

Environmental Management Services, Inc.

42809 236th Avenue SE, Enumclaw, Washington 98022
Telephone (360) 825-8560 / Fax (360) 825-8640

April 26, 1999

Ms. Stacie Doran
American Golf Corporation
Bear Creek Country Club
13737 202nd Avenue NE
Woodinville, WA 98072

RELEASE # 421552
BEAR CREEK C. C.
WOODINVILLE
LIST # 2461

RE: Groundwater Monitoring Results – March 1999
Former UST Location
Bear Creek Country Club, Woodinville, WA

Dear Ms. Doran:

Environmental Management Services (EMS) has conducted monitoring and sampling of six groundwater monitoring wells in the vicinity of two former underground storage tanks (USTs) at the above-referenced location (the site). This letter report presents the results of the groundwater monitoring event.

Site Description

The site is located at the Bear Creek Country Club in Woodinville, Washington (Figure 1). Bear Creek Country Club is a private golf course, located in an area of residential land use. The nearest surface water is Bear Creek, located approximately 1,500 feet west of the site.

The site is located west of the maintenance building along the southern edge of the country club. The site is bounded by an access road to the south, the maintenance building to the east, and the golf course to the north and west (Figure 2). An aboveground fuel storage tank (AST) is located west of the maintenance building, in the approximate location of the former dispenser island. The area between the AST and the building is paved with asphalt and concrete. The area west of the AST is covered with grass and other vegetation. The site slopes toward the west and drainage swales are located northwest of the AST and along the access road.

Background

In March 1997, two 1,000-gallon USTs, used to store gasoline and diesel fuel, along with product piping and dispensers, were removed by PSCI Environmental, of Bothell, Washington. Soil samples collected following removal indicated that one sample from the UST excavation slightly exceeded Model Toxics Control Act (MTCA) Method A Soil Cleanup Levels. However, a sample collected from beneath the dispenser contained 4,200 parts per million (ppm) of diesel (TPH-D). Further soil sampling was conducted toward the west and TPH-D was identified in 11 additional samples extending approximately 130 feet southwest of the former dispensers. The samples were collected at depths ranging from 5 to 9 feet below ground surface (bgs). No groundwater was apparently encountered during the UST removal or subsequent soil sampling.

12/4/01 ✓

In May 1997, Global Environmental, of Seattle, Washington (Global), excavated approximately 35 tons of contaminated soil from the area of the former dispenser for off-site treatment and disposal. A monitoring point (MP-1) was installed during backfilling of the excavation. Three groundwater monitoring wells (MW-1 through MW-3) were also installed downgradient of the former dispenser to facilitate testing of cleanup alternatives. Groundwater was encountered at depths of approximately three to four feet bgs.

Global installed and operated a soil remediation system consisting of bio-venting with extensive de-watering to increase the amount of soil exposed to treatment. Subsequent groundwater monitoring, conducted in April 1998, indicated that diesel-range hydrocarbons are present in samples from MW-2 and MW-3 at concentrations exceeding MTCA Method A Groundwater Cleanup Levels.

EMS conducted groundwater monitoring during May 1998. Monitoring results indicated that diesel-range hydrocarbons were present at concentrations above MTCA Method A Cleanup Levels in wells MW-1, MW-2, MW-3 and monitoring point MP-1. During October 1998, EMS installed and sampled three additional monitoring wells at the site (MW-4 through MW-6) to delineate the extent of groundwater impacts at the site. None of the additional wells contained hydrocarbon concentrations above Method A Cleanup Levels.

Purpose and Scope of Work

The purpose of this investigation was to characterize the magnitude and extent of diesel-range hydrocarbon impacts to groundwater at the site. To meet this objective the following scope of work was performed:

- Measured groundwater depth in each of the wells,
- Collected groundwater samples from each of the six monitoring wells,
- Submitted the samples for laboratory analysis for diesel and oil-range hydrocarbons, and
- Prepared this report.

Groundwater Monitoring

Groundwater levels were measured in each of the wells on March 22, 1999. Prior to sampling, depth to water was measured from the measuring points at the top of each PVC well casing using a Solinst water level indicator. The water level indicator was decontaminated prior to each use. Depth to water ranged from 0.86 to 4.25 feet. Consistent with the surface topography, the groundwater elevations slope toward the west. The depth to water measurements and groundwater elevations are presented on Table 1. Historic groundwater monitoring data is presented on Table 2.

