AP - 018

REPORTS

3/20/2000

Hydrogeology and Groundwater in the Vicinity of the Osborn Ranch, Jal, New Mexico Sections 12 and 13, T25S, R36E Sections 7 and 18, T25S, R37E

March 20, 2000

prepared for:

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PRIVILEGED AND CONFIDENTIAL

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HYDROGEOLOGY AND GROUNDWATER IN THE VICINITY OF THE OSBORN RANCH, JAL, NEW MEXICO

1.0 Introduction

Concerns over possible surface and subsurface damage as a result of oilfield production operations on the Rocky Top Ranch owned by Clay and Jeri Osborn of Jal, New Mexico, has led to soils and groundwater investigations conducted by Safety and Environmental Solutions, Inc. (SESI), of Hobbs, New Mexico, on behalf of the Osborn's, and by Cornerstone Environmental Resources, Inc. (CERI), of Dallas, Texas, on behalf of the current oilfield operator, Bristol Resources Corporation. Several reports on soils investigation and one previous report on groundwater sampling have been prepared by the involved parties. These reports are not reviewed in this report but are cited where necessary. The list of previous reports may be found with other references in Section 8.0 (References).

The purpose of the current investigation is to determine existing groundwater conditions in the vicinity of the main ranch residences currently occupied by the Osborn family and their guests. This includes delineation of groundwater flow and water quality. The investigation was begun as a result of increases during the past several years in chlorides and total dissolved solids (TDS) in groundwater used for domestic purposes. A key purpose of the investigation was to determine if groundwater movement was from areas of oilfield activities and if water quality had been impacted by spills, leaks, and/or disposal of oilfield produced water.

Bristol Resources is the current operator of oilfield properties known as the South Langley Jal Unit located in Sections 7 and 18 of Township 25 South, Range 37 East (T25S, R37E). Bristol is the successor to several other operators who have produced oil from the area for over 50 years. Bristol and/or previous operators have had spills, leaks, and/or disposed of oilfield wastes during this period. Prior to regulation by the New Mexico Oil Conservation Division of produced water disposal in the 1950's and 1960's, produced water was commonly placed in unlined evaporation pits. Subsequent to banning of this practice, disposal occurs into OCD-permitted injection wells. However, notwithstanding the banning of surface disposal, flow lines, storage tanks, and/or the injection wells themselves are subject to leaks, overflows, and downhole failures. Some current waste management problems that have occurred at the Bristol locations are documented in the CERI and SESI reports listed in Section 8 (References).

2.0 Geography

2.1 Location

The Osborn Rocky Top Ranch is located in Sections 11 (SE/4), 12 and 13 of T25S, R36E, and Sections 1 (SW/4), 7 and 18 of T25S, R37E, Lea County, New Mexico (Figure 1). The ranch headquarters where the Osborn residence is located is in the NE/4 of Section 18, immediately north of the Jal Country Club. The community of Jal is approximately one mile south of the

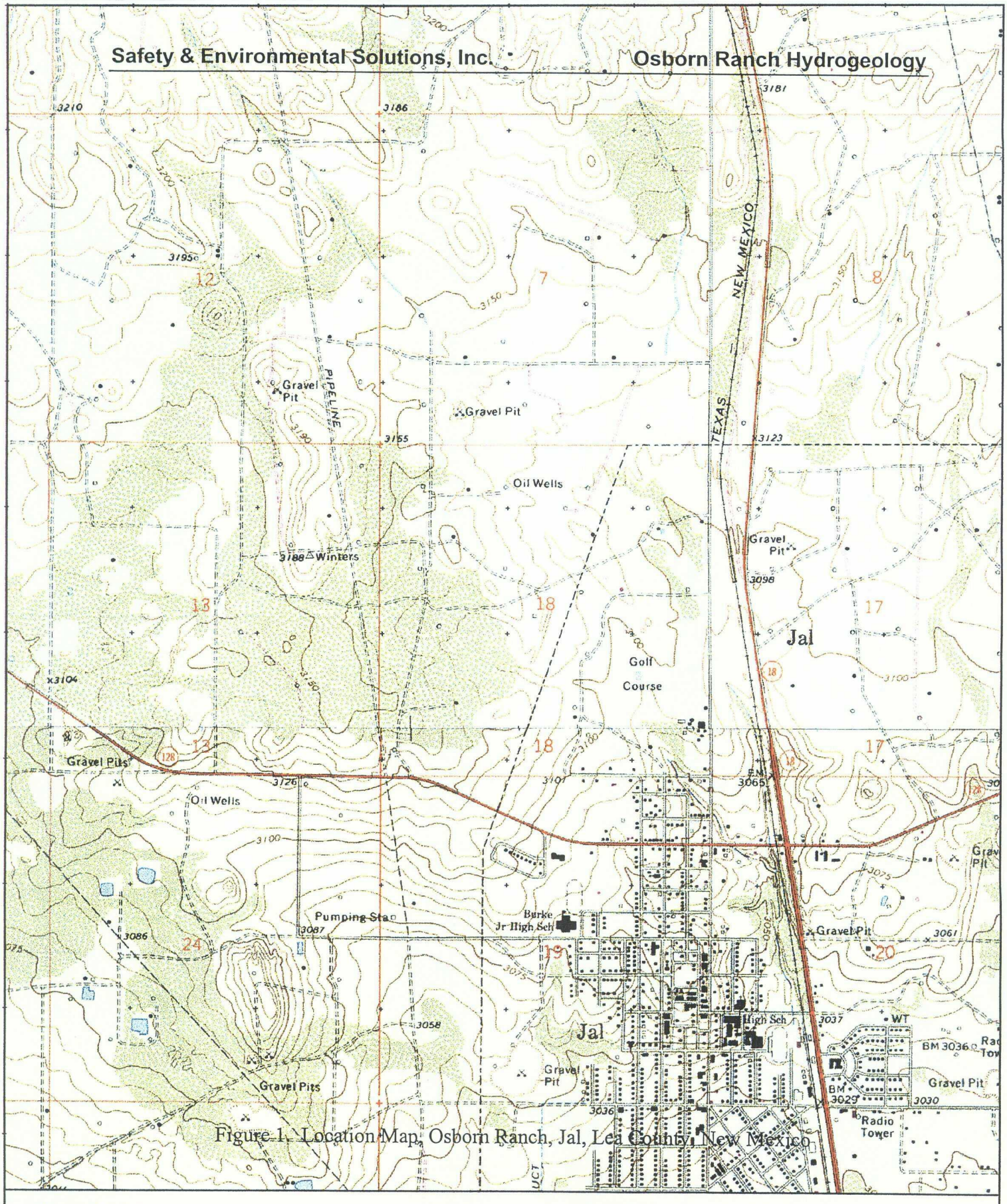


Figure 1. Location Map, Osborn Ranch, Jal, Lea County, New Mexico

Name: JAL NW
Date: 3/20/100
Scale: 1 inch equals 2000 feet

Location: 032° 07' 50.4" N 103° 12' 12.8" W
Caption: Osborn Ranch

ranch residence. The five Osborn water wells are located within several hundred feet of the ranch buildings. Water wells are also located at the Jal Country Club. Several of the country club wells are used to supply water for sale to local oil operators for use in drilling or other oilfield activities. The county club uses treated wastewater effluent from Jal to irrigate the greens and fairways. The application of the effluent is permitted under a groundwater discharge plan approved by the New Mexico Environment Department (NMED).

2.2 Topographic Setting

The Osborn ranch is located in southern Lea County on a topographic feature called the Eunice Plain (Nicholson and Clebsch, 1961). The elevation of the area is approximately 3,100 feet above Mean Sea Level. The Eunice Plain consists mostly of a hard caliche surface overlain in most areas by reddish-brown dune sand from several inches to several feet thick. The Plain has a general and gentle southeast slope toward Monument Draw. In some areas the underlying surface consists of alluvial sediments consisting of calcareous silt in buried channels or Quaternary lake basins. Vegetation consists of shin oak, mesquite and a variety of grasses.

2.3 Climate

The climate of southern Lea County is characterized by low annual rainfall, low humidity, and high average annual temperature (Nicholson and Clebsch, 1961). The climate is classified as marginal between semiarid and arid. Precipitation near Jal averages about 9 inches per year and is highly variable both areally and seasonally, although maximum values are usually recorded in the summer months. The average monthly temperature ranges from a low of about 45°F to 81°F with an average of about 62°F. Maximums commonly exceed 100°F in summer. In addition to heat and dryness, the other characteristic weather feature in the area is wind. Windy conditions occur throughout the year, but are most common and most intense in springtime. Gusts during this season are commonly powerful enough to damage structures, move sand, and generate large volumes of blowing dust.

3.0 Geology

The geology of the area has extensively described by Nicholson and Clebsch (1961) in their report on "Geology and Ground-water Conditions in Southern Lea County." Others in the profession have published numerous papers related to geological conditions important for the exploration and development of the oil and natural gas resources of the region. Only the near-surface geology relevant for this report is reviewed here

Southern Lea County includes parts of the Delaware and Permian Basins. Rocks of the Paleozoic Era (Ordovician through Permian periods) are located at depth and contain oil and gas deposits along with highly mineralized oil-field waters. Unconformably overlying these are Mesozoic Era rocks of the Triassic period. The Triassic rocks are in turn unconformably overlain by rocks of the Cenozoic Tertiary and Quaternary periods, which include the Ogallala Formation and recent alluvium.

The Triassic rocks are composed of red and green claystones, red siltstones, shale and sandstones (generally minor). The rocks yield small quantities of water from the sandstones, but the water

has a high sulfate content. The upper surface of the Triassic rocks has been eroded producing channels and depressions which have been filled by the younger Ogallala and alluvial sediments. These structural features provide a variety of pathways for movement of fluids atop the Triassic rocks.

The Cenozoic Ogallala and alluvial formations generally have much coarser sediments, although fine grained silts and clays are found both in the Ogallala and in alluvial lake deposits. The Ogallala formation ranges up to about 300 feet in thickness and is mainly a calcareous, unconsolidated sand, but it also contains clay, silt, and gravel. Beds of mixed clay and gravel are commonly found at the base of the formation. In most locations the Ogallala formation is capped with a thick layer of dense caliche which ranges in thickness from a few feet to greater than 60 feet. At the surface, the caliche is well cemented and hard, but is softer and more porous at increasing depth where it grades into the underlying sands.

The alluvium has been deposited in topographically low areas where the Ogallala has been stripped away or where erosion channels have been scoured into the Triassic rocks or Ogallala formation and later buried. The alluvium is generally less than 100 feet thick. At the surface it is usually a calcareous silt, but in some locations a cover of reddish-brown dune sand is found. Nicholson and Clebsch (1961) state that up to 80 percent of the area of southern Lea County has a surface cover of the fine to medium sand with thickness ranging from a veneer of several inches up to 30 feet.

At the Osborn ranch, the Ogallala formation outcrops to the north and west of the ranch headquarters, while alluvial sediments with some surficial sand are present in the area of the residences. Surface drainage is by means of a relatively undefined drainage system that trends from the north and northwest to the south. Alluvial material is present at the surface in the vicinity of the drainages. At the community of Jal and further to the south, all surface sediments are alluvial in nature.

4.0 Groundwater

4.1 Reported Occurrence of Groundwater

Nicholson and Clebsch (1961) document relatively thin zones of water saturation in the alluvial sediments immediately north of Jal in the vicinity of the Osborn ranch. Thickness of saturated sediments was estimated at about 20 feet. Water in a well just east of the ranch was reported at a depth of about 63 feet during pumping in 1953; no depth of well was given. No other wells in the vicinity of the ranch were reported in the 1961 report. However, several wells in Jal which were completed in Triassic rocks have a reported saturated thickness of 200 to 300 feet.

4.2 Current Groundwater Investigation

A detailed groundwater investigation was conducted in the vicinity of the Osborn ranch beginning on February 22, 2000. Previously, water levels at several wells in the vicinity of the ranch residences and at the Bristol-installed monitor well had been measured in December 1999, but a detailed groundwater map had not been produced due to the small number of measured

water levels, a lack of surveyed casing elevations, and due to the pumping drawdown in the main ranch house well. Although groundwater movement was anticipated generally to be from northwest to southeast, the lack of accurate measurements prevented knowledgeable assumptions as to the possible source(s) of the increasing chloride and total dissolved solids concentrations in the ranch wells.

A trip to the ranch was made on February 22 and locations of wells possibly suitable for measuring water level elevations and/or groundwater sampling were noted. The Jal Country Club was visited and Mr. Harrell Butler from the City of Jal showed the locations of wells used for production of water for sale and the locations of other wells on the property. As a result of that trip, John W. West Surveying Company of Hobbs was contacted to survey the wells and to generate a map showing well locations and casing elevations. On February 29, 2000, SESI staff technicians measured water level elevations and total depth in all the wells identified as suitable for study. The City of Jal shut down it's pumping wells for a minimum of twelve hours to allow recovery of water levels prior to measurement of static water levels. Water quality sampling was performed as described in Section 5.2.

4.3 Groundwater Occurrence and Movement

Information collected during the late February investigation was organized and tabulated for the purpose of drawing groundwater elevation maps. Table 1 lists the wells used in the study while Table 2 provides a summary of water level elevations and total depth. Water levels measured both in December 1999 and February 2000 are included in the table.

Water level elevations range from a high of 3,078.47 feet above MSL at well #6 (the north water well in Section 7), to 3,047.32 feet at well #8 (Jal Country Club Monitor Well 3) which is an elevation difference of 31 feet over a distance of about one mile. The average saturated thickness of the sediments ranges from 20 to 40 feet (assuming that the water supply wells completely penetrate to the bottom of the saturated zone). However, one unused country club well (#10) measured less than one foot of water in the casing; the probe may have encountered an obstruction before reaching total depth. Another well (#13) at the country club and used for pumping water for sale had a saturated thickness of 81.4 feet. The completion details of this well are unknown, but it may have been drilled partially into the Triassic rocks beneath the Ogallala or alluvial surface sediments unless a buried channel or depression was encountered. The two oilfield-related monitor wells installed in the past few years (#4, #7) have between 11 and 13 feet of saturated thickness.

The water level elevation data for both December 1999 and February 2000 was plotted on two maps and water level elevation contours drawn (Figures 2 and 3). Figure 2 shows groundwater on December 15, 1999, moving from the vicinity of Bristol line leak and Monitor Well 4 directly toward the Osborn pumping well (at that time the Main House Well, #2). Therefore, any contaminants present in the groundwater will also migrate toward well #2. The groundwater gradient (outside the area of the pumping cone of depression) is 1 foot per 325 feet, or 0.003 feet per foot. No monitor wells are located to the north or east of the spill site, so no further delineation of groundwater movement is currently possible at this location.

Table 1. List of Water and Monitor Wells in the Vicinity of the Osborn Ranch, Jal, Lea County, New Mexico

Well Name	Map ID	State Engineer Information	Comment
Front House Windmill	#1	NE, SE, NE, NE Sec. 18, T25S, R37E	Owner's well #4
Front House Well	#5	NE, SE, NE, NE Sec. 18, T25S, R37E	Owner's well #5
Main House Well	#2	SE, SW, NE, NE Sec. 18, T25S, R37E	Owner's well #1 (also, Jal CC Monitor well 11)
Back House Windmill	#3	SE, SW, NE, NE Sec. 18, T25S, R37E	Owner's well #2
West Water Well	#14	SW, SW, NE, NE Sec. 18, T25S, R37E	Owner's well #3
Bristle Resources Well	#4	- -	Monitor well
North (Section 7) Water Well	#6	NW, NE, SW, SW Sec. 7, T25S, R37E	Unused, owner's well #6
SW (TX-NM pipeline) Well	#7	- -	Monitor well
Jal Country Club MW-3	#8	*	Production & monitor well
Jal Country Club MW-4	#9	*	Production & monitor well
Jal Country Club NE MW	#10	*	Unused well
Jal Country Club NW MW	#11	*	Unused well
Jal Country Club Windmill	#12	*	Monitor well #18, plugged
Jal Country Club MW-2	#13	*	Production & monitor well
Jal Country Club Center MW	#15	*	Unused well
Section 13 Water Well	- -	SW, SE, SE, SW Sec. 13, T25S, R36E	Unused, owner's well #7

Notes:

* These and several other wells located at the Jal Country Club are registered with the State Engineer Office (SEO) as permit CP-473. All wells are located in the SE1/4 of Section 18, T25S, R37E. For this report, no attempt was made to correlate Jal CC wells listed here with those on file with the SEO.

