



DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS 833D COMBAT SUPPORT GROUP (TAC)  
HOLLOMAN AIR FORCE BASE, NM 88330 5000

*File HAFB  
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REPLY TO  
ATTN OF 833 CSG/DEV

07 AUG 1991

SUBJECT Groundwater Reports

TO ATTN: Dr Bruce Swanton  
Hazardous and Radioactive Waste Bureau  
New Mexico Environment Department  
1190 St. Francis Dr.  
Santa Fe, New Mexico 87503

1. Enclosed are one copy each of the following reports:

-Third Semi-annual Groundwater Sampling Report

-Background Contamination Indicator Parameter Summary Statistics for  
Upgradient Wells Report and Comparisons with Data from the Second  
Semi-annual Groundwater Sampling Episode

-Background Contamination Indicator Parameter Summary Statistics for  
Upgradient Wells Report and Comparisons with Data from the Third  
Semi-annual Groundwater Sampling Episode

2. Please contact Mrs Sharon Moore at 479-3931 if you have any  
questions/comments regarding these reports.

*Howard E. Moffitt*  
HOWARD E. MOFFITT  
Deputy Base Civil Engineer

Atch  
3 Reports

cc: See Distribution List

*Reports  
Not Found*

AUG - 8

FEDERAL FACILITIES COMPLIANCE AGREEMENT

cc w/ ATCH

Mr. Courtland Fesmire Certified Mail - Return Receipt Request P 336 128 519  
Attn: Ellen Graber  
US Environmental Protection Agency, Region VI, 6H-CS  
First Interstate Bank Tower  
1445 Ross Avenue  
Dallas, Texas 75202-2733

Dr. Bruce Swanton Certified Mail - Return Receipt Request P 754 967 381  
Hazardous Waste Bureau  
Environmental Improvement Division  
New Mexico Health and Environment Department  
1190 St. Francis Dr.  
Santa Fe, New Mexico 87503

Mr Mark Peycke, Assistant Regional Counsel, (Certified Mail - Return Receipt  
US Environmental Protection Agency, Region VI, 6C-H Request P 336 128 521)  
First Interstate Bank Tower  
1445 Ross Avenue  
Dallas, Texas 75202-2733

Bureau of Land Management  
1800 Marquess  
Las Cruces, NM 88005

Fish and Wildlife Service  
3530 Pan American Highway NE  
Albuquerque, NM 87107

Radian Corporation  
8501 Mo-Pac Blvd  
Austin, TX 78720-1088

cc w/o ATCH

833 AD/JA  
Holloman AFB, NM 88330

HQ TAC/JA & HQ TAC/DEV  
Langley AFB, VA 23665

US Army Corps of Engineers  
Omaha District  
Attn: Larry Janis  
215 N. 17th Street  
Omaha, NE 68102-4978

Mr. Raymond P Churan  
Regional Environmental Officer  
United States Department of the Interior  
PO Box 649  
Albuquerque, NM 87103

Attn: Mr Lopez and Mr Jahns  
U.S. Air Force  
PO Box 116  
525 Griffin St  
Dallas, TX 75202

**THIRD SEMIANNUAL  
GROUNDWATER SAMPLING REPORT  
JANUARY 14 - JANUARY 17, 1991  
HOLLOMAN AIR FORCE BASE, NEW MEXICO**

Prepared for:

**HQ TAC/DEEV  
Langley AFB, Virginia 23665-5542**

Under Contract with:

**U.S. Army Corps of Engineers, Omaha District  
215 North 17th Street, CEMRO-ED-EB  
Omaha, Nebraska 68102-4978**

Prepared by:

**International Technology Corporation  
5301 Central Avenue, N.E., Suite 700  
Albuquerque, New Mexico 87108**

**June 1991**

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<b>2</b>	<b>Concentrations of Groundwater Quality Parameters, Sewage Treatment Lagoons Monitoring Wells, Holloman Air Force Base, New Mexico, January 1991</b>
<b>3</b>	<b>Concentrations of Groundwater Contamination Indicator Parameters, Sewage Treatment Lagoons Monitoring Wells, Holloman Air Force Base, New Mexico, January 1991</b>
<b>4</b>	<b>Method Detection Limits, Sewage Treatment Lagoons Monitoring Wells, Holloman Air Force Base, New Mexico, January 1991</b>

## **1.0 Introduction**

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International Technology Corporation (IT) is the prime Architect-Engineer (A-E) contracted by the U.S. Army Corps of Engineers, Omaha District, to implement a Resource Conservation and Recovery Act (RCRA) Groundwater Monitoring Program (described in Code of Federal Regulations Title 40, Part 265 [40 CFR 265]) at the sewage lagoons and Lakes Holloman and Stinky, Holloman Air Force Base, New Mexico. The groundwater monitoring program is being performed under Contract No. DACW45-88-D-0008 and in accordance with the December 22, 1989, signed Federal Facility Compliance Agreement (FFCA) between Holloman Air Force Base, the New Mexico Environmental Improvement Division, and the U.S. Environmental Protection Agency, Region VI. As part of the groundwater monitoring program, this groundwater sampling episode, the seventh since August 1989, was performed during the period January 14 through 17, 1991, by IT. This January 1991 sampling episode is the third of a series of four semiannual sampling episodes planned at the Holloman Air Force Base sewage treatment lagoons monitoring wells designed to satisfy the semiannual and annual sampling requirements of 40 CFR 265.92(d)(1) and (2) and the FFCA. This report describes the results of the third semiannual sampling round. Groundwater sampling was conducted in accordance with the Architect-Engineer Safety, Health and Emergency Response Plan (A-E SHERP) (IT, 1989a) and the Architect-Engineer Quality Control Plan/Sampling Plan for Groundwater Study and Monitoring Program, Holloman Air Force Base, New Mexico (A-E QCP/SP) (IT, 1989b). The A-E QCP/SP is based on the Hydrogeologic Investigation Report and Groundwater Monitoring Plan for the Sewage Treatment Lagoons, Holloman Air Force Base, NM 88330 (Radian, 1989). The groundwater monitoring plan was approved by the EPA in 1989.

In accordance with the groundwater monitoring requirements of 40 CFR 265.92(d), samples were collected and analyzed for concentrations of those parameters characterizing the groundwater quality [40 CFR 265.92(b)(2)]. Concentrations for groundwater contamination indicator parameters [40 CFR 265.92(b)(3)] were also determined in the samples. Descriptions of field methods employed and a discussion of analytical and quality control results are provided below. Job logs documenting daily field activities are presented in Appendix A.

## **2.0 Field Methods and Measurements**

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Field measurements made prior to groundwater sample collection determined the presence or absence of organic vapors and nonaqueous phase liquids in the wells, well water-levels,

and total well depths. This information led to calculation of well-bore water volumes, the volumes of water to be purged prior to well sampling, and the frequency of field pH and specific conductance measurements taken during well purging. Data forms documenting field measurement activities are provided in Appendix B.

### ***2.1 Organic Vapor Detection***

The presence of organic vapors in a well-bore atmosphere can be an indicator of nonaqueous phase liquids possibly being present in the well. Prior to measuring water levels in each well, the well head atmosphere was analyzed for organic vapors using a calibrated HNu PI-101 field photoionization detector with a 10.2-eV lamp. Calibration of the HNu instrument was accomplished using a standard reference gas (100-ppm isobutylene/air) prior to analyzing any well head atmospheres. Additionally, a background organic vapor concentration value was measured at each well location by sampling the atmosphere at large. Then, immediately after opening the monitor well cap, the detector was inserted into the well casing and the organic vapor content was measured. Well head organic vapor concentrations at wells MW-1, S-2, MW-3, MW-8, and S-4 ranged from not detectable to 0.4 parts per million (ppm). These four well head organic vapor measurement values were less than or equal to atmospheric background values. Wells MW-2, MW-4, MW-5, MW-6, and MW-7 had organic vapor values 0.1 to 0.2 ppm above atmospheric background values, but all organic vapor measurements were less than 0.4 ppm. This low level of detection indicates the probable absence of nonaqueous phase liquids in the wells.

### ***2.2 Water Level, Total Depth, and Immiscible Organic Layer***

Water level, total well depth, and the location or absence of immiscible organic layers were determined by measurement from surveyed points indicated on the tops of the well casings. An ORS interface probe, calibrated using a steel surveyor's tape, was used to measure the distances between top of casing and both water surface and well bottom. The ORS probe creates a beeping tone when water is encountered and a steady tone when encountering immiscible layers either less dense or denser than water. Immiscible layers were not detected in any of the monitoring wells. Results of the water level and total well depth measurements, as well as calculated well volumes and sampling purge volumes, are listed in Table 1.

### ***2.3 Well Evacuation***

Well evacuation and groundwater sampling were performed following procedures in the A-E QCP/SP. New protective clothing was donned by site personnel and nondedicated sampling equipment was decontaminated using nonphosphate detergent wash, tap water

rinse, deionized water rinse, methanol, and hexane rinses prior to actual well evacuations. Dedicated 1 1/2-inch-diameter teflon bailers with stainless steel leaders attached to polypropylene ropes were used to purge and sample the wells. Approximately five well volumes of water were purged from the wells with five to seven measurements of pH, specific conductance, and temperature being recorded at intervals during bailing. Turbid water was initially noted in the bails from wells MW-3, MW-5, MW-6, and MW-7. Water from these wells generally cleared as bailing progressed. Well S-4 was initially clear and then became turbid at the end of the sampling. An absence of particulates was noted in the bails from the remaining wells. Water bailed from wells S-2, MW-2, and MW-4 were noted as being odorous. Field notes describing the well evacuations are contained in Appendix B. Following the purge of approximately five well volumes of water from a monitoring well, collection of groundwater samples at that well began.

## **2.4 Groundwater Sampling**

The monitor wells were sampled upon completion of the purging criteria. The wells sampled include the upgradient well MW-1, S-2 (which may or may not be upgradient of the facility), and downgradient wells MW-2, MW-3, MW-4, MW-5, MW-6, MW-7, MW-8, and S-4. Quality assurance samples were also collected during this January 1991 sampling episode. These samples included a blind field duplicate sample collected at well MW-4 and identified as well MW-12 and two duplicate quality assurance samples collected at wells MW-2 and MW-4 which were forwarded to the U.S. Army Corps of Engineers, Missouri River Division Laboratory, Omaha, Nebraska, for independent analysis. A trip blank sample for purgeable organic halides (POX), identified as well MW-11, was prepared in Albuquerque prior to travelling to Holloman Air Force Base. Concentrations of analytes which were sampled in each of the wells are listed in the tables of analytical results (Tables 2 and 3).

### **Field Measurements**

The parameters specific conductance, pH, and temperature were measured in the field during well purging, and before and after each sampling sequence. Specific conductance was to be determined using a Cole-Parmer model 1481-60 conductance meter in automatic temperature compensation mode. This meter is capable of determining the specific conductance of groundwater over a wide range of values. However, after the first sample collection at well MW-1 there were questions concerning operation of the Cole-Parmer conductivity meter. A back-up meter (YSI 33) provided by IT-Austin was used to finish the sampling round. pH was determined using an Orion SA-250 meter, calibrated at least daily. Temperature was determined using a mercury in glass thermometer. These field

measurements were recorded on the field sampling data sheets located in Appendix B. Specific conductance and pH measurements are also summarized in Table 3.

### Sample Collection

Groundwater samples were obtained from each well by carefully pouring from the dedicated teflon bailers. All samples were poured directly into prepared sampling containers. There was no field filtration of samples. Clean surgical gloves were donned immediately prior to sample collection. Groundwater samples for laboratory analysis were collected in the following order:

- Purgeable organic halides (POX)
- Total organic carbon (TOC)
- Metals (cations)
- Phenolics
- General chemistry (anions).

### Sample Containers and Preservatives

Sample collection containers were supplied by the International Technology Analytical Services (ITAS) laboratory in Middlebrook (Knoxville), Tennessee. Appropriate sample preservatives were added to the containers at the laboratory prior to shipment.

### **2.5 Sample Handling and Shipment**

All samples were isolated in sealable plastic bags and placed on ice in a shipping cooler immediately after collection. Samples were shipped by overnight carrier in a sealed shipping container with complete chain-of-custody documentation to the ITAS laboratories in Middlebrook (Knoxville), Tennessee and Cincinnati, Ohio; and to the U.S. Army Corps of Engineers, Missouri River Division Laboratory in Omaha, Nebraska. Chain-of-custody documentation for all samples are located in Appendix C.

## **3.0 Analytical Results**

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Samples from each of the wells were analyzed for the parameters listed in 40 CFR 265.92(b)(2) as groundwater quality indicator parameters, and 40 CFR 265.92(b)(3) as groundwater contamination indicator parameters. Laboratory analytical reports containing analytical results, quality control results, and method detection limits are presented in Appendix D. Summaries of analytical results are presented in Tables 2 and 3.

### **3.1 Method Detection Limits**

Method detection limits (MDL) actually achieved by the analytical laboratories during analyses of the January 1991 samples are listed in Table 4. The groundwater quality parameters, phenols and manganese, and the contamination indicator parameter, POX, were analyzed for but not detected in some samples at the method detection limit values listed in Table 3. All other analyzed parameters were quantifiable above their respective method detection limits.

### **3.2 Groundwater Quality Parameters**

Analytical results for parameters indicating groundwater quality including chloride, sodium, sulfate, iron, manganese, and phenols are listed in Table 2. While samples from the Holloman Air Force Base monitoring wells are generally typified as high in dissolved solids content, there are wide variations in major analyte concentrations from well to well. The lowest chloride concentrations were reported in the 800 to 2,000 mg/L range in samples from wells S-2 (upgradient), MW-2 and MW-4 (downgradient). Samples from wells MW-3, MW-5, MW-6, MW-8, and S-4 were reported having chloride concentrations between 2,000 and 6,000 mg/L. The greatest chloride concentrations were reported in samples from wells MW-1 (upgradient), MW-7 (downgradient), ranging from 26,000 to 47,000 mg/L. Chloride concentration in MW-12, the environmental duplicate from well MW-4 was reported at 1,600 mg/L chloride. Sodium concentrations in the well samples ranged less than 1,000 mg/L at wells S-2, MW-2, and MW-7. MW-3, MW-4, MW-5, and MW-8 ranged between 1,500 mg/L to 2,100 mg/L. MW-1, MW-6, and S-4 ranged from 8,050 and 15,300 mg/L. Sulfate concentrations ranged between 1,600 (MW-6) and 40,000 (MW-7) mg/L in the well samples. Concentration values for iron ranged from approximately 109 (MW-7) to 14,800 (MW-8) µg/L. Manganese concentrations were undetected at 2.0 µg/L in one upgradient well, MW-1, and the downgradient well S-4. Manganese concentrations in the remaining downgradient wells ranged from 564 (MW-4) to 3,110 (MW-5) µg/L. Phenols were not detected in upgradient well MW-1 and downgradient well S-4 at 0.01 mg/L. Phenol concentrations were equal to or slightly above the MDL in the remaining wells.

### **3.3 Contamination Indicator Parameters**

Concentrations of the groundwater contamination indicator parameters (pH, specific conductance, total organic carbon, and purgeable organic halides) for samples from the Holloman Air Force Base monitor wells are listed in Table 3. Four replicate measurements of each contamination indicator parameter are reported for all the wells and the environmental duplicate (MW-12) for the laboratory analyzed parameters. pH values measured in the field after sampling ranged from 6.73 to 7.25 pH units. Specific

conductance, also measured in the field, ranged from 4,180 to 40,500  $\mu\text{mhos/cm}$  at 25°C. Total organic carbon analytical results were distributed between not detectable at 1 mg/L to 7 mg/L across the Holloman well samples. Results for analyses of purgeable organic halides (POX) on the well samples are also reported in Table 3. At least one of the four replicate samples per well showed POX as nondetectable at 10  $\mu\text{g/L}$  as chloride. All measurements of POX in wells MW-1, MW-2, MW-4, MW-5, MW-6, and S-4 were nondetectable. POX was detected in at least one sample replicate from the remaining wells, and the trip blank.

## **4.0 Quality Control**

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Field sampling procedures conforming to the A-E QCP/SP were documented daily on an "A-E Daily Quality Control Report for Groundwater Monitoring at Holloman Air Force Base, New Mexico" form. These daily quality control reports are contained in Appendix E.

Quality control (QC) samples were collected during the January 1991 sampling effort for analysis in accordance with the procedures specified in the A-E QCP/SP. Environmental duplicate samples and purgeable organic halide trip blank samples were collected.

Duplicate samples from wells MW-2 and MW-4 were collected and transmitted to the U.S. Army Corps of Engineers, Missouri River Division Laboratory in Omaha, Nebraska, for independent analysis. An additional set of blind duplicate field samples were collected at well MW-4 and submitted to the ITAS laboratory for analysis. This blind duplicate sample is identified in Tables 2 and 3, as well number MW-12, where the analytical results are listed along with the results for the MW-4 sample analyses. Each duplicate sample fraction was collected from a new bail of groundwater immediately after collecting the sample fraction in order to minimize variabilities due to time or sampling mechanics.

A purgeable organic halide (POX) trip blank sample was prepared at the IT-Albuquerque warehouse immediately prior to field personnel traveling to the sampling site, and was shipped to the analytical laboratory with the POX samples from the Holloman wells. The POX trip blank sample was designated as well number MW-11. Results of the POX trip blank sample analysis (100  $\mu\text{g/L}$  POX as chloride) is listed in Table 3 and indicates possible sample contamination. Positive, though inconsistent, POX results in the Holloman well samples and the trip blank, could be a result of sample container contamination occurring at the laboratory.

Laboratory quality control data are contained within the Certificates of Analyses, Appendix D. The ITAS Middlebrook (Knoxville) laboratory performed matrix spike and matrix spike duplicate analyses on the sample from well S-4. Matrix spike recovery exceeded control limits (75-125 percent) for iron (136 percent). A post-digest spike was performed for iron and was within acceptable results. The duplicate relative percent difference (RPD) results indicate that either sample nonhomogeneity or matrix interferences were a problem in this particular digestion. Possible matrix interferences include the high concentration of sodium and the viscosity problems caused by such high concentrations. Any quality control data which exceeded controls were flagged by the ITAS Middlebrook (Knoxville) laboratory as required in the EPA CLP Statement of Work (July 1987). All other quality control data reported by ITAS Middlebrook (Knoxville) were within control limits.

Sample analysis holding times were met for all analyses of the January 1991 Holloman well samples, except for MW-1 phenols analysis. ITAS Laboratory Report #47584 indicates sample MW-1 was analyzed one day past the holding time. However phenol results were nondetectable (Table 2), which is consistent with previous results.

## ***5.0 Continuing Groundwater Monitoring*** \_\_\_\_\_

Continued monitoring operations at the Holloman Air Force Base Sewage Treatment Lagoons will be determined following a data analysis satisfying the requirements of 40 CFR 265.93(b). The data collected in this sampling round will be compared statistically with data collected during four previous sampling rounds (August through December 1989). The statistical analysis entails calculating the arithmetic mean and variance based on the four replicate measurements of contamination indicator parameters on each sample from this January 1991 sampling round. These are compared statistically to the initial background arithmetic mean for these parameters collected in earlier sampling rounds, i.e., the values for upgradient wells measured in the August through December 1989 sampling episodes. The comparison considers individually each of the wells in the monitoring system and uses the Student's t-test at the 0.01 level of significance to determine statistically significant increases (and decreases, in the case of pH) relative to initial background that can be attributed to the lagoons.

## **6.0 References**

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International Technology Corporation (IT), 1989a, "Safety, Health & Emergency Response Plan (A-E SHERP)," Ground Water Detection Monitoring Program," Holloman Air Force Base, New Mexico.

International Technology Corporation (IT), 1989b, "A-E Quality Control Plan and Sampling Plan (A-E QCP/SP) For Ground Water Study and Monitoring Program," Holloman Air Force Base, New Mexico.

Radian Corporation, 1989, "Hydrogeologic Investigation Report and Proposed Ground Water Monitoring Plan for the Sewage Treatment Lagoons, Holloman Air Force Base, NM 88330," Holloman Air Force Base, New Mexico.

**TABLE 1****GROUNDWATER ELEVATIONS AND WATER VOLUMES PURGED FROM  
THE SEWAGE TREATMENT LAGOONS MONITORING WELLS  
HOLLOMAN AIR FORCE BASE, NEW MEXICO  
JANUARY 1991**

Monitor Well	Top of <sup>(a)</sup> Casing Elevation (FAMSL)	Depth to <sup>(b)</sup> Groundwater (Feet)	Groundwater Elevation (FAMSL)	Total <sup>(b)</sup> Depth (Feet)	Well Volume (Gallons)	Gallons Discharged Prior To Sampling	Gal. Discharged Well Volumes Prior To Sampling
MW-1	4053.42	10.83	4042.59	17.81	4.54	23	5.1
S-2	4040.56	8.36	4032.20	20.29	1.94	10	5.1
MW-2	4039.78	4.77	4035.01	17.76	8.45	43	5.1
MW-3	4037.38	8.13	4029.25	17.72	6.24	32	5.1
MW-4	4030.30	5.36	4024.94	17.76	8.07	41	5.1
MW-5	4039.30	4.87	4034.43	17.77	8.34	42	5.0
MW-6	4031.21	6.05	4025.16	17.77	7.63	39	5.1
MW-7	4039.88	5.80	4034.08	17.69	7.74	39	5.0
MW-8	4040.50	5.35	4035.15	17.75	8.07	41	5.1
S-4	4034.46	8.67	4025.79	14.35	0.92	5	5.4

<sup>(a)</sup>A-E Groundwater Monitoring Report/Quality Control Summary for the First Groundwater Sampling Round Holloman Air Force Base, New Mexico, October 1989, Radian Corporation, Austin, TX.

<sup>(b)</sup>Reference from top of casing. Measured on January 14, 1991.

**Table 2**

**Concentrations of Groundwater Quality Parameters  
Sewage Treatment Lagoons Monitoring Wells  
Holloman Air Force Base, New Mexico  
January 1991**

Parameter	Units	Monitor Well					
		MW-1	S-2	MW-2	MW-3	MW-4	MW-12 (Duplicate MW-4)
Chloride	mg/L	26,000	1,000	870	3,500	800	1,600
Iron	µg/L	157	130	467	376	793	663
Manganese	µg/L	2.0-U	137	667	1,550	564	552
Phenols	mg/L	0.01-U	0.01	0.01	0.01	0.01	0.02
Sodium	mg/L	8,050	727	555	1,850	1,570	1,710
Sulfate	mg/L	2,800	3,200	2,500	3,200	2,000	2,900

Parameter	Units	Monitor Well				
		MW-5	MW-6	MW-7	MW-8	S-4
Chloride	mg/L	5,100	4,000	47,000	4,100	2,500
Iron	µg/L	2,700	681	109	14,800	631
Manganese	µg/L	3,110	651	1,220	976	2.0-U
Phenols	mg/L	0.01-U	0.02	0.02	0.02	0.01
Sodium	mg/L	1,920	15,300	837	2,020	9,730
Sulfate	mg/L	3,100	1,600	40,000	4,000	2,100

U = Compound was analyzed for but not detected. The table value is the detection limit for the sample.

**Table 3**

**Concentrations of Groundwater Contamination  
Indicator Parameters  
Sewage Treatment Lagoons Monitoring Wells  
Holloman Air Force Base, New Mexico  
January 1991**

Monitor Well	pH	Specific Conductance (umhos/cm @ 25°C)	Total Organic Carbon (mg/L)	Purgeable Organic Halides (µg/L as Cl)
MW-1	6.76	35,200	1-U	ND
	6.79	35,200	1-U	ND
	6.78	33,500	1-U	ND
	6.79	33,100	1-U	ND
S-2	7.25	4,500	6	ND
	7.22	5,300	7	16
	7.22	5,100	7	ND
	7.21	5,100	6	ND
MW-2	7.25	4,200	4	ND
	7.22	4,180	4	ND
	7.23	4,200	4	ND
	7.22	4,220	4	ND
MW-3	7.07	9,200	7	ND
	7.04	9,200	7	18
	7.03	9,100	7	ND
	7.03	8,900	7	18
MW-4	7.03	9,200	5	ND
	7.02	11,500	5	ND
	7.04	11,600	6	ND
	7.13	12,500	6	ND
MW-12 (Duplicate MW-4)	NA	NA	6	ND
			6	580
			6	ND
			5	ND
MW-5	6.78	9,800	5	ND
	6.73	10,000	5	ND
	6.73	10,000	5	ND
	6.73	10,000	5	ND
MW-6	6.83	40,280	3	ND
	6.86	40,400	4	ND
	6.89	40,500	3	ND
	6.88	40,400	3	ND
MW-7	6.90	6,200	3	28
	6.90	6,500	3	ND
	6.87	6,500	3	ND
	6.89	6,500	3	98

**Table 3  
(continued)**

**Concentrations of Groundwater Contamination  
Indicator Parameters  
Sewage Treatment Lagoons Monitoring Wells  
Holloman Air Force Base, New Mexico  
January 1991**

Monitor Well	pH	Specific Conductance (umhos/cm @ 25°C)	Total Organic Carbon (mg/L)	Purgeable Organic Halides (µg/L as Cl)
MW-8	6.81	10,000	4	95
	6.83	10,000	4	74
	6.83	10,000	4	81
	6.83	10,000	4	ND
S-4	7.24	30,000	1	ND
	7.20	30,150	1	ND
	7.25	30,100	1	ND
	7.25	30,100	1	ND
MW-11 (trip blank)	NA	NA	NA	100

ND = Not detected at 10 µg/L as chloride.

U = Compound was analyzed for but not detected. The table value is the detection limit for the sample.

NA = Not Applicable.

**Table 4**

**Method Detection Limits,  
Sewage Treatment Lagoons Monitoring Wells  
Holloman Air Force Base, New Mexico  
January 1991**

<b>Parameter</b>	<b>Detection Limit</b>
TOC	1 mg/L
POX	10 µg/L
Chloride	0.5 mg/L
Sulfate	1.5 mg/L
Phenols	0.01 mg/L
Iron	10 µg/L
Manganese	2 µg/L
Sodium	200 µg/L

**APPENDIX A**  
**JOB LOGS**

**JOB LOG**

COMPANY COE  
 LOCATION HAFB - Wastewater Treatment Lagoons  
 WORK PERFORMED GW Monitoring

DATE Mon 1/14/90  
 JOB NUMBER 30125102

PREPARED BY A Houska SUPERVISOR D. Meyer

CLASS	NAME	START	ARRIVED JOB	TIME OUT	LEFT JOB	STOP	---
Tech	K. Schmidt	0500	1030	—	1500	1545	10.7
Tech	J. Saavedra	0500	1030	—	1500	1545	10.7
APSL	A. Houska	0430	1030	—	1500	1545	11.2

AMT / HRS.	MATERIAL/EQUIPMENT	AMT / HRS.	MATERIAL/EQUIPMENT	AMT / HRS.	MATERIAL/EQUIPMENT
	HNu PID				
	ORS Interface Probe				
	Decomm Equipment				
	1/2 Bx Surgical Gloves				
	Steel Measuring Tape				

TIME	FIELD ACTIVITY DAILY LOG
0750	Arrive at warehouse - load gear; Pass POX trip blank.
0850	Begin drive to Alamogordo.
0915	Arrive at store in Alamogordo for supplies.
1020	Arrive at Base Security gate
1035	Gain access to HAFB → stop at S. Moore's office for keys, trailers etc.
1055	Arrive at WWT area - Begin unloading equipment, calibrating equipment, fluid-level prep.
1135	Arrive at MW-3. Hold tailgate safety meeting. Begin taking fluid-level measurements.
1156	Arrive at well MW-2, take fl's.
1207	Arrive at well MW-8.
1226	Arrive at MW-5.
1236	Arrive at MW-7.
1255	Arrive at MW-1.



# JOB LOG

COMPANY COE-HAFB DATE Tuesday 1/15/91  
 LOCATION Alamogordo, NM JOB NUMBER 30251.02.07  
 WORK PERFORMED Ground Water monitoring at Holloman Air Force Base - wastewater Treatment Lagoons.  
 PREPARED BY A. Houska SUPERVISOR D. Meyer

CLASS.	NAME	START	ARRIVED JOB	TIME OUT	LEFT JOB	STOP	TOTAL
APSc	A. Houska	0650	0735	1/2 hr	1600	1930	12 hr.
Tech	J. Saavedra	0650	0735	1/2 hr	1600	1630	9 hrs
Tech	K. Schmidt	0650	0735	1/2 hr	1600	1630	9 hrs

AMT./ HRS.	MATERIAL/EQUIPMENT	AMT./ HRS.	MATERIAL/EQUIPMENT	AMT./ HRS.	MATERIAL/EQUIPMENT
	N. Sauer		pH Meter		
	Barrels		Cond Meter		
	Decom. Equipment		thermom.		
	Sample Containers/Acid		tyvek suits		
	Coolers /ICE		Surgical gloves		
	Vermiculite		nitrile gloves.		

TIME	FIELD ACTIVITY DAILY LOG
0650	Load gear; leave motel; stop at store enroute to base for gas + field supplies.
0722	At HAFB - enter gate.
0735	Arrive at MW-1 - Prep for sample collection, calibrate equipment.
0905	Sample collection complete at MW-1. A.H. to airport to pick up litmus paper. J.S. + K.S. complete clean-up at well before moving to well MW-5. Delayed by HAFB security at MW-5.
1015	Question concerning operation of conductivity meter. Call IT-office. K.S. + J.S. continue with labeling sample containers + trouble shooting meter. - Back-up conductivity meters accuracy is not acceptable. Make arrangements to ship in two new meters.
1240	1/2 hr break for lunch



# JOB LOG

 COMPANY COE  
 LOCATION HAFB, Alamogordo, NM  
 WORK PERFORMED GIW Monitoring at Wastewater Treatment Lagoons.

 DATE Wednesday 1/16/91  
 JOB NUMBER 301251.02.07

 PREPARED BY: A. Houska SUPERVISOR D. Meyer

CLASS	NAME	START	ARRIVED JOB	TIME OUT	LEFT JOB	STOP	TOTAL
APSc	A. Houska	0700	0830	1/2 hr	1815	1840	11.16
Tech	J. Saavedra	0700	0830	1/2 hr	1815	1840	11.16
Tech	K. Schmidt	0700	0830	1/2 hr	1815	1840	11.16

AMT./ HRS.	MATERIAL/EQUIPMENT	AMT./ HRS.	MATERIAL/EQUIPMENT	AMT./ HRS.	MATERIAL/EQUIPMENT
	V. squares		pH Meter		
	Barbers		thermism		
	Decon Equipmt		Cond. Meter		
	Sample containers/acid		tube suites		
	Coolers/ICE		Surgical gloves		
	vermiculite		nitrile gloves		

TIME	FIELD ACTIVITY DAILY LOG
0700	Load gear in vehicles - stop at store enroute to HAFB for site. Delayed accessing base because of threat of terrorism.
0830	Arrive at monitor well MW-5 - Set up for sampling. Calibrate equipment.
0850	Begin purging 5 well casing volumes + monitoring gw
0925	Collect gw sample at MW-5; Clean-up site + move to MW-7.
1010	Begin purging/monitoring 5 well casing volumes.
1045	Collect gw sample; continue with gw monitoring. Clean-up site + move to MW-8. (stop at shed enroute)
1115	Begin sample prep at MW-8.
1135	Begin purging/monitoring 5 well casing volumes.
1207	Collect gw sample; continue with gw monitoring.
1240	Move to MW-3. Set-up for sampling.
1250	Begin purging 5 casing volumes.
1330	Collect gw sample. Continue w- gw monitoring. Clean-up site.



# JOB LOG

COMPANY COE - Holloman AFB  
 LOCATION Alamogordo, NM  
 WORK PERFORMED GW monitoring round #7 at HAFB wastewater treatment lagoons.  
 PREPARED BY A. Houska

DATE Thursday 1/17/91  
 JOB NUMBER 31251.02.0

SUPERVISOR D. Meyer

CLASS	NAME	START	ARRIVED JOB	TIME OUT	LEFT JOB	STOP	TOTAL
APSc	A. Houska	0645	0710	-	1530	2030	
Tech	T. Saavedra	0645	0710	-	1530	2030	
Tech	K. Schmidt	0645	0710	-	1530	2030	

AMT / HRS.	MATERIAL/EQUIPMENT	AMT / HRS.	MATERIAL/EQUIPMENT	AMT / HRS.	MATERIAL/EQUIPMENT
	Sample containers/acid		pH Meter		
	Viscosen		Thermometer		
	baulkers		Cond. Meter		
	decom equipment		Tyvek Suits		
	ice/coolers		Surgical gloves		
	vicmiculite		nitrile suits-gloves		

TIME	FIELD ACTIVITY DAILY LOG
0645	Load equipment in vehicles; check out of motel. Drive to back area of lagoon - stop for ice + supplies enroute.
0710	Arrive at HAFB boundary - drive back to well MW-6. Begin equipment calibration + prep for sampling.
0800	Begin purging 5 casing volumes.
0845	Collect gw sample, complete monitoring, clean-up + move to S-4.
0910	Arrive at S-4; prep for sample collection.
0945	Collect gw sample, complete monitoring; clean-up + move to MW-4.
1030	Arrive at MW-4; prep for sample collection.
1040	Begin purging 5 casing volumes.
1115	Begin sample collection - 3 sets (QA + duplicate).
1140	Sample collection complete - pack samples; clean-up site.
1215	Arrive at gate to HAFB - Renew base pass.
1305	Permitted on base. Stop at store for supplies. Return to MW-1 to confirm conductivity with new meter. - Return supplies to WWTava.



**APPENDIX B**

**FIELD DATA**

GROUNDWATER FIELD DATA SHEET  
 COE-HOLLOMAN AIR FORCE BASE  
 WASTEWATER TREATMENT LAGOONS

IT Project No. 301251.02.1 7

Parameter Description	Value
SAMPLE CONTROL NUMBER	MW-010191
DATE SAMPLED	1/15/91
TIME	0900 (1)
SAMPLER'S INITIALS	AH, JS, KS
WELL/BORING LOCATION	MW-1
WELL/BORING DIAMETER (in)	4
ELEVATION OF TOP OF WELL CASING REFERENCED TO MEAN SEA LEVEL (MSL)	4053.42 FMSL
WATER-LEVEL MEASUREMENT	---
Total Depth (ft)	17.81
Depth to Groundwater (ft)	10.83
CALCULATIONS	
Thickness of Groundwater (ft)	6.98
Well Volume (gallons)	4.54
Purge Volume (gallons) for five casing volumes	22.71 → 23
NUMBER OF SAMPLE BOTTLES AND TYPE COLLECTED	See field notebook
pH	See page 2
Conductance ( $\mu$ hos)	See page 2
Temperature ( $^{\circ}$ C)	See page 2

## COMMENTS:

° HNu PID Background = 0.3 ppm; Well borehole = 0.2 ppm.  
 Date 1/14/91; Time 1300

° See field notebook for equipment type and calibration data; equipment calibrated at beginning and end of each field day.

° See field notebook for decontamination procedure.

(1) Coliform Bacteria sample collection time = NA.

GROUNDWATER FIELD DATA SHEET  
COE-HOLLOMAN AIR FORCE BASE  
WASTEWATER TREATMENT LAGOONS

IT Project No. 301251.02.07

Parameter Description	Value
SAMPLE CONTROL NUMBER	S-020191
DATE SAMPLED	011691
TIME	1500 (1)
SAMPLER'S INITIALS	AH, JS, KS
WELL/BORING LOCATION	S-2
WELL/BORING DIAMETER (in)	2
ELEVATION OF TOP OF WELL CASING REFERENCED TO MEAN SEA LEVEL (MSL)	4046.56 FAMSL
<b>WATER-LEVEL MEASUREMENT</b>	
Total Depth (ft)	20.29
Depth to Groundwater (ft)	8.36
<b>CALCULATIONS</b>	
Thickness of Groundwater (ft)	11.93
Well Volume (gallons)	1.94
Purge Volume (gallons) for five casing volumes	9.71 → 10
NUMBER OF SAMPLE BOTTLES AND TYPE COLLECTED	See field notebook
pH	See page 2
Conductance (µmhos)	See page 2
Temperature (°C)	See page 2

**COMMENTS:**

- ° HNu PID Background = 0.2 ppm; Well borehole = ND ppm.  
Date 11/14/91; Time 1315
- ° See field notebook for equipment type and calibration data; equipment calibrated at beginning and end of each field day.
- ° See field notebook for decontamination procedure.

