std. units)	Unat (mg/l)	Mo (mg/l)	Se (mg/l)	NO3 (mg/l)	Ra226 (pCi/l)	Ra228 (pCi/l)	Cr (mg/l)	V (mg/l)	Th230 (pCi/l)
CW2	5/6/1998	ENER	—	0.0195	—	0.0050	—	—	—	—	—	—
	8/5/1998	ENER	8.29	0.0133	< 0.0300	0.0090	< 0.100	< 0.200	< 1.000	—	< 0.0100	< 0.200
	10/28/1998	ENER	—	0.0150	—	0.0060	—	—	—	—	—	—
	2/4/1999	ENER	8.14	0.0129	< 0.0300	0.0050	< 0.100	< 0.200	< 1.000	—	< 0.0100	< 0.200
	5/20/1999	ENER	—	0.0130	—	0.0080	—	—	—	—	—	—
	8/17/1999	ENER	8.24	0.0145	< 0.0300	0.0080	< 0.100	< 0.200	< 1.000	—	< 0.0100	< 0.200
	11/4/1999	ENER	—	0.0100	—	0.0070	—	—	—	—	—	—
	2/2/2000	ENER	8.44	0.0130	< 0.0300	0.0100	0.160	< 0.200	1.80	—	< 0.0100	0.200
	5/2/2000	ENER	—	0.0154	—	0.0140	—	—	—	—	—	—
	8/2/2000	ENER	8.13	0.0183	0.0301	0.0075	0.120	< 0.200	< 1.000	—	< 0.0100	< 0.200
	11/28/2000	ENER	—	0.0115	—	0.0151	—	—	—	—	—	—
	5/30/2001	ENER	—	0.0160	< 0.0300	0.0130	—	—	—	—	—	—
	2/26/2002	ENER	—	0.0690	0.0600	0.0130	—	—	—	—	—	—
	8/15/2002	ENER	—	0.0400	0.0500	0.0210	—	—	—	—	—	—
	8/21/2002	ENER	—	0.100	0.0900	0.0190	—	—	—	—	—	—
	4/23/2003	ENER	—	0.0339	< 0.0300	0.0180	—	—	—	—	—	—
	7/10/2003	ENER	8.63	0.0163	< 0.0300	0.0220	0.300	< 0.200	< 1.000	—	< 0.0100	< 0.200
CW3	1/29/1982	HMC	—	< 0.0085	0.0200	0.0600	0.300	0.800	—	—	—	—
	3/9/1982	HMC	7.70	< 0.0085	0.0200	< 0.0100	0.500	0.500	—	—	—	—
	3/10/1982	HMC	7.90	< 0.0085	0.0200	< 0.0100	0.600	0.800	—	—	—	—
	7/15/1982	HMC	8.30	< 0.0085	0.0500	—	< 0.100	—	—	—	—	—
	9/15/1982	HMC	8.30	< 0.0085	0.0500	0.0200	< 0.100	1.30	—	—	—	—
	12/23/1982	HMC	8.10	< 0.0085	< 0.0100	0.0300	0.800	—	—	—	—	—
	2/11/1983	HMC	8.10	< 0.0085	< 0.0100	0.0200	0.700	—	—	—	—	—
	4/14/1983	HMC	8.10	0.0034	0.0100	0.0500	0.800	—	—	—	—	—
	6/28/1983	HMC	8.20	0.0085	0.0100	* 0.0070	* 0.0200	0.700	—	—	—	—
	9/12/1983	HMC	8.50	0.0034	0.0200	0.0300	0.600	0.300	—	—	—	—
	10/27/1983	HMC	8.20	0.0102	0.0100	0.0100	0.300	—	—	—	—	—
	1/6/1984	HMC	7.60	0.0170	0.0300	0.0200	0.500	—	—	—	—	—

* Signifies Specific Conductivity from HMC

TABLE C-2. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

pH THROUGH Th-230

Sample Point Name	Date	Lab	pH (std. units)	Unat (mg/l)	Mo (mg/l)	Se (mg/l)	NO3 (mg/l)	Ra226 (pCi/l)	Ra228 (pCi/l)	Cr (mg/l)	V (mg/l)	Th230 (pCi/l)
CW3	2/14/1984	HMC	—	0.0170	—	—	—	—	—	—	—	—
	4/4/1984	HMC	8.30	0.0102	0.0300	< 0.0100	4.30	—	—	—	—	—
	7/26/1984	HMC	7.60	< 0.0100	0.0100	0.0100	7.90	0.400	—	—	—	—
	10/12/1984	HMC	8.00	0.0102	0.0100	0.0100	—	—	—	—	—	—
	1/17/1985	HMC	7.50	0.0170	0.0100	0.0100	0.300	—	—	—	—	—
	4/10/1985	HMC	8.10	0.0254	0.0100	0.0100	1.50	—	—	—	—	—
	7/22/1985	HMC	7.90	0.0170	0.0200	0.0100	2.00	0.900	—	—	—	—
	10/4/1985	HMC	7.70	0.0085	0.0100	0.0100	2.90	—	—	—	—	—
	1/9/1986	HMC	7.40	0.0170	0.0100	0.0100	2.80	—	—	—	—	—
	4/8/1986	HMC	7.90	0.0102	0.0100	0.0200	4.20	—	—	—	—	—
	7/16/1986	HMC	7.90	0.0204	0.0200	< 0.0100	6.20	0.200	—	—	—	—
	10/13/1986	HMC	7.60	0.0170	0.0100	0.0200	5.30	—	—	—	—	—
	1/8/1987	HMC	8.00	< 0.0100	0.0200	0.0100	6.50	—	—	—	—	—
	4/9/1987	HMC	8.30	0.0170	0.0100	0.0200	2.30	—	—	—	—	—
	7/22/1987	HMC	7.20	0.0509	0.0100	0.0100	2.50	—	—	—	—	—
	10/15/1987	HMC	7.70	< 0.0100	0.0100	0.0100	0.600	—	—	—	—	—
	2/2/1988	HMC	7.70	< 0.0100	0.0200	0.0200	0.700	—	—	—	—	—
	4/20/1988	HMC	8.20	0.0339	0.0200	0.0100	0.200	—	—	—	—	—
	7/20/1988	HMC	8.00	0.0254	0.0200	0.0200	0.400	0.200	—	—	—	—
	10/12/1988	HMC	8.00	0.0170	0.0100	0.0100	0.400	0.200	—	—	—	—
	1/24/1989	HMC	8.20	< 0.0100	0.0100	0.0100	0.500	—	—	—	—	—
	4/25/1989	HMC	8.40	< 0.0100	0.0200	0.0100	0.300	—	—	—	—	—
	9/15/1989	HMC	8.60	0.0170	< 0.0100	0.0100	0.200	1.000	* 0.100	*< 0.0100	< 0.0100	* 0
	11/29/1989	HMC	—	0.0424	—	0.0100	—	* 0.300	* 0.500	—	—	* 0
	2/15/1990	BARR	—	—	0.0400	—	—	< 0.200	< 0.900	< 0.100	—	< 0.200
	2/15/1990	HMC	7.50	0.0170	0.0100	0.0100	0.200	0.100	—	< 0.0100	< 0.0100	—
	5/8/1990	HMC	—	0.0424	—	0.0100	—	—	—	—	—	—
	5/20/1990	HMC	—	0.0509	—	< 0.0100	—	—	—	—	—	—
	8/7/1990	HMC	7.90	0.0763	0.0100	0.0100	1.50	—	—	—	—	—