Table 2. Water Level Elevations and Total Depth of Wells in the Vicinity of the Osborn Ranch, Jal, Lea County, New Mexico

ID and Name	Casing Elevation (feet)	Date	Depth to Water (feet)	Water Level Elevation (feet)	Measured Total Depth (feet)
#1, Front House Windmill	3,095.92	12-15-99 02-29-00	43.58 52.05	3,052.34 3,043.87	65.19 (?) 69.01
#2, Main House Well	3,095.32	12-15-99 02-29-00	45.66 42.33	3,049.66 3,052.99	- - 86.45
#3, Back House Windmill	3,101.64	12-15-99 02-29-00	49.44 48.50	3,052.20 3,053.14	74.80 75.60
#4, Bristol Monitor Well	3,105.99	12-15-99 02-29-00	51.14 51.03	3,054.85 3,054.96	- - 62.37
#5, Front House Well	3,096.47	12-15-99 02-29-00	43.96 44.92	3,052.51 3,051.55	- - 66.16
#6, North (Sec. 7) Water Well	3,133.90	02-29-00	55.43	3,078.47	78.74
#7, SW (TX-NM) Mon. Well	3,126.02	02-29-00	64.08	3,061.94	77.36
#8, Jal CC Monitor Well 3	3,091.47	02-29-00	44.15	3,047.32	78.22
#9, Jal CC Monitor Well 4	3,094.64	02-29-00 03-02-00	42.19 45.58	3,052.45 3,049.06	80.19 - -
#10, Jal CC NE Monitor Well	3,092.74	02-29-00	43.13	3,049.61	43.76 (?)
#11, Jal CC NW Monitor Well	3,103.56	02-29-00	52.18	3,051.38	98.91
#12, Jal CC Windmill (MW-18)	3,103.56	02-29-00	Plugged	- -	- -
#13, Jal CC Monitor Well 2	3,082.29	02-29-00	33.68	3,048.61	115.05
#14, West Water Well	3,101.38	12-15-99 02-29-00	48.98 48.34	3,052.40 3,053.04	- - 61.37
#15, Jal CC Center Monitor Well	3,093.91	02-29-00 03-02-00	40.79 40.84	3,053.12 3,053.07	69.99 - -

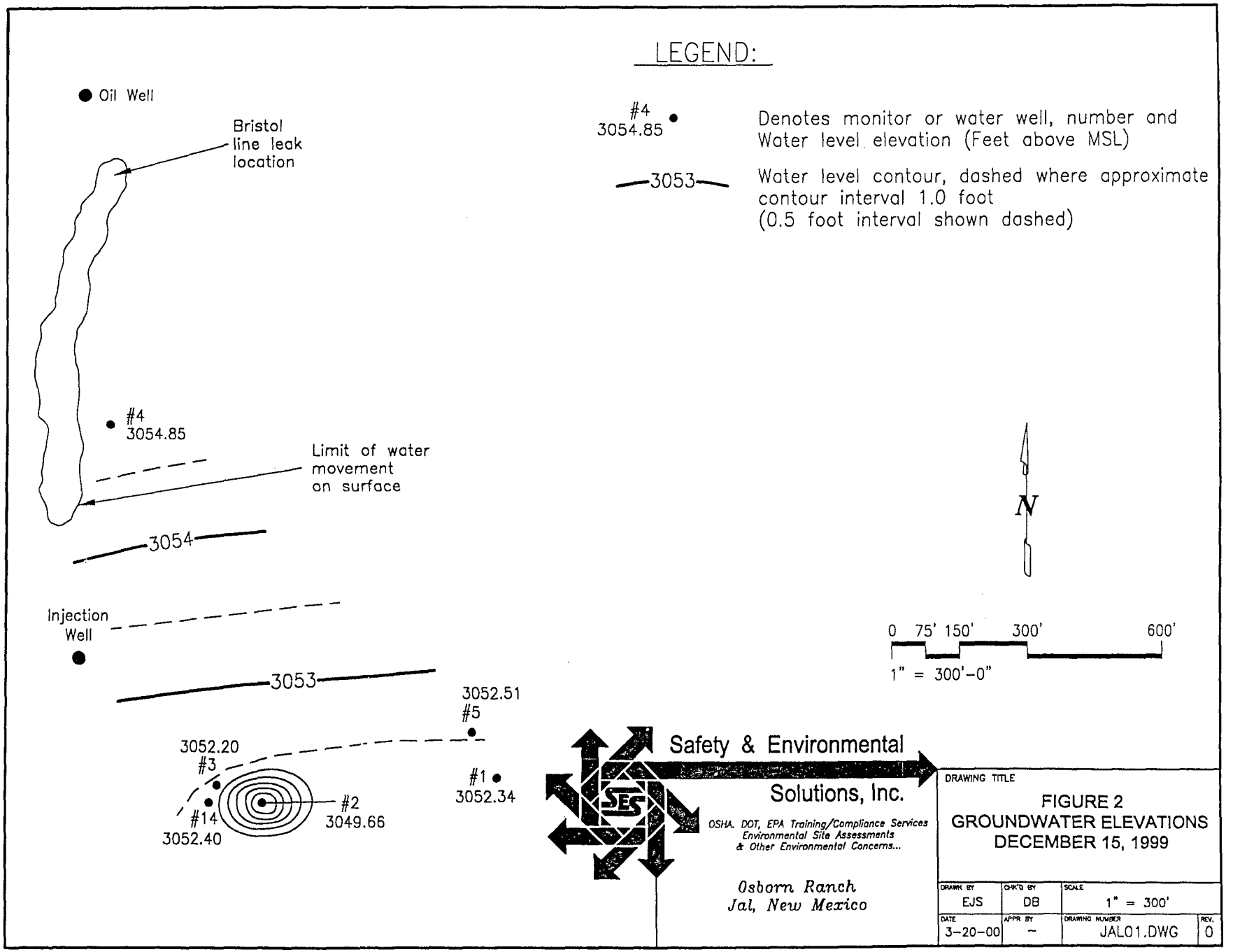

LEGEND:
Oil Well
Bristol line leak location
#4 3054.85
Denotes monitor or water well, number and Water level elevation (Feet above MSL)
3053
Water level contour, dashed where approximate contour interval 1.0 foot (0.5 foot interval shown dashed)
#4 3054.85
Limit of water movement on surface
3054
Injection Well
3053
3052.51 #5
3052.20 #3
#1 3052.34
#2 3049.66
#14 3052.40
N
0 75' 150' 300' 600'
1" = 300'-0"
Safety & Environmental Solutions, Inc.
OSHA, DOT, EPA Training/Compliance Services
Environmental Site Assessments
& Other Environmental Concerns...
Osborn Ranch
Jal, New Mexico
DRAWING TITLE
FIGURE 2
GROUNDWATER ELEVATIONS
DECEMBER 15, 1999
DRAWN BY EJS
CHK'D BY DB
SCALE 1" = 300'
DATE 3-20-00
APPR BY –
DRAWING NUMBER JAL01.DWG
REV. 0

Figure 3. Groundwater Elevations, February 29, 2000, Osborn Ranch, Jal, Lea County, New Mexico

#6
3078.47

3075

3070

3065

3060

3055

See Enlarged Area below

Bristol line leak location

Oil Well

BC
USGLO

12 | 7
13 | 18

7 | 8
18 | 17

Limit of water movement on surface

#4
3054.96

Contour Interval
2.0 feet

Injection Well

3051.55
#5

3053.14
#3

#14
3053.04

#2
3052.99

#1
3043.87

Osborn Ranch Wells

#7
3061.94

3051.38
#11

3050

3049.61
#10

#9
3049.06

#15
3053.12
(?)

#8
3047.32

#12
(Plugged)

#13
3048.61

R-36-E

R-37-E

13 | 18
24 | 19

1/2" STEEL ROD W/PVC CAP

18 | 17
19 | 20

SPIKE NAIL

Note:
0.5 foot contour interval
shown dashed

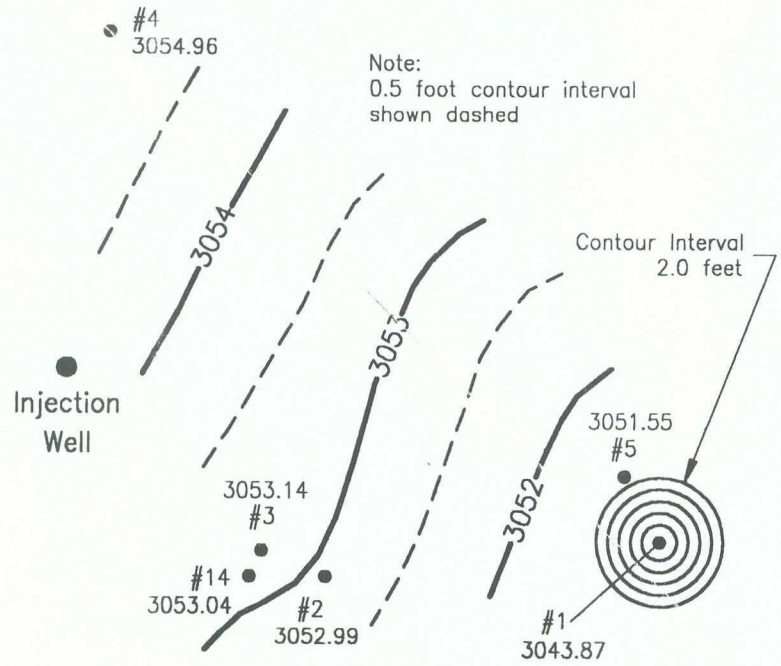
0 150' 300' 600' 1200'
1" = 600'-0"

LEGEND:

#13
3048.61
Denotes monitor or water well, number and Water level elevation (Feet above MSL)

Denotes found survey monument as noted

3055
Water level contour, dashed where approximate contour interval 1.0 foot unless otherwise shown



Enlarged Area
Scale: 1" = 300'

Safety & Environmental Solutions, Inc.

OSHA, DOT, EPA Training/Compliance Services
Environmental Site Assessments
& Other Environmental Concerns...

Osborn Ranch
Jal, New Mexico

DRAWING TITLE

FIGURE 3
GROUNDWATER ELEVATIONS
FEBRUARY 29, 2000

DRAWN BY	CHK'D BY	SCALE	
EJS	DB	1" = 600'	
DATE	APPR BY	DRAWING NUMBER	REV.
3-20-00	–	JAL01.DWG	0

Figure 3 provides an overview of groundwater movement in the vicinity of the ranch and the Jal Country Club on February 29, 2000. Groundwater movement is generally from northwest to southeast. The gradient is about twice as steep in the northwest (0.007 ft/ft) and flattens in the vicinity of the ranch and country club (0.003 ft/ft). No evidence is seen of a pumping cone of depression at the country club, although the wells have been shut in only for about 12 hours. Also, no evidence of groundwater movement from the vicinity of the country club wells toward the Osborn Ranch was seen.

The Osborn's are currently pumping well #1 due to the increased levels of chloride and TDS in well #2. The direction of movement from the vicinity of the Bristol line leak is generally towards well #1, although the movement is not as direct as was movement in December to well #2. However, a plume of contaminated water located between wells #4 and #2 will now move toward well #1 as result of the cessation of pumping of well #2 and commencement of pumping of well #1.

5.0 Water Quality

5.1 Reported Water Quality

The quality of groundwater in southern Lea County is quite variable due of a number of natural and man-caused factors. In areas where oilfield produced water has not impacted groundwater, water from the Ogallala and from alluvium produced from weathering of the Ogallala is moderately high in calcium plus magnesium, low in sodium plus potassium, moderately low in sulfate and chloride, and moderately high in TDS (Nicholson and Clebsch, 1961). Groundwater from Triassic rocks shows a wide range in calcium and magnesium concentrations, is high in sodium and moderately high in sulfate, and moderately low in chloride. However, in the Triassic rocks both sulfate and chloride can show a wide range in concentration, and TDS is typically somewhat higher than in Ogallala waters.

Where natural groundwater has been impacted by discharges of saline produced water from oilfield operations, increases of sodium, chloride and TDS can be expected with lessor increases in calcium, magnesium and sulfate. A significant increase in inorganic constituents from produced water can make the water non potable for domestic use, including gardening. Nicholson and Clebsch (1961) discuss instances of brine contamination of potable water, and present some criteria for identification of impacted water. However, their proposed identification methods, utilizing ratios of chloride and sulfate may be overly conservative in that virtually all of the waters tested for this report would have failed. This would suggest that brine has contaminated all the wells in the vicinity of the ranch which is not believed to be the case. A more accepted procedure is the use of the Piper Trilinear Diagram which displays the inorganic components graphically so that water analyses can be examined visually for evidence of mixing of natural water with oilfield produced water. The use of this method to evaluate water quality will be discussed in more detail in Section 5.3.

In addition to the inorganic constituents, organic contaminants such as benzene, toluene, ethylbenzene and xylenes (BTEX) are present in oilfield produced water. Improper disposal of waters containing these contaminants can make an otherwise potable water unacceptable due to

taste, odor, or elevated health risk from toxic or cancer-causing chemicals. The EPA and the state of New Mexico have developed drinking water and groundwater standards for the occurrence of these contaminants in water supplies.

During the time that the Jal Country Club has been applying treated city wastewater effluent at the golf course, the NMED has required monitoring of chlorides, nitrates and TDS at several locations, including the Osborn Main House well (#2). A review of information collected shows recently elevated values of chloride and TDS at the Osborn well #2 (Table 3). The. Chloride and TDS data show an increase since 1996 with the increase accelerating during 1998 and 1999 (Figure 4).

Table 3. Chloride and Total Dissolved Solids (TDS) Measured at Osborn Main House Well, Osborn Ranch, Jal, Lea County, New Mexico

Date	Chloride (mg/L)	TDS (mg/L)
05/23/96	172	992
11/21/96	176	714
05/27/97	182	938
11/05/97	241	1,250
05/11/98	218	1,100
11/30/98	292	1,280
05/17/99	319	1,580
11/22/99	419	1,570
12/15/99	432	1,782

5.2 Current Water Quality Investigation

SESI began collection of water quality data from wells in the vicinity of the Osborn Ranch on December 15, 1999. Previously, Cornerstone Environmental Resources had collected a limited amount of data in July 1999 for inclusion in the groundwater sampling portion of their Phase II environmental assessment report. Although key constituents were sampled, a complete set of major chemical cations and anions in water must be analyzed so that a mixing study can be performed using the Piper diagrams.

Additional water wells were sampled beginning on February 22 and continuing through March 14, 2000. For wells which were not regularly pumped or sampled, at least three casing volumes of water were removed prior to sampling. Following standard sampling protocol, water electrical conductivity and pH were monitored during pumping until stable. Samples were also obtained of the wastewater effluent applied at the Jal County Club, of water sold by the Jal County Club for

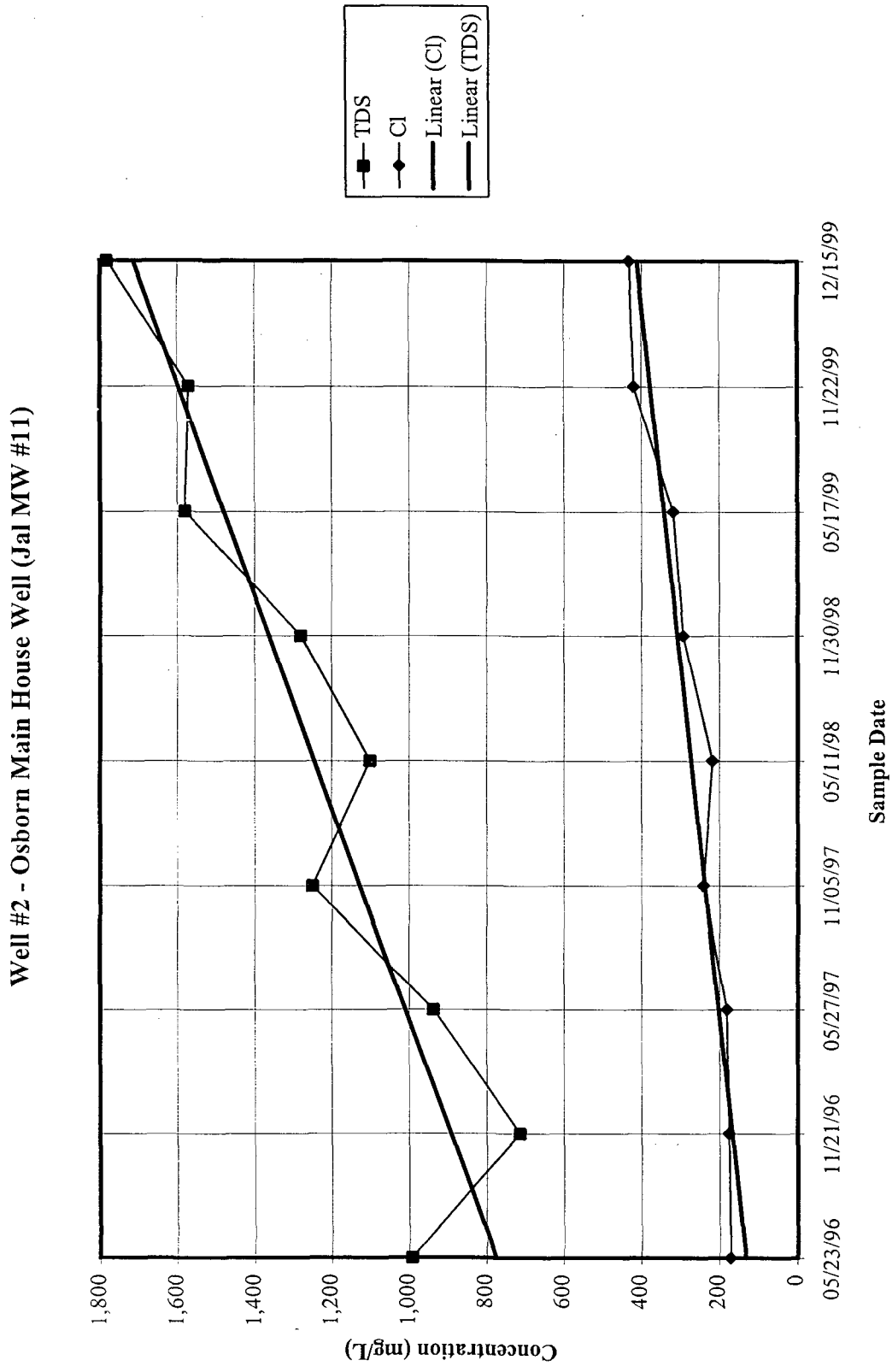


Figure 4. Chloride and TDS Increase in Well #2, Osborn Main House Well, 1996-1999

oilfield use, and of produced water slated for injection well disposal and similar to that which leaked from the surface flow lines. Samples collected were placed on ice and transported to one of two analytical laboratories for analysis. A chain-of-custody form was used to list samples and to have the laboratory acknowledge receipt of the samples.

5.3 Results of the Water Quality Investigation

The results of the current water quality investigation are presented in Table 4. The table shows obvious elevated levels of inorganic constituents at several locations. These locations include water from the Osborn's Main House well (#2), the West Water well (#14), the Bristol monitor well (#4), the north (Section 7) monitor well (#6), the Jal Country Club monitor wells 3 and 4 (#8 and #9), and the Jal Country Club water tanks. A sample of produced water (taken from the injection pump located near the Bristol monitor well) was obtained from Mr. Clay Osborn.

In addition to analysis of inorganic constituents, samples were tested for BTEX hydrocarbons. Those tested include the five water and windmills in the vicinity of the ranch residences (well ID #1, 2, 3, 5, and 14), the North Water well (#6), the SW (TX-NM) monitor well (#7) and the Jal Country Club water sale tanks. All samples tested less than 0.002 mg/L for benzene, toluene and ethylbenzene. All samples tested less than 0.006 mg/L for xylene. These values are at the method detection level for these constituents.