(1) Coliform Bacteria sample collection time = NA.

ph Meter check against 7.00 buffer: Reading 7.03

PURGING DATA:

<u>TIME</u>	<u>VOLUME PURGED (GAL)</u>	<u>TEMP (C°)</u>	<u>pH</u>	<u>SC (umHos/cm)</u>	<u>COMMENTS</u>
1501	2	15.0	7.13	4750	CLEAR, STRONG H <sub>2</sub> S ODOOR, SMALL AMOUNTS OF GLASS
1505	4	15.5	7.16	4680	CLEAR, STRONG H <sub>2</sub> S ODOOR, SMALL AMOUNTS OF GLASS
1508	6	16.0	7.15	4830	CLEAR, SLIGHT H <sub>2</sub> S ODOOR, SMALL AMOUNTS OF GLASS IN WATER
1512	8	16.0	7.18	4782	CLEAR, SLIGHT H <sub>2</sub> S ODOOR, SMALL AMOUNTS OF GLASS
1516	10	15.5	7.21	4820	CLEAR, SLIGHT H <sub>2</sub> S ODOOR, SMALL AMOUNTS OF GLASS

Reading after sample collection: (4 Replicate Readings)

1530	—	15.5	7.25	4500
1533	—	16.0	7.22	5300
1535	—	16.0	7.22	5100
1538	—	16.0	7.21	5100

Additional Comments: NEW GLOVES WERE DONNED PRIOR TO SAMPLE COLLECTION.  
 PROBES SAT IN SOLUTION FOR ~ 2 MIN. BEFORE RECORDING FIELD PARAMETERS

GROUNDWATER FIELD DATA SHEET  
COE-HOLLOMAN AIR FORCE BASE  
WASTEWATER TREATMENT LAGOONS

IT Project No. 301251.02.07

Parameter Description	Value
SAMPLE CONTROL NUMBER	Mw-020191
DATE SAMPLED	011691
TIME	1730 (1)
SAMPLER'S INITIALS	AH, JS, KS
WELL/BORING LOCATION	MW-2
WELL/BORING DIAMETER (in)	2
ELEVATION OF TOP OF WELL CASING REFERENCED TO MEAN SEA LEVEL (MSL)	4039.78 FAMSL
WATER-LEVEL MEASUREMENT	----
Total Depth (ft)	17.76
Depth to Groundwater (ft)	7.77
CALCULATIONS	
Thickness of Groundwater (ft)	12.99
Well Volume (gallons)	8.45
Purge Volume (gallons) for five casing volumes	42.27 → 43
NUMBER OF SAMPLE BOTTLES AND TYPE COLLECTED	See field notebook
pH	See page 2
Conductance (µmhos)	See page 2
Temperature (°C)	See page 2

## COMMENTS:

◦ HNu PID Background = 0.3 ppm; Well borehole = 0.4 ppm.  
Date 1/15/90; Time 1158

◦ See field notebook for equipment type and calibration data; equipment calibrated at beginning and end of each field day.

◦ See field notebook for decontamination procedure.

(1) Coliform Bacteria sample collection time = NA.

One QA sample also collected at this well for analysis (except Pest/PCB) by  
COE (ID = GMW-020191). No 12/15/17

Parameters alternated, first MW-020191 then Q samples.

ph Meter check against 7.00 buffer: Reading 7.00

PURGING DATA:

<u>TIME</u>	<u>VOLUME PURGED (GAL)</u>	<u>TEMP (C°)</u>	<u>pH</u>	<u>SC (umHos/cm)</u>	<u>COMMENTS</u>
1650	7	15.5	7.37	4220	CLEAR, SLIGHT H <sub>2</sub> S ODOUR, NO H <sub>2</sub> S
1656	14	15.5	7.36	4225	CLEAR, STRONG H <sub>2</sub> S ODOUR, NO H <sub>2</sub> S
1701	21	15.0	7.30	4220	CLEAR, STRONG H <sub>2</sub> S ODOUR, NO H <sub>2</sub> S
1707	28	15.0	7.35	4100	CLEAR, SLIGHT H <sub>2</sub> S ODOUR, NO H <sub>2</sub> S
1714	35	15.0	7.37	4,230	CLEAR, SLIGHT H <sub>2</sub> S ODOUR, NO H <sub>2</sub> S
1726	43	15.0	7.28	4,210	CLEAR, SLIGHT H <sub>2</sub> S ODOUR, NO H <sub>2</sub> S

Reading after sample collection:

(4 Replicate Readings)

1745	-	15.0	7.25	4200
1749	-	15.5	7.22	4150
1752	-	15.0	7.23	4200
1759	-	15.0	7.22	4220

Additional Comments: NEW GLASSES WERE DONNED PRIOR TO SAMPLE COLLECTION  
 READING SAT IN SOLUTION FOR ~ 2 MIN. BEFORE FIELD PARAMETERS  
 WERE RECORDED.

GROUNDWATER FIELD DATA SHEET  
COE-HOLLOMAN AIR FORCE BASE  
WASTEWATER TREATMENT LAGOONS

IT Project No. 301251.02.07

Parameter Description	Value
SAMPLE CONTROL NUMBER	MW-030191
DATE SAMPLED	01/16/91
TIME	1330 (1)
SAMPLER'S INITIALS	AH, JS, KS
WELL/BORING LOCATION	MW-3
WELL/BORING DIAMETER (in)	4
ELEVATION OF TOP OF WELL CASING REFERENCED TO MEAN SEA LEVEL (MSL)	4037.32 FAMSL
<b>WATER-LEVEL MEASUREMENT</b>	----
Total Depth (ft)	17.72
Depth to Groundwater (ft)	8.13
<b>CALCULATIONS</b>	
Thickness of Groundwater (ft)	9.59
Well Volume (gallons)	6.24
Purge Volume (gallons) for five casing volumes	31.21 → 32
<b>NUMBER OF SAMPLE BOTTLES AND TYPE COLLECTED</b>	See field notebook
pH	See page 2
Conductance (µmhos)	See page 2
Temperature (°C)	See page 2

**COMMENTS:**

- HNu PID Background = 0.3 ppm; Well borehole = ND ppm.  
Date 1/14/91; Time 1148
  - See field notebook for equipment type and calibration data; equipment calibrated at beginning and end of each field day.
  - See field notebook for decontamination procedure.
- (1) Coliform Bacteria sample collection time = NA.

ph Meter check against 7.00 buffer: Reading 7.01

PURGING DATA:

<u>TIME</u>	<u>VOLUME PURGED (GAL)</u>	<u>TEMP (C°)</u>	<u>pH</u>	<u>SC (umHos/cm)</u>	<u>COMMENTS</u>
1254	5	16.0	7.09	9200	slightly cloudy, no color or odor
1300	10	16.0	7.13	9000	very slightly cloudy, no color or odor
1304	15	16.5	7.08	9200	very slightly cloudy, no color or odor
1309	20	16.5	7.12	9200	very slightly cloudy, no color or odor
1318	25	16.5	7.08	9100	clear, no color or odor
1325	32	17.0	7.07	9000	clear, no color or odor

Reading after sample collection:

(4 Replicate Readings)

1337	—	17.0	7.07	9200 <del>5</del>
1340	—	16.5	7.04	9200
1343	—	17.0	7.03	9100
1346	—	17.0	7.03	8900

Additional Comments: new gloves were worn prior to sample collection  
 probes sat in solution for ~ 2 min. before recording field  
 parameters.

IT Project No. 301251.02.07

GROUNDWATER FIELD DATA SHEET  
 COE-HOLLOMAN AIR FORCE BASE  
 WASTEWATER TREATMENT LAGOONS

Parameter Description	Value
SAMPLE CONTROL NUMBER	MW-040191
DATE SAMPLED	01/17/91
TIME	1130 (1)
SAMPLER'S INITIALS	AH, JS, KS
WELL/BORING LOCATION	MW-4
WELL/BORING DIAMETER (in)	4
ELEVATION OF TOP OF WELL CASING REFERENCED TO MEAN SEA LEVEL (MSL)	4030.30 FAMSL
<b>WATER-LEVEL MEASUREMENT</b>	
Total Depth (ft)	17.76
Depth to Groundwater (ft)	5.36
<b>CALCULATIONS</b>	
Thickness of Groundwater (ft)	12.40
Well Volume (gallons)	8.07
Purge Volume (gallons) for five casing volumes	40.35 → 41
NUMBER OF SAMPLE BOTTLES AND TYPE COLLECTED	See field notebook
pH	See page 2
Conductance (µmhos)	See page 2
Temperature (°C)	See page 2

- COMMENTS:**
- ° HNu PID Background = 0.2 ppm; Well borehole = 0.3 ppm.  
Date 1/14/91; Time 1444
  - ° See field notebook for equipment type and calibration data; equipment calibrated at beginning and end of each field day.
  - ° See field notebook for decontamination procedure.

(1) Coliform Bacteria sample collection time = NA.

Time for duplicate recorded on CoC as 1230. (ID = MW-120191)  
 QA sample (except for Pest/PCB) also collected (ID = QMW-040191)

Sample collection order MW-4, MW-12 + QMW-4 - alternating parameters. All bottles of a subset filled prior to switching sets. New boiler of water used if set switched.

ph Meter check against 7.00 buffer: Reading 7.10

PURGING DATA:

<u>TIME</u>	<u>VOLUME PURGED (GAL)</u>	<u>TEMP (C°)</u>	<u>pH</u>	<u>SC (umHos/cm)</u>	<u>COMMENTS</u>
1047	7	15.0	7.26	8,900	CLEAR, STRONG H <sub>2</sub> S ODOOR SUSPENDED SOLIDS
1052	14	15.5	7.00	9,200	CLEAR, STRONG H <sub>2</sub> S ODOOR, SOLID
1054	21	15.5	7.05	9,100	CLEAR, STRONG H <sub>2</sub> S ODOOR
1101	28	15.5	7.05	9,200	CLEAR, STRONG H <sub>2</sub> S ODOOR
1107	35	16.0	6.92	9,500	CLEAR, STRONG H <sub>2</sub> S ODOOR
1111	41	15.5	6.96	9,300	CLEAR, STRONG H <sub>2</sub> S ODOOR

Reading after sample collection: (4 Replicate Readings)

1141	—	15.5	7.03	9,200
1144	—	17.0	7.02	<del>10,150</del> 11,500
1148	—	17.5	7.04	<del>10,160</del> 11,600
1151	—	19.0	7.13	12,500

Additional Comments: NEW GLOVES WERE DONNED PRIOR TO SAMPLE COLLECTION.  
 PROBES SAT IN SOLUTION FOR ~2 min. BEFORE RECORDING FIELD  
 PARAMETERS.

GROUNDWATER FIELD DATA SHEET  
COE-HOLLOMAN AIR FORCE BASE  
WASTEWATER TREATMENT LAGOONS

IT Project No. 301251.02.07

Parameter Description	Value
SAMPLE CONTROL NUMBER	MW-050191
DATE SAMPLED	011691
TIME	0920 (L)
SAMPLER'S INITIALS	AH, JS KS
WELL/BORING LOCATION	MW-5
WELL/BORING DIAMETER (in)	4"
ELEVATION OF TOP OF WELL CASING REFERENCED TO MEAN SEA LEVEL (MSL)	4039.30 FMSL
<b>WATER-LEVEL MEASUREMENT</b>	
Total Depth (ft)	17.77
Depth to Groundwater (ft)	4.87
<b>CALCULATIONS</b>	
Thickness of Groundwater (ft)	12.90
Well Volume (gallons)	8.340
Purge Volume (gallons) for five casing volumes	41.98 → 42
<b>NUMBER OF SAMPLE BOTTLES AND TYPE COLLECTED</b>	See field notebook
pH	See page 2
Conductance (µmhos)	See page 2
Temperature (°C)	See page 2

**COMMENTS:**

° HNu PID Background = 0.3 ppm; Well borehole = 0.4 ppm.  
Date 1/14/91; Time 1229

° See field notebook for equipment type and calibration data; equipment calibrated at beginning and end of each field day.

° See field notebook for decontamination procedure.

(1) Coliform Bacteria sample collection time = NA.

ph Meter check against 7.00 buffer: Reading 7.14

PURGING DATA:

TIME	VOLUME PURGED (GAL)	TEMP (C°)	pH	SC (umHos/cm)	COMMENTS
<del>0858</del>	<del>1</del>	<del>13.0</del>	<del>6.79</del>	<del>8500</del>	<del>SCALING PROBLEM ON 1/2" PIPING TO STOP LOG TO LOG PROBLEMS</del>
0902	1	14.0	6.78	9200	SLIGHTLY BLOODY, NO OTHER PROBLEMS
0907	2	15.0	6.79	9100	SLIGHTLY BLOODY, NO OTHER PROBLEMS
0912	3	15.0	6.77	9500	VERY SLIGHTLY BLOODY, NO OTHER PROBLEMS
0917	3.5	14.75	6.85	9200	VERY SLIGHTLY BLOODY, NO OTHER PROBLEMS
0923	4.2	15.0	6.74	9200	VERY SLIGHTLY BLOODY, NO OTHER PROBLEMS

Reading after sample collection: (4 Replicate Readings)

0935	-	15.0	6.78	9500
0938	-	15.0	6.73	10001
0941	-	15.0	6.73	10000
0944	-	15.0	6.73	10.000

Additional Comments: READINGS WERE TAKEN AFTER PIPES SAT IN SOLUTION FOR ~ 2 MINUTES. NEW GLOVES WERE DONNED BEFORE SAMPLES WERE COLLECTED.

GROUNDWATER FIELD DATA SHEET  
COE-HOLLOMAN AIR FORCE BASE  
WASTEWATER TREATMENT LAGOONS

IT Project No. 301251.02.07

Parameter Description	Value
SAMPLE CONTROL NUMBER	MW-060191
DATE SAMPLED	011791
TIME	0845 (1)
SAMPLER'S INITIALS	AH, JS, KS
WELL/BORING LOCATION	MW-6
WELL/BORING DIAMETER (in)	4
ELEVATION OF TOP OF WELL CASING REFERENCED TO MEAN SEA LEVEL (MSL)	4031.21 FAMSL
WATER-LEVEL MEASUREMENT	----
Total Depth (ft)	17.71
Depth to Groundwater (ft)	6.05
CALCULATIONS	
Thickness of Groundwater (ft)	11.72
Well Volume (gallons)	7.63
Purge Volume (gallons) for five casing volumes	38.14 → 39
NUMBER OF SAMPLE BOTTLES AND TYPE COLLECTED	See field notebook
pH	See page 2
Conductance ( $\mu$ mhos)	See page 2
Temperature ( $^{\circ}$ C)	See page 2

**COMMENTS:**

◦ HNu PID Background = 0.2 ppm; Well borehole = 0.3 ppm.  
Date 11/17/91; Time 1416

◦ See field notebook for equipment type and calibration data; equipment calibrated at beginning and end of each field day.

◦ See field notebook for decontamination procedure.

(1) Coliform Bacteria sample collection time = NA.

ph Meter check against 7.00 buffer: Reading 0.616

PURGING DATA:

<u>TIME</u>	<u>VOLUME PURGED (GAL)</u>	<u>TEMP (C°)</u>	<u>pH</u>	<u>SC (umHos/cm)</u>	<u>COMMENTS</u>
0817	6	14.0	7.19	<del>37.850</del> 38.500	SLIGHTLY CLOUDY, NO ODOOR OR COLOR
0820	12	14.5	7.06	39.600	VERY SLIGHTLY CLOUDY, NO ODOOR OR COLOR
0825	18	14.0	7.12	38.000	CLOUDY, NO ODOOR OR COLOR
0830	24	15.0	6.88	40.040	CLEAR, NO ODOOR OR COLOR
				37.999	
0835	30	15.5	6.90	<del>38.8</del>	CLEAR, NO ODOOR OR COLOR
0840	36	15.0	6.99	39.000	SLIGHTLY CLOUDY, NO ODOOR OR COLOR
0843	39	15.5	6.94	39.020	

Reading after sample collection:

(4 Replicate Readings)

0856	—	15.5	6.83	40.280
0859	—	16.5	6.86	40.400
0902	—	17.0	6.89	40.490
0905	—	17.0	6.88	40.400

Additional Comments: NEW CLOUDS WERE DOWNED PRIOR TO SAMPLE COLLECTION.  
 PROBES SAT IN SOLUTION FOR ~ 7 MIN BEFORE FIELD PARAMETERS WERE  
 RECORDED.

IT Project No. 301251.02.17

GROUNDWATER FIELD DATA SHEET  
COE-HOLLOMAN AIR FORCE BASE  
WASTEWATER TREATMENT LAGOONS

Parameter Description	Value
SAMPLE CONTROL NUMBER	MW-070191
DATE SAMPLED	01/14/91
TIME	1030 (1)
SAMPLER'S INITIALS	AH, JS, KS
WELL/BORING LOCATION	MW-7
WELL/BORING DIAMETER (in)	4"
ELEVATION OF TOP OF WELL CASING REFERENCED TO MEAN SEA LEVEL (MSL)	4039.88 FAMSL
WATER-LEVEL MEASUREMENT	----
Total Depth (ft)	17.69
Depth to Groundwater (ft)	2.00 5:30
CALCULATIONS	
Thickness of Groundwater (ft)	11.89
Well Volume (gallons)	7.74
Purge Volume (gallons) for five casing volumes	38.69 → 39
NUMBER OF SAMPLE BOTTLES AND TYPE COLLECTED	See field notebook
pH	See page 2
Conductance (µmhos)	See page 2
Temperature (°C)	See page 2

## COMMENTS:

° HNu PID Background = 0.2 ppm; Well borehole = 0.4 ppm.

Date 1/14/91; Time 1242

° See field notebook for equipment type and calibration data; equipment calibrated at beginning and end of each field day.

° See field notebook for decontamination procedure.

(1) Coliform Bacteria sample collection time = NA.

ph Meter check against 7.00 buffer: Reading 7.02

PURGING DATA:

<u>TIME</u>	<u>VOLUME PURGED (GAL)</u>	<u>TEMP (C°)</u>	<u>pH</u>	<u>SC (umHos/cm)</u>	<u>COMMENTS</u>
1014	6	16.0	6.86	6.400	SLIGHTLY CLOUDY, NO COLOR
1019	12	15.0	6.90	6.500	SLIGHTLY CLOUDY, NO COLOR
1023	18	16.0	6.91	6.500	SLIGHTLY CLOUDY, SLIGHT CHLORINE
1031	24	16.0	6.89	6.600	VERY SLIGHTLY CLOUDY, NO COLOR
1036	30	16.5	6.93	6.200	VERY SLIGHTLY CLOUDY, NO COLOR, NO CHLORINE
1041	36	16.0	6.89	6.200	VERY SLIGHTLY CLOUDY, SLIGHT CHLORINE NO COLOR
1044	39	16.5	6.89	6.200	CLEAR, SLIGHT CHLORINE NO COLOR

Reading after sample collection:

(4 Replicate Readings)

1056	—	16.0	6.90	6.200
1058	—	16.0	6.90	6.500
1101	—	16.0	6.87	6.500
1104	—	16.0	6.89	6.500

Additional Comments: NEW GLOVES WERE DONNED BEFORE SAMPLE COLLECTION BEGAN  
 PROBES SAT IN SOLUTION BEFORE FIELD PARAMETERS WERE RECORDED. (~ 2 min)

GROUNDWATER FIELD DATA SHEET  
COE-HOLLOMAN AIR FORCE BASE  
WASTEWATER TREATMENT LAGOONS

IT Project No. 301251.02.07

Parameter Description	Value
SAMPLE CONTROL NUMBER	MW-080191
DATE SAMPLED	01/16/91
TIME	1215 (1)
SAMPLER'S INITIALS	AH, JS, KS
WELL/BORING LOCATION	MW-8
WELL/BORING DIAMETER (in)	4
ELEVATION OF TOP OF WELL CASING REFERENCED TO MEAN SEA LEVEL (MSL)	4040.50 FAMSL
<b>WATER-LEVEL MEASUREMENT</b>	----
Total Depth (ft)	17.75
Depth to Groundwater (ft)	5.35
<b>CALCULATIONS</b>	
Thickness of Groundwater (ft)	12.40
Well Volume (gallons)	8.07
Purge Volume (gallons) for five casing volumes	40.35 → 41
<b>NUMBER OF SAMPLE BOTTLES AND TYPE COLLECTED</b>	See field notebook
pH	See page 2
Conductance (µmhos)	See page 2
Temperature (°C)	See page 2

**COMMENTS:**

° HNu PID Background = 0.4 ppm; Well borehole = 0.4 ppm.  
Date 1/14/91; Time 1210

° See field notebook for equipment type and calibration data; equipment calibrated at beginning and end of each field day.

° See field notebook for decontamination procedure.

(1) Coliform Bacteria sample collection time = NA.

ph Meter check against 7.00 buffer: Reading 7.03

PURGING DATA:

<u>TIME</u>	<u>VOLUME PURGED (GAL)</u>	<u>TEMP (C°)</u>	<u>pH</u>	<u>SC (umHos/cm)</u>	<u>COMMENTS</u>
1137	6	15.5	6.93	9300	CLEAR, NO ODOOR OR COLOR
1142	12	17.0	6.85	<del>10200</del> 10200	CLEAR, NO ODOOR OR COLOR
1147	18	17.0	6.92	9800	CLEAR, NO ODOOR OR COLOR
1152	24	17.0	6.91	9600	CLEAR, NO ODOOR OR COLOR
1156	30	16.5	6.92	9100	SLIGHTLY CLOUDY, NO ODOOR, NO COLOR
1200	36	17.0	6.93	9500	VERY SLIGHTLY CLOUDY, NO ODOOR OR COLOR
1204	41	17.0	6.90	10000	CLEAR, NO ODOOR OR COLOR

Reading after sample collection: (4 Replicate Readings)

1217	—	16.5	6.81	10000
1223	—	17.0	6.83	10001
1226	—	17.0	6.83	9999
1229	—		6.83	9996

Additional Comments: NEW GLOVES WERE DONNED PRIOR TO SAMPLE COLLECTION,  
 PROBES SAT IN SOLUTION ~ 2 MIN BEFORE RECORDING FIELD PARAMETERS

GROUNDWATER FIELD DATA SHEET  
COE-HOLLOMAN AIR FORCE BASE  
WASTEWATER TREATMENT LAGOONS

IT Project No. 301251.02.07

Parameter Description	Value
SAMPLE CONTROL NUMBER	S-040191
DATE SAMPLED	011791
TIME	0945 1045 AMH (1)
SAMPLER'S INITIALS	AH, JS, KS
WELL/BORING LOCATION	S-4
WELL/BORING DIAMETER (in)	2
ELEVATION OF TOP OF WELL CASING REFERENCED TO MEAN SEA LEVEL (MSL)	4034.46 FAMSL
<b>WATER-LEVEL MEASUREMENT</b>	
Total Depth (ft)	14.35
Depth to Groundwater (ft)	8.67
<b>CALCULATIONS</b>	
Thickness of Groundwater (ft)	5.68
Well Volume (gallons)	0.92
Purge Volume (gallons) for five casing volumes	4.6 → 5
NUMBER OF SAMPLE BOTTLES AND TYPE COLLECTED	See field notebook
pH	See page 2
Conductance (µmhos)	See page 2
Temperature (°C)	See page 2

**COMMENTS:**

- ° HNu PID Background = 0.2 ppm; Well borehole = 0.2 ppm.  
Date 1/14/91; Time 1408
  - ° See field notebook for equipment type and calibration data; equipment calibrated at beginning and end of each field day.
  - ° See field notebook for decontamination procedure.
- (1) Coliform Bacteria sample collection time = NA.

ph Meter check against 7.00 buffer: Reading 7.13

PURGING DATA:

<u>TIME</u>	<u>VOLUME PURGED (GAL)</u>	<u>TEMP (C°)</u>	<u>pH</u>	<u>SC (umHos/cm)</u>	<u>COMMENTS</u>
0929	1	14.5	7.22	30100	CLEAR, NO ODOOR
0932	2	15.5	7.22	30110	CLEAR, NO ODOOR
0936	3	15.0	7.22	30110	CLEAR, NO ODOOR
0939	4	15.5	7.26	30090	SLIGHTLY CLOUDY, NO ODOOR
0942	5	15.0	7.26	30.020	SLIGHTLY CLOUDY, NO ODOOR

Reading after sample collection: (4 Replicate Readings)

0954	-	15.0	7.24	30.000
0957	-	15.6	7.20	30.150
0959	-	15.0	7.25	30.060
1002	-	15.0	7.25	30.090

Additional Comments: NEW GLOVES WERE DONNED PRIOR TO SAMPLE COLLECTION. PROBES SAT IN SOLUTION FOR ~ 2 min BEFORE RECORDING FIELD PARAMETERS



# WATER LEVEL INDICATOR CALIBRATION - HAFB

EQUIPMENT NUMBER S/N 00720

EQUIPMENT NAME ORS Interface Probe

DATE 1/14/91 Time = 1515 DATE LAST CALIBRATED 1/14/91

CALIBRATION PERIOD Post field use calibration

Interface Probe MARKER (FT.)	CALIBRATED READING (FT.) Steel Tape	MARKER (FT.)	CALIBRATED READING (FT.)						
0	NA	105		205		305		405	
5.00	<del>4.99</del> 5.01	110		210		310		410	
10.00	9.99	115		215		315		415	
15.00	14.99	120		220		320		420	
20.00	19.99	125		225		325		425	
25.00	24.99	130		230		330		430	
30.00	29.99	135		235		335		435	
35.00	34.99	140		240		340		440	
40.00	39.99	145		245		345		445	
45.00	44.99	150		250		350		450	
50.00	49.99	155		255		355		455	
55	—	160		260		360		460	
60	—	165		265		365		465	
65	—	170		270		370		470	
70	—	175		275		375		475	
75	—	180		280		380		480	
80		185		285		385		485	
85		190		290		390		490	
90		195		295		395		495	
95		200		300		400		500	
100									

NOTE: ACCEPTANCE IS ± 0.1 FEET

Calibrated to 50 FT

SIGNED [Signature]

**APPENDIX C**  
**SAMPLE CHAIN-OF-CUSTODY DOCUMENTATION**



REQUEST FOR ANALYSIS

R/A Control No. 208130  
C/C Control No. 158065

PROJECT NAME COE-Nolloman ~~Atkins~~  
 PROJECT NUMBER 301251.02.07  
 PROFIT CENTER NUMBER 3515  
 PROJECT MANAGER Dawn Meyer  
 BILL TO IT Corp  
501 Central Ave, NE, Suite 700  
Albuquerque, NM 87108  
 PURCHASE ORDER NO. \_\_\_\_\_

DATE SAMPLES SHIPPED 01/16/91  
 LAB DESTINATION ITAS-Knox  
 LABORATORY CONTACT Mary Tyler  
 SEND LAB REPORT TO Dawn Meyer  
IT-ADD  
 DATE REPORT REQUIRED 02/12/91  
 PROJECT CONTACT Dawn Meyer  
 PROJECT CONTACT PHONE NO. (505) 242-8800

Sample No.	Sample Type	Sample Volume	Preservative	Requested Testing Program	Special Instructions
MW-030191	Groundwater	250 ml	Jel; H <sub>2</sub> SO <sub>4</sub>	TOC x 4	Analyze as specified in attached sheet
↓	↓	1 l	HNO <sub>3</sub>	T. Metals (Fe, Mn, Na)	
↓	↓	1 l	H <sub>2</sub> SO <sub>4</sub>	Phenolics	
↓	↓	1 l		Wet Chem (chloride, sulfate)	
OMH 1/16/91 MW S-020191	↓	250 ml	H <sub>2</sub> SO <sub>4</sub>	TOC x 4	↓
S-020191	↓	1 l	HNO <sub>3</sub>	T. Metals (Fe, Mn, Na)	
↓	↓	1 l	H <sub>2</sub> SO <sub>4</sub>	Phenolics	
		1 l		Wet Chem (chloride, sulfate)	
LAST LINE					

TURNAROUND TIME REQUIRED: (Rush must be approved by the Laboratory Project Manager.) QC LEVEL: (Levels I and II are standard; project-specific requirements must be submitted to lab work.)

Normal  Rush \_\_\_\_\_ (Subject to rush surcharge.) I  II \_\_\_\_\_ Project Specific \_\_\_\_\_

POSSIBLE HAZARD IDENTIFICATION: (Please indicate if sample(s) are hazardous materials and/or suspected to contain high concentrations of hazardous substances.)

Non-hazard \_\_\_\_\_ Flammable \_\_\_\_\_ Skin Irritant \_\_\_\_\_ Highly Toxic \_\_\_\_\_ Other Biological (Please specify)

SAMPLE DISPOSAL: (Please indicate disposition of sample following analysis. Lab will charge for packing, shipping, archive and disposal.)

Return to Client \_\_\_\_\_ Disposal by Lab  Archive \_\_\_\_\_ (Indicate number of months.)

FOR LAB USE ONLY

Received by S. Hair ITAS

Date/Time 1-17-91 0900

ITNA 47584



CHAIN OF CUSTODY RECORD

R/A Control No. 208130  
C/C Control No. 158065

PROJECT NAME/NUMBER COE-HAFB/301251.02.07

LAB DESTINATION ITAS-Knoxville

SAMPLE TEAM MEMBERS A. Houska/J. Saavedra/K. ...

CARRIER/WAYBILL NO Federal Express No. 4330213941

Table with 7 columns: Sample Number, Sample Location and Description, Date and Time Collected, Sample Type, Container Type, Condition on Receipt (Name and Date), Disposal Record No. Rows include MW-03019 and S-020191 with various sample details and container types like Amber Glass and CPE.

Special Instructions: Contact project manager immediately if samples arrive damaged or container is broken.

Possible Sample Hazards: Biological

SIGNATURES: (Name, Company, Date and Time)

1. Relinquished By: Ann M. Houska; IT Corp; 011691; 1600  
Received By: J. Saavedra ITAS 1-17-90 0900

3. Relinquished By: [Redacted]  
Received by: [Redacted]

2. Relinquished By: \_\_\_\_\_  
Received By: \_\_\_\_\_

4. Relinquished By: \_\_\_\_\_  
Received By: \_\_\_\_\_

ITNA 47584



# CHAIN-OF-CUSTODY RECORD

R/A Control No. 208131  
C/C Control No. 158066

PROJECT NAME/NUMBER COE-HAFB/301251.02.07

LAB DESTINATION ITAS-Knoxville

SAMPLE TEAM MEMBERS A/ Houska/J. Saavedra/R. Schmidt

CARRIER/WAYBILL NO. Federal Express No. 4330213941

Sample Number	Sample Location and Description	Date and Time Collected	Sample Type	Container Type	Condition on Receipt (Name and Date)	Disposal Record No.
MW-07019	Monitor Well No. MW-7	011691, 1030	Groundwater	Amber Glass	OK RAC 1/17/91, 0900	
↓	↓	↓ ; 1030	↓	CPE	↓	
↓	↓	↓ ; 1030	↓	Amber Glass	↓	
↓	↓	↓ ; 1030	↓	CPE	↓	
MW-08019	MW-8	011691, 1215		Amber Glass		
↓	↓	↓ ; 1215	↓	CPE	↓	
↓	↓	↓ ; 1215	↓	Amber Glass	↓	
↓	↓	↓ ; 1215	↓	CPE	↓	
		<u>Last Line</u>				

Special Instructions: Contact project manager immediately if samples arrive damaged or custody seal is broken.

Possible Sample Hazards: Biological

SIGNATURES: (Name, Company, Date and Time)

1. Relinquished By: Ann M Houska, IT Corp, 011691, 1600

Received By: S. Rain, ITAS, 1-17-91, 0900

2. Relinquished By: \_\_\_\_\_

Received By: \_\_\_\_\_

3. Relinquished By: \_\_\_\_\_

Received by: \_\_\_\_\_

4. Relinquished By: \_\_\_\_\_

Received By: \_\_\_\_\_

ITNA 47584



**INTERNATIONAL  
TECHNOLOGY  
CORPORATION**

**REQUEST FOR ANALYSIS**

R/A Control No. 208131  
C/C Control No. 158066

PROJECT NAME COE - Holloman AFB  
PROJECT NUMBER 301251.02.07  
PROFIT CENTER NUMBER 3515  
PROJECT MANAGER Dann Meyer  
BILL TO IT Corp  
5801 Central Ave, NE, Suite 700  
Albuquerque, NM 87108  
PURCHASE ORDER NO. \_\_\_\_\_

DATE SAMPLES SHIPPED 01/16/91  
LAB DESTINATION ITAS - Kmar  
LABORATORY CONTACT Mary Tyler  
SEND LAB REPORT TO Dann Meyer  
IT-ABD  
DATE REPORT REQUIRED 02/01/91  
PROJECT CONTACT Alanna Meyer  
PROJECT CONTACT PHONE NO. (505) 262-9800

Sample No.	Sample Type	Sample Volume	Preservative	Requested Testing Program	Special Instructions
MW-070191	Groundwater	250 ml	Jca; H <sub>2</sub> SO <sub>4</sub>	TOC x 4	Analysis as specified
		1 l	; HNO <sub>3</sub>	T. Metals (Fe, Mn, Na)	in attached sheet
		1 l	; H <sub>2</sub> SO <sub>4</sub>	Phenolics	
		1 l		Wet Chem (Chloride, sulfate)	
MW-080191		250 ml	; H <sub>2</sub> SO <sub>4</sub>	TOC x 4	
		1 l	; HNO <sub>3</sub>	T. Metals (Fe, Mn, Na)	
		1 l	; H <sub>2</sub> SO <sub>4</sub>	Phenolics	
		1 l		Wet Chem (Cate)	
LAST LINE					

TURNAROUND TIME REQUIRED: (Rush must be approved by the Laboratory Project Manager.)  
 Normal  Rush \_\_\_\_\_ (Subject to rush surcharge.)  
 QC LEVEL: (Levels II and III are for project-specific requirements must be submitted to lab.)  
 I  II \_\_\_\_\_ Project Specific \_\_\_\_\_

POSSIBLE HAZARD IDENTIFICATION: (Please indicate if sample(s) are hazardous materials and/or suspected to contain high concentrations of toxic substances.)  
 Non-hazardous \_\_\_\_\_ Flammable \_\_\_\_\_ Skin Irritant \_\_\_\_\_ Highly Toxic \_\_\_\_\_  
 Other Biological (Please Specify)

SAMPLE DISPOSAL: (Please indicate disposition of sample following analysis. Lab will charge for packing, shipping, archive and disposal.)  
 Return to Client \_\_\_\_\_ Disposal by Lab  Archive \_\_\_\_\_ (Indicate number of months.)

FOR LAB USE ONLY  
 Received by S. Han ITAS Date/Time 1-17-91 0900



CHAIN-OF-CUSTODY RECORD

R/A Control No. 208132

C/C Control No. 158072

PROJECT NAME/NUMBER COE-HAFB/301251.02.07

LAB DESTINATION ITAS-Knoxville

SAMPLE TEAM MEMBERS A. Houska/J. Saavedra/K. Schlot

CARRIER/WAYBILL NO. Federal Express NO. 4330213941

Table with 7 columns: Sample Number, Sample Location and Description, Date and Time Collected, Sample Type, Container Type, Condition on Receipt (Name and Date), Disposal Record No. Rows include MW-010191 and MW-050191.

Special Instructions: Contact project manager immediately if samples arrive damaged or container is broken.

Possible Sample Hazards: Biological

SIGNATURES: (Name, Company, Date and Time)

1. Relinquished By: A. Houska, IT, 011691; 1600

Received By: J. Saavedra, ITAS 1-17-91 0900

2. Relinquished By: \_\_\_\_\_

Received By: \_\_\_\_\_

3. Relinquished By: \_\_\_\_\_

Received by: \_\_\_\_\_

4. Relinquished By: \_\_\_\_\_

Received By: \_\_\_\_\_

ITNA 47584



**INTERNATIONAL  
TECHNOLOGY  
CORPORATION**

**REQUEST FOR ANALYSIS**

R/A Control No. **208132**  
C/C Control No. **158072**

PROJECT NAME COE-Holloman AFB  
PROJECT NUMBER 301251.02.07  
PROFIT CENTER NUMBER 3515  
PROJECT MANAGER Dean Meyer  
BILL TO IT Corp  
5301 Central Ave. NE, Suite 700  
Albuquerque, NM 87108  
PURCHASE ORDER NO. \_\_\_\_\_

DATE SAMPLES SHIPPED 01/16/91  
LAB DESTINATION ITAS-King  
LABORATORY CONTACT Mary Miller  
SEND LAB REPORT TO Dean Meyer  
IT-ABO  
DATE REPORT REQUIRED 02/22/91  
PROJECT CONTACT Dean Meyer  
PROJECT CONTACT PHONE NO. (505) 426-8500

Sample No.	Sample Type	Sample Volume	Preservative	Requested Testing Program	Special Instructions
MW-010191	Groundwater	250 ml	See; H <sub>2</sub> SO <sub>4</sub>	TOC x 4	Analyze and report in attached sheets.
↓	↓	1 l	↓; HNO <sub>3</sub>	T. Metals (Fe, Mn, Na)	
↓	↓	1 l	↓; H <sub>2</sub> SO <sub>4</sub>	Phenolics	
↓	↓	1 l	↓	Wet Chem (Chloride, sulfate)	
MW-050191	↓	250 ml	↓; H <sub>2</sub> SO <sub>4</sub>	TOC x 4	↓
↓	↓	1 l	↓; HNO <sub>3</sub>	T. Metals (Fe, Mn, Na)	
↓	↓	1 l	↓; H <sub>2</sub> SO <sub>4</sub>	Phenolics	
				Wet Chem (C)	

TURNAROUND TIME REQUIRED: (Rush must be approved by the Laboratory Project Manager.)  
 Normal  Rush \_\_\_\_\_ (Subject to rush surcharge.)  
 QC LEVEL: (Levels II and III submitted to lab before analysis. Level-specific requirements must be submitted to lab before analysis.)  
 I  II \_\_\_\_\_ Project Specific \_\_\_\_\_

POSSIBLE HAZARD IDENTIFICATION: (Please indicate if sample(s) are hazardous materials and/or suspected to contain high level concentrations.)  
 Non-hazard \_\_\_\_\_ Flammable \_\_\_\_\_ Skin Irritant \_\_\_\_\_ Highly Toxic \_\_\_\_\_ Other Biological  
 (Please specify)

SAMPLE DISPOSAL: (Please indicate disposition of sample following analysis. Lab will charge for packing, shipping, archive and disposal.)  
 Return to Client \_\_\_\_\_ Disposal by Lab  Archive \_\_\_\_\_ (Indicate number of months.)

