LONGHORN ARMY AMMUNITION PLANT

KARNACK, TEXAS

ADMINISTRATIVE RECORD

VOLUME 1 of 4

1998

Bate Stamp Numbers
022179 - 022485

Prepared for:

Department of the Army
Longhorn Army Ammunition Plant
Marshall, Texas 75671

1998

Volume 1 of 5

1998

A. Title: Letter - Subject: Longhorn Army Ammunition Plant
Group 2 - Waste Water Treatment Plant at Burning Ground No. 3 and Landfill Site 16 Chronic Toxicity Testing Report for the Treated Waste Water from Site 16
Enclosure: The above report with transmittal letter from Dudley Beene, USACE
Group(s): 2
Site(s): 16
Location: Austin, Texas, Texas Natural Resource Conservation Commission
Author: Diane R. Poteet, Project Manager. RI/FS II Unit
Recipient: James A. McPherson, Commander's Representative, Longhorn AAP
Date: January 13, 1998
Bate Stamp: 022179 - 022215

B. Title: Letter - Subject: Longhorn Army Ammunition Plant
Record of Decision for No Further Action at Group I Sites
Attach: Record of Decision for No Further Action at Group I Sites
Group(s): 1
Site(s): 1, 11, 27 and XX
Location: Dallas, Texas, US Environmental Protection Agency
Author: Chris G. Villarreal, Project Manager
Recipient: James A. McPherson, Commander's Representative, Longhorn AAP
Date: January 26, 1998
Bate Stamp: 022216 - 022247

C. Title: Letter - Subject: Draft Work Plan (Part I) and Sampling and Analysis Plan (Part II) for the Group 2 Sites, Phase III Remedial Investigation/ Feasibility Study at the Longhorn Army Ammunition Plant, Karnack, TX
Enclosure: The above draft work plan
Group(s): 2
Site(s): 12,17,18,24,29 and 32
Location: Tulsa, OK, USA Corps of Engineers, Tulsa District
Author: Yolane Hartsfield for Burl Ragland, Lead Project Manager
Recipient: David Tolbert, Army, Project Manager, Longhorn AAP
Date: January 26, 1998
Bate Stamp: 022248 - 022388

D. Title: Letter - Subject: Investigations for Perchlorate at Federal Facilities
Location: Dallas, Texas, US Environmental Protection Agency
Author: David W. Neleigh, Chief, New Mexicao and Federal Facilities Section

	Recipient:	Allan Posnick, Chief, Pollution Cleanup Division, TNRCC
	Date:	January 28, 1998
	Bate Stamp:	022389 - 022390
E:	Title:	Minutes - COE/Contractor/LHAAP Meeting Minutes
	Group(s):	General
	Site(s):	General
	Location:	Longhorn Army Ammunition Plant, Karnack, Texas
	Author:	Yolane Hartsfield, USACE, Tulsa District
	Recipient:	All Parties
	Date:	11 February 1998
	Bate Stamp:	022391 - 022392
F:	Title:	Minutes - Monthly Managers' Meeting, Longhorn AAP
	Group(s):	General
	Site(s):	General
	Location:	Longhorn Army Ammunition Plant, Longhorn AAP
	Author:	Yolane Hartsfield, Project Manager, USACE, Tulsa District
	Recipient:	All Parties
	Date:	18 February 1998
	Bate Stamp:	022393 - 022397
G:	Title:	Minutes - Technical Review Committee Meeting
	Group(s):	General
	Site(s):	General
	Location:	Longhorn Army Ammunition Plant
	Author:	Yolane Hartsfield, USACE, Tulsa District
	Recipient:	All Parties
	Date:	10 March 1998
	Bate Stamp:	022398 - 022406
H:	Title:	Minutes - (Amended) Technical Review Committee Meeting
	Group(s):	General
	Site(s):	General
	Location:	Longhorn Army Ammunition Plant, Karnack, Texas
	Author:	Yolane Hartsfield, USACE, Tulsa District
	Recipient:	All Parties
	Date:	10 March 1998
	Bate Stamp:	022407 - 022413

I: Title: Letter - Subject: 1998 Texas Environmental Excellence Award
Group(s):
Site(s):
Location: Austin, Texas, Texas Natural Resource Conservation Commission
Author: Andrew Neblett, Director Office of Pollution Prevention & Recycling
Recipient: James A. McPherson, Commander's Representative, Longhorn AAP
Date: March 11, 1998
Bate Stamp: 022414 - 022415

J: Title: Minutes - Teleconference Longhorn Army Ammunition Plant
Group(s): General
Site(s): General
Location: Longhorn Army Ammunition Plant, Karnack, Texas
Author: Yolane Hartsfield, USACE, Tulsa District
Recipient: All Parties
Date: 16 March 1998
Bate Stamp: 022416 - 022418

K: Title: Minutes - Teleconference (Amended) Longhorn AAP
Group(s): General
Site(s): General
Location: Longhorn Army Ammunition Plant, Karnack, Texas
Author: Yolane Hartsfield, USACE, Tulsa District
Recipient: All Parties
Date: 16 March 1998
Bate Stamp: 022419 - 022429

L: Title: Letter - Subject: Longhorn Army Ammunition Plant
Group 2 Baseline Risk Assessment Work Plan
Enclosure: Memorandum - Subject: Group 2 Baseline Risk Assessment
Work Plan for Longhorn AAP
Group(s): 2
Site(s): 12,17,18,24,29,32
Location: Dallas, Texas, US Environmental Protection Agency
Author: Chris G. Villarreal, Project Manager
Recipient: James A. McPherson, Commander's Representative, Longhorn AAP
Date: March 30, 1998
Bate Stamp: 022430 - 022432

M: Title: Letter - Subject: Longhorn Army Ammunition Plant
Group 2 - Baseline Risk Assessment Work Plan
Enclosure: TNRCC Comments, Group 2 - Baseline Risk Assessment
Work Plan
Group(s): 2
Site(s): 12,17,18,24,29,32
Location: Austin, Texas, Texas Natural Resource Conservation Commission
Author: Diane R. Poteet, Project Manager, Superfund Cleanup Section
Recipient: James A. McPherson, Commander's Representative, Longhorn AAP
Date: April 1, 1998
Bate Stamp: 02433 - 022452

N: Title: Letter - Subject: NRDA Trustee Contact for the Longhorn Army Ammunition Plant
Group(s): N/A
Site(s): N/A
Location: Austin, Texas, Texas Natural Resource Conservation Commission
Author: Richard, Seiler, Program Manager, Natural Resource Trustee Program
Recipient: David Tolbert, Army, Project Manager, Longhorn AAP
Date: April 3, 1998
Bate Stamp: 022453

O: Title: Minutes - Longhorn Army Ammunition Plant Draft Monthly Manager's Meeting
Group(s): General
Site(s): General
Location: Longhorn Army Ammunition Plant, Karnack, Texas
Author: Not Shown
Recipient: All Parties
Date: 23 April 1998
Bate Stamp: 022454 - 022456

P: Title: Letter - Subject: Jonna Polk - New Project Manager
Group(s): N/A
Site(s): N/A
Location: Tulsa, Oklahoma, USA Corps of Engineers
Author: Russell K. Holeman, Director, Military/Environmental Project Mgmt
Recipient: James A. McPherson, Commander's Representative, Longhorn AAP
Date: April 30, 1998
Bate Stamp: 022457 - 022458

Q: Title: Letter - Subject: Longhorn Army Ammunition Plant Group 5 Final Site Characterization Investigation Report
Group(s): 5
Site(s): 52, 63
Location: Dallas, Texas, US Environmental Protection Agency
Author: William K. Honker, Chief, AR/OK/TX Branch, Superfund Division
Recipient: James A. McPherson, Commander's Representative, Longhorn AAP
Date: May 11, 1998
Bate Stamp: 022459 - 022468

R: Title: FAX - Concurrence Letter - Group 5 Final Site Characterization Report
Group(s): 5
Site(s): 52, 63
Location: Dallas, Texas, US Environmental Protection Agency
Author: Chris G. Villarreal, Project Manager
Recipient: David Tolbert, Army, Project Manager, Longhorn AAP
Date: May 12, 1998
Bate Stamp: 022469 - 022472

S:	Title:	Letter - Subject: Longhorn Army Ammunition Plant (LHAAP) Final Work Plan and Sampling and Analysis Plan Group 2 Sites, Phase III Remedial Investigation/Feasibility Study
	Enclosure:	EPA Comments on above plan
	Group(s):	2
	Site(s):	12,17,18,24,29,32
	Location:	Dallas, Texas, US Environmental Protection Agency
	Author:	Chris G. Villarreal, Remedial Project Manager, Superfund Division
	Recipient:	James A. McPherson, Commander's Representative, Longhorn AAP
	Date:	May 14, 1998
	Bate Stamp:	022473 - 022480
T:	Title:	Letter - Subject: Longhorn Army Ammunition Plant Group 5 - Final Site Characterization Report
	Group(s):	5
	Site(s):	52, 63
	Location:	Austin, Texas, Texas Natural Resource Conservation Commission
	Author:	Diana R. Poteet, Project Manager, Superfund Cleanup Section
	Recipient:	James A. McPherson, Commander's Representative, Longhorn AAP
	Date:	May 21, 1998
	Bate Stamp:	022481 - 022483
U:	Title:	Letter - Subject: Longhorn Army Ammunition Plant Group 2 - Final Work Plan for Phase III Remedial Investigation/ Feasibility Study
	Group(s):	2
	Site(s):	12,17,18,24,29,32
	Location:	Austin, Texas, Texas Natural Resource Conservation Commission
	Author:	Diane R. Poteet, Project Manager, Superfund Cleanup Section
	Recipient:	James A. McPherson, Commander's Representative, Longhorn AAP
	Date:	May 20, 1998
	Bate Stamp:	022484 - 022485

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

CERTIFIED MAIL
Z 746 032 981
RETURN RECEIPT REQUESTED

January 13, 1998

James A. McPherson, Commander's Representative
Longhorn/Louisiana Army Ammunition Plant
Attn: SIOLH-CR
P.O. Box 658
Doyline, LA 71023

Re: **Longhorn Army Ammunition Plant**
Group 2 - Waste Water Treatment Plant at Burning Ground No. 3 and Landfill Site 16
Chronic Toxicity Testing Report for the Treated Waste Water from Site 16

Dear Mr. McPherson:

The Texas Natural Resource Conservation Commission (TNRCC) staff has completed its review of the above referenced document, which we received on November 11, 1997. The TNRCC concurs with the Army's test results. If you have any further questions regarding this matter, please call me at (512) 239-2502.

Sincerely,

Diane R. Poteet

Diane R. Poteet
Project Manager (MC-143), RI/FS II Unit
Superfund Investigation Section
Pollution Cleanup Division

Enclosure

cc: Chris Villarreal, EPA Region 6 (6SF-AP)
Yolane Hartsfield, COE Tulsa District (CESWT-PP-EA)
Oscar Linebaugh, COE Eastern Area Office (CESWF-AD-E)

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RADIAN INTERNATIONAL LLC

Longhorn Army Ammunition Plant
P.O. Box 107
Karnack, TX 75661
(903) 679-3448
FAX (903) 679-3357

BCS-97-LHBGPIII-050
October 28,1997

Mr. Dudley C. Beene, II
Area Engineer
USACE Fort Worth District
280 Miller Road
Bossier City, Louisiana 71112-2505

Reference: **Contract No. DACA56-93-D-0016**
Delivery Order No. 0002, Interim Remedial Action
Burning Ground No. 3, LHAAP 18&24
Longhorn Army Ammunition Plant, Karnack, Texas

Subject: **Report of Chronic Toxicity Testing**
Treated Groundwater from Area 16

Dear Mr. Beene:

Please find attached four copies of the Chronic Toxicity Testing Report for the Treated Groundwater from Area 16. Three copies of this report will need to be transmitted to Mr. David Tolbert of the Longhorn Army Ammunition Plant.

If you should have any questions or require additional information, please do not hesitate to contact me at (903) 679-3448.

Sincerely,

Bryan C. Smith
Project Manager

cf: Ramona Wagner, USACE Tulsa District, HTRW Office
Yolane Hartsfield, USACE Tulsa District, PPMD
Vic Heister, USACE Tulsa District, PPMD
Oscar Linebaugh, USACE Ft. Worth District, EAO
Jim Hall, Radian
John Adzema, Radian
Chris Edgmon, Radian

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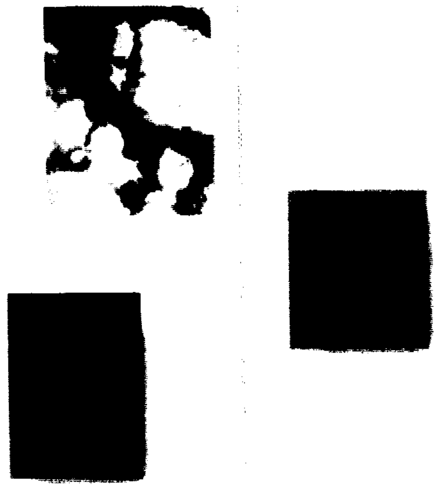

Report of Chronic Toxicity Tests Performed in Compliance with Texas Natural Resource Conservation Commission Requirements on Treated Groundwater from Area 16 at

Longhorn Army Ammunition Plant
October 1997

Analyses Performed and Report Prepared and submitted by:

RADIAN International LLC
P.O. Box 658
Doyline, LA 71023

RADIAN INTERNATIONAL LLC

022182

REPORT OF CHRONIC TOXICITY TESTS

October 1997

Treated Groundwater from
Longhorn Army Ammunition Plant Area 16

Toxicity Tests Performed by: Elizabeth A. West, Senior Chemist
Joseph R. West, Laboratory Manager

Report Prepared by: Elizabeth A. West
Elizabeth A. West, Senior Chemist

Approved by: Joseph R. West
Joseph R. West, Laboratory Manager
Louisiana Army Ammunition Plant

RADIAN International LLC
P.O. Box 658
Doyline, LA 71023
(318) 459-5087

TABLE OF CONTENTS

Appendix I: Tables

Appendix I , continued

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Report of Chronic Toxicity Tests
on Treated Groundwater from Longhorn AAP Area 16
October 1997

A. Requested Analyses:

Ceriodaphnia dubia survival and reproduction test Method 1002.0; EPA/600/4-89/001

Fathead Minnow (*Pimephales promelas*) larval survival and growth test Method 1000.0; EPA/600/4-89/001

Samples: Grab Sample taken from effluent pipe during discharge of Treated Groundwater from Longhorn AAP Area 16

Toxicity is based on comparisons of survival, growth and reproduction data from different effluent dilutions and 100 percent dilution water (control).

B. Longhorn Army Ammunition Plant (LHAAP) is a U.S. Government-owned facility operated under Army Contract, including remediation efforts at Area 16 by RADIAN International LLC. The facility is located in the northeast corner of Harrison County, Texas, 3.6 miles from the Louisiana border. The installation is located adjacent to Caddo Lake at Caddo Lake State Park with the Town of Uncertain at the northern boundary and the Town of Karnack at the western boundary with the nearest major city being Marshall, Texas, 15 miles to the southwest. LHAAP occupies 8,493 acres of land, of which most is in an undeveloped condition. Receiving waters flowing through the plant are Saunders Branch, Harrison Bayou, an unnamed tributary (locally known as North Bayou), and another unnamed tributary (locally known as Central Bayou). The treated groundwater from Area 16 flows into Harrison Bayou.

C. There is no production at Longhorn AAP. Only clean-up and construction activities are in progress.

D. The toxicity tests were performed by the Chemical Labortory at Louisiana Army Ammunition Plant which is also operated under an Army contract by Thiokol Corporation.

1. The laboratory may be contacted at the address below:

RADIAN International LLC
Louisiana Army Ammunition Plant
Chemical Laboratory
P.O. Box 658
Doyline, LA 71023

The telephone Point of Contact is the Laboratory Manager, Joseph R. West, PhD. at (318) 459-5087.

2. Toxicity tests were performed by Elizabeth West, Senior Chemist and Joseph R. West, PhD, Laboratory Manager.

3. The Chemical Laboratory at Louisiana Army Ammunition Plant (LAAP) has participated in DMR self-monitoring for chronic toxicity since 1988. The Laboratory has obtained acceptable results in both tests described in Paragraph A. above during the NPDES Laboratory Performance Evaluation for DMR-QA Studies since then.

E. Moderately Hard Synthetic Freshwater (MHSF) was used for the controls and dilution water in all tests. Results of Chemical and Physical testing of all samples is included in the Results tables at the end of the report.

F. Ceriodaphnia dubia Survival and Reproduction Test

1. Method 1002.0 in EPA/600/4-89/001: Ceriodaphnia Survival and Reproduction Test

Larvae exposure:	static renewal system of 5 concentrations of effluent and dilution water (control)
Duration:	until at least 60% of surviving control organisms had three broods of offspring
end-points:	adverse effects on survival and reproduction

2. Dilutions per test: 6 Test chambers: 50 ml beakers
Replicates: ten per dilution Sample volume: 15 ml / beaker

3. Test organisms used: *Ceriodaphnia dubia* neonates
Source: in-house individual cultures(original culture provided by Aquatic Biosystems in July 1995 and raised in-house since then)
Age at start: less than 24 hours old
Acclimated: in MHSF at 25 ± 1°C (transferred randomly / one organism in each chamber)
Food: once/day 0.1 ml of Yeast/Cerophyll/Troutchow and 0.1 ml of Selenastrum capricornutum algae

4. Incubator temperature during testing periods: Mean 24.6 °C
Range: Low 24.0 °C High 25.0 °C

5. Date and time tests started and terminated:

Started: 10/9/97;1730 Terminated: 10/17/97;1015

G. Fathead Minnow Larval Survival and Growth Test

1. Method 1000.0 in EPA/600/4-89/001: Fathead Minnow Larval Survival and Growth Test.

   Larvae exposure: static renewal system
   5 concentrations of effluent and dilution water (control)
   Duration: seven days
   end-points: adverse effects on survival and growth

2. Dilutions per test: 6 | Test chambers: 600 ml pyrex beakers
   Replicates: five per dilution | Sample volume: 250 ml per beaker

3. Test organisms used: newly hatched *Pimephales promelas*
   Source: Aquatic Biosystems, Inc. Fort Collins, CO.
   Age at start: less than 48 hours old
   acclimated: to 25 ± 1°C before the start of the test
   (transferred randomly / ten organisms in each chamber)
   Food: newly-hatched Artemia cysts three times daily
   (No food was given during the last 18 hours of the test)

4. Incubator temperature during testing periods: Mean 24.6 °C
   Range: Low 24.0 °C High 25.0 °C

5. Date and time tests started and terminated:

   Started: 10/9/97; 1730 Terminated: 10/16/97; 1045

H. Quality Assurance Data

1. Laboratory Precision and Organism Sensitivity were determined monthly using the Reference Toxicant Cadmium Chloride (obtained from Aldrich Chemical Co., Catalog No. 20,290-8). Two 24-hour acute toxicity tests were performed simultaneously with each organism. Appropriate dilutions were made with medium hard synthetic water.

	Ceriodaphnia dubia	*Pimephales promelas*
Precision (std. deviation)	0.02	0.06
Sensitivity (24-hour LC50), mg/l	0.26	1.19
95% Confidence Limits, mg/l - LWL	0.14	0.83
UWL	0.34	1.33
Coefficient of Variation, %	20.7	12.1

- The average LC50 for the tests is reported as sensitivity.
- 95% confidence limits for precision and the coefficient of variation are calculated from control charts using the last seven data points generated.

2. Performance of control organisms in both tests meet acceptability criteria in the most recent revision of the Chronic Toxicity Procedures (EPA-EMSL, March 1989).

Ceriodaphnia dubia	October 1997	*Pimephales promelas*	October 1997
Percent Survival	90	Percent Survival	98
Percent of surviving females having at least 3 Broods	89	CV Percent Survival	4.6
Average young per surviving female	15.6	Average dry wt. (mg) of surviving larvae	0.87
CV Percent	37.4	CV Percent Growth	4.5

3. Quality Assurance on Chemical and Physical Measurements

Quality Assurance on Chemical and Physical Measurements
Groundwater from Longhorn Area 16, October 1997

Date	Temp	D.O.	pH		Alkalinity		Hardness		Conductivity	
	Est SD	Est SD	Est SD	QA Result	Est SD	%Recovery	Est SD	%Recovery	Est SD	%Recovery
9-Oct	0.050	0.050	0.000	9.09	0.000	101.5%	0.000	99.6%	0.5	84.8%
10-Oct	0.150	0.050	0.000	9.06	0.000	100.7%	0.500	---	11.000	83.3%
11-Oct	0.000	0.050	0.000	9.04	1.050	101.1%	0.000	100.3%	1.500	83.4%
12-Oct	0.100	0.050	0.000	8.98	---	102.1%	0.000	102.1%	2.000	94.6%
13-Oct	0.300	0.150	0.000	8.97	0.100	100.8%	0.100	99.7%	0.500	94.6%
14-Oct	0.100	0.050	0.050	9.02	0.000	102.1%	0.300	100.4%	6.500	93.8%
15-Oct	0.000	0.100	0.050	9.02	0.750	101.8%	0.000	102.0%	6.500	94.2%
16-Oct	0.050	0.000	0.000	9.00	0.200	100.8%	1.000	102.1%	2.500	93.8%
Average	0.094	0.062	0.013	9.02	0.300	101.3%	0.238	100.9%	3.875	90.3%
SD	0.098	0.044	0.023	S.U.	0.425	0.006	0.358	0.012	3.749	0.054

advisory range:
8.88 - 9.28

COMMENTS:

QA Samples used: Environmental Resource Associates; Arvada, Colorado.
ERA Lot 9972 for pH, Alkalinity and Conductivity on 10/9 - 10/11, and Lot 9966 for 10/12 - 10/16.
ERA Lot 9967 for Hardness

--- - not run.

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4. The methods used for determining physical and chemical data are listed below:

Reference: I. EPA/600/4-79/020
II. Standard Methods for the Examination of Water and Wastewater (Edition)

Analysis	Description	Reference Method
1. pH	Electrode Method	I 150.1
2. Temperature	Thermometric	
3. Dissolved Oxygen	Membrane Probe	I 360.1
4. Total Alkalinity	Titration Method, Bromcresol Green	II (16) 403
5. Hardness	EDTA Titration	II (16) 314B
6. Conductivity	Conductance Meter	I 120.1

I. There was no significant difference found between the survival and growth of the minnows or survival and reproduction of the *Ceriodaphnia dubia* exposed the Control (MHSF) and 100% Sample. Results are in the Tables at the end of the report.

TABLE 1-A: RESULTS OF CHRONIC TOXICITY TESTS
on Treated Groundwater from Longhorn AAP Area 16 October 1997

		Ceriodaphnia dubia		*Pimephales promelas*	
		Survival	Reproduction	Survival	Growth
Treated groundwater from LHAAP Area 16 (GW16)	NOEC(%effluent)	100%	100%	100%	100%
	CV%	—	38.9	4.6	10.1
	Performance of 100% Sample	70% Survival	avg young 10.9	100% Survival	avg dry wt. 1.08 mg

TABLE II : Biological Data on *Ceriodaphnia dubia* Chronic Survival and Reproduction Test for Treated Groundwater from Longhorn Area 16, October 1997

Conc.	Day	A	B	C	D	E	F	G	H	I	J	# of young	# of adults	young/adult
# 1	1	0	0	0	0	0	0	0	0	0	0	0	10	0.0
	2	0	0	0	0	0	0	0	0	0	0	0	10	0.0
	3	0	0	0	0	0	0	0	0	0	0	0	10	0.0
CONTROL	4	0	2	2	0	1	3	0	0	4	0	12	10	1.2
	5	0	0	0	8	0	0	6	0	0	8	22	10	2.2
	6	4	5	4	3	2	4	1	X	5	0	28	9	3.1
	7	6	9	4	3	9	5	5	---	5	10	56	9	6.2
	8	2	0	0	0	10	0	0	---	0	10	22	9	2.4
	Total	12	16	10	14	22	12	12	X	14	28	140	9	15.6

Conc.	Day	A	B	C	D	E	F	G	H	I	J	# of young	# of adults	young/adult
# 2	1	0	0	0	0	0	0	0	0	0	0	0	10	0.0
	2	0	0	0	0	0	0	0	0	0	0	0	10	0.0
	3	4	4	0	5	4	4	4	0	0	0	25	10	2.5
6%	4	10	7	4	9	7	7	8	4	1	4	61	10	6.1
	5	0	0	0	1	0	0	1	4	0	5	11	10	1.1
	6	6	5	3	4	6	6	5	0	5	0	40	10	4.0
	7	2	5	6	0	5	5	5	4	6	5	43	10	4.3
	8	0	0	8	0	0	0	0	6	2	7	23	10	2.3
	Total	22	21	21	19	22	22	23	18	14	21	203	10	20.3

Conc.	Day	A	B	C	D	E	F	G	H	I	J	# of young	# of adults	young/adult
# 3	1	0	0	0	0	0	0	0	0	0	0	0	10	0.0
	2	0	0	0	0	0	0	0	0	0	0	0	10	0.0
	3	0	0	2	0	0	0	4	0	3	4	13	10	1.3
13%	4	2	1	7	2	4	0	0	4	5	8	33	10	3.3
	5	0	5	0	2	1	0	8	4	2	0	22	10	2.2
	6	5	0	2	0	5	2	5	1	5	6	31	10	3.1
	7	5	6	5	4	2	7	5	6	7	6	53	10	5.3
	8	5	8	0	6	4	5	0	9	0	1	38	10	3.8
	Total	17	20	16	14	16	14	22	24	22	25	190	10	19.0

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TABLE II - A : Biological Data on *Ceriodaphnia dubia* Chronic Survival and Reproduction Test for Treated Groundwater from Longhorn Area 16, October 1997

Conc.	Day	A	B	C	D	E	F	G	H	I	J	# of young	10	young/adult
# 4	1	0	0	0	0	0	0	0	0	0	0	0	10	0.0
	2	0	0	0	0	0	0	0	0	0	0	0	10	0.0
	3	0	0	0	2	0	0	0	0	0	5	7	10	0.7
25%	4	4	4	4	8	0	4	4	2	2	10	42	10	4.2
	5	6	0	0	0	5	5	6	0	4	0	26	10	2.6
	6	0	3	5	7	1	0	0	4	0	1	21	10	2.1
	7	5	4	3	6	3	8	4	4	4	X	41	9	4.6
	8	6	7	0	1	4	7	7	0	7	---	39	9	4.3
	Total	21	18	12	24	13	24	21	10	17	X(16)	160	9	17.8

Conc.	Day	A	B	C	D	E	F	G	H	I	J	# of young	# of adults	young/adult
# 5	1	0	0	0	0	0	0	0	0	0	0	0	10	0.0
	2	0	0	0	0	0	0	0	0	0	0	0	10	0.0
	3	2	3	0	0	4	0	0	0	1	4	14	10	1.4
50%	4	X(8)	0	4	3	7	4	3	2	9	7	39	9	4.3
	5	---	8	0	1	0	3	0	0	0	0	12	9	1.3
	6	---	3	1	3	5	0	5	4	2	8	31	9	3.4
	7	---	4	6	3	4	3	2	5	3	7	37	9	4.1
	8	---	0	0	0	0	6	0	5	0	0	11	9	1.2
	Total	X(10)	18	11	10	20	16	10	16	15	26	142	9	15.8

Conc.	Day	A	B	C	D	E	F	G	H	I	J	# of young	# of adults	young/adult
# 6	1	0	0	0	0	0	0	0	0	0	0	0	10	0.0
	2	0	0	0	0	0	0	0	0	0	0	0	10	0.0
	3	0	2	0	0	0	0	0	4	0	4	10	10	1.0
100%	4	3	5	4	3	3	X	0	0	0	2	20	9	2.2
	5	0	0	4	2	0	---	4	6	9	0	25	9	2.8
	6	0	4	0	0	6	---	X	2	4	3	19	8	2.4
	7	2	4	2	0	4	---	---	X	3	2	17	7	2.4
	8	0	0	0	1	0	---	---	---	0	0	1	7	0.1
	Total	5	15	10	6	13	X	X(4)	X(12)	16	11	76	7	10.9

022194

TABLE I (1 of 4 pages)
BIOMONITORING REPORTING

Permittee: Longhorn Army Ammunition Plant
Permit No.: Landfill Remediation Project
Outfall No.: Treated Groundwater from Area 16

CERIODAPHNIA DUBIA SURVIVAL AND REPRODUCTION TEST

Dates and Times Composites Collected:		Date	Time		Date	Time
	No. 1: FROM	10/9/97	1445	GRAB		
	No. 2: FROM:					
	No. 3: FROM:					

Test Initiated: 5:30 p.m. 10/9/97 Date

Dilution Water Used: ____ Receiving Water   X Reconstituted Water

NUMBER OF YOUNG PRODUCED PER FEMALE @ TEST TERMINATION

Percent Effluent (%)

REP	0%	6.25%	12.5%	25%	50%	100%
A	12	22	17	21	D-10	5
B	16	21	20	18	18	15
C	10	21	16	12	11	10
D	14	19	14	24	10	6
E	22	22	16	13	20	13
F	12	22	14	24	16	D
G	12	23	22	21	10	D-4
H	D	18	24	10	16	D-12
I	14	14	22	17	15	16
J	28	21	25	D-16	26	11
Surviving Mean	15.6	20.3	19.0	17.8	15.8	10.9
Total Mean	14.0	20.3	19.0	17.6	15.2	9.2
CV% *	37.4	13.1	21.6	29.2	33.1	38.9

* Coefficient of variation = standard deviation x 100/mean

TABLE I (2 of 4 pages)

BIOMONITORING REPORTING

Permittee: Longhorn Army Ammunition Plant
Permit No.: Landfill Remediation Project
Outfall No.: Treated Groundwater from Area 16

CERIODAPHNIA DUBIA SURVIVAL AND REPRODUCTION TEST

1. Indicate statistical package employed to determine the NOEC (Reproduction) as per EPA Methods: EMSL Cincinnati Dunnett Software Version 1.5

2. Enter percent effluent corresponding to the NOEC for reproduction:

NOEC reproduction = 100% effluent

PERCENT SURVIVAL

Percent Effluent (%)

Time of Reading	0%	6.25%	12.5%	25%	50%	100%
24 hour	100	100	100	100	100	100
48 hour	100	100	100	100	100	100
Test Term.	90	100	100	90	90	70