* Signifies Specific Conductivity from HMC

TABLE C-2. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

pH THROUGH Th-230

Sample Point Name	Date	Lab	pH (std. units)	Unat (mg/l)	Mo (mg/l)	Se (mg/l)	NO3 (mg/l)	Ra226 (pCi/l)	Ra228 (pCi/l)	Cr (mg/l)	V (mg/l)	Th230 (pCi/l)
CW3	8/7/1990	BARR	—	—	—	—	—	< 0	< 0.400	—	—	0.200
	11/27/1990	HMC	—	< 0.0085	—	0.0200	—	—	—	—	—	—
	11/27/1990	BARR	—	—	—	< 0.0020	—	—	—	—	—	—
	2/19/1991	HMC	7.70	0.0339	0.0100	0.0200	4.00	—	—	< 0.0100	< 0.0100	—
	2/19/1991	BARR	—	—	—	—	—	0.200	1.60	—	—	< 0.100
	5/15/1991	HMC	—	0.0678	—	< 0.0100	—	—	—	—	—	—
	8/13/1991	BARR	7.99	* 0.0678	* 0.0200	*< 0.0100	* 4.90	0.100	0.600	*< 0.0100	*< 0.0100	< 0.100
	11/26/1991	HMC	—	0.0509	—	< 0.0100	—	—	—	—	—	—
	2/2/1992	ENER	—	—	—	—	—	< 0.200	< 1.000	—	—	< 0.200
	2/20/1992	HMC	8.10	0.0678	0.0100	< 0.0100	0.700	—	—	< 0.0100	< 0.0100	—
	5/20/1992	HMC	—	0.0509	—	< 0.0100	—	—	—	—	—	—
	7/29/1992	ENER	8.33	* 0.0170	< 0.100	*< 0.0100	* 3.00	0.500	1.70	*< 0.0100	< 0.100	< 0.200
	11/4/1992	HMC	—	0.0254	—	< 0.0100	—	—	—	—	—	—
	2/8/1993	HMC	8.30	0.0509	< 0.0100	< 0.0100	4.80	—	—	< 0.0100	< 0.0100	—
	5/4/1993	HMC	—	0.0254	—	< 0.0100	—	—	—	—	—	—
	8/11/1993	ENER	8.49	* 0.0594	< 0.0100	< 0.0010	0.130	0.700	3.10	< 0.0500	< 0.100	< 1.000
	11/1/1993	ENER	—	0.0110	—	< 0.0010	—	—	—	—	—	—
	2/2/1994	ENER	7.68	0.0190	< 0.0300	0.0070	< 0.100	< 0.200	1.40	< 0.0500	< 0.0100	< 0.200
	2/2/1994	ENER	7.89	0.0250	< 0.0500	< 0.0100	< 0.100	11.7	< 1.000	< 0.0500	< 0.0100	< 0.200
	3/9/1994	ENER	7.83	0.0270	< 0.0300	< 0.0050	0.150	< 0.200	< 1.000	< 0.0500	< 0.0100	< 0.200
	5/3/1994	ENER	—	0.0270	—	< 0.0050	—	—	—	—	—	—
	8/1/1994	ENER	8.15	0.0260	< 0.0300	< 0.0050	< 0.100	< 0.200	< 1.000	< 0.0500	< 0.0100	< 0.200
	11/1/1994	ENER	—	0.0270	—	0.0050	—	—	—	—	—	—
	2/2/1995	ENER	8.17	0.0260	< 0.0300	< 0.0050	< 0.100	0.600	< 1.000	< 0.0500	< 0.0100	< 0.200
	5/5/1995	ENER	—	0.0170	—	< 0.0050	—	—	—	—	—	—
	8/2/1995	ENER	8.25	0.0250	< 0.0300	< 0.0050	< 0.100	< 0.200	< 1.000	< 0.0500	< 0.0100	< 0.200
	11/15/1995	ENER	—	0.0330	—	< 0.0050	—	—	—	—	—	—
	11/27/1995	ENER	8.32	0.0245	< 0.0300	< 0.0100	0.110	< 0.200	2.40	< 0.0500	< 0.0100	< 0.200
	2/12/1996	ENER	8.24	0.0300	0.0500	< 0.0100	< 0.100	< 0.200	< 1.000	—	—	0.400