Although a simple comparison of the inorganic analytical results might appear sufficient to determine if the produced water is the source of elevated chloride and other constituents in the monitor wells, a more scientific method is necessary because of the various combinations of constituents that are possible. For example, a water sample might be high in chloride implying brine contamination from produced water. However, instead of sodium the cation might be calcium which is not characteristic of produced water, but could be from other oilfield chemicals.

The Piper Trilinear Diagram requires an analysis of major cations and anions for use in the diagram. The diagram utilizes two equilateral triangles in the left and right corners with a diamond-shaped field in between the triangles (Figure 5). One of the triangles contains cation concentrations (in milliequivalents per liter) and the other anion concentrations. Cation concentrations are proportionally represented by calcium, magnesium, sodium plus potassium while anion concentrations are represented by chloride, sulfate, and carbonate plus bicarbonate. Once plotted in their respective triangles, the points are extended into the central diamond-shaped field where they provide general information on the makeup of the water.

The most important feature of the Piper Diagram is the ability to graphically view the water composition and make conclusions regarding the source(s) of the water sample. The method is especially good at determining whether a water sample is a mixture of two independent waters, or whether it is from a third source. For a water sample to be a mixture of two other sources, it must plot along or close to a straight line in each of the three fields, unless a chemical or ion exchange reaction is occurring.

Table 4. Water Quality of Inorganic Constituents in Wells and at Other Locations in the Vicinity of the Osborn Ranch, Jal, Lea County, NM

Sample Location	Well ID	Sample Date	Sodium (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	Carbonate (mg/L)	Bicarbonate (mg/L)	Nitrate (mg/L)	TDS (mg/L)
Front House Windmill	1	12/15/99	116	64	27	4.3	125	171	0.0	215	2.6	780
		12/17/99	110	67	22	4.5	133	146	0.0	200	--	872
Front House Well	5	12/15/99	94	85	50	6.4	158	243	0.0	190	7.1	918
Main House Well	2	07/21/99	122	--	61	6.0	342	304	--	--	--	--
		12/15/99	213	162	47	6.7	432	282	0.0	205	7.5	1,782
		03/03/00	98	225	67	3.4	420	320	0.0	201	9.3	1,500
Back House Windmill	3	12/15/99	81	73	9.3	4.4	121	83	0.0	176	1.2	484
		12/17/99	89	52	19	4.4	133	92	0.0	151	--	623
West Water Well	14	07/21/99	405	--	135	13.0	687	1,440	--	--	--	--
		12/15/99	186	114	47	6.0	295	364	0.0	116	5.1	1,502
		03/03/00	154	150	44	3.4	270	460	0.0	173	6.7	1,300
Bristol Monitor Well	4	07/21/99	125	--	41	6.0	348	154	--	--	--	--
		02/29/00	85	147	50	9.7	380	111	0.0	146	1.2	915
		03/03/00	125	164	58	6.7	410	150	0.0	158	3.1	1,200
North (Sec. 7) Monitor Well	6	12/30/99	396	195	67	7.6	857	257	0.0	195	0.7	2,300
		03/14/00	203	193	68	5.2	770	250	0.0	84	<1.0	1,700
SW (TX-NM) Monitor Well	7	01/06/00	125	134	54	6.9	210	274	0.0	312	1.4	1,419
		03/14/00	76	208	62	1.7	200	420	0.0	362	3.5	1,200

Note:

1. Analysis on 7/21/99 sampled by Cornerstone Environmental Resources, Inc., for Bristol Resources. All other analyses sampled by SESI
2. TDS – Total dissolved solids by method of evaporation and weight of residue
3. EPA drinking water standards – Chloride 250 mg/L, Sulfate 250 mg/L, Nitrate 10 mg/L, TDS 500 mg/L
4. NM Water Quality Commission Groundwater Standards – Chloride 250 mg/L, Sulfate 600 mg/L, Nitrate 10 mg/L, TDS 1,000 mg/L

Table 4. Water Quality of Inorganic Constituents in Wells and at Other Locations in the Vicinity of the Osborn Ranch, Jal, Lea County, NM (concluded)

Sample Location	Well ID	Sample Date	Sodium (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	Carbonate (mg/L)	Bicarbonate (mg/L)	Nitrate (mg/L)	TDS (mg/L)
Jal CC MW-3	8	02/22/00	386	337	143	16	668	1,085	0.0	268	5.5	2,650
Jal CC MW-4	9	02/22/00	369	257	131	12	596	948	0.0	210	5.5	2,080
NE CC MW	10	02/29/00	79	77	21	6.2	152	111	0.0	156	1.7	623
NW CC Monitor Well	11	02/29/00 03/14/00	95 85	43 54	62 57	12.2 7.8	332 400	3.9 5.2	0.0 0.0	137 121	0.2 <1.0	788 710
Jal CC Effluent	- -	02/22/00	231	91	61	24	188	468	115	83	- -	1,153
Jal CC Tanks	- -	01/12/00 02/22/00	579 - -	180 - -	59 - -	10.6 - -	667 - -	796 - -	0.0 - -	239 - -	- - 5.3	2,260 - -
Produced Water	- -	07/21/00 03/03/00	15,700 11,490	- - 1,125	3,170 3,127	404 557	27,000 30,000	4,590 4,500	- - 0.0	- - 1,008	- - <1.0	- - 59,000

Note:

1. Analysis on 7/21/99 sampled by Cornerstone Environmental Resources, Inc., for Bristol Resources. All other analyses sampled by SESI
2. TDS – Total dissolved solids by method of evaporation and weight of residue
3. EPA drinking water standards – Chloride 250 mg/L, Sulfate 250 mg/L, Nitrate 10 mg/L, TDS 500 mg/L
4. NM Water Quality Commission Groundwater Standards – Chloride 250 mg/L, Sulfate 600 mg/L, Nitrate 10 mg/L, TDS 1,000 mg/L

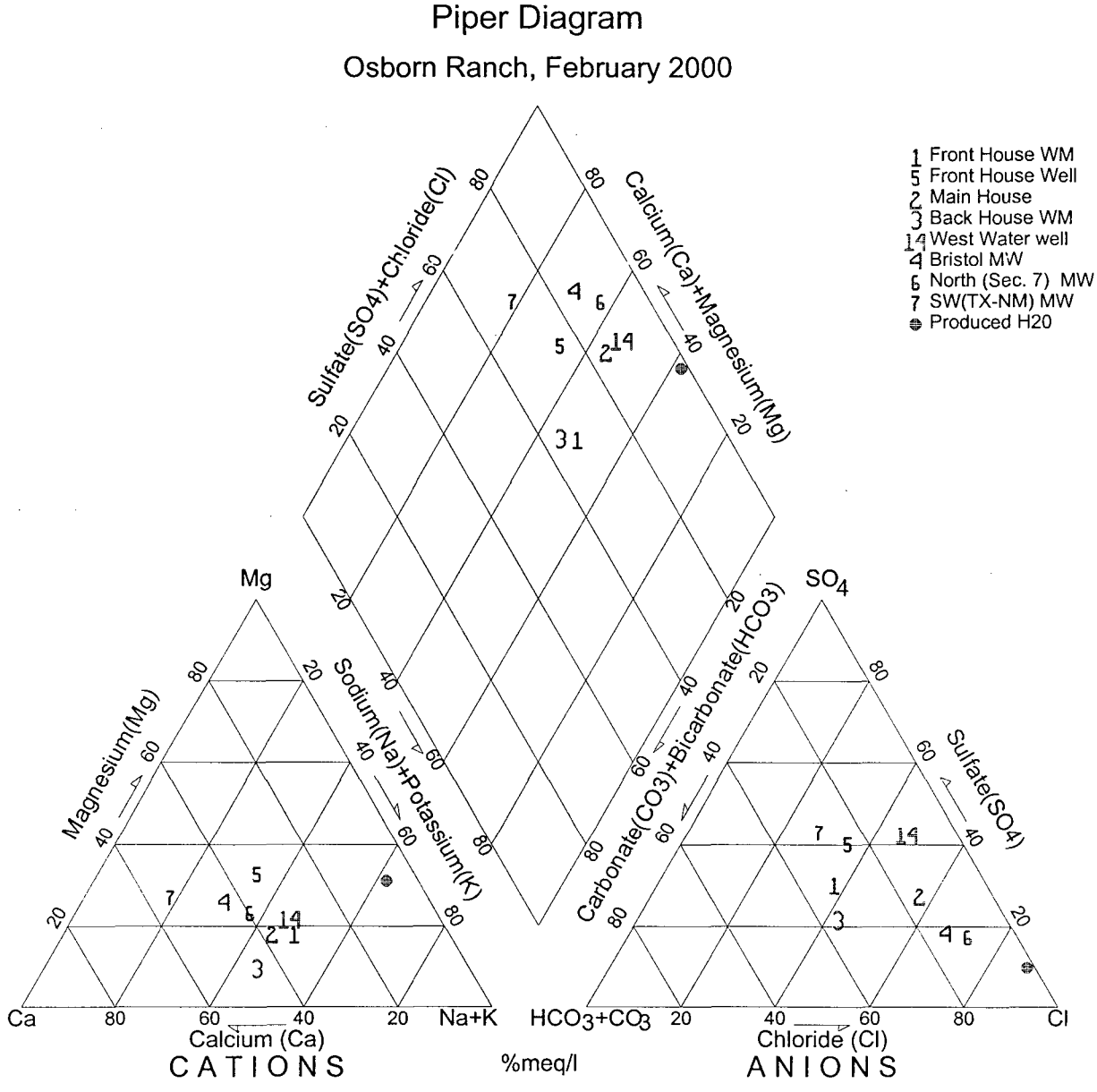


Figure 5. Piper Trilinear Diagram, February 2000, Osborn Ranch, Jal, New Mexico

Figure 5 shows the relationship of the several well water samples taken in the vicinity of the Osborn Ranch house plus samples from other monitor wells on the property and from produced water prior to downhole injection. In this instance the anion composition of the Main House water well (#2) falls between that of produced water and water from the Front House well (#5). Water from the Bristol monitor well (#4) is even closer to the anionic composition of produced water. Waters from the front and back windmills (#1 and #3) show a lessor impact from produced water chlorides and they retain much of their carbonate-bicarbonate composition.

In the cation triangle, sodium-calcium ion exchange reactions complicate interpretation, but the sodium plus potassium percentage in well #2 is higher than that in #5. Well #4 shows a lower percentage of sodium plus potassium in the water which may be the result of the sodium from the produced water replacing calcium and magnesium in the sediments and releasing these two constituents to the groundwater. The windmill waters (#1, #3) have a moderate amount of calcium and a lessor amount of magnesium than the other samples

In the diamond center, water from the Main House well (#2) is located between the produced water and water from the Front House well (#5). Water from the two windmills (#1, #3) retains its calcium carbonate-bicarbonate composition while the Bristol water shows the result of high chlorides and the exchange of sodium in the produced water for calcium and magnesium present in the sediments.

Water in the North (Section 7) well (#6) and in the Southwest (TX-NM) well (#7) are unrelated. Although both wells are located on the western edge of the study area, #6 has been severely impacted by chlorides from produced water while #7 has been impacted very little if at all. For many years oilfield tank batteries have been located upgradient from the North well (#6). Although located near oilfield production and installed to detect and monitor groundwater impacts from a hydrocarbon release, the Southwest well (#7) contains less than 30 percent chlorides (vs. 70 percent for #6), and greater than 50 percent calcium (versus 40 percent for #6)

The conclusions to be drawn from the examination of the Piper Diagram are 1) that the water in the Main House Well (#2) is a mixture of native groundwater and oilfield produced water, and 2) that elevated levels of chloride in the Bristol monitor well is due to mixing of native groundwater with produced water although some sodium in the water in the vicinity of the well has been exchanged on the calcareous sediments for calcium which is dissolved in the water.

6.0 Discussion

In their discussion of brine contamination of shallow groundwater in southern Lea County, Nicholson and Clebsch (1961, p.104) point out that under some circumstances a mixture of brine and fresh water can be pumped by water wells. Although the brine might move very near a producing well, it still may not be pumped by the well for several reasons. The well may not extend to the base of the aquifer or low permeability beds may retard water movement into the well. The pumping schedule and rate of pumping may not be sufficient to draw the produced water into the well except after prolonged and heavy pumping; contamination might appear less intense in samples collected during short pumping cycles. Also, samples taken only

intermittently from monitor wells receiving little pumping can mask effects of contamination which might appear with heavier and more frequent use.

Several of these points have applicability at the Osborn ranch. First, it appears that the Main House well (#2) supplied most of the water in the area of the ranch houses prior to the time that chloride and dissolved solids concentrations accelerated upward in 1996. Lessor pumping of that well in the future may well reduce the amount of brine captured by the cone of depression. Wells pumped to a lessor extent, especially the two windmills, show lower concentration impacts of the produced water. Secondly, the two monitor wells having shallow completions (Bristol #4 with 11 feet of saturation and the Southwest (TX-NM) #7 with 13 feet of saturation) show markedly different concentrations of constituents. The Bristol well especially shows impacts of produced water even though it is not completed in a deep zone and has not been heavily pumped. This could indicate that contamination has migrated from the surface to the upper portion of the aquifer versus contamination flowing at the base of the aquifer in channels and along the top of Triassic redbed surface.

7.0 Conclusions

1. As a result of the study, groundwater movement in the vicinity of the Osborn Ranch is from the north and northwest to the south and southeast. Movement was in a more southerly direction in December 1999 than in February 2000, with the slight change in direction likely due a change in pumping locations from the Main House well to the Front House windmill.
2. The groundwater movement is from the general location of oil and gas production operations on the ranch. Mapping of groundwater contours in December 1999 indicate groundwater movement from the vicinity of a surface leak of oil and gas produced water (i.e. wastewater); a monitor well (#4) placed intermediate between the leak and the pumping wells at the ranch shows chloride contamination consistent with a release of produced water. Use of the Piper Trilinear Diagram shows the water in the Main House well to be a mixture of the produced water and native water.
3. Based on data from the shallow monitor well (Bristol, #4) discussed in Section 6.0, above, it is very likely that contamination of the shallow subsurface water zone resulted from one or more leaks in the produced water lines. Since other oil and gas-related sources are in the area (e.g. an injection well, production wells, tanks and tank batteries) and may have potentially contributed to the groundwater contamination, the degree of contribution from the line leak can not be ascertained without additional investigation.
4. Due to the south and southeasterly direction of groundwater movement and the contamination of groundwater by oilfield operations (either past or present) as determined by analysis of the groundwater, there is a likelihood that the water wells in the vicinity of the ranch residences will continue to show increased salt concentrations resulting in a decrease in quality of the potable water available to the ranch owners and residents.

8.0 References

Cornerstone Environmental Resources, Inc. "Phase II Environmental Assessment, South Langley Jal Unit, Lea County, New Mexico, January 1999." Prepared for Bristol Resources Corporation, Dallas, Texas

Cornerstone Environmental Resources, Inc. "Phase II Environmental Assessment, June 1999 Soil Borings, South Langley Jal Unit, Lea County, New Mexico." Prepared for Bristol Resources Corporation, Dallas, Texas

Cornerstone Environmental Resources, Inc. "Phase II Environmental Assessment, July 1999 Groundwater Sampling, South Langley Jal Unit, Lea County, New Mexico." Prepared for Bristol Resources Corporation, Dallas, Texas

Cornerstone Environmental Resources, Inc. "Phase II Environmental Assessment, January, 2000 Soil Sampling, Abandoned Tank Batteries; Site 1, Sec. 18, T25S, R37E; Site 2, Sec. 18, T25S, R37E; Site 3, Sec. 18, T25S, R37E; South Langley Jal Unit, Lea County, New Mexico." Prepared for Bristol Resources Corporation, Dallas, Texas

Hem, John D., 1992. "Study and Interpretation of the Chemical Characteristics of Natural Water, Third Edition." U.S Geological Survey Water-Supply Paper 2254, U.S. Government Printing Office, Washington, DC.

Nicholson, A. Jr., and Clebsch, A. Jr.,1961. "Geology and Ground-Water Conditions in Southern Lea County, New Mexico." Ground-Water Report 6, NM Bureau of Mines and Mineral Resources, Socorro, New Mexico.

Safety and Environmental Solutions, Inc. "Interim Report, Environmental Site Assessment, Osborn Ranch, Sections 7, 12, 13, and 18 of Township 25 South Range 37 East, Lea County, New Mexico, January 27, 2000." Prepared for Mr. Clay Osborn, Jal, New Mexico.

APPENDIX
COPIES OF WATER ANALYSES

TRACEANALYSIS, INC.

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4725 Ripley Avenue, Suite A El Paso, Texas 79922 888•588•3443 915•585•3443 FAX 915•585•4944
E-Mail: lab@traceanalysis.com

Analytical and Quality Control Report

Bob Allen
Safety & Environmental Solutions Inc.
P. O. Box 1613
Hobbs, NM 88240

Report Date: 3/9/00

Project Number: N/A
Project Name: Osburn Ranch
Project Location: Jal, NM

Order ID Number: A00030309

Enclosed are the Analytical Results and Quality Control Data Reports for the following samples submitted to TraceAnalysis, Inc. for analysis:

Sample Number	Sample Description	Matrix	Date Taken	Time Taken	Date Received
141693	Produced Water	Water	3/3/00	7:00	3/3/00
141694	Monitor Well #4	Water	3/3/00	7:00	3/3/00
141695	West Water Well #14	Water	3/3/00	7:00	3/3/00
141696	Main House Well #2	Water	3/3/00	7:00	3/3/00

These results represent only the samples received in the laboratory. The Quality Control Report is generated on a batch basis. All information contained in this report is for the analytical batch(es) in which your sample(s) were analyzed.

This report consists of a total of 7 pages and shall not be reproduced except in its entirety, without written approval of TraceAnalysis, Inc.