3. Enter percent effluent corresponding to the NOEC for survival:
(Calculated using Fisher's Exact Test)

NOEC survival = 100% effluent

Fisher's Exact Test: Treated Groundwater from Longhorn Area 16,

	Number of alive (successes)	dead (failures)	number of observations
CONTROL	9 (a)	1 (A-a)	10 (A)
100%	7 (b)	3 (B-b)	10 (B)
	16	4	20

acceptable

Is a/A >=b/B?

order OK

A =	10	a =	9
B =	10	b =	7

Not Significantly Different; Passes Fisher's Exact Test

Contingency Table used:
Significant Levels of B:
Values of B for 0.05 Probability
A=10, B=10

when a =	* if b is less than:
10	6
9	4
8	3
7	2
6	1
5	0
4	0

I-6

022196

-iodaphnia Reproduction for Treated Groundwater from Longhorn Area 16, 10/97

Summary Statistics and ANOVA

Transformation = None

Conc.	n	Mean	s.d.	cv%
= control	9	15.5556	5.8119	37.4
2	10	20.3000	2.6687	13.1
3	10	19.0000	4.1096	21.6
4	9	17.7778	5.1908	29.2
5	9	15.7778	5.2148	33.1
6	7	10.8571	4.2201	38.9

) the mean for this conc. is significantly less than the control mean at alpha = 0.05 (1-sided) by a t - test with Bonferroni adjustment of alpha level

inimum detectable difference for
-tests with Bonferroni adjustment = -5.246808
is difference corresponds to -33.73 percent of control

****
*
Note - the above value for the minimum *
detectable difference is approximate as *
the sample sizes are not the same for all of *
the concentrations. *
****

etween concentrations
um of squares = 449.802116 with 5 degrees of freedom.

rror mean square = 21.381052 with 48 degrees of freedom.

artlett's test p-value for equality of variances = .363

RADIAN
International LLC

Louisiana Army Ammunition Plant
Chemical Lab

Chemical and Physical Data on: Treated Groundwater from Longhorn Area 16, for *Ceriodaphnia dubia* Survival and Reproduction Test

Control	DAY 1	2	3	4	5	6	7	8	Comments units
Temperature	24.2	24.1	24.5	24.5	22.1	23.4	23.9	23.4	degrees Centigrade
D.O. Initial	8.0	8.4	8.1	8.1	8.7	8.8	8.8	8.8	mg/L
Final	8.0	8.1	7.6	8.7	8.9	8.3	7.6	7.4	
pH Initial	8.3	8.4	8.3	8.4	8.2	8.3	8.3	8.3	Standard Units
Final	8.2	8.1	8.0	8.1	8.1	8.2	8.0	8.0	
Alkalinity	68.0	68.0	68.0	67.0	66.0	68.0	67.6	64.7	mg/L as CaCO3
Hardness	97.9	97.9	97.9	97.9	98.0	97.9	97.9	97.9	mg/L as CaCO3
Conductivity	328	323	325	325	328	322	323	343	micromhos/cm

	DAY 1	2	3	4	5	6	7	8	Comments
Concentration	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	
D.O. Initial	7.8	8.1	7.9	8.6	7.8	8.9	8.4	8.1	
Final	7.9	8.2	7.8	8.7	8.4	8.3	7.1	6.5	
pH Initial	8.2	8.2	8.3	8.2	8.3	8.3	8.3	8.3	
Final	8.1	8.0	8.1	8.2	8.1	8.1	7.9	7.8	
Conductivity	395	394	400	393	403	405	403	413	

	DAY 1	2	3	4	5	6	7	8	Comments
Concentration	25%	25%	25%	25%	25%	25%	25%	25%	
D.O. Initial	8.0	8.1	7.9	8.4	7.7	8.9	8.2	8.1	
Final	8.0	8.4	7.9	8.5	8.8	8.3	6.5	7.4	
pH Initial	8.2	8.1	8.2	8.1	8.2	8.2	8.2	8.2	
Final	8.3	8.0	8.1	8.1	8.1	8.1	7.7	7.8	
Conductivity	625	613	611	607	618	617	612	621	

100%	DAY 1	2	3	4	5	6	7	8	Comments
Temperature	24.1	24.8	24.4	24.9	21.6	23.4	23.5	23.4	
D.O. Initial	7.9	8.6	7.9	8.3	8.2	8.6	8.9	8.7	
Final	8.0	8.1	7.9	8.5	9.0	9.0	7.8	8.2	
pH Initial	7.6	7.5	7.5	7.8	7.6	7.6	7.6	7.6	
Final	7.6	7.5	7.6	7.6	7.6	7.9	7.5	7.5	
Alkalinity	16.5	15.4	16.9	16.5	14.6	16.5	16.5	14.8	
Hardness	81.6	81.6	81.6	81.6	81.6	81.9	81.6	85.7	
Conductivity	1433	1440	1428	1426	1436	1426	1419	1503	
Initial Temp:	2.8	2.3	3.8	4.0	1.8	1.6	2.1	3.5	

TABLE 2 : Survival Data on *Pimephales promelas* Larval Survival and Growth Test
for: Treated Groundwater from Longhorn Area 16,

Conc.	Day	A	B	C	D	E	AVE
CONTROL	1	10	10	10	10	10	10
	2	10	10	10	10	10	10
	3	10	10	10	10	10	
	4	10	9	10	10	10	
	5	10	9	10	10	10	
	6	10	9	10	10	10	
	7	10	9	10	10	10	
	Survival	100%	90%	100%	100%	100%	98%
# 1	1	10	10	10	10	10	10
	2	10	10	10	10	10	10
	3	10	10	10	10	10	
6%	4	10	10	10	10	10	
	5	10	10	10	10	10	
	6	10	10	10	10	10	
	7	10	10	10	10	10	
	Total	100%	100%	100%	100%	100%	100%
# 2	1	10	10	10	10	10	10
	2	10	10	10	10	10	10
	3	10	10	10	10	10	
13%	4	10	10	10	10	10	
	5	10	10	10	10	10	
	6	10	10	10	10	10	
	7	10	10	10	10	10	
	Total	100%	100%	100%	100%	100%	100%
# 3	1	10	10	10	10	10	10
	2	10	10	10	10	10	10
	3	10	10	10	10	10	
25%	4	10	10	10	10	10	
	5	10	10	10	10	10	
	6	10	10	10	10	10	
	7	10	10	10	10	10	
	Total	100%	100%	100%	100%	100%	100%
# 4	1	10	10	10	10	10	10
	2	10	10	10	10	10	10
	3	10	10	10	10	10	
50%	4	10	10	10	10	10	
	5	10	10	10	10	10	
	6	10	10	10	10	10	
	7	10	10	10	10	10	
	Total	100%	100%	100%	100%	100%	100%
# 5	1	10	10	10	10	10	10
	2	10	10	10	10	10	10
	3	10	10	10	10	10	
100%	4	10	10	10	10	10	
	5	10	10	10	10	10	
	6	10	10	10	10	10	
	7	10	10	10	10	10	
	Total	100%	100%	100%	100%	100%	100%

TABLE 3 : Growth Data on *Pimephales promelas* Larval Survival and Growth Test for: Treated Groundwater from Longhorn Area 16,

Dilution	repl.	No.	Final g	Initial g	Total dry g	# of fish	mean dry mg	Avg dry mg
CONTROL	A	1	0.11672	0.10826	0.00846	10	0.85	0.87
	B	2	0.11647	0.10907	0.00740	9	0.82	
	C	3	0.11834	0.10922	0.00912	10	0.91	
	D	4	0.11684	0.10778	0.00906	10	0.91	
	E	5	0.11756	0.10877	0.00879	10	0.88	
# 1 6%	A	36	0.11584	0.10785	0.00799	10	0.80	0.96
	B	37	0.11860	0.10884	0.00976	10	0.98	
	C	38	0.11762	0.10771	0.00991	10	0.99	
	D	39	0.11854	0.10800	0.01054	10	1.05	
	E	40	0.11776	0.10812	0.00964	10	0.96	
# 2 13%	A	41	0.11624	0.10782	0.00842	10	0.84	0.86
	B	42	0.11668	0.10818	0.00850	10	0.85	
	C	43	0.11730	0.10868	0.00862	10	0.86	
	D	44	0.11706	0.10846	0.00860	10	0.86	
	E	45	0.11574	0.10694	0.00880	10	0.88	
# 3 25%	A	46	0.11832	0.10974	0.00858	10	0.86	0.82
	B	47	0.11812	0.10855	0.00957	10	0.96	
	C	48	0.11599	0.10877	0.00722	10	0.72	
	D	49	0.11751	0.10898	0.00853	10	0.85	
	E	50	0.11667	0.10948	0.00719	10	0.72	
# 4 50%	A	51	0.11783	0.10898	0.00885	10	0.89	0.88
	B	52	0.11823	0.10888	0.00935	10	0.94	
	C	53	0.11818	0.10943	0.00875	10	0.87	
	D	54	0.11668	0.10867	0.00801	10	0.80	
	E	55	0.11808	0.10914	0.00894	10	0.89	
# 5 100%	A	56	0.12231	0.11066	0.01165	10	1.17	1.08
	B	57	0.11826	0.10790	0.01036	10	1.04	
	C	58	0.11773	0.10726	0.01047	10	1.05	
	D	59	0.11712	0.10781	0.00931	10	0.93	
	E	60	0.11975	0.10775	0.01200	10	1.20	

Temperature Ranges in degrees Celsius:

	High	Low	Average
Incubator Range:	25.0	24.0	24.6
Initial Sample Temp.:	4.0	1.6	2.8

TABLE I (3 of 4 pages)
BIOMONITORING REPORTING

Permittee: Longhorn Army Ammunition Plant
Permit No.: Landfill Remediation Project
Outfall No.: Treated Groundwater from Area 16

FATHEAD MINNOW LARVAE GROWTH AND SURVIVAL
(*Pimephales promelas*)

Dates and Times Samples Collected:		Date	Time		Date	Time
	No. 1: FROM	10/9/97	1445	GRAB		
	No. 2: FROM:					
	No. 3: FROM:					

Test initiated: 5:30 p.m. 10/9/97 Date

Dilution Water Used: ____Receiving Water X Reconstituted Water

DATA TABLE FOR GROWTH OF FATHEAD MINNOWS

Effluent Concen-tration (%)	Average Dry Weight in Milligrams in Replicate Chambers					Mean Dry Weight (mg)	CV% *
	A	B	C	D	E		
0%	0.85	0.82	0.91	0.91	0.88	0.87	4.5
6.25%	0.80	0.98	0.99	1.05	0.96	0.96	9.8
12.5%	0.84	0.85	0.86	0.86	0.88	0.86	1.7
25%	0.86	0.96	0.72	0.85	0.72	0.82	12.5
50%	0.89	0.94	0.87	0.80	0.89	0.88	5.8
100%	1.17	1.04	1.05	0.93	1.20	1.08	10.1

*Coefficient of Variation = standard deviation X 100/mean

1. Indicate the Statistical Package employed to determine the NOEC (Growth).
   As per EPA Methods: EMSL Cincinnati Dunnett Software Version 1.5

2. Enter percent effluent corresponding to the NOEC for growth:
   NOEC growth = 77% effluent

022202

TABLE I (4 of 4 pages)
BIOMONITORING REPORTING

Permittee: Longhorn Army Ammunition Plant
Permit No.: Landfill Remediation Project
Outfall No.: Treated Groundwater from Area 16

FATHEAD MINNOW LARVAE GROWTH AND SURVIVAL

DATA TABLE FOR FATHEAD MINNOW SURVIVAL

Effluent Concentration (%)	Percent Survival in Replicate Chambers					Mean Percent Survival			CV %*
	A	B	C	D	E	24h	48h	7 Days	
0%	100	90	100	100	100	100	100	98	4.6
6.25%	100	100	100	100	100	100	100	100	0.0
12.5%	100	100	100	100	100	100	100	100	0.0
25%	100	100	100	100	100	100	100	100	0.0
50%	100	100	100	100	100	100	100	100	0.0
100%	100	100	100	100	100	100	100	100	0.0

* coefficient of variation = standard deviation X 100/mean

1. Indicate the Statistical Package employed to determine the NOEC (Survival) as per EPA Methods: EMSL Cincinnati Dunnett Program Version 1.5

2. Enter percent effluent corresponding to the NOEC for survival:

   NOEC survival = 100% effluent

3. Enter the percent effluent corresponding to the lowest NOEC determined for either species in this toxicity test:

   Lowest NOEC = 100% effluent

innow Survival for Treated Groundwater from Longhorn Area 16, October 1997

Summary Statistics for Raw Data

Conc.	n	Mean	s.d.	cv%
= control	5	.9800	.0447	4.6
2	5	1.0000	.0000	.0
3	5	1.0000	.0000	.0
4	5	1.0000	.0000	.0
5	5	1.0000	.0000	.0
6	5	1.0000	.0000	.0

innow Survival for Treated Groundwater from Longhorn Area 16, October 1997

Summary Statistics and ANOVA

Transformation = Arc Sine Square Root

Conc.	n	Mean	s.d.	cv%
= control	5	1.3794	.0729	5.3
2	5	1.4120	.0000	.0
3	5	1.4120	.0000	.0
4	5	1.4120	.0000	.0
5	5	1.4120	.0000	.0
6	5	1.4120	.0000	.0

) the mean for this conc. is significantly less than
the control mean at alpha = 0.05 (1-sided) by Dunnett's test

inimum detectable difference for Dunnett's test = -.044412
ais corresponds to a difference of -.018393 in original units
ais difference corresponds to -1.91 percent of control

etween concentrations
um of squares = .004427 with 5 degrees of freedom.

rror mean square = .000885 with 24 degrees of freedom.

****
Warning - the test for equality of variances could not be computed as 1 or more of the variances is zero.
****

innow Growth for Treated Groundwater from Longhorn Area 16, October 1997

Summary Statistics and ANOVA

Transformation = None

Conc.	n	Mean	s.d.	cv%
1 = control	5	.8740	.0391	4.5
2	5	.9560	.0934	9.8
3	5	.8580	.0148	1.7
4	5	.8220	.1026	12.5
5	5	.8780	.0507	5.8
6	5	1.0780	.1089	10.1

*) the mean for this conc. is significantly less than the control mean at alpha = 0.05 (1-sided) by Dunnett's test

Minimum detectable difference for Dunnett's test = -.114713
This difference corresponds to -13.13 percent of control

Between concentrations sum of squares = .215510 with 5 degrees of freedom.

Error mean square = .005907 with 24 degrees of freedom.

Bartlett's test p-value for equality of variances = .016

RADIAN
International LLC

Louisiana Army Ammunition Plant
Chemical Lab

Chemical and Physical Data on: Treated Groundwater from Longhorn Area 16,
for *Pimephales promelas* Chronic Toxicity test

Control	DAY 1	2	3	4	5	6	7	Comments units
Temperature	24.2	24.1	24.5	24.5	22.1	23.4	23.4	degrees Centigrade
D.O. Initial	8.0	8.4	8.1	8.1	8.7	8.8	8.8	mg/L
Final	5.5	4.8	4.1	5.4	5.2	5.3	6.6	
pH Initial	8.3	8.4	8.3	8.4	8.2	8.3	8.3	Standard Units
Final	7.6	7.5	7.5	7.5	7.5	7.6	8.0	
Alkalinity	68.0	68.0	68.0	67.0	66.0	68.0	64.7	mg/L as CaCO3
Hardness	97.9	97.9	97.9	97.9	98.0	97.9	97.9	mg/L as CaCO3
Conductivity	328	323	325	325	327.5	322	343	micromhos/cm

	DAY 1	2	3	4	5	6	7	Comments
Concentration	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	
D.O. Initial	7.8	8.1	7.9	8.6	7.8	8.9	8.1	
Final	5.7	4.9	4.1	5.1	4.5	5.1	6.1	
pH Initial	8.2	8.2	8.3	8.2	8.3	8.3	8.3	
Final	7.6	7.5	7.3	7.6	7.4	7.5	7.6	
Conductivity	395	394	400	393	403	405	413	

	DAY 1	2	3	4	5	6	7	Comments
Concentration	25%	25%	25%	25%	25%	25%	25%	
D.O. Initial	8.0	8.1	7.9	8.4	7.7	8.9	8.1	
Final	5.9	4.5	4.2	5.3	4.6	4.4	6.4	
pH Initial	8.2	8.1	8.2	8.1	8.2	8.2	8.2	
Final	7.6	7.4	7.4	7.5	7.4	7.4	7.6	
Conductivity	625	613	611	607	618	617	621	

100%	DAY 1	2	3	4	5	6	7	Comments
Temperature	24.1	24.8	24.4	24.9	21.6	23.4	23.4	
D.O. Initial	7.9	8.6	7.9	8.3	8.2	8.6	8.7	
Final	6.3	5.1	5.3	5.5	5.4	5.2	6.8	
pH Initial	7.6	7.5	7.5	7.8	7.6	7.6	7.6	
Final	7.2	7	7	7.1	7	7.0	7.1	
Alkalinity	16.5	15.4	16.9	16.5	14.6	16.5	14.8	
Hardness	81.6	81.6	81.6	81.6	81.6	81.9	85.7	
Conductivity	1433	1440	1428	1426	1436	1426	1503	
Initial Temp:	2.8	2.3	3.8	4.0	1.8	1.6	3.5	

Appendix II : Bench Sheets and Chain of Custody form

RADIAN INTERNATIONAL LLC

LOUISIANA ARMY AMMUNITION PLANT
Chemical Laboratory
P.O. Box 658
Doyline, LA 71023

Treated Groundwater from LH Area 16

GW16

Organism: Ceriodaphnia dubia
Source: In-house culture
Age: <24hrs
Food: YCT and Selenastrum capricornutum

Tests: Survival and Reproduction

Date Tests Started: 10/9/97
Time Tests Started: ~~1730~~ 1230 EWT Incubator Temperature: 25.0°C
Investigators: E West Sample Temperature: 2.8°C
J.R. West

Initial Data (Applies for each outfall):

Number of Dilutions including Control: 6
Number of Replicates per Dilution : 10
Number of Organisms per Replicate : 1

Dilution Water Used: MHSF

Treated Groundwater from LH Area 16

RADIAN INTERNATIONAL LLC

LOUISIANA ARMY AMMUNITION PLANT
Chemical Laboratory
P.O. Box 658
Doyline, LA 71023

Ceriodaphnia dubia Observations

Day 1

DATE 10/10/97
TIME 1300
INC TEMP 25.0

DILUTIONS	# of young REPLICATES										# of Live Adults
	A	B	C	D	E	F	G	H	I	J	
CONTROL	0	0	0	0	0	0	0	0	0	0	10
1 6%	0	0	0	0	0	0	0	0	0	0	10
2 12.5%	0	0	0	0	0	0	0	0	0	0	10
3 25%	0	0	0	0	0	0	0	0	0	0	10
4 50%	0	0	0	0	0	0	0	0	0	0	10
5 100%	0	0	0	0	0	0	0	0	0	0	10

Day 2

DATE 10/11/97
TIME 1215
INC TEMP 25.0°C

DILUTIONS # %	REPLICATES										# of Live Adults
	A	B	C	D	E	F	G	H	I	J	
CONTROL	0	0	0	0	0	0	0	0	0	0	10
1 6	0	0	0	0	0	0	0	0	0	0	10
2 12.5	0	0	0	0	0	0	0	0	0	0	10
3 25	0	0	0	0	0	0	0	0	0	0	10
4 50	0	0	0	0	0	0	0	0	0	0	10
5 100	0	0	0	0	0	0	0	0	0	0	10

Day 3

DATE 10/12/97
TIME 0945
INC TEMP 24.9°C

DILUTIONS	REPLICATES										# of Live Adults
	A	B	C	D	E	F	G	H	I	J	
CONTROL	0	0	0	0	0	0	0	0	0	0	10
1 6	4	4	0	5	4	4	4	0	0	0	10
2 12.5	0	0	2	0	0	0	4	0	3	4	10
3 25	0	0	0	2	0	0	0	0	0	5	10
4 50	2	3	0	0	34	0	0	0	1	4	10
5 100	0	2	0	0	0	6	~~4~~0	4	4	0	10

022209

RADIAN INTERNATIONAL LLC

LOUISIANA ARMY AMMUNITION PLANT
Chemical Laboratory
P.O. Box 658
Doyline, LA 71023

GW16, continued

Ceriodaphnia dubia observations

Day 4

DATE 10/13/97
TIME 1300
INC TEMP 24.8°C

DILUTIONS	REPLICATES										
	A	B	C	D	E	F	G	H	I	J	
CONTROL	0	2	2	0	1	3	0	0	4	0	10
1 6	10	7	4	9	7	7	8	4	1	4	10
2 12.5	2	1	7	2	4	0	0	4	5	8	10
3 25	4	4	4	8	0	4	4	2	2	10	10
4 50	X8	0	4	3	7	4	3	2	9	7	9
5 100	3	5	4	3	3	X	0	0	0	2	9

Day 5

DATE 10/14-97
TIME 1200
INC TEMP 24.0°C

DILUTIONS	REPLICATES										
	A	B	C	D	E	F	G	H	I	J	
CONTROL	0	0	0	8	0	0	6	0	0	8	10
1 6	0	0	0	1	0	0	1	4	0	5	10
2 12.5	0	5	0	2	1	8	0	4	2	0	10
3 25	6	0	0	6	5	5	6	0	4	0	10
4 50	—	8	0	1	0	3	6	0	0	0	9
5 100	0	0	4	2	0	—	4	6	9	0	9

Day 6

DATE 10-15-97
TIME 1150
INC TEMP 24.6

DILUTIONS	REPLICATES										# of Live Adults
	A	B	C	D	E	F	G	H	I	J	
CONTROL	4	5	4	3	2	4	1	X	5	0	9
1 6	6	5	3	4	6	6	5	0	5	0	10
2 12.5	5	0	2	0	5	2	5	1	5	6	10
3 25	0	3	5	7	1	0	0	4	0	1	10
4 50	—	3	1	3	5	0	5	4	2	8	9
5 100	0	4	0	0	6	—	X	2	4	3	8

GW16, page 3

Ceriodaphnia dubia observations

DATE 10-16-97
TIME 1800
INC TEMP 24.8

Day 7

DILUTIONS		A	B	C	D	E	F	G	H	I	J	
CONTROL		6	9	4	3	9	5	5	–	5	10	9
1	6	2	5	6	0	5	5	5	4	6	5	10
2	12.5	5	6	5	4	2	7	5	6	7	6	10
3	25	5	4	3	6	3	8	4	4	4	X	9
4	50	–	4	6	3	4	3	2	5	3	7	9
5	100	2	4	2	0	4	–	–	X	3	2	7

DATE 10-17-97
TIME 1015
INC TEMP 24.0

Day 8

DILUTIONS		A	B	C	D	E	F	G	H	I	J	# of Live Adults
CONTROL		2	0	0	0	10	0	0	–	0	10	9
1	6	0	0	8	0	0	0	0	6	2	7	10
2	12.5	5	8	0	6	4	5	0	9	0	1	10
3	25	6	7	0	1	4	7	7	0	7	–	9
4	50	–	0	0	0	0	6	0	5	0	0	9
5	100	0	0	0	1	0	–	–	–	0	0	7

022211

RADIAN INTERNATIONAL LLC

LOUISIANA ARMY AMMUNITION PLANT
Chemical Laboratory
P.O. Box 658
Doyline, LA 71023

Treated Wastewater from
Groundwater Treatment Plant
Area 16 Longhorn AAP
Sampled: 10-9-97
by: James Pratt

Organism: *Pimephales promelas*
Source: Aquatic Bio Systems
Age: <48 hrs
Food: Artemia Napulii (Newly-hatched Brine Shrimp)

Tests: Survival and Growth

Date Tests Started: 10-9-97
Time Tests Started: 1730 Incubator Temperature: 25.0°C
Investigators: J. West Sample Temperature: 2.8°C
E. West

Initial Data (Applies for each outfall):

Number of Dilutions including Control: 6
Number of Replicates per Dilution : 5
Number of Organisms per Replicate : 10

Dilution Water Used: MHSF (Moderately Hard Synthetic Freshwater)

RADIAN International LLC

Louisiana Army Ammunition Plant
Chemical Lab

Pimephales promelas Chronic Survival and Growth Test
Sample: Treated Groundwater from Longhorn Area 16,

Live organisms

Day 1
Date and Time: 10-10-97 ; 1335
Incubator temperature: 25.0 degC

Dilution	Conc.	A	B	C	D	E
CONTRO	0%	10	10	10	10	10
1	6.25%	10	10	10	10	10
2	12.5%	10	10	10	10	10
3	25%	10	10	10	10	10
4	50%	10	10	10	10	10
5	100%	10	10	10	10	10

Day 2
Date and Time: 10/11/97 1130
Incubator temperature: 25.0 degC

Dilution	Conc.	A	B	C	D	E
CONTRO	0%	10	10	10	10	10
1	6.25%	10	10	10	10	10
2	12.50%	10	10	10	10	10
3	25%	10	10	10	10	10
4	50%	10	10	10	10	10
5	100%	10	10	10	10	10

Day 3
Date and Time: 10/12/97 1040
Incubator temperature: 24.9 degC

Dilution	Conc.	A	B	C	D	E
CONTRO	0%	10	10	10	10	10
1	6.25%	10	10	10	10	10
2	12.50%	10	10	10	10	10
3	25%	10	10	10	10	10
4	50%	10	10	10	10	10
5	100%	10	10	10	10	10

Day 4
Date and Time: 10/13/97 1215
Incubator temperature: 24.8 degC ~~1310~~ gpm

Dilution	Conc.	A	B	C	D	E
CONTRO	0%	10	9	10	10	10
1	6.25%	10	10	10	10	10
2	12.50%	10	10	10	10	10
3	25%	10	10	10	10	10
4	50%	10	10	10	10	10
5	100%	10	10	10	10	10

Day 5
Date and Time: 10/14/97 1315
Incubator temperature: 24.0 degC

Dilution	Conc.	A	B	C	D	E
CONTRO	0%	10	9	10	10	10
1	6.25%	10	10	10	10	10
2	12.50%	10	10	10	10	10
3	25%	10	10	10	10	10
4	50%	10	10	10	10	10
5	100%	10	10	10	10	10

RADIAN International LLC

Louisiana Army Ammunition Plant
Chemical Lab

Day 6

Date and Time: 10/15/97 1335
Incubator temperature: 24.8 degC

Dilution	Conc.	A	B	C	D	E
CONTRO	0%	10	9	10	10	10
1	6.25%	10	10	10	10	10
2	12.50%	10	10	10	10	10
3	25%	10	10	10	10	10
4	50%	10	10	10	10	10
5	100%	10	10	10	10	10

Day 7

Date and Time: 10-16-97 ; 1100
Incubator temperature: 24.0 degC

Dilution	Conc.	A	B	C	D	E
CONTRO	0%	10	9	10	10	10
1	6.25%	10	10	10	10	10
2	12.50%	10	10	10	10	10
3	25%	10	10	10	10	10
4	50%	10	10	10	10	10
5	100%	10	10	10	10	10

RADIAN INTERNATIONAL LLC

DATE 10-16-97
TIME 1100
INC TEMP 24.0

LOUISIANA ARMY AMMUNITION PLANT
Chemical Laboratory
P.O. Box 658
Doyline, LA 71023

Oven temperature: 103 °C
Date/Time in: 10-16-97/1130
out:

Dilution	repl.	No.	Final g	Initial g	Total dry g	# of fish	mean dry mg	Avg dry mg
CONTROL	A	1	0.11672	0.10826		10		
	B	2	0.11647	0.10907		9		
	C	3	0.11934	0.10922		10		
	D	4	0.11684	0.10778		10		
	E	5	0.11756	0.10877		10		
# 1	A	36	0.11584	0.10785		10		
	B	37	0.11860	0.10884		10		
	C	38	0.11762	0.10771		10		
	D	39	0.11854	0.10800		10		
	E	40	0.11776	0.10812		10		
# 2	A	41	0.11624	0.10782		10		
	B	42	0.11668	0.10818		10		
	C	43	0.11730	0.10868		10		
	D	44	0.11706	0.10846		10		
	E	45	0.11574	0.10694		10		
# 3	A	46	0.11832	0.10974		10		
	B	47	0.11812	0.10855		10		
	C	48	0.11599	0.10877		10		
	D	49	0.11751	0.10898		10		
	E	50	0.11667	0.10948		10		
# 4	A	51	0.11783	0.10898		10		
	B	52	0.11823	0.10888		10		
	C	53	0.11818	0.10943		10		
	D	54	0.11668	0.10867		10		
	E	55	0.11808	0.10914		10		
# 5	A	56	0.12231	0.11066		10		
	B	57	0.11826	0.10790		10		
	C	58	0.11773	0.10726		10		
	D	59	0.11712	0.10781		10		
	E	60	0.11975	0.10775		10		

RADIAN INTERNATIONAL LLC

Chain of Custody Record

Page 1 of 1

PROJECT LHAAP Karnack Tx 75661 Phase III

SITE GNTP Effluent to Bayou

PREPARED BY (Signature) [signature]

FIELD SAMPLE I.D.	SAMPLE MATRIX	DATE/TIME	MS/MSD	NO. OF CONTAINERS	ANALYSES: Toxicity											REMARKS
LH18/24/16-Outfall	water	10-9-97			2											
LH18/24/16-Bayou	"	"			2											

REMARKS

RELINQUISHED BY:	DATE	TIME
[signature]	10/9	15:00

RECEIVED BY:	DATE	TIME	RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	DATE	TIME	RELINQUISHED BY:	DATE	TIME

LAB USE ONLY

RECEIVED FOR LABORATORY BY:	DATE	TIME	AIRBILL NO.	OPENED BY:	DATE	TIME	TEMP°C	SEAL #	CONDITION
Elizabeth West	10/9/97	1615	N/A	E West	10/9/97	1620			

REMARKS: Filtered Bayou water prior to testing.

IEG-4/FH13-96-30337coc.FH5

022215

022216

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS, TX 75202-2733

January 26, 1998

VIA REGULAR MAIL

James A. McPherson, Commander's Representative
Longhorn/Louisiana Army Ammunition Plant
Attn: SIOLH-CR
P.O. Box 658
Doyline, LA 71023

Re: Longhorn Army Ammunition Plant
Record of Decision for No Further Action at Group 1 Sites

Dear Mr. McPherson:

Please find attached a copy of the signed Record of Decision (ROD) for No Further Action at the Group 1 Sites. This document was signed by Mr. Jerry Clifford, the Environmental Protection Agency's Region 6 Acting Regional Administrator on January 23, 1998.

If you have any questions, please contact me at (214) 665-6758.