FOR LAB USE ONLY  
 Received by S. Han ITAS Date/Time 1-17-91 0900

XI-4-114



CHAIN-OF-CUSTODY RECORD

R/A Control No. 208113

C/C Control No. 158050

PROJECT NAME/NUMBER COE-HAFB/301251.02.07

LAB DESTINATION ITAS-Cinc.

SAMPLE TEAM MEMBERS A. Houska/J.Saavedra/K. Schmidt

CARRIER/WAYBILL NO. Federal Express No. 4330213871

Table with 7 columns: Sample Number, Sample Location and Description, Date and Time Collected, Sample Type, Container Type, Condition on Receipt (Name and Date), Disposal Recbrd No. Rows include MW-020191, MW-060191, S-040191, MW-040191, MW-120191, and a 'Last Line' entry.

Special Instructions: Contact project manager immediately if samples arrive damaged or custody seal is broken.

Possible Sample Hazards: Biological

SIGNATURES: (Name, Company, Date and Time)

1. Relinquished By: Ann M. Houska; IT Corp; 01/17/91; 1650

3. Relinquished By: \_\_\_\_\_

Received By: [Signature] ITAS, 1/18/91 1120

Received by: \_\_\_\_\_

2. Relinquished By: \_\_\_\_\_

4. Relinquished By: \_\_\_\_\_

Received By: \_\_\_\_\_

Received By: \_\_\_\_\_

XI-01-114



INTERNATIONAL TECHNOLOGY CORPORATION

REQUEST FOR ANALYSIS

R/A Control No. 208113  
C/C Control No. 158050

PROJECT NAME COE- Holloman AFB  
PROJECT NUMBER 301251.02.07  
PROFIT CENTER NUMBER 3515  
PROJECT MANAGER Dann Meyer  
BILL TO IT Corp  
5301 Central Ave, NE, Suite 700  
Albuquerque, NM 87108  
PURCHASE ORDER NO. 91-113

DATE SAMPLES SHIPPED 01/17/91  
LAB DESTINATION ITAS- Cine  
LABORATORY CONTACT Wendy Coates  
SEND LAB REPORT TO Dann Meyer  
IT-ABQ  
DATE REPORT REQUIRED 02/15/91  
PROJECT CONTACT Dann Meyer  
PROJECT CONTACT PHONE NO. (505) 262-8800

Sample No.	Sample Type	Sample Volume	Preservative	Requested Testing Program	Special Instructions
MW-020191	<u>Groundwater</u>	<u>4x 250 ml</u>	<u>Ice</u>	<u>4x POX-EPA METHOD #9021</u>	<u>Analyze as specified on attached sheets.</u>
MW-060191	↓	↓ ↓	↓	↓ ↓	
<sup>11/20/91</sup> S-040191	↓	↓ ↓	↓	↓ ↓	
MW-040191	↓	↓ ↓	↓	↓ ↓	
MW-0120191	↓	↓ ↓	↓	↓ ↓	
			<u>Last Line</u>		

TURNAROUND TIME REQUIRED: (Rush must be approved by the Laboratory Project Manager.)  
Normal  Rush \_\_\_\_\_ (Subject to rush surcharge.)  
QC LEVEL: (Levels II and III subject to surcharge; project-specific requirements must be submitted to lab before beginning work.)  
I  II \_\_\_\_\_ III \_\_\_\_\_ Project Specific \_\_\_\_\_

POSSIBLE HAZARD IDENTIFICATION: (Please indicate if sample(s) are hazardous materials and/or suspected to contain high levels of hazardous substances.)  
Non-hazard \_\_\_\_\_ Flammable \_\_\_\_\_ Skin Irritant \_\_\_\_\_ Highly Toxic \_\_\_\_\_ Other Biological  
(Please Specify)

SAMPLE DISPOSAL: (Please indicate disposition of sample following analysis. Lab will charge for packing, shipping, archive and disposal.)  
Return to Client \_\_\_\_\_ Disposal by Lab  Archive \_\_\_\_\_ (Indicate number of months.)

FOR LAB USE ONLY  
Received by [Signature] Date/Time 1/18/91 1120



XI-01-102

CHAIN-OF-CUSTODY RECORD

R/A Control No. 208114

C/C Control No. 158053

PROJECT NAME/NUMBER COE-HAFb/301251,02,07

LAB DESTINATION ITAS-Cinc

SAMPLE TEAM MEMBERSA. Houska, J. Saavedra, K. Schmidt

CARRIER/WAYBILL NO. Federal Express No. 4330214221

Sample Number	Sample Location and Description	Date and Time Collected	Sample Type	Container Type	Condition on Receipt (Name and Date)	Disposal Record No
MW-010191	Monitor well no. MW-1	011591; 0900	Groundwater	Amber Glass W/Septa Cap		
MW-050191	MW-5	011691; 0920				
MW-070191	MW-7	011691; 1030				
MW-080191	MW-8	011691; 1215				
MW-030191	MW-3	011691; 1330				
MW-110191	MW-11	011491; 0500				
S-020191	S-2	011691; 1500				
Last Line						

Special Instructions: Contact project manager immediately if samples arrive damaged or custody seal is broken.

Possible Sample Hazards: Biological

SIGNATURES: (Name, Company, Date and Time)

1. Relinquished By: A. Houska, IT; 011691; 1600

Received By: J. Saavedra, ITAS; 1/17/91 1120

2. Relinquished By: \_\_\_\_\_

Received By: \_\_\_\_\_

3. Relinquished By: \_\_\_\_\_

Received by: \_\_\_\_\_

4. Relinquished By: \_\_\_\_\_

Received By: \_\_\_\_\_



**INTERNATIONAL  
TECHNOLOGY  
CORPORATION**

**XI-01-102**

**REQUEST FOR ANALYSIS**

R/A Control No. 208114

C/C Control No. 158053

PROJECT NAME COE-Holloman AFB  
 PROJECT NUMBER 301251.02.07  
 PROFIT CENTER NUMBER 3515  
 PROJECT MANAGER Dann Meyer  
 BILL TO IT Corp  
5301 Central Ave, NE, Suite 700  
Albuquerque, NM 87108  
 PURCHASE ORDER NO. 91-113

DATE SAMPLES SHIPPED 01/16/91  
 LAB DESTINATION ITAS-CINC  
 LABORATORY CONTACT Wendy Coates  
 SEND LAB REPORT TO Dann Meyer  
IT-ABQ  
 DATE REPORT REQUIRED 02/15/91  
 PROJECT CONTACT Dann Meyer  
 PROJECT CONTACT PHONE NO. (505) 262-8800

Sample No.	Sample Type	Sample Volume	Preservative	Requested Testing Program	Special Instructions
MW-010191	<u>Groundwater</u>	<u>4 x 250 ml</u>	<u>Sec.</u>	<u>4 x POX-EPA METHOD # 9021</u>	<u>Analyze as specified on attached sheets</u>
MW-050191	↓	↓	↓	↓	↓
MW-070191	↓	↓	↓	↓	↓
MW-080191	↓	↓	↓	↓	↓
MW-030191	↓	↓	↓	↓	↓
MW-110191	↓	<u>1 x 250 ml</u>	↓	↓	↓
<u>45-020191</u>	↓	<u>4 x 250 ml</u>	↓	↓	↓
<u>← LAST LINE</u>					

TURNAROUND TIME REQUIRED: (Rush must be approved by the Laboratory Project Manager.)  
 Normal  Rush \_\_\_\_\_ (Subject to rush surcharge.)  
 QC LEVEL: (Levels II and III subject to surcharge; project-specific requirements must be submitted to lab before beginning work.)  
 I  II \_\_\_\_\_ III \_\_\_\_\_ Project Specific \_\_\_\_\_

POSSIBLE HAZARD IDENTIFICATION: (Please indicate if sample(s) are hazardous materials and/or suspected to contain high levels of hazardous substances.)  
 Non-hazard \_\_\_\_\_ Flammable \_\_\_\_\_ Skin Irritant \_\_\_\_\_ Highly Toxic \_\_\_\_\_ Other Biological  
 (Please Specify)

SAMPLE DISPOSAL: (Please indicate disposition of sample following analysis. Lab will charge for packing, shipping, archive and disposal.)

Return to Client \_\_\_\_\_ Disposal by Lab  Archive \_\_\_\_\_ (Indicate number of months.)

FOR LAB USE ONLY

Received by [Signature]

Date/Time 1/17/91 1120



# CHAIN-OF-CUSTODY RECORD

R/A Control No. 208129

C/C Control No. 158064

PROJECT NAME/NUMBER COE-HAFB/301251.02.07

LAB DESTINATION ITAS-Knoxville

SAMPLE TEAM MEMBERS A. Houska/J. Saavedra/K. Schmidt

CARRIER/WAYBILL NO. Federal Express No. 4330214232

Sample Number	Sample Location and Description	Date and Time Collected	Sample Type	Container Type	Condition on Receipt (Name and Date)	Disposal Record No.
MW-040191	Monitor Well NO. <u>MW-4</u>	011791, 1130	Groundwater	Amber Glass	OK RMC 1/18/91 0830 4°C	
↓	↓	011791, 1130	↓	CPE	↓	
↓	↓	011791, 1130	↓	Amber Glass	↓	
↓	↓	011791, 1130	↓	CPE	↓	
S-040191	S-4	011791, 0945	↓	Amber Glass	↓	
↓	↓	011791, 0945	↓	CPE	↓	
↓	↓	011791, 0945	↓	Amber Glass	↓	
↓	↓	011791, 0945	↓	CPE	↓	
Last Line						

Special Instructions: Contact project manager immediately if samples arrive damaged or custody seal is broken.

Possible Sample Hazards: Biological

SIGNATURES: (Name, Company, Date and Time)

1. Relinquished By: Ann M Houska, IT, 011791, 1650

Received By: Kevin Cedar, ITAS, 1/18/91 0830

3. Relinquished By: \_\_\_\_\_

Received by: \_\_\_\_\_

2. Relinquished By: \_\_\_\_\_

4. Relinquished By: \_\_\_\_\_

Received By: \_\_\_\_\_

Received By: \_\_\_\_\_

ITNA 47599



**INTERNATIONAL  
TECHNOLOGY  
CORPORATION**

**REQUEST FOR ANALYSIS**

R/A Control No. **208129**

C/C Control No. **158064**

PROJECT NAME COE-Holloman AFB  
 PROJECT NUMBER 301251.02.07  
 PROFIT CENTER NUMBER 8515  
 PROJECT MANAGER Rann Meyer  
 BILL TO IT Corp  
5301 Central Ave, NE, Suite 700  
Albuquerque, NM 87108  
 PURCHASE ORDER NO. \_\_\_\_\_

DATE SAMPLES SHIPPED 01/17/91  
 LAB DESTINATION ITAS-Knox  
 LABORATORY CONTACT Mary Tyler  
 SEND LAB REPORT TO Rann Meyer  
IT-ABQ  
 DATE REPORT REQUIRED 02/22/91  
 PROJECT CONTACT Rann Meyer  
 PROJECT CONTACT PHONE NO. (505) 262-8800

Sample No.	Sample Type	Sample Volume	Preservative	Requested Testing Program	Special Instructions
MW-040191	Groundwater	250 ml	Ice; H <sub>2</sub> SO <sub>4</sub>	TOC x 4	Analyze as specified in attached sheets.
MW-040191	↓	1 l	HNO <sub>3</sub>	T. METALS (Fe, Mn, Na)	
MW-040191		1 l	H <sub>2</sub> SO <sub>4</sub>	Phenolics	
MW-040191		1 l	}	Wet Chem (chloride, sulfate)	
S-040191		250 ml		; H <sub>2</sub> SO <sub>4</sub>	
S-040191		1 l	; HNO <sub>3</sub>	T. Metals (Fe, Mn, Na)	
S-040191		1 l	; H <sub>2</sub> SO <sub>4</sub>	Phenolics	
S-040191		1 l	↓	Wet Chem (chloride, sulfate)	
Last Line					

TURNAROUND TIME REQUIRED: (Rush must be approved by the Laboratory Project Manager.)  
 Normal  Rush \_\_\_\_\_ (Subject to rush surcharge.)  
 QC LEVEL: (Levels II and III subject to surcharge; project-specific requirements must be submitted to lab before beginning work.)  
 I  II \_\_\_\_\_ III \_\_\_\_\_ Project Specific \_\_\_\_\_

POSSIBLE HAZARD IDENTIFICATION: (Please indicate if sample(s) are hazardous materials and/or suspected to contain high levels of hazardous substances.)  
 Non-hazard \_\_\_\_\_ Flammable \_\_\_\_\_ Skin Irritant \_\_\_\_\_ Highly Toxic \_\_\_\_\_  
 Other Biological (Please Specify)

SAMPLE DISPOSAL: (Please indicate disposition of sample following analysis. Lab will charge for packing, shipping, archive and disposal.)  
 Return to Client \_\_\_\_\_ Disposal by Lab  Archive \_\_\_\_\_ (Indicate number of months.)

FOR LAB USE ONLY  
 Received by Kevina Cedar Date/Time 1/18/91, 0930  
ITNA 47599



CHAIN-OF-CUSTODY RECORD

R/A Control No. 208128

C/C Control No. 158067

PROJECT NAME/NUMBER COE-HAFB/301251.02.07

LAB DESTINATION ITAS-Knoxville

SAMPLE TEAM MEMBERS A. Houska/J. Saavedra/K. Schmidt

CARRIER/WAYBILL NO. Federal Express No. 4330214232

Sample Number	Sample Location and Description	Date and Time Collected	Sample Type	Container Type	Condition on Receipt (Name and Date)	Disposal Record No.
MW-120191	Monitor Well NO. MW-12	011791; 1230	Groundwater	Amber Glass	OK KMC 1/18/01 0830 4°C	
MW-120191	↓	011791; ↓	↓	CPE	↓	
MW-120191	↓	011791; ↓	↓	Amber Glass	↓	
MW-120191	↓	011791; ↓	↓	CPE	↓	
----- LAST LINE -----						

Special Instructions: Contact project manager immediately if samples arrive damaged or custody seal is broken

Possible Sample Hazards: Biological

SIGNATURES: (Name, Company, Date and Time)

1. Relinquished By: A. Houska, IT Corp, 011791; 1650  
Received By: Kevin Cedar, ITAS, 1/18/01, 0830

3. Relinquished By: \_\_\_\_\_  
Received by: \_\_\_\_\_

2. Relinquished By: \_\_\_\_\_  
Received By: \_\_\_\_\_

4. Relinquished By: \_\_\_\_\_  
Received By: \_\_\_\_\_

ITNA 47599



**REQUEST FOR ANALYSIS**

R/A Control No. 208128  
 C/C Control No. 158067

PROJECT NAME CDE - Holloman ABB  
 PROJECT NUMBER 301251.02.07  
 PROFIT CENTER NUMBER 3515  
 PROJECT MANAGER Dana Meyer  
 BILL TO IT Corp  
5301 Central Ave, NE, Suite 700  
Albuquerque, NM 87109  
 PURCHASE ORDER NO. \_\_\_\_\_

DATE SAMPLES SHIPPED 01/17/91  
 LAB DESTINATION ITAS - Knox  
 LABORATORY CONTACT Mary Tyler  
 SEND LAB REPORT TO Dana Meyer  
IT-ABB  
 DATE REPORT REQUIRED 02/22/91  
 PROJECT CONTACT Dana Meyer  
 PROJECT CONTACT PHONE NO. (505) 262-8800

Sample No.	Sample Type	Sample Volume	Preservative	Requested Testing Program	Special Instructions
MW-120191	<u>Groundwater</u>	<u>250 ml</u>	<u>Ice; H<sub>2</sub>SO<sub>4</sub></u>	<u>TOC x 4</u>	<u>Analyze as specified in attached sheets</u>
MW-120191	↓	<u>1 l</u>	<u>HNO<sub>3</sub></u>	<u>T. METALS (Fe, Mn, Na)</u>	
MW-120191	↓	<u>1 l</u>	<u>H<sub>2</sub>SO<sub>4</sub></u>	<u>Phenolics</u>	
MW-120191	↓	<u>1 l</u>		<u>Wet Chem (chloride, sulfate)</u>	
<u>Last Line</u>					

TURNAROUND TIME REQUIRED: (Rush must be approved by the Laboratory Project Manager.)  
 Normal  Rush \_\_\_\_\_ (Subject to rush surcharge.)  
 QC LEVEL: (Levels II and III subject to surcharge; project-specific requirements must be submitted to lab before beginning work.)  
 I  II \_\_\_\_\_ III \_\_\_\_\_ Project Specific \_\_\_\_\_

POSSIBLE HAZARD IDENTIFICATION: (Please indicate if sample(s) are hazardous materials and/or suspected to contain high levels of hazardous substances.)  
 Non-hazard \_\_\_\_\_ Flammable \_\_\_\_\_ Skin Irritant \_\_\_\_\_ Highly Toxic \_\_\_\_\_ Other Biological  
 (Please Specify)

SAMPLE DISPOSAL: (Please indicate disposition of sample following analysis. Lab will charge for packing, shipping, archive and disposal.)  
 Return to Client \_\_\_\_\_ Disposal by Lab  Archive \_\_\_\_\_ (Indicate number of months.)

FOR LAB USE ONLY  
 Received by Kevin Cedar

Date / Time 1/18/91, 0830  
ITNA 47599



# CHAIN-OF-CUSTODY RECORD

208127

R/A Control No. 4330214232 amH 11/7/91

C/C Control No. 158070

PROJECT NAME/NUMBER COE-HAFB/301251\_02\_07

LAB DESTINATION ITAS-Knoxville

SAMPLE TEAM MEMBERS A. Houska/J. Saavedra/K. Schmidt

CARRIER/WAYBILL NO. Federal Express No. 4330214232

Sample Number	Sample Location and Description	Date and Time Collected	Sample Type	Container Type	Condition on Receipt (Name and Date)	Disposal Record No.
MW-020191	Monitor Well No. <u>MW-2</u>	011691; 1730	Groundwater	Amber Glass	4 OK KMC 1/18/91, 0830	
MW-020191	↓	011691; 1730	↓	CPE		
MW-020191	↓	011691; 1730	↓	Amber Glass		
MW-020191	↓	011691; 1730	↓	CPE		
MW-060191	MW-6	011791; 0845	↓	Amber Glass		
MW-060191	↓	011791; 0845	↓	CPE		
MW-060191	↓	011791; 0845	↓	Amber Glass		
MW-060191	↓	011791; 0845	↓	CPE		

Special Instructions: Contact project manager immediately if samples arrive damaged or custody seal is broken.

Possible Sample Hazards: Biological

SIGNATURES: (Name, Company, Date and Time)

1. Relinquished By: Ann M Houska, ITCop; 011791; 1650

Received By: J. Saavedra, ITAS-K 1-18-91 0830

2. Relinquished By: \_\_\_\_\_

Received By: \_\_\_\_\_

3. Relinquished By: \_\_\_\_\_

Received by: \_\_\_\_\_

4. Relinquished By: \_\_\_\_\_

Received By: \_\_\_\_\_

ITNA 47599



### REQUEST FOR ANALYSIS

R/A Control No. 208127  
 C/C Control No. 158070

PROJECT NAME COE- Holloman AFB  
 PROJECT NUMBER 301251.02.07  
 PROFIT CENTER NUMBER 3515  
 PROJECT MANAGER Dana Meyer  
 BILL TO IT Corp.  
5301 Central Ave, NE, Suite 700  
Albuquerque, NM 87108  
 PURCHASE ORDER NO. \_\_\_\_\_

DATE SAMPLES SHIPPED 01/17/91  
 LAB DESTINATION ITAS - Knox  
 LABORATORY CONTACT Mary Tyler  
 SEND LAB REPORT TO Dana Meyer  
IT-ABQ  
 DATE REPORT REQUIRED 02/12/91  
 PROJECT CONTACT Dana Meyer  
 PROJECT CONTACT PHONE NO. (505) 262-8800

Sample No.	Sample Type	Sample Volume	Preservative	Requested Testing Program	Special Instructions
MW-020191	<u>Groundwater</u>	<u>250 ml</u>	<u>Ice; H<sub>2</sub>SO<sub>4</sub></u>	<u>TOC x 4</u>	<u>Analyze as specified in attached sheets.</u>
MW-020191	↓	<u>1 l</u>	<u>HNO<sub>3</sub></u>	<u>T. Metals (Fe, Mn, Na)</u>	
MW-020191	↓	<u>1 l</u>	<u>H<sub>2</sub>SO<sub>4</sub></u>	<u>Phenolics</u>	
MW-020191	↓	<u>1 l</u>	)	<u>Wet Chem (chloride, sulfate)</u>	
MW-060191	↓	<u>250 ml</u>	<u>; H<sub>2</sub>SO<sub>4</sub></u>	<u>TOC x 4</u>	
MW-060191	↓	<u>1 l</u>	<u>; HNO<sub>3</sub></u>	<u>T. Metals (Fe, Mn, Na)</u>	
MW-060191	↓	<u>1 l</u>	<u>; H<sub>2</sub>SO<sub>4</sub></u>	<u>Phenolics</u>	
MW-060191	↓	<u>1 l</u>	↓	<u>Wet Chem (chloride, sulfate)</u>	
		<u>Last Line</u>			

TURNAROUND TIME REQUIRED: (Rush must be approved by the Laboratory Project Manager.)  
 Normal  Rush \_\_\_\_\_ (Subject to rush surcharge.)  
 QC LEVEL: (Levels II and III subject to surcharge; project-specific requirements must be submitted to lab before beginning work.)  
 I  II \_\_\_\_\_ III \_\_\_\_\_ Project Specific \_\_\_\_\_

POSSIBLE HAZARD IDENTIFICATION: (Please indicate if sample(s) are hazardous materials and/or suspected to contain high levels of hazardous substances.)  
 Non-hazard \_\_\_\_\_ Flammable \_\_\_\_\_ Skin Irritant \_\_\_\_\_ Highly Toxic \_\_\_\_\_  
 Other Biological (Please Specify)

SAMPLE DISPOSAL: (Please indicate disposition of sample following analysis. Lab will charge for packing, shipping, archive and disposal.)  
 Return to Client \_\_\_\_\_ Disposal by Lab  Archive \_\_\_\_\_ (Indicate number of months.)

FOR LAB USE ONLY  
 Received by [Signature]

Date/Time 1-18-91 0830  
ITNA 47599



CHAIN-OF-CUSTODY RECORD

R/A Control No. 208123

C/C Control No. 158059

PROJECT NAME/NUMBER Wastewater Treatment Upgrade  
CPE-Holloman AFB/31125102-07 LAB DESTINATION USAF Air Force Civil Engineer Lab

SAMPLE TEAM MEMBERS A. Houska / J. Swartz / K. Schmitt CARRIER/WAYBILL NO. 4: detal Express No 4330213856

Sample Number	Location	Date and Time Collected	Sample Type	Container Type	Condition on Receipt (Name and Date)	Disposal Record No.
QMW-020191	Monitor well MW-2	011691, 1730	Microbiota	Amber glass - Septa cap		
QMW-020191		011691, 1730		Amber glass		
QMW-020191		011691, 1730		CPE		
QMW-020191		011691, 1730		Amber glass		
QMW-020191		011691, 1730		CPE		
QMW-040191	MW-4	011791, 1130		Amber glass - septa cap		
QMW-040191		011791, 1130		Amber glass		
QMW-040191		011791, 1130		CPE		
QMW-040191		011791, 1130		Amber glass		
QMW-040191		011791, 1130		CPE		

Special Instructions: Contact project manager immediately if samples arrive damaged or custody seal is broken

Possible Sample Hazards: Biological

SIGNATURES: (Name, Company, Date and Time)

1. Relinquished By: Ann M Houska, IT, 011791, 1650  
Received By: \_\_\_\_\_

3. Relinquished By: \_\_\_\_\_  
Received by: \_\_\_\_\_

2. Relinquished By: \_\_\_\_\_  
Received By: \_\_\_\_\_

4. Relinquished By: \_\_\_\_\_  
Received By: \_\_\_\_\_

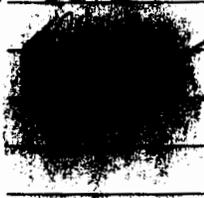


**INTERNATIONAL  
TECHNOLOGY  
CORPORATION**

**REQUEST FOR ANALYSIS**

R/A Control No. **208123**

C/C Control No. ~~208122~~ **158059** QAM 1/17

PROJECT NAME Wastewater Treatment Lagoons  
COE-Hickman AFB  
 PROJECT NUMBER 301251.02.07  
 PROFIT CENTER NUMBER 3515  
 PROJECT MANAGER Meyer  
 BILL TO   
 PURCHASE ORDER NO. NA

DATE SAMPLES SHIPPED 01/17/91  
 LAB DESTINATION USACE Missouri River Div Lab  
 LABORATORY CONTACT Dr. Joe Solsky  
 SEND LAB REPORT TO 17 Corps  
5301 Central Ave NE, Ste 700  
Albuquerque, NM 87108  
 DATE REPORT REQUIRED 02/15/91  
 PROJECT CONTACT Kevin Meyer  
 PROJECT CONTACT PHONE NO. (505) 262-8800

Sample No.	Sample Type	Sample Volume	Preservative	Requested Testing Program	Special Instructions
QMW-020191	<u>Groundwater</u>	<u>4 x 250 ml</u>	<u>ice</u>	<u>POX x 4</u>	<u>Analyze as specified on attached sheets</u>
QMW-020191		<u>1 x 250 ml</u>	<u>H<sub>2</sub>SO<sub>4</sub></u>	<u>TOC x 4</u>	
QMW-020191		<u>1 l</u>	<u>; HNO<sub>3</sub></u>	<u>T. Metals (Fe, Mn, Na)</u>	
QMW-020191		<u>1 l</u>	<u>; H<sub>2</sub>SO<sub>4</sub></u>	<u>Phenolics</u>	
QMW-020191		<u>1 l</u>		<u>Wet Chem (chloride, sulfate)</u>	
QMW-040191		<u>4 x 250 ml</u>		<u>POX x 4</u>	
QMW-040191		<u>1 x 250 ml</u>	<u>; H<sub>2</sub>SO<sub>4</sub></u>	<u>TOC x 4</u>	
QMW-040191		<u>1 l</u>	<u>; HNO<sub>3</sub></u>	<u>T. Metals (Fe, Mn, Na)</u>	
QMW-040191		<u>1 l</u>	<u>; H<sub>2</sub>SO<sub>4</sub></u>	<u>Phenolics</u>	
QMW-040191		<u>1 l</u>		<u>Wet Chem (Fe, Mn, Na)</u>	

TURNAROUND TIME REQUIRED: (Rush must be approved by the Laboratory Project Manager.)  
 Normal  Rush \_\_\_\_\_ (Subject to rush surcharge.)  
 QC LEVEL: (Levels II and III subject to surcharge; project-specific requirements must be submitted to lab before beginning work.)  
 I  II \_\_\_\_\_ III \_\_\_\_\_ Project Specific \_\_\_\_\_

POSSIBLE HAZARD IDENTIFICATION: (Please indicate if sample(s) are hazardous materials and/or suspected to contain high levels of hazardous substances.)  
 Non-hazard \_\_\_\_\_ Flammable \_\_\_\_\_ Skin Irritant \_\_\_\_\_ Highly Toxic \_\_\_\_\_  
 Other Biological (Please Specify)

SAMPLE DISPOSAL: (Please indicate disposition of sample following analysis. Lab will charge for packing, shipping, archive and disposal.)  
 Return to Client \_\_\_\_\_ Disposal by Lab  Archive \_\_\_\_\_ (Indicate number of months.)

FOR LAB USE ONLY  
 Received by \_\_\_\_\_ Date/Time \_\_\_\_\_

**APPENDIX D**  
**CERTIFICATES OF ANALYSES**



# ANALYTICAL SERVICES

## CERTIFICATE OF ANALYSIS

IT Corporation  
5301 Central Avenue NE  
Suite 700  
Albuquerque, New Mexico 87108  
Attn: Mr. Dann Meyer

Date: February 5, 1991

Job Number 21270

P.O. Number 91-113

This is the Certificate of Analysis for the following samples:

Client Project ID: Holloman AFB  
Date Received: January 17 & 18, 1991  
Work Order: X1-01-102, 114  
Number of Samples: 12  
Sample Type: Liquid

### I. Introduction

Twelve liquid samples were received by ITAS Cincinnati on January 17 and 18, 1991. The samples were labeled as follows:

Water MW-010191	Water MW-030191	Water MW-060191
Water MW-050191	Water MW-110191	Water S-040191
Water MW-070191	Water S-020191	Water MW-040191
Water MW-080191	Water MW-020191	Water MW-120191

### II. Analytical Results/Methodology

The analytical results for this report are presented by analytical test. Each set of data will include sample identification information, the analytical results, and the appropriate detection limits.

The analysis requested was POX according to the procedures outlined in EPA Method 9021. Each sample was analyzed in quadruplicate except for sample # MW-110191 for which only one bottle was received.

Reviewed and Approved by:

C. Craig Crume  
Project Manager  
101102

American Council of Independent Laboratories  
International Association of Environmental Testing Laboratories  
American Association for Laboratory Accreditation

Client: Holloman AFB  
Work Order: Multiple  
10110202

IT ANALYTICAL SERVICES  
CINCINNATI, OH

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### III. Quality Control

Immediately following the analytical data for the samples can be found the QA/QC information that pertains to these samples. The purpose of this information is to demonstrate that the data enclosed is scientifically valid and defensible. This QA/QC data is used to assess the laboratory's performance during the analysis of the samples it accompanies. All quantitations were performed from within the calibrated range of the analytical instrument.

Client: Holloman AFB  
Work Order: X1-01-102  
10110201

IT ANALYTICAL SERVICES  
CINCINNATI, OH

Analytical Results, ug/L

Client Sample ID	Lab No.	POX
Water MW-010191	102-01A	ND
	B	ND
	C	ND
	D	ND
Water MW-050191	102-02A	ND
	B	ND
	C	ND
	D	ND
Water MW-070191	102-03A	28
	B	ND
	C	ND
	D	98
Water MW-080191	102-04A	95
	B	74
	C	81
	D	ND
Water MW-030191	102-05A	ND
	B	18
	C	ND
	D	18
Water MW-110191	102-06A	100
Water S-020191	102-07A	ND
	B	16
	C	ND
	D	ND
Detection Limit		10

ND = Not detected above the reported detection limit

Client: Holloman AFB  
Work Order: X1-01-114  
10111401

IT ANALYTICAL SERVICES  
CINCINNATI, OH

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Analytical Results, ug/L

Client Sample ID	Lab No.	POX
-----	-----	-----
Water MW-020191	114-01A	ND
	B	ND
	C	ND
	D	ND
Water MW-060191	114-02A	ND
	B	ND
	C	ND
	D	ND
Water S-040191	114-03A	ND
	B	ND
	C	ND
	D	ND
Water MW-040191	114-04A	ND
	B	ND
	C	ND
	D	ND
Water MW-120191	114-05A	ND
	B	580
	C	ND
	D	ND
Detection Limit		10

ND = Not detected above the reported detection limit

Client: Holloman AFB  
Work Order: X1-01-102  
10110203

IT ANALYTICAL SERVICES  
CINCINNATI, OH

Quality Assurance Data

Quality Control  
Standard Reference Solutions

Analyte	Theoretical Value, ug/L	FOR:	Percent Recovery
POX	5	10201 + 02	99.8
			99.4
			98.6
			103
			102
			103
		10203 + 06	
			99.6
			99.0
		10204 + 05	
			99.8
		10207 + 11401	
			94.4
			103
		11402 - 11405	
			106
			105
			105
			95.6



INTERNATIONAL  
TECHNOLOGY  
CORPORATION

# ANALYTICAL SERVICES

## CERTIFICATE OF ANALYSIS

IT Corporation  
5301 Central N.E., Suite 700  
Albuquerque, NM 87108  
ATTN: Dann Meyer *DLL 2/27/91*

February 20, 1991

Job Number: ITNA 47599

P.O. Number: 301251.02.07

This is the Certificate of Analysis for the following samples:

Client Project ID: Holloman AFB  
Date Received by Lab: 01/18/91  
Number of Samples: Five (5)  
Sample Type: Water

### PHENOLS ANALYSIS

Results in mg/liter (ppm)

<u>Client Sample ID</u>	<u>Lab Sample ID</u>	<u>Result</u>
MW-020191	PP6200	0.01
MW-040191	PP6201	0.01
MW-060191	PP6202	0.02
MW-120191	PP6203	0.02
S-040191	PP6204	0.01
Method Blank	P2019	0.01 U -

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.

Date of Analysis: 02/13/91

Reviewed and Approved:

*Alyce R. Moore*  
Alyce R. Moore  
Laboratory Manager

American Council of Independent Laboratories  
International Association of Environmental Testing Laboratories  
American Association for Laboratory Accreditation

IT Corporation  
February 20, 1991

IT ANALYTICAL SERVICES  
5815 MIDDLEBROOK PIKE  
KNOXVILLE, TN

Client Project ID: Holloman AFB

Job Number: ITNA 47599

TOTAL CARBON ANALYSIS  
Results in mg/liter (ppm)  
Sample Matrix: Water

<u>Client Sample ID</u>	<u>Lab Sample ID</u>	<u>Result</u>
MW-020191	PP6195	4
MW-040191	PP6196	5
MW-040191	PP6196	5
MW-040191	PP6196	6
MW-040191	PP6196	6
MW-060191	PP6197	3
MW-060191	PP6197	4
MW-060191	PP6197	3
MW-060191	PP6197	3
MW-120191	PP6198	6
MW-120191	PP6198	6
MW-120191	PP6198	6
MW-120191	PP6198	5
S-040191	PP6199	1
Method Blank	B0553	1 U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.

Date of Analysis: 01/22 - 01/24/91

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INTERNATIONAL  
TECHNOLOGY  
CORPORATION

# ANALYTICAL SERVICES

## CERTIFICATE OF ANALYSIS

IT Corporation  
5301 Central N.E., Suite 700  
Albuquerque, NM 87108  
ATTN: Dann Meyer *DM 2/21/91*

February 20, 1991

Job Number: ITNA 47599

P.O. Number: 301251.02.07

This is the Certificate of Analysis for the following samples:

Client Project ID: Holloman AFB  
Date Received by Lab: 01/18/91  
Number of Samples: Five (5)  
Sample Type: Water

### I. Introduction

On 01/18/91, five (5) water samples arrived at the ITAS-Knoxville, Tennessee, laboratory from the IT-Albuquerque, New Mexico, office in support of the Holloman AFB project. The list of analytical tests performed, as well as date of receipt and analysis, can be found in the attached report.

### II. Analytical Results/Methodology

The analytical results for this report are presented by analytical test. Each set of data will include sample identification information and the analytical results. Please note that all data are blank corrected, i.e., if any compound is found in the corresponding laboratory blank, it is subtracted from the analytical result before it is reported.

The samples were analyzed for Target Analyte List (TAL) metals by cold vapor atomic absorption spectroscopy (CVAA), graphite furnace atomic absorption spectroscopy (GFAA), and inductively coupled plasma spectroscopy (ICP) in accordance with the EPA CLP 3/90 Statement of Work.