Dr. Blair Leftwich, Director

Analytical Results Report

Sample Number: 141693
Description: Produced Water

Param	Result	Dilution	Analytical Method	Date Prepared	Date Analyzed	Analyst	Prep Batch #	QC Batch #	RDL
Alkalinity (mg/L as CaCo3)									
Hydroxide Alkalinity	<1.0	1	E 310.1	3/6/00	3/6/00	JS	PB01089	QC01314	1
Carbonate Alkalinity	<1.0	1	E 310.1	3/6/00	3/6/00	JS	PB01089	QC01314	1
Bicarbonate Alkalinity	827	1	E 310.1	3/6/00	3/6/00	JS	PB01089	QC01314	1
Total Alkalinity	827	1	E 310.1	3/6/00	3/6/00	JS	PB01089	QC01314	1
Dissolved Metals (mg/L)									
Dissolved Calcium	1125	1	E 200.7	3/7/00	3/7/00	RR	PB01161	QC01328	0.5
Dissolved Magnesium	3127	1	E 200.7	3/7/00	3/7/00	RR	PB01161	QC01328	0.5
Dissolved Potassium	557	1	E 200.7	3/7/00	3/7/00	RR	PB01161	QC01328	0.5
Dissolved Sodium	11490	1	E 200.7	3/7/00	3/7/00	RR	PB01161	QC01328	0.5
Ion Chromatography (IC) (mg/L)									
CL	* 30,000	1	E 300.0	3/2/00	3/4/00	JS	PB01066	QC01291	0.5
Nitrate-N	<1.0	1	E 300.0	3/2/00	3/4/00	JS	PB01066	QC01291	0.2
Sulfate	* 4500	1	E 300.0	3/2/00	3/4/00	JS	PB01066	QC01291	0.5

* CL - Chloride was re-ran on IC030600.sch (PB01099; QC01326). ICV %IA = 93; CCV %IA = 92; Matrix spikes RPD = 1; Matrix spikes %EA = 83.

* Sulfate - Sulfate was re-ran on IC030600.sch (PB01099; QC01326). ICV %IA = 96; CCV %IA = 98; Matrix spikes RPD = 2; Matrix spikes %EA = 98.

Sample Number: 141694
Description: Monitor Well #4

Param	Result	Dilution	Analytical Method	Date Prepared	Date Analyzed	Analyst	Prep Batch #	QC Batch #	RDL
Alkalinity (mg/L as CaCo3)									
Hydroxide Alkalinity	<1.0	1	E 310.1	3/6/00	3/6/00	JS	PB01089	QC01314	1
Carbonate Alkalinity	<1.0	1	E 310.1	3/6/00	3/6/00	JS	PB01089	QC01314	1
Bicarbonate Alkalinity	130	1	E 310.1	3/6/00	3/6/00	JS	PB01089	QC01314	1
Total Alkalinity	130	1	E 310.1	3/6/00	3/6/00	JS	PB01089	QC01314	1
Dissolved Metals (mg/L)									
Dissolved Calcium	164	1	E 200.7	3/7/00	3/7/00	RR	PB01161	QC01328	0.5
Dissolved Magnesium	58	1	E 200.7	3/7/00	3/7/00	RR	PB01161	QC01328	0.5
Dissolved Potassium	6.7	1	E 200.7	3/7/00	3/7/00	RR	PB01161	QC01328	0.5
Dissolved Sodium	125	1	E 200.7	3/7/00	3/7/00	RR	PB01161	QC01328	0.5
Ion Chromatography (IC) (mg/L)									
CL	410	1	E 300.0	3/2/00	3/4/00	JS	PB01066	QC01291	0.5
Fluoride	2.1	1	E 300.0	3/2/00	3/4/00	JS	PB01066	QC01291	0.2
Nitrate-N	3.1	1	E 300.0	3/2/00	3/4/00	JS	PB01066	QC01291	0.2
Sulfate	150	1	E 300.0	3/2/00	3/4/00	JS	PB01066	QC01291	0.5

Sample Number: 141695
Description: West Water Well #14

Param	Result	Dilution	Analytical Method	Date Prepared	Date Analyzed	Analyst	Prep Batch #	QC Batch #	RDL
Alkalinity (mg/L as CaCo3)									
Hydroxide Alkalinity	<1.0	1	E 310.1	3/6/00	3/6/00	JS	PB01089	QC01314	1

Carbonate Alkalinity	<1.0	1	E 310.1	3/6/00	3/6/00	JS	PB01089	QC01314	1
Bicarbonate Alkalinity	142	1	E 310.1	3/6/00	3/6/00	JS	PB01089	QC01314	1
Total Alkalinity	142	1	E 310.1	3/6/00	3/6/00	JS	PB01089	QC01314	1
Dissolved Metals (mg/L)									
Dissolved Calcium	150	1	E 200.7	3/7/00	3/7/00	RR	PB01161	QC01328	0.5
Dissolved Magnesium	44	1	E 200.7	3/7/00	3/7/00	RR	PB01161	QC01328	0.5
Dissolved Potassium	3.4	1	E 200.7	3/7/00	3/7/00	RR	PB01161	QC01328	0.5
Dissolved Sodium	154	1	E 200.7	3/7/00	3/7/00	RR	PB01161	QC01328	0.5
Ion Chromatography (IC) (mg/L)									
CL	270	1	E 300.0	3/2/00	3/4/00	JS	PB01066	QC01291	0.5
Fluoride	2.2	1	E 300.0	3/2/00	3/4/00	JS	PB01066	QC01291	0.2
Nitrate-N	6.7	1	E 300.0	3/2/00	3/4/00	JS	PB01066	QC01291	0.2
Sulfate	460	1	E 300.0	3/2/00	3/4/00	JS	PB01066	QC01291	0.5

Sample Number: 141696
Description: Main House Well #2

Param	Result	Dilution	Analytical Method	Date Prepared	Date Analyzed	Analyst	Prep Batch #	QC Batch #	RDL
Alkalinity (mg/L as CaCo3)									
Hydroxide Alkalinity	<1.0	1	E 310.1	3/6/00	3/6/00	JS	PB01089	QC01314	1
Carbonate Alkalinity	<1.0	1	E 310.1	3/6/00	3/6/00	JS	PB01089	QC01314	1
Bicarbonate Alkalinity	165	1	E 310.1	3/6/00	3/6/00	JS	PB01089	QC01314	1
Total Alkalinity	165	1	E 310.1	3/6/00	3/6/00	JS	PB01089	QC01314	1
Dissolved Metals (mg/L)									
Dissolved Calcium	225	1	E 200.7	3/7/00	3/7/00	RR	PB01161	QC01328	0.5
Dissolved Magnesium	67	1	E 200.7	3/7/00	3/7/00	RR	PB01161	QC01328	0.5
Dissolved Potassium	3.4	1	E 200.7	3/7/00	3/7/00	RR	PB01161	QC01328	0.5
Dissolved Sodium	98	1	E 200.7	3/7/00	3/7/00	RR	PB01161	QC01328	0.5
Ion Chromatography (IC) (mg/L)									
CL	420	1	E 300.0	3/2/00	3/4/00	JS	PB01066	QC01291	0.5
Fluoride	2.3	1	E 300.0	3/2/00	3/4/00	JS	PB01066	QC01291	0.2
Nitrate-N	9.3	1	E 300.0	3/2/00	3/4/00	JS	PB01066	QC01291	0.2
Sulfate	320	1	E 300.0	3/2/00	3/4/00	JS	PB01066	QC01291	0.5

Quality Control Report
Method Blanks

Param	Flag	Blank Result	Reporting Limit	Date Analyzed	Prep Batch #	QC Batch #
Hydroxide Alkalinity (mg/L as CaCo3)		<1.0	1	3/6/00	PB01089	QC01314
Carbonate Alkalinity (mg/L as CaCo3)		<1.0	1	3/6/00	PB01089	QC01314
Bicarbonate Alkalinity (mg/L as CaCo3)		<2.0	1	3/6/00	PB01089	QC01314
Total Alkalinity (mg/L as CaCo3)		<2.0	1	3/6/00	PB01089	QC01314

Param	Flag	Blank Result	Reporting Limit	Date Analyzed	Prep Batch #	QC Batch #
Dissolved Calcium (mg/L)		<.5	0.5	3/7/00	PB01161	QC01328
Dissolved Magnesium (mg/L)		<.5	0.5	3/7/00	PB01161	QC01328
Dissolved Potassium (mg/L)		<.5	0.5	3/7/00	PB01161	QC01328
Dissolved Sodium (mg/L)		<.5	0.5	3/7/00	PB01161	QC01328

Param	Flag	Blank Result	Reporting Limit	Date Analyzed	Prep Batch #	QC Batch #
CL (mg/L)		<0.5	0.5	3/4/00	PB01066	QC01291
Fluoride (mg/L)		<0.2	0.2	3/4/00	PB01066	QC01291
Nitrate-N (mg/L)		<0.2	0.2	3/4/00	PB01066	QC01291
Sulfate (mg/L)		<0.5	0.5	3/4/00	PB01066	QC01291

Quality Control Report
Matrix Spike and Matrix Duplicate Spike

Standard	Param	Sample Result	Dil.	Spike Amount Added	Matrix Spike Result	% Rec.	RPD	% Rec. Limit	RPD Limit	QC Batch #
MS	CL (mg/L)	420	1	125	526.03	85		80 - 120	0 - 20	QC01291
MS	Fluoride (mg/L)	2.3	1	25	28.39	104		80 - 120	0 - 20	QC01291
MS	Nitrate-N (mg/L)	9.3	1	50	56.82	95		80 - 120	0 - 20	QC01291
MS	Sulfate (mg/L)	320	1	125	436.35	93		80 - 120	0 - 20	QC01291
MSD	CL (mg/L)	420	1	125	532.63	90	6	80 - 120	0 - 20	QC01291
MSD	Fluoride (mg/L)	2.3	1	25	27.85	102	2	80 - 120	0 - 20	QC01291
MSD	Nitrate-N (mg/L)	9.3	1	50	56.00	93	2	80 - 120	0 - 20	QC01291
MSD	Sulfate (mg/L)	320	1	125	440.58	96	4	80 - 120	0 - 20	QC01291

Standard	Param	Sample Result	Dil.	Spike Amount Added	Matrix Spike Result	% Rec.	RPD	% Rec. Limit	RPD Limit	QC Batch #
MS	Dissolved Calcium (mg/L)	1125	1	1000	2196	107		75 - 125	0 - 20	QC01328
MS	Dissolved Magnesium (mg/L)	3127	1	1000	4112	99		75 - 125	0 - 20	QC01328
MS	Dissolved Potassium (mg/L)	557	1	1000	1721	116		75 - 125	0 - 20	QC01328
MS	Dissolved Sodium (mg/L)	11490	1	1000	12410	92		75 - 125	0 - 20	QC01328
MSD	Dissolved Calcium (mg/L)	1125	1	1000	2165	104	3	75 - 125	0 - 20	QC01328
MSD	Dissolved Magnesium (mg/L)	3127	1	1000	4037	91	8	75 - 125	0 - 20	QC01328
MSD	Dissolved Potassium (mg/L)	557	1	1000	1747	119	2	75 - 125	0 - 20	QC01328
MSD	Dissolved Sodium (mg/L)	11490	1	1000	12620	113	20	75 - 125	0 - 20	QC01328

Quality Control Report
Duplicates

Standard	Param	Flag	Duplicate Result	Sample Result	Dilution	RPD	RPD Limit	QC Batch #
Duplicate	Hydroxide Alkalinity (mg/L as CaCo		<1.0	<1.0	1	0	0 - 20	QC01314
Duplicate	Carbonate Alkalinity (mg/L as CaCo		<1.0	<1.0	1	0	0 - 20	QC01314
Duplicate	Bicarbonate Alkalinity (mg/L as CaC		47	49	1	4	0 - 20	QC01314
Duplicate	Total Alkalinity (mg/L as CaCo3)		47	49	1	4	0 - 20	QC01314

Quality Control Report
Lab Control Spikes and Duplicate Spike

	Param	Blank Result	Dil.	Spike Amount Added	Matrix Spike Result	% Rec.	RPD	% Rec. Limit	RPD Limit	QC Batch #
LCS	Dissolved Calcium (mg/L)	<.5	1	1000	980	98		75 - 125	0 - 20	QC01328
LCS	Dissolved Magnesium (mg/L)	<.5	1	1000	999	100		75 - 125	0 - 20	QC01328
LCS	Dissolved Potassium (mg/L)	<.5	1	1000	999	100		75 - 125	0 - 20	QC01328
LCS	Dissolved Sodium (mg/L)	<.5	1	1000	976	98		75 - 125	0 - 20	QC01328
LCSD	Dissolved Calcium (mg/L)	<.5	1	1000	984	98	0	75 - 125	0 - 20	QC01328
LCSD	Dissolved Magnesium (mg/L)	<.5	1	1000	944	94	6	75 - 125	0 - 20	QC01328
LCSD	Dissolved Potassium (mg/L)	<.5	1	1000	1003	100	0	75 - 125	0 - 20	QC01328
LCSD	Dissolved Sodium (mg/L)	<.5	1	1000	983	98	1	75 - 125	0 - 20	QC01328

Quality Control Report
Continuing Calibration Verification Standard

Standard	Param	Flag	CCVs TRUE Conc.	CCVs Found Conc.	CCVs Percent Recovery	Percent Recovery Limits	Date Analyzed	QC Batch #
ICV	Hydroxide Alkalinity (mg/L as CaCo3)		0	<1.0	0	80 - 120	3/6/00	QC01314
ICV	Carbonate Alkalinity (mg/L as CaCo3)		0	208	0	80 - 120	3/6/00	QC01314
ICV	Bicarbonate Alkalinity (mg/L as CaCo3)		0	20	0	80 - 120	3/6/00	QC01314
ICV	Total Alkalinity (mg/L as CaCo3)		236	228	97	80 - 120	3/6/00	QC01314
CCV 1	Hydroxide Alkalinity (mg/L as CaCo3)		0	<1.0	0	80 - 120	3/6/00	QC01314
CCV 1	Carbonate Alkalinity (mg/L as CaCo3)		0	214	0	80 - 120	3/6/00	QC01314
CCV 1	Bicarbonate Alkalinity (mg/L as CaCo3)		0	15	0	80 - 120	3/6/00	QC01314
CCV 1	Total Alkalinity (mg/L as CaCo3)		236	229	97	80 - 120	3/6/00	QC01314

Standard	Param	Flag	CCVs TRUE Conc.	CCVs Found Conc.	CCVs Percent Recovery	Percent Recovery Limits	Date Analyzed	QC Batch #
ICV	Dissolved Calcium (mg/L)		20	20.9	105	75 - 125	3/7/00	QC01328
ICV	Dissolved Magnesium (mg/L)		20	20.2	101	75 - 125	3/7/00	QC01328
ICV	Dissolved Potassium (mg/L)		20	21.1	106	75 - 125	3/7/00	QC01328
ICV	Dissolved Sodium (mg/L)		20	20.6	103	75 - 125	3/7/00	QC01328
CCV 1	Dissolved Calcium (mg/L)		1	21	2100	75 - 125	3/7/00	QC01328
CCV 1	Dissolved Magnesium (mg/L)		20	20.4	102	75 - 125	3/7/00	QC01328
CCV 1	Dissolved Potassium (mg/L)		20	20.5	102	75 - 125	3/7/00	QC01328
CCV 1	Dissolved Sodium (mg/L)		20	20.3	102	75 - 125	3/7/00	QC01328

Standard	Param	Flag	CCVs TRUE Conc.	CCVs Found Conc.	CCVs Percent Recovery	Percent Recovery Limits	Date Analyzed	QC Batch #
ICV	CL (mg/L)		12.5	11.46	92	80 - 120	3/4/00	QC01291
ICV	Fluoride (mg/L)		2.5	2.53	101	80 - 120	3/4/00	QC01291
ICV	Nitrate-N (mg/L)		5	4.63	93	80 - 120	3/4/00	QC01291
ICV	Sulfate (mg/L)		12.5	12.26	98	80 - 120	3/4/00	QC01291
CCV 1	CL (mg/L)		12.5	11.40	91	80 - 120	3/4/00	QC01291
CCV 1	Fluoride (mg/L)		2.5	2.53	101	80 - 120	3/4/00	QC01291
CCV 1	Nitrate-N (mg/L)		5	4.61	92	80 - 120	3/4/00	QC01291
CCV 1	Sulfate (mg/L)		12.5	11.88	95	80 - 120	3/4/00	QC01291

141693-96

A000 30309

TraceAnalysis, Inc.

6701 Aberdeen Avenue Lubbock, Texas 79424
Tel (806) 794 1296 Fax (806) 794 1298
1 (800) 378 1296

CHAIN-OF-CUSTODY RECORD AND ANALYSIS REQUEST

Project Manager: Bob Allen

Phone #: (505) 397-0510

FAX #: (505) 393-4388

Company Name & Address: Safety + Environmental Solutions Inc.

Project #: 703 East Clinton P.O. Box 1613 Hobbs, NM 88240

Project Name: Osburn Ranch

Project Location: Jal, NM

Sampler Signature:

LAB # (LAB USE ONLY)	FIELD CODE	# CONTAINERS	Volume/Amount	MATRIX: WATER	SOIL	AIR	SLUDGE	PRESERVATIVE METHOD: HCL	HNO3	ICE	NONE	SAMPLING: DATE	TIME
141693	Produced Water	1		✓						✓		3/3/00	7:00 AM
94	Monitor Well #4	1		✓						✓		3/3/00	7:00 AM
95	West Water Well #4	1		✓						✓		3/3/00	7:00 AM
96	Main House Well #2	1		✓						✓		3/3/00	7:00 AM

ANALYSIS REQUEST

BTEX MTBE	TPH	Total Metals Ag As Ba Cd Cr Pb Hg Se	TCLP Metals Ag As Ba Cd Cr Pb Hg Se	TCLP Volatiles	TCLP Semi Volatiles	RCI	8240 / 8260	8270	Cl SO4 CO3 HCO3 F NO3	Cations + Anions	Nitrates Nitrites per Dave Boger 3/3/00
										✓	✓
										✓	✓
										✓	✓
										✓	✓

SPECIAL HANDLING

Turn around # of days

Fax ASAP

Hold

Relinquished by:	Date:	Time:	Received by:	Date:	Time:
Relinquished by:	Date:	Time:	Received by:	Date:	Time:
Relinquished by:	Date:	Time:	Received at Laboratory by: Mell Green	Date: 3-3-00	Time: 11:15am

REMARKS

3/10

MS carry in 6°

Apr-12-96 07:33A

P.01

TRACEANALYSIS, INC.