Sincerely,

Chris G. Villarreal

Chris G. Villarreal
Project Manager

Attachment

cc: Yolane Hartsfield, COE Tulsa District
Diane Poteet, TNRCC (MC-143)
Oscar Linebaugh, Jr., COE Fort Worth District

022217

RECORD OF DECISION

FOR

NO FURTHER ACTION

AT

GROUP 1 SITES

LONGHORN ARMY AMMUNITION PLANT

KARNACK, TEXAS

JANUARY 1998

022218

GROUP 1 SITES
LONGHORN ARMY AMMUNITION PLANT
RECORD OF DECISION

NO FURTHER ACTION

JANUARY 1998

A. SITE NAME AND LOCATION

Group 1 Sites (Site 1, Inert Burning Grounds; Site 11, Suspected TNT Burial Site; Site 27, South Test Area; Site XX, Ground Signal Test Area), Longhorn Army Ammunition Plant Karnack, Texas.

B. STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected No Further Action alternative for Group 1 Sites, Longhorn Army Ammunition Plant (LHAAP), in Karnack, Texas. This selection is made in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the administrative record for this site.

The State of Texas concurs with the selected remedy. A copy of the concurrence letter is attached (Appendix A).

C. ASSESSMENT OF THE SITES

There are no actual or threatened releases of hazardous substances as a result of previous activities from these sites that may present an imminent and substantial endangerment to public health, welfare, or the environment.

D. DESCRIPTION OF THE SELECTED REMEDY

This Record of Decision addresses No Further Action.

E. STATUTORY DETERMINATION

Based on previous studies and surveys, no remedial action is warranted to protect human health and the environment at Sites 1, 11, 27, and XX. This decision complies with Federal and State applicable or relevant and appropriate requirements and is cost effective. There will be no further action at Group 1 Sites. The following sections discuss how the selected alternative for the Group 1 Sites meet the statutory requirements.

Protection of Human Health and the Environment
Based on an analysis of site data and criteria for performing a risk analysis, it was concluded that the site does not pose an unacceptable risk to human health or the environment.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)
The Remedial Investigation was conducted in accordance with CERCLA as amended by SARA and the National Oil and Hazardous Substances Contingency Plan. Since no further action is being proposed, further compliance with ARARs ends with this document.

Cost Effectiveness
Since no further action is recommended, cost is not an issue.

Use of Permanent Solutions and Alternative Treatment Technologies or resource Recovery Technologies to the Maximum Extent Practicable
Since no further action is recommended, this is not an issue.

Preference for Treatment as a Principal Element
Since no further action is recommended, this is not an issue.

Jerry Clifford
Acting Regional Administrator
EPA Region 6

January 23, 1998
Date

Signature sheet for the foregoing Group 1 Sites No Further Action Record of Decision between the Department of the Army and the U.S. Environmental Protection Agency, with concurrence by the Texas Natural Resource Conservation Commission.

James Fairall, Jr.
COL GS Chief of Staff
U.S. Army Industrial Operations Command

27 Oct 97
Date

022221

Signature sheet for the foregoing Group 1 Sites No Further Action Record of Decision between the Department of the Army and the U.S. Environmental Protection Agency, with concurrence by the Texas Natural Resource Conservation Commission.

David Jollet
Installation Remedial Project Manager

2 Oct 97
Date

Cyril [illegible]
Major Subordinate Command DERP PM

9 Oct 97
Date

[illegible]
Installation/Major Subordinate Command
Legal Advisor

10 Oct. 1997
Date

Stephen D. [illegible]
Installation/Major Subordinate Command
Public Affairs Officer

10 Oct 97
Date

022222

TABLE OF CONTENTS

Figures

ACRONYMS

ARARs	Applicable, Relevant, and Appropriate Requirements
COPC	Chemical of Potential Concern
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
DERP	Defense Environmental Restoration Program
FS	Feasibility Study
FFA	Federal Facility Agreement
INF Treaty	Intermediate-Range Nuclear Force Treaty
IOC	U S. Army Industrial Operations Command
LHAAP	Longhorn Army Ammunition Plant
MEC	Methylene Chloride
mg/kg	milligrams per kilogram
mg/l	milligrams per liter
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
RI	Remedial Investigation
ROD	Record of Decision
SARA	Superfund Amendment and Reauthorization Act of 1986
TNRCC	Texas Natural Resource Conservation Commission
TNT	Trinitrotoluene
TCE	Trichloroethene
µg/kg	micrograms per kilogram
µg/l	micrograms per liter.

DECISION SUMMARY

A. Longhorn Army Ammunition Plant Location and Description

Longhorn Army Ammunition Plant (LHAAP) is located in central east Texas in the northeast corner of Harrison County, approximately 14 miles northeast of Marshall, Texas, and approximately 40 miles west of Shreveport, Louisiana (Figure 1). The installation occupies 8,493 acres between State Highway 43 and the western shore of Caddo Lake and is accessed by State Highways 43 and 134. Site 11, suspected TNT Burial Site, and Site 27, South Test Area, are situated in the south central portion of the facility (Figure 2). Site 1, Inert Burning Grounds, is situated in the extreme northwestern portion and Site XX, Ground Signal Test Area, is located in the southeastern portion of LHAAP.

The installations is situated on gently rolling land with an average slope of three percent towards the northeast. Most of the terrain slopes three percent or less, but slopes as steep as 12 percent are common in the western and northwestern portions of the installation and along the Harrison Bayou flood plain. Elevations on LHAAP vary from 170 to 335 feet above mean sea level (msl).

The facility is located in a region commonly called the Pineywoods, a deep inland extension of the Gulf Coastal Plain that extends into Texas, Louisiana, Arkansas, and Oklahoma. The area is characterized by mixed pine hardwood forests that cover gently rolling to hilly terrain. Mild temperatures and ample rainfall in east Texas provide excellent conditions to support an abundant and diverse plant community. This, in turn, provides a number of niches for a rich faunal community. LHAAP is forested with loblolly and shortleaf pines, a variety of oaks, sweet gum, black tupelo, ash, bald cypress, and a few scattered willows. Pine trees predominate throughout the installation.

Caddo Lake, Caddo Lake State Park, and the small unincorporated town of Karnack border LHAAP. Other surrounding land is forested, with an oil and natural gas field located to the east of the installation along the Louisiana border. Caddo Lake State Park is located approximately west-northwest of the installation and the town of Uncertain is north.

All surface water from LHAAP drains into Caddo Lake via four drainage systems that cross portions of the installation. These systems are known as Saunders Branch, Harrison Bayou, Central Creek, and Goose Prairie Creek.

022225

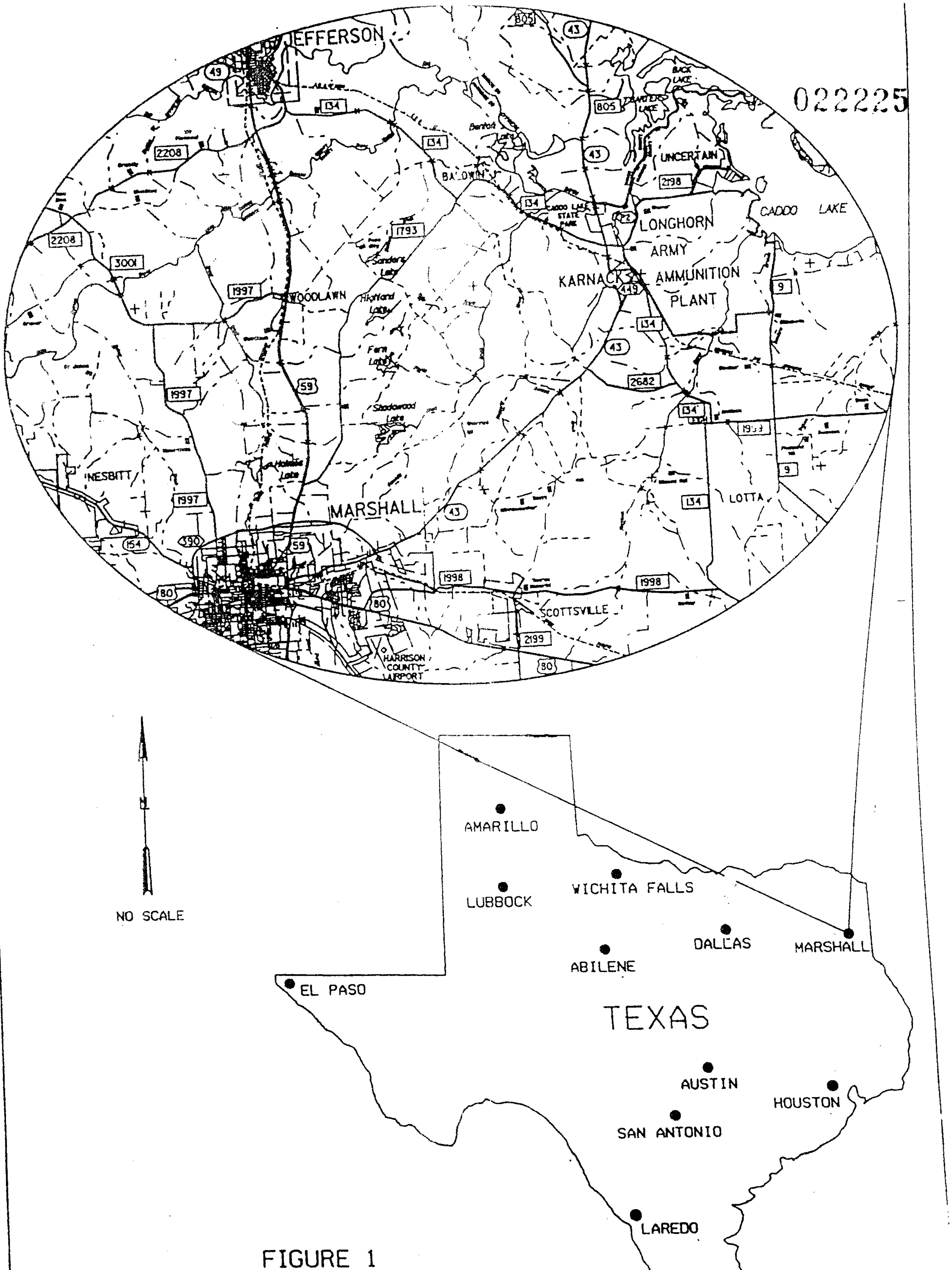
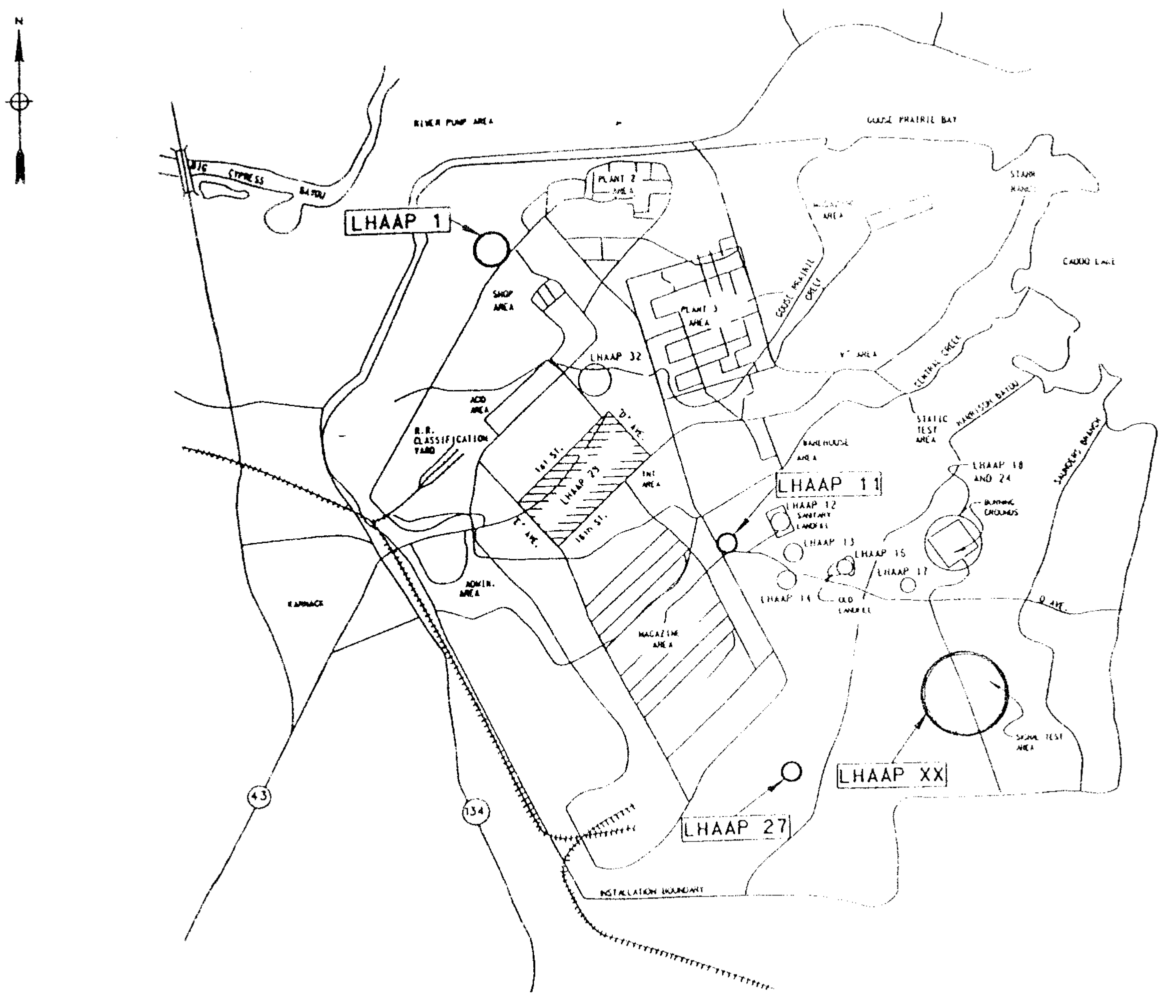


FIGURE 1
LONGHORN ARMY AMMUNITION PLANT AREA MAP
KARNACK, TEXAS

022226



SITES IN THIS INVESTIGATION

LHAAP 11
LHAAP 1
LHAAP XX
LHAAP 27

3000 0 3000 6000
SCALE IN FEET

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

$ THINK VALUE ENGINEERING - IT SAVES MONEY $	
	U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS TULSA, OKLAHOMA
DESIGNED BY:	LONGHORN ARMY AMMUNITION PLANT HARRISON COUNTY, TEXAS
DRAWN BY:	LHAAP SITE LOCATION MAP
CHECKED BY:	
SUBMITTED BY:	FIGURE 2
CHIEF, GEOTECH BR.	

LHAAP is situated on an outcrop of the Wilcox Group, which crops out over a large part of the eastern half of Harrison County. The Wilcox consists mostly of fine- to medium-grained sands interbedded with a considerable amount of clay and seams of lignite. The Wilcox Group is underlain conformably by the predominantly calcareous clay of the Midway Group. Regional dip of the Wilcox is to the northwest into the East Texas Syncline, while the ground surface generally dips to the southeast.

The Wilcox Group has been identified by the Texas Water Development Board as the basal unit of the regional Cypress aquifer, also known as the Carrizo-Wilcox aquifer. The Cypress aquifer outcrops over most of Harrison County and is comprised of, in ascending order, the Wilcox Group, the Carrizo Sand, the Reklaw Formation, and the Queen City Sand. All units are believed to be hydraulically connected. All of these units dip to the northwest into the East Texas Syncline. At LHAAP, only the Wilcox Group of the Cypress aquifer is present.

The availability of groundwater in Harrison County is largely dependent on the hydrologic characteristics of the units comprising the Cypress aquifer. The Wilcox Group outcropping in the area of LHAAP yields small (less than 50 gallons per minute [gpm]) to moderate (50-500 gpm) quantities of fresh water to wells throughout the county. As the basal unit of the Cypress aquifer, the Wilcox is also considered as the base of fresh water in the area. The Midway Group, which does not yield usable quantities of water, tends to serve as a relatively impermeable basement to the overlying water-bearing Wilcox.

B. LHAAP History and Enforcement Activities

Longhorn Army Ammunition Plant was, until 1996, a government-owned, contractor-operated (Longhorn Division of Thiokol Corporation) industrial facility under the jurisdiction of the U.S. Army. Its primary mission was to load, assemble, and pack pyrotechnic and illuminating/signal ammunition and solid propellant rocket motors. The installation is currently inactive, but overseen by the U.S. Army Industrial Operations Command (IOC).

Longhorn Army Ammunition Plant was established in October 1942 with the primary mission of producing trinitrotoluene (TNT) flake in the Plant 1 area. Production of TNT continued through World War II until August 1945 when the plant went on standby status until February 1952. Pyrotechnic ammunition, such as photoflash bombs, simulators, hand signals, and tracers for 40mm ammunition were manufactured at LHAAP from 1952 until 1956. The Plant 3 area rocket motor facility began operation in November of 1955. Production of rocket motors continued to be the primary mission of LHAAP until 1965, when the production of pyrotechnic and illuminating ammunition was re-established.

Recent operations consisted of compounding pyrotechnic and propellant mixtures; loading, assembling and packing activities; accommodating receipt and shipment of containerized cargo. The installation has also been responsible for the static firing and elimination of Pershing I and II rocket motors in compliance with the Intermediate-Range Nuclear Force Treaty in effect between the United States and the former Soviet Union.

As part of the U.S. Army Installation Restoration Program, the installation began an environmental investigation of current and previously used waste disposal sites in 1976. The LHAAP installation was added to the National Priorities List (NPL) on August 9, 1990 (54 Federal Register 35509). After being listed on the NPL, the U.S. Army, U.S. Environmental Protection Agency (EPA), and Texas Natural Resource Conservation Commission (TNRCC) - formerly known as the Texas Water Commission (TWC) - entered into a Comprehensive Environmental Response Compensation, and Liability Act (CERCLA) Section 120 Agreement for remedial activities at the facility. The CERCLA Section 120 Agreement, referred to as the Federal Facility Agreement (FFA), became effective on December 30, 1991.

C. Highlights of Community Participation

The U.S. Army, EPA, and TNRCC have provided public outreach to the community surrounding LHAAP concerning the Group 1 sites on the facility. The outreach program has included fact sheets, site visits, invitations to attend quarterly technical and regulatory review meetings, and public meetings.

Copies of the Administrative Record documents have been made available to the public at several information repository locations, including Karnack High School, EPA Region VI Library, TNRCC, and Marshall Public Library. The Proposed Plan for No Further Action was released to the public on July 21, 1997. Copies of the Proposed Plan were placed at the Karnack Post Office, and the Marshall Library. In addition, copies of the Proposed Plan, Fact Sheet and notice of the upcoming Public Meeting were sent to members of the community that have shown interest in activities at LHAAP and attended other public meetings. Notice of the public meeting was also published in the *Marshall News Messenger*, *Longview News Journal*, and *The Times* in Shreveport. A public comment period was designated from July 21, 1997, to August 20, 1997. A public meeting was held on August 7, 1997, at the Karnack High School. The purpose of the meeting was to discuss the proposed plan and to solicit public comments on the No Further Action alternative for the Group 1 Sites.

Representatives of the U.S. Army, EPA, and TNRCC were present at the public meeting to answer questions. Only one written comment was received during the public comment period. Comments expressed at the public meeting and during the comment period are addressed in the Responsiveness Summary which is attached as Appendix B.

D. Current and Future Health Risks

A human health risk analysis is a procedure which uses a combination of facts and assumptions to estimate the potential for adverse effects on human health from exposure to contaminants found at a particular site. Risks are determined by evaluating known chemical exposure limits and actual chemical concentrations at the site. The actual concentrations are compared to the exposure to a concentration known to have an adverse impact. Carcinogenic risks are expressed in terms of the chance of developing cancer after a lifetime of exposure to the contaminants. Non-carcinogenic risks are based on exposures to concentrations of contaminants greater than concentrations known to have an adverse lifetime non-cancerous impact. Conservative assumptions are used in calculation risks that weigh in favor of protecting human health.

The national risk, or probability, that an individual may develop some form of cancer from everyday sources, over a 70-year life span, is estimated at one-in-four. This one-in-four probability is considered the "natural incidence" of cancer in the United States. To protect human health, the EPA has set the range from one in ten thousand to one in one million (expressed as $1x10^{-4}$ to $1x10^{-6}$) lifetime excess cancer incidents as the remedial goal for Superfund sites. A risk of one in one million means that one person out of one million people could develop cancer as a result of a lifetime exposure to the site contaminants.

The level of concern for non-carcinogenic contaminants is determined by calculating a **hazard index.** If the hazard index exceeds one (1), there may be concern for potential non-cancer effects for lifetime exposure to the site contaminants.

The site-specific risk assessment process begins by evaluating the current site risk, also called the **baseline risk**, posed to human health. Baseline risks are estimated for anticipated land use at a site. This typically involves use of exposure parameters developed for either future industrial or residential land use. Industrial land use parameters assume human exposure occurs over a typical workday and result in lower exposure than residential. Baseline risk assessments for these sites were developed based on future industrial land use.

E. Site 1, Inert Burning Grounds

Location and Description. **Site 1 is approximately 10 acres in size and is lightly timbered. Current vegetation patterns serve as only a rough indication of past disposal areas due to considerable regrowth of trees during the 25 or more years that have elapsed since the site was used for waste disposal. Surface drainage flows in a southeasterly direction to Goose Prairie Creek. Total surface drainage distance from the site to Caddo Lake is approximately four miles via Goose Prairie Creek.**

Site History and Enforcement Activities. The Inert Burning Grounds was originally used during World War II by Monsanto Chemical Company for burning trash, ashes, scrap lumber, and waste from burned 2,4,6-TNT. Bulk 2,4,6-TNT may also have been burned at the site. The site was not used between August 1945 and February 1952 when LHAAP was in a standby status. Universal Match Corporation later used the site to burn wastes, including photo flash powder, for a few years during the 1950s until most burning operations were transferred to the Burning Ground No. 2/Flashing Area (Site 17) located on the installation. Intermittent, small-scale burning operations may have continued at the site into the early 1960s. It is suspected that burning operations were conducted in one or more burn pits or pans that were subsequently filled or covered. Burn residues were most likely not removed. It is also suspected that some wastes may have been dumped without burning and were subsequently covered by or mixed with fill material.

Summary of Site Characteristics. Soils encountered at Site 1 consist of interbedded silty and clayey sands, and sandy silts and clays of the Wilcox Group. Groundwater is encountered at approximately 10 feet below ground surface.

The soil investigations at Site 1 included 115 soil samples from 17 borings. The following compounds were detected in the soil (the concentrations found are shown in parentheses): toluene (6.7 μg/kg), xylene (30.6 μg/kg), styrene (6 μg/kg), acetone (10-32 μg/kg), methylene chloride (7-20 μg/kg), di-n-butyl phthalate (330-3580 μg/kg), and bis (2-ethylhexyl) phthalate (330-1200 μg/kg). The phthalates are a common plastic additive and is most likely a field contaminant resulting from the interaction of decontamination fluids with plastic gloves on the workers (leaching out the phthalate). Methylene chloride and acetone are also common laboratory contaminants. The following metals were detected in the soils (the concentrations found are shown in parentheses): arsenic (0.057-6 mg/kg), barium (17.3-18.8 mg/kg), chromium (1.7-32.1 mg/kg), lead (4-75 mg/kg), nickel (1.5-44.4 mg/kg).

Twelve groundwater grab samples and seven groundwater monitoring well samples (from newly installed wells) were obtained from Site 1 during the RI. The purpose of collecting groundwater grab samples was to obtain preliminary field screening data of potential groundwater contaminants. No explosive or metal contaminants were found in the grab samples. The only explosive to appear in the monitoring well samples was 2,6-dinitrotoluene (2,6 DNT) which was detected at 14 μg/l. Acetone (12 and 19 μg/l) and 2-butanone (11 and 18 μg/l) were also detected. The following metals and anions were detected in the groundwater monitoring wells (the maximum concentrations found are in parentheses): barium (0.19 mg/l), chromium (0.056 mg/l), lead (0.041 mg/l), chlorides (13.3 mg/l), nitrate/nitrite (3.5 mg/l), sulfate (3490 mg/l). All metals detected are approximately at or below background levels.

During the RI, 10 surface water and 13 sediment samples were collected. The only organic compound detected in the surface water at Site 1 was toluene (6.3 μg/l). The following metals and anions were detected in the surface water (the concentrations found are in parentheses): barium (0.052-0.47 mg/l), lead (0.005-0.045 mg/l), chlorides (3.8-17 mg/l), sulfates (2-69.5 mg/l). The following compounds were detected in the sediments (the concentrations found are in parentheses): acetone (57-94 μg/kg), 2-butanone (13 μg/kg), benzoic acid (2300-2700 μg/kg) and methylene chloride (13 μg/kg). No explosive constituents were found in any sample. The following metals and anions were detected in the sediments (the concentrations found are in parentheses): arsenic (0.76-5.1 mg/kg), barium (13.4-88.4 mg/kg), chromium (4.4-21 mg/kg), lead (3.6-13 mg/kg), nickel (1.2-6.3 mg/kg), chlorides (44-1060 mg/kg), sulfates (30 - 74.6 mg/kg).

Summary of Site Risks.

Chemicals of Potential Concern (COPC)
COPCs in site soils and ditch sediments included several organic compounds, a variety of polynuclear aromatic hydrocarbons, and metals. COPCs in groundwater included organics and metals. With the exception of a few chemicals eliminated from evaluation due to detection in blank samples or not detected in verification sampling, all detected chemicals were carried through risk quantification procedures.

Risk Analysis
Based on an analysis of site data and criteria for performing a risk analysis, it was concluded that the conditions at the site do not pose an unacceptable risk to human health.

Ecological Assessment
Based on ecological methodology used in the risk assessment, four metals (antimony, chromium, lead, and nickel) were identified as main contributors to screening-level risk estimates. Further evaluation of data for Site 1 revealed that these metals exist at concentrations approximating background levels for the facility. As such, it is the conclusion of this screening-level assessment that little or no ecological concerns are associated with Site 1 and that further ecological evaluations and remediation are unwarranted.

F. Site 11, Suspected TNT Burial Site

***Location and Description*. The 10-acre site has been inactive since its suspected use in the 1940s (USACE, 1992). The site consists of a relatively flat area of cut grass immediately north of the intersection, bounded by Avenue P on the west, Avenue Q on the south, and the tree line on the north and east. A large forested area extending to Central Creek is present north of the site. Surface drainage from the area flows to ditches along the eastern and western edges of the site, eventually draining to Central Creek. Total surface water flow distance from the site to Caddo Lake via Central Creek is**

approximately three miles. A small depression, about 100 feet wide, exists on the north side of the site.

Site History and Enforcement Activities. Based on previous information collected, bulk trinitrotoluene (TNT) may have been disposed of near the intersection of avenues P and Q during the 1940s. Other than the designation of this location in the early 1980s as the Suspected TNT Burial Site, there is no confirmed documentation that TNT burial occurred at this site.

Summary of Site Characteristics Soils encountered at the site consist primarily of interbedded silty and clayey sands, and sandy silts and clays of the Wilcox Group. Groundwater is encountered at depths of four to 12 feet below ground surface.

The soil investigations at Site 11 included 33 soil samples from nine borings. The following compounds were detected in the soil (the concentrations found are shown in parentheses): methylene chloride (14-32 µg/kg), acetone (23-80 µg/kg), and di-n-butyl phthalate (440-755 µg/kg). Acetone was detected in field blanks indicating field contamination. Di-n-butyl phthalate was found in the laboratory method blank and is a common laboratory contaminant along with methylene chloride. The following metals were detected in the soil (the range of concentrations found are in parentheses): arsenic (0.3 -9.7 mg/kg), barium (1.5 - 167 mg/kg), chromium (1.1 - 18.5 mg/kg), lead (1.6 - 16 mg/kg), nickel (1.5 - 15.1 mg/kg). All metals concentrations are approximately at or below background levels.

Six groundwater grab samples and three groundwater monitoring well samples from newly installed wells were taken at the site during the RI. The purpose of collecting groundwater grab samples was to obtain preliminary field screening data of potential groundwater contaminants. No organic, explosive, or metal contaminants were found in the grab samples except for 0.62 µg/l of 1,3,5-trinitrobenzene. Although the explosive constituent was detected in the grab samples, the explosive contamination was not confirmed in the monitoring well samples. The following metals were detected in the groundwater monitoring wells (the maximum concentrations found are in parentheses): barium (0.139 mg/l), chromium (.049 mg/l), lead (.016 mg/l), and nickel (.051 mg/l). All detected metals concentrations are approximately at or below background levels.

Two surface water and two sediment samples were collected during the RI. The following metals were detected in the surface water (the maximum concentrations found are in parentheses): barium (0.18 mg/l), and lead (0.011 mg/l). The following metals and anions were detected in the sediments: arsenic (3.9 mg/kg), barium (41.7 mg/kg), lead (13 mg/kg), nickel (3.1 mg/kg), chloride (44 mg/kg) and sulfate (30 mg/kg). No organic or explosive type contaminants were detected.

Summary of Site Risks.

Chemicals of Potential Concern (COPC)
A review of data collected during all remedial investigations at Site 11 reveals that the site possesses extremely low levels (if any) of contamination, and evidence of a chemical release at the site is questionable. However, due to detection of low levels of methylene chloride and single detection of two metals exceeding background ranges in site soils, risk evaluations were performed for the site. All detected chemicals were retained as COPC for evaluation of total cumulative risk.

Risk Analysis
Based on an analysis of site data and criteria for performing a risk analysis, it was concluded that the conditions at the site do not pose an unacceptable risk to human health.

Ecological Risk Assessment.
Based on ecological methodology used in the risk assessment, three metals (chromium, lead, and nickel) were identified as main contributors to screening-level risk estimates. Further evaluation of data for Site 11 revealed that these metals exist at concentrations approximating background levels for the facility. As such, it is the conclusion of this screening-level assessment that no ecological concerns are associated with Site 11 constituents and that further ecological evaluations and remediation are unwarranted.

G. **Site 27, South Test Area**

Location and Description. The South Test Area is in the south central portion of LHAAP. The earthen test pad is approximately 2,000 feet southeast of Avenue P and the magazine area. The entrance to the test area is on Avenue P approximately 1,700 feet northeast of its intersection with Avenue E. A deteriorated asphalt and gravel road runs from the entrance to the test pad. The concrete bunkers and observation building previously described are located along the road approximately halfway between the entrance and the test pad. A circular, 50-foot wide fire lane with a 2,000-foot diameter is centered at the test pad. The fire lane was constructed in 1954 and was apparently maintained until the early 1960s. It is now partially overgrown with brush and small trees. Site 27 lies within the Harrison Bayou flood plain. Total surface water flow distance from the site to Caddo Lake via Harrison Bayou is approximately three miles.