* Signifies Specific Conductivity from HMC

TABLE C-2. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

pH THROUGH Th-230

Sample Point Name	Date	Lab	pH (std. units)	Unat (mg/l)	Mo (mg/l)	Se (mg/l)	NO3 (mg/l)	Ra226 (pCi/l)	Ra228 (pCi/l)	Cr (mg/l)	V (mg/l)	Th230 (pCi/l)
CW3	5/14/1996	ENER	—	0.0260	—	< 0.0100	—	—	—	—	—	—
	7/31/1996	ENER	8.09	0.0281	< 0.0300	0.0030	< 0.100	< 0.200	< 1.000	< 0.0500	< 0.0100	< 0.200
	11/4/1996	ENER	8.35	0.0266	< 0.0300	< 0.0050	< 0.100	< 0.200	—	—	—	—
	2/3/1997	ENER	7.89	0.0260	< 0.0300	< 0.0050	< 0.100	< 0.200	< 1.000	< 0.0500	< 0.0100	< 0.200
	4/29/1997	ENER	—	0.0280	—	< 0.0050	—	—	—	—	—	—
	7/28/1997	ENER	—	0.0280	—	< 0.0050	—	—	—	—	—	—
	10/13/1997	ENER	8.29	0.0280	< 0.0300	< 0.0050	< 0.100	< 0.200	< 1.000	< 0.0500	< 0.0100	< 0.200
	2/10/1998	ENER	8.16	0.0294	< 0.0300	< 0.0050	< 0.100	< 0.200	< 1.000	—	< 0.0100	0.200
	5/5/1998	ENER	—	0.0389	—	< 0.0050	—	—	—	—	—	—
	8/4/1998	ENER	8.22	0.0315	0.0400	< 0.0050	< 0.100	< 0.200	< 1.000	—	< 0.0100	< 0.200
	10/28/1998	ENER	—	0.0310	—	< 0.0050	—	—	—	—	—	—
	2/3/1999	ENER	7.97	0.0328	< 0.0300	< 0.0050	< 0.100	< 0.200	< 1.000	—	< 0.0100	< 0.200
	5/11/1999	ENER	—	0.0307	—	< 0.0050	—	—	—	—	—	—
	8/17/1999	ENER	8.24	0.0320	< 0.0300	< 0.0050	< 0.100	< 0.200	< 1.000	—	< 0.0100	< 0.200
	11/9/1999	ENER	—	0.0250	—	< 0.0050	—	—	—	—	—	—
	2/8/2000	ENER	7.90	0.0270	< 0.0300	< 0.0050	0.140	0.100	< 1.000	—	< 0.0100	0.200
	2/8/2000	ENER	# 8.10	# 0.0260	# < 0.0300	# < 0.0050	# < 0.100	# < 0.200	# < 1.000	—	# < 0.0100	# < 0.200
	4/27/2000	ENER	—	0.0290	—	< 0.0050	—	—	—	—	—	—
	8/2/2000	ENER	8.04	0.0020	< 0.0300	< 0.0050	< 0.100	< 0.200	< 1.000	—	< 0.0100	0.400
	8/2/2000	ENER	# 8.26	# 0.0289	# < 0.0300	# 0.0050	# < 0.100	# < 0.200	# < 1.000	—	# < 0.0100	# < 0.200
	11/28/2000	ENER	—	0.0240	—	< 0.0050	—	—	—	—	—	—
	2/13/2001	ENER	—	0.0352	< 0.0300	0.0090	—	—	—	—	—	—
	6/5/2001	ENER	—	0.0340	< 0.0300	0.0070	—	—	—	—	—	—
	2/25/2002	ENER	—	1.33	1.19	0.0430	—	—	—	—	—	—
	2/25/2002	ENER	—	# 1.35	# 1.19	# 0.0460	—	—	—	—	—	—
	4/29/2002	ENER	—	1.34	1.26	0.0680	—	—	—	—	—	—
	8/21/2002	ENER	—	1.69	1.49	0.0600	—	—	—	—	—	—
	4/23/2003	ENER	—	1.74	1.54	0.0370	—	—	—	—	—	—
	7/7/2003	ENER	8.08	2.11	1.66	0.0350	0.200	< 0.200	< 1.000	—	0.0300	< 0.200

Signifies Quality Control Sample

TABLE C-2. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

pH THROUGH Th-230

Sample Point Name	Date	Lab	pH (std. units)	Unat (mg/l)	Mo (mg/l)	Se (mg/l)	NO3 (mg/l)	Ra226 (pCi/l)	Ra228 (pCi/l)	Cr (mg/l)	V (mg/l)	Th230 (pCi/l)
CW9	4/13/1987	HMC	7.90	< 0.0100	0.0100	0.0100	1.10	0.900	—	—	—	—
	8/2/1988	HMC	8.00	0.0254	0.0200	0.0100	1.50	0.0300	—	—	—	—
	10/12/1988	HMC	7.90	0.0085	0.0600	0.0100	0.300	0.200	—	—	—	—
	10/9/1989	HMC	8.50	0.0254	0.110	0.0100	0.200	0.100	—	< 0.0100	< 0.0100	* 0
	8/6/1990	HMC	7.70	0.0170	0.100	0.0100	1.70	—	—	—	—	—
	8/8/1990	BARR	—	—	—	—	—	10.00	—	—	—	—
	8/20/1991	HMC	7.70	0.0170	0.0800	0.0100	3.00	* 0.400	—	—	—	—
	9/2/1992	HMC	8.10	< 0.0085	0.0900	0.0100	0.600	* 0.300	—	—	—	—
	9/13/1993	ENER	8.01	0.0060	0.100	0.0680	< 0.100	< 0.200	< 1.000	< 0.0500	< 0.100	< 1.000
	9/20/1994	ENER	8.26	0.0520	< 0.0300	0.0060	< 0.100	1.000	< 1.000	< 0.0500	< 0.0100	< 0.200
	9/19/1995	ENER	7.97	0.0554	0.100	< 0.0050	0.370	< 0.200	—	—	—	—
	9/4/1997	ENER	8.15	0.0050	0.0300	< 0.0050	< 0.100	< 0.200	—	—	—	—
	9/29/1998	ENER	7.99	0.0050	0.0700	< 0.0050	< 0.100	0.400	—	—	—	—
	9/15/1999	ENER	7.48	0.0111	0.0800	< 0.0050	< 0.100	0.500	—	—	—	—
	8/30/2000	ENER	7.87	0.0051	0.0400	< 0.0050	0.130	< 0.200	—	—	—	—
	7/8/2003	ENER	8.08	0.0122	< 0.0300	0.0110	< 0.100	0.500	< 1.000	—	< 0.0100	0.300
CW10	4/9/1987	HMC	—	0.0170	0.0100	0.0300	3.60	1.10	—	—	—	—
	4/9/1987	HMC	7.70	—	—	—	—	—	—	—	—	—
	8/2/1988	HMC	7.60	0.0339	0.0100	0.0100	0.600	1.10	—	—	—	—
	10/12/1988	HMC	7.40	0.0339	0.0100	0.0100	0.600	3.00	—	—	—	—
	8/17/1989	HMC	8.10	0.0254	< 0.0100	< 0.0100	0.200	0.100	—	—	—	—
	8/6/1990	HMC	7.50	0.0339	0.0200	0.0100	1.90	—	—	—	—	—
	8/8/1990	BARR	—	—	—	—	—	< 0.100	—	—	—	—
	8/20/1991	HMC	7.30	0.0509	< 0.0100	0.0100	1.90	* 0.500	—	—	—	—
	9/23/1992	HMC	7.50	0.0085	< 0.0100	0.0100	0.640	* 0.0800	—	—	—	—
	9/13/1993	ENER	7.88	0.0120	< 0.0500	< 0.0010	0.100	0.300	1.30	< 0.0500	< 0.100	< 1.000
	9/15/1994	ENER	7.81	0.0260	< 0.0300	0.0070	< 0.100	0.600	< 1.000	< 0.0500	< 0.0100	< 0.200
	9/15/1994	ENER	7.81	0.0270	< 0.0300	0.0050	< 0.100	0.700	< 1.000	< 0.0500	< 0.0100	< 0.200