Reviewed and Approved:

*Alyce R. Moore*  
Alyce R. Moore  
Laboratory Manager

American Council of Independent Laboratories  
International Association of Environmental Testing Laboratories  
American Association for Laboratory Accreditation

IT Corporation  
February 20, 1991

IT ANALYTICAL SERVICES  
5815 MIDDLEBROOK PIKE  
KNOXVILLE, TN

Client Project ID: Holloman AFB

Job Number: ITNA 47599

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### III. Quality Control

The samples were digested on 01/31/91 for ICP and analyzed by ICP on 02/06/91. All run QC was acceptable. A duplicate/spike pair was prepared using sample 040191. Spike recovery (accuracy) results were outside acceptable limits for iron. A post digestion spike was performed as required by CLP protocol with acceptable results. The duplicate RPD (precision) results indicate that either sample nonhomogeneity or matrix interferences are a problem with this analyte. It should be noted, however, that both the precision and spike results are just outside acceptable limits. The serial dilution for this sample is almost outside acceptable limits for iron, indicating that matrix interferences are present. Possible matrix interferences include the high concentration of sodium and the viscosity problems caused by such high concentrations. All sodium values are reported from dilutions. No other problems were encountered.

1000  
900  
800  
700  
600  
500  
400  
300  
200  
100  
0

## DATA FORMS

COVER PAGE - INORGANIC ANALYSES DATA PACKAGE

Lab Name: ITAS\_KNOXVILLE Contract: HOLLOMAN\_A
Lab Code: ITSTU Case No.: 47599 SAS No.: SDG No.:MW-020
SOW No.: 3/90\_

Table with 2 columns: EPA Sample No. and Lab Sample ID. Rows include sample numbers like -020191, -040191, -060191, -120191, -040191, S-0401D, S-0401S and corresponding Lab Sample IDs like PP6210, PP6211, PP6212, PP6213, PP6214, PP6214-D, PP6214-S.

Were ICP interelement corrections applied ? Yes/No YES
Were ICP background corrections applied ? Yes/No YES
If yes - were raw data generated before application of background corrections ? Yes/No NO\_

Comments:

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in the computer-readable data submitted on floppy diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature.

Signature: Christopher Kaufer Name: Christopher Kaufer
Date: Feb. 08, 91 Title: Group Supervisor

1  
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MW-020191

Lab Name: ITAS\_KNOXVILLE Contract: HOLLOMAN\_A

Lab Code: ITSTU Case No.: 47599 SAS No.: SDG No.: MW-020

Matrix (soil/water): WATER Lab Sample ID: PP6210

Level (low/med): LOW Date Received: 02/07/91

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-36-0	Antimony				NR
7440-38-2	Arsenic				NR
7440-39-3	Barium				NR
7440-41-7	Beryllium				NR
7440-43-9	Cadmium				NR
7440-70-2	Calcium				NR
7440-47-3	Chromium				NR
7440-48-4	Cobalt				NR
7440-50-8	Copper				NR
7439-89-6	Iron	467		N*	P
7439-92-1	Lead				NR
7439-95-4	Magnesium				NR
7439-96-5	Manganese	667			P
7439-97-6	Mercury				NR
7440-02-0	Nickel				NR
7440-09-7	Potassium				NR
7782-49-2	Selenium				NR
7440-22-4	Silver				NR
7440-23-5	Sodium	555000			P
7440-28-0	Thallium				NR
7440-62-2	Vanadium				NR
7440-66-6	Zinc				NR
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture: \_\_\_\_\_

Color After: COLORLESS Clarity After: CLEAR Artifacts: \_\_\_\_\_

Comments:

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1  
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MW-040191

Lab Name: ITAS\_KNOXVILLE Contract: HOLLOMAN\_A

Lab Code: ITSTU Case No.: 47599 SAS No.: SDG No.: MW-020

Matrix (soil/water): WATER Lab Sample ID: PP6211

Level (low/med): LOW Date Received: 02/07/91

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-36-0	Antimony				NR
7440-38-2	Arsenic				NR
7440-39-3	Barium				NR
7440-41-7	Beryllium				NR
7440-43-9	Cadmium				NR
7440-70-2	Calcium				NR
7440-47-3	Chromium				NR
7440-48-4	Cobalt				NR
7440-50-8	Copper				NR
7439-89-6	Iron	793		N*	P
7439-92-1	Lead				NR
7439-95-4	Magnesium				NR
7439-96-5	Manganese	546			P
7439-97-6	Mercury				NR
7440-02-0	Nickel				NR
7440-09-7	Potassium				NR
7782-49-2	Selenium				NR
7440-22-4	Silver				NR
7440-23-5	Sodium	1570000			P
7440-28-0	Thallium				NR
7440-62-2	Vanadium				NR
7440-66-6	Zinc				NR
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

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1  
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MW-060191

Lab Name: ITAS\_KNOXVILLE \_\_\_\_\_ Contract: HOLLOMAN\_A

Lab Code: ITSTU\_ Case No.: 47599 SAS No.: \_\_\_\_\_ SDG No.: MW-020

Matrix (soil/water): WATER Lab Sample ID: PP6212\_\_\_\_\_

Level (low/med): LOW\_ Date Received: 02/07/91

% Solids: \_\_\_\_\_0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L\_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-36-0	Antimony				NR
7440-38-2	Arsenic				NR
7440-39-3	Barium				NR
7440-41-7	Beryllium				NR
7440-43-9	Cadmium				NR
7440-70-2	Calcium				NR
7440-47-3	Chromium				NR
7440-48-4	Cobalt				NR
7440-50-8	Copper				NR
7439-89-6	Iron	681		N*	P
7439-92-1	Lead				NR
7439-95-4	Magnesium				NR
7439-96-5	Manganese	651			P
7439-97-6	Mercury				NR
7440-02-0	Nickel				NR
7440-09-7	Potassium				NR
7782-49-2	Selenium				NR
7440-22-4	Silver				NR
7440-23-5	Sodium	15300000			P
7440-28-0	Thallium				NR
7440-62-2	Vanadium				NR
7440-66-6	Zinc				NR
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR\_ Texture: \_\_\_\_\_

Color After: COLORLESS Clarity After: CLEAR\_ Artifacts: \_\_\_\_\_

Comments:

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INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MW-120191

Lab Name: ITAS\_KNOXVILLE \_\_\_\_\_ Contract: HOLLOMAN\_A

Lab Code: ITSTU\_ Case No.: 47599 SAS No.: \_\_\_\_\_ SDG No.: MW-020

Matrix (soil/water): WATER Lab Sample ID: PP6213\_\_\_\_\_

Level (low/med): LOW\_ Date Received: 02/07/91

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L\_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-36-0	Antimony				NR
7440-38-2	Arsenic				NR
7440-39-3	Barium				NR
7440-41-7	Beryllium				NR
7440-43-9	Cadmium				NR
7440-70-2	Calcium				NR
7440-47-3	Chromium				NR
7440-48-4	Cobalt				NR
7440-50-8	Copper				NR
7439-89-6	Iron	663		N*	P
7439-92-1	Lead				NR
7439-95-4	Magnesium				NR
7439-96-5	Manganese	552			P
7439-97-6	Mercury				NR
7440-02-0	Nickel				NR
7440-09-7	Potassium				NR
7782-49-2	Selenium				NR
7440-22-4	Silver				NR
7440-23-5	Sodium	1710000			P
7440-28-0	Thallium				NR
7440-62-2	Vanadium				NR
7440-66-6	Zinc				NR
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR\_ Texture: \_\_\_\_\_

Color After: COLORLESS Clarity After: CLEAR\_ Artifacts: \_\_\_\_\_

Comments:

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INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

S-040191

Lab Name: ITAS\_KNOXVILLE Contract: HOLLOMAN\_A

Lab Code: ITSTU Case No.: 47599 SAS No.: SDG No.: MW-020

Matrix (soil/water): WATER Lab Sample ID: PP6214

Level (low/med): LOW Date Received: 02/07/91

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-36-0	Antimony				NR
7440-38-2	Arsenic				NR
7440-39-3	Barium				NR
7440-41-7	Beryllium				NR
7440-43-9	Cadmium				NR
7440-70-2	Calcium				NR
7440-47-3	Chromium				NR
7440-48-4	Cobalt				NR
7440-50-8	Copper				NR
7439-89-6	Iron	631		N*	P
7439-92-1	Lead				NR
7439-95-4	Magnesium				NR
7439-96-5	Manganese	2.0	U		P
7439-97-6	Mercury				NR
7440-02-0	Nickel				NR
7440-09-7	Potassium				NR
7782-49-2	Selenium				NR
7440-22-4	Silver				NR
7440-23-5	Sodium	9730.000			P
7440-28-0	Thallium				NR
7440-62-2	Vanadium				NR
7440-66-6	Zinc				NR
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

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2A  
INITIAL AND CONTINUING CALIBRATION VERIFICATION

Lab Name: ITAS\_KNOXVILLE\_\_\_\_\_ Contract: HOLLOMAN\_A  
 Lab Code: ITSTU\_ Case No.: 47599 SAS No.: \_\_\_\_\_ SDG No.: MW-020  
 Initial Calibration Source: SPEX\_\_\_\_\_  
 Continuing Calibration Source: SPEX\_\_\_\_\_

Concentration Units: ug/L

Analyte	Initial Calibration			Continuing Calibration				M	
	True	Found	%R(1)	True	Found	%R(1)	Found		%R(1)
Aluminum									NR
Antimony									NR
Arsenic									NR
Barium									NR
Beryllium									NR
Cadmium									NR
Calcium									NR
Chromium									NR
Cobalt									NR
Copper									NR
Iron	40000.0	43406.61	108.5	40000.0	43167.59	107.9	43670.70	109.2	P
Lead									NR
Magnesium									NR
Manganese	4000.0	4030.28	100.8	4000.0	3965.81	99.1	3938.69	98.5	P
Mercury									NR
Nickel									NR
Potassium									NR
Selenium									NR
Silver									NR
Sodium	40000.0	40971.70	102.4	40000.0	40897.03	102.2	41306.19	103.3	P
Thallium									NR
Vanadium									NR
Zinc									NR
Cyanide									NR

(1) Control Limits: Mercury 80-120; Other Metals 90-110; Cyanide 85-115

2A  
INITIAL AND CONTINUING CALIBRATION VERIFICATION

Lab Name: ITAS\_KNOXVILLE\_\_\_\_\_

Contract: HOLLOMAN\_A

Lab Code: ITSTU\_

Case No.: 47599

SAS No.: \_\_\_\_\_

SDG No.: MW-020

Initial Calibration Source: SPEX\_\_\_\_\_

Continuing Calibration Source: SPEX\_\_\_\_\_

Concentration Units: ug/L

Analyte	Initial Calibration			Continuing Calibration				M	
	True	Found	%R(1)	True	Found	%R(1)	Found		%R(1)
Aluminum									NR
Antimony									NR
Arsenic									NR
Barium									NR
Beryllium									NR
Cadmium									NR
Calcium									NR
Chromium									NR
Cobalt									NR
Copper									NR
Iron				40000.0	43668.31	109.2	42772.78	106.9	P
Lead									NR
Magnesium									NR
Manganese				4000.0	4031.15	100.8	3903.63	97.6	P
Mercury									NR
Nickel									NR
Potassium									NR
Selenium									NR
Silver									NR
Sodium				40000.0	40627.51	101.6	39516.38	98.8	P
Thallium									NR
Vanadium									NR
Zinc									NR
Cyanide									NR

(1) Control Limits: Mercury 80-120; Other Metals 90-110; Cyanide 85-115

2B  
CRDL STANDARD FOR AA AND ICP

Lab Name: ITAS\_KNOXVILLE\_\_\_\_\_

Contract: HOLLOMAN\_A

Lab Code: ITSTU\_ Case No.: 47599

SAS No.: \_\_\_\_\_

SDG No.: MW-020

AA CRDL Standard Source: \_\_\_\_\_

ICP CRDL Standard Source: NBS\_\_\_\_\_

Concentration Units: ug/L

Analyte	CRDL Standard for AA			CRDL Standard for ICP				
	True	Found	%R	True	Initial Found	%R	Final Found	%R
Aluminum								
Antimony								
Arsenic								
Barium								
Beryllium								
Cadmium								
Calcium								
Chromium								
Cobalt								
Copper								
Iron								
Lead								
Magnesium								
Manganese				30.0	30.37	101.2	29.15	97.2
Mercury								
Nickel								
Potassium								
Selenium								
Silver								
Sodium								
Thallium								
Vanadium								
Zinc								

3  
BLANKS

Lab Name: ITAS\_KNOXVILLE\_\_\_\_\_

Contract: HOLLOMAN\_A

Lab Code: ITSTU\_

Case No.: 47599

SAS No.: \_\_\_\_\_

SDG No.: MW-020

Preparation Blank Matrix (soil/water): WATER

Preparation Blank Concentration Units (ug/L or mg/kg): UG/L\_

Analyte	Initial Calib. Blank (ug/L)		Continuing Calibration Blank (ug/L)						Preparation Blank		M
		C	1	C	2	C	3	C		C	
Aluminum											NR
Antimony											NR
Arsenic											NR
Barium											NR
Beryllium											NR
Cadmium											NR
Calcium											NR
Chromium											NR
Cobalt											NR
Copper											NR
Iron	10.0	U	10.0	U	10.0	U	10.0	U	12.4	B	P
Lead											NR
Magnesium											NR
Manganese	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	P
Mercury											NR
Nickel											NR
Potassium											NR
Selenium											NR
Silver											NR
Sodium	200.0	U	200.0	U	200.0	U	200.0	U	200.0	U	P
Thallium											NR
Vanadium											NR
Zinc											NR
Cyanide											NR

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BLANKS

Lab Name: ITAS\_KNOXVILLE \_\_\_\_\_ Contract: HOLLOMAN\_A  
 Lab Code: ITSTU\_ Case No.: 47599 SAS No.: \_\_\_\_\_ SDG No.: MW-020  
 Preparation Blank Matrix (soil/water): \_\_\_\_\_  
 Preparation Blank Concentration Units (ug/L or mg/kg): \_\_\_\_\_

Analyte	Initial Calib. Blank (ug/L)		Continuing Calibration Blank (ug/L)						Preparation Blank		M
		C	1	C	2	C	3	C		C	
Aluminum											NR
Antimony											NR
Arsenic											NR
Barium											NR
Beryllium											NR
Cadmium											NR
Calcium											NR
Chromium											NR
Cobalt											NR
Copper											NR
Iron			10.0	U							P
Lead											NR
Magnesium											NR
Manganese			2.0	U							P
Mercury											NR
Nickel											NR
Potassium											NR
Selenium											NR
Silver											NR
Sodium			200.0	U							P
Thallium											NR
Vanadium											NR
Zinc											NR
Cyanide											NR

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ICP INTERFERENCE CHECK SAMPLE

Lab Name: ITAS\_KNOXVILLE \_\_\_\_\_ Contract: HOLLOMAN\_A  
 Lab Code: ITSTU\_ Case No.: 47599 SAS No: \_\_\_\_\_ SDG No.: MW-020  
 ICP ID Number: JA1100 \_\_\_\_\_ ICS Source: SPEX \_\_\_\_\_

Concentration Units: ug/L

Analyte	True		Initial Found			Final Found		
	Sol. A	Sol. AB	Sol. A	Sol. AB	%R	Sol. A	Sol. AB	%R
Aluminum	500000	513000	515005	517802.4	100.9	466115	471892.3	92.0
Antimony								
Arsenic								
Barium		471		504.6	107.1		486.8	103.4
Beryllium		473		491.0	103.8		462.9	97.9
Cadmium		861		954.0	110.8		945.4	109.8
Calcium	500000	484000	527605	528253.5	109.1	503510	508759.9	105.1
Chromium		417		472.8	113.4		450.4	108.0
Cobalt		402		476.3	118.5		434.2	108.0
Copper		420		483.8	115.2		412.0	98.1
Iron	200000	194	205887	205772.8		194051	195138.1	
Lead		901		950.0	105.4		976.0	108.3
Magnesium	500000	491000	510725	514639.3	104.8	491009	499292.2	101.7
Manganese		370		433.1	117.1		415.1	112.2
Mercury								
Nickel		820		946.8	115.5		913.4	111.4
Potassium								
Selenium								
Silver		901		1015.9	112.8		997.3	110.7
Sodium								
Thallium								
Vanadium		423		469.3	110.9		445.7	105.4
Zinc		849		940.0	110.7		926.6	109.1

FORM IV - IN

3/90

5A  
SPIKE SAMPLE RECOVERY

EPA SAMPLE NO.

Lab Name: ITAS\_KNOXVILLE\_\_\_\_\_

Contract:HOLLOMAN\_A

S-0401S

Lab Code: ITSTU\_

Case No.: 47599

SAS No.: \_\_\_\_\_

SDG No.: MW-020

Matrix: WATER\_\_\_\_\_

Level (low/med): LOW\_\_\_\_\_

% Solids for Sample: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L\_

Analyte	Control Limit %R	Spiked Sample Result (SSR) C	Sample Result (SR) C	Spike Added (SA)	%R	Q	M
Aluminum							NR
Antimony							NR
Arsenic							NR
Barium							NR
Beryllium							NR
Cadmium							NR
Calcium							NR
Chromium							NR
Cobalt							NR
Copper							NR
Iron	75-125	1995.1600	631.2200	1000.00	136.4	N	P
Lead							NR
Magnesium							NR
Manganese	75-125	382.2500	2.0000	500.00	76.4		P
Mercury							NR
Nickel							NR
Potassium							NR
Selenium							NR
Silver							NR
Sodium							NR
Thallium							NR
Vanadium							NR
Zinc							NR
Cyanide							NR

Comments:

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5B  
POST DIGEST SPIKE SAMPLE RECOVERY

EPA SAMPLE NO.

Lab Name: ITAS\_KNOXVILLE\_\_\_\_\_

Contract: HOLLOMAN\_A

S-0401A
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Lab Code: ITSTU\_

Case No.:

47599 SAS No.:

\_\_\_\_\_

SDG No.: MW-020

Matrix: WATER\_\_\_\_\_

Level (low/med): LOW\_\_\_\_\_

Concentration Units: ug/L

Analyte	Control Limit %R	Spiked Sample Result (SSR)	C	Sample Result (SR)	C	Added (SA)	%R	Q	M
Aluminum									NR
Antimony									NR
Arsenic									NR
Barium									NR
Beryllium									NR
Cadmium									NR
Calcium									NR
Chromium									NR
Cobalt									NR
Copper									NR
Iron		1591.73		631.22		1000.0	96.1		P
Lead									NR
Magnesium									NR
Manganese		404.42		2.00	U	500.0	80.9		P
Mercury									NR
Nickel									NR
Potassium									NR
Selenium									NR
Silver									NR
Sodium									NR
Thallium									NR
Vanadium									NR
Zinc									NR
Cyanide									NR

Comments:

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6  
DUPLICATES

EPA SAMPLE NO.

S-0401D

Lab Name: ITAS\_KNOXVILLE \_\_\_\_\_ Contract: HOLLOMAN\_A  
 Lab Code: ITSTU\_ Case No.: 47599 SAS No.: \_\_\_\_\_ SDG No.: MW-020  
 Matrix (soil/water): WATER Level (low/med): LOW  
 % Solids for Sample: 0.0 % Solids for Duplicate: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L\_

Analyte	Control Limit	Sample (S)	C	Duplicate (D)	C	RPD	Q	M
Aluminum								NR
Antimony								NR
Arsenic								NR
Barium								NR
Beryllium								NR
Cadmium								NR
Calcium								NR
Chromium								NR
Cobalt								NR
Copper								NR
Iron		631.2200		809.5300		24.8	*	P
Lead								NR
Magnesium								NR
Manganese		2.0000	U	2.0000	U			P
Mercury								NR
Nickel								NR
Potassium								NR
Selenium								NR
Silver								NR
Sodium		9728500.0000		9647400.0000		0.8		P
Thallium								NR
Vanadium								NR
Zinc								NR
Cyanide								NR

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LABORATORY CONTROL SAMPLE

Lab Name: ITAS\_KNOXVILLE\_\_\_\_\_

Contract: HOLLOMAN\_A

Lab Code: ITSTU\_

Case No.: 47599

SAS No.: \_\_\_\_\_

SDG No.: MW-020

Solid LCS Source: \_\_\_\_\_

Aqueous LCS Source: SPEX\_\_\_\_\_

Analyte	Aqueous (ug/L)			Solid (mg/kg)				
	True	Found	%R	True	Found	C	Limits	%R
Aluminum								
Antimony								
Arsenic								
Barium								
Beryllium								
Cadmium								
Calcium								
Chromium								
Cobalt								
Copper								
Iron	20000.0	23066.50	115.3					
Lead								
Magnesium								
Manganese	4000.0	4035.00	100.9					
Mercury								
Nickel								
Potassium								
Selenium								
Silver								
Sodium	20000.0	21528.90	107.6					
Thallium								
Vanadium								
Zinc								
Cyanide								



U.S. EPA - CLP

9  
ICP SERIAL DILUTION

EPA SAMPLE NO.

S-0401L

Lab Name: ITAS\_KNOXVILLE\_\_\_\_\_

Contract: HOLLOMAN\_A

Lab Code: ITSTU\_

Case No.: 47599

SAS No.: \_\_\_\_\_

SDG No.: MW-020

Matrix (soil/water): WATER

Level (low/med): LOW\_\_

Concentration Units: ug/L

Analyte	Initial Sample Result (I)	C	Serial Dilution Result (S)	C	% Difference	Q	M
Aluminum							
Antimony							
Arsenic							
Barium							
Beryllium							
Cadmium							
Calcium							
Chromium							
Cobalt							
Copper							
Iron	631.22		680.90		7.9		P
Lead							
Magnesium							
Manganese	2.00	U	10.00	U			P
Mercury							
Nickel							
Potassium							
Selenium							
Silver							
Sodium	972850.00		976400.00		0.4		P
Thallium							
Vanadium							
Zinc							

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10

Instrument Detection Limits (Quarterly)

Lab Name: ITAS\_KNOXVILLE Contract: HOLLOMAN\_A  
 Lab Code: ITSTU Case No.: 47599 SAS No.: SDG No.: MW-020  
 ICP ID Number: JA1100 Date: 01/15/91  
 Flame AA ID Number :  
 Furnace AA ID Number :

Analyte	Wave-length (nm)	Back-ground	CRDL (ug/L)	IDL (ug/L)	M
Aluminum	308.20		200	40.0	P
Antimony	206.80		60	30.0	P
Arsenic	193.60		10	40.0	P
Barium	493.40		200	2.0	P
Beryllium	313.00		5	1.0	P
Cadmium	228.80		5	5.0	P
Calcium	317.90		5000	30.0	P
Chromium	267.70		10	10.0	P
Cobalt	228.60		50	20.0	P
Copper	324.70		25	10.0	P
Iron	259.90		100	10.0	P
Lead	220.30		3	30.0	P
Magnesium	279.00		5000	30.0	P
Manganese	257.60		15	2.0	P
Mercury			0.2		NR
Nickel	231.60		40	20.0	P
Potassium	766.00		5000	1000.0	P
Selenium	196.00		5	60.0	P
Silver	328.00		10	5.0	P
Sodium	588.90		5000	200.0	P
Thallium	190.80		10	40.0	P
Vanadium	292.40		50	10.0	P
Zinc	213.80		20	5.0	P

Comments:

U.S. EPA - CLP

11A  
ICP Interelement Correction Factors (Annually)

Lab Name: ITAS\_KNOXVILLE \_\_\_\_\_ Contract: HOLLOMAN\_A  
 Lab Code: ITSTU\_ Case No.: 47599 SAS No.: \_\_\_\_\_ SDG No.: MW-020  
 ICP ID Number: JA1100 \_\_\_\_\_ Date: 10/15/90

Analyte	Wave-length (nm)	Interelement Correction Factors for :				
		Al	Ca	Fe	Mg	AS_
Aluminum	308.20	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Antimony	206.80	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Arsenic	193.60	0.0103600	0.0000000	0.0013600	0.0000000	0.0000000
Barium	493.40	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Beryllium	313.00	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Cadmium	228.80	0.0000000	0.0000000	0.0000000	0.0000000	0.0055600
Calcium	317.90	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Chromium	267.70	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Cobalt	228.60	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Copper	324.70	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Iron	259.90	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Lead	220.30	0.0006800	0.0000000	0.0000000	0.0000000	0.0000000
Magnesium	279.00	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Manganese	257.60	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Mercury						
Nickel	231.60	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Potassium	766.00	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Selenium	196.00	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Silver	328.00	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Sodium	588.90	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Thallium	190.80	0.0000000	0.0000000	0.0103900	0.0000000	0.0000000
Vanadium	292.40	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Zinc	213.80	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000

Comments:

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## U.S. EPA - CLP

11B  
ICP Interelement Correction Factors (Annually)

Lab Name: ITAS\_KNOXVILLE\_\_\_\_\_ Contract: HOLLOMAN\_A  
 Lab Code: ITSTU\_ Case No.: 47599 SAS No.: \_\_\_\_\_ SDG No.: MW-020  
 ICP ID Number: JA1100\_\_\_\_\_ Date: 10/15/90

Analyte	Wave-length (nm)	Interelement Correction Factors for :				
		BA_	BE_	CO_	CR_	NI_
Aluminum	308.20	0.0000000	0.0000000	0.0000000	0.0055800	0.0000000
Antimony	206.80	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Arsenic	193.60	0.0006600	0.0000000	0.0005200	0.0000000	0.0000000
Barium	493.40	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Beryllium	313.00	0.0000000	0.0000000	0.0000000	0.0002800	0.0001200
Cadmium	228.80	0.0000000	0.0025800	0.0000000	0.0000000	0.0000000
Calcium	317.90	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Chromium	267.70	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Cobalt	228.60	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Copper	324.70	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Iron	259.90	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Lead	220.30	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Magnesium	279.00	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Manganese	257.60	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Mercury						
Nickel	231.60	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Potassium	766.00	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Selenium	196.00	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Silver	328.00	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Sodium	588.90	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Thallium	190.80	0.0000000	0.0000000	0.0018300	0.0000000	0.0000000
Vanadium	292.40	0.0000000	0.0000000	0.0000000	0.0000000	0.0032600
Zinc	213.80	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000

Comments:

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U.S. EPA - CLP

11B

ICP Interelement Correction Factors (Annually)

Lab Name: ITAS\_KNOXVILLE\_\_\_\_\_

Contract: HOLLOMAN\_A

Lab Code: ITSTU\_ Case No.: 47599

SAS No.: \_\_\_\_\_

SDG No.: MW-020

ICP ID Number: JA1100\_\_\_\_\_

Date: 10/15/90

Analyte	Wave-length (nm)	Interelement Correction Factors for :				
		V_	_____	_____	_____	_____
Aluminum	308.20	0.0218400				
Antimony	206.80	0.0000000				
Arsenic	193.60	0.0128200				
Barium	493.40	0.0000000				
Beryllium	313.00	0.0062300				
Cadmium	228.80	0.0000000				
Calcium	317.90	0.0000000				
Chromium	267.70	0.0000000				
Cobalt	228.60	0.0000000				
Copper	324.70	0.0000000				
Iron	259.90	0.0000000				
Lead	220.30	0.0000000				
Magnesium	279.00	0.0000000				
Manganese	257.60	0.0000000				
Mercury						
Nickel	231.60	0.0000000				
Potassium	766.00	0.0000000				
Selenium	196.00	0.0000000				
Silver	328.00	0.0000000				
Sodium	588.90	0.0000000				
Thallium	190.80	0.0019670				
Vanadium	292.40	0.0000000				
Zinc	213.80	0.0000000				

Comments:

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U.S. EPA - CLP

12  
ICP Linear Ranges (Quarterly)

Lab Name: ITAS\_KNOXVILLE\_\_\_\_\_

Contract: HOLLOMAN\_A

Lab Code: ITSTU\_ Case No.: 47599

SAS No.: \_\_\_\_\_ SDG No.: MW-020

ICP ID Number: JA1100\_\_\_\_\_

Date: 10/15/90

Analyte	Integ. Time (sec.)	Concentration (ug/L)	M
Aluminum	6.00	500000.0	P
Antimony	6.00	15000.0	P
Arsenic	6.00	15000.0	P
Barium	6.00	15000.0	P
Beryllium	6.00	15000.0	P
Cadmium	6.00	15000.0	P
Calcium	6.00	500000.0	P
Chromium	6.00	15000.0	P
Cobalt	6.00	15000.0	P
Copper	6.00	40000.0	P
Iron	6.00	500000.0	P
Lead	6.00	40000.0	P
Magnesium	6.00	500000.0	P
Manganese	6.00	40000.0	P
Mercury			NR
Nickel	6.00	15000.0	P
Potassium	6.00	500000.0	P
Selenium	6.00	15000.0	P
Silver	6.00	15000.0	P
Sodium	6.00	500000.0	P
Thallium	6.00	15000.0	P
Vanadium	6.00	15000.0	P
Zinc	6.00	15000.0	P

Comments:

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IT Corporation  
February 26, 1991

IT ANALYTICAL SERVICES  
5815 MIDDLEBROOK PIKE  
KNOXVILLE, TN

Client Project ID: Holloman AFB

Job Number: ITNA 47584

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## II. Analytical Results/Methodology (continued)

The samples were analyzed for total phenols by manual distillation/chloroform extraction/colorimetric determination based on EPA SW-846 method 9065.

## III. Quality Control

The samples were analyzed for total organic carbon from 01/21 to 01/24/91. No problems were encountered. Sample MW-080191 was broken during laboratory storage. A portion of this sample was removed from the container for phenol analysis and analyzed for TOC. No impact on data is expected.

The samples were analyzed for chloride and sulfate on 02/11 and 02/12/91. No problems were encountered.

The samples were analyzed for phenols on 02/13/91. Sample MW-010191 was analyzed one day past the holding time. No other problems were encountered.

IT Corporation  
February 26, 1991

IT ANALYTICAL SERVICES  
5815 MIDDLEBROOK PIKE  
KNOXVILLE, TN

Client Project ID: Holloman AFB

Job Number: ITNA 47584

TOTAL ORGANIC CARBON ANALYSIS

Results in mg/liter (ppm)

Sample Matrix: Water

<u>Client Sample ID</u>	<u>Lab Sample ID</u>	<u>Total Organic Carbon</u>
S-020191	PP6082	6
S-020191	PP6082	7
S-020191	PP6082	7
S-020191	PP6082	6
MW-010191	PP6083	1 U
MW-030191	PP6084	7
MW-050191	PP6085	5
MW-070191	PP6086	3
MW-080191	PP6099	4
Method Blank	B0554	1 U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.

Date of Analysis: 01/21 - 01/24/91

IT Corporation  
February 26, 1991

IT ANALYTICAL SERVICES  
5815 MIDDLEBROOK PIKE  
KNOXVILLE, TN

Client Project ID: Holloman AFB

Job Number: ITNA 47584

ION CHROMATOGRAPHY ANION SCAN

Results in mg/liter (ppm)

Sample Matrix: Water

<u>Client Sample ID</u>	<u>Lab Sample ID</u>	<u>Chloride</u>	<u>Sulfate</u>
Method Blank	F0645	0.50 U	1.5 U
S-020191	PP6088	1,000	3,200
MW-010191	PP6089	26,000	2,800
MW-030191	PP6090	3,500	3,200
MW-050191	PP6091	5,100	3,100
MW-070191	PP6092	47,000	40,000
MW-080191	PP6093	4,100	4,000

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.

Date of Analysis: 02/11 and 02/12/91

IT Corporation  
February 26, 1991

IT ANALYTICAL SERVICES  
5815 MIDDLEBROOK PIKE  
KNOXVILLE, TN

Client Project ID: Holloman AFB

Job Number: ITNA 47584

TOTAL PHENOLS ANALYSIS

Results in mg/liter (ppm)

Sample Matrix: Water

<u>Client Sample ID</u>	<u>Lab Sample ID</u>	<u>Result</u>
S-020191	PP6094	0.01
MW-010191	PP6095	0.01 U
MW-030191	PP6096	0.01
MW-050191	PP6097	0.01 U
MW-070191	PP6098	0.02
MW-080191	PP6099	0.02
Method Blank	P2019	0.01 U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.