The site boundary is based on a study of historical aerial photographs, current vegetation patterns, and field observations. The site covers an area of approximately six acres.

Site History and Enforcement Activities. The South Test Area was constructed in 1954 and was used by Universal Match Corporation for testing photoflash bombs that were produced at LHAAP until about 1956. The bombs were tested by exploding them in the air over an elevated, semi-elliptical earthen test pad within the flood plain of Harrison Bayou. Testing was observed and controlled from a building on a hilltop 1,000 feet west-northwest of the test pad. Bombs awaiting testing were stored in three earth-covered concrete bunkers a few hundred feet west of the observation building.

During the late 1950s, illuminating (signal) devices were disabled within pits excavated in the vicinity of the test pad. During the early 1960s, leaking production items (possibly 3- to 4-pound canisters of white phosphorus) were disabled in the vicinity of the test pad. In the early 1980s, approximately 52,000 one- and two-pound photoflash cartridges were destroyed in a 500-square foot area situated about 300 feet east of the observation building and immediately north of the road extending from the observation building to the test pad. The South Test Area has not been used since the early 1980s.

Summary of Site Characteristics. Soils encountered at Site 27 consist of interbedded silty and clayey sands, and sandy silts and clays of the Wilcox Group. Groundwater is encountered at 7 to 9 feet below ground surface.

The RI soil investigations at Site 27 included 47 soil samples from 14 borings. The following metals were detected in the soil (the range of concentrations found are in parentheses): arsenic (0.4-5.2 mg/kg), barium (9.8-639 mg/kg), chromium (1.6-22.2 mg/kg), lead (2-26.3 mg/kg), nickel (1-18.6 mg/kg). All metals detected are approximately at or below background levels. No explosive compounds or volatile organic compounds were detected in any of the soil samples.

Ten groundwater grab samples and four groundwater monitoring well samples (from newly installed wells) were obtained from Site 27 during the RI. The purpose of collecting groundwater grab samples was to obtain preliminary field screening data of potential groundwater contaminants. No explosive constituents were found in the groundwater grab samples. The following metals and anions were detected in the groundwater monitoring wells (the maximum concentrations found are in parentheses): barium (0.097 mg/l), chromium (.053 mg/l), nickel (.37 mg/l), chloride (3700 mg/l), and nitrate (1.17 mg/l). No explosive, semivolatile or volatile organics were detected in any of the monitoring well samples. All metals detected are approximately at or below background levels.

Four sediment and four surface water samples were collected during the RI. The only organic compound found in the sediments was di-n-butyl phthalate found in two of the samples. The following metals and anions were detected in the sediments (the concentrations found are in parentheses): arsenic (0.7-1.1 mg/kg), barium (39-254 mg/kg), chromium (1.9-5.2 mg/kg), lead (4-9 mg/kg), nickel (2.8-6 mg/kg), nitrate/nitrite (2.17-2.36 mg/kg), sulfate (30-50 mg/kg). No volatiles, semivolatiles, or explosive constituents were found in the surface water. The following metals and anions were detected in the surface water (the concentrations found are in parentheses): barium (0.11-0.29 mg/l), lead (0.015 mg/l), chlorides (15.1-48.7 mg/l), nitrate/nitrite (0.2-0.33 mg/l), sulfate (30-50 mg/l).

Summary of Site Risks.

Chemicals of Potential Concern

COPC in site soils and ditch sediments included several metals at levels approximating background concentrations. COPCs in groundwater included several metals within background ranges and below drinking water maximum contaminant levels (MCLs). Most notable among groundwater COPC was nickel which exceeded its MCL and background levels in all detected samples. No detected chemicals at the site were eliminated from evaluation and all were carried through risk quantification procedures.

Risk Analysis

Based on an analysis of site data and criteria for performing a risk analysis, it was concluded that the conditions at the site do not pose an unacceptable risk to human health.

Ecological Risk Assessment

Based on ecological methodology used in the risk assessment, four metals (barium, chromium, lead, and nickel) were identified as main contributors to screening-level risk estimates in surface and subsurface soils. Further evaluation of data for Site 27 revealed that these metals exist at concentrations approximating background levels for the facility. As such, it is the conclusion of this screening-level assessment that little or no ecological concerns are associated with Site 27 and that further ecological evaluations and remediation are unwarranted.

H. Site XX, Ground Signal Test Area

Location and Description. The Ground Signal Test Area is in the southeastern portion of LHAAP. Access to the site is provided by an asphalt paved road that intersects Long Point Road just east of its intersection with Avenue Q. The access road proceeds in a general south-southeasterly direction for about 0.4 mile to the center of the site and continues for another 0.7 mile to the southern LHAAP boundary. Approximately 70 percent of the site is located within the watershed of Saunders Branch. The remaining 30 percent lies within the watershed of Harrison Bayou. Both of these streams flow into Caddo Lake. The total surface water flow distance from the site to Caddo Lake via Saunders Branch and its tributaries is about 2.0 miles and via Harrison Bayou and its tributaries is about 2.3 miles.

Surface water runoff from Saunders Branch watershed portion of the site is collected by drainage ditches along the circular dirt road forming the outer margin of the site. These ditches converge to form a northeast-trending drainage way that carries the runoff to Saunders Branch. Surface water runoff from the remainder of the site is collected by drainage ditches along the circular road or by the drainage ways extending into the southwestern part of the site. The drainage ditches and drainage ways converge to form a drainage way that conveys the runoff onto the flood plain of Harrison Bayou. The site encompasses an area of approximately 80 acres.

Site History and Enforcement Activities. The Ground Signal Test Area has been used intermittently since April 1963 for aerial and on-ground testing and destruction of a variety of devices, including red phosphorus smoke wedges, infrared flares, illuminating 60 and 81 millimeter (mm) mortar shells, illuminating 40 to 155 mm cartridges, button bombs, and various types of explosive simulators. Prior to the recent rocket motor burn-outs at the site for the INF Treaty, the site was used intermittently over a 20-year period for testing and burn-out of rocket motors from Nike-Hercules, Pershing, and Sargent missiles. About 1970, one of the Sargent rocket motors was inadvertently destroyed when it exploded in an excavated pit near the center of the site just west of the road crossing the site. Debris from the explosion was reportedly placed in the resulting crater and the crater was backfilled. Since late in 1988, the site has also been used for the burn-out of rocket motors in Pershing missiles destroyed in accordance with the INF Treaty between the United States and the former Soviet Union.

Summary of Site Characteristics. Soils encountered at Site XX consist of interbedded silty and clayey sands, and sandy silts and clays of the Wilcox Group. Groundwater is encountered at 10 to 15 feet below ground surface.

The RI soil investigations at Site XX included 18 soil samples from eight borings. The following compounds were detected in the soil (the concentrations found are shown in parentheses): acetone (10,300 μg/kg), trichloroethene (42 μg/kg), and methylene chloride (18 μg/kg). Methylene chloride and acetone are common laboratory contaminants. The following metals were detected in the soil (the range of concentrations found are in parentheses): arsenic (1 -328 mg/kg), barium (20.2 - 227.8 mg/kg), chromium (4.9 - 28.9 mg/kg), lead (4-27.6 mg/kg). All metals are approximately at or below background levels.

Seven groundwater grab samples and two groundwater monitoring well samples were obtained from Site XX during the RI. The purpose of collecting groundwater grab samples was to obtain preliminary field screening data of potential groundwater contaminants. No organic or explosive constituents were detected in any groundwater samples (grab samples or monitoring wells). The following metals and anions were detected in the groundwater monitoring wells (the maximum concentrations found are in parentheses): barium (0.11 mg/l), nickel (0.157 mg/l), sulfates (1622 mg/l), chlorides (1000 mg/l). All metals and anions detected are approximately at or below background levels.

Seven sediment samples and seven surface water samples were collected during the RI. No volatile, semivolatile, or explosive constituents were detected in any of the samples, with the exception of phthalates in four of the sediment samples. Phthalates are a common laboratory contaminant. The following metals and anions were detected in the surface water (the concentrations found are in parentheses): barium (0.06-0.13 mg/l), chlorides (2.6 - 31.0 mg/l), nitrate/nitrites (0.09 - 0.3 mg/l), sulfates (2.0- 32 mg/l). The following metals and anions were detected in the sediments (the concentrations found are in parentheses): arsenic (0.9-3.5 mg/kg), barium (23.3 - 126 mg/kg), chromium (3.5-9.8 mg/kg), lead (4-9 mg/kg), nickel (3.1-14.7 mg/kg). All metals and anions detected are approximately at or below background levels.

Summary of Site Risks.

Chemicals of Potential Concern

COPCs in site soils and ditch sediments included several metals at levels approximating background concentrations. COPCs in groundwater included several metals within background ranges and below drinking water MCLs. Due to failure to detect organic compounds through verification soil-gas sampling, acetone and methylene chloride were eliminated as COPCs.

Risk Analysis

Based on an analysis of site data and criteria for performing a risk analysis, it was concluded that the conditions at the site do not pose an unacceptable risk to human health.

Ecological Risk Assessment

Based on ecological methodology used in the risk assessment, two metals (chromium and nickel) were identified as main contributors to screening-level risk estimates. Further evaluation of data for Site XX revealed that these metals exist at concentrations approximating background levels for the facility. As such, it is the conclusion of this screening-level assessment that little or no ecological concerns are associated with Site XX and that further ecological evaluations and remediation are unwarranted.

I. Summary of the Comparative Analysis of Alternatives

CERCLA regulations require that remedial alternatives be evaluated against nine criteria to determine which alternative(s) provide the best balance between the criteria and, therefore, should be implemented at the site. The following sections present an explanation of the criteria.

Overall Protection of Public Health and the Environment

This criteria addresses the way in which a potential remedy would reduce, eliminate, or control the risks posed by the site to human health and the environment. The methods used to achieve an adequate level of protection may be through engineering controls,

treatment, techniques, or other controls such as restrictions on the future use of the site. 022238
Based on an analysis of site data, and criteria for performing a risk analysis, it was concluded that the sites do not pose an unacceptable risk to human health or the environment. There is no risk identified as a result of past activities.

Compliance with ARARs
Compliance with applicable or relevant and appropriate requirements (ARARs) assures that a selected remedy will meet all related Federal, State, and local requirements. The requirements may specify maximum concentrations of chemicals that can remain at a site; design or performance requirements for treatment technologies; and restrictions that may limit potential remedial activities at a site because of its location. The RI was conducted in accordance with CERCLA as amended by SARA and the National Oil and Hazardous Substances Pollution Contingency Plan. Since no further action is being proposed, further compliance with ARARs ends with this document.

Long-term Effectiveness or Permanence
This criteria addresses the ability of a potential option to reliably protect human health and the environment over time, after the cleanup goals have been accomplished. Although chemicals of concern are identified, future use scenarios are evaluated in the risk assessment and no future remedial activity is found to be necessary. Therefore, this criteria is not applicable.

Reduction of Toxicity, Mobility, or Volume of Contaminants
This criteria assesses how effectively a proposed remedy will address the contamination problem. Factors considered include: the nature of the treatment process; the amount of hazardous materials that will be destroyed by the treatment process; how effectively the process reduces the toxicity, mobility, and volume of waste; and the type and quantity of contamination that will remain after treatment. This criteria is not applicable since no remedial action is warranted.

Short-term Effectiveness
This criteria assesses short-term risks to the workers, the community, and the time factor. Cleanup technologies often require several years for implementation. A potential remedy is evaluated for the length of time required for implementation and the potential impact on human health and the environment during the remedial action. Since no further action is recommended, short term risks of exposure from future response actions are not present.

Implementability
Implementability addresses the ease with which a potential remedy can be put in place. Factors such as technical feasibility and availability of materials and services are considered. Since no further action is recommended, implementability is not an issue.

Cost

Costs (including estimated capital costs required for design and construction and projected long-term maintenance costs) are considered and compared to the benefit that will result from implementing the remedy. Since no further action is recommended, cost is not an issue.

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Regulatory Acceptance

The State has an opportunity to review the documents in the Administrative Record and the Proposed Plan and offer comments. The State may agree with, oppose, or have no comment on the preferred alternatives. TNRCC and EPA have been consulted throughout the investigations at the Group 1 Sites. Both agencies have reviewed the Proposed Plan for No Further Action. The preferred alternative of No Further Action was fully evaluated during the public comment period, and support for the alternative has been indicated.

Community Acceptance

During the public comment period, interested persons or organizations may comment on the alternatives. These comments are considered in making the final remedy selection. The comments are addressed in a document called Responsiveness Summary which is part of the Record of Decision. Community comments will be an important consideration in the final decision for the site. A public meeting was held August 7, 1997 and verbal public comments were received. Only one written comment was received during the public comment period. These comments have been addressed in the Responsiveness Summary included as Appendix B.

J. The Selected Remedy

Based on the information available and studies performed, the U.S. Army believes that no further remedial action is warranted at the Group 1 Sites.

K. Statutory Determination

The primary responsibility at CERCLA sites is to select actions that are protective of human health and the environment. Section 121 of CERCLA requires that the selected action for the site comply with applicable or relevant and appropriate environmental standards established under Federal and State environmental laws, unless a waiver is granted. The selected remedy must also be cost effective. The following sections discuss how the selected alternative for the Group 1 Sites meet the statutory requirements.

Protection of Human Health and the Environment

Based on an analysis of site data and criteria for performing a risk analysis, it was concluded that the site does not pose an unacceptable risk to human health or the environment.

Compliance with Applicable or Relevant and Appropriate Requirements
The RI was conducted in accordance with CERCLA as amended by SARA and the National Oil and Hazardous Substances Pollution Contingency Plan. Since no further action is being proposed, further compliance with ARARs ends with this document.

Cost Effectiveness
Since no further action is recommended, cost is not an issue.

Use of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable
Since no further action is recommended, this is not an issue.

Preference for Treatment as a Principal Element
Since no further action is recommended, this is not an issue.

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APPENDIX A

The State of Texas, Letter of Concurrence

022242

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

September 30, 1997

Mr. Myron O. Knudson, P.E., Director
Superfund Division
U.S. Environmental Protection Agency
Region 6
1445 Ross Avenue
Dallas, TX 75202-2733

RE: Record of Decision for Areas Referred to as the Group 1 Sites Within the Longhorn Army Ammunition Plant

Dear Mr. Knudson:

We have reviewed the proposed Record of Decision (ROD) for No Further Action at the Group 1 Sites within the Longhorn Army Ammunition Plant (LHAAP). We concur that the remedy described in the September 1997 ROD is the most appropriate for these sites.

Based on previous studies and surveys, no remedial action is warranted to protect human health and the environment at LHAAP Group 1 Sites. This decision complies with Federal and State applicable or relevant and appropriate requirements and is cost effective.

Sincerely,

Dan Pearson
Executive Director

DP/dp

P.O. Box 13087 • Austin, Texas 78711-3087 • 512/239-1000

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APPENDIX B

RESPONSIVENESS SUMMARY

NO FURTHER ACTION
GROUP 1 SITES
LONGHORN ARMY AMMUNITION PLANT

NO FURTHER ACTION
GROUP 1 SITES
LONGHORN ARMY AMMUNITION PLANT

This Community Relations Responsiveness Summary provides written responses to comments submitted during the public comment period (21 July to 20 August 1997) regarding the Proposed Plan of Action for Group 1 Sites.

Section I: Background of Community Involvement and Concerns. This section provides a brief history of community interest and concerns raised during the remedial planning activities at the sites.

Section II: Summary of Major Comments Received: The comments (both oral and written) are summarized. The U.S. Army responses are provided.

I. Background of Community Involvement and Concerns

The Proposed Plan of Action was released to the general public on 21 July 1997. The public comment period began 21 July and ended 20 August 1997. A public meeting was held on 7 August 1997 at Karnack High School. The purpose of the meeting was to discuss the proposed plant and to solicit public comments on no further action at the Group 1 Sites. Representatives of the U.S. Army made presentations about the history of the sites and answered public comments during the public meeting. Representatives of the Texas Natural Resource Conservation Commission (TNRCC) attended the meeting and assisted in the responses to public comments. Notice of the comment period and public meeting was given in the *Marshall News Messenger*, *The Times* in Shreveport, and the *Longview News Journal*. Invitation letters and copies of the proposed plan were mailed to previous attendees of public meetings and to people who have shown interest in the Longhorn program.

II. Summary of Major Comments Received

The following comments and questions were received during the comment period and the public meeting. A full account of the public meeting can be found in the public meeting transcripts that are documented in the LHAAP Administrative Record.

1. Written comment received from Mr. Tony N. Williams, City Manager, City of Marshall:

   I am concerned that the proposed plan will make the reuse of the 8,400 acres that is the Longhorn Army Ammunition Plant less likely. Does this proposed plan restrict or delay the Army or others from using the property in any reasonable manner? Would this plan prevent the Army from selling or leasing this acreage and its buildings to others for business or industrial usage in the near future?

I, and many others in the area near Longhorn, want to see this facility creating jobs and other economic benefits. The local economy has been hurt by the loss of jobs from the ammunition plant shut down.

Without a clean environmental survey report, who will buy, lease, or operate a business on these premises?

East Texas needs the property that was the Longhorn Army Ammunition Plant creating jobs to support families.

Response:

The entire acreage comprising Longhorn Army Ammunition Plant is not contaminated. However portions of the installation have: 1) been found to be contaminated; or, 2) are under investigation to determine the presence and extent of contamination, or confirm the absence of contamination. The Army is committed to the clean up of all sites as identified using the RCRA and CERCLA processes and in accordance with EPA and TNRCC rules and regulations.

The Proposed Plan is not a document for citing such restrictions on land use. Any site on the installation which contains known levels of constituents in the groundwater or soil, but the constituents' concentrations are at or near background levels or at levels below risk based levels as established by the EPA or TNRCC is required by Texas law to be deed recorded with such information attached. Much of the Installation will be open for any type of redevelopment once excessed. Any areas meeting this criteria will be deed recorded appropriately, and if restricted, the goal is to restrict to industrial development and use.

2. Comment from public meeting, offered by Ms. Mary Humphrey:

   Ms. Humphrey inquired if PCB's were found on the site.

Response:

   No PCBs were found.

3. Comment at the Public Meeting from Mr. Kelvin Boykins:

   Mr. Boykins general concerns were over the groundwater migrating off-base containing possible constituents that might be damaging to the drinking water supply out of Leigh. Mr. Boykins questioned how the Army was able to adequately characterize all contamination in the groundwater and suggested that monitoring wells be installed outside the base boundary to assure that no contaminants from the installation were outside the boundary. He mentioned discoloration of his drinking water over the past few years.

Response:

Both Mr. McPherson, Commander's Representative Longhorn/Louisiana AAP, and Mr. Jones, TNRCC Region 5, responded to Mr. Boykins' questions. Mr. McPherson explained that the general groundwater flow across the installation was toward Caddo Lake and not in the general direction of the surrounding communities drinking water supply. Mr. Jones and Mr. McPherson further explained to Mr. Boykins that the Army had thoroughly investigated suspect sites on Longhorn AAP and no contamination had been found to migrate off the installation. Mr. Jones added that any suspected contamination, from any source, in the drinking water would be discovered through annual monitoring rounds required by the TNRCC. All of these results are available to the public through the local water supplier or through the Region 5, TNRCC office.

4. Comment from the public meeting provided by Mr. David Carlile:

Mr. Carlile asked whether any sampling, groundwater, surface water or soil borings, had been performed off site. He further stated that he had read in reports in the Marshall Library that perimeter wells on the installation showed low levels of Benzene and TCE above background. Mr. Carlile then asked Mr. Jones if the detection limits the TNRCC used in sampling drinking water wells were low enough to detect levels of constituents that might be harmful to human health.

Response:

Mr. McPherson replied that there has been no sampling of any media beyond the installation boundary. No investigation on post has indicated there to be contamination beyond the plant boundary. As for the perimeter wells, Mr. McPherson stated that he was not aware of the reports that Mr. Carlile was referring to that contained this information. Perimeter wells are sampled quarterly and have never shown any detection of these types of contaminants. Mr. Jones clarified for Mr. Carlile that the detection limits of TNRCC sampling on drinking water wells are low enough to show harmful effects to the receptors.

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APPENDIX C

INDEX OF ADMINISTRATIVE RECORD

DEPARTMENT OF THE ARMY
TULSA DISTRICT, CORPS OF ENGINEERS
P. O. BOX 61
TULSA, OKLAHOMA 74121-0061

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REPLY TO
ATTENTION OF:

CESWT-PP-ME (200-1c)

26 January 1998

MEMORANDUM FOR Commander, Longhorn/Louisiana Army Ammunition Plants, ATTN: SIOLH-OR (Mr. David Tolbert), Post Office Box 658, Doyline, LA 71023

SUBJECT: Draft Work Plan (Part I) and Sampling and Analysis Plan (Part II) for the Group 2 Sites, Phase III Remedial Investigation/Feasibility Study at the Longhorn Army Ammunition Plant, Karnack, Texas

1. Please find enclosed two copies of the subject document

2. If you have any questions, please contact me at 918-669-7530.

Encls

for Yolane Hartsfield
BURL RAGLAND
Lead Project Manager
Army Team

022249

Sverdrup

Final Work Plan
for the
Group 2 Sites, Phase III Remedial Investigation/Feasiblity Study
at the
Longhorn Army Ammunition
Plant (LHAAP)
Karnack, Texas

Submitted to
U.S. Army Corps of Engineers
Tulsa District
CONTRACT NO. DACA56-97-D-0001
Modification No.1 to Delivery Order No. 1

Prepared by
Sverdrup Environmental, Inc.
St. Louis, Missouri

April 1998

DEPARTMENT OF THE ARMY
TULSA DISTRICT, CORPS OF ENGINEERS
P. O. BOX 61
TULSA, OKLAHOMA 74121-0061

022250

REPLY TO
ATTENTION OF:

CESWT-PP-ME (200-1c) 13 January 1998

MEMORANDUM FOR Commander, Longhorn/Louisiana Army Ammunition Plants, ATTN: SIOLH-OR (Mr. David Tolbert), Post Office Box 658, Doyline, LA 71023

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1. Please find enclosed two copies of the subject document for review and comments. The normal review period is 30 days but we respectfully request that your comments be returned by COB 28 January 1998 (phone, fax, or formal) if at all possible. If this schedule creates a problem please contact Ms. Yolane Hartsfield at 918-669-7530 of Cliff Murray at 918-669-7573.

2. Your prompt response after careful review is greatly appreciated.

Burl Ragland
BURL RAGLAND
Lead Project Manager
Army Team

Encls

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LIST of ACRONYMS and ABBREVIATIONS

ARARs - Applicable, Relevant, and Appropriate Federal and State Regulations
ASTM - American Society of Testing Methods
BGS- Below Ground Surface
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act
1,2-DCE - 1,2-Dichloroethylene
DNT - Dinitrotoluene
DQO - Data Quality Objective
EPA - Environmental Protection Agency
EPS- Environmental Protection Systems, Inc.
ERMA - Environmental Regulatory Management
FID - Flame Ionization Detector
HDPE- High Density Polyethylene
ID- Inside Diameter
IDW - Investigation Derived Waste
IRIS - Integrated Risk Information System
LAP- Load, Assemble, and Pack
LEL - Lower Explosive Limit
LHAAP- Longhorn Army Ammunition Plant
MSL - Mean Sea Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NAD - North American Datum
NCP - National Contingency Plan
NGVD- National Geodetic Vertical Datum
NT - Nitrotoluene
OD - Outside Diameter
OSWER - Office of Solid Waste and Emergency Response
PCBs- Polychlorinated Biphenyls
PID - Photoionization Detector
ppm - Parts Per Million
PVC - Polyvinyl Chloride
QA/QC- Quality Assurance/Quality Control
RI/FS- Remedial Investigation/Feasibility Study
SAP- Sampling and Analysis Plan
SSHP- Site Safety and Health Plan
SvE - Sverdrup Environmental, Inc.
Sverdrup- Sverdrup Environmental, Inc.
SVOCs- Semi-Volatile Organic Compounds
SWD - Southwest Division
TAL- Target Analyte List
1,1,1-TCA - 1,1,1-Trichloroethane

TCRA - Time Critical Removal Action
TNB - Trinitrobenzene
TNRCC - Texas Natural Resources Conservation Commission
TNT- 2,4,6-Trinitrotoluene
USACE- U.S. Army Corps of Engineers, Tulsa District
USAEHA- U.S. Army Environmental Hygiene Agency
USATHAMA - U.S. Army Toxic and Hazardous Materials Agency
USCS - Unified Soil Classification System
VOCs- Volatile Organic Compounds
µg/l - micrograms per liter

LIST of FIGURES

LIST of TABLES

SECTION 1.0 INTRODUCTION

The U.S. Army Corps of Engineers, Tulsa District (USACE) contracted with Sverdrup Environmental, Inc. (Sverdrup) to perform a Phase III Remedial Investigation/Feasibility Study (RI/FS) on Group 2 Sites 12, 17, and 29 at the Longhorn Army Ammunition Plant (LHAAP), Karnack, Texas. Sverdrup has prepared this Work Plan as required under the provisions of Modification No.1 to Delivery Order No. 01 of Contract No. DACA56-97-D-0001.

1.1 Purpose

The purpose of this Phase III RI/FS is to further study Group 2 Sites 12, 17, and 29, identified in the Phase II Remedial Investigation, which require additional information in order to fully verify the presence of contaminants and to characterize any releases that may have occurred. It is the intent of this Phase III investigation to complete all field work and provide the necessary information to complete the Remedial Investigation and Feasibility Study. Due to the inherent heterogeneities associated with field investigations, future investigation activities could still be required to completely delineate the full extent of all contamination detected in previous investigations.

The remaining Group 2 Sites (Sites 16, 18/24, and 32) are being addressed separately. A Time Critical Removal Action (TCRA) was initiated at Site 16 in December 1995, and subsequently redesignated as an Accelerated Remedial Investigation/Feasibility Study and Groundwater Treatability Study. This RI/FS and Treatability Study is currently ongoing. An Interim Remedial Action is presently underway at Site 18/24. At Site 32, the need for further investigation activities is currently being evaluated.

This Work Plan presents an overview of how the Phase III field work is to be conducted at Sites 12, 17, and 29, in order to meet the Data Quality Objectives (DQOs) identified for these sites. This overview includes a description of the activities associated with mobilization, site set-up, drilling, well installation, and data collection procedures/methods. Additionally, this overview presents the number and type of borings, and wells to be installed; location of borings, wells, and/or sample points; number and type of samples to be collected; and type of analysis to be performed on collected samples.

Site specific DQOs identified for these Group 2 Sites, which are to be addressed by this Phase III remedial investigation, include the following:

Site 12

- The collection of additional sediment and surface water samples for confirmation sampling of previous detections around the border of the site to define the extent of the impacted area.

- The installation of additional monitoring wells and the collection of groundwater samples to better delineate the extent of groundwater contamination.

Site 17

- The collection of additional sediment and surface water samples in an area in the northeast portion of the site to confirm previous sampling results.

- The collection of shallow soil samples to define the area of apparent incinerated explosive ash disposal north and northwest of monitoring well 17WW03.

- The installation of additional monitoring wells and the collection of groundwater samples to better delineate the extent of groundwater contamination.

Site 29

- The collection of sediment and surface water samples in runoff pathways between the site and Goose Prairie Creek to the east to evaluate potential contaminant migration pathways.

- The collection of shallow soil samples for use in the evaluation of risk in the preparation of a risk assessment of the site.

- The use of direct push technology for the collection of groundwater samples around the former production facilities to evaluate groundwater quality and assist in the determination of locations for new monitoring wells to be installed.

- The installation of additional monitoring wells and the collection of groundwater samples to better delineate the extent of groundwater contamination.

1.2 Work Plan Organization

This Work Plan documents the objectives of the field work activities for the Phase III RI/FS to be performed at Sites 12, 17, and 29 under Modification No. 1 of Delivery Order No.1. The objectives shall be accomplished through the installation of monitoring wells and the collection and analysis of soil, surface soil, sediment, surface water, and groundwater samples. The following is a summary of information provided:

Section 1.0	Purpose and organization of Work Plan.
Section 2.0	General information on facility location and background; site location, history, and background and a summary of previous investigations.
Section 3.0	Summary of field investigation activities.
Section 4.0	Summary of field operations
Section 5.0	Summary of Feasibility Study activities.
Section 6.0	Summary of Baseline Risk Assessment activities.
Section 7.0	Project schedule and schedule of deliverables

The data quality procedures and techniques to be used for the investigation and study are discussed in the Sampling and Analysis Plan (SAP) presented in Part 2 of this document. The following is a summary of information provided in the SAP:

Section 1.0	Report and Project Quality Assurance/Quality Control (QA/QC) Organization
Section 2.0	Summary of the Data Quality Objectives (DQOs) for this project.
Section 3.0	Summary of the field QA/QC procedures and techniques.
Section 4.0	Summary of sample handling and testing.
Section 5.0	Discusses sample integrity.
Section 6.0	Discusses data reduction, validation and reporting
Section 7.0	Discusses audits.
Section 8.0	Discusses corrective actions.
Section 9.0	References.
Appendix A	Forms
Appendix B	Analytical Tables

1.3 Project Organization

The USACE will use a multi-disciplinary project team to oversee all project activities. Project management will be performed by USACE. Project activities will be performed by contractors to USACE. This organizational structure is shown in Figure 1-1.

Field operations will be conducted by either Sverdrup or USACE personnel. Sverdrup will be responsible for field and office activities included in the scope of work. All subcontractors contracted by Sverdrup to perform field activities task will comply with all aspects of the Project Work Plan, SAP, and Site Safety and Health Plan (SSHP).

FIGURE 1-1:
ORGANIZATIONAL STRUCTURE
FOR THE PHASE III RI/FS OF THE GROUP 2 SITES.

LHAAP
Project Manager
Dave Tolbert

USACE
Project Manager
Yolane Hartsfield

USACE
Technical Manager
Cliff Murray

Sverdrup Environmental, Inc.
Project Manager
David Bockelmann

SECTION 2.0 SITE BACKGROUND, PHYSICAL SETTING and PREVIOUS INVESTIGATIONS

This section presents general information regarding the location, history, climatology, and physiography of LHAAP. Additionally, this section discusses the specific location, history, geology, hydrogeology, and previous investigation results of Sites 12, 17, and 29.

2.1 LHAAP General Information

2.1.1 Location

LHAAP is located in central east Texas in the northeast corner of Harrison County, approximately 14 miles northeast of Marshall, Texas, and approximately 40 miles west of Shreveport, Louisiana. The installation occupies 8,493 acres between State Highway 43 and the western shore of Caddo Lake. State Highways 43 and 134 access the installation. A location map is shown on Figure 2-1.