* Signifies Specific Conductivity from HMC

TABLE C-2. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

pH THROUGH Th-230

Sample Point Name	Date	Lab	pH (std. units)	Unat (mg/l)	Mo (mg/l)	Se (mg/l)	NO3 (mg/l)	Ra226 (pCi/l)	Ra228 (pCi/l)	Cr (mg/l)	V (mg/l)	Th230 (pCi/l)
CW13	12/29/1994	ENER	8.10	0.0450	< 0.0300	0.0360	< 0.0100	< 0.200	< 1.000	< 0.0500	< 0.0100	< 0.200
	12/29/1994	ENER	8.13	0.0460	< 0.0300	0.0510	< 0.0100	< 0.200	1.70	< 0.0500	< 0.0100	< 0.200
	2/11/1995	ENER	8.33	0.0500	< 0.0300	0.244	1.32	< 0.200	< 1.000	< 0.0500	< 0.0100	< 0.200
	5/28/1996	ENER	8.42	0.0500	< 0.0300	0.102	0.540	0.500	< 1.000	< 0.0500	< 0.0100	0.900
	6/14/1996	ENER	—	0.0960	< 0.0300	0.191	—	—	—	—	—	—
CW14	2/1/1995	ENER	8.23	0.0190	< 0.0300	0.222	5.02	< 0.200	< 1.000	< 0.0500	< 0.0100	< 0.200
	2/1/1995	ENER	8.16	0.0190	< 0.0300	0.0830	1.90	< 0.200	< 1.000	< 0.0500	< 0.0100	< 0.200
	2/17/1995	ENER	8.64	0.0100	< 0.0300	0.0990	2.22	< 0.200	—	< 0.0500	< 0.0100	—
	3/2/1995	ENER	8.39	0.0120	< 0.0300	0.100	2.36	0.300	< 1.000	< 0.0500	0.0200	< 0.200
CW15	2/7/1995	ENER	7.91	0.0150	< 0.0300	0.0210	0.650	2.30	2.00	< 0.0500	< 0.0100	< 0.200
	11/20/1995	ENER	7.65	0.0190	< 0.0300	0.0300	3.58	0.300	< 1.000	< 0.0500	< 0.0100	< 0.200
	10/15/1996	ENER	8.10	0.0235	< 0.0300	0.0290	3.78	< 0.200	< 1.000	< 0.0500	< 0.0100	< 0.200
	6/3/1997	ENER	—	0.0450	—	0.0250	—	—	—	—	—	—
	11/8/1997	ENER	7.80	0.0240	< 0.0300	0.0420	4.67	< 0.200	—	—	—	—
	5/19/1998	ENER	—	0.0315	—	0.0150	—	—	—	—	—	—
	11/5/1998	ENER	8.20	0.0310	< 0.0300	0.0100	1.03	0.400	—	—	—	—
	11/5/1998	ENER	# 8.10	# 0.0330	# < 0.0300	# 0.0110	# 1.02	# < 0.200	—	—	—	—
	11/5/1998	ACZ	# 8.10	# 0.0280	# < 0.0100	# 0.0120	# 1.08	—	# 0.130	—	—	—
	6/3/1999	ENER	—	0.0330	—	0.0140	—	—	—	—	—	—
	6/21/2000	ENER	—	0.0501	—	0.0361	—	—	—	—	—	—
	6/6/2001	ENER	—	0.0209	—	0.0310	—	—	—	—	—	—
	6/24/2002	ENER	—	0.0170	—	0.0350	—	—	—	—	—	—
	7/14/2003	ENER	8.13	0.0155	< 0.0300	0.0390	3.90	< 0.200	< 1.000	—	< 0.0100	< 0.200
CW17	2/13/1995	ENER	7.70	0.121	< 0.0300	0.0690	13.4	0.300	3.90	< 0.0500	< 0.0100	< 0.200
	11/28/1995	ENER	7.89	0.126	< 0.0300	0.0690	15.0	0.300	1.20	< 0.0500	< 0.0100	< 0.200
	8/27/1996	ENER	7.74	0.0690	0.0600	0.116	15.3	31.3	—	—	—	—
	6/3/1997	ENER	—	0.137	0.0900	0.0850	—	—	—	—	—	—
	11/8/1997	ENER	7.73	0.153	< 0.0300	0.0740	14.9	< 0.200	—	—	—	—

Signifies Quality Control Sample

TABLE C-2. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

pH THROUGH Th-230

Sample Point Name	Date	Lab	pH (std. units)	Unat (mg/l)	Mo (mg/l)	Se (mg/l)	NO3 (mg/l)	Ra226 (pCi/l)	Ra228 (pCi/l)	Cr (mg/l)	V (mg/l)	Th230 (pCi/l)
CW17	5/18/1998	ENER	—	0.137	< 0.0300	0.0760	—	—	—	—	—	—
	11/5/1998	ENER	7.88	0.141	< 0.0300	0.0630	14.3	< 0.200	—	—	—	—
	11/5/1998	ACZ	# 7.70	# 0.139	# 0.0300	# 0.0740	# 16.8	# 0.700	—	—	—	—
	11/5/1998	ENER	# 7.96	# 0.141	# < 0.0300	# 0.0660	# 14.9	# 0.200	—	—	—	—
	6/1/1999	ENER	—	0.141	—	0.0730	—	—	—	—	—	—
	6/19/2000	ENER	—	0.175	—	0.0808	—	—	—	—	—	—
	6/7/2001	ENER	—	0.140	—	0.0710	—	—	—	—	—	—
	6/27/2002	ENER	—	0.131	—	0.0680	—	—	—	—	—	—
	7/10/2003	ENER	7.74	0.114	< 0.0300	0.0780	10.3	< 0.200	< 1.000	—	< 0.0100	< 0.200
CW18	2/9/1995	ENER	7.94	0.0280	< 0.0300	0.0760	< 0.100	< 0.200	1.50	< 0.0500	< 0.0100	< 0.200
	11/21/1995	ENER	—	—	—	—	—	—	< 1.000	—	—	< 0.200
	11/22/1995	ENER	8.59	0.0160	0.0500	< 0.0100	0.140	0.300	—	< 0.0500	< 0.0100	—
	8/27/1996	ENER	—	0.135	< 0.0300	0.129	—	—	—	—	—	—
	10/15/1996	ENER	8.27	0.148	< 0.0300	0.105	1.21	< 0.200	—	—	—	—
	1/3/1997	ENER	—	0.124	< 0.0300	0.0870	—	—	—	—	—	—
	4/17/1997	ENER	—	0.113	< 0.0300	0.0680	—	—	—	—	—	—
	11/19/1997	ENER	8.20	0.0954	< 0.0300	0.0480	1.44	< 0.200	—	—	—	—
	4/14/1998	ENER	—	0.0805	< 0.0300	0.0440	—	—	—	—	—	—
	11/4/1998	ENER	8.33	0.0850	< 0.0300	0.0340	1.37	< 0.200	—	—	—	—
	7/22/1999	ENER	—	0.0647	< 0.0300	0.0360	—	—	—	—	—	—
	7/20/2000	ENER	—	0.0659	< 0.0300	0.0230	—	—	—	—	—	—
	7/24/2001	ENER	—	0.0460	< 0.0300	0.0260	—	—	—	—	—	—
	7/23/2002	ENER	—	0.0390	< 0.0300	0.0210	—	—	—	—	—	—
	4/28/2003	ENER	—	0.0416	< 0.0300	0.0200	—	—	—	—	—	—
	7/7/2003	ENER	7.89	0.0424	< 0.0300	0.0210	1.70	< 0.200	< 1.000	—	< 0.0100	0.300
CW24	2/21/1995	ENER	7.45	0.101	< 0.0300	0.0620	12.3	0.800	< 1.000	< 0.0500	< 0.0100	< 0.200
	8/27/1996	ENER	7.79	0.119	0.0400	0.0340	8.37	4.70	—	—	—	—
	11/8/1997	ENER	—	0.129	< 0.0300	0.0460	—	—	—	—	—	—