Groundwater Sampling and Analysis

Prior to sampling, each well was purged by removing a minimum of three well casing volumes of water or until the well pumped dry. Each of the wells pumped dry before three volumes could be removed. Following recharge, samples were collected using a peristaltic pump and disposable tubing. The samples were contained in laboratory-supplied glass jars and were properly labeled, sealed, and placed in a cooler with ice. The samples were transported under standard chain-of-custody protocol to North Creek Analytical of Bothell, Washington for laboratory analysis.

Ms. Stacie Doran
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The samples were analyzed for diesel-range hydrocarbons (TPH-D) by Washington State Department of Ecology Method WTPH-D. The laboratory results indicated that TPH-D was present in three of the six samples. Concentrations ranged from 1.03 ppm in MW-2 to 0.402 ppm in MW-1. The groundwater analytical results are presented on Table 3. The historical analytical results are presented on Table 4. The laboratory results are attached.

Summary

Groundwater monitoring was conducted at six monitoring wells at the site. Depth to water ranges from 0.86 to 4.25 feet with an overall groundwater flow direction toward the west. Three of the samples contained detectable concentrations of diesel-range hydrocarbons, however, only one sample slightly exceeded the MTCA Method A Groundwater Cleanup Level of 1 ppm. Furthermore, none of the perimeter wells contained detectable concentrations of hydrocarbons. Based on these results, it is clear that the downgradient extent of groundwater impacts has been defined.

Limitations

Services provided by EMS have been conducted in a manner consistent with the care and skill ordinarily exercised by members of the consulting industry in this area. No other representation, expressed or implied, is intended in this report.

EMS appreciates the opportunity to provide American Golf Corporation with consulting services. If you have any questions or require additional information, please do not hesitate to call me at (360) 825-8560.

Sincerely



Chris L. Jones
Environmental Management Services, Inc.

Attachments

Table 1
Groundwater Monitoring Data

Bear Creek Country Club
Woodinville, Washington
March 22, 1999

Well Number	Top of Casing Elevation (ft)	Depth to Water (ft)	Groundwater Elevation (ft)
MP-1	99.18	4.25	94.93
MW-1	98.58	4.21	94.37
MW-2	95.74	1.64	94.1
MW-3	92.32	0.86	91.46
MW-4	95.11	1.00	94.11
MW-5	91.66	1.62	90.04
MW-6	94.21	1.76	92.45

Note:

Top of Casing Elevations relative to a temporary benchmark with an assigned elevation of 100 feet above mean sea level.

Table 2
Historic Groundwater Monitoring Data

Bear Creek Country Club
Woodinville, Washington

Well Number	Top of Casing Elevation (ft)	Date	Depth to Water (ft)	Groundwater Elevation (ft)	Elevation Change
MP-1	99.18	5/14/98	5.17	94.01	-
		3/22/99	4.25	94.93	0.92
MW-1	98.58	5/14/98	5.53	93.05	-
		3/22/99	4.21	94.37	1.32
MW-2	95.74	5/14/98	4.11	91.63	-
		3/22/99	1.64	94.10	2.47
MW-3	92.32	5/14/98	2.21	90.11	-
		3/22/99	0.86	91.46	1.35
MW-4	95.11	3/22/99	1.00	94.11	-
MW-5	91.66	3/22/99	1.62	90.04	-
MW-6	94.21	3/22/99	1.76	92.45	-

Note:

Top of Casing Elevations relative to a temporary benchmark with an assigned elevation of 100 feet above mean sea level.