2.1.2 History and Description

LHAAP is a government-owned, contractor-operated industrial facility under the jurisdiction of the U.S. Army Armament, Munitions, and Chemical Command. Its primary mission was to load, assemble, and pack (LAP) pyrotechnic and illuminating/signal ammunition and solid propellant rocket motors. The general layout of LHAAP is shown in Figure 2-2.

Longhorn Army Ammunition Plant was established in October 1942 with the primary mission of producing 2,4,6-trinitrotoluene (TNT) flake in the TNT Production Area. Monsanto Chemical Company was the first contract operator of the plant. Production of TNT continued through World War II until August 1945 when Monsanto's role ceased. The plant was placed on standby

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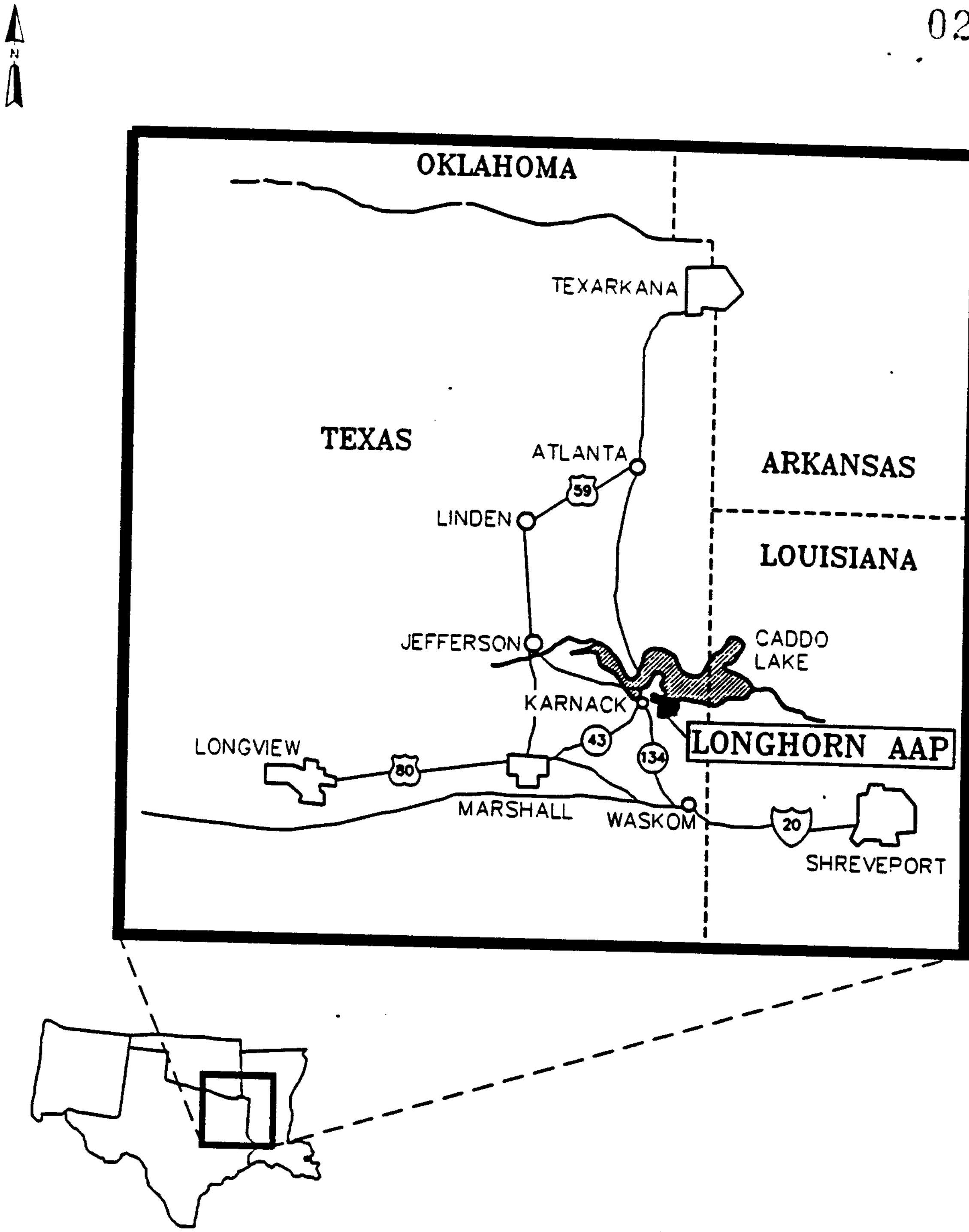

US Army Corps of Engineers Tulsa District

Sverdrup ENVIRONMENTAL

VICINITY MAP
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

DWN:	DES.:	PROJECT NO.: 000187
CHKD:	APPD:	FIGURE NO.: 2-1
DATE JUNE 97	REV.:	

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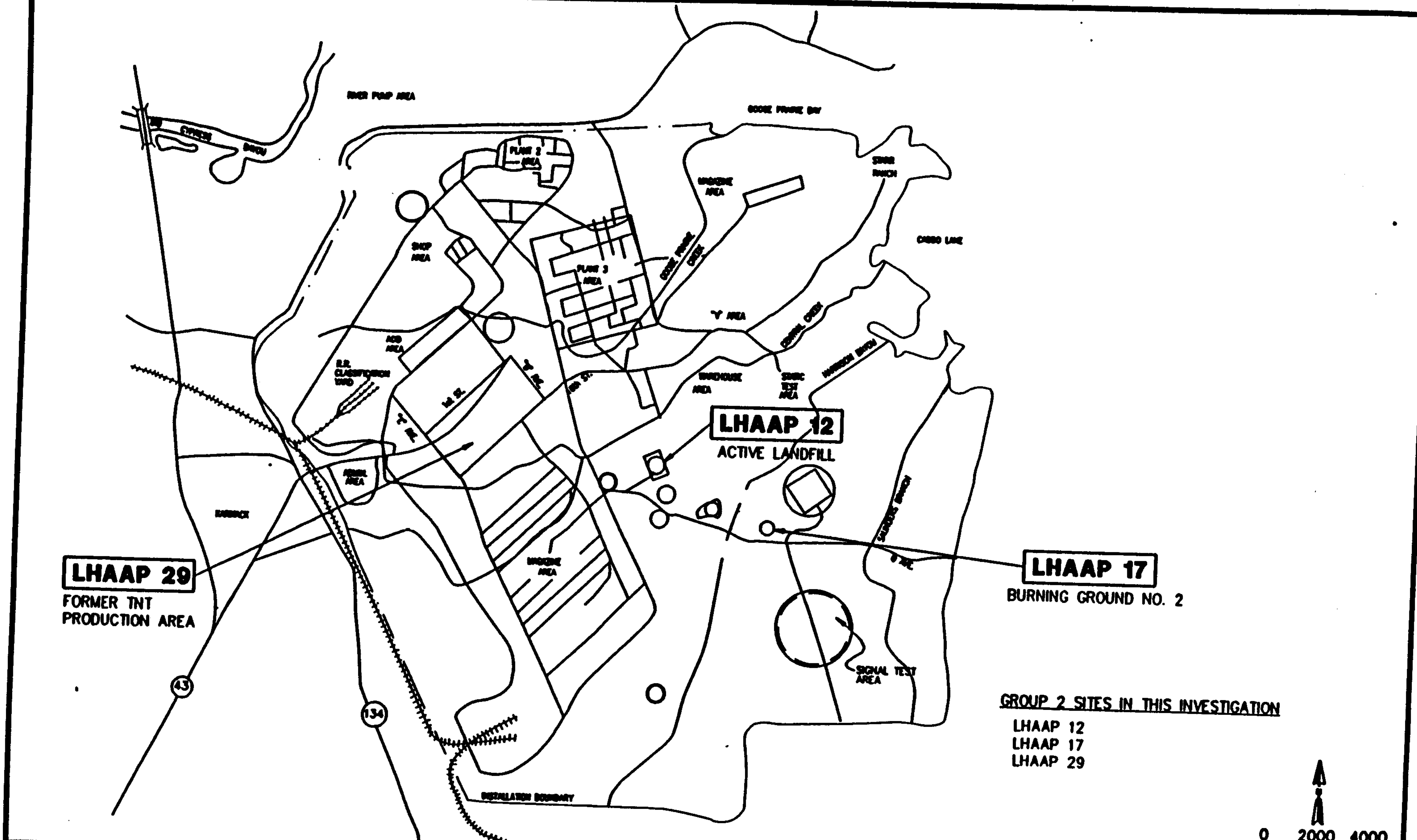

US Army Corps of Engineers Tulsa District

Sverdrup ENVIRONMENTAL

FACILITY
LAYOUT MAP
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

DWN:	DES.:	PROJECT NO.: 000187
CHKD:	APPD:	
DATE: NOV 97	REV.:	FIGURE NO.: 2-2

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status until February 1952. From 1952 until 1956, Universal Match Corporation was the operating contractor, producing pyrotechnic ammunition such as photoflash bombs, simulators, hand signals, and 40 mm tracers.

In November 1955, Thiokol Corporation began operation of the Plant 3 area rocket motor facility. Thiokol Corporation assumed responsibility for total operation of the plant with the departure of Universal Match Corporation in 1956. Production of rocket motors continued to be the primary mission of LHAAP until 1965, when the production of pyrotechnic and illuminating ammunition was reestablished. These operations consisted of compounding pyrotechnic and propellant mixtures, load, assembly, and packing (LAP) activities, accommodating receipt and shipment of containerized cargo, and the maintenance and/or layaway of standby facilities and equipment for mobilization planning. The installation has also been responsible for the static firing and elimination of Pershing I and II rocket motors in compliance with the Intermediate-Range Nuclear Force Treaty in effect between the United States and the former U.S.S.R.

2.1.3 Climatology

LHAAP is located in a moist, subhumid to humid, mild climate. The average annual rainfall is 46 inches. Precipitation is fairly evenly distributed throughout the year, although summer and fall are frequently drought seasons, and December through May are often the wettest months. Precipitation is usually in the form of rain and on rare occasions as snow.

2.1.4 Physiography

LHAAP is characterized by mixed pine-hardwood forests that cover gently rolling to hilly terrain with an average slope of 3 percent towards the northeast. Most of the terrain at LHAAP slopes 3 percent or less, but slopes as steep as 12 percent are common in the western and northwestern portions of the installation and also along the Harrison Bayou floodplain (See Figure 2-2). LHAAP is surrounded by pine-hardwood forests and agricultural land. The northeastern border is formed by Caddo Lake and Goose Prairie Bayou. Ground surface elevations on LHAAP vary from 170 ft to 335 ft above Mean Sea Level (MSL) as referenced to the National Geodetic Vertical Datum (NGVD), 1929.

All surface water from LHAAP drains northeastwardly into Caddo Lake via four drainage systems: Saunder's Branch, Harrison Bayou, Central Creek, and Goose Prairie Creek. Caddo Lake is a part of Big Cypress Bayou, into which a small portion of the northwest corner of the installations drains. Saunder's Branch of Martin's Creek flows onto LHAAP near the southeast corner of the installation and flows northward into Caddo Lake. Approximately 11 percent of the heavily wooded eastern section of the plant is drained by this system. Harrison Bayou enters LHAAP on the southern edge of the installation. The bayou carries 30 percent of the surface drainage of LHAAP and bisects the installation in a northeasterly direction. Central Creek enters LHAAP on its western edge just south of the town of Karnack. Approximately 29 percent of the surface drainage from the installation is carried to Caddo Lake via this drainage course. The headwaters of Goose Prairie Creek are located near the northwest corner of the plant and consist of one large creek and several smaller tributaries. Goose Prairie Creek flows across the northern edge of the installation and drains approximately 30 percent of LHAAP.

2.2 SITE 12 (Active Landfill) Information

2.2.1 Description

The Active Landfill was established in 1963 and was used for the disposal of industrial solid wastes, and possibly hazardous wastes, generated at LHAAP. From 1978, the landfill was used continuously for the disposal of non-hazardous industrial solid waste until its closure in April 1994.

Site 12 is located in the central portion of LHAAP and covers an area of approximately 7 acres, as shown on Figure 2-2. The center of the site is about 1,700 ft east-northeast of the intersection of Avenue P and Avenue Q. The entrance to the site's graveled access road is on Avenue Q about 0.2 mile east of Avenue P.

2.2.2 Site Geology/hydrogeology

General soil and geologic maps indicate that the site is situated on the outcrop of the Wilcox Group. The Wilcox materials at the site generally consist of a few feet of residually-derived soils overlying interbedded silty and clayey sands, and sandy silts and clays. Excavations at the site removed some of the residual soils and exposed the underlying sands, silts, and clays. Most of the excavated materials were later replaced with waste and soil fill materials.

Surficial soils generally range in thickness from 0 to 3.5 ft and consist of brown and gray clayey silt grading into a brown sandy clay. Below the surficial soils, a moist, brown to reddish brown sandy clay ranging from 3 to 10 ft thick is typically encountered across LHAAP 12. Extending below this zone to depths ranging from 6 to 17.5 ft below ground surface (BGS) is a saturated silty, sometimes clayey, brown and gray sand. A clay layer, which may locally act as an aquitard to groundwater movement, was encountered within the suspected boundary of the landfill at approximately El. 172 to 180 ft NGVD. This clay layer was not encountered in borings for wells 12WW05 and 12WW07, however. Fill material, consisting of debris mixed with gray, clayey sandy silt, was encountered in borings for wells 12WW03 and 12WW04. The fill material was encountered at depths from 5 to 10 ft BGS in 12WW03 and from 10 to 18 ft BGS in 12WW04. These borings were located near the suspected centerline of the landfill. Seven groundwater monitoring wells (12WW01 through 12WW07) were drilled and installed during the Phase 1 RI, and information from these wells, coupled with information from two previously installed monitoring wells, were utilized to investigate the shallow aquifer of LHAAP 12.

During previous investigations, groundwater elevation measurements were also collected at each of the fourteen existing monitoring wells (12WW01 through 12WW12, 12-103, & 12-121), on June 17 and 18, 1995, and are presented in Table 3.1, Page 3-2, of the Phase II, Group II Field Summary Report (Sverdrup 1996). With the exception of monitoring well 12WW11, which was installed below the first clay layer, the majority of the Site 12 monitoring wells were completed in the first saturated zone encountered in each borehole. Within portions of the site a shallow clay layer was encountered which may act as a basal aquitard between the shallow saturated zone and intermediate saturated zone. This clay layer was found to be continuous across the site with the exception of monitoring well 12WW05 and 12WW07 located at the landfills western boundary. The June 1995 potentiometric measurements indicate the shallow groundwater gradient is to the northeast as depicted in Figure 3-3 in the Phase II, Group II Field Summary Report (Sverdrup 1996).

Rising head hydraulic conductivity test (slug test) were executed on several of the previously installed monitoring wells. The average hydraulic conductivity value calculated from the slug test data is 1.67 E-03 cm/sec.

2.2.3 Previous Investigations

Site 12 was originally investigated in 1980 by the U.S. Army Environmental Hygiene Agency (USAEHA) with the installation of 4 monitoring wells and the collection of groundwater samples. In 1982, 2 additional wells were installed by Environmental Protection Systems, Inc. as part of a "LHAAP Contamination survey", and all 6 monitoring wells were sampled. A series of surface water and sediment samples were then collected by Thiokol Corporation in the spring of 1991. In 1993, SvE conducted Phase I of a Remedial Investigation at Site 12 which included the installation of 7 additional monitoring wells and the collection of additional sediment and surface water samples for chemical analysis. Based upon the results of the Phase I investigation, a Phase II RI was conducted in 1995 by SvE which included the collection of subsurface soil samples for geotechnical analysis, a downhole geophysical survey, groundwater sampling, and the installation of 5 new monitoring wells and the abandonment of 5 existing wells. A detailed discussion of each of the previous investigations conducted at Site 12 is presented in Section 3.0, of the Phase II, Group II Field Summary Report (Sverdrup 1996).

2.2.4 Historical Data Summary

Results of previous investigations indicated the presence of primarily volatile organics and explosive compounds along with trace amounts of metals detected in groundwater, surface water and sediment samples. A summary of the maximum concentrations of detected contaminants is presented in Table 2.1. A detailed listing of previous investigation results is presented in Section 3.0, of the Phase II, Group II Field Summary Report (Sverdrup 1996) along with Figures presenting contaminant concentrations in Section 9.0 of the Field Summary Report. Previous investigation sample locations are presented in Figure 2-3.

Volatile organics including Trichloroethene (TCE), 1,2-Dichloroethene (1,2-DCE), and 1,1,1-Trichloroethane (1,1,1-TCA) were detected in groundwater samples from the shallow monitoring well 12WW12 located on the north side of the old landfill. Additional groundwater samples collected from Geoprobe points on the northeast side of the landfill also indicated the presence of volatile organics in the shallow groundwater in this portion of the landfill, primarily in the vicinity of well 12WW12. Acetone, 2-butanone, toluene, xylene, and ethylbenzene were also detected in soil samples collected at the previously plugged and abandoned monitoring well location 12WW04, located in the center of the landfill. Acetone was also detected in a surface water sample collected at location 12SW12. Acetone is a chemical commonly used in laboratory procedures and its presence may be the result of laboratory induced contamination. Trace amounts of explosives were detected in several monitoring well samples (BH-18, 121, and 12WW06) in the south and central portions of the landfill, and in a surface water sample collected at location 12SW07. Explosive compounds were also detected in numerous Geoprobe groundwater samples collected on the northeast side of the landfill. Metals including barium and chromium were detected in soil samples collected at locations 12SD03 and 12SB02.

Thus based upon these previous investigation results, additional groundwater monitoring wells are required on the northeast side of the landfill to fully delineate the extent of groundwater contamination along with the collection of additional sediment and surface water samples to completely evaluate the surface water runoff from the landfill.

TABLE 2.1
SUMMARY OF COMPOUNDS
DETECTED IN PRE-PHASE III INVESTIGATIONS
SITE 12

ANALYSES	COMPOUNDS	MAXIMUM DETECTED CONCENTRATION	MAXIMUM CONCENTRATION LOCATION
GROUNDWATER SAMPLES			
VOCs (Units: µg/l)	2-Butanone	11	121
	Chlorobenzene	7 J	12WW12
	1,2-Dichloroethene, Total	122	12WW12
	Methylene Chloride	45	103
	1,1,1-Trichloroethane	66	103
	Trichloroethene	495	12WW12
SVOCs (Units: µg/l)	1,1'-Bicyclohexyl	11	BH-19
	bis(2-ethylhexyl)phthalate	15	12WW01
Explosives (Units: µg/l)	1,3-DNB	2.25	BH-18
	2-amino-4,6-DNT	0.56	12WW06
	4-amino-4,6-DNT	0.78	121
	2-NT	1.4	121
	RDX	2.27 J	12WW01
	1,3,5-Trinitrobenzene	17	121
	2,4,6-TNT	2.5	121
Metals (Units: mg/l)	Aluminum	0.361	MW-103
	Arsenic	0.0132 J	12WW07
	Barium	1.63	12WW09
	Cadmium	0.01152	103, 121
	Chromium	2.42	12WW09
	Lead	0.09 J	12WW 09
	Manganese	1.99	BH-17
	Nickel	1.36	12WW 09
	Strontium	1.16	BH19
Anions (Units: mg/l)	Chloride	2,725	BH19
	Nitrate	0.6	12WW06
	Phosphates	1.89	BH-17
	Sulfate	409	121

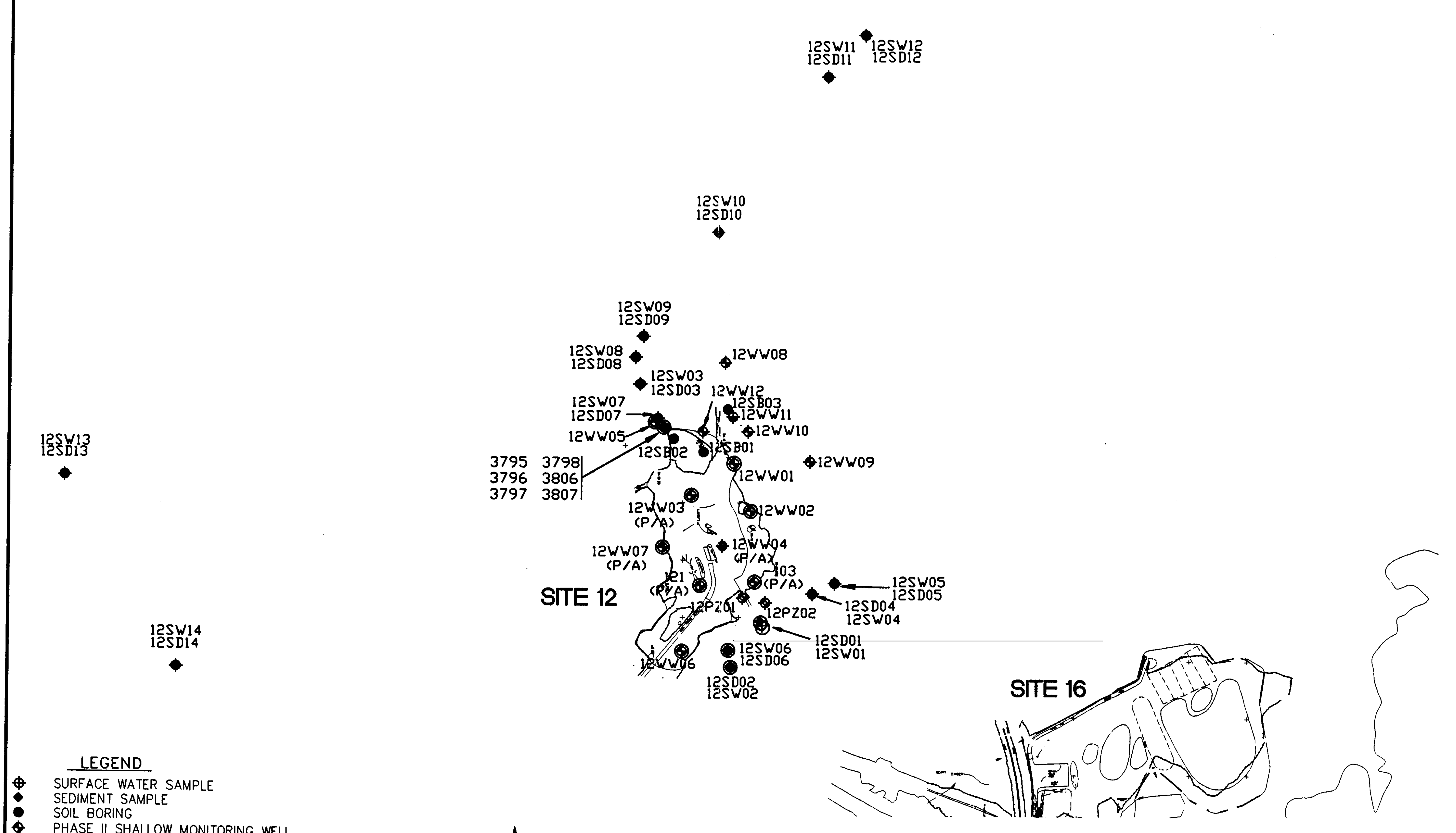
TABLE 2.1
SUMMARY OF COMPOUNDS
DETECTED IN PRE-PHASE III INVESTIGATIONS
SITE 12

ANALYSES	COMPOUNDS	MAXIMUM DETECTED CONCENTRATION	MAXIMUM CONCENTRATION LOCATION
SURFACE WATER SAMPLES			
VOCs (Units: µg/l)	Acetone	10	12SW12
	Methylene Chloride	17	12SW11
Explosives (Units: µg/l)	1,3-DNB	0.64	12SW07
Metals (Units: mg/l)	Barium	0.272	12SW05
	Cadmium	0.00674	12SW03
	Copper	0.009	12SW14
	Lead	0.00575	12SW01
	Zinc	0.039	12SW05
Anions (Units: mg/l)	Chloride	4.6	12SW03
	Nitrate	5.47	12SW02
	Sulfate	2.1	12SW01
SEDIMENT SAMPLES			
VOCs (Units: µg/kg)	Acetone	52	12SD07
SVOCs (Units: µg/kg)	Di-n-butyl phthalate	1800 B	12SD03
Metals (Units: mg/kg)	Antiomony	1.54 J	12SD13
	Arsenic	10.3 J	12SD01
	Barium	384 J	12SD03
	Cadmium	6.27 J	12SD10
	Chromium	24.7	12SD03
	Copper	11.4	12SD13
	Lead	16.6	12SD06
	Nickel	11.4 J	12SD03
	Selenium	0.62	12SD12
	Thallium	4.11	12SD03
Anions (Units: mg/kg)	Zinc	42.7	12SD07
	Chloride	137	12SD03
	Sulfate	88.6	12SD03

**TABLE 2.1
SUMMARY OF COMPOUNDS
DETECTED IN PRE-PHASE III INVESTIGATIONS
SITE 12**

ANALYSES	COMPOUNDS	MAXIMUM DETECTED CONCENTRATION	MAXIMUM CONCENTRATION LOCATION
SOIL SAMPLES			
VOCs (Units: µg/kg)	Acetone	1364 J	12WW 04A(10-11)
	2-Butanone	110	12WW04A(10-11)
	Ethylbenzene	68	12WW 04A(10-11)
	2-Hexanone	15	12WW04A(10-11)
	Methylene Chloride	11	12WW02(20-22)
	4-Methyl-2-pentanone	23	12WW04A(10-11)
	Tetrachloroethene	9.8	12SB02(1-2)
	Toluene	73	12WW03(5-6)
	Xylene, Total	109	12WW 04A(10-11)
SVOCs (Units: µg/kg)	Bis(2-ethylhexyl) phthalate	5000	12WW 07(10-12)
	Butyl benzyl phthalate	2700	12WW01(5-7)
	Di-n-butyl phthalate	5300	12WW 03(0-2)
Metals (Units: mg/kg)	Arsenic	16.1	12WW02(0-2)
	Barium	436 J	12WW02(5-7)
	Chromium	30.3	12SB02(1-2)
	Lead	37.6	12WW03(5-6)
	Nickel	38 J	12WW02(5-7)
	Silver	1.31	12WW03(0-2)
	Thallium	1.85	12WW05(10-12)
	Mercury	0.14	12WW03(5-6)
Anions (Units: mg/kg)	Chloride	390	12WW01(10-12)
	Nitrate	0.3	12WW03(5-6)
	Sulfate	451.1	12SB02(1-2)

B - The analyte was detected in an associate blank (Organics Only).
J - Analyte positively identified, but the concentration was approximate.
Sources: " LHAAP RI/FS Work Plan", Volume 1, June 1992 & "LHAAP RI/FS Field Investigation Summary Report", February 1994.



LEGEND

- SURFACE WATER SAMPLE
- SEDIMENT SAMPLE
- SOIL BORING
- PHASE II SHALLOW MONITORING WELL
- PHASE II DEEP MONITORING WELL
- PHASE II PIEZOMETER
- PRE-PHASE II SHALLOW MONITORING WELL
- PRE-PHASE II SURFACE WATER AND SEDIMENT SAMPLE
- (P/A) PLUGGED AND ABANDONED AFTER PHASE II SAMPLING

US Army Corps of Engineers Tulsa District

Sverdrup ENVIRONMENTAL

SITE 12
ACTIVE LANDFILL SITE MAP
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

DWN: BSM	DES.:	PROJECT NO.: 000187
CHKD:	APPD:	
DATE: NOV 97	REV.:	FIGURE NO.: 2-3

P:\SVE_CLNT\TULSA\LH_02\GEO\MAPS\MLHN206.DWG

2.3 SITE 17 Burning Ground No.2/Flashing Area

2.3.1 Description

Site 17 is located in the southeastern quadrant of LHAAP, as shown in Figure 2-2, at the intersection of Long Point Road and Avenue Q and immediately southwest of Site 18. The site is located within a heavily wooded section of LHAAP. The site has two 185 ft by 305 ft cleared areas separated by a gravel access road. The site is relatively flat and is covered with grass and scattered brush.

Burning Ground No. 2/Flashing Area was used for burning bulk TNT, photo flash powder, and reject material when LHAAP was operated by Universal Match Corporation. In 1959, all of the materials removed from the TNT Production Area (Site 29) and the TNT Waste Disposal Plant (Site 32) during razing were burned and/or flashed at this site. The site was then used until 1980 as a flashing area to decontaminate recoverable metal by-products. Burning trenches were located around the inside perimeter of the previously fenced area and within the open area on the western side of the site. As each trench filled with ash, it was covered and a new trench was excavated. The waste residues were reportedly removed in 1984 and the site was allowed to revegetate. The site is presently inactive.

2.3.2 Site Geology/Hydrogeology

The site is located within the 100-year floodplain of Harrison Bayou which is consistent with the alluvial deposits identified in the soil borings completed at Site 17. In the boreholes for monitoring wells 17WW03, 17WW04, and 17WW06 a silty to clayey sand was encountered at the surface and extended to depths ranging from 5 - 20 ft. The remaining borehole locations contained surficial soils which consisted of clayey silt grading to a silty clay and extended to a maximum depth of 15 ft. This soil material is underlain by a silty to clayey sand deposit. A sandy silt to silty clay layer was encountered below the sand deposit in each of the Phase II RI boreholes. In soil boring 17SB08, the sandy silt layer was interbedded with clay and sand lenses and extended to a depth of 50 ft. A thick, fine to medium grained sand deposit extended from 50 - 151 ft in depth. Soil boring 17SB08 was terminated at a depth of 152 ft in a dense, dark gray clayey shale, the Midway Formation, which was first encountered at a depth of 151 ft.

Groundwater elevation measurements were collected at seven of the existing monitoring wells (17WW01 through 17WW06, and 130) and are presented in Table 5.2, Page 5-11, of the Phase II, Group II Field Summary Report (Sverdrup 1996). With the exception of monitoring well 17WW05, which was completed as a deep monitoring well, the remainder of the Site 17 monitoring wells were completed in the first saturated zone encountered in each borehole. Within portions of the site, a shallow clayey silt to silty clay layer was encountered which may act as a basal aquitard between the shallow saturated zone and the intermediate saturated zone. The potentiometric measurements indicate that the shallow groundwater gradient is to the west-northwest, as shown in Figure 5-3, in the Phase II, Group II Field Summary Report (Sverdrup 1996).

Rising head hydraulic conductivity test (slug test) were executed on several of the existing monitoring wells. Hydraulic conductivity values calculated from slug test data yield an average hydraulic conductivity value of 3.15 E-3 cm/sec in the shallow saturated zone.