Signifies Quality Control Sample

TABLE C-2. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

pH THROUGH Th-230

Sample Point Name	Date	Lab	pH (std. units)	Unat (mg/l)	Mo (mg/l)	Se (mg/l)	NO3 (mg/l)	Ra226 (pCi/l)	Ra228 (pCi/l)	Cr (mg/l)	V (mg/l)	Th230 (pCi/l)
CW24	11/24/1998	ENER	—	0.154	< 0.0300	0.0640	—	—	—	—	—	—
	10/3/2000	ENER	—	0.128	< 0.0300	0.0798	—	—	—	—	—	—
	7/10/2003	ENER	7.88	0.122	< 0.0300	0.0400	10.1	1.10	< 1.000	—	< 0.0100	< 0.200
CW26	4/4/1995	ENER	8.16	0.0180	< 0.0300	0.192	1.90	0.400	1.10	< 0.0500	< 0.0100	< 0.200
	4/4/1995	ENER	8.09	0.0190	< 0.0300	0.236	2.05	< 0.200	< 1.000	< 0.0500	< 0.0100	< 0.200
	11/27/1995	ENER	8.04	0.0185	< 0.0300	0.246	2.53	0.200	< 1.000	< 0.0500	< 0.0100	< 0.200
	8/28/1996	ENER	—	0.0180	< 0.0300	0.332	—	—	—	—	—	—
	5/30/1997	ENER	—	0.0160	< 0.0300	0.337	—	—	—	—	—	—
	11/19/1997	ENER	7.93	0.0180	< 0.0300	0.213	1.86	< 0.200	—	—	—	—
	5/20/1998	ENER	—	0.0234	0.120	0.272	—	—	—	—	—	—
	11/4/1998	ENER	7.97	0.0250	< 0.0300	0.317	3.20	0.300	—	—	—	—
	6/3/1999	ENER	—	0.0219	—	0.364	—	—	—	—	—	—
	6/3/1999	ENER	—	# 0.0217	—	# 0.360	—	—	—	—	—	—
	6/21/2000	ENER	—	0.0177	—	0.262	—	—	—	—	—	—
	6/6/2001	ENER	—	0.0200	—	0.247	—	—	—	—	—	—
	6/26/2002	ENER	—	0.0190	—	0.224	—	—	—	—	—	—
	7/16/2003	ENER	7.80	0.0242	< 0.0300	0.215	2.10	< 0.200	< 1.000	—	< 0.0100	< 0.200
CW28	4/5/1995	ENER	8.28	0.0140	< 0.0300	0.0310	0.530	< 0.200	1.70	< 0.0500	< 0.0100	< 0.200
	4/13/1995	ENER	6.64	0.0110	0.0300	0.0480	1.42	< 0.200	< 1.000	< 0.0500	< 0.0100	< 0.200
	11/21/1995	ENER	8.50	0.0110	< 0.0300	0.0830	1.68	< 0.200	1.000	< 0.0500	< 0.0100	0.500
	8/27/1996	ENER	—	0.0360	< 0.0300	0.0530	—	—	—	—	—	—
	11/19/1997	ENER	—	0.0720	< 0.0300	0.0540	—	—	—	—	—	—
	11/4/1998	ENER	—	0.0760	< 0.0300	0.0270	—	—	—	—	—	—
	7/26/1999	ENER	—	# 0.0647	—	# 0.0320	—	—	—	—	—	—
	7/26/1999	ENER	—	0.0610	—	0.0320	—	—	—	—	—	—
	7/20/2000	ENER	—	0.0831	—	0.0308	—	—	—	—	—	—
	7/24/2001	ENER	—	0.0480	—	0.0160	—	—	—	—	—	—
	7/23/2002	ENER	—	0.0360	—	0.0830	—	—	—	—	—	—

Signifies Quality Control Sample

TABLE C-2. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

pH THROUGH Th-230

Sample Point Name	Date	Lab	pH (std. units)	Unat (mg/l)	Mo (mg/l)	Se (mg/l)	NO3 (mg/l)	Ra226 (pCi/l)	Ra228 (pCi/l)	Cr (mg/l)	V (mg/l)	Th230 (pCi/l)
CW28	4/28/2003	ENER	—	0.0172	< 0.0300	0.0920	—	—	—	—	—	—
	7/7/2003	ENER	8.47	0.0144	< 0.0300	0.135	1.60	< 0.200	< 1.000	—	< 0.0100	< 0.200
CW29	6/5/1995	ENER	7.86	0.0114	< 0.0300	0.0110	0.360	0.600	4.10	< 0.0500	< 0.0100	< 0.200
	6/7/1995	ENER	7.99	0.0155	< 0.0300	0.0340	0.830	0.400	< 1.000	< 0.0500	< 0.0100	< 0.200
	6/9/1995	ENER	7.98	0.0170	< 0.0300	0.0790	1.60	0.300	< 1.000	< 0.0500	< 0.0100	0.600
	11/13/1995	ENER	8.02	0.0110	< 0.0300	0.0230	0.390	1.000	—	—	—	—
	10/14/1996	ENER	7.79	0.0144	< 0.0300	0.0160	0.460	0.400	< 1.000	< 0.0500	< 0.0100	< 0.200
	5/30/1997	ENER	—	0.0090	—	< 0.0140	—	—	—	—	—	—
	11/8/1997	ENER	7.93	0.0120	< 0.0300	0.0170	0.430	< 0.200	—	—	—	—
	5/19/1998	ENER	—	0.0164	—	0.0280	—	—	—	—	—	—
	11/5/1998	ENER	7.85	0.0098	< 0.0300	0.0120	0.410	< 0.200	—	—	—	—
	6/3/1999	ENER	—	0.0123	—	0.0200	—	—	—	—	—	—
	6/21/2000	ENER	—	0.0101	—	0.0272	—	—	—	—	—	—
	6/6/2001	ENER	—	0.0150	—	0.0300	—	—	—	—	—	—
	6/24/2002	ENER	—	0.0150	—	0.0310	—	—	—	—	—	—
	7/10/2003	ENER	8.16	0.0532	< 0.0300	0.155	1.80	< 0.200	< 1.000	—	< 0.0100	< 0.200
CW31	9/15/1995	ENER	8.19	0.0102	< 0.0300	< 0.0100	0.130	0.300	< 1.000	< 0.0500	< 0.0100	0.500
	10/17/1996	ENER	8.05	0.0067	< 0.0300	< 0.0050	< 0.100	< 0.200	< 1.000	< 0.0500	< 0.0100	< 0.200
	11/14/1997	ENER	—	0.0140	< 0.0300	< 0.0050	—	—	—	—	—	—
	11/19/1998	ENER	—	0.0160	—	< 0.0050	—	—	—	—	—	—
	6/2/1999	ENER	—	0.0140	—	< 0.0050	—	—	—	—	—	—
	6/21/2000	ENER	—	0.0079	—	< 0.0050	—	—	—	—	—	—
	6/7/2001	ENER	—	0.0069	—	< 0.0050	—	—	—	—	—	—
	6/26/2002	ENER	—	0.0100	—	< 0.0050	—	—	—	—	—	—
	7/21/2003	ENER	8.02	0.0131	< 0.0300	< 0.0050	< 0.100	< 0.200	< 1.000	—	< 0.0100	< 0.200
CW32	9/13/1995	ENER	8.38	0.0104	< 0.0300	2.67	< 0.100	0.900	< 1.000	< 0.0500	< 0.0100	< 0.200
	12/11/1995	ENER	7.83	< 0.0100	< 0.0300	< 0.0100	< 0.100	0.900	< 1.000	< 0.0500	< 0.0100	< 0.200
	12/15/1995	ENER	7.84	0.0050	< 0.0100	< 0.0100	< 0.100	1.40	< 1.000	< 0.0100	< 0.0100	0.800