Date of Analysis: 02/13/91

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**DATA FORMS**



1  
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

S-020191

Lab Name: ITAS\_KNOXVILLE \_\_\_\_\_ Contract: HOLLOMAN\_A

Lab Code: ITSTU\_ Case No.: 47584 SAS No.: \_\_\_\_\_ SDG No.: MW-010

Matrix (soil/water): WATER Lab Sample ID: PP6076\_\_\_\_\_

Level (low/med): LOW\_ Date Received: 01/17/91

% Solids: \_\_\_\_\_0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L\_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-36-0	Antimony				NR
7440-38-2	Arsenic				NR
7440-39-3	Barium				NR
7440-41-7	Beryllium				NR
7440-43-9	Cadmium				NR
7440-70-2	Calcium				NR
7440-47-3	Chromium				NR
7440-48-4	Cobalt				NR
7440-50-8	Copper				NR
7439-89-6	Iron	130			P
7439-92-1	Lead				NR
7439-95-4	Magnesium				NR
7439-96-5	Manganese	137			P
7439-97-6	Mercury				NR
7440-02-0	Nickel				NR
7440-09-7	Potassium				NR
7782-49-2	Selenium				NR
7440-22-4	Silver				NR
7440-23-5	Sodium	727000			P
7440-28-0	Thallium				NR
7440-62-2	Vanadium				NR
7440-66-6	Zinc				NR
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR\_ Texture: \_\_\_\_\_

Color After: COLORLESS Clarity After: CLEAR\_ Artifacts: \_\_\_\_\_

Comments:

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1  
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MW-010191

Lab Name: ITAS\_KNOXVILLE Contract: HOLLOMAN\_A

Lab Code: ITSTU Case No.: 47584 SAS No.: SDG No.: MW-010

Matrix (soil/water): WATER Lab Sample ID: PP6077

Level (low/med): LOW Date Received: 01/17/91

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-36-0	Antimony				NR
7440-38-2	Arsenic				NR
7440-39-3	Barium				NR
7440-41-7	Beryllium				NR
7440-43-9	Cadmium				NR
7440-70-2	Calcium				NR
7440-47-3	Chromium				NR
7440-48-4	Cobalt				NR
7440-50-8	Copper				NR
7439-89-6	Iron	157			P
7439-92-1	Lead				NR
7439-95-4	Magnesium				NR
7439-96-5	Manganese	2.0	U		P
7439-97-6	Mercury				NR
7440-02-0	Nickel				NR
7440-09-7	Potassium				NR
7782-49-2	Selenium				NR
7440-22-4	Silver				NR
7440-23-5	Sodium	8050000			P
7440-28-0	Thallium				NR
7440-62-2	Vanadium				NR
7440-66-6	Zinc				NR
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

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1  
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MW-030191

Lab Name: ITAS\_KNOXVILLE Contract: HOLLOMAN\_A

Lab Code: ITSTU Case No.: 47584 SAS No.: SDG No.: MW-010

Matrix (soil/water): WATER Lab Sample ID: PP6078

Level (low/med): LOW Date Received: 01/17/91

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-36-0	Antimony				NR
7440-38-2	Arsenic				NR
7440-39-3	Barium				NR
7440-41-7	Beryllium				NR
7440-43-9	Cadmium				NR
7440-70-2	Calcium				NR
7440-47-3	Chromium				NR
7440-48-4	Cobalt				NR
7440-50-8	Copper				NR
7439-89-6	Iron	376			P
7439-92-1	Lead				NR
7439-95-4	Magnesium				NR
7439-96-5	Manganese	1550			P
7439-97-6	Mercury				NR
7440-02-0	Nickel				NR
7440-09-7	Potassium				NR
7782-49-2	Selenium				NR
7440-22-4	Silver				NR
7440-23-5	Sodium	1850000			P
7440-28-0	Thallium				NR
7440-62-2	Vanadium				NR
7440-66-6	Zinc				NR
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

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1  
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MW-050191

Lab Name: ITAS\_KNOXVILLE Contract: HOLLOMAN\_A

Lab Code: ITSTU Case No.: 47584 SAS No.: SDG No.: MW-010

Matrix (soil/water): WATER Lab Sample ID: PP6079

Level (low/med): LOW Date Received: 01/17/91

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-36-0	Antimony				NR
7440-38-2	Arsenic				NR
7440-39-3	Barium				NR
7440-41-7	Beryllium				NR
7440-43-9	Cadmium				NR
7440-70-2	Calcium				NR
7440-47-3	Chromium				NR
7440-48-4	Cobalt				NR
7440-50-8	Copper				NR
7439-89-6	Iron	2700			P
7439-92-1	Lead				NR
7439-95-4	Magnesium				NR
7439-96-5	Manganese	3110			P
7439-97-6	Mercury				NR
7440-02-0	Nickel				NR
7440-09-7	Potassium				NR
7782-49-2	Selenium				NR
7440-22-4	Silver				NR
7440-23-5	Sodium	1920000			P
7440-28-0	Thallium				NR
7440-62-2	Vanadium				NR
7440-66-6	Zinc				NR
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:  
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1  
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MW-070191

Lab Name: ITAS\_KNOXVILLE Contract: HOLLOMAN\_A

Lab Code: ITSTU Case No.: 47584 SAS No.: SDG No.: MW-010

Matrix (soil/water): WATER Lab Sample ID: PP6080

Level (low/med): LOW Date Received: 01/17/91

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-36-0	Antimony				NR
7440-38-2	Arsenic				NR
7440-39-3	Barium				NR
7440-41-7	Beryllium				NR
7440-43-9	Cadmium				NR
7440-70-2	Calcium				NR
7440-47-3	Chromium				NR
7440-48-4	Cobalt				NR
7440-50-8	Copper				NR
7439-89-6	Iron	109			P
7439-92-1	Lead				NR
7439-95-4	Magnesium				NR
7439-96-5	Manganese	1220			P
7439-97-6	Mercury				NR
7440-02-0	Nickel				NR
7440-09-7	Potassium				NR
7782-49-2	Selenium				NR
7440-22-4	Silver				NR
7440-23-5	Sodium	837000			P
7440-28-0	Thallium				NR
7440-62-2	Vanadium				NR
7440-66-6	Zinc				NR
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

U.S. EPA - CLP

1  
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MW-080191

Lab Name: ITAS\_KNOXVILLE \_\_\_\_\_ Contract: HOLLOMAN\_A  
Lab Code: ITSTU\_ Case No.: 47584 SAS No.: \_\_\_\_\_ SDG No.: MW-010  
Matrix (soil/water): WATER Lab Sample ID: PP6081\_\_\_\_\_  
Level (low/med): LOW\_ Date Received: 01/17/91  
% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L\_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-36-0	Antimony				NR
7440-38-2	Arsenic				NR
7440-39-3	Barium				NR
7440-41-7	Beryllium				NR
7440-43-9	Cadmium				NR
7440-70-2	Calcium				NR
7440-47-3	Chromium				NR
7440-48-4	Cobalt				NR
7440-50-8	Copper				NR
7439-89-6	Iron	14800			P
7439-92-1	Lead				NR
7439-95-4	Magnesium				NR
7439-96-5	Manganese	976			P
7439-97-6	Mercury				NR
7440-02-0	Nickel				NR
7440-09-7	Potassium				NR
7782-49-2	Selenium				NR
7440-22-4	Silver				NR
7440-23-5	Sodium	2020000			P
7440-28-0	Thallium				NR
7440-62-2	Vanadium				NR
7440-66-6	Zinc				NR
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR\_ Texture: \_\_\_\_\_  
Color After: COLORLESS Clarity After: CLEAR\_ Artifacts: \_\_\_\_\_

Comments:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

U.S. EPA - CLP

2A  
INITIAL AND CONTINUING CALIBRATION VERIFICATION

Lab Name: ITAS\_KNOXVILLE\_\_\_\_\_ Contract: HOLLOMAN\_A  
 Lab Code: ITSTU\_ Case No.: 47584 SAS No.: \_\_\_\_\_ SDG No.: MW-010  
 Initial Calibration Source: SPEX\_\_\_\_\_  
 Continuing Calibration Source: SPEX\_\_\_\_\_

Concentration Units: ug/L

Analyte	Initial Calibration			Continuing Calibration				M	
	True	Found	%R(1)	True	Found	%R(1)	Found		%R(1)
Aluminum									NR
Antimony									NR
Arsenic									NR
Barium									NR
Beryllium									NR
Cadmium									NR
Calcium									NR
Chromium									NR
Cobalt									NR
Copper									NR
Iron	40000.0	43406.61	108.5	40000.0	43167.59	107.9	43670.70	109.2	P
Lead									NR
Magnesium									NR
Manganese	4000.0	4030.28	100.8	4000.0	3965.81	99.1	3938.69	98.5	P
Mercury									NR
Nickel									NR
Potassium									NR
Selenium									NR
Silver									NR
Sodium	40000.0	40971.70	102.4	40000.0	40897.03	102.2	41306.19	103.3	P
Thallium									NR
Vanadium									NR
Zinc									NR
Cyanide									NR

(1) Control Limits: Mercury 80-120; Other Metals 90-110; Cyanide 85-115

2A  
INITIAL AND CONTINUING CALIBRATION VERIFICATION

Lab Name: ITAS\_KNOXVILLE \_\_\_\_\_ Contract: HOLLOMAN\_A  
 Lab Code: ITSTU\_ Case No.: 47584 SAS No.: \_\_\_\_\_ SDG No.: MW-010  
 Initial Calibration Source: SPEX \_\_\_\_\_  
 Continuing Calibration Source: SPEX \_\_\_\_\_

Concentration Units: ug/L

Analyte	Initial Calibration			Continuing Calibration				M	
	True	Found	%R(1)	True	Found	%R(1)	Found		%R(1)
Aluminum									NR
Antimony									NR
Arsenic									NR
Barium									NR
Beryllium									NR
Cadmium									NR
Calcium									NR
Chromium									NR
Cobalt									NR
Copper									NR
Iron				40000.0	43668.31	109.2	42772.78	106.9	P
Lead									NR
Magnesium									NR
Manganese				4000.0	4031.15	100.8	3903.63	97.6	P
Mercury									NR
Nickel									NR
Potassium									NR
Selenium									NR
Silver									NR
Sodium				40000.0	40627.51	101.6	39516.38	98.8	P
Thallium									NR
Vanadium									NR
Zinc									NR
Cyanide									NR

(1) Control Limits: Mercury 80-120; Other Metals 90-110; Cyanide 85-115

2A  
INITIAL AND CONTINUING CALIBRATION VERIFICATION

Lab Name: ITAS\_KNOXVILLE \_\_\_\_\_ Contract: HOLLOMAN\_A  
 Lab Code: ITSTU\_ Case No.: 47584 SAS No.: \_\_\_\_\_ SDG No.: MW-010  
 Initial Calibration Source: SPEX \_\_\_\_\_  
 Continuing Calibration Source: SPEX \_\_\_\_\_

Concentration Units: ug/L

Analyte	Initial Calibration			Continuing Calibration				M	
	True	Found	%R(1)	True	Found	%R(1)	Found		%R(1)
Aluminum									NR
Antimony									NR
Arsenic									NR
Barium									NR
Beryllium									NR
Cadmium									NR
Calcium									NR
Chromium									NR
Cobalt									NR
Copper									NR
Iron	40000.0	43437.02	108.6	40000.0	42324.36	105.8	43770.29	109.4	P
Lead									NR
Magnesium									NR
Manganese	4000.0	4058.27	101.5	4000.0	3958.01	99.0	3950.31	98.8	P
Mercury									NR
Nickel									NR
Potassium									NR
Selenium									NR
Silver									NR
Sodium	40000.0	41173.22	102.9	40000.0	39609.84	99.0	42723.60	106.8	P
Thallium									NR
Vanadium									NR
Zinc									NR
Cyanide									NR

(1) Control Limits: Mercury 80-120; Other Metals 90-110; Cyanide 85-115

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2A  
INITIAL AND CONTINUING CALIBRATION VERIFICATION

Lab Name: ITAS\_KNOXVILLE\_\_\_\_\_

Contract: HOLLOMAN\_A

Lab Code: ITSTU\_

Case No.: 47584

SAS No.: \_\_\_\_\_

SDG No.: MW-010

Initial Calibration Source: SPEX\_\_\_\_\_

Continuing Calibration Source: SPEX\_\_\_\_\_

Concentration Units: ug/L

Analyte	Initial Calibration			Continuing Calibration					M
	True	Found	%R(1)	True	Found	%R(1)	Found	%R(1)	
Aluminum									NR
Antimony									NR
Arsenic									NR
Barium									NR
Beryllium									NR
Cadmium									NR
Calcium									NR
Chromium									NR
Cobalt									NR
Copper									NR
Iron				40000.0	43555.93	108.9	43844.50	109.6	P
Lead									NR
Magnesium									NR
Manganese				4000.0	3946.46	98.7	3984.65	99.6	P
Mercury									NR
Nickel									NR
Potassium									NR
Selenium									NR
Silver									NR
Sodium				40000.0	43524.37	108.8	43867.09	109.7	P
Thallium									NR
Vanadium									NR
Zinc									NR
Cyanide									NR

(1) Control Limits: Mercury 80-120; Other Metals 90-110; Cyanide 85-115

2B  
CRDL STANDARD FOR AA AND ICP

Lab Name: ITAS\_KNOXVILLE\_\_\_\_\_

Contract: HOLLOMAN\_A

Lab Code: ITSTU\_ Case No.: 47584

SAS No.: \_\_\_\_\_

SDG No.: MW-010

AA CRDL Standard Source: \_\_\_\_\_

ICP CRDL Standard Source: NBS\_\_\_\_\_

Concentration Units: ug/L

Analyte	CRDL Standard for AA			CRDL Standard for ICP				
	True	Found	%R	True	Initial Found	%R	Final Found	%R
Aluminum								
Antimony								
Arsenic								
Barium								
Beryllium								
Cadmium								
Calcium								
Chromium								
Cobalt								
Copper								
Iron								
Lead								
Magnesium								
Manganese				30.0	30.18	100.6	29.71	99.0
Mercury								
Nickel								
Potassium								
Selenium								
Silver								
Sodium								
Thallium								
Vanadium								
Zinc								

3  
BLANKS

Lab Name: ITAS\_KNOXVILLE \_\_\_\_\_ Contract: HOLLOMAN\_A  
 Lab Code: ITSTU\_ Case No.: 47584 SAS No.: \_\_\_\_\_ SDG No.: MW-010  
 Preparation Blank Matrix (soil/water): WATER  
 Preparation Blank Concentration Units (ug/L or mg/kg): UG/L\_

Analyte	Initial Calib. Blank (ug/L)		Continuing Calibration Blank (ug/L)						Preparation Blank		M
		C	1	C	2	C	3	C		C	
Aluminum											NR
Antimony											NR
Arsenic											NR
Barium											NR
Beryllium											NR
Cadmium											NR
Calcium											NR
Chromium											NR
Cobalt											NR
Copper											NR
Iron	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U	P
Lead											NR
Magnesium											NR
Manganese	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	P
Mercury											NR
Nickel											NR
Potassium											NR
Selenium											NR
Silver											NR
Sodium	200.0	U	200.0	U	200.0	U	200.0	U	208.1	B	P
Thallium											NR
Vanadium											NR
Zinc											NR
Cyanide											NR

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3  
BLANKS

Lab Name: ITAS\_KNOXVILLE \_\_\_\_\_ Contract: HOLLOMAN\_A  
 Lab Code: ITSTU\_ Case No.: 47584 SAS No.: \_\_\_\_\_ SDG No.: MW-010  
 Preparation Blank Matrix (soil/water): \_\_\_\_\_  
 Preparation Blank Concentration Units (ug/L or mg/kg): \_\_\_\_\_

Analyte	Initial Calib. Blank (ug/L)	C	Continuing Calibration Blank (ug/L)						Preparation Blank	C	M
			1	C	2	C	3	C			
Aluminum										NR	
Antimony										NR	
Arsenic										NR	
Barium										NR	
Beryllium										NR	
Cadmium										NR	
Calcium										NR	
Chromium										NR	
Cobalt										NR	
Copper										NR	
Iron			10.0	U						P	
Lead										NR	
Magnesium										NR	
Manganese			2.0	U						P	
Mercury										NR	
Nickel										NR	
Potassium										NR	
Selenium										NR	
Silver										NR	
Sodium			200.0	U						P	
Thallium										NR	
Vanadium										NR	
Zinc										NR	
Cyanide										NR	

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3  
BLANKS

Lab Name: ITAS\_KNOXVILLE \_\_\_\_\_ Contract: HOLLOMAN\_A  
 Lab Code: ITSTU\_ Case No.: 47584 SAS No.: \_\_\_\_\_ SDG No.: MW-010  
 Preparation Blank Matrix (soil/water): \_\_\_\_\_  
 Preparation Blank Concentration Units (ug/L or mg/kg): \_\_\_\_\_

Analyte	Initial Calib. Blank (ug/L)		Continuing Calibration Blank (ug/L)						Preparation Blank		M
		C	1	C	2	C	3	C		C	
Aluminum											NR
Antimony											NR
Arsenic											NR
Barium											NR
Beryllium											NR
Cadmium											NR
Calcium											NR
Chromium											NR
Cobalt											NR
Copper											NR
Iron	10.0	U	10.0	U	10.0	U	10.0	U			P
Lead											NR
Magnesium											NR
Manganese	2.0	U	2.0	U	2.0	U	2.0	U			P
Mercury											NR
Nickel											NR
Potassium											NR
Selenium											NR
Silver											NR
Sodium	200.0	U	200.0	U	200.0	U	200.0	U			P
Thallium											NR
Vanadium											NR
Zinc											NR
Cyanide											NR

3  
BLANKS

Lab Name: ITAS\_KNOXVILLE\_\_\_\_\_

Contract: HOLLOMAN\_A

Lab Code: ITSTU\_

Case No.: 47584

SAS No.: \_\_\_\_\_

SDG No.: MW-010

Preparation Blank Matrix (soil/water): \_\_\_\_\_

Preparation Blank Concentration Units (ug/L or mg/kg): \_\_\_\_\_

Analyte	Initial Calib. Blank (ug/L)	C	Continuing Calibration Blank (ug/L)						C	M
			1	C	2	C	3	C		
Aluminum										NR
Antimony										NR
Arsenic										NR
Barium										NR
Beryllium										NR
Cadmium										NR
Calcium										NR
Chromium										NR
Cobalt										NR
Copper										NR
Iron			10.0	U	10.0	U				P
Lead										NR
Magnesium										NR
Manganese			2.0	U	2.0	U				P
Mercury										NR
Nickel										NR
Potassium										NR
Selenium										NR
Silver										NR
Sodium			200.0	U	200.0	U				P
Thallium										NR
Vanadium										NR
Zinc										NR
Cyanide										NR

4

ICP INTERFERENCE CHECK SAMPLE

Lab Name: ITAS\_KNOXVILLE Contract: HOLLOMAN\_A  
 Lab Code: ITSTU Case No.: 47584 SAS No: SDG No.: MW-010  
 ICP ID Number: JA1100 ICS Source: SPEX

Concentration Units: ug/L

Analyte	True		Initial Found			Final Found		
	Sol. A	Sol. AB	Sol. A	Sol. AB	%R	Sol. A	Sol. AB	%R
Aluminum	500000	513000	515005	517802.4	100.9	466115	471892.3	92.0
Antimony								
Arsenic								
Barium		471		504.6	107.1		486.8	103.4
Beryllium		473		491.0	103.8		462.9	97.9
Cadmium		861		954.0	110.8		945.4	109.8
Calcium	500000	484000	527605	528253.5	109.1	503510	508759.9	105.1
Chromium		417		472.8	113.4		450.4	108.0
Cobalt		402		476.3	118.5		434.2	108.0
Copper		420		483.8	115.2		412.0	98.1
Iron	200000	194	205887	205772.8		194051	195138.1	
Lead		901		950.0	105.4		976.0	108.3
Magnesium	500000	491000	510725	514639.3	104.8	491009	499292.2	101.7
Manganese		370		433.1	117.1		415.1	112.2
Mercury								
Nickel		820		946.8	115.5		913.4	111.4
Potassium								
Selenium								
Silver		901		1015.9	112.8		997.3	110.7
Sodium								
Thallium								
Vanadium		423		469.3	110.9		445.7	105.4
Zinc		849		940.0	110.7		926.6	109.1

4  
ICP INTERFERENCE CHECK SAMPLE

Lab Name: ITAS\_KNOXVILLE \_\_\_\_\_ Contract: HOLLOMAN\_A  
 Lab Code: ITSTU\_ Case No.: 47584 SAS No: \_\_\_\_\_ SDG No.: MW-010  
 ICP ID Number: JA1100 \_\_\_\_\_ ICS Source: SPEX \_\_\_\_\_

Concentration Units: ug/L

Analyte	True		Initial Found			Final Found		
	Sol. A	Sol. AB	Sol. A	Sol. AB	%R	Sol. A	Sol. AB	%R
Aluminum	500000	513000	500281	502436.2	97.9	499717	501563.8	97.8
Antimony								
Arsenic								
Barium		471		479.4	101.8		483.0	102.5
Beryllium		473		484.6	102.5		478.4	101.1
Cadmium		861		984.2	114.3		977.5	113.5
Calcium	500000	484000	509480	513965.3	106.2	508932	508187.7	105.0
Chromium		417		464.2	111.3		450.9	108.1
Cobalt		402		474.9	118.1		454.7	113.1
Copper		420		473.9	112.8		456.1	108.6
Iron	200000	194	199513	200226.5		198889	198395.2	
Lead		901		997.2	110.7		983.8	109.2
Magnesium	500000	491000	498876	500878.1	102.0	485273	488535.0	99.5
Manganese		370		432.7	116.9		418.0	113.0
Mercury								
Nickel		820		926.8	113.0		913.0	111.3
Potassium								
Selenium								
Silver		901		1029.3	114.2		1004.0	111.4
Sodium								
Thallium								
Vanadium		423		473.6	112.0		456.3	107.9
Zinc		849		937.3	110.4		919.0	108.2

FORM IV - IN

3/90

7  
LABORATORY CONTROL SAMPLE

Lab Name: ITAS\_KNOXVILLE\_\_\_\_\_

Contract: HOLLOMAN\_A

Lab Code: ITSTU\_

Case No.: 47584

SAS No.: \_\_\_\_\_

SDG No.: MW-010

Solid LCS Source: \_\_\_\_\_

Aqueous LCS Source: SPEX\_\_\_\_\_

Analyte	Aqueous (ug/L)			Solid (mg/kg)				
	True	Found	%R	True	Found	C	Limits	%R
Aluminum								
Antimony								
Arsenic								
Barium								
Beryllium								
Cadmium								
Calcium								
Chromium								
Cobalt								
Copper								
Iron	20000.0	22517.40	112.6					
Lead								
Magnesium								
Manganese	4000.0	3986.40	99.7					
Mercury								
Nickel								
Potassium								
Selenium								
Silver								
Sodium	20000.0	19118.30	95.6					
Thallium								
Vanadium								
Zinc								
Cyanide								



9  
ICP SERIAL DILUTION

EPA SAMPLE NO.

S-0201L

Lab Name: ITAS\_KNOXVILLE Contract: HOLLOMAN\_A

Lab Code: ITSTU Case No.: 47584 SAS No.: SDG No.: MW-010

Matrix (soil/water): WATER Level (low/med): LOW

Concentration Units: ug/L

Analyte	Initial Sample Result (I)		Serial Dilution Result (S)		% Difference	Q	M
		C		C			
Aluminum							
Antimony							
Arsenic							
Barium							
Beryllium							
Cadmium							
Calcium							
Chromium							
Cobalt							
Copper							
Iron	129.65		129.90	B	0.2		P
Lead							
Magnesium							
Manganese	136.97		144.75		5.7		P
Mercury							
Nickel							
Potassium							
Selenium							
Silver							
Sodium	726700.00		717375.00		1.3		P
Thallium							
Vanadium							
Zinc							

10  
Instrument Detection Limits (Quarterly)

Lab Name: ITAS\_KNOXVILLE\_\_\_\_\_

Contract: HOLLOMAN\_A

Lab Code: ITSTU\_ Case No.: 47584

SAS No.: \_\_\_\_\_

SDG No.: MW-010

ICP ID Number: JA1100\_\_\_\_\_

Date: 01/15/91

Flame AA ID Number : \_\_\_\_\_

Furnace AA ID Number : \_\_\_\_\_

Analyte	Wave-length (nm)	Back-ground	CRDL (ug/L)	IDL (ug/L)	M
Aluminum	308.20		200	40.0	P
Antimony	206.80		60	30.0	P
Arsenic	193.60		10	40.0	P
Barium	493.40		200	2.0	P
Beryllium	313.00		5	1.0	P
Cadmium	228.80		5	5.0	P
Calcium	317.90		5000	30.0	P
Chromium	267.70		10	10.0	P
Cobalt	228.60		50	20.0	P
Copper	324.70		25	10.0	P
Iron	259.90		100	10.0	P
Lead	220.30		3	30.0	P
Magnesium	279.00		5000	30.0	P
Manganese	257.60		15	2.0	P
Mercury			0.2		NR
Nickel	231.60		40	20.0	P
Potassium	766.00		5000	1000.0	P
Selenium	196.00		5	60.0	P
Silver	328.00		10	5.0	P
Sodium	588.90		5000	200.0	P
Thallium	190.80		10	40.0	P
Vanadium	292.40		50	10.0	P
Zinc	213.80		20	5.0	P

Comments:

11A  
ICP Interelement Correction Factors (Annually)

Lab Name: ITAS\_KNOXVILLE\_\_\_\_\_ Contract: HOLLOMAN\_A  
 Lab Code: ITSTU\_ Case No.: 47584 SAS No.: \_\_\_\_\_ SDG No.: MW-010  
 ICP ID Number: JA1100\_\_\_\_\_ Date: 10/15/90

Analyte	Wave-length (nm)	Interelement Correction Factors for :				
		Al	Ca	Fe	Mg	AS_
Aluminum	308.20	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Antimony	206.80	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Arsenic	193.60	0.0103600	0.0000000	0.0013600	0.0000000	0.0000000
Barium	493.40	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Beryllium	313.00	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Cadmium	228.80	0.0000000	0.0000000	0.0000000	0.0000000	0.0055600
Calcium	317.90	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Chromium	267.70	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Cobalt	228.60	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Copper	324.70	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Iron	259.90	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Lead	220.30	0.0006800	0.0000000	0.0000000	0.0000000	0.0000000
Magnesium	279.00	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Manganese	257.60	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Mercury						
Nickel	231.60	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Potassium	766.00	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Selenium	196.00	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Silver	328.00	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Sodium	588.90	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Thallium	190.80	0.0000000	0.0000000	0.0103900	0.0000000	0.0000000
Vanadium	292.40	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Zinc	213.80	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000

Comments:

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11B  
ICP Interelement Correction Factors (Annually)

Lab Name: ITAS\_KNOXVILLE\_\_\_\_\_ Contract: HOLLOMAN\_A  
 Lab Code: ITSTU\_ Case No.: 47584 SAS No.: \_\_\_\_\_ SDG No.: MW-010  
 ICP ID Number: JA1100\_\_\_\_\_ Date: 10/15/90

Analyte	Wave-length (nm)	Interelement Correction Factors for :				
		BA_	BE_	CO_	CR_	NI_
Aluminum	308.20	0.0000000	0.0000000	0.0000000	0.0055800	0.0000000
Antimony	206.80	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Arsenic	193.60	0.0006600	0.0000000	0.0005200	0.0000000	0.0000000
Barium	493.40	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Beryllium	313.00	0.0000000	0.0000000	0.0000000	0.0002800	0.0001200
Cadmium	228.80	0.0000000	0.0025800	0.0000000	0.0000000	0.0000000
Calcium	317.90	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Chromium	267.70	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Cobalt	228.60	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Copper	324.70	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Iron	259.90	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Lead	220.30	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Magnesium	279.00	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Manganese	257.60	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Mercury						
Nickel	231.60	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Potassium	766.00	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Selenium	196.00	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Silver	328.00	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Sodium	588.90	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Thallium	190.80	0.0000000	0.0000000	0.0018300	0.0000000	0.0000000
Vanadium	292.40	0.0000000	0.0000000	0.0000000	0.0000000	0.0032600
Zinc	213.80	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000

Comments:

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11B  
ICP Interelement Correction Factors (Annually)

Lab Name: ITAS\_KNOXVILLE \_\_\_\_\_ Contract: HOLLOMAN\_A  
 Lab Code: ITSTU Case No.: 47584 SAS No.: \_\_\_\_\_ SDG No.: MW-010  
 ICP ID Number: JA1100 \_\_\_\_\_ Date: 10/15/90

Analyte	Wave-length (nm)	Interelement Correction Factors for :				
		V				
Aluminum	308.20	0.0218400				
Antimony	206.80	0.0000000				
Arsenic	193.60	0.0128200				
Barium	493.40	0.0000000				
Beryllium	313.00	0.0062300				
Cadmium	228.80	0.0000000				
Calcium	317.90	0.0000000				
Chromium	267.70	0.0000000				
Cobalt	228.60	0.0000000				
Copper	324.70	0.0000000				
Iron	259.90	0.0000000				
Lead	220.30	0.0000000				
Magnesium	279.00	0.0000000				
Manganese	257.60	0.0000000				
Mercury						
Nickel	231.60	0.0000000				
Potassium	766.00	0.0000000				
Selenium	196.00	0.0000000				
Silver	328.00	0.0000000				
Sodium	588.90	0.0000000				
Thallium	190.80	0.0019670				
Vanadium	292.40	0.0000000				
Zinc	213.80	0.0000000				

Comments:

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12  
ICP Linear Ranges (Quarterly)

Lab Name: ITAS\_KNOXVILLE \_\_\_\_\_ Contract: HOLLOMAN\_A  
 Lab Code: ITSTU\_ Case No.: 47584 SAS No.: \_\_\_\_\_ SDG No.: MW-010  
 ICP ID Number: JA1100 \_\_\_\_\_ Date: 10/15/90

Analyte	Integ. Time (sec.)	Concentration (ug/L)	M
Aluminum	6.00	500000.0	P
Antimony	6.00	15000.0	P
Arsenic	6.00	15000.0	P
Barium	6.00	15000.0	P
Beryllium	6.00	15000.0	P
Cadmium	6.00	15000.0	P
Calcium	6.00	500000.0	P
Chromium	6.00	15000.0	P
Cobalt	6.00	15000.0	P
Copper	6.00	40000.0	P
Iron	6.00	500000.0	P
Lead	6.00	40000.0	P
Magnesium	6.00	500000.0	P
Manganese	6.00	40000.0	P
Mercury			NR
Nickel	6.00	15000.0	P
Potassium	6.00	500000.0	P
Selenium	6.00	15000.0	P
Silver	6.00	15000.0	P
Sodium	6.00	500000.0	P
Thallium	6.00	15000.0	P
Vanadium	6.00	15000.0	P
Zinc	6.00	15000.0	P

Comments:

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INTERNATIONAL  
TECHNOLOGY  
CORPORATION

# ANALYTICAL SERVICES

## CERTIFICATE OF ANALYSIS

IT Corporation  
5301 Central N.E., Suite 700  
Albuquerque, NM 87108  
ATTN: Dann Meyer *DM 4/11/91*

April 11, 1991

Job Number: ITNA 47584/ITNA 47599 (QC Data)

P.O. Number: 301251.02.07

This is the Certificate of Analysis for the following samples:

Client Project ID: Holloman AFB  
Date Received by Lab: 01/17 and 01/18/91  
Number of Samples: Eleven (11)  
Sample Type: Water

### MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Results in mg/liter (ppm)

Client Sample ID: S-020191  
Lab Sample ID: PP6082

<u>Compound</u>	<u>Conc. Spike Added</u>	<u>Sample Result</u>	<u>Conc. MS</u>	<u>% Rec.</u>	<u>Conc. MSD</u>	<u>% Rec.</u>	<u>RPD</u>
total organic carbon	32	6	38	100	39	103	3.0

RPD = Relative Percent Difference

Date of Analysis: 01/23/91

Reviewed and Approved:

*Alyce R. Moore*  
Alyce R. Moore  
Laboratory Manager

American Council of Independent Laboratories  
International Association of Environmental Testing Laboratories  
American Association for Laboratory Accreditation

IT Corporation  
April 11, 1991

IT ANALYTICAL SERVICES  
5815 MIDDLEBROOK PIKE  
KNOXVILLE, TN

Client Project ID: Holloman AFB

Job Number: ITNA 47584/  
ITNA 47599 (QC Data)

MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Results in mg/liter (ppm)

Sample Matrix: Water

Client Sample ID: MW-020191  
Lab Sample ID: PP6195

<u>Compound</u>	<u>Conc. Spike Added</u>	<u>Sample Result</u>	<u>Conc. MS</u>	<u>% Rec.</u>	<u>Conc. MSD</u>	<u>% Rec.</u>	<u>RPD</u>
total organic carbon	32	4	35	97	36	100	3.0

RPD = Relative Percent Difference

Date of Analysis: 01/23/91

IT Corporation  
April 11, 1991

IT ANALYTICAL SERVICES  
5815 MIDDLEBROOK PIKE  
KNOXVILLE, TN

Client Project ID: Holloman AFB

Job Number: ITNA 47584/  
ITNA 47599 (QC Data)

MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Results in mg/liter (ppm)

Sample Matrix: Water

Client Sample ID: MW-040191  
Lab Sample ID: PP6196

<u>Compound</u>	<u>Conc. Spike Added</u>	<u>Sample Result</u>	<u>Conc. MS</u>	<u>% Rec.</u>	<u>Conc. MSD</u>	<u>% Rec.</u>	<u>RPD</u>
total organic carbon	32	6	36	94	37	97	3.1

RPD = Relative Percent Difference

Date of Analysis: 01/23/91

**APPENDIX E**  
**A-E DAILY QUALITY CONTROL REPORTS**

Date: 1/14/91

Sheet No.: 028  
Page 1 of 1

RCRA Detection Monitoring  
A-E DAILY QUALITY CONTROL REPORT FOR GROUNDWATER MONITORING  
HOLLOMAN AFB, NEW MEXICO

Task/Site No.: 7<sup>th</sup> Sampling Round - Annual + Semi-Annual Parameters

Weather: Clear; sunny, low approximately 30°F, high approximately 55°

Work Performed: At 10 monitor wells: 1) Monitor background and wellbore headspace for the presence of organic vapors using an HNu Photoionization Detector. 2) Measure depth to fluids and total well depths using an interface probe. - No light or dense immiscible phases detected in any monitor well.

Sampling Performed: NA

Problems and Corrective Actions: HAFB operating at high security level due to Middle East Crisis - extra time required for base access and security checks (throughout project round).

Quality Control Activities Initiated: Field equipment was calibrated before and after use. One POX trip blank (poured at IT-Warehouse) was maintained on ice under Chain of Custody procedures. All down-well equipment deconned between monitor wells.

Signature: Ann Huska, IT-ABQ.

Date: 1/15/91

## RCRA Detection Monitoring

Sheet No.: 029A-E DAILY QUALITY CONTROL REPORT FOR GROUNDWATER MONITORING  
HOLLOMAN AFB, NEW MEXICO

Page 1 of 1

Task/Site No.: 7<sup>th</sup> Sampling Round - Annual + Semi-Annual Parameters plus PCB/Pest sample collected at COE's request at all monitor wells.

Weather: Clear, slight wind, low approximately 35°F; high approximately 50°F.

Work Performed: Equipment calibration; purge and sample 1 monitor well; held samples under chain of custody procedure; prep sample containers for sampling round.

Sampling Performed: Sampling conducted at MW-1. 4 replicates collected for TOC, POX and field parameters (pH, spec. conductivity + temp).

Sample preservatives were added in the field; pH was verified with litmus paper which was taped to the sample container.

Problems and Corrective Actions: Specific conductivity readings varied significantly from previous sample rounds. No difficulty with equipment was noted. However; to exercise due diligence, sampling was delayed to allow for shipment of backup equipment. Extra time was used to prepare sample containers.

Quality Control Activities Initiated: Dedicated sampling equipment was used at all monitor wells. Field equipment was calibrated daily before and after field use. Samples were maintained under Chain of Custody procedures.

Signature: Ann Hruska, IT-ABQ

Date: 1/16/91

Sheet No.: 030

Page 1 of 1

RCRA Detection Monitoring

A-E DAILY QUALITY CONTROL REPORT FOR GROUNDWATER MONITORING  
HOLLOMAN AFB, NEW MEXICO

Task/Site No.: 7<sup>th</sup> Sampling Round - Annual + Semi-Annual Parameters plus PCB/Pest sample collected at COE's request at all monitor wells.

Weather: Clear in morning with clouds building to east in afternoon. Low approximately 35°F High approximately 50°F.

Work Performed: Equipment calibration; purge + sample 6 monitor wells; samples maintained under Chain of Custody procedure; sent samples from 6 monitor wells via overnight federal Express to three analytical laboratories.

Sampling Performed: Sampling conducted at MW-5, MW-7, MW-8, MW-3, S-2, and MW-2. 4 replicate samples collected for TOC, POX and field parameters (pH, spec. cond. + temp) at all wells.

Problems and Corrective Actions: None

Quality Control Activities Initiated: Dedicated equipment used at all wells. Field equipment was calibrated daily before and after field use. Samplers were maintained under Chain of Custody procedures. POX trip blank sent into lab with samples. One QA sample set collected at MW-2 for  
Signature: Ann M. Hauska, IT-ABQ

analysis by COE - Missouri River Division Laboratory.

Date: 1/17/91

Sheet No.: 031

Page 1 of 1

RCRA Detection Monitoring  
A-E DAILY QUALITY CONTROL REPORT FOR GROUNDWATER MONITORING  
HOLLOMAN AFB, NEW MEXICO

Task/Site No.: 7<sup>th</sup> Sampling Round - Annual + Semi-Annual Parameters plus PCB/Pest sample collection at COE's request at all monitor wells.

Weather: Cold, high of approximately 35°F; very cloudy + windy.

Work Performed: Equipment calibration; purge + sample 3 monitor wells; purge + monitor field parameters at MW-1 using new conductivity meter; samples maintained under Chain of Custody procedure, package + sent via overnight delivery (Federal Express) to three analytical laboratories. Drive to Albuquerque.

Sampling Performed: Sampling conducted at MW-6, S-4 and MW-4.

Four replicate samples were collected for TOC, POX and field parameters (pH, Spec. conductivity + temperature) at all wells.

Problems and Corrective Actions: None

Quality Control Activities Initiated: Dedicated equipment used at all wells. Field equipment was calibrated daily before and after field use. Samples were maintained under Chain of Custody procedures. One QA sample

signature: Ann M. Huska, IT-ABQ

and one environmental duplicate (identified as MW-12) were collected at MW-4.

**BACKGROUND CONTAMINATION INDICATOR PARAMETERS  
SUMMARY STATISTICS FOR UPGRADIENT WELLS AND  
COMPARISONS WITH DATA FROM THE THIRD  
SEMANNUAL GROUNDWATER SAMPLING EPISODE  
SEWAGE TREATMENT LAGOONS MONITORING WELLS  
HOLLOMAN AIR FORCE BASE, NEW MEXICO**

Prepared for:

**HQ TAC/DEEV  
Langley AFB, VA 23665-5542**

Under contract with:

**U.S. Army Corps of Engineers, Omaha District  
215 North 17th Street, CEMRO-ED-EB  
Omaha, Nebraska 68102-4978**

Prepared by:

**International Technology Corporation  
5301 Central Avenue, N.E., Suite 700  
Albuquerque, New Mexico 87108**

**June 1991**

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## **1.0 Introduction**

---

International Technology Corporation (IT) is the prime Architect-Engineer (A-E) contracted by the U.S. Army Corps of Engineers, Omaha District, to implement a groundwater investigation of the sewage lagoons and Lakes Holloman and Stinky, Holloman Air Force Base, New Mexico. The investigative program is being performed under Contract No. DACW45-88-D-0008. As part of the investigative program, groundwater sampling has been conducted eight times to date, once during each of the months of August, September, November, and December 1989, and again in January and July 1990, with a re-collection episode in September (IT, 1990d). The most recent sampling occurred January 14-17, 1991 (IT, 1991). Groundwater sampling was conducted in accordance with the A-E Quality Control and Sampling Plan (A-E QCP/SP) for Groundwater Study and Monitoring Program, Holloman Air Force Base, New Mexico (IT, 1989a).

### **1.1 Requirements of 40 CFR 265.92**

The requirements of 40 CFR 265.92 specify that during the first year of sampling initial background concentrations or values must be established [40 CFR 265.92(c)(1)] for the parameters characterizing the suitability of the groundwater as a drinking water supply (40 CFR 265, Appendix III), the constituents characterizing groundwater quality [40 CFR 265.92(b)(2)], and groundwater contamination indicator parameters [40 CFR 265.92(b)(3)] for all wells. The sewage treatment lagoons at Holloman Air Force Base had been in operation for some years prior to the initialization of this groundwater monitoring program. Consequently, all monitoring wells were sampled during each sampling episode, but, as the sewage treatment lagoons are an existing facility, only the upgradient wells are evaluated for establishing background constituent concentrations. According to the regulations, background water monitoring is to be performed by sampling quarterly for the first year. The Holloman Air Force Base sewage treatment lagoons monitoring wells, however, were sampled on an accelerated schedule during August, September, November, and December of 1989. The data collected during these sampling episodes, as previously reported by Radian (1989) and IT (1989b; 1990a, b), represent establishment of initial background concentrations as required by 40 CFR 265.92(c)(1).