2.3.3 Previous Investigations

Site 17 was originally investigated in 1984 by Environmental Protection Systems, Inc. (EPS) for the U.S. Army Toxic and hazardous Material Agency (USATHAMA) with the installation of one shallow monitoring wells. An additional site investigation was conducted in 1987 by EPS for Thiokol Corporation which included 7 soil borings and the collection of soil samples for chemical analysis. In 1993, SvE conducted Phase I of a Remedial Investigation at Site 17 which included the installation of 1 additional monitoring well and the collection of groundwater, surface water, sediment, and soil samples for chemical analysis. Based upon the results of the Phase I investigation, a Phase II RI was conducted in 1995 by SvE which included the installation of 5 additional monitoring wells and the collection of additional surface water, sediment, subsurface soils, and groundwater samples. A detailed discussion of each of the previous investigations conducted at Site 17 is presented in Section 5.0 of the Phase II, Group II Field Summary Report (Sverdrup 1996).

2.3.4 Historical Data Summary

Results of previous investigations indicated the presence of primarily volatile organics, explosive compounds, and metals, detected in the groundwater, surface water and sediment samples collected at Site 17. A summary of the maximum concentrations of contaminants detected is presented in Table 2.2. A detailed listing of previous investigation results is presented in Section 5.0 of the Phase II, Group II Field Summary Report (Sverdrup 1996) along with Figures presenting contaminant concentrations in Section 9.0 of the Field Summary Report. Previous investigation sample locations at Site 17 are presented in Figure 2-4.

Volatile organics including TCE, and 1,2-DCE, were detected in groundwater and soil samples from monitoring well 17WW01 located in the west-central portion of the site and in several monitoring located on the west side of the site (17WW04 and 17WW06). In addition, volatile organics were detected in numerous Geoprobe groundwater samples collected on the west side of the site. Acetone was detected in soil sample collected at sample location 17SD02, 17SB04, and 17SW04 at concentration ranging from 29 to 150 μg/kg. As previously mentioned, acetone is a chemical commonly used in laboratory procedures and its presence may be the result of laboratory induced contamination. Explosive compounds including 2,4-DNT, 2,6-DNT, 1,3,5-TNB, and 2,4,6-TNT were detected primarily in shallow soil samples collected from 0 to 2 ft BGS at sample locations 17SB02, 17SB03, and 17SB06 with the highest concentrations detected at 17SB02. Explosive compound concentrations diminished at depth. Explosive compounds were also detected in several shallow Geoprobe groundwater samples collected on the west side of the site. Heavy metals including barium, chromium, and lead were detected at elevated levels in soil samples collected at sample location 17SB01, 17SB03, and 17SB04.

Based upon the previous investigation results, additional groundwater monitoring wells are required on the west side of the site to fully delineate the extent of groundwater contamination, and the collection of additional soil samples from shallow soil boring in the central portion of the site are needed to delineate the extent of explosive contamination in the vicinity of 17SB02 and 17SB03.

TABLE 2.2
SUMMARY OF COMPOUNDS
DETECTED IN PRE-PHASE III INVESTIGATIONS
SITE 17

ANALYSES	COMPOUNDS	MAXIMUM DETECTED CONCENTRATION	MAXIMUM CONCENTRATION LOCATION
GROUNDWATER SAMPLES			
VOCs (Units: µg/l)	Chloroform	16	130
	1,1-Dichloroethane	8	17WW01
	1,2-Dichloroethane	62	17WW01
	1,1-Dichloroethene	51	17WW01
	cis-1,2-Dichloroethene	6	17WW01
	trans-1,2-Dichloroethene	11	17WW01
	cis-1,2-Dichloroethene, Total	17	17WW01
	Methylene Chloride	153	130
	Trichloroethene	5320	17WW01
SVOCs (Units: µg/l)	Tetrahydrofuran	46	130
Explosives (Units: µg/l)	1,3,5-TNB	2.3	130
Metals (Units: mg/l)	Aluminum	5.6	130
	Antimony	0.8	130
	Barium	0.852	17WW03
	Cadmium	0.02	130
	Chromium	0.016	17WW05
	Lead	0.032	17-C7
	Magnesium	38	130
	Manganese	0.54	130
	Strontium	1.16	130
Anions (Units: mg/l)	Bromine	8	130
	Chloride	2,348	130
	Fluoride	1	130
	Nitrate	0.38	17-C7
	Sulfate	502	17WW02

TABLE 2.2
SUMMARY OF COMPOUNDS
DETECTED IN PRE-PHASE III INVESTIGATIONS
SITE 17

ANALYSES	COMPOUNDS	MAXIMUM DETECTED CONCENTRATION	MAXIMUM CONCENTRATION LOCATION
SURFACE WATER SAMPLES			
VOCs (Units µg/l)	Acetone	29	17SW04
Metals (Units: mg/l)	Arsenic	0.0146	17SW02
	Barium	1.48	17SW02
	Chromium	0.05	17SW06
	Copper	0.027	17SW06
	Lead	0.1	17SW09
	Nickel	0.097	17SW09
	Thallium	0.0103	17SW02
	Zinc	0.192	17SW09
Anions(Units: mg/l)	Chloride	4000	17SW0116
	Sulfate	10500	17SW0116
SEDIMENT SAMPLES			
VOCs (Units: µg/kg)	Acetone	194	17SD02
	2-Butanone	26	17SD02
	2-Hexanone	71	17SD05
Metals (Units: mg/kg)	Arsenic	11.7 J	17SD02
	Barium	20500	17SD07
	Cadmium	0.78	17SD05
	Chromium	25.8	17SD07
	Lead	228.2	17SD07
	Mercury	0.28	17SD07
	Nickel	13.6	17SD07
	Selenium	1.67	17SD01
	Zinc	165	17SD07
Anions (Units: mg/kg)	Chloride	116	17SD02
	Nitrate	0.16	17SD02
	Sulfate	290	17SD02

TABLE 2.2
SUMMARY OF COMPOUNDS
DETECTED IN PRE-PHASE III INVESTIGATIONS
SITE 17

ANALYSES	COMPOUNDS	MAXIMUM DETECTED CONCENTRATION	MAXIMUM CONCENTRATION LOCATION
SOIL SAMPLES			
VOCs (Units: µg/kg)	Acetone	150	17SB04(2.5-4.5)
	2-Butanone	28	17SB04(2.5-4.5)
	1,1-Dichlroethane	67 J	17WW01(0-2)
	1,2-Dichloroethane	9	17WW01(5-7)
	1,1-Dichloroethene	8	17WW01(2.5-4.5)
	Methylene Chloride	9	17WW01(2.5-4.5)
	Trichloroethene	110	17WW01(2.5-4.5)
	Trichlorofluoroethane	7 J	17WW01(0-2)
SVOCs (Units: µg/kg)	Benzo(a)anthracene	1600	17SB01(0-2)
	Benzo(a)pyrene	1700	17SB01(0-2)
	Benzo(g,h,i)perylene	1100	17SB01(0-2)
	Chrysene	1300	17SB01(0-2)
	Di-n-butyl phthalate	4000	17SB06(2.5-4.5)
	Fluoranthene	2300	17SB01(0-2)
	Indeno(1,2,3-cd)pyrene	1100	17SB01(0-2)
	Pyrene	1700	17SB01(0-2)
Explosives (Units: mg/kg)	2-amino-4,6-DNT	16 J	17SB03(0-2)
	4-amino-4,6-DNT	4.8 J	17SB03(0-2)
	2,4-DNT	4000	17SB02(0-2)
	2,6-DNT	500	17SB02(0-2)
	1,3,5-TNB	360	17SB06(0-2)
	2,4,6-TNT	82 J	17SB06(0-2)
Metals (Units mg/kg)	Antimony	1.53 J	17SB04(0-2)
	Arsenic	7.71	17SB04(0-2)
	Barium	1600 J	17SB01(0-2)
	Cadmium	7.33	17SB04(0-2)
	Chromium	59.6	17WW01(0-2)
	Lead	597	17SB04(0-2)
	Mercury	0.23	17SB04(0-2)
	Nickel	34	17SB04(0-2)
	Silver	1.78	17SB04(0-2)
	Thallium	4.80	17SB03(0-2)
Anions (Units mg/kg)	Chloride	1130.8	17SB05(2.5-4.5)
	Nitrate	14.6	17SB01(5-7)
	Sulfate	5683.5	17SB03(0-2)

J - Analyte positively identified, but the concentration was approximate.
Sources: " LHAAP RI/FS Work Plan", Volume 1, June 1992 & "LHAAP RI/FS Field Investigation Summary Report", February 1994.

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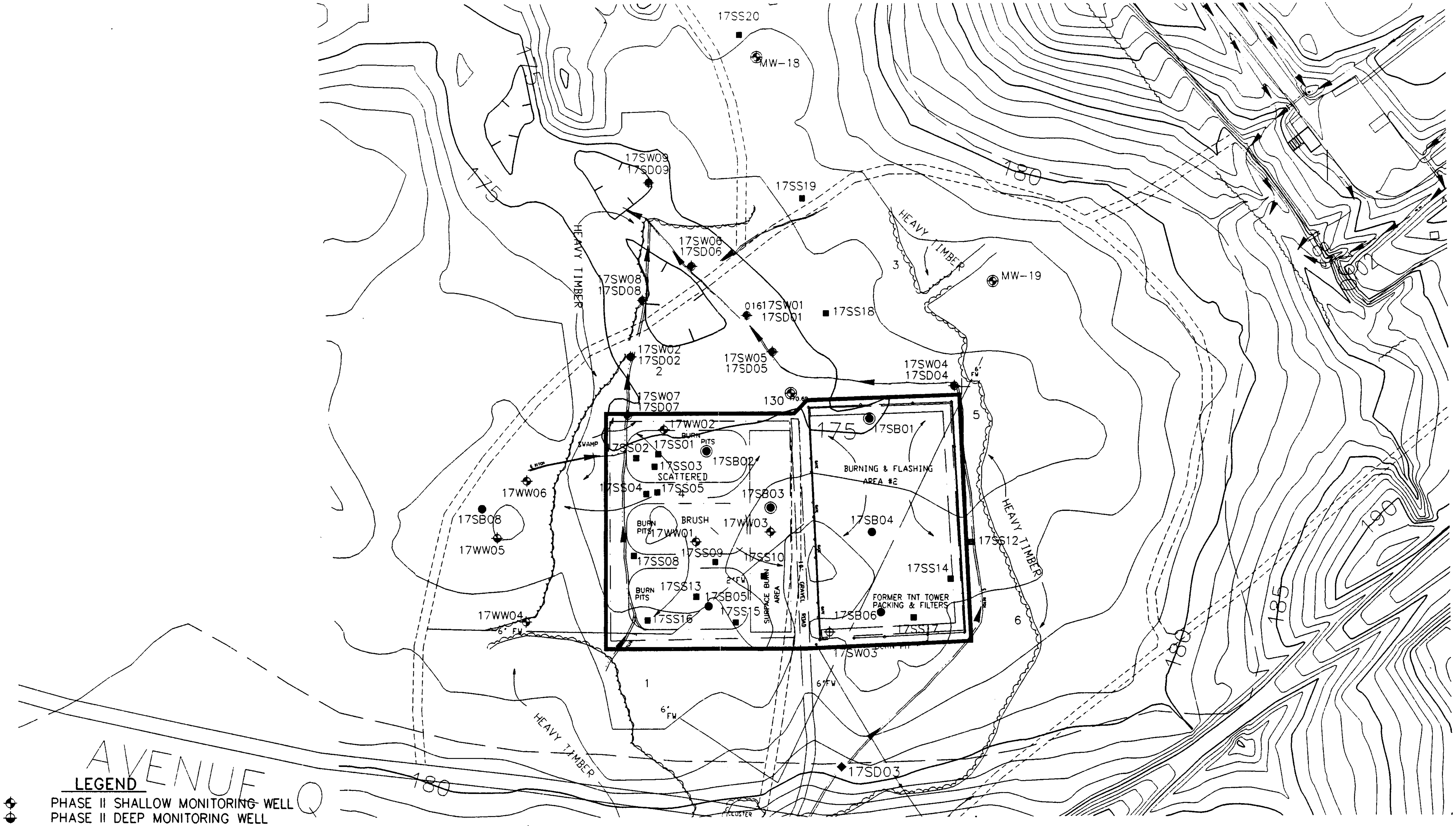

LEGEND

- PHASE II SHALLOW MONITORING WELL
- PHASE II DEEP MONITORING WELL
- PHASE II SOIL BORING
- PHASE II SURFACE WATER SAMPLE
- PHASE II SEDIMENT SAMPLE
- PRE-PHASE II SHALLOW MONITORING WELL
- PRE-PHASE II SOIL BORING
- SURFACE SOIL
- SURFACE DRAINAGE FLOW DIRECTION

N

0 60 120
FEET

US Army Corps of Engineers Tulsa District

Sverdrup ENVIRONMENTAL

SITE 17
BURNING GROUND No. 2/FLASH AREA SITE MAP
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

DWN. BSM	DES.	PROJECT NO.: 000187
CHKD:	APPD:	FIGURE NO. 2-4
DATE NOV 97	REV.:	

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2.4 Site 29: Former TNT Production Area

2.4.1 Description

Site 29 is a heavily wooded site located in the western central portion of the LHAAP installation as shown on Figure 2-2. The area of the site is approximately 85 acres. The site is bounded by Avenue E on the southwest, Zuegner Drive on the northwest, 18th Street on the southeast, and Avenue D on the northeast. A portion of Site 29, the Bulk Toluene Storage Area, is located in a wooded area across Avenue D.

Site 29 was a TNT Production Area from October 1942 to August 1945. The production facility manufactured approximately 400 million pounds of flake TNT from five regular production lines and one standby line. Each production line was essentially the same and consisted of four main elements: an unloading area where acids and toluene were unloaded and held in above ground storage tanks until use; a nitrating area where flake TNT was produced by nitrating toluene with nitric acid; a wash area where the flake TNT was washed to remove impurities and then dried; and a loading area where the cardboard-boxed flake TNT was loaded onto trucks.

The TNT wastewater ("red liquor") generated at the wash areas of the production facility was collected in a storage tank and pump house adjacent to 16th Street and then pumped through a 6-in. underground wooden pipeline to the TNT Waste Disposal Plant (Site 32). A wastewater ("yellow liquor") generated by the production facility was also pumped to Site 32 through the pipeline.

Cooling water ("blue water") drain lines from the production facility emptied into an open ditch alongside 16th Street. The "blue water", likely contaminated with acids, was conveyed to the Neutralization House for neutralization and discharge to the natural surface water regime.

Based on analyses of TNT wastewater generated at another U.S. Army ammunition plant (USATHAMA, April 1990), and assuming that a continuous-type TNT purification process was employed, the "red liquor" was most likely a strongly acidic (pH of 3 - 4) wastewater containing approximately 15 percent total dissolved solids comprised of roughly equal parts of inorganic salts and nitrobodies. The inorganic salts were principally sodium sulfite, sodium sulfate, and sodium nitrite. The nitrobodies were sodium salts of dinitrotoluene sulfonic acids with traces of 2,4,6-TNT.

The composition of the "yellow liquor" is uncertain. It may have been principally a mixture of water, nitric acid, and sulfuric acid generated by washing crude TNT free of acids, hence the yellow color. The "yellow liquor" was likely compatible with the "red liquor" because it was pumped through the same wooden pipeline from the production facility to the TNT Disposal Plant. "Yellow liquor" was likely mixed with the "red liquor" at some point during the treatment and disposal process.

Both the "red liquor" and "yellow liquor" likely contained low concentrations of metals derived from the source water and picked up during the TNT purification and wastewater treatment processes. Metals found in the "red liquor" analyzed at another plant (USATHAMA, April 1990) included calcium, iron, magnesium, potassium, aluminum, chromium, barium, copper, cadmium, and silver, with the total calcium concentration highest at 346 mg/l and the total silver concentration lowest at 0.040 mg/l.

The production facility was inactive from August 1945 to 1959 when most of its building and above ground storage tanks were removed. The debris was burned or flashed at Burning Ground No. 2/Flashing Area (Site 17). There have been only limited activities at the site since the end of World War II.

2.4.2 Site Geology/Hydrogeology

In five of the 11 boreholes drilled at Site 29, a silty to clayey sand was encountered at the surface which extended to depths ranging from 3 - 10 ft BGS. The remaining six borehole locations contained surficial soils which consisted of clayey silt grading to a silty clay extending to a maximum depth of 40 ft BGS. This soil material is underlain by a silty to clayey sand deposit. A sandy silt to silty clay layer was encountered below the sand deposit at depths ranging from 15 - 26 ft BGS in each of the Phase II RI boreholes with the exception of boreholes 29WW02, 29WW10, and 29WW11. Additional silt, clay and sand layers were encountered with depth in boreholes 29SB52 and 29SB53 which were terminated at depths of 157 ft BGS and 140 ft BGS, respectively.

Groundwater elevation measurements were collected at each of the 17 existing monitoring wells (29WW01 through 29WW11, and 114 through 119) in June, 1995. With the exception of monitoring wells 29WW04 and 29WW08, which were completed as deep monitoring wells, the remainder of the Site 29 monitoring wells were completed in the first saturated zone encountered in each borehole. Groundwater potentiometric measurements collected in June 1995 are presented in Table 7.2, Page 7-13, of the Phase II, Group II Field Summary Report (Sverdrup 1996). These potentiometric measurement data indicates the shallow groundwater gradient is to the east-southeast as shown in Figure 7-3 in the Phase II, Group II Field Summary Report (Sverdrup 1996).

A rising head hydraulic conductivity test (slug test) was executed on 11 existing monitoring wells. The average hydraulic conductivity value calculated from the slug test data is 2.2 E-3 cm/sec in the shallow groundwater zone at Site 29.

2.4.3 Previous Investigations

Site 29 was originally investigated in 1984 by EPS for USATHAMA with the installation of 6 monitoring wells and the collection of surface water and sediment samples. Additional site investigation activity was then conducted in 1987 by EPS which included 35 shallow soil borings and the collection of soil samples, surface water and sediment samples, and groundwater samples from the existing monitoring wells. In 1993, SvE conducted Phase I of a Remedial Investigation at Site 29 which included the collection of additional surface water and sediment samples and the advancement of 15 soil boring for the collection of groundwater grab samples. Based upon the results of the Phase I investigation, a Phase II RI was conducted in 1995 by SvE which included the installation of 11 additional monitoring wells, the collection of additional surface water, sediment, subsurface soils, and the collection of groundwater samples from the new and existing monitoring wells and from 35 Geoprobe locations. In addition, samples were collected from the wastewater pipeline which runs across the site. This waste line is still present at the site. A detailed discussion of each of the previous investigations conducted at Site 29 is presented in Section 7.0 of the Phase II, Group II Field Summary Report (Sverdrup 1996).

2.4.4 Historical Data Summary

Results of previous investigations indicated the presence of volatile organics and explosive compounds detected in the groundwater, surface water and sediment samples collected at Site 29. A summary of the maximum concentrations of contaminants detected during previous investigations is presented in Table 2.3. A detailed listing of previous investigation results is presented in Section 7.0 of the Phase II, Group II Field Summary Report (Sverdrup 1996) along with figures presenting contaminant concentrations in Section 9.0 of the Field Summary Report. Previous investigation sample locations at Site 29 are presented in Figure 2-5.

Explosive compounds were detected in both soil and groundwater samples collected on site. In groundwater, explosive compounds including 2,4-DNT, 2,6-DNT, 2-NT, 3-NT, and 4-NT were detected in several monitoring wells including 29WW05, 29WW06, and 116 located on the east side of the site. Explosive compounds were also detected in numerous shallow groundwater samples collected from Geoprobe locations on both the east and west sides of the site. In soils, explosive compounds including 2,4-DNT, 2-aminio-4,6-DNT, 4-amino-4,6-DNT, and 2,4,6-TNT were detected at soil sampling location 29SB08 and 29SB15. Acetone was detected in sediment samples from sample locations 29SD12 and 29SD(20-22). As previously mentioned, acetone is a chemical commonly used in laboratory procedures and its presence may be the result of laboratory induced contamination. Elevated metals concentrations including barium, chromium, and lead were detected at sample locations 29SD13 and 29SD17.

Thus based upon these previous investigation results, additional groundwater monitoring wells are required on both the east and west sides of the site to fully delineate the extent of groundwater contamination detected in the Geoprobe samples. To assist in the proper placement of these new monitoring wells, the collection of shallow groundwater samples from additional Geoprobe locations is recommended, primarily in the center of the site where there is an absence of data.

TABLE 2.3
SUMMARY OF COMPOUNDS
DETECTED IN PRE-PHASE III INVESTIGATIONS
SITE 29

ANALYSES	COMPOUNDS	MAXIMUM DETECTED CONCENTRATION	MAXIMUM CONCENTRATION LOCATION
GROUNDWATER SAMPLES			
SVOCs (Units: µg/l)	Bis(2-Chloro-ethoxy) methane	0.23	116
Explosives (Units: µg/l))	1,3-DNB	0.4 J	29WW06
	2,4-DNT	165 J	29WW05
	2,6-DNT	160	116
	2-NT	4600 J	116
	3-NT	670	116
	4-NT	220	116
	1,3,5-TNB	8.1 J	29WW06
Metals (Units: mg/l)	Barium	6.5	116
	Cadmium	0.00623	119
	Chromium	7.6	29WW11
	Lead	0.35	29WW06
	Mercury	0.003	118
	Nickel	8.4	29WW11
	Selenium	0.35	118
Anions (Units: mg/l)	Chloride	1560	119
	Nitrate	1.0	118
	Sulfate	1520	116
SURFACE WATER SAMPLES			
SVOCs (Units: µg/l)	Bis(2-Ethylhexyl) Phthalate	45	29SW13
Explosives (Units: µg/l)	2-amino-4,6-DNT	0.96	29SW14
	4-amino-4,6-DNT	2.2	29SW14
	2-NT	2.1 J	29SW01 & 29SW03
	3-NT	1.3	29SW01 & 29SW03
	4-NT	0.37	29SW03
Metals (Units: mg/l)	Arsenic	0.0133	29SW18
	Barium	0.141	29SW05
	Copper	0.01	29SW20
	Lead	0.0106	29SW03
Anions (Units: mg/l)	Chloride	21.9	29SW17
	Nitrate	3.76	29SW17
	Sulfate	14.9	29SW08

TABLE 2.3
SUMMARY OF COMPOUNDS
DETECTED IN PRE-PHASE III INVESTIGATIONS
SITE 29

ANALYSES	COMPOUNDS	MAXIMUM DETECTED CONCENTRATION	MAXIMUM CONCENTRATION LOCATION
SEDIMENT SAMPLES			
VOCs (Units: µg/kg)	Acetone	112	29SD12
	Toluene	31	29SD12
SVOCs (Units: µg/kg)	Butyl benzyl phthalate	580	29SD03
	Di-n-butyl phthalate	11,000	29SD13
Explosives (Units: mg/kg)	2-amino-4,6-DNT	0.020J	29SD13
	4-amino-4,6-DNT	0.016	29SD13
	2,4,6-TNT	0.051J	29SD13
Metals (Units: mg/kg)	Arsenic	15.0	29SD07
	Barium	139 J	29SD13
	Chromium	68.3	29SD17
	Lead	88.2	29SD13
	Mercury	0.22	29SD13
	Nickel	25.4 J	29SD13
	Silver	1.93	29SD11
	Thallium	1.74	29SD18
Anions (Units: mg/kg)	Chloride	13	29SD08
	Nitrate	0.21	29SD10
	Sulfate	18.6	29SD01
SOIL SAMPLES			
VOCs (Units: µg/kg)	Acetone	400	29SB(20-22)
	2-Butanone	15	29SB14(20-22)
	Methlyene Chloride	28	29SB07(5-7)
SVOCs (Units: µg/kg)	Bis(2-ethylhexyl) phthalate	4000	29SB08(15-17)
	Butyl benzyl phthalate	1600	29SB08(15-17)
	Di-n-butyl phthalate	3000	29SB(10-12) & 29SB01(20-22)
Explosives (Units: mg/kg)	2,4-DNT	6.2	29SB15(0-2)]
	2-amino-4,6-DNT	15	29SB15(0-2)
	4-amino-4,6-DNT	12	29SB15(0-2)
	1,3,5-TNB	0.43	29SB08(0-2)
	2,4,6-TNT	110	29SB15(0-2)

TABLE 2.3
SUMMARY OF COMPOUNDS
DETECTED IN PRE-PHASE III INVESTIGATIONS
SITE 29

ANALYSES	COMPOUNDS	MAXIMUM DETECTED CONCENTRATION	MAXIMUM CONCENTRATION LOCATION
Metals (Units: mg/kg)	Antimony	1.24 J	29SB(15-17)
	Arsenic	16.5	29SB14(5-7)
	Barium	532	29SB10(5-7)
	Chromium	38.1	29SB04(10-12)
	Lead	247	29SB07(0-2)
	Mercury	0.15	29SB12(15-17)
	Nickel	81.3	29SB02(10-12)
	Silver	5 J	29SB09(20-22)
	Thallium	2.46	29SB13(10-12)
	Chloride	359.6	29SB13(20-22)
	Nitrate	1.89	29S B06(15-17)
	Sulfate	3251.4	29SB14(15-17)
WASTELINE CONTENTS LIQUID SAMPLES			
Explosives (Units: µg/l)	2,4-DNT	300	29WL01
	2-amino-4,6-DNT	910 J	29WL01
	4-amino-4,6-DNT	600	29WL01
	1,3,5-TNB	88	29WL01
	2,4,6-TNB	3500 J	29WL01
WASTELINE CONTENTS SOLID SAMPLES			
Explosives (Units: mg/kg)	2,4-DNT	1.2	29WL02
	2,6-DNT	56	29WL03
	1,3,5-TNB	39	29WL03
	2,4,6-TNT	3700	29WL03
WASTELINE SOIL SAMPLES			
VOCs (Units: µg/kg)	Acetone	25	29SL03(4.5-5.5)
WASTELINE SOIL SAMPLES			
Explosives (Units: mg/kg)	2-amino-4,6-DNT	0.40 J	29SL01(4.5)

B - The analyte was detected in an associate blank (Organics Only).
J - Analyte positively identified, but the concentration was approximate.
Sources: " LHAAP RI/FS Work Plan", Volume 1, June 1992 & "LHAAP RI/FS Field Investigation Summary Report", February 1994.

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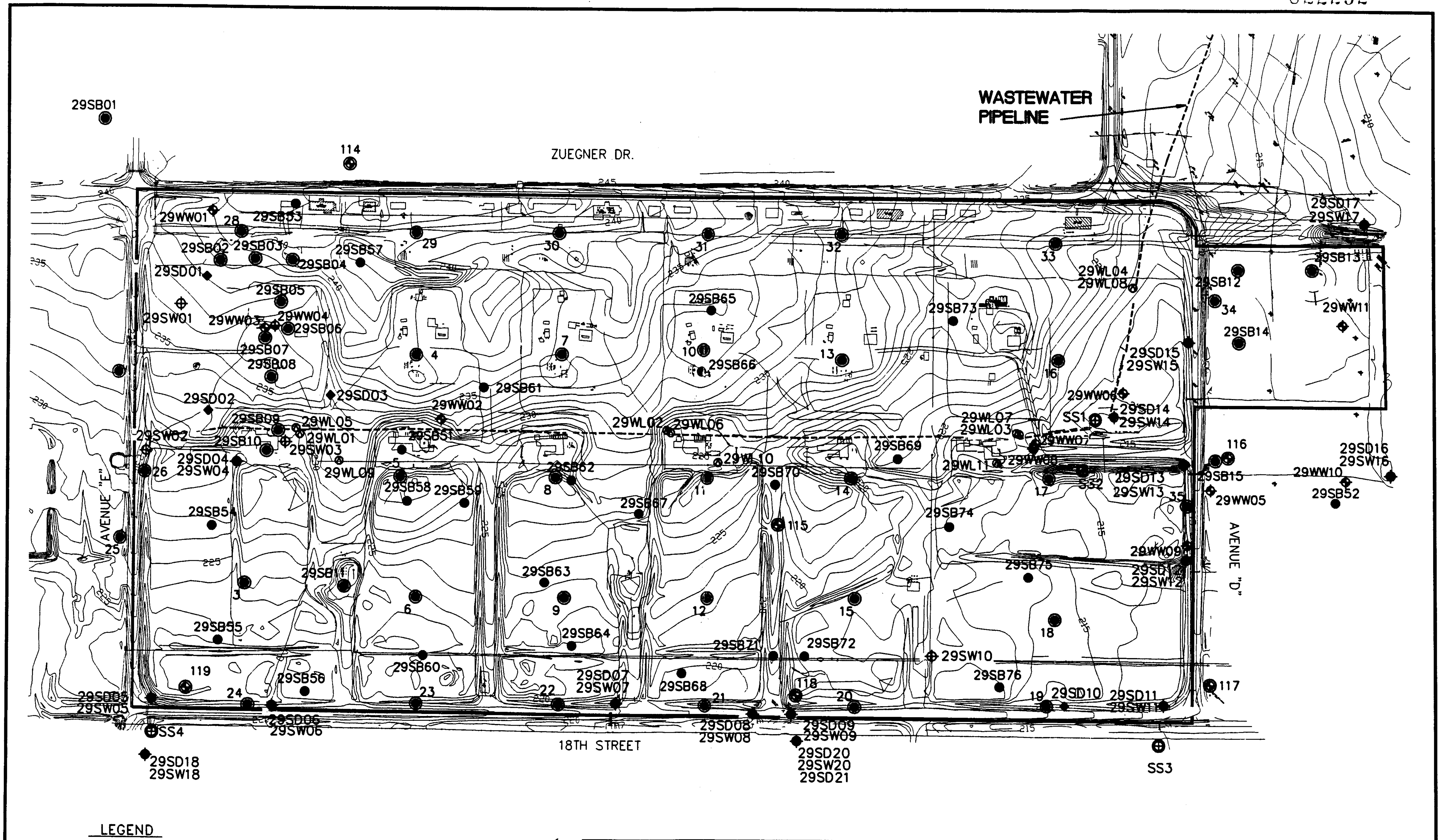

LEGEND

- PHASE II SHALLOW MONITORING WELL
- PHASE II DEEP MONITORING WELL
- PHASE II SOIL BORING
- PRE-PHASE II SHALLOW MONITORING WELL
- PRE-PHASE II SOIL BORING
- PRE-PHASE II SURFACE WATER/SEDIMENT SAMPLE

0 150 300
FEET

US Army Corps of Engineers Tulsa District

Sverdrup ENVIRONMENTAL

SITE 29
FORMER TNT PRODUCTION AREA SITE MAP
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

DWN: BSM	DES:	PROJECT NO.: 000187
CHKD:	APPD:	
DATE: NOV 97	REV.	FIGURE NO.: 2-5

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SECTION 3.0 FIELD INVESTIGATION ACTIVITIES

The purpose of this investigation is to further study those areas identified in the Phase II Remedial Investigation which require additional investigation, in order to fully verify the presence of contaminants, primarily VOCs, high explosives, and metals, and to characterize any releases that may have occurred. It is intended that this investigation will complete all field work and provide the necessary information to finalize the Remedial Investigation/Feasibility Study

The following site specific Phase III RI/FS activities have been developed to meet these goals and include the following:

Site 12

- Collection of 5 sediment and 5 surface water samples.
- Installation of 4 shallow and 3 intermediate monitoring wells.
- Collection of groundwater samples from 8 existing wells and 7 new wells.