TABLE C-2. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

pH THROUGH Th-230

Sample Point Name	Date	Lab	pH (std. units)	Unat (mg/l)	Mo (mg/l)	Se (mg/l)	NO3 (mg/l)	Ra226 (pCi/l)	Ra228 (pCi/l)	Cr (mg/l)	V (mg/l)	Th230 (pCi/l)
CW32	10/17/1996	ENER	7.87	0.0030	< 0.0300	< 0.0050	< 0.100	0.700	2.30	< 0.0500	< 0.0100	< 0.200
	6/3/1997	ENER	—	0.0010	—	< 0.0050	—	—	—	—	—	—
	11/18/1997	ENER	7.91	0.0020	< 0.0300	0.0090	< 0.100	< 0.200	—	—	—	—
	5/20/1998	ENER	—	0.0060	—	0.0090	—	—	—	—	—	—
	11/19/1998	ENER	7.86	0.0020	< 0.0300	0.0210	< 0.100	0.600	—	—	—	—
	6/2/1999	ENER	—	0.0010	—	0.0180	—	—	—	—	—	—
	6/21/2000	ENER	—	0.0010	—	0.0207	—	—	—	—	—	—
	6/7/2001	ENER	—	0.0014	—	0.0180	—	—	—	—	—	—
	6/26/2002	ENER	—	0.0020	—	0.0180	—	—	—	—	—	—
	7/21/2003	ENER	7.83	0.0020	< 0.0300	0.0120	< 0.100	1.80	< 1.000	—	< 0.0100	< 0.200
CW33	9/8/1995	ENER	7.77	< 0.0100	< 0.0300	< 0.0100	0.130	0.600	< 1.000	< 0.0500	< 0.0100	< 0.200
	9/12/1995	ENER	7.30	< 0.0100	< 0.0300	< 0.0100	< 0.100	< 0.200	< 1.000	—	—	0.700
	10/17/1996	ENER	8.23	0.0080	< 0.0300	< 0.0050	< 0.100	0.500	< 1.000	< 0.0500	< 0.0100	< 0.200
	11/18/1997	ENER	—	0.0215	—	0.0100	—	—	—	—	—	—
	11/24/1998	ENER	—	0.0060	—	0.0130	—	—	—	—	—	—
	6/2/1999	ENER	—	0.0040	—	0.0140	—	—	—	—	—	—
	6/21/2000	ENER	—	0.0058	—	0.0168	—	—	—	—	—	—
	6/7/2001	ENER	—	0.0055	—	0.0120	—	—	—	—	—	—
	6/26/2002	ENER	—	0.0260	—	0.0100	—	—	—	—	—	—
	7/21/2003	ENER	7.89	0.0148	< 0.0300	0.0080	< 0.100	< 0.200	< 1.000	—	< 0.0100	0.300
CW35	10/12/1995	ENER	8.01	0.151	< 0.0300	0.0610	8.37	0.600	< 1.000	< 0.0500	< 0.0100	0.800
	11/28/1995	ENER	8.24	0.141	< 0.0300	0.0120	1.16	1.40	< 1.000	< 0.0500	< 0.0100	0.700
	8/27/1996	ENER	8.04	0.172	0.0300	0.0870	2.51	2.00	—	—	—	—
	6/3/1997	ENER	—	0.189	—	0.0320	—	—	—	—	—	—
	11/6/1997	ENER	7.71	0.201	< 0.0300	0.0320	2.87	1.10	—	—	—	—
	5/18/1998	ENER	—	0.178	—	0.0340	—	—	—	—	—	—
	5/18/1998	ENER	—	# 0.172	—	# 0.0340	—	—	—	—	—	—
	11/5/1998	ENER	7.94	0.222	< 0.0300	0.0410	3.35	1.30	—	—	—	—