6701 Aberdeen Avenue, Suite 9 Lubbock, Texas 79424 800•378•1296 806•794•1296 FAX 806•794•1298
4725 Ripley Avenue, Suite A El Paso, Texas 79922 888•588•3443 915•585•3443 FAX 915•585•4944
E-Mail: lab@traceanalysis.com

Analytical and Quality Control Report

Bob Allen
Safety & Environmental Solutions Inc.
P. O. Box 1613
Hobbs, NM 88240

Report Date: 3/15/00

Project Number: N/A
Project Name: Osburn Ranch
Project Location: Jal, NM

Order ID Number: A00030309

Enclosed are the Analytical Results and Quality Control Data Reports for the following samples submitted to TraceAnalysis, Inc. for analysis:

Sample Number	Sample Description	Matrix	Date Taken	Time Taken	Date Received
141693	Produced Water	Water	3/3/00	7:00	3/3/00
141694	Monitor Well #4	Water	3/3/00	7:00	3/3/00
141695	West Water Well #14	Water	3/3/00	7:00	3/3/00
141696	Main House Well #2	Water	3/3/00	7:00	3/3/00

These results represent only the samples received in the laboratory. The Quality Control Report is generated on a batch basis. All information contained in this report is for the analytical batch(es) in which your sample(s) were analyzed.

This report consists of a total of 3 pages and shall not be reproduced except in its entirety, without written approval of TraceAnalysis, Inc.

Dr. Blair Leftwich, Director

Analytical Results Report

Sample Number: 141693
Description: Produced Water

Param	Result	Dilution	Analytical Method	Date Prepared	Date Analyzed	Analyst	Prep Batch #	QC Batch #	RDL
Conductivity (uMHOS/cm)									
Specific Conductance	80000	1	SM 2510B	3/13/00	3/13/00	MD	PB01215	QC01464	
TDS (mg/L)									
Total Dissolved Solids	59000	1	E 160.1	3/14/00	3/15/00	MD	PB01259	QC01519	10

Sample Number: 141694
Description: Monitor Well #4

Param	Result	Dilution	Analytical Method	Date Prepared	Date Analyzed	Analyst	Prep Batch #	QC Batch #	RDL
Conductivity (uMHOS/cm)									
Specific Conductance	1700	1	SM 2510B	3/13/00	3/13/00	MD	PB01215	QC01464	
TDS (mg/L)									
Total Dissolved Solids	1200	1	E 160.1	3/14/00	3/15/00	MD	PB01259	QC01519	10

Sample Number: 141695
Description: West Water Well #14

Param	Result	Dilution	Analytical Method	Date Prepared	Date Analyzed	Analyst	Prep Batch #	QC Batch #	RDL
Conductivity (uMHOS/cm)									
Specific Conductance	1800	1	SM 2510B	3/13/00	3/13/00	MD	PB01215	QC01464	
TDS (mg/L)									
Total Dissolved Solids	1300	1	E 160.1	3/14/00	3/15/00	MD	PB01259	QC01519	10

Sample Number: 141696
Description: Main House Well #2

Param	Result	Dilution	Analytical Method	Date Prepared	Date Analyzed	Analyst	Prep Batch #	QC Batch #	RDL
Conductivity (uMHOS/cm)									
Specific Conductance	2100	1	SM 2510B	3/13/00	3/13/00	MD	PB01215	QC01464	
TDS (mg/L)									
Total Dissolved Solids	1500	1	E 160.1	3/14/00	3/15/00	MD	PB01259	QC01519	10

Quality Control Report
Method Blanks

Param	Flag	Blank Result	Reporting Limit	Date Analyzed	Prep Batch #	QC Batch #
Specific Conductance (uMHOS/cm)		6.0		3/13/00	PB01215	QC01464

Param	Flag	Blank Result	Reporting Limit	Date Analyzed	Prep Batch #	QC Batch #
Total Dissolved Solids (mg/L)		<10	10	3/15/00	PB01259	QC01519

Quality Control Report
Duplicates

Standard	Param	Flag	Duplicate Result	Sample Result	Dilution	RPD	RPD Limit	QC Batch #
Duplicate	Specific Conductance (uMHOS/cm)		3062	3100	1	1	0 - 20	QC01464

Standard	Param	Flag	Duplicate Result	Sample Result	Dilution	RPD	RPD Limit	QC Batch #
Duplicate	Total Dissolved Solids (mg/L)		591	590	1	0	0 - 20	QC01519

Quality Control Report
Continuing Calibration Verification Standard

Standard	Param	Flag	CCVs TRUE Conc.	CCVs Found Conc.	CCVs Percent Recovery	Percent Recovery Limits	Date Analyzed	QC Batch #
ICV	Specific Conductance (uMHOS/cm)		1413	1308	93	80 - 120	3/13/00	QC01464
CCV 1	Specific Conductance (uMHOS/cm)		1413	1337	95	80 - 120	3/13/00	QC01464

Standard	Param	Flag	CCVs TRUE Conc.	CCVs Found Conc.	CCVs Percent Recovery	Percent Recovery Limits	Date Analyzed	QC Batch #
ICV	Total Dissolved Solids (mg/L)		1000	990	99	80 - 120	3/15/00	QC01519
CCV 1	Total Dissolved Solids (mg/L)		1000	997	100	80 - 120	3/15/00	QC01519

CARDINAL LABORATORIES

PHONE (915) 673-7001 • 2111 BEECHWOOD • ABILENE, TX 79603
PHONE (505) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240

ANALYTICAL RESULTS FOR
SAFETY & ENVIRONMENTAL SOLUTIONS, INC.
ATTN: DAVID BOYER
703 E. CLINTON, SUITE #103
HOBBS, NM 88240
FAX TO: (505) 393-4388

Receiving Date: 02/22/00
Reporting Date: 02/28/00
Project Number: NOT GIVEN
Project Name: OSBORN RANCH
Project Location: JAL

Sampling Date: 02/22/00
Sample Type: GROUNDWATER
Sample Condition: COOL & INTACT
Sample Received By: AH
Analyzed By: AH

LAB NUMBER	SAMPLE ID	Na (mg/L)	Ca (mg/L)	Mg (mg/L)	K (mg/L)	Conductivity (u mhos/cm)	T-Alkalinity ($mgCaCO_3/L$)
ANALYSIS DATE:		02/28/00	02/23/00	02/23/00	02/23/00	02/23/00	02/23/00
H4661-1	JAL CC EFFLUENT	231	91	61	24	1818	260
H4661-3	JAL CC MW-3	386	337	143	16	4497	220
H4661-4	JAL CC MW-4	369	257	131	12	3806	172
Quality Control		NR	52	53	4.89	1392	NR
True Value QC		NR	50	50	5.00	1413	NR
% Recovery		NR	104	106	98	98.5	NR
Relative Percent Difference		NR	7.7	7.5	NR	0.2	NR
METHODS:			SM3500-Ca-D	3500-Mg E	8049	120.1	310.1

LAB NUMBER	SAMPLE ID	Cl^- (mg/L)	SO_4 (mg/L)	CO_3 (mg/L)	HCO_3 (mg/L)	pH (s.u.)	TDS (mg/L)
ANALYSIS DATE:		02/23/00	02/23/00	02/23/00	02/23/00	02/23/00	02/23/00
H4661-1	JAL CC EFFLUENT	188	468	115	83	8.75	1153
H4661-3	JAL CC MW-3	668	1085	0	268	7.25	2650
H4661-4	JAL CC MW-4	596	948	0	210	7.29	2080
Quality Control		960	53.2	NR	971	7.01	NR
True Value QC		1000	50.0	NR	1000	7.00	NR
% Recovery		96	106	NR	97	100	NR
Relative Percent Difference		5.2	8.5	NR	NR	0.1	NR
METHODS:		SM4500-Cl-B	375.4	310.1	310.1	150.1	160.1

Chemist

3/2/00
Date

H4661A-XLS

CARDINAL LABORATORIES

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PHONE (505) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240

ANALYTICAL RESULTS FOR
SAFETY & ENVIRONMENTAL SOLUTIONS, INC.
ATTN: DAVID BOYER
703 E. CLINTON, SUITE #103
HOBBS, NM 88240
FAX TO: (505) 393-4388

Receiving Date: 02/22/00
Reporting Date: 03/02/00
Project Number: NOT GIVEN
Project Name: OSBORN RANCH
Project Location: JAL

Sampling Date: 02/22/00
Sample Type: GROUNDWATER
Sample Condition: COOL & INTACT
Sample Received By: AH
Analyzed By: AH

LAB NUMBER	SAMPLE ID	TKN (mg/L)	NO_3-N (mg/L)	NO_2-N (mg/L)
ANALYSIS DATE:		03/02/00	02/23/00	02/23/00
H4661-2	~~NORTH POND~~ Jal CC Tank	-	5.25	0.07
H4661-3	JAL CC MW-3	-	5.51	0.06
H4661-4	JAL CC MW-4	-	5.46	0.06
H4661-5	OSBORN FISH POND	1.30	3.61	0.12
Quality Control		2.45	3.09	0.23
True Value QC		2.50	3.00	0.25
% Recovery		98	103	92
Relative Percent Difference		4.0	6.1	13.0
METHODS: EPA 600/4-79-020		351.3	352.1	354.1

Chemist

3/2/00
Date

H4661NXLS

![Cardinal Laboratories logo]

CARDINAL LABORATORIES, INC.

2111 Beechwood, Abilene, TX 79603 — 101 East Marland, Hobbs, NM 88240

(915) 673-7001 Fax (915) 673-7020 — (505) 393-2326 Fax (505) 393-2476

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

Page 1 of 1

Company Name:	SESI
Project Manager:	DAVID BOYER
Address:	703 E Clinton, P.O. Box 1613
City: Hobbs	State: NM Zip: 88241
Phone #:	397-0510
Fax #:	393-4388
Project #:	Project Owner:
Project Name:	Osborn Ranch
Project Location:	Jal #

BILL TO	PO #:
Company:	SESI
Attn:	KRISTI
Address:	
City:	
State:	Zip:
Phone #:	
Fax #:	

LAB I.D. (FOR LAB USE ONLY)	Sample I.D.	(G)RAB OR (C)OMP.	# CONTAINERS	MATRIX: GROUNDWATER	WASTEWATER	SOIL	OIL	SLUDGE	OTHER: Pond	PRES.: ACID:	ICE / COOL	OTHER:	SAMPLING DATE (2000)	TIME	Cat/Ans/An.TDS	NO2-NO3	TKN	ANALYSIS REQUEST
H4661-0	Jal CC Effluent	—											—	—				
H4661-01	North Pond	X	3		X						X		2/22	1310	X	X	X	No TKN, NO2 NO3
H4661-02	Jal CC Pump station	X	1	X							X		"	1320	X	X		No Cat/Ans/TDS 2/22/00
H4661-03	Jal CC MW-3	X	2	X							X		"	1325	X	X		
H4661-04	Jal CC MW-4	X	2	X							X		"	1330	X	X		
H4661-05	Osborn Fish Pond	X	2						X		X		"	1300		X	X	

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Terms and Conditions: Interest will be charged on all accounts more than 30 days past due at the rate of 24% per annum from the original date of invoice, and all costs of collections, including attorney's fees.

Sampler Relinquished: D. Boyer	Date: 2/22/00 Time: 2:05	Received By:	Phone Result ☐ Yes ☐ No Additional Fax #: / Fax Result: ☐ Yes ☐ No
Relinquished By:	Date: 2/22/00 Time: 2:05	Received By: (Lab Staff) Amy Hill	REMARKS: H4661-1
Delivered By: (Circle One) (Sampler) - UPS - Bus - Other:		Sample Condition: Cool ☑ Yes ☐ No; Intact ☑ Yes ☐ No	CHECKED BY: (Initials)

† Cardinal cannot accept verbal changes. Please fax written changes to 915-673-7020.

281-1335

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PHONE (505) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240

ANALYTICAL RESULTS FOR
SAFETY & ENVIRONMENTAL SOLUTIONS, INC.
ATTN: DEE WHATLEY
703 E. CLINTON, STE 103
HOBBS, NM 88240
FAX TO: (505) 393-4388

Receiving Date: 02/29/00
Reporting Date: 03/02/00
Project Number: NOT GIVEN
Project Name: OSBURN RANCH
Project Location: JAL, NM

Sampling Date: 02/29/00
Sample Type: GROUNDWATER
Sample Condition: COOL & INTACT
Sample Received By: AH
Analyzed By: AH

LAB NUMBER	SAMPLE ID	Na (mg/L)	Ca (mg/L)	Mg (mg/L)	K (mg/L)	Conductivity (u mhos/cm)	T-Alkalinity (mgCaCO3/L)
ANALYSIS DATE:		03/02/00	03/01/00	03/01/00	03/01/00	03/01/00	03/01/00
H4683-1	WELL #4	85	147	50	9.7	1621	120
H4683-4	WELL #10	79	77	21	6.2	952	128
H4683-5	WELL #11	95	43	62	12.2	1251	112
Quality Control		NR	52	53	4.89	1392	NR
True Value QC		NR	50	50	5	1413	NR
% Accuracy		NR	104	106	98	98.5	NR
Relative Percent Difference		NR	7.7	7.5	2.2	0.2	NR
METHODS:			SM3500-Ca-D	3500-Mg E	8049	120.1	310.1

LAB NUMBER	SAMPLE ID	Cl (mg/L)	SO4 (mg/L)	CO3 (mg/L)	HCO3 (mg/L)	pH (s.u.)	TDS (mg/L)
ANALYSIS DATE:		03/01/00	03/02/00	03/01/00	03/01/00	03/01/00	03/03/00
H4683-1	WELL #4	380	111	0	146	7.27	915
H4683-4	WELL #10	152	111	0	156	7.59	623
H4683-5	WELL #11	332	3.87	0	137	7.90	788
Quality Control		1000	53.17	NR	971	7.02	NR
True Value QC		1000	50.00	NR	1000	7.00	NR
% Accuracy		100	106	NR	97	100	NR
Relative Percent Difference		4.0	8.5	NR	-	0	NR
METHODS:		SM4500-Cl-B	375.4	310.1	310.1	150.1	160.1

Chemist

3/2/00
Date

H4683A.XLS

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PHONE (505) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240

ANALYTICAL RESULTS FOR
SAFETY & ENVIRONMENTAL SOLUTIONS, INC.
ATTN: DEE WHATLEY
703 E. CLINTON, STE 103
HOBBS, NM 88240
FAX TO: (505) 393-4388

Receiving Date: 02/29/00
Reporting Date: 03/01/00
Project Number: NOT GIVEN
Project Name: OSBURN RANCH
Project Location: JAL, NM

Sampling Date: 02/29/00
Sample Type: GROUNDWATER
Sample Condition: COOL & INTACT
Sample Received By: AH
Analyzed By: AH

LAB NUMBER	SAMPLE ID	NO_3-N (mg/L)	NO_2-N (mg/L)
ANALYSIS DATE:		03/01/00	03/01/00
H4683-1	WELL #4 BRISTOL	1.18	0.02
H4683-2	WELL #6 SEC. 7 WW	0.65	0.02
H4683-3	WELL #7 TNM	1.37	0.02
H4683-4	WELL #10 JCC	1.71	0.03
H4683-5	WELL #11 JCC	0.21	0.02
Quality Control		3.08	0.23
True Value QC		3.00	0.25
% Recovery		103	93
Relative Percent Difference		0.3	0

METHOD: EPA 600/4-79-020, 352.1, 354.1

Chemist

3/1/00
Date

H4683BXLS

CARDINAL LABORATORIES, INC.

2111 Beechwood, Abilene, TX 79603 (915) 673-7001 Fax (915) 673-7020
101 East Marland, Hobbs, NM 88240 (505) 393-2326 Fax (505) 393-2476

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

Page____ of____

Company Name:	SESI	BILL TO	PO #:
Project Manager:	Dee Whatley	Company:	
Address:	703 E. Clinton, Ste 103	Attn:	
City:	Hobbs State: NM Zip: 88240	Address:	
Phone #:	397-0510	City:	
Fax #:	393-4388	State:	Zip:
Project #:	Project Owner:	Phone #:	
Project Name:	Osburn Ranch	Fax #:	
Project Location:	Jal NM		

FOR LAB USE ONLY LAB I.D.	Sample I.D.	(G)RAB OR (C)OMP.	# CONTAINERS	MATRIX: GROUNDWATER	WASTEWATER	SOIL	OIL	SLUDGE	OTHER :	PRES.: ACID:	ICE / COOL	OTHER :	SAMPLING: DATE	TIME	ANALYSIS REQUEST: Cations & Anions	N, trates & Nitrites
H4683-1	Well #4 Bristol	G	1	✓							✓		2-29-00	3:40	✓	✓
-2	Well #6 JCC, TNM	G	1	✓							✓		2-29-00			✓
-3	Well #7 TNM	G	1	✓							✓					✓
-4	Well #10 JCC	G	1	✓							✓				✓	✓
-5	Well #11 JCC	G	1	✓							✓				✓	✓

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Terms and Conditions: Interest will be charged on all accounts more than 30 days past due at the rate of 24% per annum from the original date of invoice, and all costs of collections, including attorney's fees.

Sampler Relinquished:	Date: 2-29-00 Time: 3:40pm	Received By:	Phone Result ☐ Yes ☐ No Additional Fax #:
Relinquished By:	Date: 2/29/00 Time: 3:40	Received By: (Lab Staff)	Fax Result: ☐ Yes ☐ No
Delivered By: (Circle One) Sampler - UPS - Bus - Other:	Sample Condition Cool: ☑ Yes ☐ No Intact: ☑ Yes ☐ No	CHECKED BY: (Initials)	REMARKS:

† Cardinal cannot accept verbal changes. Please fax written changes to 915-673-7020.