Table 3
Groundwater Analytical Results

Bear Creek Country Club
Woodinville, Washington
March 22, 1999

Well Number	TPH-Diesel
MW-1	0.402
MW-2	1.03
MW-3	0.613
MW-4	<0.250
MW-5	<0.250
MW-6	<0.250
MTCA Method "A" Cleanup Level	1.0

Notes:

Analyses by Ecology Method WTPH-D

TPH-Diesel = Diesel-range Total Petroleum Hydrocarbons

All results in milligrams per liter (mg/L) or parts per million

< = Not detected at the referenced method reporting limit

Bolded values exceed MTCA Method "A" Cleanup Levels

Table 4 **Historical Groundwater Analytical Results**

Bear Creek Country Club
Woodinville, Washington

Well Number	Date	TPH-Diesel	TPH - Oil
MP-1	5/14/98	20.8	<8.25
MW-1	5/14/98	5.33	1.23
	3/22/99	0.402	NA
MW-2	5/14/98	1.11	<0.750
	3/22/99	1.03	NA
MW-3	5/14/98	4.03	<0.750
	3/22/99	0.613	NA
MW-4	10/13/98	<0.250	NA
	3/22/99	<0.250	NA
MW-5	10/13/98	<0.250	NA
	3/22/99	<0.250	NA
MW-6	10/13/98	0.323	NA
	3/22/99	<0.250	NA
MTCA Method "A" Cleanup Level		1.0	1

Notes:

May 14, 1998 analyses by Ecology Method WTPH-D Extended

All other analyses by Ecology Method WTPH-D

TPH-Diesel = Diesel-range Total Petroleum Hydrocarbons

TPH-Oil = Oil-range Total Petroleum Hydrocarbons

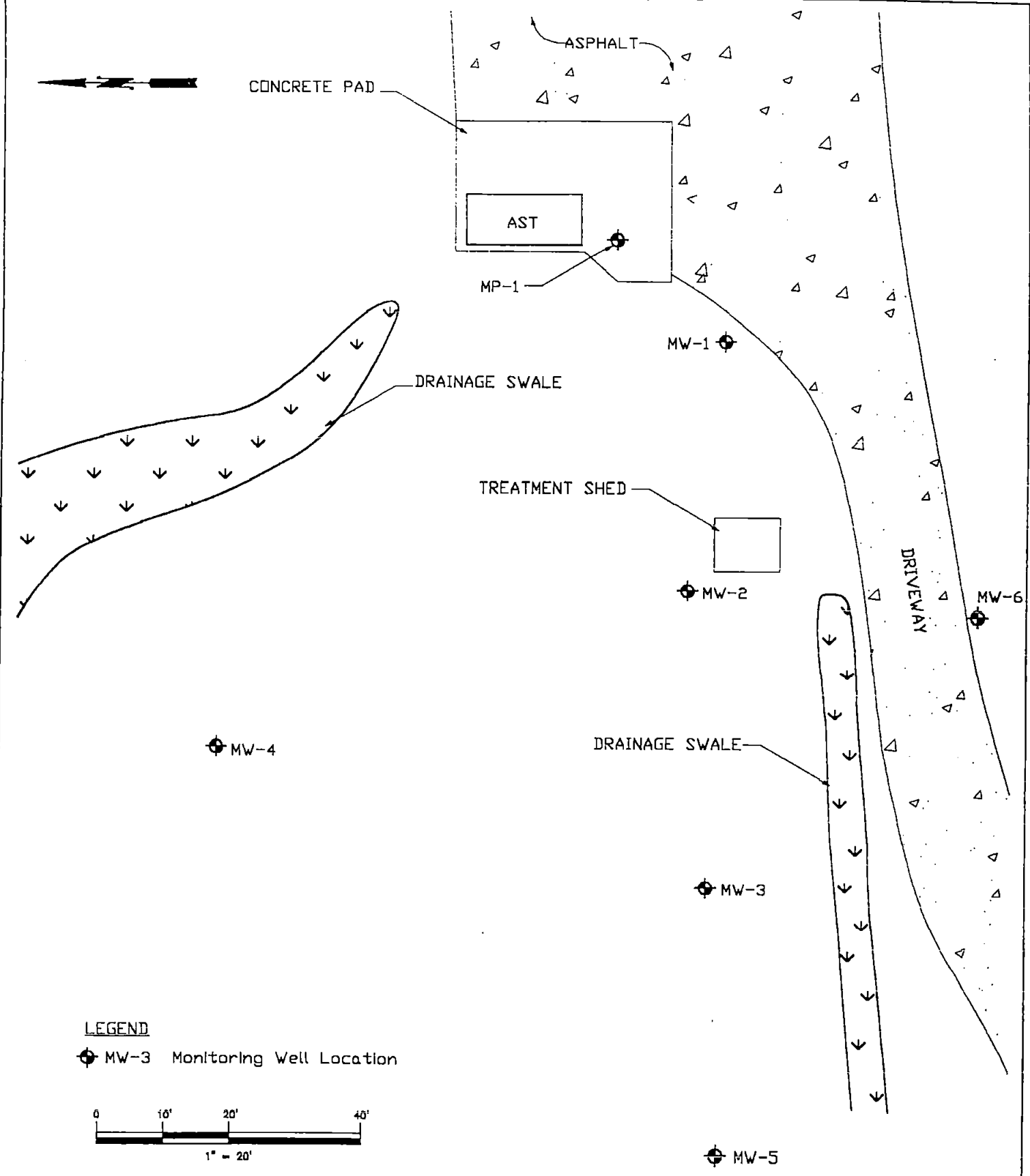
All results in milligrams per liter (mg/L) or parts per million