Signifies Quality Control Sample

TABLE C-2. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

pH THROUGH Th-230

Sample Point Name	Date	Lab	pH (std. units)	Unat (mg/l)	Mo (mg/l)	Se (mg/l)	NO3 (mg/l)	Ra226 (pCi/l)	Ra228 (pCi/l)	Cr (mg/l)	V (mg/l)	Th230 (pCi/l)
CW35	6/1/1999	ENER	—	0.185	—	0.520	—	—	—	—	—	—
	6/19/2000	ENER	—	0.231	—	0.0661	—	—	—	—	—	—
	6/7/2001	ENER	—	0.172	—	0.0610	—	—	—	—	—	—
	6/27/2002	ENER	—	0.181	—	0.0680	—	—	—	—	—	—
	7/10/2003	ENER	7.74	0.162	< 0.0300	0.0530	5.90	0.700	< 1.000	—	< 0.0100	< 0.200
CW36	10/23/1995	ENER	7.79	0.0130	< 0.0300	0.0350	< 0.100	0.900	< 1.000	< 0.0500	< 0.0100	< 0.200
	10/17/1996	ENER	8.07	0.0046	< 0.0300	< 0.0050	< 0.100	0.600	< 1.000	< 0.0500	< 0.0100	< 0.200
	6/3/1997	ENER	—	0.0020	—	< 0.0050	—	—	—	—	—	—
	11/14/1997	ENER	7.98	0.0052	< 0.0300	< 0.0050	< 0.100	< 0.200	—	—	—	—
	5/20/1998	ENER	—	0.0061	—	< 0.0050	—	—	—	—	—	—
	11/3/1998	ENER	7.99	0.0030	< 0.0300	< 0.0050	< 0.100	< 0.200	—	—	—	—
	7/17/2003	ENER	7.96	0.0028	< 0.0300	< 0.0050	< 0.100	< 0.200	< 1.000	—	< 0.0100	< 0.200
CW37	1/9/1996	ENER	7.92	0.0320	< 0.0300	0.0960	6.83	< 0.200	< 1.000	< 0.0500	< 0.0100	0.700
	1/12/1996	ENER	8.04	0.0240	< 0.0300	0.0740	7.11	0.200	< 1.000	< 0.0500	< 0.0100	< 0.200
	10/16/1996	ENER	7.98	0.0244	< 0.0300	0.0940	8.22	0.300	< 1.000	< 0.0500	< 0.0100	< 0.200
	11/8/1997	ENER	—	0.0280	—	0.0810	—	—	—	—	—	—
	11/24/1998	ENER	—	0.0280	—	0.0790	—	—	—	—	—	—
	6/2/1999	ENER	—	0.0270	—	0.0860	—	—	—	—	—	—
	6/27/2000	ENER	—	0.0294	—	0.0809	—	—	—	—	—	—
	6/27/2000	ENER	—	# 0.0282	—	# 0.0739	—	—	—	—	—	—
	6/6/2001	ENER	—	0.0300	—	0.0820	—	—	—	—	—	—
	7/1/2002	ENER	—	0.0280	—	0.0800	—	—	—	—	—	—
	7/14/2003	ENER	8.01	0.0242	< 0.0300	0.0750	6.20	0.300	3.20	—	< 0.0100	< 0.200
CW39	11/9/1995	ENER	7.86	0.0173	< 0.0300	0.0850	5.73	< 0.200	1.40	< 0.0500	< 0.0100	< 0.200
	10/18/1996	ENER	8.10	0.0218	< 0.0300	0.0310	4.58	0.500	< 1.000	< 0.0500	< 0.0100	< 0.200
	11/24/1998	ENER	—	0.0450	—	0.0630	—	—	—	—	—	—
	7/14/2003	ENER	8.02	0.0262	< 0.0300	0.0490	4.50	< 0.200	< 1.000	—	< 0.0100	< 0.200
CW41	10/18/1996	ENER	8.31	0.0149	< 0.0300	0.0160	1.26	0.400	< 1.000	< 0.0500	0.0100	< 0.200

Signifies Quality Control Sample

TABLE C-2. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

pH THROUGH Th-230

Sample Point Name	Date	Lab	pH (std. units)	Unat (mg/l)	Mo (mg/l)	Se (mg/l)	NO3 (mg/l)	Ra226 (pCi/l)	Ra228 (pCi/l)	Cr (mg/l)	V (mg/l)	Th230 (pCi/l)
CW41	1/16/1997	ENER	7.70	0.0130	< 0.0300	0.0240	3.19	< 0.200	—	—	—	—
	4/17/1997	ENER	8.17	0.0180	< 0.0300	0.0080	1.08	< 0.200	—	—	—	—
	9/29/1997	ENER	—	0.0130	< 0.0300	0.0140	—	—	—	—	—	—
	4/13/1998	ENER	8.08	0.0158	< 0.0300	0.0120	1.33	< 0.200	—	—	—	—
	9/28/1998	ENER	—	0.0220	< 0.0300	0.0090	—	—	—	—	—	—
	7/14/2003	ENER	8.37	0.0483	< 0.0300	0.0150	7.30	< 0.200	1.60	—	< 0.0100	0.300
CW43	2/7/1997	ENER	8.06	0.0250	< 0.0300	0.0130	0.230	7.20	< 1.000	< 0.0500	< 0.0100	< 0.200
	4/28/1997	ENER	8.04	0.0240	< 0.0300	0.0090	1.61	0.600	—	—	—	—
	9/30/1997	ENER	—	0.0210	< 0.0300	0.0100	—	—	—	—	—	—
	4/14/1998	ENER	7.92	0.0245	< 0.0300	0.0120	3.71	0.300	—	—	—	—
	9/29/1999	ENER	—	0.0315	—	0.0130	—	—	—	—	—	—
	8/29/2000	ENER	—	0.0251	—	0.0140	—	—	—	—	—	—
	9/27/2001	ENER	—	0.0299	—	0.0140	—	—	—	—	—	—
	10/2/2002	ENER	—	0.0300	—	0.0230	—	—	—	—	—	—
	7/17/2003	ENER	7.99	0.0330	< 0.0300	0.0250	3.10	< 0.200	< 1.000	—	< 0.0100	< 0.200
CW50	5/29/2003	ENER	7.71	0.0417	< 0.0300	< 0.0050	< 0.100	0.600	2.20	—	< 0.0100	0.300
	7/1/2003	ENER	7.98	0.0424	< 0.0300	0.0070	< 0.100	0.400	< 1.000	—	< 0.0100	0.300
CW52	6/11/2003	ENER	7.82	0.0412	< 0.0300	0.0170	0.800	0.700	< 1.000	—	< 0.0100	0.300
	7/1/2003	ENER	7.80	0.0098	< 0.0300	0.0280	< 0.100	0.700	< 1.000	—	< 0.0100	0.300
WCW	6/16/1980	HMC	8.70	< 0.0085	0.0600	< 0.0100	< 0.100	1.10	—	< 0.0100	—	—
	7/7/1980	HMC	—	< 0.0085	—	—	—	—	—	—	—	—
	11/17/1980	HMC	7.90	< 0.0085	0.0300	0.0100	< 0.100	2.10	—	—	—	—
	12/2/1980	HMC	8.30	< 0.0085	0.0200	< 0.0100	0.670	0.700	—	—	—	—
	8/18/1981	HMC	8.30	< 0.0085	0.0200	0.0100	0.400	0.500	—	—	—	—
	9/21/1981	HMC	—	0.0085	0.0200	< 0.0100	0.500	1.30	—	—	—	—
	10/8/1981	HMC	—	< 0.0085	0.0100	< 0.0100	0.300	1.10	—	—	—	—
	11/19/1981	HMC	—	0.0254	0.0200	< 0.0100	0.400	0.500	—	—	—	—
	12/31/1981	HMC	—	< 0.0085	0.0200	< 0.0100	0.200	0.500	—	—	—	—