Additionally required in 40 CFR 265.92(c)(2), initial background arithmetic means and variances for the contamination indicator parameters [40 CFR 265.92(b)(3)] are to be calculated for upgradient wells using at least four replicate measurements for each sample and pooling the respective parameter measurements obtained during the first year. Data presented later in this report comply with the requirements of 40 CFR 265.92(c)(2).

Following the first year of sampling which meets the requirements of 40 CFR 265.92(b) and (c), the sampling frequencies for the constituents characterizing groundwater quality and the contamination indicator parameters are established in 40 CFR 265.92(d). Parameters characterizing groundwater quality must be sampled annually [40 CFR 265.92(d)(1)]. Groundwater contamination indicator parameters must be sampled semiannually [40 CFR 265.92(d)(2)]. In January 1990, the annual and semiannual sampling requirements were met. These data were reported by IT (1990c). In July 1990, and with the September 1990 resampling, the second semiannual sampling requirements were met. Sampling in January 1991 met one third semiannual and second annual requirements.

### **1.2 Requirements of 40 CFR 265.93**

The calculation of arithmetic means and variances for the parameters indicating groundwater contamination are required in 40 CFR 265.93(b) based on at least four replicate measurements of the respective parameters at each well monitored during the semiannual sampling episodes. The first semiannual groundwater sampling episode at Holloman Air Force Base was conducted in January 1990, one month after completion of the first four monthly sampling episodes. The second semiannual groundwater sampling episode was conducted in July 1990, with resampling occurring in September. The third semiannual groundwater sampling episode was conducted in January 1991. The summary statistics calculated from the sampling episodes are to be compared to the initial background means by use of the Student's t-test at the 0.01 level of significance (alpha) to determine statistically whether significant increases (and decreases in the case of pH) have occurred with respect to background.

In this report summary statistics are calculated for the contamination indicator parameters at upgradient wells (representing background) during the first four monthly sampling rounds by pooling the monthly replicate averages. These background summary statistics are compared with the replicate averages calculated for all wells sampled during the January 1991 third semiannual sampling episode. As specified in the A-E QCP/SP, comparisons of the January 1991 data with the individual upgradient wells, MW-1 and S-2, are reported here. Additionally, a final set of comparisons are made comparing the January data against a pooling of all upgradient well data. As proposed in the A-E QCP/SP, the average replicate t-test is the Student's t-test utilized here for the background versus semiannual sampling data comparisons.

## **2.0 Methodology**

---

The methodology for performing the averaged replicate t-test statistical comparison between background parameter values at the upgradient wells and the January data involve three distinct steps. First, the data from the upgradient wells collected during the first four sampling rounds are listed and the summary statistics calculated. Second, the data from all wells for the third semiannual sampling episode (January 1991) are listed and summary statistics calculated. Third, using the summary statistics, the average replicate t-test is applied to make comparisons between the two data sets. Prior to discussing the results of these comparisons in Section 3.0, discussions concerning the quality and accuracy of the data themselves and of the procedures employed in this report are included in this section. The methodology used in this report follows closely the example data and calculations found in RCRA Ground Water Monitoring Technical Enforcement Guidance Document (TEGD), Appendix B (National Water Well Association, 1986).

### **2.1 Tabulation of Background Field and Laboratory Data from the Upgradient Wells**

Table 1 is a compilation of contamination indicator parameter data collected in the field and laboratory for the upgradient wells MW-1 and S-2 during groundwater sampling activities in August, September, November, and December 1989. The contamination indicator parameters listed include pH and specific conductance, both determined in the field, total organic carbon (TOC) and purgeable organic halides (POX) which were measured in samples sent to analytical laboratories. The data are reported exactly as returned from the laboratories with respect to significant digits. However, laboratory conventions for expressing "less than detection limit" values (ND, U) have been standardized in this report using the "less than" (<) symbol.

The values listed in Table 1 resulted from field measurement and sample analysis by personnel from two different A-E contractors and their laboratories. All data collected during the first sampling episode in August 1989 resulted from the work of Radian Corporation, Austin, Texas (Radian, 1989). Subsequent sampling episodes were completed by IT. The following discussions, concerning field measurements, instrumental accuracies, laboratory method detection limits, etc., are only applicable to the data collected by IT.

#### ***pH Measurements***

Measurements for pH were taken in the field using an Orion SA 250 pH meter in automatic temperature compensation mode. The pH meter was calibrated daily prior to sampling, at a minimum, and calibration was checked against standard pH 7.00 buffer

solution prior to initiating sampling at each well. The pH meter calibration was checked again against three standard buffers (pH 4.01, 7.00, and 10.00) at the end of the sampling day. Four measurements were taken from separate bailings after purging approximately five well volumes of water and collecting samples at each well. pH measurements were recorded to the nearest one-hundredth pH unit as indicated in Table 1. pH is a logarithmic scale (negative logarithm of the hydronium ( $\text{H}_3\text{O}^+$ ) ion concentration, conventionally referred to in this report as hydrogen ion concentration or just hydrogen). In order to compare pH values using the t-test, pH values are converted to their equivalent hydrogen ion concentrations (an arithmetic scale). Table 2 shows the upgradient background pH values converted to hydrogen ion concentrations using the formula:

$$\text{micro moles/L } (\mu\text{mol/L}) \text{ Hydrogen} = -\log^{-1} (\text{pH}) \times 10^6 \mu\text{mol/L}$$

All subsequent pH values are recalculated as hydrogen ion concentrations in micro moles per liter ( $\mu\text{mol/L}$ ) prior to calculating statistics in this report.

### ***Specific Conductance***

Initial background specific conductance measurements were taken in the field using a Cole Parmer model 1418-60 conductance meter in automatic temperature calibration mode. All measurements were taken on the instrument's 0 - 200,000  $\mu\text{mhos/cm}$  @ 25°C scale. The instrument was calibrated daily prior to beginning well sampling using a standard reference solution at the scale midpoint. Four replicate measurements were taken at each well following purging and chemistry sample collection. Calibration was rechecked at the end of the sampling day.

### ***Total Organic Carbon (TOC) and Purgeable Organic Halides (POX)***

The Table 1 values for TOC and POX resulted from laboratory analysis of samples collected in the field. The data are reported here exactly as reported by the laboratories with respect to significant digits. The numerous data coding conventions employed by the various laboratories to identify limits of detection or values less than detectable (U, ND, representing undetected, not detected, or "less than" some detection limit value, for example) are not reported here exactly as they were reported by the analytical laboratories. Rather, all "less than detectable" values are represented in this report by the "less than" symbol (<) indicating that the constituent was not detected at the lower limit of detection value following the "less than" symbol. Matrix spike and matrix spike duplicate quality control (QC) data are included in Appendix D of the third semiannual report (IT, 1991).

## **2.2 Calculation of Background Summary Statistics for Upgradient Wells**

Summary statistics calculated for each month's replicate measurements for the upgradient wells MW-1 and S-2 during the first four episodes are listed in Tables 3, 4, 5, and 6. Each table lists one contamination indicator parameter: Table 3 displays hydrogen (pH) data; Table 4 displays specific conductance data; Table 5 displays TOC data; and Table 6 displays POX data.

The column entries in Tables 3 through 6 include the well name and month sampled; N, representing the number of that month's measurements reported above the limit of detection; PROPORTION, month's measurements which were reported less than the detection limit; MEAN, or arithmetic average; VARIANCE, listing calculated sample variance; STANDARD DEVIATION, listing calculated sample standard deviation; and C.V., listing calculated coefficient of variation. Methods of calculating the summary statistics and example calculations are presented below.

Values for the monthly means are simple arithmetic averages calculated by summing all the measurements and dividing by a count of the measurements. In cases where some of the measurements were less than the detection limit, values of one-half of the reported detection limit are used in the summary calculations. When all measurements for that month are less than a detection limit, the detection limit itself is reported as the replicate mean and calculation of further summary statistics is not applicable. Calculated mean values are rounded to the number of least significant digits reported in that month's replicate data. An example of the calculation of the monthly replicate mean using the specific conductance measurements for well MW-1 collected in November 1989 is shown below.

Example calculation of the November 1989 specific conductance mean from four replicate measurements well MW-1:

Equation:

$$\bar{y} = \frac{\sum_{i=1}^n y_i}{n}$$

where

$\bar{y}$  = replicate average (mean)

$y_i$  = concentration measurement from this well, MW-1, this sampling episode, November 1989, sum  $y_i$  from  $i = 1$  to  $n$ , where  $y_i$  = individual concentration or specific conductance measurement

$n$  = number of measurements

Calculation (units are  $\mu\text{mhos/cm}$  @  $25^\circ\text{C}$ ):

$(59,100 \mu\text{mhos/cm} + 59,600 \mu\text{mhos/cm} + 60,100 \mu\text{mhos/cm} + 60,100 \mu\text{mhos/cm}) / 4 = 59,725 \mu\text{mhos/cm}$ , which rounds to the original data accuracy of  $59,700 \mu\text{mhos/cm}$ .

Variance is calculated as the sample variance and is a measure of how dispersed the individual measurements are about the mean. The equation for sample variance and an example calculation using the same data from above follows.

Equation:

$$s^2 = \frac{\sum_{i=1}^n (y_i - \bar{y})^2}{n - 1}$$

where

$s^2$  = sample variance  
 $\bar{y}$ ,  $y_i$ , and  $n$  are as before.

Calculation:

$(59,100 \mu\text{mhos/cm} - 59,725 \mu\text{mhos/cm})^2 + (59,600 \mu\text{mhos/cm} - 59,725 \mu\text{mhos/cm})^2 + (60,100 \mu\text{mhos/cm} - 59,725 \mu\text{mhos/cm})^2 + (60,100 \mu\text{mhos/cm} - 59,725 \mu\text{mhos/cm})^2 / (4-1) = 229,167 \mu\text{mhos}^2/\text{cm}^2$

which rounds to the original data accuracy of  $229,200 \mu\text{mhos}^2/\text{cm}^2$ .

Standard deviation is calculated as the sample standard deviation. Since the variance calculation returns the measurement units as squared values, the calculation of standard deviation takes the square root of the variance and returns a measurement of dispersion about the mean in units equivalent to the original data.

Equation:

$$s = \sqrt{s^2}$$

where

s = sample standard deviation  
s<sup>2</sup> = as previously stated.

Calculation:

$$s = \sqrt{229,167 \text{ } \mu\text{mhos}^2/\text{cm}^2} = 479 \text{ } \mu\text{mhos}/\text{cm}$$

which rounds to the original data accuracy of 500  $\mu\text{mhos}/\text{cm}$ .

All calculations of the background summary statistics mean, variance, and standard deviation in this report were calculated using commercially available computer spreadsheet software. Means, variances, and standard deviations were calculated from tables containing the raw data (and assumed data in the case of less than detection limit values) by the use of "canned" functions or subroutines built into the spreadsheet software. Consequently, and as in the example calculations just provided, intermediate results are not rounded before being input to subsequent calculations and are in most cases carried to ten or twelve decimal places internally in the computer software. There is a possibility that recalculation of the summary statistics provided here with hand calculators or other means could disclose slight discrepancies in the results due to calculator or software rounding peculiarities.

The final summary statistical value describing the replicate measurements on Tables 3 through 6 is coefficient of variation (C.V.). Coefficient of variation is a gross indicator of how well the distribution of measurements follows the standard normal bell-shaped curve. Coefficient of variation is a percentage measure calculated by dividing the standard deviation by the mean, times 100. Generally C.V.s less than one are considered to indicate that the data distribution probably does not deviate from a normal distributional curve. The corollary is not necessarily true, that C.V.s greater than one indicate a non-normal distribution. Small sample sizes, as is the case with the replicate Holloman well data presented here, can exhibit C.V.s greater than one due to the limited data set, but this does not indicate that the distributions are non-normal. Values for the coefficient of variation in this report are calculated using the rounded means and standard deviations shown in the summary statistics tables and are themselves rounded to two decimal places. An example calculation for C.V. follows using the same November 1989 specific conductance data from well MW-1.

Equation:

$$C.V. = (s/\bar{y}) \times 100$$

where

C.V. = coefficient of variation  
s,  $\bar{y}$  = as previously stated.

Calculation:

$$(500 \text{ } \mu\text{mhos/cm} / 59,700 \text{ } \mu\text{mhos/cm}) \times 100 = 0.84$$

Table 7 lists results of pooling the summary statistics calculated for each month's sampling at the upgradient wells during the first year (Tables 3 through 6) and lists summary statistics calculated using these replicate averages. Table 7 shows background pooled summary statistics for the upgradient wells, MW-1 and S-2, and all upgradient wells combined. Data presented in Table 7 comply with the requirements of 40 CFR 295.92(c)(2) for calculating the arithmetic means and variances of contamination indicator parameters at the upgradient wells during the first year of sampling.

The methods of calculation applicable to Table 7 are identical to those previously described for Tables 3 through 6 except that instead of using the individual replicate measurements the means of the replicates measured each sampling month, August through December 1989 are used in the calculations.

As described in Section 2.5 of this report, the means for the contamination indicator parameters from the upgradient wells listed in Table 7 are compared with the replicate averages calculated from all wells sampled during the third semiannual sampling episode (January 1991) in the averaged replicate t-test. The purpose of the average replicate t-test is to evaluate whether or not contamination has occurred downgradient of the Holloman Air Force Base sewage lagoons.

### **2.3 *Tabulation of Third Semiannual Field and Laboratory Data from All Wells***

Table 8 lists contamination indicator parameter data collected from all wells during the third semiannual sampling episode in January 1991. Four replicate measurements of pH and specific conductance were collected using instrumentation and procedures described in the third semiannual data report (IT, 1991). An additional column in Table 8 shows the field pH measurements converted to hydrogen ion concentrations in micro moles per liter.

All TOC sample concentrations were quantifiable above the detection limit with the exception of all four replicates from well MW-1. January 1991 POX values were reported in ug/L. To be consistent with background units, values were converted to mg/L in Table 8. Eight of the total 40 POX measurements reported were quantifiable above the

0.010 mg/L as chloride detection limits in the January 1991 samples. This detection limit is approximately one-half the detection limit reported for the background POX measurements. Additionally, POX concentrations were detected in the January 1991 trip blank sample (IT, 1991); consequently POX values greater than detection are suspect.

#### **2.4 Calculation of Summary Statistics from the Third Semiannual Sampling Episode, All Wells, January 1991**

Table 9 contains the results of summary statistics calculations for the contamination indicator parameters at all wells sampled during the third semiannual sampling episode in January 1991. Mean, variance, standard deviation, and coefficient of variation values are listed for each parameter (hydrogen, specific conductance, TOC, and POX) at each well, calculated from the data listed in Table 8. All calculations were performed on a pocket calculator for the third semiannual sampling and data. The data listed in Table 9 comply with the requirements of 40 CFR 265.93(b) for calculation of means and variances of at least four replicate measurements of the contamination indicator parameters taken at all wells during the semiannual sampling episodes.

The means for the replicate measurements of the contamination indicator parameters from all wells sampled in January 1991 listed in Table 8 are used with the pooled average replicate means and standard deviations from the upgradient background calculations (Table 7) in the averaged replicate t-test. The purpose of the average replicate t-test is to evaluate whether or not the Holloman Air Force Base sewage lagoons have caused groundwater contamination.

#### **2.5 Calculations of the Averaged Replicate t-Test Statistical Comparisons**

Tables 10 through 15 calculate the average replicate t-statistic comparing the upgradient background means with the replicate sampling means from January 1991 TOC data. Table 10 lists the January replicate means ( $Y_m$ ), the January replicate means minus the background means ( $Y_m - Y_b$ ), and the calculated average replicate t-statistic for the parameters hydrogen and specific conductance, comparing all wells sampled in January 1991 with the background means from the upgradient well MW-1. Table 11 lists similar information for the parameters TOC and POX compared to the background means at upgradient well MW-1. Tables 12 and 13 follow in similar fashion comparing January replicate hydrogen and specific conductance means (Table 12) and TOC and POX means (Table 13) with background means from the upgradient well S-2. Tables 14 and 15 make similar comparisons with all upgradient background averaged replicate values pooled together. Additional data contained on the tables include critical values for the t-statistic ( $t_c$ ) (Tables 16 and 17). Calculated values of t (absolute values in the case of hydrogen)

that exceed the Table 16 or 17 critical value for t ( $t_c$ ) indicate that concentrations measured in January 1991 well samples are statistically greater (or lesser in the case of hydrogen) than the comparative background well(s) concentration. Discussions of the averaged replicate t-statistic and its calculation on Tables 10 through 15 follow below.

The methodology used in calculating the average replicate t-statistics in this report follows closely the example data and calculations found in the RCRA Ground Water Monitoring Technical Enforcement Guidance Document (TEGD), Appendix B (National Water Well Association, 1986). The t-statistics reported in Tables 10 through 15 were calculated on a scientific pocket calculator. The average replicate t-statistic is a variant of the Student's t-statistic. However, the average replicate t-statistic utilizes the number of background wells and background sampling rounds as an adjustment factor in the statistic. The average replicate t-statistic is described as the difference between the semiannual sampling episode replicate mean and the upgradient background mean, divided by the background standard deviation times the square root of the quantity one plus one divided by the quantity number of the background wells times the number of background sampling episodes. An example calculation of the average replicate t-statistic comparing the specific conductance replicate mean from the January 1991 sampling at well MW-2 with the background mean from the upgradient well MW-1 is presented.

Equation:

$$t = \frac{\bar{y}_m - \bar{y}_b}{s_b \sqrt{1 + 1/(n_b \times O_b)}}$$

where

- t = the average replicate t-statistic for this well (MW-2), this parameter (specific conductance and this semiannual sampling episode January 1991)
- $\bar{y}_m$  = the mean of the replicate measurements for January 1991
- $\bar{y}_b$  = background mean for the upgradient well MW-1
- $s_b$  = background standard deviation for the upgradient well MW-1
- $n_b$  = number of background wells
- $O_b$  = number of background observations or sampling episodes establishing background during the first year.

Calculation:

$$(4,200 \text{ } \mu\text{mhos/cm} - 57,500 \text{ } \mu\text{mhos/cm}) / (6,200 \text{ } \mu\text{mhos/cm} \times \sqrt{1 + (1/(1 \times 4))}) \cong -7.691$$

Using Table 16, the number of wells sampled in January (10), and degrees of freedom associated with this t-test (3), the critical value of t ( $t_c$ ) is determined to be 7.285. Since the t-statistic calculated is less than the critical value for t, there is no indication that the specific conductance in well MW-2 sampled in January is greater than well MW-1 background. In the previous example calculation, the result was stated as approximate. This is due to the fact that the intermediate denominator term of the t-statistic ( $s_x$ ) times the square root of  $(1 + 1 / (1 \times 4))$  has been rounded prior to completing the calculation in Tables 10 through 15. The intermediate denominator terms for a given parameter's t calculations remain constant when comparing the replicate means and are given in the footnotes to Tables 10 through 15. All the information necessary to calculate the t-statistics are provided on the tables. Thus, t-statistics can be calculated using the information provided on the tables without the introduction of rounding errors caused by variations in hand calculators or other computational means.

Critical values for t are found in Tables 16 and 17. In the case of hydrogen (pH), where 40 CFR 265.93(b) requires the detection of increases or decreases in pH, a two-tailed table of critical values is utilized (Table 17), and the absolute value of the t-statistic compared to the critical value of t must be used. A single-tailed table of critical values for the t-statistic is utilized for comparisons of all other contamination indicator parameters and is found in Table 16. Values in these tables were excerpted from the TEGD (National Water Well Association, 1986).

## **3.0 Discussion of Results**

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Results for the average replicate t-test comparisons of the January 1991 data and the data of the background well(s) are listed below.

### **3.1 January 1991 Data Compared to Upgradient Well MW-1**

As indicated in Tables 10 and 11, none of the calculated t-statistics for hydrogen ion concentration, specific conductance, TOC, or POX exceed the respective critical values for t. This indicates that there are no statistical increases (or decreases in the case of hydrogen ion concentration) between the contamination indicator parameter values in any wells sampled in January 1991 and the background mean values from the upgradient well MW-1.

### **3.2 January 1991 Data Compared to Upgradient Well S-2**

As indicated in Tables 12 and 13, the upgradient well MW-1 shows statistical differences in specific conductance for the replicate averages of the January 1991 sampling when compared to the upgradient well S-2 background means. This indicates that there are differences in the concentrations of these measured parameters between the two upgradient wells. This unusual occurrence may be caused by site hydrologic factors discussed in Section 4.0 below. Additionally, at wells MW-6 and S-4, January specific conductance replicate average values are statistically greater than the background means at the upgradient well S-2. These comparisons are based on the fact that the calculated t-statistics exceed the Table 16 and 17 critical values of t for those wells. Note that MW-6 and S-4 values were also statistically greater than S-2 in the first and second semiannual rounds.

### **3.3 January 1991 Data Compared to All Upgradient Wells**

As indicated in Tables 14 and 15, when the January 1991 replicate averages are compared to pooled background means and standard deviations of all upgradient wells (MW-1 and S-2), there are no indications of any January 1991 means statistically exceeding (or statistically less than in the case of hydrogen) their respective critical values for t. Consequently, the contamination indicator parameters show no statistical excursions above or below pooled upgradient background mean concentrations. This partially results from the increased variance of the background data set when means from the upgradient wells MW-1 and S-2 are combined. Wells MW-1 and S-2 exhibit significant differences in parameter concentrations as previously noted.

## **4.0 Hydrographs and Potentiometric Surface Maps**

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In January groundwater elevations were obtained at each monitoring well prior to sampling, pursuant to 40 CFR 265.92(e). These data were presented in the data reports for the sampling round and are shown in Table 18. These data were used to construct hydrographs for each well and potentiometric surface maps of the site for each sampling period. The hydrographs and potentiometric surface maps were prepared pursuant to 40 CFR 265.93 (f), which requires evaluation of groundwater surface elevations data to determine whether the requirements for locating the monitoring wells continues to be satisfied.

The hydrographs are shown in Figure 1. These were prepared by IT using the GRAPHER program (Golden Software, Inc.). The hydrographs reflect a general seasonal trend of maximum groundwater fluid levels occurring in the fall and winter and lows occurring in the summer. Most downgradient wells display an increase (of approximately two feet) in the groundwater elevation over the eight sampling episodes, generally with intermediate peaks in late September 1989 and January 1990. Upgradient well MW-1 shows only a minor September 1989 increase (less than one foot), with little overall trend.

Potentiometric surface contour maps, presented as Figures 2 through 9, were constructed using the SURFER program (Golden Software, Inc.). The contour grids were calculated by kriging, using an octant search method with a search radius of 285.66 and the nearest number of points equal to 10. Override options and curve smoothing were also used to compensate for data and computer limitations.

The construction of the potentiometric surface contours is limited by the absence of wells along the eastern margin of the lagoons. The surface maps show some mounding of groundwater at the north end of the lagoons (near lagoons A, B, and C) and perhaps at the south end of the lagoons (west and south of lagoon G).

While not readily apparent on the January 1991 potentiometric surface maps (Figure 9), earlier fluid-level data (see Figures 2 through 6) suggest that the "upgradient" well, S-2, may not be hydrologically upgradient from the lagoons and may, in fact, be influenced (at least periodically) by the lagoons. The statistically significant differences between indicator parameters at well S-2 and MW-1, the other upgradient well (Section 3.2), may be due, in part, to the effect of the lagoons. This evidence indicates that monitoring well S-2 may not meet the requirements of 40 CFR 265.91(a); however, monitoring well MW-1 is clearly upgradient in all potentiometric surface maps. Thus, the groundwater monitoring program,

as currently configured, is meeting the minimum requirements of 40 CFR 265.91; i.e., at least one monitoring well is installed hydraulically upgradient from the facility.

## **5.0 Conclusions**

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A groundwater monitoring system of wells was installed at the Holloman Air Force Base sewage treatment lagoons in 1989. Two wells (MW-1 and S-2) were designed as hydrologically upgradient from the lagoons and eight are hydrologically downgradient. A program of sampling and analysis of groundwater collected from these wells was initiated in August 1989 to satisfy the requirements of EPA regulations (40 CFR 265, Subpart F). Four sampling episodes at approximately monthly intervals were performed to determine the quality of the drinking water (Appendix III), groundwater quality, and groundwater contamination indicator parameters in these wells, according to 40 CFR 265.92(a) through (c) and (e). The fifth, sixth, seventh (a re-collection round), and eighth sampling rounds in January, July, September 1990, and January 1991, respectively, met requirements for semiannual and annual sampling and analysis described in 40 CFR 265.92(d).

Statistical comparisons between upgradient (background) groundwater quality data collected during the first four monthly samplings with downgradient groundwater quality data collected in January 1991 showed few statistically significant changes among contamination indicator parameters (specific conductivity, TOC, and POX). The statistical program met the requirements of 40 CFR 265.93(b). No differences between groundwater indicator parameters in MW-1 and downgradient wells are statistically significant. Specific conductivity between upgradient well S-2 and downgradient wells MW-6 and S-4 has shown statistically significant differences. This is consistent with earlier sampling rounds. Statistically significant differences between well S-2 and MW-1 (specific conductance) suggest different influences on groundwater composition at these two (presumably) upgradient wells. The different influences have not been thoroughly investigated.

Groundwater table elevations measured at the various wells and potentiometric surface maps constructed from these data suggest a possible explanation for the differences between "upgradient" wells, MW-1 and S-2. Potentiometric surface maps (Figures 2 through 8) suggest S-2 may periodically be hydraulically downgradient from the lagoons and may be influenced by them. Although the controls on the potentiometric map contours are weak between the lagoons and well S-2, S-2 should be considered suspect as a true upgradient well. The program continues to meet the minimum requirements for a groundwater monitoring system, according to 40 CFR 265.92(a)(1); i.e., at least one monitoring well (MW-1) is upgradient from the lagoons. The potentiometric surface maps indicate no possible influence on well MW-1 by the lagoons.

## **6.0 References**

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**Table 1**

**Groundwater Contamination Indicator Parameters  
Background Data From Two Upgradient Wells  
Sampled Approximately Monthly  
Sewage Treatment Lagoons Monitoring Wells  
Holloman Air Force Base, New Mexico,  
1989**

Month	Well	Replicate	pH	Specific Conductance ( $\mu$ mhos/cm@ 25°C)	TOC (mg/L)	POX (mg/L, as chloride)
Aug	MW-1	1	6.53	48900	<1.0	<0.024
		2	6.66	48200	<1.0	0.089
		3	6.70	48500	19.0	0.082
		4	6.69	48500	19.0	<0.024
Sep	MW-1	1	6.73	61300	1.0	0.5
		2	6.72	62400	<1.0	2.1
		3	6.71	62900	<1.0	1.0
		4	6.72	63100	<1.0	4.1
Nov	MW-1	1	6.76	59100	<1.0	0.14
		2	6.76	59600	<1.0	0.13
		3	6.74	60100	<1.0	0.12
		4	6.76	60100	<1.0	0.13
Dec	MW-1	1	6.76	59200	1.0	<0.010
		2	6.73	59900	1.0	<0.010
		3	6.75	59500	1.0	<0.010
		4	6.74	59200	1.0	<0.010
Aug	S-2	1	7.10	10450	6.2	<0.024
		2	7.11	9750	7.3	<0.024
		3	7.13	9570	10	<0.024
		4	7.09	9700	5.8	<0.024
Sep	S-2	1	7.07	11600	6.0	0.080
		2	7.11	11500	6.0	<0.05
		3	7.13	11700	5.0	0.090
		4	7.12	11800	5.0	<0.05
Nov	S-2	1	7.22	8900	6.71	<0.024
		2	7.28	8400	7.13	<0.024
		3	7.30	8500	7.02	<0.024
		4	7.31	8400	7.02	<0.024
Dec	S-2	1	7.25	7400	6.0	<0.010
		2	7.26	6800	6.0	<0.010
		3	7.23	7300	6.0	<0.010
		4	7.23	7300	6.0	<0.010

**Table 2**

**Conversion of Background pH Values to Hydrogen Ion  
Concentrations in Micro Moles Per Liter ( $\mu\text{mol/L}$ )  
Sewage Treatment Lagoons Monitoring Wells  
Holloman Air Force Base, New Mexico,  
1989**

Month	Well	Replicate	pH	Hydrogen ( $\mu\text{mol/L}$ )
Aug	MW-1	1	6.53	0.295
		2	6.66	0.219
		3	6.70	0.200
		4	6.69	0.204
Sep	MW-1	1	6.73	0.186
		2	6.72	0.191
		3	6.71	0.195
		4	6.72	0.191
Nov	MW-1	1	6.76	0.174
		2	6.76	0.174
		3	6.74	0.182
		4	6.76	0.174
Dec	MW-1	1	6.76	0.174
		2	6.73	0.186
		3	6.75	0.178
		4	6.74	0.182
Aug	S-2	1	7.10	0.079
		2	7.11	0.078
		3	7.13	0.074
		4	7.09	0.081
Sep	S-2	1	7.07	0.085
		2	7.11	0.078
		3	7.13	0.074
		4	7.12	0.076
Nov	S-2	1	7.22	0.060
		2	7.28	0.052
		3	7.30	0.050
		4	7.31	0.049
Dec	S-2	1	7.25	0.056
		2	7.26	0.055
		3	7.23	0.059
		4	7.23	0.059

**Table 3**

**Summary Statistics Describing the Replicate Measurements  
of pH ( $\mu\text{mol/L}$  Hydrogen) Taken During the Establishment of  
Background Concentrations  
Sewage Treatment Lagoons Monitoring Wells  
Holloman Air Force Base, New Mexico,  
1989**

Well	Month	N	Proportion <DL	Mean	Variance	Standard Deviation	C.V.
MW-1	Aug	4	0	0.229	1.98E-03	0.044	19.18
	Sep	4	0	0.191	1.28E-05	0.004	2.10
	Nov	4	0	0.176	1.68E-05	0.004	2.27
	Dec	4	0	0.180	2.86E-05	0.005	2.78
S-2	Aug	4	0	0.078	9.30E-06	0.003	3.84
	Sep	4	0	0.078	2.34E-05	0.005	6.40
	Nov	4	0	0.053	2.58E-05	0.005	9.44
	Dec	4	0	0.057	3.88E-06	0.002	3.49

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N = Number of values greater than detection limit.  
DL = Detection Limit.  
C.V. = Coefficient of Variation.

**Table 4**

**Summary Statistics Describing the Replicate Measurements  
of Specific Conductance ( $\mu\text{mhos/cm}$  @ 25°C)  
Taken During the Establishment of Background Concentrations  
Sewage Treatment Lagoons Monitoring Wells  
Holloman Air Force Base, New Mexico,  
1989**

Well	Month	N	Proportion <DL	Mean	Variance	Standard Deviation	C.V.
MW-1	Aug	4	0	48500	82500	300	0.62
	Sep	4	0	62400	649000	800	1.28
	Nov	4	0	59700	229200	500	0.84
	Dec	4	0	59500	110000	300	0.50
S-2	Aug	4	0	9870	156560	400	4.05
	Sep	4	0	11700	16600	100	0.85
	Nov	4	0	8600	56700	200	2.33
	Dec	4	0	7200	73300	300	4.17

---

N = Number of values greater than detection limit.  
DL = Detection Limit.  
C.V. = Coefficient of Variation.

**Table 5**

**Summary Statistics Describing the Replicate Measurements  
of TOC (mg/L) Taken During the Establishment of  
Background Concentrations  
Sewage Treatment Lagoons Monitoring Wells  
Holloman Air Force Base, New Mexico,  
1989**

Well	Month	N	Proportion <DL	Mean	Variance	Standard Deviation	C.V.
MW-1	Aug	2	0.50	9.8	114.1	10.7	109.18
	Sep	1	0.75	0.6	0.1	0.2	33.33
	Nov	0	1.00	<1.0	NA	NA	NA
	Dec	4	0.00	1.0	0	0	0.00
S-2	Aug	4	0	7.3	3.6	1.9	26.03
	Sep	4	0	6.0	0	1.0	16.67
	Nov	4	0	6.97	0.03	0.18	2.58
	Dec	4	0	6.0	0	0	0.00

---

N = Number of values greater than detection limit.  
DL = Detection Limit.  
C.V. = Coefficient of Variation.  
NA = Not Applicable

**Table 6**

**Summary Statistics Describing the Replicate Measurements  
of POX (mg/L as Chloride) Taken During the Establishment of  
Background Concentrations  
Sewage Treatment Lagoons Monitoring Wells  
Holloman Air Force Base, New Mexico,  
1989**

Parameter	Well	Month	N	Proportion <DL	Mean	Variance	Standard Deviation	C.V
POX (mg/L as chloride)	MW-1	Aug	2	0.50	0.049	0.002	0.043	87.76
		Sep	4	0	1.9	2.5	1.6	84.21
		Nov	4	0	0.13	0.00	0.01	7.69
		Dec	0	1.00	<0.010	NA	NA	NA
	S-2	Aug	0	1.00	<0.024	NA	NA	NA
		Sep	2	0.50	0.06	0.00	0.03	50.00
		Nov	0	1.00	<0.024	NA	NA	NA
		Dec	0	1.00	<0.010	NA	NA	NA

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N = Number of values greater than detection limit.  
DL = Detection Limit.  
C.V. = Coefficient of Variation.  
NA = Not Applicable.

**Table 7**

**Summary Statistics Describing the Replicate  
Averages for Upgradient Wells  
Background Concentrations of Contamination Indicator Parameters  
Sewage Treatment Lagoons Monitoring Wells  
Holloman Air Force Base, New Mexico,  
1989**

Well	Parameter	N	Proportion <DL	Mean <sup>(a)</sup>	Variance	Standard <sup>(a)</sup> Deviation	C.V.
MW-1	Hydrogen	4	0	0.194	5.98E-04	0.024	12.37
	Sp. Cond.	4	0	57500	37949200	6200	10.78
	TOC	3	0.25	3	21	5	166.67
	POX	3	0.25	0.5	0.8	0.9	180.00
S-2	Hydrogen	4	0	0.067	1.80E-04	0.013	19.40
	Sp. Cond.	4	0	9300	3659200	1900	20.43
	TOC	4	0	7	0	1	14.29
	POX	1	0.75	0.022	0.001	0.025	113.64
All Upgradient Wells	Hydrogen	8	0	0.130	4.96E-03	0.070	53.85
	Sp. Cond.	8	0	33400	681133100	26100	78.14
	TOC	7	0.13	5	13	4	80.00
	POX	4	0.50	0.3	0.4	0.7	233.33

N = Number of values greater than detection limit.

DL = Detection Limit.

C.V. = Coefficient of Variation.

Sp. Cond. = Specific Conductance.

NA = Not Applicable.

<sup>(a)</sup>Units are: hydrogen (pH), µmol/L; Sp. Cond., µmhos/cm @ 25° C; TOC, mg/L; and POX, mg/L as chloride.