< = Not detected at the referenced method reporting limit

October 13, 1998 samples were grab samples collected during well installation

Bolded values exceed MTCA Method "A" Cleanup Levels

NA = Not Analyzed



Environmental Management Services, Inc.

42809 - 236th Avenue S.E.
 Enumclaw, Washington 98022

DESIGNED BY:	CJ
DRAWN BY:	JB
DATE:	November 1993
JOB No.:	

FIGURE 2
 BEAR CREEK COUNTRY CLUB
 WOODINVILLE, WA
 SITE MAP



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425.420.9210 fax 425.420.9210
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Environmental Management Services 42809 236th Avenue SE Enumclaw, WA 98022	Project: Bear Creek C.C. Project Number: not provided Project Manager: Chris Jones	Sampled: 3/22/99 Received: 3/22/99 Reported: 3/29/99 16:21
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ANALYTICAL REPORT FOR SAMPLES:

Sample Description	Laboratory Sample Number	Sample Matrix	Date Sampled
MW-1	B903473-01	Water	3/22/99
MW-2	B903473-02	Water	3/22/99
MW-3	B903473-03	Water	3/22/99
MW-4	B903473-04	Water	3/22/99
MW-5	B903473-05	Water	3/22/99
MW-6	B903473-06	Water	3/22/99

North Creek Analytical - Bothell

*The results in this report apply to the samples analyzed in accordance with the chain of custody document.
This analytical report must be reproduced in its entirety.*

Matthew Essig, Project Manager

North Creek Analytical, Inc.
Environmental Laboratory Network



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**Diesel Hydrocarbons (C12-C24) by WTPH-D
North Creek Analytical - Bothell**

Analyte	Batch Number	Date Prepared	Date Analyzed	Surrogate Limits	Reporting Limit	Result	Units	Notes*
MW-1				B903473-01			Water	
Diesel Range Hydrocarbons	0390643	3/24/99	3/26/99		0.250	0.402	mg/l	
Surrogate: 2-FBP	"	"	"	50.0-150		107	%	
MW-2				B903473-02			Water	
Diesel Range Hydrocarbons	0390643	3/24/99	3/26/99		0.250	1.03	mg/l	
Surrogate: 2-FBP	"	"	"	50.0-150		75.0	%	
MW-3				B903473-03			Water	
Diesel Range Hydrocarbons	0390643	3/24/99	3/26/99		0.250	0.613	mg/l	
Surrogate: 2-FBP	"	"	"	50.0-150		104	%	
MW-4				B903473-04			Water	
Diesel Range Hydrocarbons	0390643	3/24/99	3/26/99		0.250	ND	mg/l	
Surrogate: 2-FBP	"	"	"	50.0-150		77.7	%	
MW-5				B903473-05			Water	
Diesel Range Hydrocarbons	0390643	3/24/99	3/26/99		0.250	ND	mg/l	
Surrogate: 2-FBP	"	"	"	50.0-150		104	%	
MW-6				B903473-06			Water	
Diesel Range Hydrocarbons	0390643	3/24/99	3/26/99		0.250	ND	mg/l	
Surrogate: 2-FBP	"	"	"	50.0-150		76.5	%	

North Creek Analytical - Bothell

*Refer to end of report for text of notes and definitions.