TABLE C-2. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

pH THROUGH Th-230

Sample Point Name	Date	Lab	pH (std. units)	Unat (mg/l)	Mo (mg/l)	Se (mg/l)	NO3 (mg/l)	Ra226 (pCi/l)	Ra228 (pCi/l)	Cr (mg/l)	V (mg/l)	Th230 (pCi/l)
WCW	2/15/1982	HMC	7.90	0.0509	0.0200	< 0.0100	0.500	0.800	—	—	—	—
	3/2/1982	HMC	—	< 0.0085	0.0100	< 0.0100	0.600	0.500	—	—	—	—
	5/23/1982	HMC	8.60	< 0.0085	0.0200	< 0.0100	1.000	1.10	—	—	—	—
	11/18/1982	HMC	7.90	0.110	0.0300	0.0200	0.600	—	—	—	—	—
	2/14/1983	HMC	8.20	< 0.0085	0.0100	0.0100	0.800	—	—	—	—	—
	4/15/1983	HMC	8.30	< 0.0085	0.0200	0.0200	0.800	0.600	—	—	—	—
	6/27/1983	EID	8.75	0.0330	< 0.0100	0.0070	0.130	—	—	—	—	—
	6/27/1983	HMC	8.72	0.0085	0.0200	0.0100	1.000	0.600	—	—	—	—
	8/31/1983	HMC	8.00	0.0136	0.0200	0.0100	0.600	—	—	—	—	—
	12/19/1983	HMC	8.10	0.0068	0.0400	0.0200	4.70	—	—	—	—	—
	1/20/1984	HMC	7.90	< 0.0085	0.0200	< 0.0100	3.30	—	—	—	—	—
	4/26/1984	HMC	8.40	< 0.0100	0.0200	< 0.0100	0.900	1.80	—	—	—	—
	7/18/1984	HMC	8.20	0.0170	0.0100	0.0100	12.0	—	—	—	—	—
	11/1/1984	HMC	8.20	< 0.0100	0.0200	0.0100	14.0	—	—	—	—	—
	1/25/1985	HMC	8.30	< 0.0100	0.0200	0.0100	0.200	—	—	—	—	—
	4/22/1985	HMC	8.40	< 0.0100	0.0200	0.0100	1.20	0.500	—	—	—	—
	7/18/1985	HMC	8.60	0.0085	0.0200	0.0100	2.80	—	—	—	—	—
	10/18/1985	HMC	8.60	< 0.0100	0.0200	0.0100	3.80	—	—	—	—	—
	1/30/1986	HMC	8.20	< 0.0100	0.0100	0.0200	3.40	—	—	—	—	—
	4/29/1986	HMC	8.00	< 0.0100	0.0100	0.0100	1.80	—	—	—	—	—
	7/30/1986	HMC	7.80	< 0.0100	0.0100	0.0200	4.30	—	—	—	—	—
	12/3/1986	HMC	7.90	0.0085	0.0200	0.0100	2.60	—	—	—	—	—
	3/19/1987	HMC	8.20	< 0.0100	0.0300	0.0100	2.40	—	—	—	—	—
	7/1/1987	HMC	7.90	< 0.0100	0.0100	0.0100	3.00	0.200	—	—	—	—
	9/30/1987	HMC	8.20	< 0.0100	0.0100	0.0100	0.900	—	—	—	—	—
	2/29/1988	HMC	8.70	< 0.0100	0.0100	0.0100	0.200	0.200	—	—	—	—
	5/27/1988	HMC	7.80	0.0170	0.0300	0.0100	0.800	0.200	—	—	—	—
	8/30/1988	HMC	7.90	0.0085	0.0200	0.0100	0.200	—	—	—	—	—
	10/12/1988	HMC	7.20	0.0254	0.0100	0.0100	0.300	0.200	—	—	—	—

TABLE C-2. WATER QUALITY ANALYSES FOR THE CHINLE AQUIFERS. (cont.)

pH THROUGH Th-230

Sample Point Name	Date	Lab	pH (std. units)	Unat (mg/l)	Mo (mg/l)	Se (mg/l)	NO3 (mg/l)	Ra226 (pCi/l)	Ra228 (pCi/l)	Cr (mg/l)	V (mg/l)	Th230 (pCi/l)
WCW	4/7/1989	HMC	8.40	0.0339	0.0100	< 0.0100	1.10	0.300	—	—	—	—
	7/5/1989	HMC	8.50	0.0339	0.0300	< 0.0100	0.300	—	—	—	—	—
	10/20/1989	HMC	8.70	0.0085	< 0.0100	0.0100	0.200	0.300	—	< 0.0100	< 0.0100	* 0
	6/25/1990	HMC	8.80	0.0170	0.0100	0.0100	0.700	—	—	—	—	—
	6/10/1991	HMC	8.50	< 0	< 0.0100	0.0100	1.70	* 0.100	—	—	—	—
	9/17/1992	HMC	9.10	< 0.0085	< 0.0100	< 0.0100	0.820	* 0.300	—	—	—	—
	6/8/1993	HMC	9.00	0.0254	0.0100	< 0.0100	0.800	—	—	—	—	—
	6/15/1994	ENER	8.31	0.0110	< 0.0300	< 0.0050	< 0.100	< 0.200	< 1.000	< 0.0500	< 0.0100	< 0.200
	6/15/1994	ENER	8.42	0.0150	< 0.0300	< 0.0100	< 0.100	12.9	< 1.000	< 0.0500	< 0.0100	< 0.200
	10/25/1994	ENER	8.41	0.0130	< 0.0300	< 0.0050	< 0.100	< 0.200	—	—	—	—
	5/22/1996	ENER	8.73	0.0110	< 0.0300	< 0.0100	< 0.100	< 0.200	< 1.000	< 0.0500	< 0.0100	0.800
	5/22/1997	ENER	9.00	0.0080	< 0.0300	< 0.0050	< 0.100	0.500	—	—	—	—
	5/6/1998	ENER	9.21	0.0097	< 0.0300	< 0.0050	< 0.100	< 0.200	—	—	—	—
	5/11/1999	ACZ	# 8.30	# 0.0181	# < 0.0100	# 0.0030	# 0.100	# 0.0600	—	—	—	—
	5/11/1999	ENER	8.51	0.0230	< 0.0300	0.0140	< 0.100	< 0.200	—	—	—	—
	5/16/2000	ENER	7.85	0.0176	< 0.0300	< 0.0050	< 0.100	< 0.200	—	—	—	—
	7/17/2003	ENER	8.41	0.0180	< 0.0300	< 0.0050	< 0.100	< 0.200	1.90	—	< 0.0100	< 0.200
WR25	10/12/1995	ENER	7.86	0.116	< 0.0300	0.145	16.7	< 0.200	< 1.000	< 0.0500	< 0.0100	< 0.200
	11/28/1995	ENER	7.75	0.169	0.130	0.0170	1.55	< 0.200	2.10	< 0.0500	< 0.0100	< 0.200
	8/27/1996	ENER	8.10	0.0680	0.0700	0.236	21.8	14.4	—	—	—	—
	11/8/1997	ENER	—	0.0780	< 0.0300	0.152	—	—	—	—	—	—
	11/5/1998	ENER	—	0.0870	< 0.0300	0.120	—	—	—	—	—	—
	11/5/1998	ENER	—	# 0.0830	# < 0.0300	# 0.144	—	—	—	—	—	—
	11/5/1998	ACZ	—	# 0.0720	# < 0.0100	# 0.140	—	—	—	—	—	—
	10/3/2000	ENER	—	0.0740	< 0.0300	0.157	—	—	—	—	—	—
	7/10/2003	ENER	7.97	0.201	< 0.0300	0.0700	15.0	0.300	< 1.000	—	< 0.0100	< 0.200

Signifies Quality Control Sample

* Signifies Specific Conductivity from HMC