Site 17

- Collection of 5 sediment and 5 surface water samples.
- Collection of 20 shallow soil samples.
- Installation of 5 shallow and 3 intermediate monitoring wells.
- Collection of groundwater samples from 9 existing wells and 8 new wells.

Site 29

- Collection of 10 sediment and 10 surface water samples.
- Collection of 5 surface soil samples.
- Installation of 14 shallow and 8 intermediate monitoring wells.
- Collection of 60 groundwater samples using the Geoprobe.
- Collection of groundwater samples from 17 existing wells and 22 new wells.

Each of these field activities are designed to obtain site-specific data to assist in defining both the physical and chemical characteristics for Sites 12, 17, and 29. Sampling and analyses described in this plan will be performed in accordance with the procedures outlined in the SAP and SSHP.

Unless otherwise stated, the following parameters, where applicable, will be analyzed for all soil, surface soil, sediment, surface water, and groundwater samples: pH; specific conductance; temperature; dissolved oxygen; VOCs; high explosives; Target Analyte List (TAL) metals (aluminum, antimony; arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc); and anions (sulfate, chloride, and nitrates/nitrites). Additionally, as specified in the Scope of Work as a separate line item for this Phase III investigation, surface soil samples from Site 29 will be analyzed for pesticides, polychlorinated biphenyls (PCBs), and dioxins/furans for use in the Risk Assessment. All surface and subsurface soil samples will include visual classification using the Unified Soil Classification System (USCS).

3.1 SITE 12: Active Landfill

3.1.1 Sediment and Surface Water Sampling

A total of five (5) sediment samples (designated 12SD15 through 12SD19) and five (5) surface water samples (designated 12SW15 thru 12SW19) will be collected at Site 12. These sediment and surface water samples are being collected to fully verify the presence of contaminants previously detected and around the border of the site and to define the extent of the impacted area. Proposed sediment and surface water sample locations are presented on Figure 3-1. The actual final placement of sample locations may be changed in the field due to site specific conditions encountered.

Sediment samples will be collected from a depth interval of 0-½ ft and analyzed for VOCs, TAL Metals, and Explosives; see Table 3-1 for specific analytical methods, required sample containers, and preservatives. Surface water samples will be collected several inches below the surface of any flowing or standing surface waters and analyzed for VOCs, TAL Metals, Explosives, Common Anions, and Nitrate/Nitrite; see Table 3-2 for specific analytical methods, required sample containers, and preservatives.

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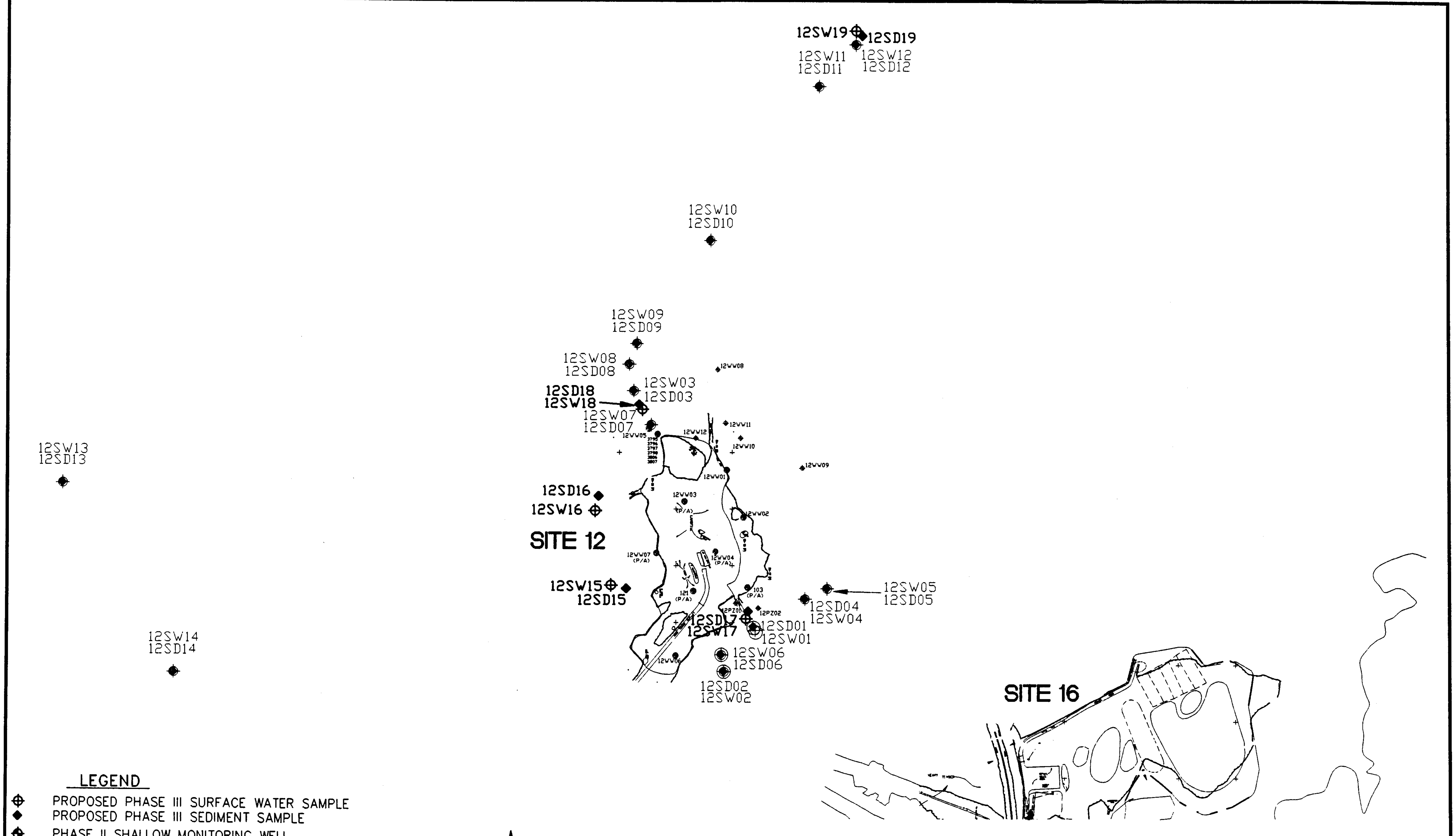

LEGEND

- ⊕ PROPOSED PHASE III SURFACE WATER SAMPLE
- ◆ PROPOSED PHASE III SEDIMENT SAMPLE
- PHASE II SHALLOW MONITORING WELL
- PHASE II DEEP MONITORING WELL
- PHASE II PIEZOMETER
- PRE-PHASE II SHALLOW MONITORING WELL
- PRE-PHASE II SURFACE WATER AND SEDIMENT SAMPLE
- (P/A) PLUGGED AND ABANDONED AFTER PHASE II SAMPLING

N

0 200 400
FEET

US Army Corps of Engineers Tulsa District Sverdrup ENVIRONMENTAL	SITE 12 - PHASE III PROPOSED SURFACE WATER AND SEDIMENT SAMPLING PLAN LONGHORN ARMY AMMUNITION PLANT KARNACK, TEXAS	DWN: BGC CHKD: DATE: OCT 97	DES: APPD: REV:
		PROJECT NO.: 000187	FIGURE NO. 3-1

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Table 3-1
SITE 12 - Sediment Samples

No. of primary samples	No. of QA/QC Samples	No. of MS/MSD Samples	Parameter	EPA Method[1]	Required Containers[2]	Required Preservative
5	1	1	VOCs	8260A[3]	2x4 oz G	cooled to 4°C, (no headspace)
5	1	1	Metals[4] (except Hg)	6010A[4]	8 oz CWM	cooled to 4°C
5	1	1	Hg	7471A	w/ Metals	cooled to 4°C
5	1	1	Explosives	8330	8 oz CWM	cooled to 4°C

(1) USEPA SW-846 methods, most current version acceptable to USACE.
(2) All containers will have Teflon-lines caps or septa. G-glass, CWM-clear wide mouth glass jars.
(3) Samples are prepared using method 5030A.
(4) Total Metals are prepared using method 3050A and are analyzed using method 6010A except for Hg using 7471A. If PQL requirements for Cd, Sb, As, Se Pb, or Tl cannot be met, they are determined using 7131A, 7041, 7060A, 7740A, 7421, & 7841 respectively.

Table 3-2
SITE 12 - Surface Water Samples

No. of primary samples	No. of QA/QC Samples	No. of MS/MSD Samples	Parameter	EPA Method[1]	Required Containers[2]	Required Preservative
5	1	1	VOCs	8260A[3]	2x40 ml VOA vial	cooled to 4°C, HCl, pH<2,
5	1	1	Metals[4] (except Hg)	6010A[4]	1L P,G	cooled to 4°C, HNO_3, pH<2
5	1	1	Hg	7470A	w/ Metals	cooled to 4°C, HNO_3, pH<2
5	1	1	Explosives	8330	2x1L AG	cooled to 4°C
5	1	1	Common Anions[5]	300.0[5]	1x1L P,G	cooled to 4°C
5	1	1	Nitrate/Nitrite	353.2	250 ml P,G	cooled to 4°C, H_2SO_4, pH<2

(1) USEPA SW-846 or USEPA 600/4-79-020 methods, most current version acceptable to USACE.
(2) All containers will have Teflon-lined caps or septa. G-glass; AG-Amber glass; P,G-HDPE or glass; B.R.-Boston round
(3) Samples are prepared using method 5030A.
(4) Total Metals are prepared using method 3005A and analyzed using method 6010A except for Hg using 7470A. If PQL requirements for Cd, Sb, As, Se, Pb, or Tl cannot be met, they are determined using 7131A, 7041, 7060A, 7740A, 7421, & 7841 respectively.
(5) Common anions include: chloride & sulfate.

3.1.2 Monitoring Well Installation

A total of seven (7) monitoring wells (designated 12WW13 through 12WW19) are to be installed at Site 12 as part of this Phase III remedial investigation. Four (4) of the new wells are to be shallow monitoring wells installed to a depth of approximately 30 ft BGS. The remaining three (3) wells are to be intermediate monitoring wells installed to a depth of approximately 70 ft BGS. These new monitoring wells are to be installed on the northeast side of the landfill to assist in the delineation of groundwater contamination detected during the Phase II investigation. The exact depth and location of the monitoring wells will be determined in the field based on lithology and field data. Proposed monitoring well locations are presented in Figure 3-2.

3.1.3 Groundwater Sampling

A total of fifteen (15) groundwater samples will be collected from the seven (7) newly installed wells and from eight (8) existing wells at Site 12. Groundwater samples are to be collected from the following monitoring wells:

Existing Wells		New Wells	
12WW01	12WW05	12WW13	12WW14
12WW06	12WW08	12WW15	12WW16
12WW09	12WW10	12WW17	12WW18
12WW11	12WW12	12WW19	

Groundwater samples will be analyzed for VOCs, TAL Metals, Explosives, Common Anions, and Nitrate/Nitrite; see Table 3-3 for specific analytical methods, required sample containers, and preservatives.

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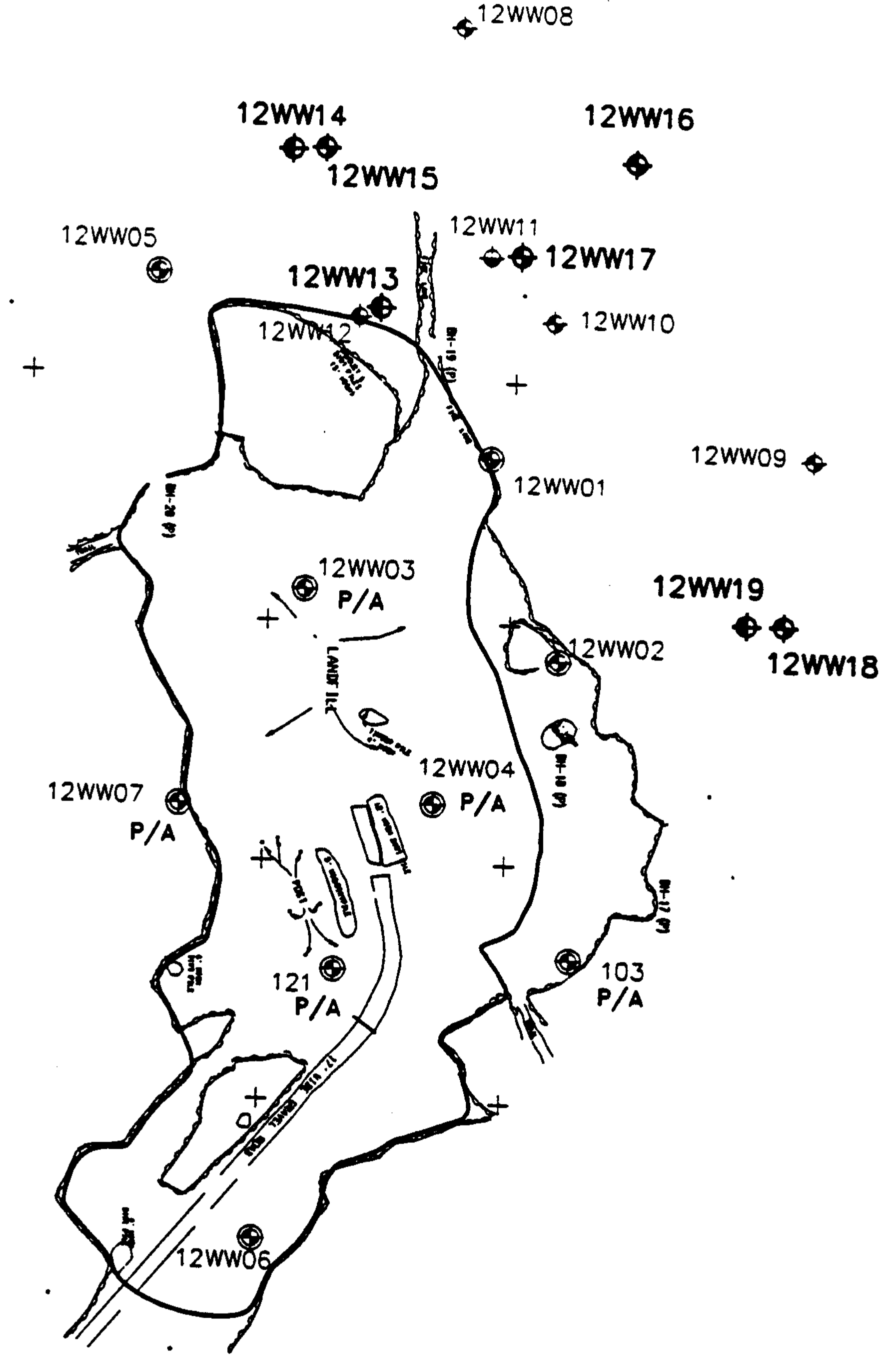

LEGEND

- PHASE III PROPOSED SHALLOW MONITORING WELL
- PHASE III PROPOSED INTERMEDIATE MONITORING WELL
- PHASE II SHALLOW MONITORING WELL
- PHASE II DEEP MONITORING WELL
- PRE-PHASE II SHALLOW MONITORING WELL

N

0 100 200

FEET

US Army Corps of Engineers Tulsa District	SITE 12 - PHASE III PROPOSED MW LOCATION PLAN LHAAP KARNACK, TEXAS	DWN: BSM	DES.:	PROJECT NO.: 000187
Sverdrup ENVIRONMENTAL		CHKD:	APPD:	FIGURE NO.: 3-2
		DATE NOV 97	REV.:	

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Table 3-3
SITE 12 - Groundwater Samples

No. of primary samples	No. of QA/QC Samples	No. of MS/MSD Samples	Parameter	EPA Method(1)	Required Containers(2)	Required Preservative
15	2	1	VOCs	8260A(3)	2x40 ml VOA vial	cooled to 4°C, HCl, pH<2,
15	2	1	Metals(4) (except Hg)	6010A(4)	1L P,G	cooled to 4°C, HNO_3, pH<2
15	2	1	Hg	7470A	w/ Metals	cooled to 4°C, HNO_3, pH<2
15	2	1	Explosives	8330	2x1L AG	cooled to 4°C
15	2	1	Common Anions(5)	300.0(5)	1x1L P,G	cooled to 4°C
15	2	1	Nitrate/Nitrite	353.2	250 ml P,G	cooled to 4°C,H_2SO_4, pH<2

(1) USEPA SW-846 or USEPA 600/4-79-020 methods, most current version acceptable to USACE.
(2) All containers will have Teflon-lined caps or septa. G-glass; AG-Amber glass; P,G-HDPE or glass; B.R.-Boston round
(3) Samples are prepared using method 5030A.
(4) Total Metals are prepared using method 3005A and analyzed using method 6010A except for Hg using 7470A. If PQL requirements for Cd, Sb, As, Se, Pb, or Tl cannot be met, they are determined using 7131A, 7041, 7060A, 7740A, 7421, & 7841 respectively.
(5) Common anions include: chloride & sulfate.

3.2 Site 17: Burning Ground No. 2/Flash Area

3.2.1 Sediment and Surface Water Sampling

A total of five (5) sediment samples (designated 17SD10 through 17SD14) and five (5) surface water samples (designated 17SW10 through 17SW14) are to be collected at Site 17. These sediment and surface water samples are being collected to confirm previous sampling results in the northeast portion of site and to evaluate surface water drainage pathways. Proposed sample locations are presented in Figure 3-3. The actual final placement of sample locations may be changed in the field due to site specific conditions encountered.

Sediment samples will be collected from a depth interval of 0-½ ft and analyzed for VOCs, TAL Metals, and Explosives; see Table 3-4 for specific analytical methods, required sample containers, and preservatives. Surface water samples will be collected several inches below the surface of any flowing or standing surface waters and analyzed for VOCs, TAL Metals, Explosives, Common Anions, and Nitrate/Nitrite; see Table 3-5 for specific analytical methods, required sample containers, and preservatives.

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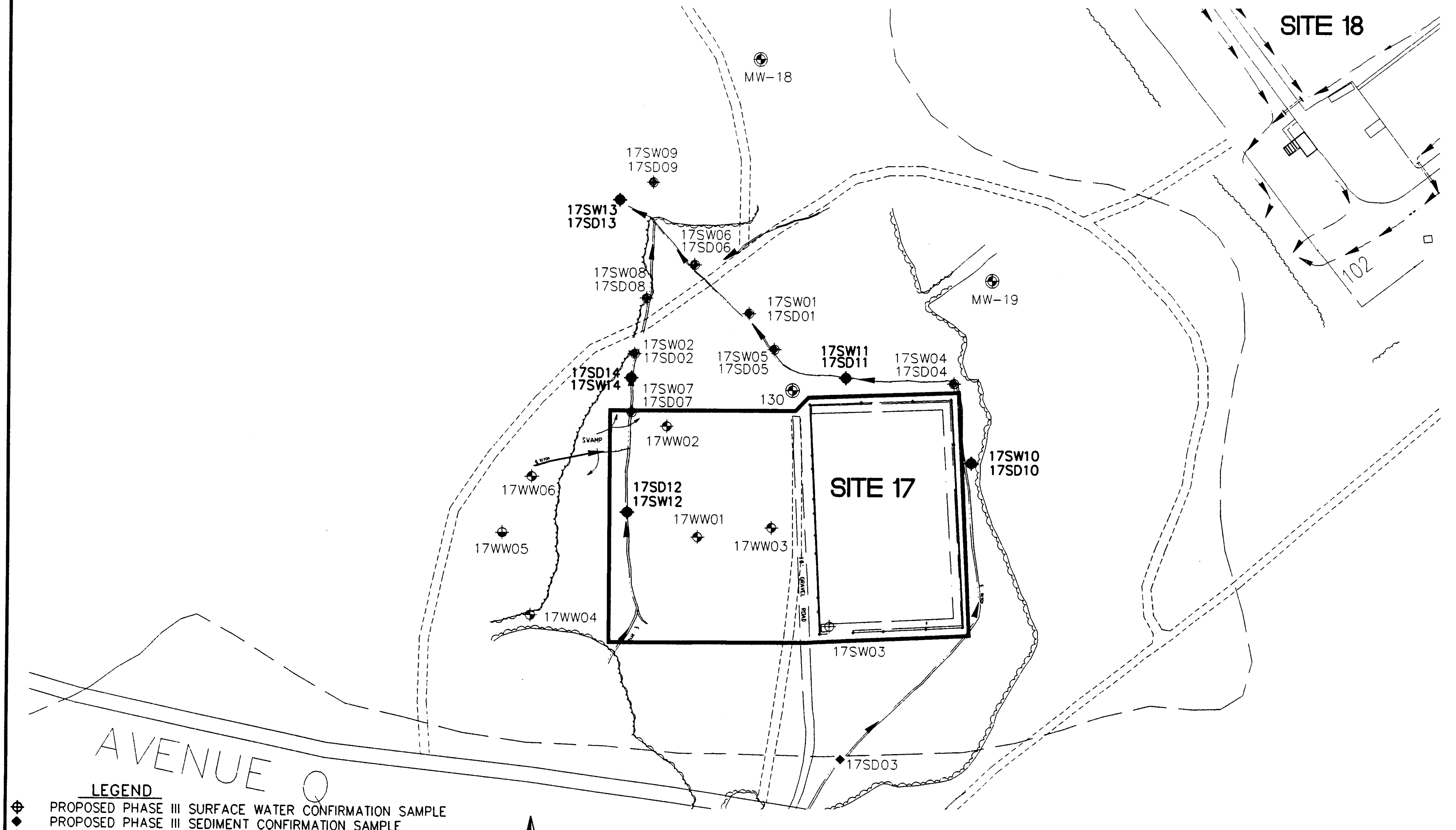

LEGEND
- PROPOSED PHASE III SURFACE WATER CONFIRMATION SAMPLE
- PROPOSED PHASE III SEDIMENT CONFIRMATION SAMPLE
- PHASE II SURFACE WATER SAMPLE
- PHASE II SEDIMENT SAMPLE
- PHASE II SHALLOW MONITORING WELL
- PHASE II DEEP MONITORING WELL
- PRE-PHASE II DEEP MONITORING WELL
- SURFACE DRAINAGE FLOW DIRECTION

US Army Corps of Engineers Tulsa District; Sverdrup ENVIRONMENTAL	SITE 17 - PHASE III PROPOSED SURFACE WATER AND SEDIMENT SAMPLING PLAN LONGHORN ARMY AMMUNITION PLANT KARNACK, TEXAS	DWN: BGC	DES:	PROJECT NO.: 000187
		CHKD:	APPD:	
		DATE: OCT 97	REV:	FIGURE NO.: 3-3

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Table 3-4
SITE 17 - Sediment Samples

No. of primary samples	No. of QA/QC Samples	No. of MS/MSD Samples	Parameter	EPA Method[1]	Required Containers[2]	Required Preservative
5	1	1	VOCs	8260A[3]	2x4 oz G	cooled to 4°C, (no headspace)
5	1	1	Metals[4] (except Hg)	6010A[4]	8 oz CWM	cooled to 4°C
5	1	1	Hg	7471A	w/Metals	cooled to 4°C
5	1	1	Explosives	8330	8 oz CWM	cooled to 4°C

(1) USEPA SW-846 methods, most current version acceptable to USACE.
(2) All containers will have Teflon-lines caps or septa. G-glass, CWM-clear wide mouth glass jars.
(3) Samples are prepared using method 5030A.
(4) Total Metals are prepared using method 3050A and are analyzed using method 6010A except for Hg using 7471A. If PQL requirements for Cd, Sb, As, Se Pb, or Tl cannot be met, they are determined using 7131A, 7041, 7060A, 7740A, 7421, & 7841 respectively.

Table 3-5
SITE 17 - Surface Water Samples

No. of primary samples	No. of QA/QC Samples	No. of MS/MSD Samples	Parameter	EPA Method[1]	Required Containers[2]	Required Preservative
5	1		VOCs	8260A[3]	2x40 ml VOA vial	cooled to 4°C, HCl, pH<2,
5	1	1	Metals[4] (except Hg)	6010A[4]	1L P,G	cooled to 4°C, HNO_3, pH<2
5	1	1	Hg	7470A	w/ Metals	cooled to 4°C, HNO_3, pH<2
5	1	1	Explosives	8330	2x1L AG	cooled to 4°C
5	1	1	Common Anions[5]	300.0[5]	1x1L P,G	cooled to 4°C
5	1	1	Nitrate/Nitrite	353.2	250 ml P,G	cooled to 4°C, H_2SO_4, pH<2

(1) USEPA SW-846 or USEPA 600/4-79-020 methods, most current version acceptable to USACE.
(2) All containers will have Teflon-lined caps or septa. G-glass; AG-Amber glass; P,G-HDPE or glass; B.R.-Boston round
(3) Samples are prepared using method 5030A.
(4) Total Metals are prepared using method 3005A and analyzed using method 6010A except for Hg using 7470A. If PQL requirements for Cd, Sb, As, Se, Pb, or Tl cannot be met, they are determined using 7131A, 7041, 7060A, 7740A, 7421, & 7841 respectively.
(5) Common anions include: chloride & sulfate.

3.2.2 Shallow Soil Samples

A total of twenty (20) depth discrete shallow soil samples will be collected from 10 locations (designated 17SS21 through 17SS30) at Site 17 to define the area of apparent incinerated explosive ash disposal north and northwest of monitoring well 17WW03. Previous investigation results indicated elevated levels of explosive compounds in the shallow soils in this area in the vicinity of Phase II soil borings 17SB02 and 17SB03. Proposed sample locations are presented in Figure 3-4.

Shallow soil samples will be collected from depth intervals of (0'-0.5') and (2.5'-3.0') and analyzed for high explosives; see Table 3-6 for specific analytical methods, required sample containers, and preservatives.

Table 3-6

SITE 17 - Shallow Soil Samples

No. of primary samples	No. of QA/QC Samples	No. of MS/MSD Samples	Parameter	EPA Method[1]	Required Containers[2]	Required Preservative
20	2	1	Explosives	8330	8 oz CWM	cooled to 4°C

(1) USEPA SW-846 methods, most current version acceptable to USACE.

3.2.3 Monitoring Well Installation

A total of eight (8) monitoring wells (designated 17WW07 through 17WW14) are to be installed at Site 17 as part of this Phase III remedial investigation. Five (5) of the new wells are to be shallow monitoring wells installed to a depth of approximately 30 ft BGL. The remaining three (3) wells are to be intermediate monitoring wells installed to a depth of approximately 70 ft BGL. In addition, 2 pilot borings will be advanced prior to well installation to identify the intervals to be screened. Following completion of pilot borings, these borings will be completed as monitoring wells.

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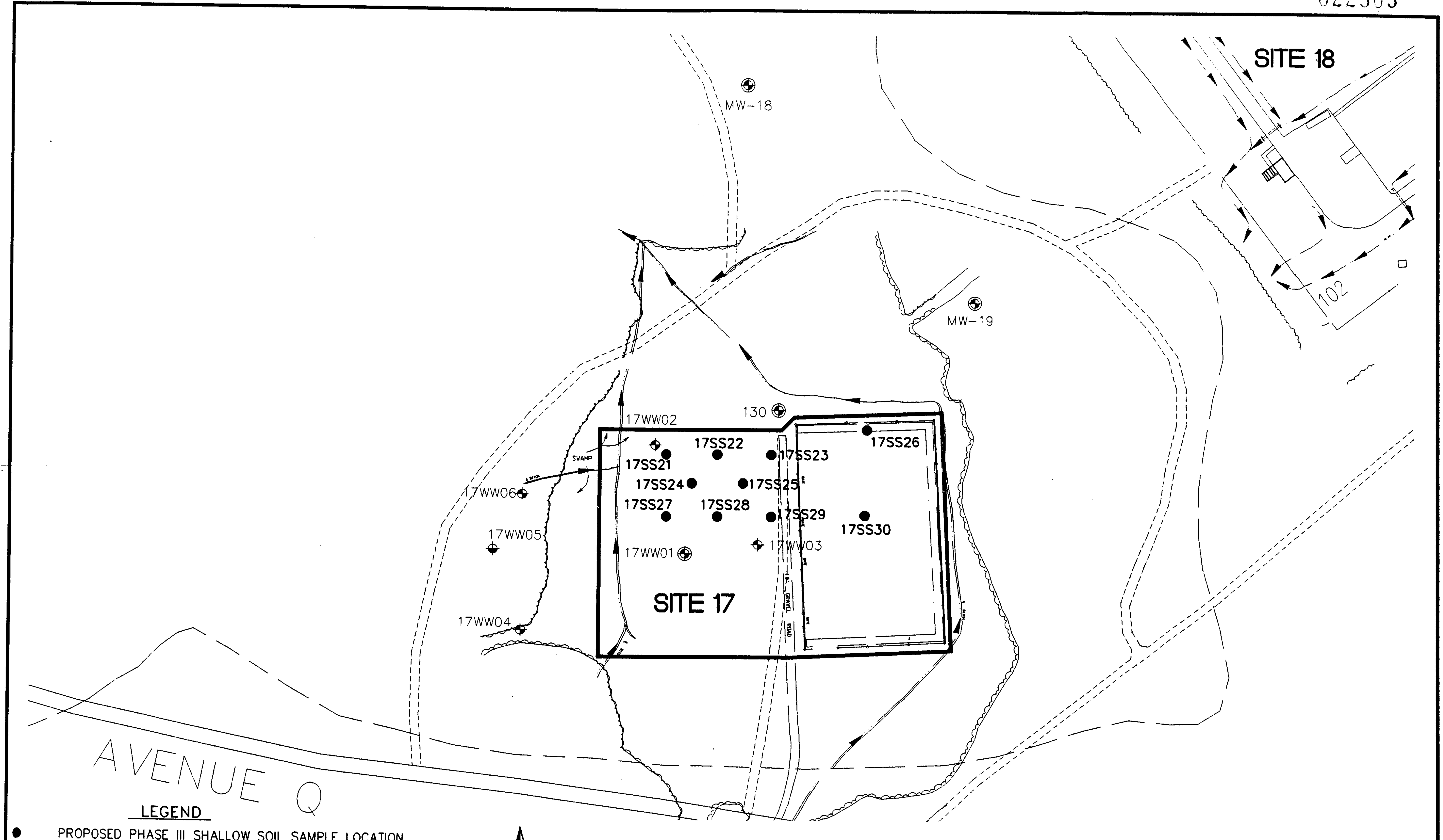

LEGEND

- ● PROPOSED PHASE III SHALLOW SOIL SAMPLE LOCATION
- PHASE II SHALLOW MONITORING WELL
- PHASE II DEEP MONITORING WELL
- PRE-PHASE II SHALLOW MONITORING WELL
- SURFACE DRAINAGE FLOW DIRECTION

NOTE: PHASE II TOTAL EXPLOSIVES CONCENTRATIONS REPORTED IN ug/L

N

0 60 120
FEET

US Army Corps of Engineers Tulsa District

Sverdrup ENVIRONMENTAL

SITE 17 - PHASE III
PROPOSED SHALLOW SOIL SAMPLING PLAN
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

DWN: BGC	DES:	PROJECT NO.: 00187
CHKD:	APPD:	
DATE: OCT 97	REV.:	FIGURE NO. 3-4

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These new monitoring wells are to be installed on the west side of the site to assist in the delineation of groundwater contamination detected during the Phase II investigation. The exact depth and location of the monitoring wells and or pilot borings will be determined in the field based on lithology and field data. Proposed monitoring well locations are presented in Figure 3-5.