Matthew Essig, Project Manager

North Creek Analytical, Inc.
Environmental Laboratory Network



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Environmental Management Services	Project: Bear Creek C.C.	Sampled: 3/22/99
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Diesel Hydrocarbons (C12-C24) by WTPH-D/Quality Control
North Creek Analytical - Bothell

Analyte	Date Analyzed	Spike Level	Sample Result	QC Result	Units	Reporting Limit Recov. Limits	Recov. %	RPD Limit	RPD %	Notes*
Batch: 0390643		Date Prepared: 3/24/99		Extraction Method: EPA 3520C/600 Series						
Blank		0390643-BLK1								
Diesel Range Hydrocarbons	3/26/99			ND	mg/l	0.250				
Surrogate: 2-FBP	"	0.326		0.280	"	50.0-150	85.9			
LCS		0390643-BS1								
Diesel Range Hydrocarbons	3/26/99	2.00		1.57	mg/l	60.0-140	78.5			
Surrogate: 2-FBP	"	0.326		0.255	"	50.0-150	78.2			
Duplicate		0390643-DUP1 B903467-04								
Diesel Range Hydrocarbons	3/26/99		0.885	0.894	mg/l			44.0	1.01	
Surrogate: 2-FBP	"	0.326		0.387	"	50.0-150	119			
Duplicate		0390643-DUP2 B903451-11								
Diesel Range Hydrocarbons	3/26/99		0.279	ND	mg/l			44.0		
Surrogate: 2-FBP	"	0.616		0.464	"	50.0-150	75.3			



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Notes and Definitions

#	Note
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DET Analyte DETECTED

ND Analyte NOT DETECTED at or above the reporting limit

NR Not Reported

dry Sample results reported on a dry weight basis

Recov. Recovery

RPD Relative Percent Difference

North Creek Analytical - Bothell

Matthew Essig, Project Manager

North Creek Analytical, Inc.
Environmental Laboratory Network



**NORTH
CREEK
ANALYTICAL**
Environmental Laboratory Services

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CHAIN OF CUSTODY REPORT

Work Order #

B903473

REPORT TO: Environmental Management Services, Inc. ATTENTION: Chris Jones ADDRESS: 42809 236th Ave SE Enumclaw, WA 98022 PHONE: 360 825 8560 FAX: 360 825-8450 PROJECT NAME: Bear Creek C.C. PROJECT NUMBER: SAMPLED BY: Chris Jones			INVOICE TO: Environmental Management Services, Inc. ATTENTION: Chris Jones ADDRESS: P.O. NUMBER: NCA QUOTE #: Analysis Request:			TURNAROUND REQUEST in Business Days * Organic & Inorganic Analyses 10 7 5 4 3 2 1 Same Day Standard Fuels & Hydrocarbon Analyses 3-4 2 1 Same Day Standard OTHER Specify: * Turnaround Requests less than standard may incur Rush Charges.		
CLIENT SAMPLE IDENTIFICATION	SAMPLING DATE/TIME	NCA SAMPLE ID (Laboratory Use Only)	WTPH-D			MATRIX (W, S, A, O)	# OF CONTAINERS	COMMENTS
1. MW-1	3/22/99 11:15	B903473-01	X					
2. MW-2	3/22/99 11:00	-02	X					
3. MW-3	3/22/99 10:45	-03	X					
4. MW-4	3/22/99 10:30	-04	X					
5. MW-5	3/22/99 10:20	-05	X					
6. MW-6	3/22/99 10:10	-06	X					
7.								
8.								
9.								
10.								
RELINQUISHED BY (Signature): [Signature] PRINT NAME: Chris Jones FIRM: EMS DATE: 3/22/99 TIME: 1:50			RECEIVED BY (Signature): [Signature] PRINT NAME: Adar Reed FIRM: NCA-B DATE: 3/22/99 TIME: 13:50					
RELINQUISHED BY (Signature): PRINT NAME: FIRM: DATE: TIME:			RECEIVED BY (Signature): PRINT NAME: FIRM: DATE: TIME:					
ADDITIONAL REMARKS: no/ 6.2°C								