CARDINAL LABORATORIES

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PHONE (505) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240

ANALYTICAL RESULTS FOR
SAFETY & ENVIRONMENTAL SOLUTIONS, INC.
ATTN: BETH ALDRICH
703 E. CLINTON, SUITE #103
HOBBS, NM 88240
FAX TO: (505) 393-4388

Receiving Date: 12/15/99
Reporting Date: 12/17/99
Project Owner: NOT GIVEN
Project Name: OSBORN RANCH
Project Location: JAL, NM

Sampling Date: 12/15/99
Sample Type: GROUNDWATER
Sample Condition: COOL & INTACT
Sample Received By: GP
Analyzed By: BC

LAB NO.	SAMPLE ID	BENZENE (mg/L)	TOLUENE (mg/L)	ETHYL BENZENE (mg/L)	TOTAL XYLENES (mg/L)
ANALYSIS DATE		12/16/99	12/16/99	12/16/99	12/16/99
H4514-1	WEST WATER WELL	<0.002	<0.002	<0.002	<0.006
H4514-2	HOUSE WELL	<0.002	<0.002	<0.002	<0.006
H4514-3	FRONT HOUSE WELL	<0.002	<0.002	<0.002	<0.006
H4514-4	FR. HOUSE WINDMILL	<0.002	<0.002	<0.002	<0.006
H4514-5	BACK HOUSE WINDMILL	<0.002	<0.002	<0.002	<0.006
Quality Control		0.092	0.104	0.100	0.307
True Value QC		0.100	0.100	0.100	0.300
% Recovery		91.8	104	99.8	102
Relative Percent Difference		3.4	3.1	0.7	1.6

METHOD: EPA SW-846 8260

Chemist

12/17/99
Date

H4514A.XLS

CARDINAL LABORATORIES

PHONE (915) 673-7001 • 2111 BEECHWOOD • ABILENE, TX 79603
PHONE (505) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240

ANALYTICAL RESULTS FOR
SAFETY & ENVIRONMENTAL SOLUTIONS, INC.
ATTN: BETH ALDRICH
703 E. CLINTON, SUITE #103
HOBBS, NM 88240
FAX TO: (505) 393-4388

Receiving Date: 12/15/99
Reporting Date: 12/17/99
Project Owner: NOT GIVEN
Project Name: OSBORN RANCH
Project Location: JAL, NM

Sampling Date: 12/15/99
Sample Type: GROUNDWATER
Sample Condition: COOL & INTACT
Sample Received By: GP
Analyzed By: GP

LAB NUMBER	SAMPLE ID	Na (mg/L)	Ca (mg/L)	Mg (mg/L)	K (mg/L)	Conductivity (u mhos/cm)	NO_3-N (mg/L)
ANALYSIS DATE:		12/17/99	12/16/99	12/16/99	12/16/99	12/17/99	12/16/99
H4514-1	WEST WATER WELL	186	114	47	6.0	2328	5.08
H4514-2	HOUSE WELL	213	162	47	6.7	2508	7.47
H4514-3	FRONT HOUSE WELL	94	85	50	6.4	1570	7.14
H4514-4	FR. HOUSE WINDMILL	116	64	27	4.3	1305	2.63
H4514-5	BACK. HOUSE WINDMILL	81	73	9.3	4.4	929	1.22
Quality Control		NR	80	49	4.96	1392	3.19
True Value QC		NR	80	50	5.00	1413	3.00
% Accuracy		NR	100	98	99	99	106
Relative Percent Difference		NR	0	2.0	0	0.2	5.6
METHODS:			SM3500-Ca-D	3500-Mg E	8049	120.1	353.3

LAB NUMBER	SAMPLE ID	Cl^- (mg/L)	SO_4 (mg/L)	CO_3 (mg/L)	HCO_3 (mg/L)	pH (s.u.)	TDS (mg/L)
ANALYSIS DATE:		12/14/99	12/17/99	12/16/99	12/16/99	12/17/99	12/16/99
H4514-1	WEST WATER WELL	295	364	0	116	7.81	1502
H4514-2	HOUSE WELL	432	282	0	205	7.73	1782
H4514-3	FRONT HOUSE WELL	158	243	0	190	7.78	918
H4514-4	FR. HOUSE WINDMILL	125	171	0	215	7.80	780
H4514-5	BACK. HOUSE WINDMILL	121	83	0	176	7.68	484
Quality Control		1010	48.63	NR	971	7.07	NR
True Value QC		1000	50.00	NR	1000	7.00	NR
% Accuracy		101	97	NR	97	101	NR
Relative Percent Difference		2.0	2.9	NR	-	0.6	NR
METHODS:		SM4500-Cl-B	375.4	310.1	310.1	150.1	160.1

Gayle A. Potter, Chemist

12/17/99
Date

H4514B.XLS

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

CARDINAL LABORATORIES, INC.

2111 Beechwood, Abilene, TX 79603 (915) 673-7001 Fax (915) 673-7020

101 East Marland, Hobbs, NM 88240 (505) 393-2326 Fax (505) 393-2476

Page____ of ____

Company Name: SESI		BILL TO	PO #:
Project Manager:		Company: SAME	
Address: 703 E. CLINTON, #103		Attn:	
City: HOBBS State: NM Zip: 88240		Address:	
Phone #: (505) 397-0510		City:	
Fax #: (505) 393-4388		State: Zip:	
Project #: Project Owner:		Phone #:	
Project Name: Osborn Ranch		Fax #:	
Project Location: JAL			

FOR LAB USE ONLY				MATRIX							PRES.			SAMPLING		ANALYSIS REQUEST												
LAB I.D.	Sample I.D.	(G)RAB OR (C)OMP.	# CONTAINERS	GROUNDWATER	WASTEWATER	SOIL	OIL	SLUDGE	OTHER:	ACID:	ICE / COOL	OTHER:	DATE	TIME	BTEX	Major Cations & Anions	Nitrate											
H4514-1	West Waterwell	C	4	X							X		12-15-99	10:11am	X	X	X											
-2	~~House~~ House Well	C	4	X							X		" "	10:25am	X	X	X											
-3	Front House Well	C	4	X							X		" "	11:39am	X	X	X											
-4	Front House Windmill	C	4	X							X		" "	1:20pm	X	X	X											
-5	Back House Windmill	C	4	X							X		" "	2:53pm	X	X	X											
													" "															
													"															

PLEASE NOTE: Liability and Damages. Cardinal's liability and client's exclusive remedy for any claim arising whether based in contract or tort, shall be limited to the amount paid by the client for the analyses. All claims including those for negligence and any other cause whatsoever shall be deemed waived unless made in writing and received by Cardinal within 30 days after completion of the applicable service. In no event shall Cardinal be liable for incidental or consequential damages, including without limitation, business interruptions, loss of use, or loss of profits incurred by client, its subsidiaries, affiliates or successors arising out of or related to the performance of services hereunder by Cardinal, regardless of whether such claim is based upon any of the above stated reasons or otherwise.

Terms and Conditions: Interest will be charged on all accounts more than 30 days past due at the rate of 24% per annum from the original date of invoice, and all costs of collections, including attorney's fees.

Sampler Relinquished:	Date:	Received By:	Phone Result ☐ Yes ☐ No Additional Fax #:
	Time:		Fax Result: ☐ Yes ☐ No
Relinquished By: Sergio Contreras	Date: 12/15/99	Received By: (Lab Staff)	REMARKS:
	Time: 4:15P		
Delivered By: (Circle One)	Sample Condition: Cool ☑ Yes ☐ No; Intact ☑ Yes ☐ No	CHECKED BY: (Initials)	
Sampler - UPS - Bus - Other:			

† Cardinal cannot accept verbal changes. Please fax written changes to 915-673-7020.

CARDINAL LABORATORIES

PHONE (915) 673-7001 • 2111 BEECHWOOD • ABILENE, TX 79603
PHONE (505) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240

ANALYTICAL RESULTS FOR
SAFETY & ENVIRONMENTAL SOLUTIONS, INC.
ATTN: BETH ALDRICH
703 E. CLINTON, SUITE #103
HOBBS, NM 88240
FAX TO: (505) 393-4388

Receiving Date: 12/17/99
Reporting Date: 12/20/99
Project Owner: NOT GIVEN
Project Name: OSBORN RANCH
Project Location: JAL, NM

Sampling Date: 12/17/99
Sample Type: GROUNDWATER
Sample Condition: COOL & INTACT
Sample Received By: GP
Analyzed By: AH

LAB NO.	SAMPLE ID	Na (mg/L)	Ca (mg/L)	Mg (mg/L)	K (mg/L)	Conductivity (u mhos/cm)	T-Alkalinity ($mgCaCO_3/L$)
ANALYSIS DATE:		12/20/99	12/20/99	12/20/99	12/20/99	12/20/99	12/20/99
H4523-1	BACK HOUSE WINDMILL	89	52	19	4.39	928	124
H4523-2	FRONT HOUSE WINDMILL	110	67	22	4.45	1306	164
Quality Control		NR	80	49	4.96	1392	NR
True Value QC		NR	80	50	5.00	1413	NR
% Accuracy		NR	100	98	99	99	NR
Relative Percent Difference		NR	0	2.0	0	0.2	NR
METHODS:			SM3500-Ca-D	3500-Mg E	8049	120.1	310.1

LAB NO.	SAMPLE ID	Cl^- (mg/L)	SO_4 (mg/L)	CO_3 (mg/L)	HCO_3 (mg/L)	pH (s.u.)	TDS (mg/L)
ANALYSIS DATE:		12/20/99	12/20/99	12/20/99	12/20/99	12/20/99	12/20/99
H4523-1	BACK HOUSE WINDMILL	133	92	0	151	7.51	623
H4523-2	FRONT HOUSE WINDMILL	133	146	0	200	7.60	872
Quality Control		1041	48.63	NR	971	7.07	NR
True Value QC		1000	50.00	NR	1000	7.00	NR
% Accuracy		104	97	NR	97	101	NR
Relative Percent Difference		3.0	2.9	NR	-	0	NR
METHODS:		SM4500-Cl-B	375.4	310.1	310.1	150.1	120.1

Amy Hill, Lab Tech

12/20/99
Date

H4523: XLS

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

CARDINAL LABORATORIES, INC.

2111 Beechwood, Abilene, TX 79603 101 East Marland, Hobbs, NM 88240

(915) 673-7001 Fax (915) 673-7020 (505) 393-2326 Fax (505) 393-2476

Company Name:	SESI	BILL TO	PO #:
Project Manager:		Company:	SESI
Address:	703 E. Clinton Ste. 103 Box 1613	Attn:	
City:	Hobbs State: NM Zip: 88240	Address:	
Phone #:	(505) 397-0510	City:	
Fax #:		State:	Zip:
Project #:	Project Owner:	Phone #:	
Project Name:	Osborn Ranch	Fax #:	
Project Location:	JAL		

FOR LAB USE ONLY				MATRIX						PRES.			SAMPLING		ANALYSIS REQUEST
LAB I.D.	Sample I.D.	(G)RAB OR (C)OMP.	# CONTAINERS	GROUNDWATER	WASTEWATER	SOIL	OIL	SLUDGE	OTHER:	ACID:	ICE / COOL	OTHER:	DATE	TIME	Cations & Anions
H4523-1	Back House Windmill	C	4	X							X		12-17-99	4:00 pm	X
-2	Front House Windmill	C	4	X							X		12-17-99	4:18 pm	X

PLEASE NOTE: Liability and Damages. Cardinal's liability and client's exclusive remedy for any claim arising whether based in contract or tort, shall be limited to the amount paid by the client for the analyses. All claims including those for negligence and any other cause whatsoever shall be deemed waived unless made in writing and received by Cardinal within 30 days after completion of the applicable service. In no event shall Cardinal be liable for incidental or consequental damages, including without limitation, business interruptions, loss of use, or loss of profits incurred by client, its subsidiaries, affiliates or successors arising out of or related to the performance of services hereunder by Cardinal, regardless of whether such claim is based upon any of the above stated reasons or otherwise.

Terms and Conditions: Interest will be charged on all accounts more than 30 days past due at the rate of 24% per annum from the original date of invoice, and all costs of collections, including attorney's fees.

Sampler Relinquished:	Date:	Received By:	Phone Result ☐ Yes ☐ No Additional Fax #:
	Time:		Fax Result: ☐ Yes ☐ No
Relinquished By:	Date: 12/17/99	Received By: (Lab Staff)	REMARKS:
	Time: 5:25 pm		
Delivered By: (Circle One)	Sample Condition Cool: ☒ Yes ☐ No Intact: ☒ Yes ☐ No	CHECKED BY: (Initials)	
Sampler - UPS - Bus - Other:			

† Cardinal cannot accept verbal changes. Please fax written changes to 915-673-7020.

CARDINAL LABORATORIES

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PHONE (505) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240

ANALYTICAL RESULTS FOR
SAFETY & ENVIRONMENTAL SOLUTIONS, INC.
ATTN: BETH ALDRICH
703 E. CLINTON, STE 103
HOBBS, NM 88240
FAX TO: (505) 393-4388

Receiving Date: 12/30/99
Reporting Date: 01/03/00
Project Owner: CLAY OSBORN
Project Name: OSBORN RANCH
Project Location: NORTH WATER WELL

Sampling Date: 12/30/99
Sample Type: GROUNDWATER
Sample Condition: COOL & INTACT
Sample Received By: AH
Analyzed By: BC

LAB NO.	SAMPLE ID	BENZENE (mg/L)	TOLUENE (mg/L)	ETHYL BENZENE (mg/L)	TOTAL XYLENES (mg/L)
ANALYSIS DATE		12/30/99	12/30/99	12/30/99	12/30/99
H4547-1	N. WATER WELL	<0.002	<0.002	<0.002	<0.006
Quality Control		0.090	0.103	0.101	0.309
True Value QC		0.100	0.100	0.100	0.300
% Recovery		89.7	103	101	103
Relative Percent Difference		0.5	3.0	2.4	2.8

METHOD: EPA SW-846 8260

Chemist

1/3/00
Date

H4547A.XLS

CARDINAL LABORATORIES

PHONE (915) 673-7001 • 2111 BEECHWOOD • ABILENE, TX 79603
PHONE (505) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240

ANALYTICAL RESULTS FOR
SAFETY & ENVIRONMENTAL SOLUTIONS, INC.
ATTN: BETH ALDRICH
703 E. CLINTON, STE 103
HOBBS, NM 88240
FAX TO: (505) 393-4388

Receiving Date: 12/30/99
Reporting Date: 01/03/00
Project Owner: CLAY OSBORN
Project Name: OSBORN RANCH
Project Location: NORTH WATER WELL

Sampling Date: 12/30/99
Sample Type: GROUNDWATER
Sample Condition: COOL & INTACT
Sample Received By: AH
Analyzed By: AH

LAB NUMBER SAMPLE ID	Na (mg/L)	Ca (mg/L)	Mg (mg/L)	K (mg/L)	Conductivity (u mhos/cm)	T-Alkalinity (mgCaCO3/L)
ANALYSIS DATE:	12/30/99	12/30/99	12/30/99	12/30/99	12/30/99	12/30/99
H4547-1 N. WATER WELL	396	195	67	7.64	3450	160
Quality Control	NR	79.97	48.70	4.96	1443	NR
True Value QC	NR	80.00	50.00	5.00	1413	NR
% Accuracy	NR	99	97	99	102	NR
Relative Percent Difference	NR	-	-	0	0.4	NR
METHODS:	SM3500-Ca-D		3500-Mg E	8049	120.1	310.1

LAB NUMBER SAMPLE ID	Cl⁻ (mg/L)	SO_4 (mg/L)	CO_3 (mg/L)	HCO_3 (mg/L)	pH (s.u.)	TDS (mg/L)
ANALYSIS DATE:	12/30/99	12/30/99	12/30/99	12/30/99	12/30/99	12/31/99
H4547-1 N. WATER WELL	857	257	0	195	7.10	2300
Quality Control	919	48.63	NR	971	7.03	NR
True Value QC	1000	50.00	NR	1000	7.00	NR
% Accuracy	91	97	NR	97	100	NR
Relative Percent Difference	1.3	2.9	NR	-	0	
METHODS:	SM4500-Cl-B	375.4	310.1	310.1	150.1	160.1

Amy Hill
Chemist

01/03/00
Date

H4547.XLS

CARDINAL LABORATORIES, INC.

2111 Beechwood, Abilene, TX 79603 (915) 673-7001 Fax (915) 673-7020
101 East Marland, Hobbs, NM 88240 (505) 393-2326 Fax (505) 393-2476

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

Company Name: SESI	BILL TO PO #:
Project Manager:	Company: SAME
Address: 703 E. CLINTON, #103	Attn:
City: HOBBS State: NM Zip: 88240	Address:
Phone #: (505) 397-0510	City:
Fax #: (505) 393-4388	State: Zip:
Project #: Project Owner: Clay Osburn	Phone #:
Project Name: Osburn Ranch	Fax #:
Project Location: North Water Well	

FOR LAB USE ONLY				MATRIX						PRES.			SAMPLING		ANALYSIS REQUEST	
LAB I.D.	Sample I.D.	(G)RAB OR (C)OMP.	# CONTAINERS	GROUNDWATER	WASTEWATER	SOIL	OIL	SLUDGE	OTHER:	ACID:	ICE / COOL	OTHER:	DATE	TIME	BTEX	Cations & Anions
H4547-1	North Water Well		4	✓							✓		12-30-99	12:45	✓	✓

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Sampler Relinquished:	Date: 12-30-99	Received By:	Phone Result ☐ Yes ☐ No Additional Fax #:
	Time: 12:45 PM		Fax Result: ☐ Yes ☐ No
Relinquished By:	Date: 12/30/99	Received By: (Lab Staff)	REMARKS:
	Time: 1:50		
Delivered By: (Circle One)	Sample Condition Cool ☐ Yes ☐ No Intact ☐ Yes ☐ No	CHECKED BY: (Initials)	
Sampler - UPS - Bus - Other:			

† Cardinal cannot accept verbal changes. Please fax written changes to 915-673-7020.