**Table 8**

**Groundwater Contamination Indicator Parameters Third Semiannual  
Sampling Episode Sewage Treatment Lagoons Monitoring Wells  
Holloman Air Force Base, New Mexico,  
January 1991**

Well	Gradient Location	Replicate	pH	Hydrogen (µmol/L)	Specific Conductance (µmhos/cm @25°C)	TOC (mg/L)	POX (mg/L as chloride)
MW-1	UP	1	6.76	0.173	35200	<1	<0.010
		2	6.79	0.162	35200	<1	<0.010
		3	6.78	0.165	33500	<1	<0.010
		4	6.79	0.162	33100	<1	<0.010
S-2	UP	1	7.25	0.056	4500	6	<0.010
		2	7.22	0.060	5300	7	0.016
		3	7.22	0.060	5100	7	<0.010
		4	7.21	0.061	5100	6	<0.010
MW-2	DOWN	1	7.25	0.056	4200	4	<0.010
		2	7.22	0.060	4200	4	<0.010
		3	7.23	0.058	4200	4	<0.010
		4	7.22	0.060	4200	4	<0.010
MW-3	DOWN	1	7.07	0.085	9200	7	<0.010
		2	7.04	0.091	9200	7	0.018
		3	7.03	0.093	9100	7	<0.010
		4	7.03	0.093	8900	7	0.018
MW-4	DOWN	1	7.03	0.093	9200	5	<0.010
		2	7.02	0.095	11500	5	<0.010
		3	7.04	0.091	11600	6	<0.010
		4	7.13	0.074	12500	6	<0.010
MW-5	DOWN	1	6.78	0.165	9800	5	<0.010
		2	6.73	0.186	10000	5	<0.010
		3	6.73	0.186	10000	5	<0.010
		4	6.73	0.186	10000	5	<0.010
MW-6	DOWN	1	6.83	0.147	40300	3	<0.010
		2	6.86	0.138	40400	4	<0.010
		3	6.89	0.128	40500	3	<0.010
		4	6.88	0.131	40400	3	<0.010
MW-7	DOWN	1	6.90	0.125	6200	3	0.028
		2	6.90	0.125	6500	3	<0.010
		3	6.87	0.135	6500	3	<0.010
		4	6.89	0.128	6500	3	0.098
MW-8	DOWN	1	6.81	0.154	10000	4	0.095
		2	6.83	0.147	10000	4	0.074
		3	6.83	0.147	10000	4	0.081
		4	6.83	0.147	10000	4	<0.010
S-4	DOWN	1	7.24	0.057	30000	1	<0.010
		2	7.20	0.063	30200	1	<0.010
		3	7.25	0.056	30100	1	<0.010
		4	7.25	0.056	30100	1	<0.010

**Table 9**

**Summary Statistics Describing the Replicate Measurements  
Taken During the Third Semiannual Sampling Episode  
Sewage Treatment Lagoons Monitoring Wells  
Holloman Air Force Base, New Mexico,  
January 1991**

Well Location	Parameter	N	Proportion <DL	Mean <sup>(a)</sup>	Variance	Standard <sup>(a)</sup> Deviation	C.V.
MW-1/UP	Hydrogen	4	0	0.166	2.7E-05	0.005	3.01
	Sp. Cond.	4	0	34250	1230000	1109	3.24
	TOC	0	1.00	<1	NA	NA	NA
	POX	0	1.00	<0.010	NA	NA	NA
S-2/UP	Hydrogen	4	0	0.059	5.0E-06	0.002	3.39
	Sp. Cond.	4	0	5000	120000	346	6.93
	TOC	4	0	7	1	1	0.00
	POX	1	.750	0.008	3.0E-05	0.006	75.0
MW-2/DOWN	Hydrogen	4	0	0.059	4.0E-06	0.002	3.39
	Sp. Cond.	4	0	4200	0	0	0
	TOC	4	0	4	0	0	0
	POX	0	1.00	<0.010	NA	NA	NA
MW-3/DOWN	Hydrogen	4	0	0.091	1.46E-05	0.004	4.20
	Sp. Cond.	4	0	9100	20000	141	1.55
	TOC	4	0	7	0	0	0
	POX	2	.50	0.012	6.0E-5	0.008	66.7
MW-4/DOWN	Hydrogen	4	0	0.088	9.30E-05	0.010	10.95
	Sp. Cond.	4	0	11200	1980000	1407	12.56
	TOC	4	0	6	1	1	16.67
	POX	0	1.00	<0.010	NA	NA	NA
MW-5/DOWN	Hydrogen	4	0	0.181	1.10E-04	0.010	5.80
	Sp. Cond.	4	0	9950	10000	100	1.00
	TOC	4	0	5	0	0	0
	POX	0	1.00	<0.010	NA	NA	NA
MW-6/DOWN	Hydrogen	4	0	0.136	7.13E-05	0.008	6.21
	Sp. Cond.	4	0	40400	6667	82	0.20
	TOC	4	0	3	0	0	0
	POX	0	1.00	<0.010	NA	NA	NA
MW-7/DOWN	Hydrogen	4	0	0.128	2.23E-05	0.005	3.69
	Sp. Cond.	4	0	6425	22500	150	2.33
	TOC	4	0	3	0	0	0
	POX	2	.50	0.034	0.002	0.044	129
MW-8/DOWN	Hydrogen	4	0	0.149	1.23E-05	0.003	2.35
	Sp. Cond.	4	0	10000	0	0	0
	TOC	4	0	4	0	0	0
	POX	3	.25	0.064	0.002	0.040	62.5
S-4/DOWN	Hydrogen	4	0	0.058	1.13E-05	0.003	5.80
	Sp. Cond.	4	0	30100	6667	82	0.27
	TOC	4	0	1	0	0	0
	POX	0	1.00	<0.010	NA	NA	NA

N = Number of values greater than detection limit.

DL = Detection Limit.

C.V. = Coefficient of variation.

Sp. Cond. = Specific conductance.

<sup>(a)</sup>Units are: hydrogen (pH), µmol/L; Sp Cond., µmhos/cm @ 25°C; TOC, mg/L; and POX, mg/L as chloride.

**Table 10**

**Results of the Averaged Replicate t-Test Comparing Background Hydrogen (pH) and Specific Conductance Data from the Upgradient Well MW-1 with Data Collected During the Third Semiannual Sampling Sewage Treatment Lagoons Monitoring Wells, Holloman Air Force Base, New Mexico, January 1991**

WELL	Hydrogen ( $\mu\text{mol/L}$ )			Specific Conductance ( $\mu\text{mhos/cm @ } 25^\circ\text{C}$ )		
	$\bar{y}_m$	$\bar{y}_m - \bar{y}_b$	t	$\bar{y}_m$	$\bar{y}_m - \bar{y}_b$	t
MW-1	0.166	-0.028	-1.04	34,250	-23,250	-3.35
S-2	0.059	-0.135	-5.00	5,000	-52,500	-7.58
MW-2	0.059	-0.135	-5.00	4,200	-53,300	-7.70
MW-3	0.091	-0.103	-3.81	9,100	-48,400	-6.98
MW-4	0.088	-0.106	-3.92	11,200	-46,300	-6.68
MW-5	0.181	-0.013	-0.48	9,950	-47,550	-6.86
MW-6	0.136	-0.058	-2.15	40,400	-17,100	-2.47
MW-7	0.128	-0.066	-2.44	6,425	-51,075	-7.37
MW-8	0.149	-0.045	-1.67	10,000	-47,500	-6.85
S-4	0.058	-0.136	-5.04	30,100	-27,400	-3.95

$\bar{y}_m$  = Monitor well replicate average for January 1991 sampling results.

$\bar{y}_b$  = Well MW-1 background average,  $S_b$  = well MW-1 background standard deviation

$\bar{y}_b$  Hydrogen = 0.194,  $S_b \sqrt{1 + 1/4} = 0.027$

$\bar{y}_b$  Specific conductance = 57,500  $S_b \sqrt{1 + 1/4} = 6,930$

t = Calculated average replicate t statistic for the monitor well compared to upgradient well MW-1.

$t_c$  = Critical value of t, from Tables 16 and 17 (overall alpha = 0.01, degrees of freedom (df) = 3).

$t_c$  Hydrogen = 8.061

$t_c$  Specific conductance = 7.285

Values for t (absolute value in the case of hydrogen) exceeding  $t_c$  indicate concentrations in the well samples are statistically greater (or lesser in the case of hydrogen) than well MW-1 background.

**Table 11**

**Results of the Averaged Replicate t-Test Comparing  
Background TOC and POX  
Data from the Upgradient Well MW-1 with Data Collected  
During the Third Semiannual Sampling Sewage Treatment Lagoons  
Monitoring Wells, Holloman Air Force Base, New Mexico,  
January 1991**

WELL	TOC (mg/L)			POX (mg/L as chloride)		
	$\bar{y}_m$	$\bar{y}_m - \bar{y}_b$	t	$\bar{y}_m$	$\bar{y}_m - \bar{y}_b$	t
MW-1	0.5 <sup>(a)</sup>	-2.5	-0.417	0.005 <sup>(b)</sup>	-0.495	-0.495
S-2	7	4	0.667	0.008	-0.492	-0.492
MW-2	4	1	0.167	0.005 <sup>(b)</sup>	-0.495	-0.495
MW-3	7	4	0.667	0.012	-0.488	-0.488
MW-4	6	3	0.500	0.005 <sup>(b)</sup>	-0.495	-0.495
MW-5	5	2	0.333	0.005 <sup>(b)</sup>	-0.495	-0.495
MW-6	3	0	0.000	0.005 <sup>(b)</sup>	-0.495	-0.495
MW-7	3	0	0.000	0.034	-0.466	-0.466
MW-8	4	1	0.167	0.064	-0.436	-0.436
S-4	1	-2	-0.333	0.005 <sup>(b)</sup>	-0.495	-0.495

<sup>(a)</sup>Assumed value, one-half detection limit of 1 mg/L.

<sup>(b)</sup>Assumed value, one-half detection limit of 0.010 mg/L as chloride.

$\bar{y}_m$  = Monitor well replicate average for January 1991 sampling results.

$\bar{y}_b$  = Well MW-1 background average,  $S_b$  = well MW-1 background standard deviation

$$\bar{y}_b \text{ TOC} = 3, S_b \sqrt{1 + 1/4} = 6$$

$$\bar{y}_b \text{ POX} = 0.5, S_b \sqrt{1 + 1/4} = 1.0$$

t = Calculated average replicate t statistic for the monitor well compared to upgradient well MW-1.

$t_c$  = Critical value of t, from Table 17 (overall alpha = 0.01, degrees of freedom (df) = 3) = 7.285.

Values for t exceeding  $t_c$  indicate concentrations in the well samples are statistically greater than Well MW-1 background.

**Table 12**

**Results of the Averaged Replicate t-Test Comparing Background Hydrogen (pH) and Specific Conductance Data from the Upgradient Well S-2 with Data Collected During the Third Semiannual Sampling Sewage Treatment Lagoons Monitoring Wells, Holloman Air Force Base, New Mexico, January 1991**

WELL	HYDROGEN ( $\mu\text{mol/L}$ )			SPECIFIC CONDUCTANCE ( $\mu\text{mhos/cm @ } 25^\circ\text{C}$ )		
	$\bar{y}_m$	$\bar{y}_m - \bar{y}_b$	t	$\bar{y}_m$	$\bar{y}_m - \bar{y}_b$	t
MW-1	0.166	0.099	6.600	34,250	24,950	11.769
S-2	0.059	-0.008	-0.533	5,000	-4,300	-2.028
MW-2	0.059	-0.008	-0.533	4,200	-5,100	-2.406
MW-3	0.091	0.024	1.600	9,100	-200	-0.094
MW-4	0.088	0.021	1.4	11,200	1,900	0.896
MW-5	0.181	0.114	7.600	9,950	650	0.307
MW-6	0.136	0.069	4.600	40,400	31,100	14.670
MW-7	0.128	0.061	4.067	6,425	-2,875	-1.356
MW-8	0.149	0.082	5.467	10,000	700	0.330
S-4	0.058	-0.009	-0.600	30,100	20,800	9.811

$\bar{y}_m$  = Monitor well replicate average for January 1991 sampling results.

$\bar{y}_b$  = Well S-2 background average,  $S_b$  = well S-2 background standard deviation

$\bar{y}_b$  Hydrogen = 0.067,  $S_b \sqrt{1 + 1/4} = 0.015$

$\bar{y}_b$  Specific conductance = 9,300,  $S_b \sqrt{1 + 1/4} = 2120$

t = Calculated average replicate t statistic for the monitor well compared to upgradient well S-2.

$t_c$  = Critical value of t, from Tables 16 and 17 (overall alpha = 0.01, degrees of freedom (df) = 3).

$t_c$  Hydrogen = 8.061

$t_c$  Specific conductance = 7.285

Values for t (absolute value in the case of hydrogen) exceeding  $t_c$  indicate concentrations in the well samples are statistically greater (or lesser in the case of hydrogen) than well S-2 background.

**Table 13**

**Results of the Averaged Replicate t-Test Comparing TOC and POX Data from the Upgradient Well S-2 with Data Collected During the Third Semiannual Sampling Sewage Treatment Lagoons Monitoring Wells, Holloman Air Force Base, New Mexico, January 1991**

WELL	TOC (mg/L)			POX (mg/L as chloride)		
	$\bar{y}_m$	$\bar{y}_m - \bar{y}_b$	t	$\bar{y}_m$	$\bar{y}_m - \bar{y}_b$	t
MW-1	0.5 <sup>(a)</sup>	-6.5	-6.500	0.005 <sup>(b)</sup>	-0.017	-0.607
S-2	7	0	0.000	0.008	-0.014	-0.500
MW-2	4	-3	-3.000	0.005 <sup>(b)</sup>	-0.017	-0.607
MW-3	7	0	0.000	0.012	-0.010	-0.357
MW-4	6	-1	-1.000	0.005 <sup>(b)</sup>	-0.017	-0.607
MW-5	5	-2	-2.000	0.005 <sup>(b)</sup>	-0.017	-0.607
MW-6	3	-4	-4.000	0.005 <sup>(b)</sup>	-0.017	-0.607
MW-7	3	-4	-4.000	0.034	0.012	0.428
MW-8	4	-3	-3.000	0.064	0.042	1.500
S-4	1	-6	-6.000	0.005 <sup>(b)</sup>	-0.017	-0.607

<sup>(a)</sup>Assumed value, one-half detection limit of 1 mg/L.

<sup>(b)</sup>Assumed value, one-half detection limit of 0.010 mg/L as chloride.

$\bar{y}_m$  = Monitor well replicate average for January 1991 sampling episode.

$\bar{y}_b$  = Well S-2 background average,  $S_b$  = well S-2 background standard deviation

$$\bar{y}_b \text{ TOC} = 7, S_b \sqrt{1 + 1/4} = 1$$

$$\bar{y}_b \text{ POX} = 0.022, S_b \sqrt{1 + 1/4} = 0.028$$

t = Calculated average replicate t statistic for the monitor well compared to upgradient well S-2.

$t_c$  = Critical value of t, from Table 17 (overall alpha = 0.01, degrees of freedom (df) = 3) = 7.285.

Values for t exceeding  $t_c$  indicate concentrations in the well samples are statistically greater than Well S-2 background.

**Table 14**

**Results of the Averaged Replicate t-Test Comparing Background Hydrogen (pH) and Specific Conductance Data from the Upgradient Wells with Data Collected During the Third Semiannual Sampling Sewage Treatment Lagoons Monitoring Wells, Holloman Air Force Base, New Mexico, January 1991**

WELL	HYDROGEN ( $\mu\text{mol/L}$ )			SPECIFIC CONDUCTANCE ( $\mu\text{mhos/cm @ } 25^\circ\text{C}$ )		
	$\bar{y}_m$	$\bar{y}_m - \bar{y}_b$	t	$\bar{y}_m$	$\bar{y}_m - \bar{y}_b$	t
MW-1	0.166	0.036	0.486	34,250	850	0.031
S-2	0.059	-0.071	-0.959	5,000	-28,400	-1.025
MW-2	0.059	-0.071	-0.959	4,200	-29,200	-1.054
MW-3	0.091	-0.039	-0.527	9,100	24,300	-0.877
MW-4	0.088	-0.042	-0.568	11,200	-22,200	-0.801
MW-5	0.181	0.051	0.689	9,950	-23,450	-0.847
MW-6	0.136	0.006	0.081	40,400	7,000	0.253
MW-7	0.128	-0.002	-0.027	6,425	-26,975	-0.974
MW-8	0.149	0.019	0.257	10,000	-23,400	-0.845
S-4	0.058	-0.072	-0.973	30,100	-3,300	-0.119

$\bar{y}_m$  = Monitor well replicate average for January 1991 sampling results.

$\bar{y}_b$  = All upgradient wells background average,  $S_b$  = All upgradient background standard deviation

$\bar{y}_b$  Hydrogen = 0.130,  $S_b \sqrt{1 + 1/8} = 0.074$

$\bar{y}_b$  Specific conductance = 33,400,  $S_b \sqrt{1 + 1/8} = 27,700$

t = Calculated average replicate t statistic for the monitor well compared to all upgradient wells.

$t_c$  = Critical value of t, from Tables 16 and 17 (overall alpha = 0.01, degrees of freedom (df) = 7).

$t_c$  Hydrogen = 5.547

$t_c$  Specific conductance = 5.111

Values for t (absolute value in the case of hydrogen) exceeding  $t_c$  indicate concentrations in the well samples are statistically greater (or lesser in the case of hydrogen) than upgradient background.

**Table 15**

**Results of the Averaged Replicate t-Test Comparing TOC and POX Data from All Upgradient Wells with Data Collected During the Third Semiannual Sampling Sewage Treatment Lagoons Monitoring Wells, Holloman Air Force Base, New Mexico, January 1991**

WELL	TOC (mg/L)			POX (mg/L as chloride)		
	$\bar{y}_m$	$\bar{y}_m - \bar{y}_b$	t	$\bar{y}_m$	$\bar{y}_m - \bar{y}_b$	t
MW-1	0.5 <sup>(a)</sup>	-4.5	-1.125	0.005 <sup>(b)</sup>	-0.295	-0.421
S-2	7	2	0.500	0.008	-0.292	-0.470
MW-2	4	-1	-0.250	0.005 <sup>(b)</sup>	-0.295	-0.421
MW-3	7	2	0.500	0.012	-0.288	-0.411
MW-4	6	1	0.250	0.005 <sup>(b)</sup>	-0.295	-0.421
MW-5	5	0	0.000	0.005 <sup>(b)</sup>	-0.295	-0.421
MW-6	3	-2	-0.500	0.005 <sup>(b)</sup>	-0.295	-0.421
MW-7	3	-2	-0.500	0.034	-0.266	-0.380
MW-8	4	-1	-0.250	0.064	-0.236	-0.337
S-4	1	-4	-1.000	0.005 <sup>(b)</sup>	-0.295	-0.421

<sup>(a)</sup> Assumed value, one-half detection limit of 1 mg/L.

<sup>(b)</sup> Assumed value, one-half detection limit of 0.010 mg/L.

$\bar{y}_m$  = Monitor well replicate average for January 1991 sampling episode.

$\bar{y}_b$  = All upgradient wells background average,  $S_b$  = All upgradient background standard deviation

$$\bar{y}_b \text{ TOC} = 5, S_b \sqrt{1 + 1/8} = 4$$

$$\bar{y}_b \text{ POX} = 0.3, S_b \sqrt{1 + 1/8} = 0.7$$

t = Calculated average replicate t statistic for the monitor well compared to all upgradient well S-2.

$t_c$  = Critical value of t, from Tables 17 (overall alpha = 0.01, degrees of freedom (df) = 7) = 5.111.

Values for t exceeding  $t_c$  indicate concentrations in the well samples are statistically greater than all upgradient wells background.

**Table 16**

**One-Tailed Critical ( $t_c$ ) Values Which Control  
the Overall Significance Level at One Percent**

Total No. of Wells	Degrees of Freedom Associated with the Averaged Replicate Test Statistic								
	3	7	11	15	19	23	27	31	35
4	6.297	4.543	4.065	3.841	3.712	3.628	3.568	3.524	3.490
5	6.534	4.609	4.175	3.939	3.803	3.714	3.651	3.604	3.569
6	6.729	4.793	4.265	4.019	3.876	3.783	3.718	3.669	3.569
7	6.896	4.889	4.342	4.086	3.939	3.842	3.774	3.724	3.388
8	7.041	4.972	4.408	4.145	3.992	3.893	3.823	4.771	3.490
9	7.169	5.045	4.466	4.196	3.039	3.937	3.865	3.812	3.569
10	7.285	5.111	4.518	4.242	4.082	3.977	3.904	3.849	3.632
11	7.390	5.171	4.566	4.283	4.120	4.013	3.938	3.882	3.685
12	7.487	5.225	4.609	4.321	4.154	4.046	3.969	3.912	3.731
13	7.576	5.276	4.648	4.356	4.186	4.076	3.998	3.940	3.771
14	7.657	5.322	4.685	4.388	4.216	4.103	4.024	3.966	3.807
15	7.736	5.366	4.719	4.418	4.243	4.129	4.049	3.989	3.839

**Source:** RCRA Ground Water Monitoring Technical Enforcement Guidance Document (TEGD),  
September 1986, National Water Well Association, Dublin, Ohio.

**Table 17**

**Two-Tailed Critical ( $t_c$ ) Values Which Control  
the Overall Significance Level at One Percent**

Total No. of Wells	Degrees of Freedom Associated with the Averaged Replicate Test Statistic								
	3	7	11	15	19	23	27	31	35
4	7.041	4.972	4.408	4.145	3.992	3.893	3.823	3.771	3.731
5	7.285	5.111	4.518	4.242	4.154	4.046	3.969	3.912	3.869
6	7.487	5.225	4.609	4.321	4.154	4.046	3.969	3.912	3.869
7	7.659	5.322	4.685	4.388	4.216	4.103	4.024	3.966	3.920
8	7.808	5.406	4.751	4.446	4.269	4.153	4.072	4.012	3.965
9	7.941	5.481	4.810	4.496	4.315	4.197	4.114	4.052	4.004
10	8.061	5.547	4.862	4.542	4.357	4.236	4.151	4.088	4.039
11	8.169	5.608	4.909	4.583	4.394	4.271	4.185	4.120	4.071
12	8.269	5.663	4.952	4.621	4.429	4.304	4.215	4.150	4.100
13	8.361	5.714	4.992	4.655	4.460	4.338	4.244	4.177	4.126
14	8.446	5.761	5.029	4.687	4.489	4.360	4.270	4.202	4.150
15	8.525	5.805	5.063	4.717	4.516	4.386	4.294	4.226	4.173

Source: RCRA Ground Water Monitoring Technical Enforcement Guidance Document (TEGD),  
September 1986, National Water Well Association, Dublin, Ohio.

**Table 18**  
**Groundwater Elevations**  
**Sewage Treatment**  
**Lagoons Monitoring Wells,**  
**Holloman Air Force Base, New Mexico,**  
**January 1991**

Monitor Well	Top of <sup>(a)</sup> Casing Elevation (FAMSL)	Depth to <sup>(b)</sup> Groundwater (Feet)	Groundwater Elevation
MW-1	4053.42	10.83	4042.59
S-2	4040.56	8.36	4032.20
MW-2	4039.78	4.77	4035.01
MW-3	4037.38	8.13	4029.25
MW-4	4030.30	5.36	4024.94
MW-5	4039.30	4.87	4034.43
MW-6	4031.21	6.05	4025.16
MW-7	4039.88	5.80	4034.08
MW-8	4040.50	5.35	4035.15
S-4	4034.46	8.67	4025.79

<sup>(a)</sup>Radian, 1989.

<sup>(b)</sup>Reference from top of casing. Measured on January 14, 1991.

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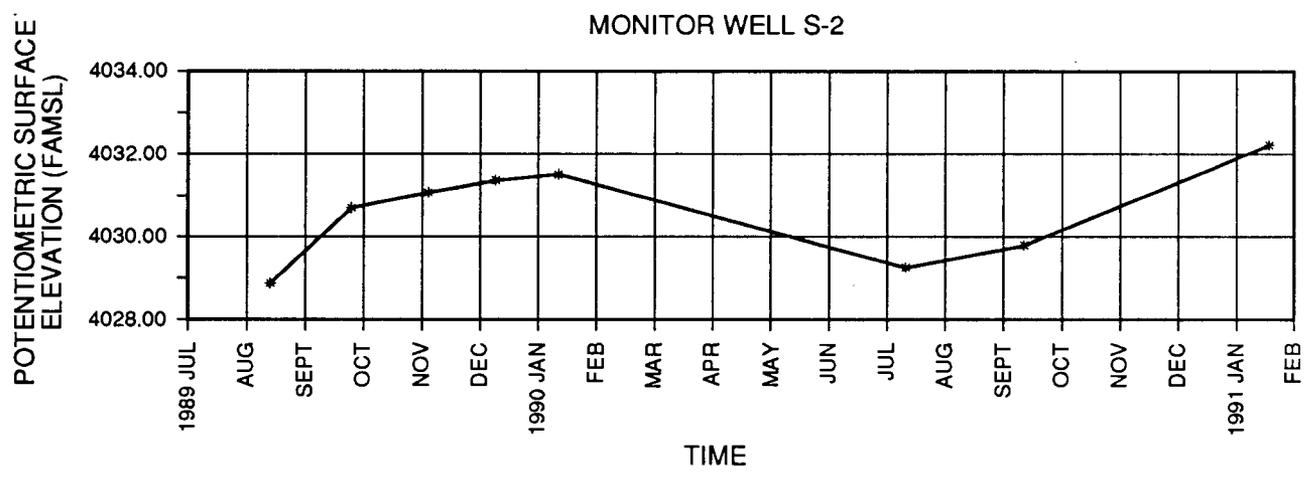
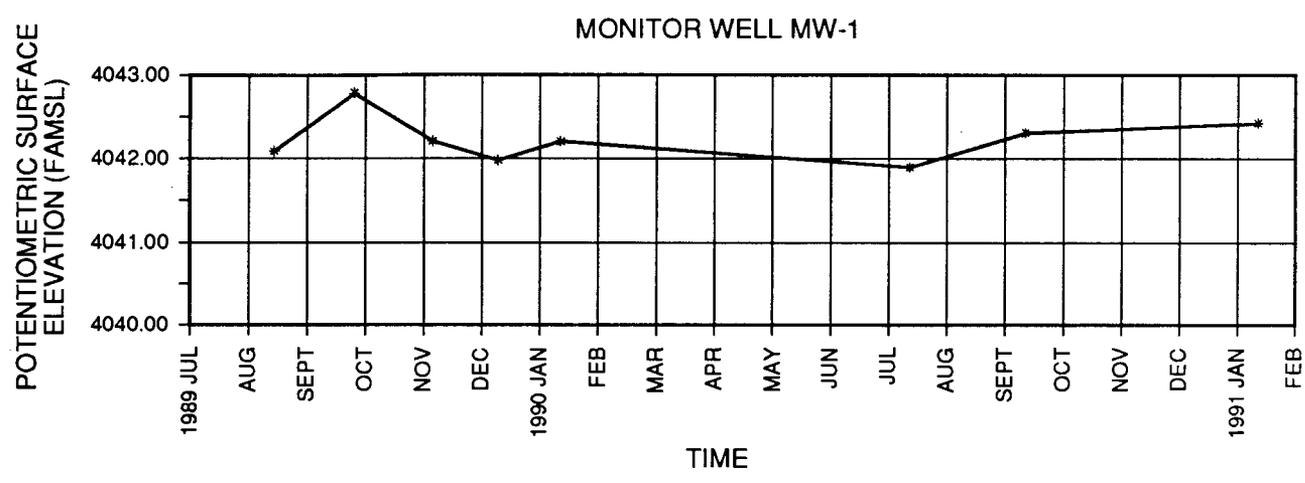


FIGURE 1  
 1 OF 5  
 HYDROGRAPHS OF  
 MONITOR WELLS AT  
 SEWAGE TREATMENT LAGOONS  
 HOLLOMAN AIR FORCE BASE  
 ALAMOGORDO, NEW MEXICO  
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301251.03.07 A2

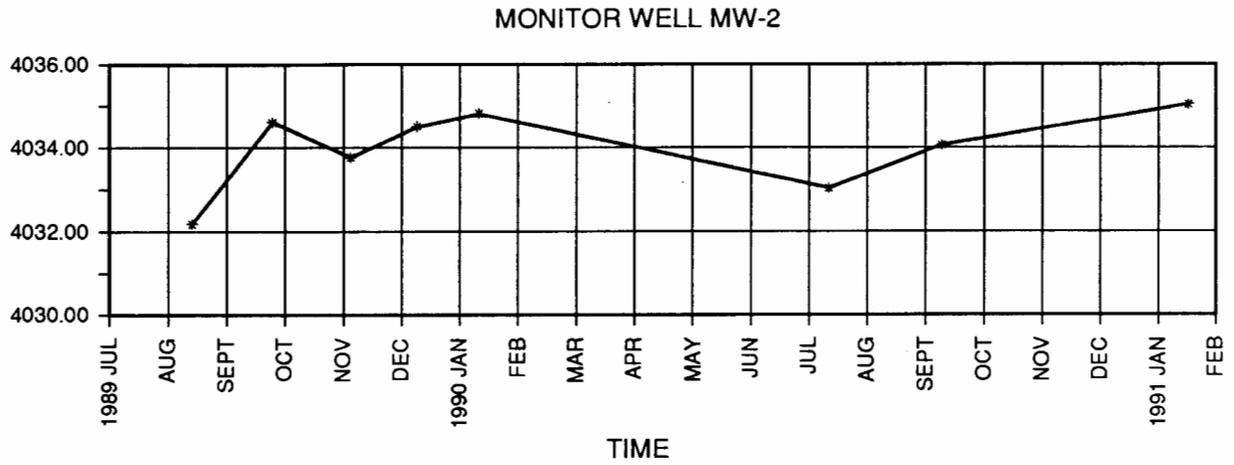
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POTENTIOMETRIC SURFACE  
ELEVATION (FAMSL)



POTENTIOMETRIC SURFACE  
ELEVATION (FAMSL)

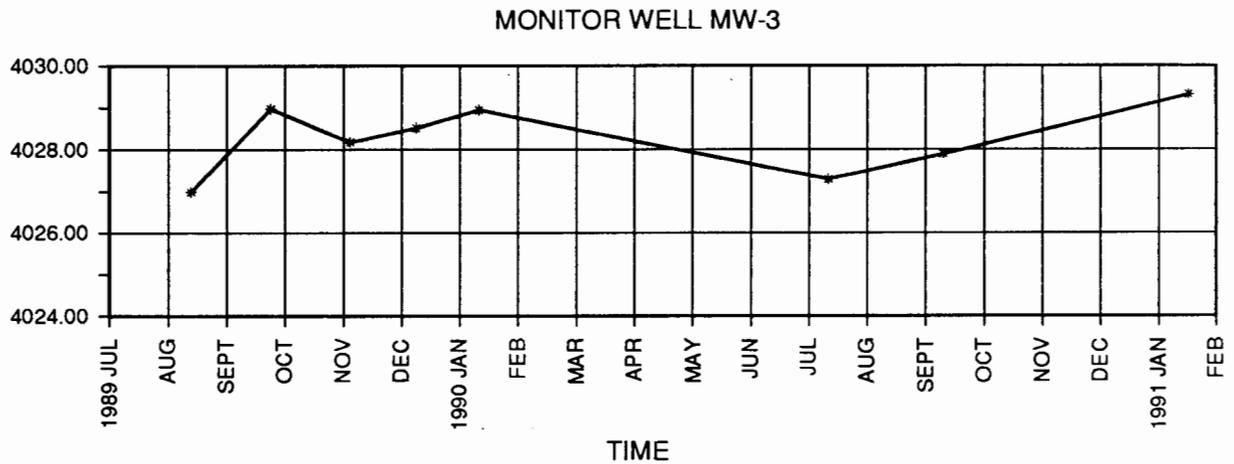


FIGURE 1

2 OF 5  
HYDROGRAPHS OF  
MONITOR WELLS AT  
SEWAGE TREATMENT LAGOONS  
HOLLOMAN AIR FORCE BASE  
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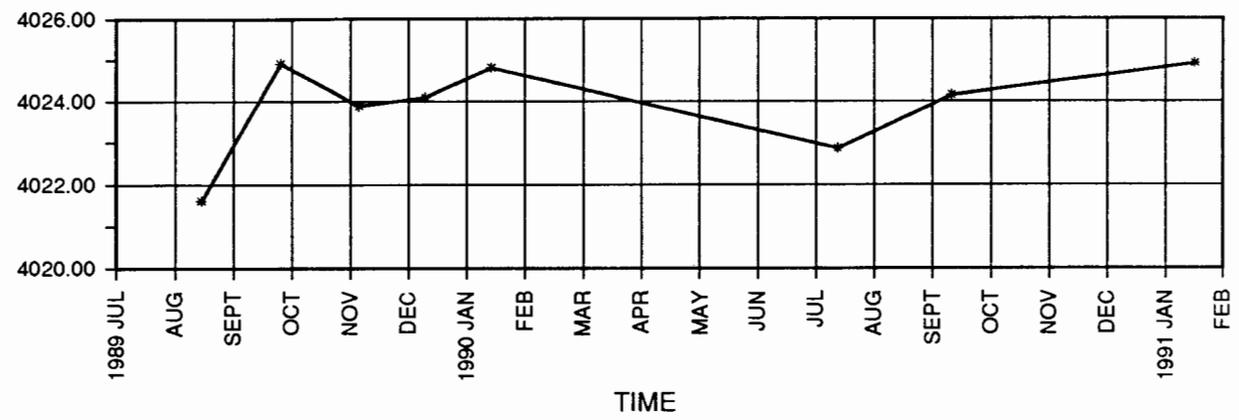
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MAR  
5/16/91

DRAWN BY

POTENTIOMETRIC SURFACE  
ELEVATION (FAMSL)

MONITOR WELL MW-4



POTENTIOMETRIC SURFACE  
ELEVATION (FAMSL)

MONITOR WELL MW-5

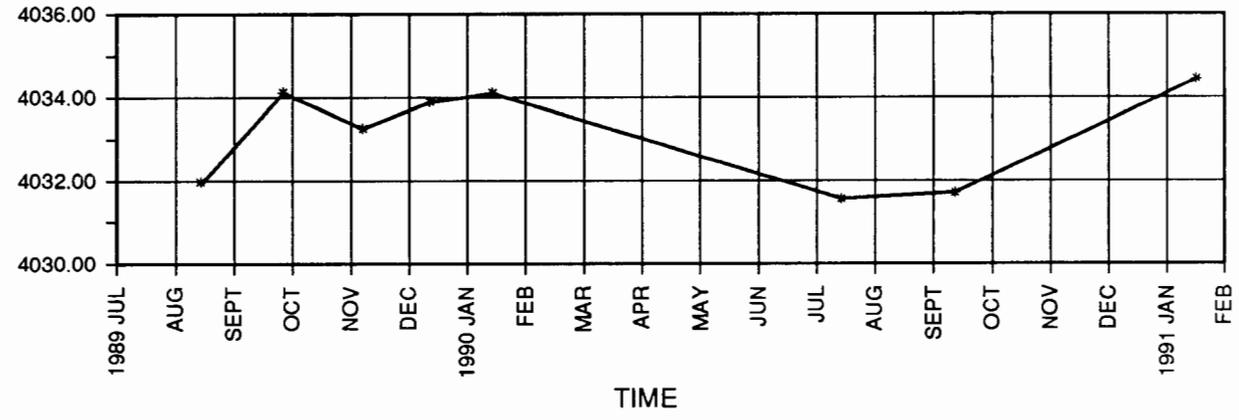


FIGURE 1

3 OF 5  
HYDROGRAPHS OF  
MONITOR WELLS AT  
SEWAGE TREATMENT LAGOONS  
HOLLOMAN AIR FORCE BASE  
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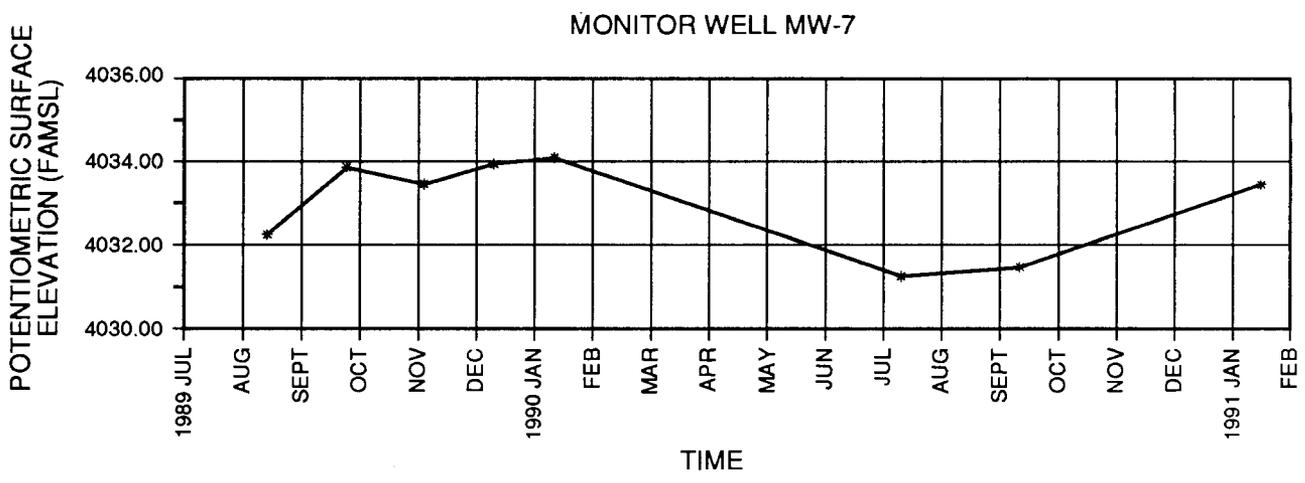
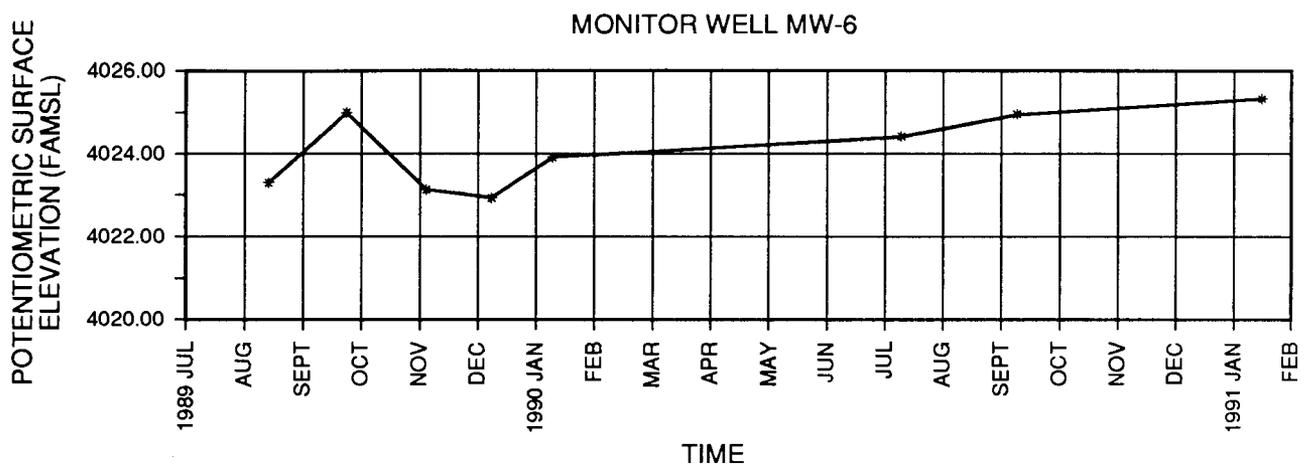