CARDINAL LABORATORIES

PHONE (915) 673-7001 • 2111 BEECHWOOD • ABILENE, TX 79603
PHONE (505) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240

ANALYTICAL RESULTS FOR
SAFETY & ENVIRONMENTAL SOLUTIONS, INC.
ATTN: BETH ALDRICH
703 E. CLINTON, STE 103
HOBBS, NM 88240
FAX TO: (505) 393-4388

Receiving Date: 01/06/00
Reporting Date: 01/10/00
Project Number: NOT GIVEN
Project Name: OSBORN RANCH
Project Location: JAL, NM

Sampling Date: 01/06/00
Sample Type: GROUNDWATER
Sample Condition: COOL & INTACT
Sample Received By: AH
Analyzed By: AH

LAB NUMBER	SAMPLE ID	Na (mg/L)	Ca (mg/L)	Mg (mg/L)	K (mg/L)	Conductivity (u mhos/cm)	T-Alkalinity (mg$CaCO_3$/L)
ANALYSIS DATE:		01/07/00	01/07/00	01/07/00	01/07/00	01/07/00	01/07/00
H4557-1	SOUTHWEST MW	125	134	54	6.93	2006	272
H4557-2	GOLF COURSE TANKS	504	218	58	8.06	4133	212
Quality Control		NR	79.97	48.70	4.96	1443	NR
True Value QC		NR	80.00	50.00	5.00	1413	NR
% Accuracy		NR	100	97	99	102	NR
Relative Percent Difference		NR	-	-	0	0.4	NR
METHODS:			SM3500-Ca-D	3500-Mg E	8049	120.1	310.1

LAB NUMBER	SAMPLE ID	Cl^- (mg/L)	SO_4 (mg/L)	CO_3 (mg/L)	HCO_3 (mg/L)	pH (s.u.)	TDS (mg/L)
ANALYSIS DATE:		01/07/00	01/07/00	01/07/00	01/07/00	01/07/00	01/07/00
H4557-1	SOUTHWEST MW	210	274	0	312	7.14	1419
H4557-2	GOLF COURSE TANKS	610	786	0	259	7.23	5170
Quality Control		919	48.63	NR	971	7.02	NR
True Value QC		1000	50.00	NR	1000	7.00	NR
% Accuracy		91	97	NR	97	100	NR
Relative Percent Difference		1.3	2.9	NR	-	0	NR
METHODS:		SM4500-Cl-B	375.4	310.1	310.1	150.1	160.1

Amy Hill
Chemist

01/10/00
Date

H4557A.XLS

CARDINAL LABORATORIES

PHONE (915) 673-7001 • 2111 BEECHWOOD • ABILENE, TX 79603
PHONE (505) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240

ANALYTICAL RESULTS FOR
SAFETY & ENVIRONMENTAL SOLUTIONS, INC.
ATTN: BETH ALDRICH
703 E. CLINTON, STE 103
HOBBS, NM 88240
FAX TO: (505) 393-4388

Receiving Date: 01/06/00
Reporting Date: 01/08/00
Project Number: NOT GIVEN
Project Name: OSBORN RANCH
Project Location: JAL, NM

Sampling Date: 01/06/00
Sample Type: GROUNDWATER
Sample Condition: COOL & INTACT
Sample Received By: AH
Analyzed By: BC

LAB NO.	SAMPLE ID	BENZENE (mg/L)	TOLUENE (mg/L)	ETHYL BENZENE (mg/L)	TOTAL XYLENES (mg/L)
ANALYSIS DATE		01/06/00	01/06/00	01/06/00	01/06/00
H4557-1	SOUTHWEST MW	<0.002	<0.002	<0.002	<0.006
H4557-2	GOLF COURSE TANKS	<0.002	<0.002	<0.002	<0.006
Quality Control		0.087	0.100	0.097	0.298
True Value QC		0.100	0.100	0.100	0.300
% Recovery		87.3	99.9	96.6	99.5
Relative Percent Difference		1.3	3.2	4.5	5.1

METHOD: EPA SW 846-8021B, 5030, 5021 Gas Chromatography

Chemist

1/8/00
Date

H4557B.XLS

CARDINAL LABORATORIES, INC.

2111 Beechwood, Abilene, TX 79603 101 East Marland, Hobbs, NM 88240
(915) 673-7001 Fax (915) 673-7020 (505) 393-2326 Fax (505) 393-2476

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

Page____ of____

Company Name:	SESI	BILL TO	PO #:
Project Manager:		Company:	SAME
Address:	703 E. CLINTON, #103	Attn:	
City:	HOBBS State: NM Zip: 88240	Address:	
Phone #:	(505) 397-0510	City:	
Fax #:	(505) 393-4388	State:	Zip:
Project #:	Project Owner:	Phone #:	
Project Name:	Osborn Ranch	Fax #:	
Project Location:	JAL		

FOR LAB USE ONLY				MATRIX							PRES.			SAMPLING		ANALYSIS REQUEST														
LAB I.D.	Sample I.D.	(G)RAB OR (C)OMP.	# CONTAINERS	GROUNDWATER	WASTEWATER	SOIL	OIL	SLUDGE	OTHER:	ACID:	ICE / COOL	OTHER:	DATE	TIME	BTEX	Cations & Anions														
H4557-1	Southwest M.W.	C	2	X							X		1-6-00	9:30am	X	X														
-2	Golf Course Tanks	C	2	X							X		1-6-00	10:00am	X	X														

PLEASE NOTE: Liability and Damages. Cardinal's liability and client's exclusive remedy for any claim arising whether based in contract or tort, shall be limited to the amount paid by the client for the analyses. All claims including those for negligence and any other cause whatsoever shall be deemed waived unless made in writing and received by Cardinal within 30 days after completion of the applicable service. In no event shall Cardinal be liable for incidental or consequential damages, including without limitation, business interruptions, loss of use, or loss of profits incurred by client, its subsidiaries, affiliates or successors arising out of or related to the performance of services hereunder by Cardinal, regardless of whether such claim is based upon any of the above stated reasons or otherwise.

Terms and Conditions: Interest will be charged on all accounts more than 30 days past due at the rate of 24% per annum from the original date of invoice, and all costs of collections, including attorney's fees.

Sampler Relinquished:	Date:	Received By:	Phone Result ☐ Yes ☐ No Additional Fax #:
	Time:		Fax Result: ☐ Yes ☐ No
Relinquished By:	Date: 1-6-00	Received By: (Lab Staff)	REMARKS:
	Time: 11:45		
Delivered By: (Circle One)	Sample Condition Cool ☐ Yes ☐ No Intact ☐ Yes ☐ No	CHECKED BY: (Initials)	
Sampler - UPS - Bus - Other:			

† Cardinal cannot accept verbal changes. Please fax written changes to 915-673-7020.

CARDINAL LABORATORIES

PHONE (915) 673-7001 • 2111 BEECHWOOD • ABILENE, TX 79603
PHONE (505) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240

ANALYTICAL RESULTS FOR
SAFETY & ENVIRONMENTAL SOLUTIONS, INC.
ATTN: BOB ALLEN
703 E. CLINTON, SUITE #103
HOBBS, NM 88240
FAX TO: (505) 393-4388

Receiving Date: 01/12/00
Reporting Date: 01/14/00
Project Number: NOT GIVEN
Project Name: OSBORN
Project Location: NOT GIVEN

Sampling Date: 01/12/00
Sample Type: GROUNDWATER
Sample Condition: COOL & INTACT
Sample Received By: GP
Analyzed By: AH

LAB NUMBER SAMPLE ID	Na (mg/L)	Ca (mg/L)	Mg (mg/L)	K (mg/L)	Conductivity (u mhos/cm)	T-Alkalinity ($mgCaCO_3/L$)
ANALYSIS DATE:	01/14/00	01/13/00	01/13/00	01/13/00	01/13/00	01/13/00
H4573-1 COUNTRY CLUB TANKS	579	180	59	10.6	3290	196
Quality Control	NR	80.0	48.7	5.00	1392	NR
True Value QC	NR	80.0	50.0	5.00	1413	NR
% Recovery	NR	100	97.4	100	98.5	NR
Relative Percent Difference	NR	0	0.6	0.8	0.2	NR
METHODS:		SM3500-Ca-D	3500-Mg E	8049	120.1	310.1

LAB NUMBER SAMPLE ID	Cl^- (mg/L)	SO_4 (mg/L)	CO_3 (mg/L)	HCO_3 (mg/L)	pH (s.u.)	TDS (mg/L)
ANALYSIS DATE:	01/13/00	01/13/00	01/13/00	01/13/00	01/13/00	01/13/00
H4573-1 COUNTRY CLUB TANKS	667	796	0	239	6.98	2260
Quality Control	1010	48.63	NR	971	7.03	NR
True Value QC	1000	50.00	NR	1000	7.00	NR
% Recovery	101	97.3	NR	97.1	100	NR
Relative Percent Difference	10.0	2.9	NR	3.0	0.1	
METHODS:	SM4500-Cl-B	375.4	310.1	310.1	150.1	160.1

Gayle A. Potter, Chemist

01/14/2000
Date

H4573 XLS

ARDINAL LABORATORIES, INC.
2111 Beechwood, Abilene, TX 79603 (915) 673-7001 Fax (915) 673-7020
101 East Marland, Hobbs, NM 88240 (505) 393-2326 Fax (505) 393-2476

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

Page____ of____

Company Name: Sesi	**BILL TO** PO #:
Project Manager: Allen	Company:
Address: 703 E Clinton	Attn:
City: Hobbs State: Zip:	Address:
Phone #: 505-3978510	City:
Fax #:	State: Zip:
Project #: Project Owner:	Phone #:
Project Name: Osborn	Fax #:
Project Location:	

ANALYSIS REQUEST: Major-Cation-Anions

LAB I.D. (FOR LAB USE ONLY)	Sample I.D.	(G)RAB OR (C)OMP.	# CONTAINERS	MATRIX: GROUNDWATER	WASTEWATER	SOIL	OIL	SLUDGE	OTHER:	PRES.: ACID:	ICE / COOL	OTHER:	SAMPLING DATE	TIME	Major-Cation-Anions												
H4573	County Club Tanks		X	V									1-12-00	3:45	X												

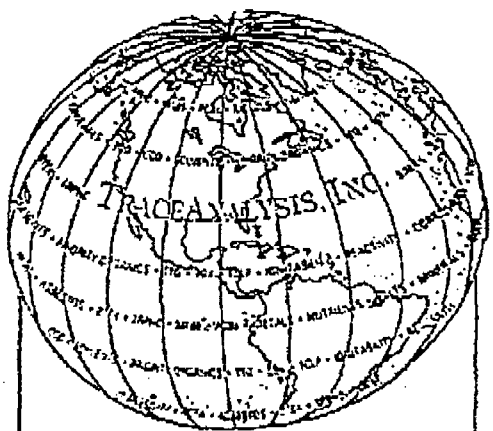
PLEASE NOTE: Liability and Damages. Cardinal's liability and client's exclusive remedy for any claim arising whether based in contract or tort, shall be limited to the amount paid by the client for the analyses. All claims including those for negligence and any other cause whatsoever shall be deemed waived unless made in writing and received by Cardinal within 30 days after completion of the applicable service. In no event shall Cardinal be liable for incidental or consequental damages, including without limitation, business interruptions, loss of use, or loss of profits incurred by client, its subsidiaries, affiliates or successors arising out of or related to the performance of services hereunder by Cardinal, regardless of whether such claim is based upon any of the above stated reasons or otherwise.

Terms and Conditions: Interest will be charged on all accounts more than 30 days past due at the rate of 24% per annum from the original date of invoice, and all costs of collections, including attorney's fees.

Sampler Relinquished: [signature]	Date: 1-12-00 Time: 4:38	Received By:	Phone Result ☐ Yes ☐ No Additional Fax #: Fax Result: ☐ Yes ☐ No REMARKS:
Relinquished By:	Date: 01/12/2000 Time: 4:40	Received By: (Lab Staff) [signature]	
Delivered By: (Circle One) Sampler - UPS - Bus - Other:		Sample Condition Cool ☒ Yes ☐ No; Intact ☒ Yes ☐ No — CHECKED BY: (Initials)	

† Cardinal cannot accept verbal changes. Please fax written changes to 915-673-7020.

TRACEANALYSIS, INC.
6701 Aberdeen Avenue, Suite 9 Lubbock, Texas 79424 800•378•1296 806•794•1296 FAX 806•794•1298
4725 Ripley Avenue, Suite A El Paso, Texas 79922 888•588•3443 915•585•3443 FAX 915•585•4944
E Mail: lab@traceanalysis.com



DRAFT

FAX COVER SHEET

TO: David Boyer

COMPANY: Safety & Envir.

DATE: 03/17/00

FAX NO: (505)281-1335

NO OF PAGES FOLLOWING:

FROM:

MESSAGE: David there will be re-run to see if the balances come out better on Monday

James

TRACEANALYSIS, INC.
A Laboratory For Advanced
Environmental Research and Analysis

TRACEANALYSIS, INC.
6701 Aberdeen Avenue, Suite 9 Lubbock, Texas 79424 800•378•1296 806•794•1296 FAX 806•794•1298
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E-Mail: lab@traceanalysis.com

Analytical and Quality Control Report

David Boyer
Safety & Environmental Solutions Inc.
P. O Box 1613
Hobbs, NM 88240

Report Date: 3/17/00

DRAFT

Project Number: N/A
Project Name: Osburn Ranch
Project Location: Jal, NM

Order ID Number: A00031502

Enclosed are the Analytical Results and Quality Control Data Reports for the following samples submitted to TraceAnalysis, Inc. for analysis:

Sample Number	Sample Description	Matrix	Date Taken	Time Taken	Date Received
142562	North West C.C. Well #11	Water	3/14/00	10:40	3/15/00
142563	MW #6 Sec. 7 Well	Water	3/14/00	11:00	3/15/00
142564	MW #7 Tex New Mex	Water	3/14/00	11:20	3/15/00

These results represent only the samples received in the laboratory. The Quality Control Report is generated on a batch basis. All information contained in this report is for the analytical batch(es) in which your sample(s) were analyzed.

This report consists of a total of 8 pages and shall not be reproduced except in its entirety, without written approval of TraceAnalysis, Inc.

Dr. Blair Leftwich, Director

Report Date: 3/17/00 Order ID Number: A00031502 Page Number: 2 of 8
N/A Osburn Ranch Jal, NM

Analytical Results Report

Sample Number: 142562
Description: North West C.C. Well #11

Param	Result	Dilution	Analytical Method	Date Prepared	Date Analyzed	Analyst	Prep Batch #	QC Batch #	RDL
Alkalinity (mg/L as CaCo3)									
Hydroxide Alkalinity	<1.0	1	E 310.1	3/17/00	3/17/00	JS	PB01307	QC01576	1
Carbonate Alkalinity	<1.0	1	E 310.1	3/17/00	3/17/00	JS	PB01307	QC01576	1
Bicarbonate Alkalinity	99	1	E 310.1	3/17/00	3/17/00	JS	PB01307	QC01576	1
Total Alkalinity	99	1	E 310.1	3/17/00	3/17/00	JS	PB01307	QC01576	1
Conductivity (uMHOS/cm)									
Specific Conductance	1300	1	SM 2510B	3/17/00	3/17/00	JS	PB01309	QC01578	
Dissolved Metals (mg/L)									
Dissolved Calcium	54	1	E 200.7	3/17/00	3/17/00	RR	PB01312	QC01572	1
Dissolved Magnesium	57	1	E 200.7	3/17/00	3/17/00	RR	PB01312	QC01572	1
Dissolved Potassium	7.8	1	E 200.7	3/17/00	3/17/00	RR	PB01312	QC01572	1
Dissolved Sodium	85	1	E 200.7	3/17/00	3/17/00	RR	PB01312	QC01572	1
Ion Chromatography (IC) (mg/L)									
Cl.	* 400	1	E 300.0	3/15/00	3/15/00	JS	PB01304	QC01573	0.5
Fluoride	0.82	1	E 300.0	3/15/00	3/15/00	JS	PB01304	QC01573	0.2
Nitrate-N	<1.0	1	E 300.0	3/15/00	3/15/00	JS	PB01304	QC01573	0.2
Sulfate	5.2	1	E 300.0	3/15/00	3/15/00	JS	PB01304	QC01573	0.5
* CL - Chloride re-ran on IC031600 sch(PB01305; QC01574) ICV %IA = 96; CCV %IA = 96; Matrix spikes RPD = 0; Matrix spikes %EA = 97									
TDS (mg/L)									
Total Dissolved Solids	710	1	E 160.1	3/15/00	3/16/00	MD	PB01287	QC01552	10

Sample Number: 142563
Description: MW #6 Sec. 7 Well

Param	Result	Dilution	Analytical Method	Date Prepared	Date Analyzed	Analyst	Prep Batch #	QC Batch #	RDL
Alkalinity (mg/L as CaCo3)									
Hydroxide Alkalinity	<1.0	1	E 310.1	3/17/00	3/17/00	JS	PB01307	QC01576	1
Carbonate Alkalinity	<1.0	1	E 310.1	3/17/00	3/17/00	JS	PB01307	QC01576	1
Bicarbonate Alkalinity	69	1	E 310.1	3/17/00	3/17/00	JS	PB01307	QC01576	1
Total Alkalinity	69	1	E 310.1	3/17/00	3/17/00	JS	PB01307	QC01576	1
Conductivity (uMHOS/cm)									
Specific Conductance	3000	1	SM 2510B	3/17/00	3/17/00	JS	PB01309	QC01578	
Dissolved Metals (mg/L)									
Dissolved Calcium	193	1	E 200.7	3/17/00	3/17/00	RR	PB01312	QC01572	1
Dissolved Magnesium	68	1	E 200.7	3/17/00	3/17/00	RR	PB01312	QC01572	1
Dissolved Potassium	5.2	1	E 200.7	3/17/00	3/17/00	RR	PB01312	QC01572	1
Dissolved Sodium	203	1	E 200.7	3/17/00	3/17/00	RR	PB01312	QC01572	1
Ion Chromatography (IC) (mg/L)									
Cl.	* 770	1	E 300.0	3/15/00	3/15/00	JS	PB01304	QC01573	0.5
Fluoride	1.1	1	E 300.0	3/15/00	3/15/00	JS	PB01304	QC01573	0.2
Nitrate-N	<1.0	1	E 300.0	3/15/00	3/15/00	JS	PB01304	QC01573	0.2
Sulfate	250	1	E 300.0	3/15/00	3/15/00	JS	PB01304	QC01573	0.5

Report Date: 3/17/00 Order ID Number: A00031502 Page Number: 3 of 8

N/A Osburn Ranch Jal, NM

* CL. - Chloride re-ran on IC031600.sch(PB01305; QC01574) ICV %IA = 96; CCV %IA = 96; Matrix spikes RPD = 0; Matrix spikes %EA 97.