FIGURE 1  
 4 OF 5  
 HYDROGRAPHS OF  
 MONITOR WELLS AT  
 SEWAGE TREATMENT LAGOONS  
 HOLLOMAN AIR FORCE BASE  
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\*Do Not Scale This Drawing\*

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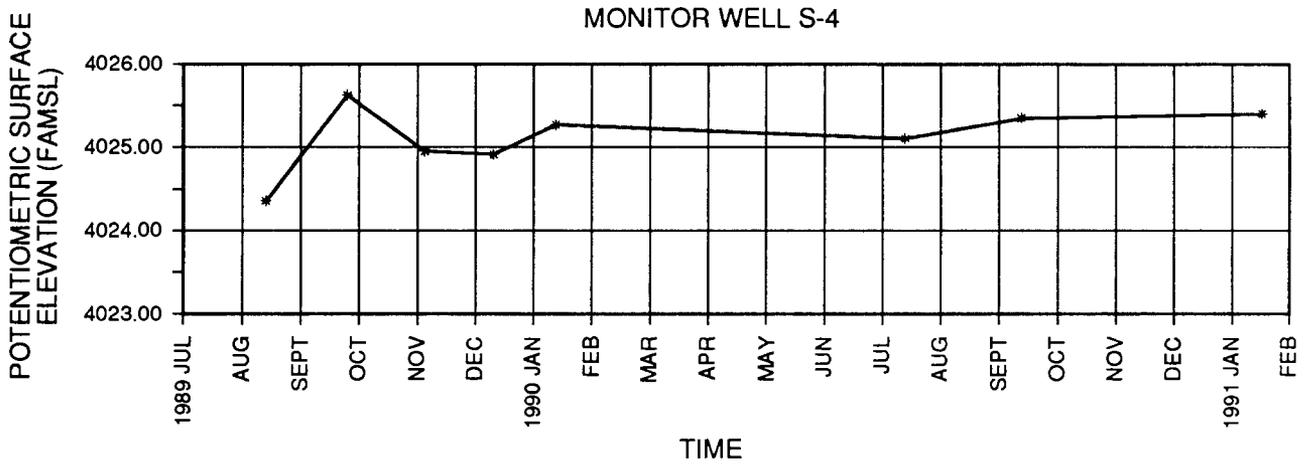
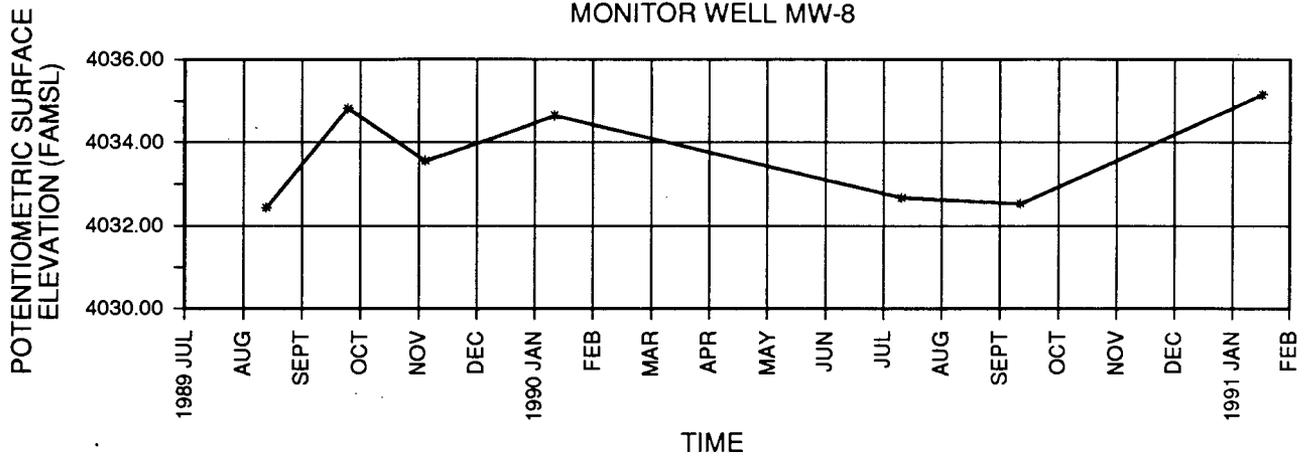
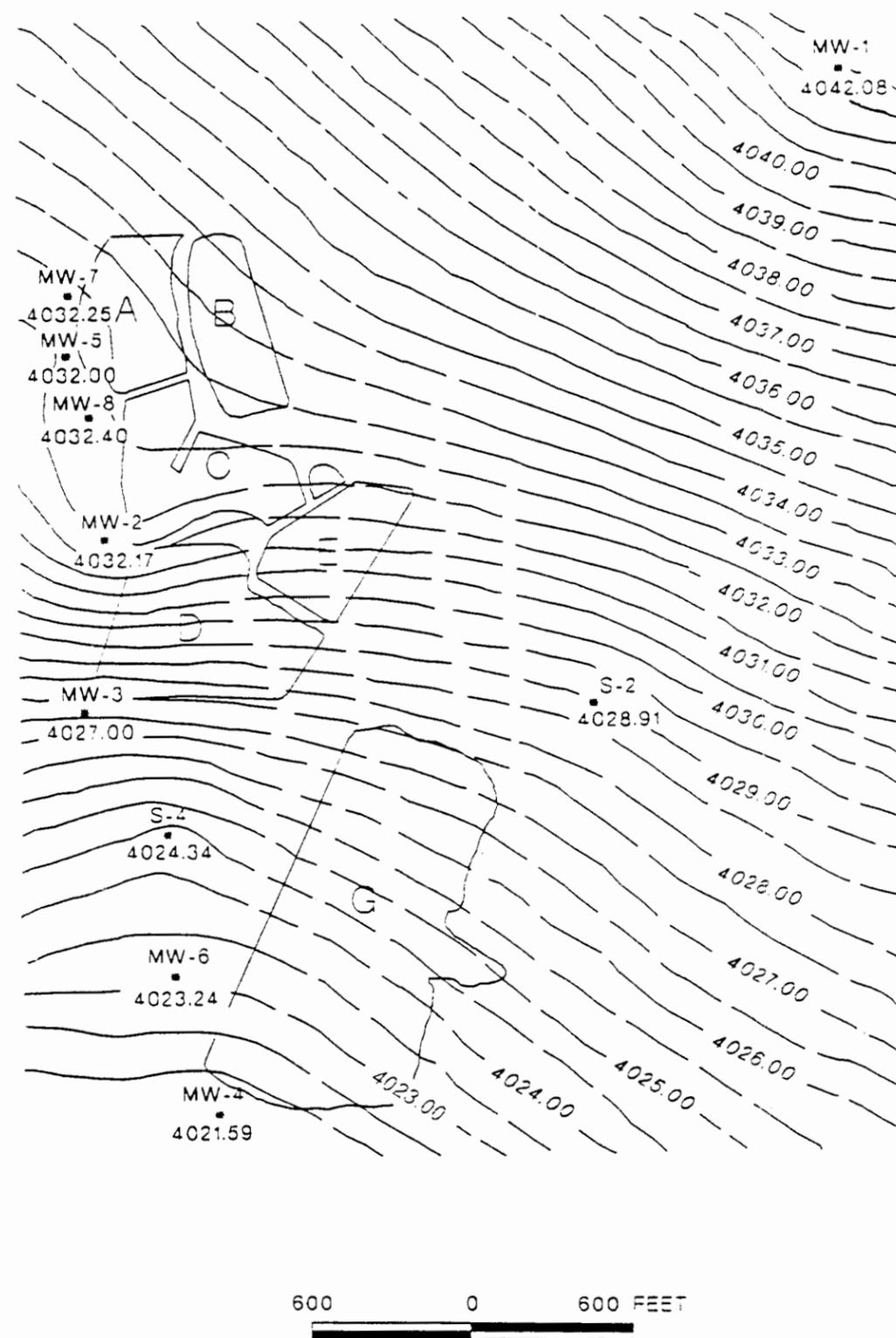


FIGURE 1

5 OF 5  
HYDROGRAPHS OF  
MONITOR WELLS AT  
SEWAGE TREATMENT LAGOONS  
HOLLOMAN AIR FORCE BASE  
ALAMOGORDO, NEW MEXICO

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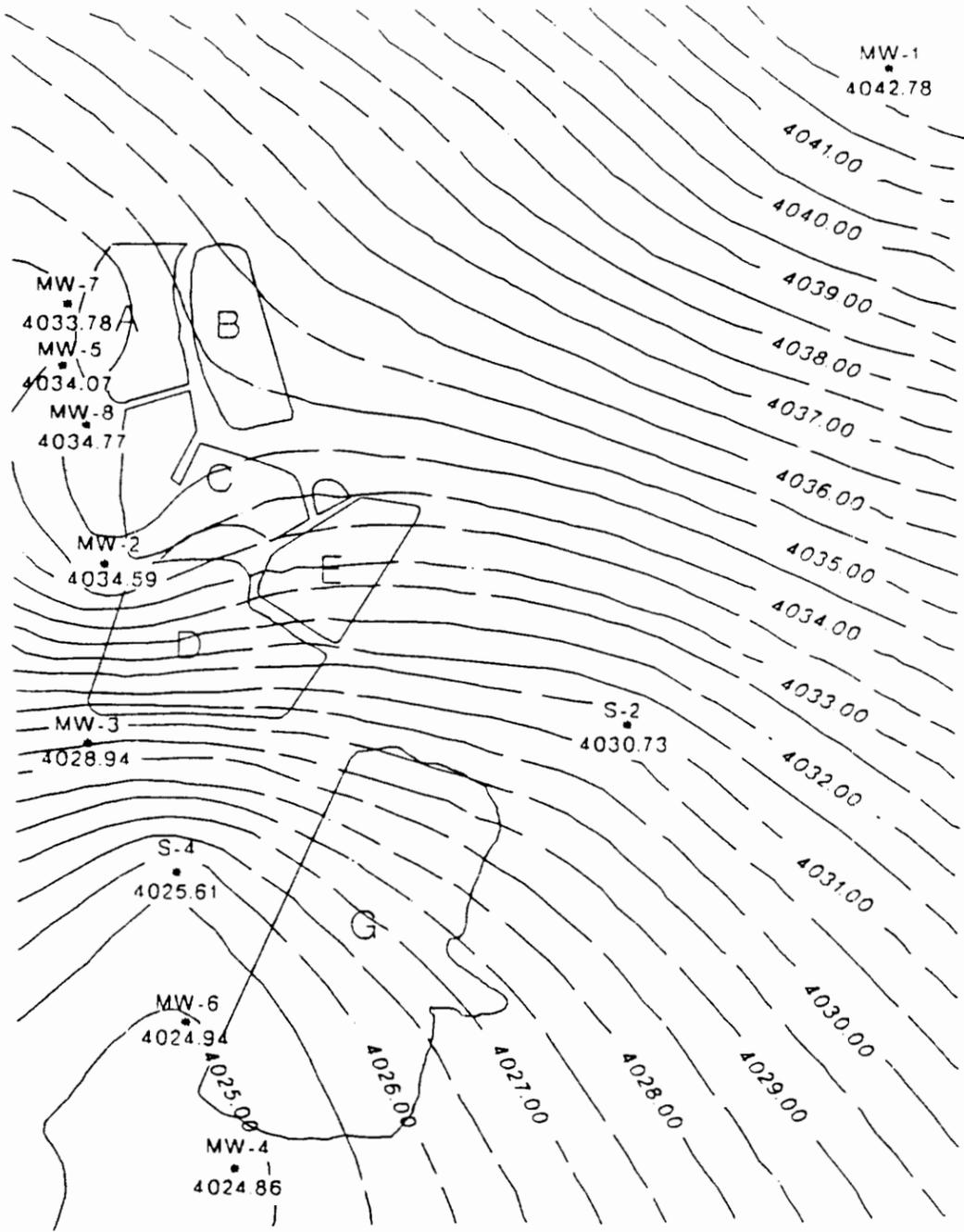


LEGEND

MW-1 WELL NUMBER  
 \* WELL LOCATION  
 4042.08 GROUND WATER POTENTIOMETRIC SURFACE ELEVATION (FAMSL)  
 — 4026.00 — GROUND WATER SURFACE CONTOUR (FAMSL)  
 CONTOUR INTERVAL = 0.5

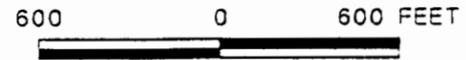
FIGURE 2  
 AUGUST 14 and 15, 1989  
 GROUND WATER POTENTIOMETRIC MAP  
 SEWAGE TREATMENT LAGOONS  
 HOLLOMAN AIR FORCE BASE  
 ALAMOGORDO, NEW MEXICO  
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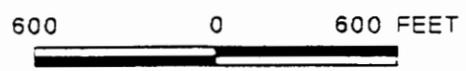
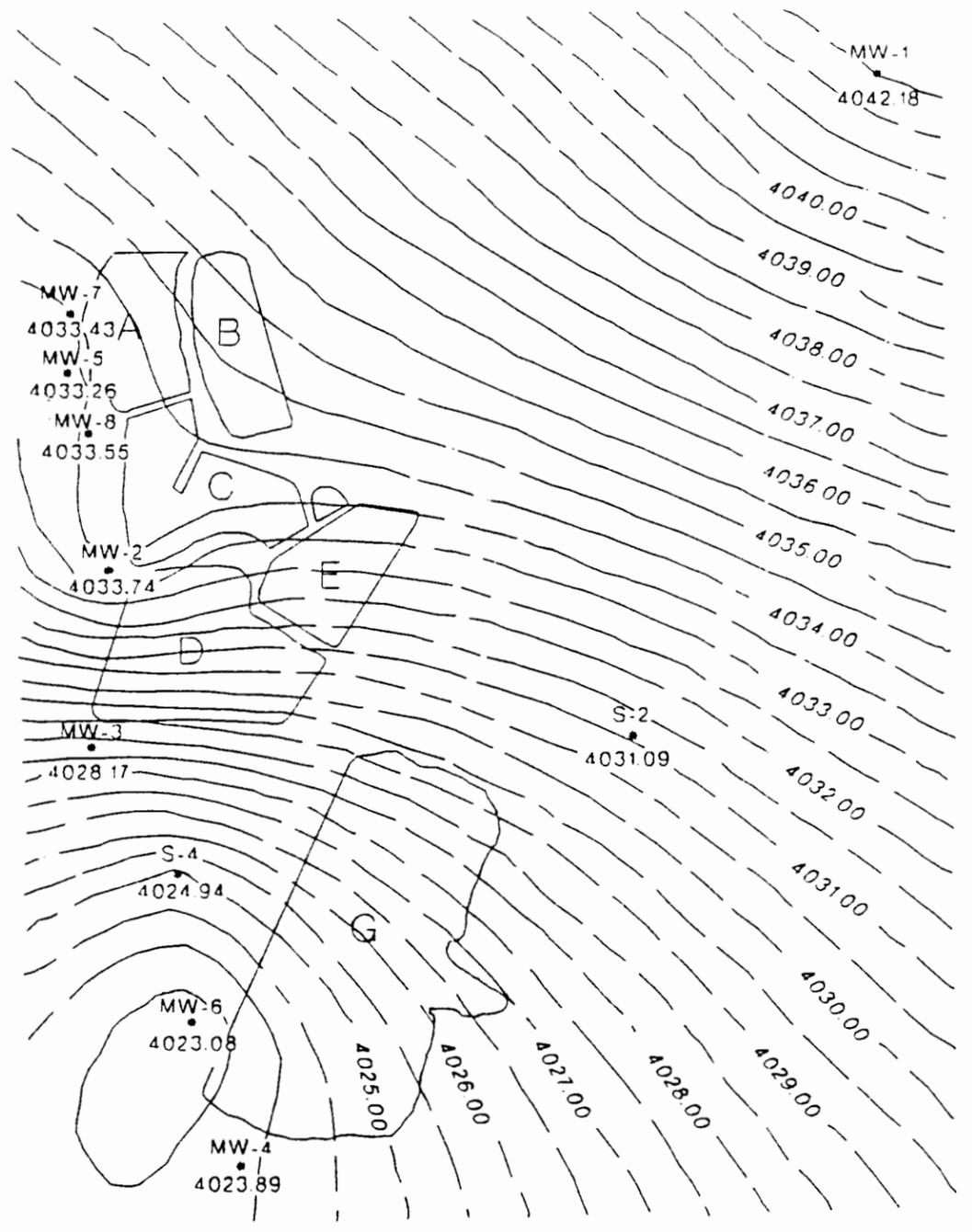
**LEGEND**

MW-1 WELL NUMBER  
 \* WELL LOCATION  
 4042.78 GROUND WATER POTENTIOMETRIC SURFACE ELEVATION (FAMSL)  
 — 4026.00 — GROUND WATER SURFACE CONTOUR (FAMSL)  
 CONTOUR INTERVAL = 0.5



**FIGURE 3**  
 SEPTEMBER 25, 1989  
 GROUND WATER POTENTIOMETRIC MAP  
 SEWAGE TREATMENT LAGOONS  
 HOLLOMAN AIR FORCE BASE  
 ALAMOGORDO, NEW MEXICO  
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 CHECKED BY: [Signature]  
 APPROVED BY: [Signature]  
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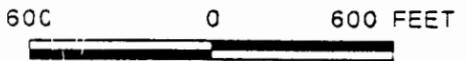
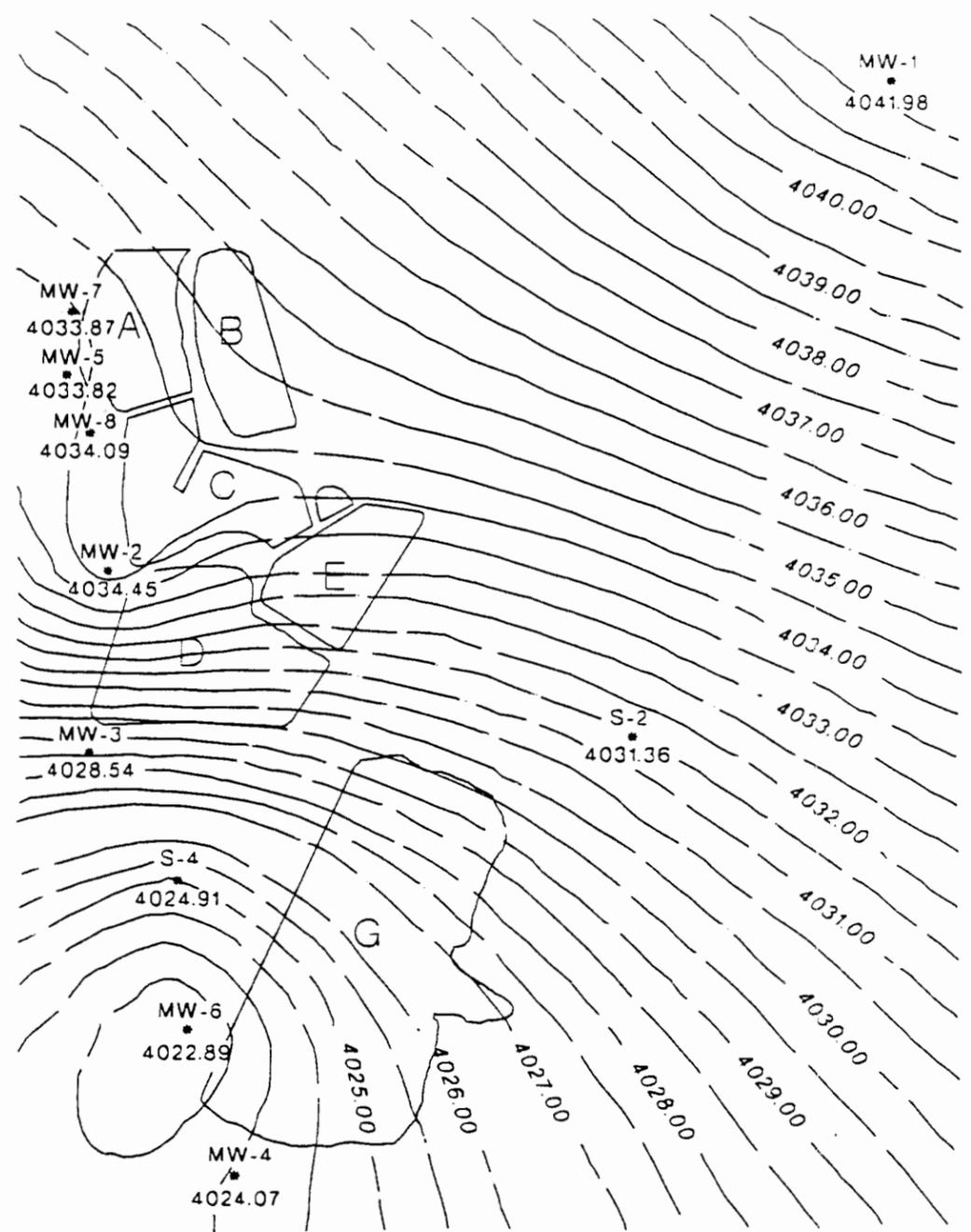


**LEGEND**

MW-1 WELL NUMBER  
 \* WELL LOCATION  
 4042.18 GROUND WATER POTENTIOMETRIC SURFACE ELEVATION (FAMSL)  
 — 4026.00 — GROUND WATER SURFACE CONTOUR (FAMSL)  
 CONTOUR INTERVAL = 0.5

**FIGURE 4**  
 NOVEMBER 5, 1989  
 GROUND WATER POTENTIOMETRIC MAP  
 SEWAGE TREATMENT LAGOONS  
 HOLLOMAN AIR FORCE BASE  
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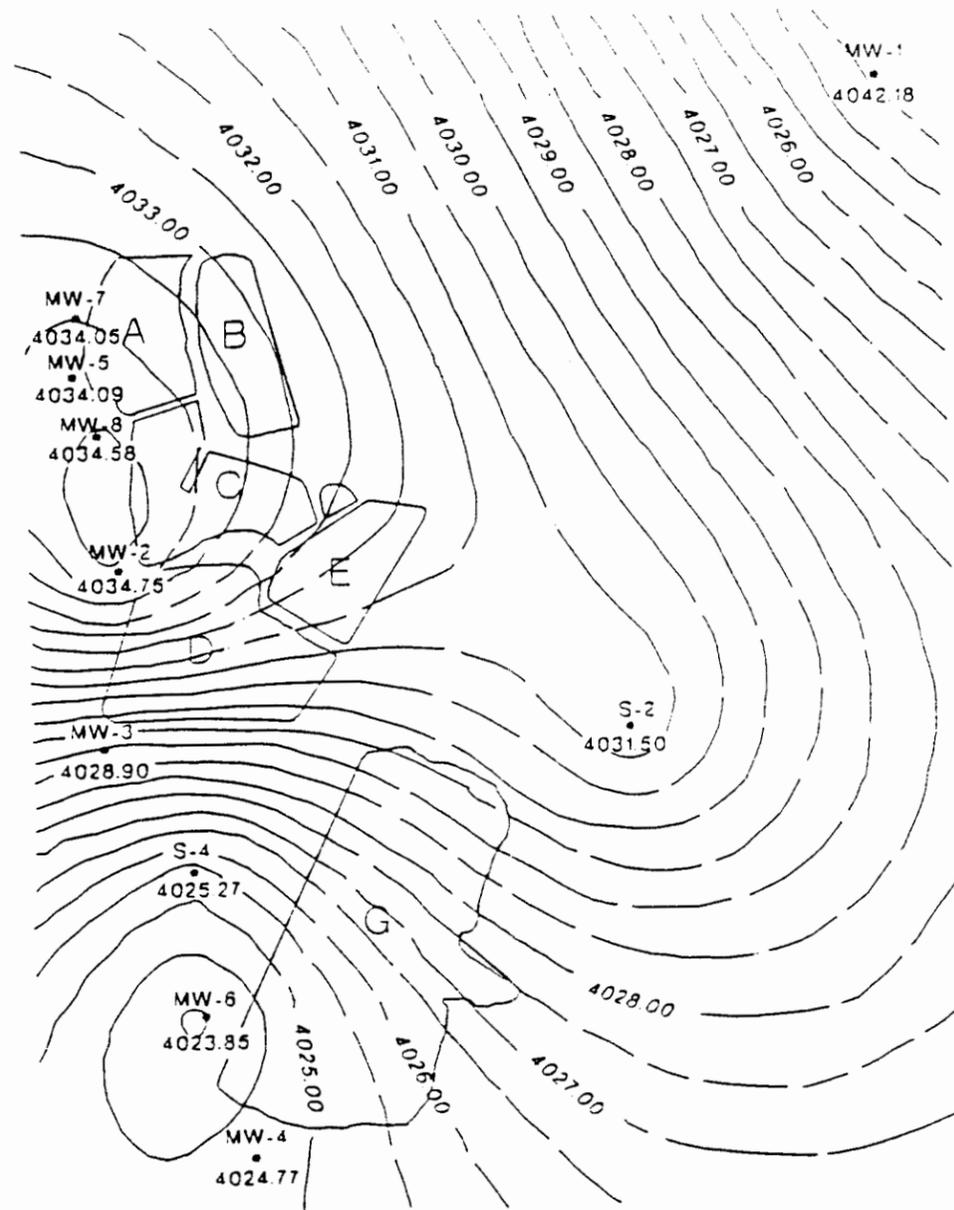


LEGEND

MW-1 WELL NUMBER  
 \* WELL LOCATION  
 4041.98 GROUND WATER POTENTIOMETRIC SURFACE ELEVATION (FAMSL)  
 — 4026.00 — GROUND WATER SURFACE CONTOUR (FAMSL)  
 CONTOUR INTERVAL = 0.5

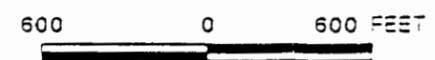
FIGURE 5  
 DECEMBER 10, 1989  
 GROUND WATER POTENTIOMETRIC MAP  
 SEWAGE TREATMENT LAGOONS  
 HOLLOMAN AIR FORCE BASE  
 ALAMOGORDO, NEW MEXICO  
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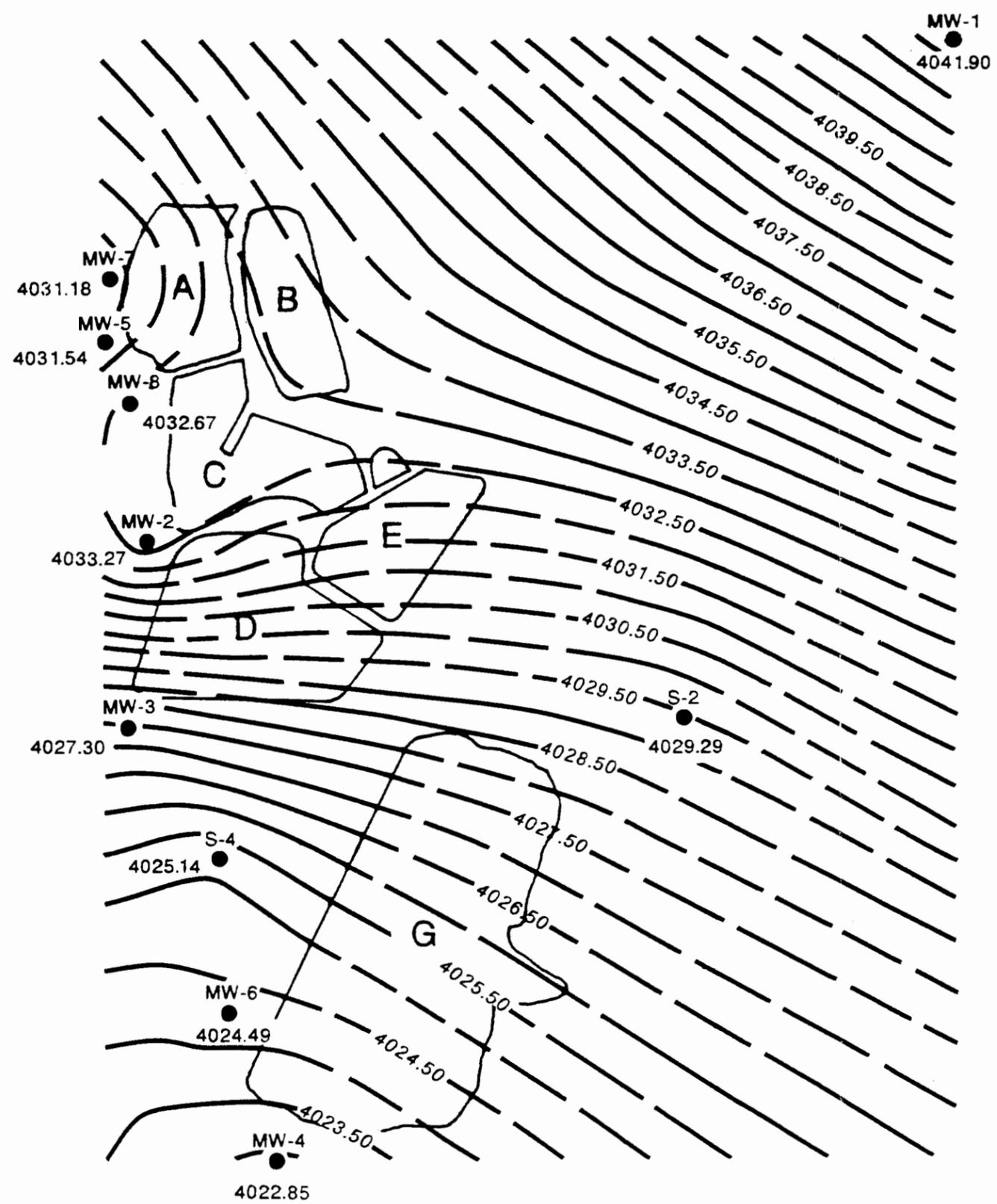
**LEGEND**

MW-1 WELL NUMBER  
 \* WELL LOCATION  
 4042.18 GROUND WATER POTENTIOMETRIC SURFACE ELEVATION (FAMSL)  
 — 4026.00 — GROUND WATER SURFACE CONTOUR (FAMSL)  
 CONTOUR INTERVAL = 0.5



**FIGURE 6**  
 JANUARY 15, 1990  
 GROUND WATER POTENTIOMETRIC MAP  
 SEWAGE TREATMENT LAGOONS  
 HOLLOMAN AIR FORCE BASE  
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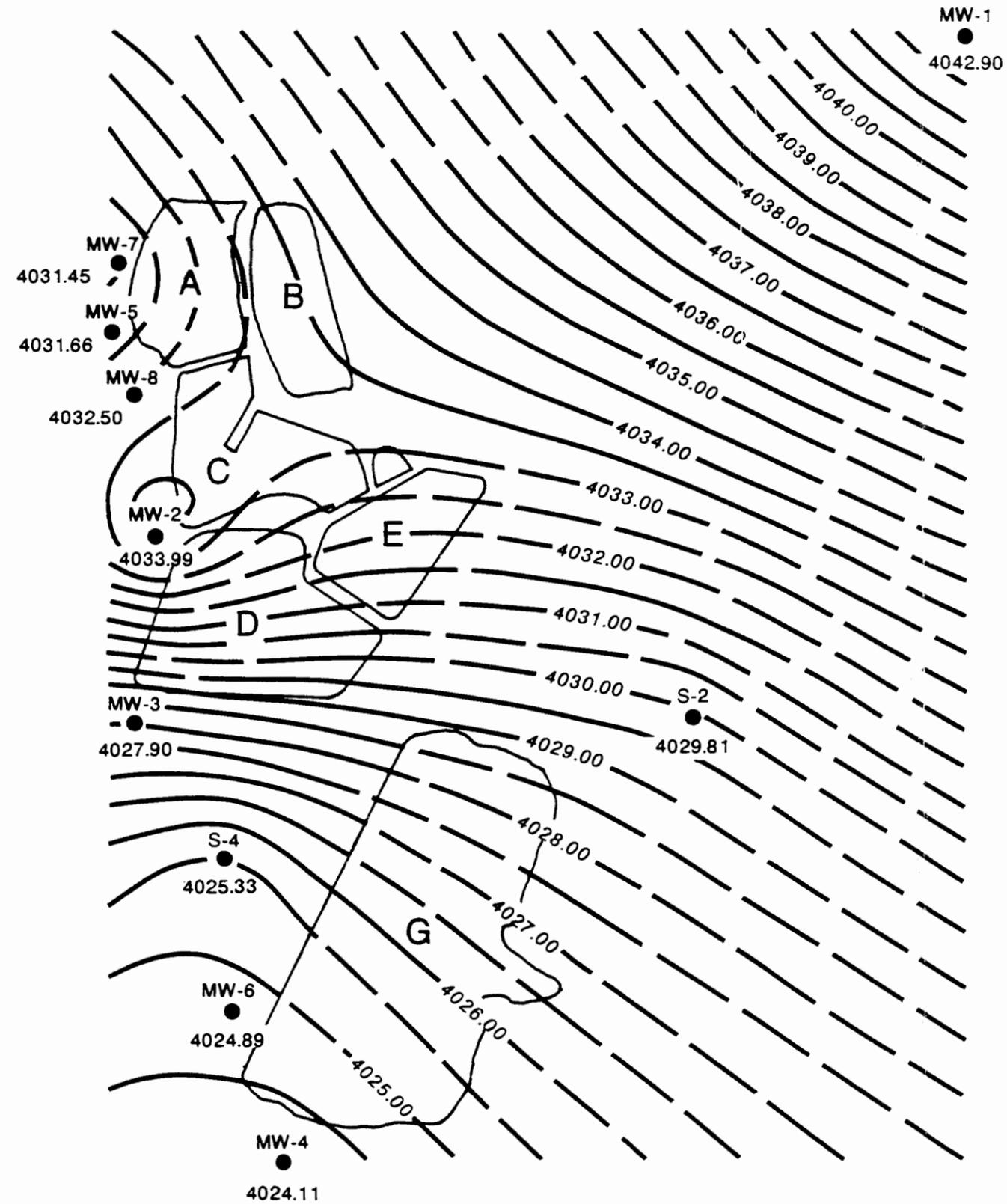
LEGEND

MW-1	WELL NUMBER
●	WELL LOCATION
4041.90	GROUND WATER POTENTIOMETRIC SURFACE ELEVATION (FAMSL)
- 4039.50 -	GROUND WATER SURFACE CONTOUR (FAMSL) CONTOUR INTERVAL = 0.5

FIGURE 7  
 JULY 17, 1990  
 GROUND WATER POTENTIOMETRIC MAP  
 SEWAGE TREATMENT LAGOONS  
 HOLLOMAN AIR FORCE BASE  
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LEGEND	
MW-1	WELL NUMBER
●	WELL LOCATION
4042.29	GROUND WATER POTENTIOMETRIC SURFACE ELEVATION (FAMSL)
- 4040.00 -	GROUND WATER SURFACE CONTOUR (FAMSL) CONTOUR INTERVAL = 0.5

FIGURE 8  
 SEPTEMBER 12, 1990  
 GROUND WATER POTENTIOMETRIC MAP  
 SEWAGE TREATMENT LAGOONS  
 HOLLOMAN AIR FORCE BASE  
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