Parm	Result	Dilution	Analytical Method	Date Prepared	Date Analyzed	Analyst	Prep Batch #	QC Batch #	RDL
TDS (mg/L)									
Total Dissolved Solids	1700	1	E 160.1	3/15/00	3/16/00	MD	PB01287	QC01552	10

Sample Number: 142564
Description: MW #7 Tex New Mex.

Parm	Result	Dilution	Analytical Method	Date Prepared	Date Analyzed	Analyst	Prep Batch #	QC Batch #	RDL
Alkalinity (mg/L as CaCo3)									
Hydroxide Alkalinity	<1.0	1	E 310.1	3/17/00	3/17/00	JS	PB01307	QC01576	1
Carbonate Alkalinity	<1.0	1	E 310.1	3/17/00	3/17/00	JS	PB01307	QC01576	1
Bicarbonate Alkalinity	297	1	E 310.1	3/17/00	3/17/00	JS	PB01307	QC01576	1
Total Alkalinity	297	1	E 310.1	3/17/00	3/17/00	JS	PB01307	QC01576	1
Conductivity (uMHOS/cm)									
Specific Conductance	1700	1	SM 2510B	3/17/00	3/17/00	JS	PB01309	QC01578	
Dissolved Metals (mg/L)									
Dissolved Calcium	208	1	E 200.7	3/17/00	3/17/00	RR	PB01312	QC01572	1
Dissolved Magnesium	62	1	E 200.7	3/17/00	3/17/00	RR	PB01312	QC01572	1
Dissolved Potassium	1.7	1	E 200.7	3/17/00	3/17/00	RR	PB01312	QC01572	1
Dissolved Sodium	76	1	E 200.7	3/17/00	3/17/00	RR	PB01312	QC01572	1
Ion Chromatography (IC) (mg/L)									
CL	200	1	E 300.0	3/15/00	3/15/00	JS	PB01304	QC01573	0.5
Fluoride	2.7	1	E 300.0	3/15/00	3/15/00	JS	PB01304	QC01573	0.2
Nitrate-N	3.5	1	E 300.0	3/15/00	3/15/00	JS	PB01304	QC01573	0.2
Sulfate Sulfate	*420	1	E 300.0	3/15/00	3/15/00	JS	PB01304	QC01573	0.5

* Sulfate - ~~Sulfate~~ re-ran on IC031600.sch(PB01305; QC01574). ICV %IA = 102; CCV %IA = 101; Matrix spikes RPD = 3; Matrix spikes %EA = 103

Parm	Result	Dilution	Analytical Method	Date Prepared	Date Analyzed	Analyst	Prep Batch #	QC Batch #	RDL
TDS (mg/L)									
Total Dissolved Solids	1200	1	E 160.1	3/15/00	3/16/00	MD	PB01287	QC01552	10

Report Date: 3/17/00 Order ID Number: A00031502 Page Number: 4 of 8
N/A Osburn Ranch Jal, NM

Quality Control Report
Method Blanks

Param	Flag	Blank Result	Reporting Limit	Date Analyzed	Prep Batch #	QC Batch #
Hydroxide Alkalinity (mg/L as CaCo3)		<1.0	1	3/17/00	PB01307	QC01576
Carbonate Alkalinity (mg/L as CaCo3)		<1.0	1	3/17/00	PB01307	QC01576
Bicarbonate Alkalinity (mg/L as CaCo3)		<4.0	1	3/17/00	PB01307	QC01576
Total Alkalinity (mg/L as CaCo3)		<4.0	1	3/17/00	PB01307	QC01576

Param	Flag	Blank Result	Reporting Limit	Date Analyzed	Prep Batch #	QC Batch #
Specific Conductance (uMHOS/cm)		4.3		3/17/00	PB01309	QC01578

Param	Flag	Blank Result	Reporting Limit	Date Analyzed	Prep Batch #	QC Batch #
Dissolved Calcium (mg/L)		<1.0	1	3/17/00	PB01312	QC01572
Dissolved Magnesium (mg/L)		<1.0	1	3/17/00	PB01312	QC01572
Dissolved Potassium (mg/L)		<1.0	1	3/17/00	PB01312	QC01572
Dissolved Sodium (mg/L)		<1.0	1	3/17/00	PB01312	QC01572

Param	Flag	Blank Result	Reporting Limit	Date Analyzed	Prep Batch #	QC Batch #
CL (mg/L)		<0.5	0.5	3/15/00	PB01304	QC01573
Fluoride (mg/L)		<0.2	0.2	3/15/00	PB01304	QC01573
Nitrate-N (mg/L)		<0.2	0.2	3/15/00	PB01304	QC01573
Sulfate (mg/L)		<0.5	0.5	3/15/00	PB01304	QC01573

Param	Flag	Blank Result	Reporting Limit	Date Analyzed	Prep Batch #	QC Batch #
Total Dissolved Solids (mg/L)		<10	10	3/16/00	PB01287	QC01552

Report Date: 3/17/00 Order ID Number: A00031502 Page Number: 5 of 8
N/A Oxburn Ranch Jal, NM

Quality Control Report
Matrix Spike and Matrix Duplicate Spike

Standard	Param	Sample Result	Dil.	Spike Amount Added	Matrix Spike Result	% Rec.	RPD	% Rec. Limit	RPD Limit	QC Batch #
MS	Dissolved Calcium (mg/L)	54	1	1000	1029	98		75 - 125	-	QC01572
MS	Dissolved Magnesium (mg/L)	57	1	1000	1040	98		75 - 125	-	QC01572
MS	Dissolved Potassium (mg/L)	7.8	1	1000	1146	114		75 - 125	-	QC01572
MS	Dissolved Sodium (mg/L)	85	1	1000	1167	108		75 - 125	-	QC01572
MSD	Dissolved Calcium (mg/L)	54	1	1000	1043	99	1	-	0 - 20	QC01572
MSD	Dissolved Magnesium (mg/L)	57	1	1000	1054	100	1	-	0 - 20	QC01572
MSD	Dissolved Potassium (mg/L)	7.8	1	1000	1159	115	1	-	0 - 20	QC01572
MSD	Dissolved Sodium (mg/L)	85	1	1000	1182	110	1	-	0 - 20	QC01572

Standard	Param	Sample Result	Dil.	Spike Amount Added	Matrix Spike Result	% Rec.	RPD	% Rec. Limit	RPD Limit	QC Batch #
MS	CL (mg/L)	39000	1	12500	49281.40	82		80 - 120	-	QC01573
MS	Nitrate-N (mg/L)	<10	1	5000	5148.66	103		80 - 120	-	QC01573
MS	Sulfate (mg/L)	6000	1	12500	19468.07	108		80 - 120	-	QC01573
MSD	CL (mg/L)	39000	1	12500	49406.98	83	1	-	0 - 20	QC01573
MSD	Nitrate-N (mg/L)	<10	1	5000	5185.49	104	1	-	0 - 20	QC01573
MSD	Sulfate (mg/L)	6000	1	12500	19303.78	106	1	-	0 - 20	QC01573

Quality Control Report
Duplicates

Standard	Param	Flag	Duplicate Result	Sample Result	Dilution	RPD	RPD Limit	QC Batch #
Duplicate	Hydroxide Alkalinity (mg/L as CaCo		<1.0	<1.0	1	0	0 - 20	QC01576
Duplicate	Carbonate Alkalinity (mg/L as CaCo		<1.0	<1.0	1	0	0 - 20	QC01576
Duplicate	Bicarbonate Alkalinity (mg/L as CaC		44	46	1	4	0 - 20	QC01576
Duplicate	Total Alkalinity (mg/L as CaCo3)		44	46	1	4	0 - 20	QC01576

Standard	Param	Flag	Duplicate Result	Sample Result	Dilution	RPD	RPD Limit	QC Batch #
Duplicate	Specific Conductance (uMHOS/cm)		103613	100000	1	4	0 - 20	QC01578

Report Date: 3/17/00 Order ID Number: A00031502 Page Number: 6 of 8
N/A Osburn Ranch Jal, NM

Standard	Param	Flag	Duplicate Result	Sample Result	Dilution	RPD	RPD Limit	QC Batch #
Duplicate	Total Dissolved Solids (mg/L)		1214	1200	1	1	0 - 20	QC01552

Quality Control Report
Lab Control Spikes and Duplicate Spike

	Param	Blank Result	Dil.	Spike Amount Added	Matrix Spike Result	% Rec.	RPD	% Rec Limit	RPD Limit	QC Batch #
LCS	Dissolved Calcium (mg/L)	<1.0	1	1000	986	99		75 - 125	-	QC01572
LCS	Dissolved Magnesium (mg/L)	<1.0	1	1000	988	99		75 - 125	-	QC01572
LCS	Dissolved Potassium (mg/L)	<1.0	1	1000	1087	109		75 - 125	-	QC01572
LCS	Dissolved Sodium (mg/L)	<1.0	1	1000	1044	104		75 - 125		QC01572
LCSD	Dissolved Calcium (mg/L)	<1.0	1	1000	982	98	0	-	0 - 20	QC01572
LCSD	Dissolved Magnesium (mg/L)	<1.0	1	1000	984	98	0	-	0 - 20	QC01572
LCSD	Dissolved Potassium (mg/L)	<1.0	1	1000	1100	110	5	-	0 - 20	QC01572
LCSD	Dissolved Sodium (mg/L)	<1.0	1	1000	1042	104	4	-	0 - 20	QC01572

	Param		Blank Result	Dil.	Spike Amount Added	Matrix Spike Result	% Rec.	RPD	% Rec. Limit	RPD Limit	QC Batch #
LCS	Fluoride (mg/L)	*	<0.2	1	2.5	2.51	100		80 - 120	-	QC01573
* Fluoride - Blank spikes used because I'm re-running the fluoride on the sample that I spiked.											
LCSD	Fluoride (mg/L)	*	<0.2	1	2.5	2.67	107	6	-	0 - 20	QC01573
* Fluoride - Blank spikes used because I'm re-running the fluoride on the sample that I spiked.											

Report Date: 3/17/00 Order ID Number: A00031502 Page Number: 7 of 8
N/A Osburn Ranch Jal, NM

Quality Control Report
Continuing Calibration Verification Standard

Standard	Param	Flag	CCVs TRUE Conc.	CCVs Found Conc.	CCVs Percent Recovery	Percent Recovery Limits	Date Analyzed	QC Batch #
ICV	Hydroxide Alkalinity (mg/L as CaCo3)		0	<1.0	0	80 - 120	3/17/00	QC01576
ICV	Carbonate Alkalinity (mg/L as CaCo3)		0	240	0	80 - 120	3/17/00	QC01576
ICV	Bicarbonate Alkalinity (mg/L as CaCo3)		0	4	0	80 - 120	3/17/00	QC01576
ICV	Total Alkalinity (mg/L as CaCo3)		236	244	103	80 - 120	3/17/00	QC01576
CCV 1	Hydroxide Alkalinity (mg/L as CaCo3)		0	<1.0	0	80 - 120	3/17/00	QC01576
CCV 1	Carbonate Alkalinity (mg/L as CaCo3)		0	228	0	80 - 120	3/17/00	QC01576
CCV 1	Bicarbonate Alkalinity (mg/L as CaCo3)		0	10	0	80 - 120	3/17/00	QC01576
CCV 1	Total Alkalinity (mg/L as CaCo3)		236	238	101	80 - 120	3/17/00	QC01576

Standard	Param	Flag	CCVs TRUE Conc.	CCVs Found Conc.	CCVs Percent Recovery	Percent Recovery Limits	Date Analyzed	QC Batch #
ICV	Specific Conductance (uMHOS/cm)		1413	1381	98	80 - 120	3/17/00	QC01578
CCV 1	Specific Conductance (uMHOS/cm)		1413	1362	96	80 - 120	3/17/00	QC01578

Standard	Param	Flag	CCVs TRUE Conc.	CCVs Found Conc.	CCVs Percent Recovery	Percent Recovery Limits	Date Analyzed	QC Batch #
ICV	Dissolved Calcium (mg/L)		20	21	105	75 - 125	3/17/00	QC01572
ICV	Dissolved Magnesium (mg/L)		20	21	105	75 - 125	3/17/00	QC01572
ICV	Dissolved Potassium (mg/L)		20	18	90	75 - 125	3/17/00	QC01572
ICV	Dissolved Sodium (mg/L)		20	18	90	75 - 125	3/17/00	QC01572
CCV 1	Dissolved Calcium (mg/L)		20	21	105	75 - 125	3/17/00	QC01572
CCV 1	Dissolved Magnesium (mg/L)		20	21	105	75 - 125	3/17/00	QC01572
CCV 1	Dissolved Potassium (mg/L)		20	19	95	75 - 125	3/17/00	QC01572
CCV 1	Dissolved Sodium (mg/L)		20	18	90	75 - 125	3/17/00	QC01572

Standard	Param	Flag	CCVs TRUE Conc.	CCVs Found Conc.	CCVs Percent Recovery	Percent Recovery Limits	Date Analyzed	QC Batch #
ICV	CL (mg/L)		12.5	11.89	95	80 - 120	3/15/00	QC01573
ICV	Fluoride (mg/L)		2.5	2.59	104	80 - 120	3/15/00	QC01573
ICV	Nitrate-N (mg/L)		5	4.75	95	80 - 120	3/15/00	QC01573
ICV	Sulfate (mg/L)		12.5	13.01	104	80 - 120	3/15/00	QC01573
CCV 1	CL (mg/L)		12.5	11.93	95	80 - 120	3/15/00	QC01573
CCV 1	Fluoride (mg/L)		2.5	2.53	101	80 - 120	3/15/00	QC01573
CCV 1	Nitrate-N (mg/L)		5	4.86	97	80 - 120	3/15/00	QC01573
CCV 1	Sulfate (mg/L)		12.5	12.59	101	80 - 120	3/15/00	QC01573

Report Date: 3/17/00 Order ID Number: A00031502 Page Number: 8 of 8
N/A Osburn Ranch Jal, NM

Quality Control Report
Continuing Calibration Verification Standard

Standard	Param	Flag	CCVs TRUE Conc.	CCVs Found Conc.	CCVs Percent Recovery	Percent Recovery Limits	Date Analyzed	QC Batch #
ICV	Total Dissolved Solids (mg/L)		1000	999	100	80 - 120	3/16/00	QC01552
CCV 1	Total Dissolved Solids (mg/L)		1000	976	98	80 - 120	3/16/00	QC01552

Cation-Anion Balance Sheet

DATE: 3/17/00

Sample #	Calcium ppm	Magnesium ppm	Sodium ppm	Potassium ppm	Alkalinity ppm	Sulfate ppm	Chloride ppm	Nitrate ppm	Fluoride ppm	TDS ppm	EC µMHOs/cm
142562	54	67	65	7.8	99.00	5.2	400	0	0.82	710	1300
142563	193	68	203	5.2	69.00	250	770	0	1.1	1700	3000
142564	208	62	76	1.7	297.00	420	200	3.5	2.7	1200	1700

Sample #	Calcium in meq/L	Magnesium in meq/L	Sodium in meq/L	Potassium in meq/L	Alkalinity in meq/L	Sulfate in meq/L	Chloride in meq/L	Nitrate in meq/L	Fluoride in meq/L	Total Cations in meq/L	Total Anions in meq/L	Percentage Error
142562	2.69	4.99	3.70	0.20	1.98	0.11	11.29	0	0.0431848	11.26	13.42	17.27517076
142563	9.63	5.60	8.83	0.13	1.38	5.21	21.72	0	0.057904	24.19	28.36	15.85699283
142564	10.36	5.10	3.31	0.04	5.94	8.74	5.64	0.246885	0.142128	18.83	20.72	9.548254844

	EC/Cation	EC/Anion				
142562	1128.2154	1341.54268	range	1170	to	1430
142563	2418.9936	2836.4504	range	2700	to	3300
142564	1883.0865	2071.8393	range	1520	to	1970

TDS/EC	TDS/Cat	TDS/Anion	
0.55	0.63	0.53	needs to be 0.55-0.77
0.57	0.70	0.60	needs to be 0.55-0.77
0.71	0.64	0.58	needs to be 0.55-0.77

142562-64

A000 31502

TraceAnalysis, Inc.

6701 Aberdeen Avenue Lubbock, Texas 79424
Tel (806) 794 1296 Fax (806) 794 1298
1 (800) 378 1296

CHAIN-OF-CUSTODY RECORD AND ANALYSIS REQUEST

Project Manager: David Boyer / Bob Allen

Phone #: (505) 397-0510

FAX #: (505) 393-4388

Company Name & Address: Safety & Environmental 703 E. Clinton

Project #:

Project Name: Osborn Ranch

Project Location: North of Jal

Sampler Signature: Sergio Contreras

LAB # (LAB USE ONLY)	FIELD CODE	# CONTAINERS	Volume/Amount	MATRIX: WATER	SOIL	AIR	SLUDGE	PRESERVATIVE METHOD: HCL	HNO3	ICE	NONE	SAMPLING: DATE	TIME	BTEX MTBE	TPH	Total Metals Ag As Ba Cd Cr Pb Hg Se	TCLP Metals Ag As Ba Cd Cr Pb Hg Se	TCLP Volatiles	TCLP Semi Volatiles	RCI	8240 / 8260	8270	Cations & Anions	TDS cond per Bob 3/15	Turn around # of days	Fax ASAP	Hold
142562	North west C.C. Well #11	1		X						X		3-14-00	10:40										X		5	X	
63	MW #6 Sec. 7 Well	1		X						X		" "	11:00										X		5	X	
64	MW #7 Tex. New. Mex	1		X						X		" "	[illegible]										X		5	X	

Relinquished by:	Date:	Time:	Received by:	Date:	Time:
Sergio Contreras	3-14-00	1:00 pm			
			Received at Laboratory by: Vicki Beasley	3-15-00	4:05 pm

REMARKS:

Tolman [illegible]