3.2.4 Groundwater Sampling

A total of seventeen (17) groundwater samples will be collected form the eight (8) newly installed wells and from nine (9) existing wells at Site 17. Groundwater samples are to be collected from the following monitoring wells:

Existing Wells		New Wells	
130	MW-18	17WW07	17WW08
MW-19	17WW01	17WW09	17WW10
17WW02	17WW03	17WW11	17WW12
17WW04	17WW05	17WW13	17WW14
17WW06			

Groundwater samples will be analyzed for VOCs, TAL Metals, Explosives, Common Anions, and Nitrate/Nitrite; see Table 3-7 for specific analytical methods, required sample containers, and preservatives.

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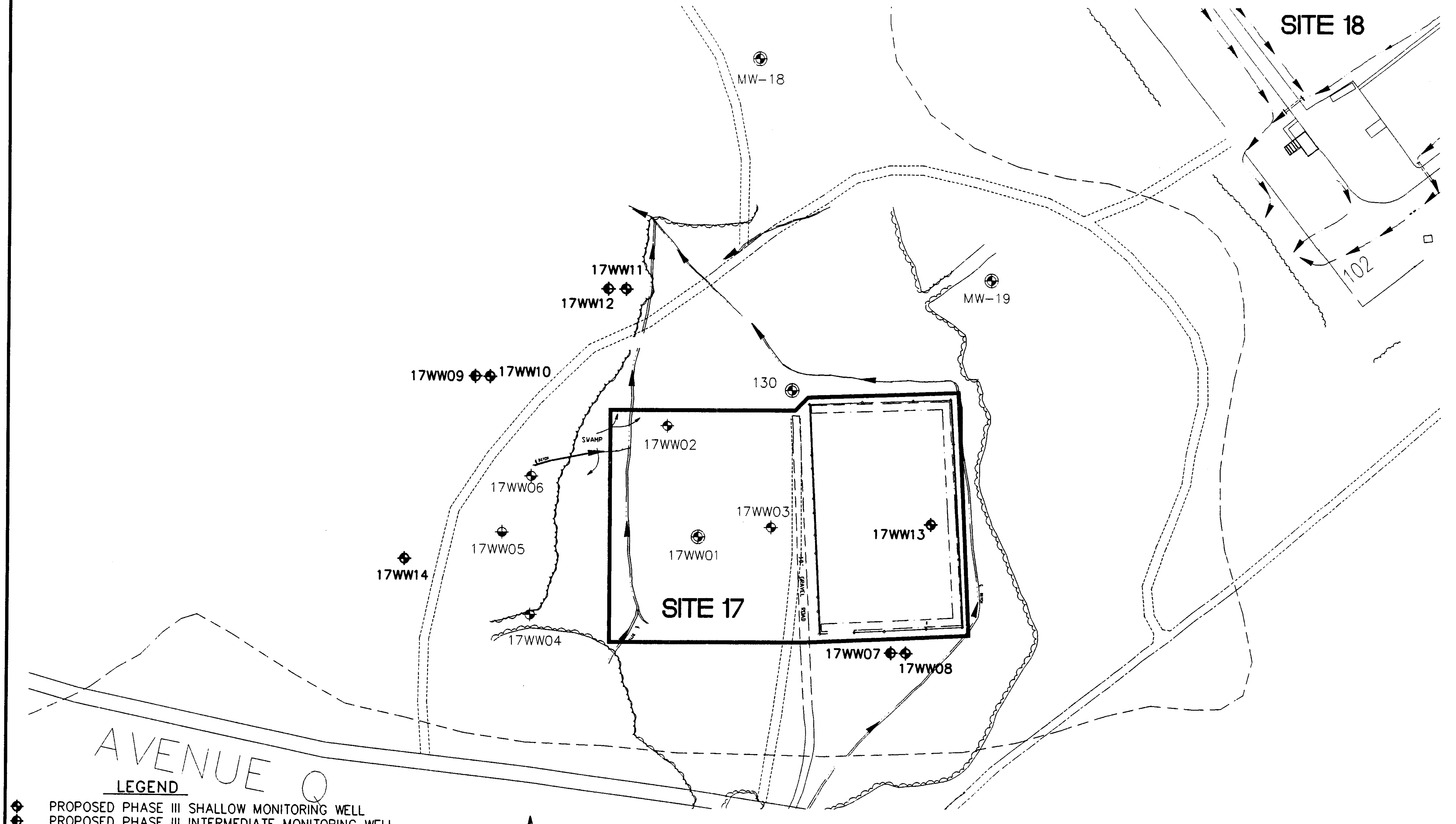

LEGEND

- PROPOSED PHASE III SHALLOW MONITORING WELL
- PROPOSED PHASE III INTERMEDIATE MONITORING WELL
- PHASE II SHALLOW MONITORING WELL
- PHASE II DEEP MONITORING WELL
- PRE-PHASE II SHALLOW MONITORING WELL
- SURFACE DRAINAGE FLOW DIRECTION

NOTE: PHASE II TOTAL VOCs CONCENTRATIONS REPORTED IN ug/L

N

0 60 120
FEET

US Army Corps of Engineers Tulsa District

Sverdrup ENVIRONMENTAL

SITE 17 - PHASE III
PROPOSED MONITORING WELL LOCATION PLAN
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

DWN: BGC	DES:	PROJECT NO.: 000187
CHKD:	APPD:	
DATE: OCT 97	REV:	FIGURE NO.: 3-5

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Table 3-7
SITE 17 - Groundwater Samples

No. of primary samples	No. of QA/QC Samples	No. of MS/MSD Samples	Parameter	EPA Method[(1)]	Required Containers[(2)]	Required Preservative
17	2	1	VOCs	8260A[(3)]	2x40 ml VOA vial	cooled to 4°C, HCl, pH<2,
17	2	1	Metals[(4)] (except Hg)	6010A[(4)]	1L P,G	cooled to 4°C, HNO_3, pH<2
17	2	1	Hg	7470A	w/ Metals	cooled to 4°C, HNO_3, pH<2
17	2	1	Explosives	8330	2x1L AG	cooled to 4°C
17	2	1	Common Anions[(5)]	300.0[(5)]	1x1L P,G	cooled to 4°C
17	2	1	Nitrate/Nitrite	353.2	250 ml P,G	cooled to 4°C,H_2SO_4, pH<2

(1) USEPA SW-846 or USEPA 600/4-79-020 methods, most current version acceptable to USACE.
(2) All containers will have Teflon-lined caps or septa. G-glass; AG-Amber glass; P,G-HDPE or glass; B.R.-Boston round
(3) Samples are prepared using method 5030A.
(4) Total Metals are prepared using method 3005A and analyzed using method 6010A except for Hg using 7470A. If PQL requirements for Cd, Sb, As, Se, Pb, or Tl cannot be met, they are determined using 7131A, 7041, 7060A, 7740A, 7421, & 7841 respectively.
(5) Common anions include: chloride & sulfate.

3.3 SITE 29: Former TNT Production Area

3.3.1 Sediment and Surface Water Sampling

A total of ten (10) sediment samples (designated 29SD22 through 29SD31) and ten (10) surface water samples (designated 29SW22 through 29SW31) are to be collected at Site 29. These sediment and surface water samples are being collected to evaluate the potential presence of contamination in the runoff pathways between the site and Goose Prairie Creek to the east. Proposed sediment and surface water sample locations are presented in Figure 3-6. The actual final placement of sample locations may be changed in the field due to site specific conditions encountered.

Sediment samples will be collected from a depth interval of 0-½ ft and analyzed for VOCs, TAL Metals, and Explosives; see Table 3-8 for specific analytical methods, required sample containers, and preservatives. Surface water samples will be collected several inches below the surface of any flowing or standing surface waters and analyzed for VOCs, TAL Metals, Explosives, Common Anions, and Nitrate/Nitrite; see Table 3-9 for specific analytical methods, required sample containers, and preservatives.

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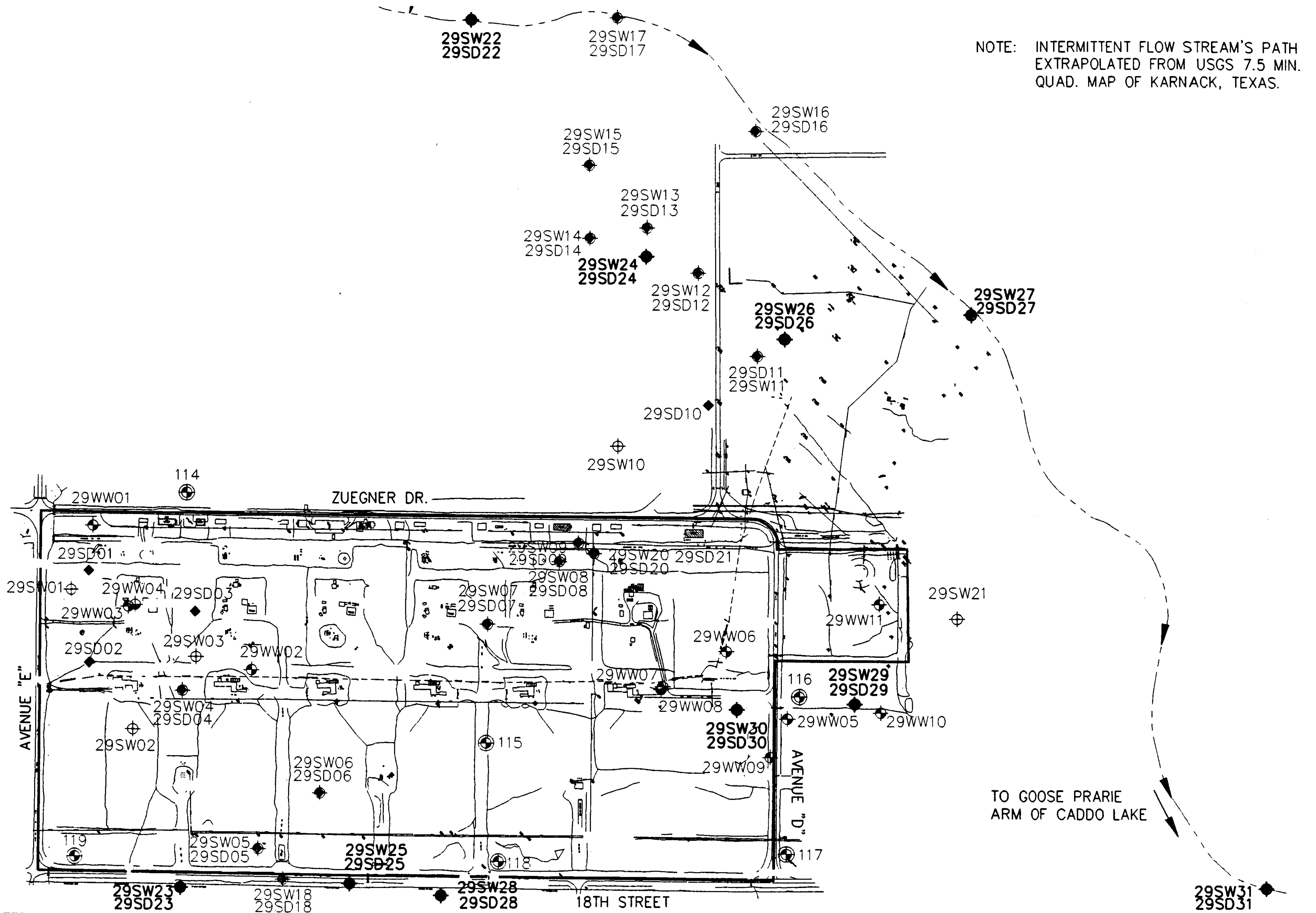
NOTE: INTERMITTENT FLOW STREAM'S PATH EXTRAPOLATED FROM USGS 7.5 MIN. QUAD. MAP OF KARNACK, TEXAS.



LEGEND

- PROPOSED PHASE III SURFACE WATER CONFIRMATION SAMPLE
- PROPOSED PHASE III SEDIMENT CONFIRMATION SAMPLE
- PHASE II SURFACE WATER SAMPLE
- PHASE II SEDIMENT SAMPLE
- PHASE II SHALLOW MONITORING WELL
- PHASE II DEEP MONITORING WELL
- PRE-PHASE II SHALLOW MONITORING WELL
- SURFACE DRAINAGE FLOW DIRECTION

0 250 500
FEET

US Army Corps of Engineers Tulsa District

Sverdrup ENVIRONMENTAL

SITE 29 - PHASE III PROPOSED SURFACE WATER AND SEDIMENT SAMPLING LOCATION PLAN
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

DWN: BGC	DES.	PROJECT NO.: 000187
CHKD:	APPD:	
DATE: JAN 98	REV.	FIGURE NO.: 3-6

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Table 3-8

SITE 29 - Sediment Samples

No. of primary samples	No. of QA/QC Samples	No. of MS/MSD Samples	Parameter	EPA Method[1]	Required Containers[2]	Required Preservative
10	1	1	VOCs	8260A[3]	2x4 oz G	cooled to 4°C, (no headspace)
10	1	1	Metals[4] (except Hg)	6010A[4]	8 oz CWM	cooled to 4°C
10	1	1	Hg	7471A	w/ Metals	cooled to 4°C
10	1	1	Explosives	8330	8 oz CWM	cooled to 4°C

(1) USEPA SW-846 methods, most current version acceptable to USACE.
(2) All containers will have Teflon-lines caps or septa. G-glass, CWM-clear wide mouth glass jars.
(3) Samples are prepared using method 5030A.
(4) Total Metals are prepared using method 3050A and are analyzed using method 6010A except for Hg using 7471A. If PQL

Table 3-9

SITE 29 - Surface Water Samples

No. of primary samples	No. of QA/QC Samples	No. of MS/MSD Samples	Parameter	EPA Method[1]	Required Containers[2]	Required Preservative
10	1	1	VOCs	8260A[3]	2x40 ml VOA vial	cooled to 4°C, HCl, pH<2,
10	1	1	Metals[4] (except Hg)	6010A[4]	1L P,G	cooled to 4°C, HNO_3, pH<2
10	1	1	Hg	7470A	w/ Metals	cooled to 4°C, HNO_3, pH<2
10	1	1	Explosives	8330	2x1L AG	cooled to 4°C
10	1	1	Common Anions[5]	300.0[5]	1x1L P,G	cooled to 4°C
10	1	1	Nitrate/Nitrite	353.2	250 ml P,G	cooled to 4°C, H_2SO_4, pH<2

(1) USEPA SW-846 or USEPA 600/4-79-020 methods, most current version acceptable to USACE.
(2) All containers will have Teflon-lined caps or septa. G-glass; AG-Amber glass; P,G-HDPE or glass; B.R.-Boston round
(3) Samples are prepared using method 5030A.
(4) Total Metals are prepared using method 3005A and analyzed using method 6010A except for Hg using 7470A. If PQL requirements for Cd, Sb, As, Se, Pb, or Tl cannot be met, they are determined using 7131A, 7041, 7060A, 7740A, 7421, & 7841 respectively.
(5) Common anions include: chloride & sulfate.

3.3.2 Shallow Soil Sampling

A total of five (5) shallow soil samples (designated 29SS01 through 29SS05) will be collected at Site 29 as part of this Phase III remedial investigation. The placement of these sample locations, as presented in Figure 3-7, was chosen for the evaluation of risk in the preparation of a risk assessment of the site. The actual final placement of sample locations may be changed in the field due to site specific conditions encountered.

Soil samples will be collected from a depth interval of 0-½ ft and analyzed for VOCs, SVOCs, TAL metals, high explosives, pesticides/PCBs, and dioxins/furans. See Table 3-10 for specific analytical methods, required sample containers, and preservatives.

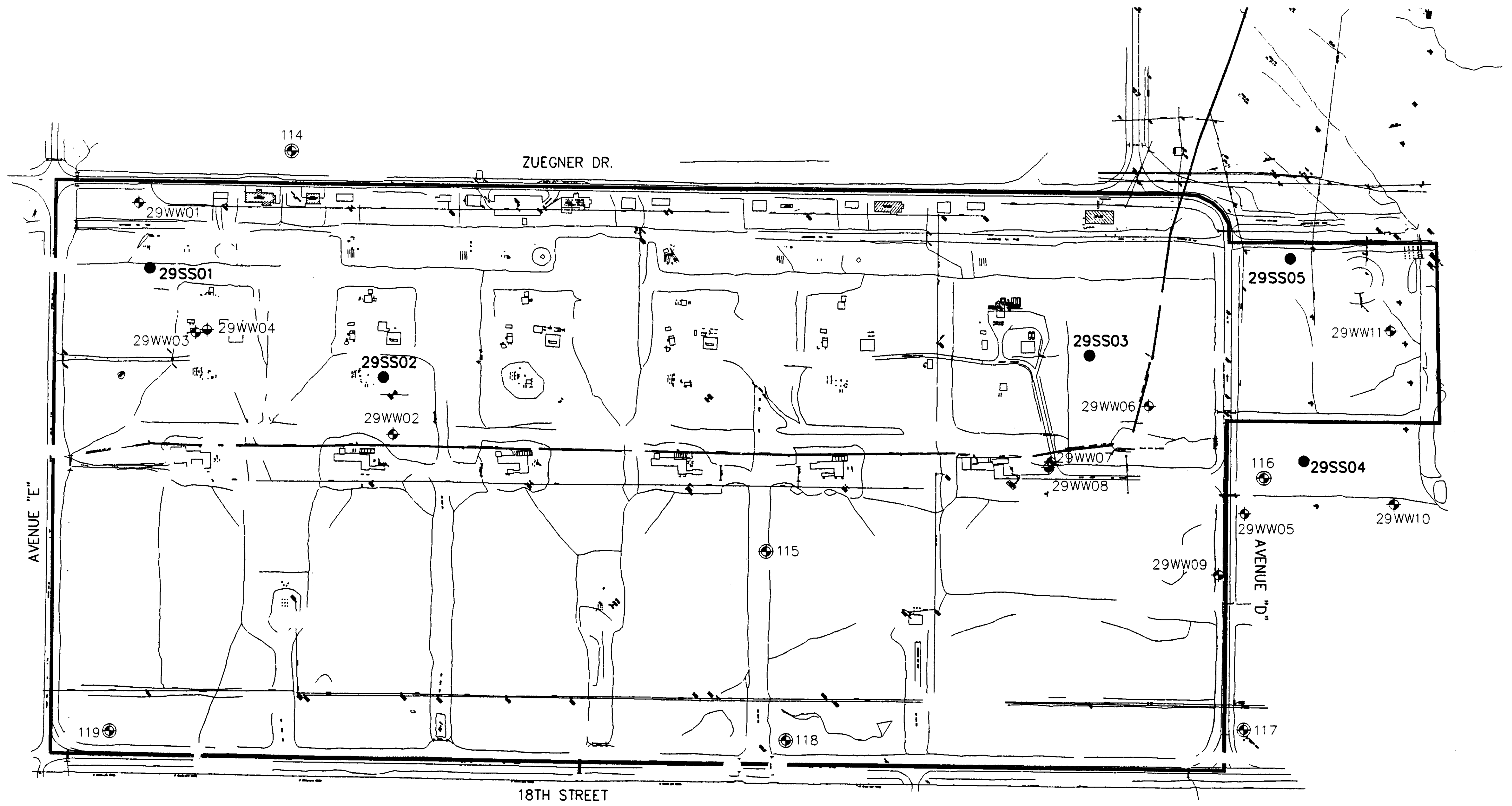
Table 3-10

SITE 29 - Shallow Soil Samples

No. of primary samples	No. of QA/QC Samples	No. of MS/MSD Samples	Parameter	EPA Method(1)	Required Containers(2)	Required Preservative
5	1	1	VOCs	8260A(3)	2x4 oz G	cooled to 4°C , (no headspace)
5	1	1	SVOCs	8270	8 oz CWM	cooled to 4°C
5	1	1	Metals(4) (except Hg)	6010A(4)	8 oz CWM	cooled to 4°C
5	1	1	Hg	7471A	w/ Metals	cooled to 4°C
5	1	1	Explosives	8330	8 oz CWM	cooled to 4°C
5	1	1	Pesticide/PCBs	8080A	8 oz CWM	cooled to 4°C
5	1	1	Dioxins/Furanes	8290	8 oz CWM	cooled to 4°C

(1) USEPA SW-846 methods, most current version acceptable to USACE.
(2) All containers will have Teflon-lines caps or septa. G-glass, CWM-clear wide mouth glass jars.
(3) Samples are prepared using method 5030A.
(4) Total Metals are prepared using method 3050A and are analyzed using method 6010A except for Hg using 7471A. If PQL requirements for Cd, Sb, As, Se Pb, or Tl cannot be met, they are determined using 7131A, 7041, 7060A, 7740A, 7421, & 7841 respectively.

022311



LEGEND

- ● PROPOSED PHASE III SHALLOW SOIL SAMPLE
- PHASE II SHALLOW MONITORING WELL
- PHASE II DEEP MONITORING WELL
- PRE-PHASE II SHALLOW MONITORING WELL

US Army Corps of Engineers Tulsa District

Sverdrup ENVIRONMENTAL

SITE 29 - PHASE III PROPOSED SHALLOW SOIL SAMPLING LOCATION PLAN
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

DWN: BSM	DES:	PROJECT NO.: 000187
CHKD:	APPD:	
DATE: NOV 97	REV:	FIGURE NO.: 3-7

P:\SVE_CLNT\TULSA\LH_02\GEO\MAPS\MLHI211.DWG

3.3.3 Geoprobe Sampling

A total of sixty (60) shallow groundwater samples will be collected at 60 locations in the vicinity of the former TNT production facilities at Site 29 using direct push technology. These shallow groundwater samples will be used further define groundwater contamination detected on the east and west sides of the site during the previous investigations and to obtain additional information about potential groundwater contamination from the center of the site where there is a deficiency of data. Data obtained from this sampling event will then be used to determine the final number and location of the proposed monitoring wells. Proposed groundwater (Geoprobe) sampling locations are presented in Figure 3-8. Final sample locations may be changed in the field due to site specific conditions encountered.

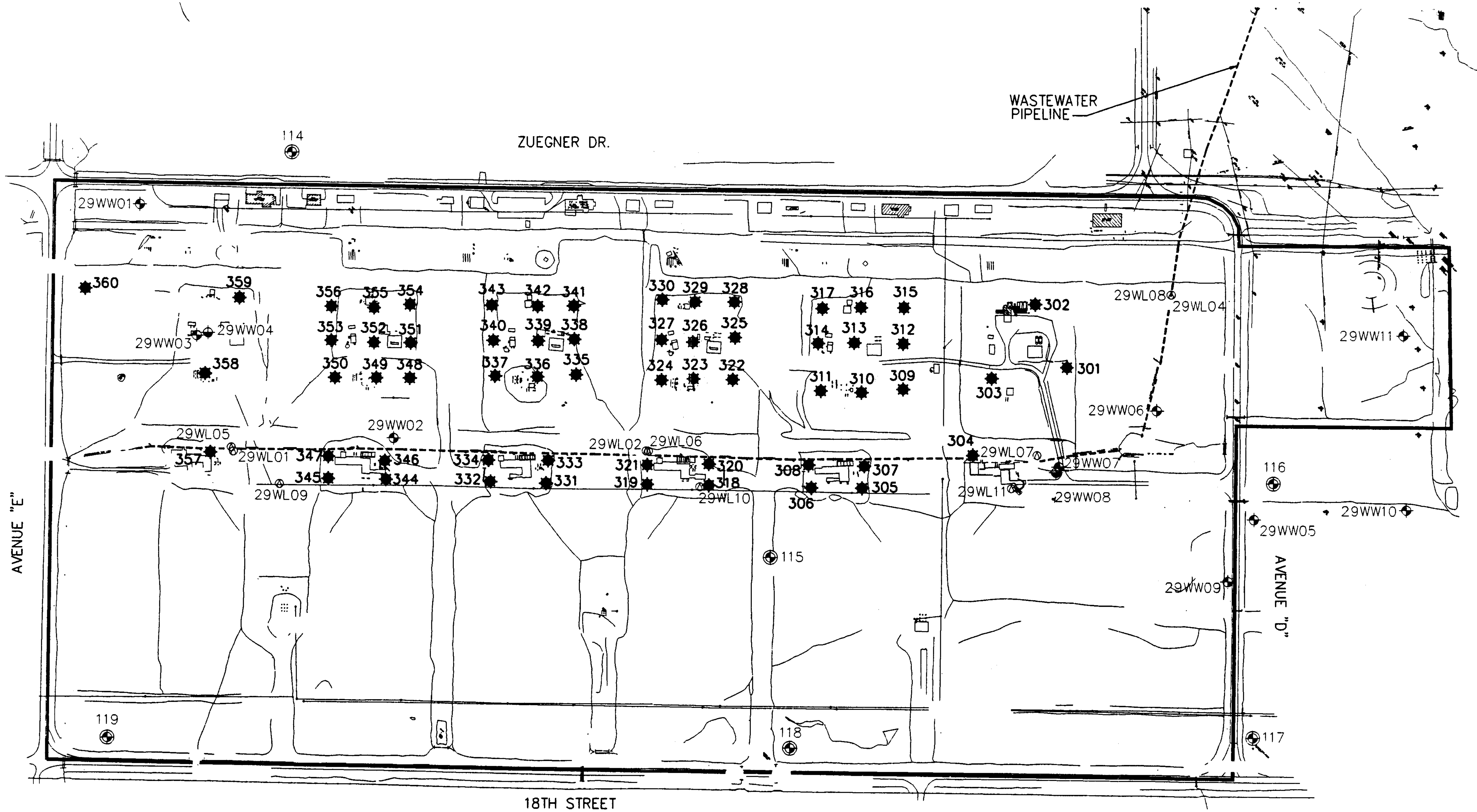
The shallow groundwater samples will be analyzed for VOCs and high explosives; see Table 3-11 for specific analytical methods, required sample containers, and preservatives.

Table 3-11
SITE 29 - Geoprobe Groundwater Samples

No. of primary samples	No. of QA/QC Samples	No. of MS/MSD Samples	Parameter	EPA Method(1)	Required Containers(2)	Required Preservative
60	6	3	VOCs	8260A(3)	2x40 ml VOA vial	cooled to 4°C, HCl, pH<2,
60	6	3	Explosives	8330	2x1L AG	cooled to 4°C

(1) USEPA SW-846 or USEPA 600/4-79-020 methods, most current version acceptable to USACE.
(2) All containers will have Teflon-lined caps or septa. G-glass; AG-Amber glass; P,G-HDPE or glass; B.R.-Boston round
(3) Samples are prepared using method 5030A.

022313



NOTE: FOR CLARITY THE PREFIX 29PB FOR THE PHASE III GEOPROBE SITEID ARE NOT SHOWN.

LEGEND

- PROPOSED PHASE III GEOPROBE LOCATION
- PRE-PHASE II SHALLOW MONITORING WELL
- PHASE II WASTELINE SAMPLE LOCATION
- PHASE II DEEP MONITORING WELL
- PRE-PHASE II SHALLOW MONITORING WELL

0 150 300
FEET

US Army Corps of Engineers Tulsa District

Sverdrup ENVIRONMENTAL

SITE 29 - PHASE III
PROPOSED GEOPROBE SAMPLING LOCATION PLAN
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

DWN: BGC	DES:	PROJECT NO.: 00187
CHKD:	APPD:	
DATE: OCT 97	REV:	FIGURE NO.: 3-8

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3.3.4 Monitoring Well Installation

A total of twenty two (22) monitoring wells (designated 29WW12 through 29WW33) are to be installed at Site 29 as part of this Phase III remedial investigation. Fourteen (14) of the new wells are to be shallow monitoring wells installed to a depth of approximately 30 ft BGS. The remaining eight (8) wells are to be intermediate monitoring wells, installed to a depth of approximately 70 ft BGS. Two pilot borings will be advanced prior to well installation to identify the intervals to be screened. The exact depth of the monitoring wells will be determined in the field based on lithology and field data. Proposed monitoring well locations are presented in Figure 3-9. Based upon the results of the Geoprobe groundwater sampling event, to be conducted prior to well installation, well locations will be adjusted to better assist in the delineation of the extent of groundwater contamination present.

3.3.5 Groundwater Sampling

A total of thirty nine (39) groundwater samples will be collected from the twenty two (22) newly installed wells and from seventeen (17) existing wells at Site 29. Groundwater samples are to be collected from the following monitoring wells:

Existing Wells		New Wells	
114	115	29WW12	29WW13
116	117	29WW14	29WW15
118	119	29WW16	29WW17
29WW01	29WW02	29WW18	29WW19
29WW03	29WW04	29WW20	29WW21
29WW05	29WW06	29WW22	29WW23
29WW07	29WW08	29WW24	29WW25
29WW09	29WW10	29WW26	29WW27
29WW11		29WW28	29WW29
		29WW30	29WW31
		29WW32	29WW33

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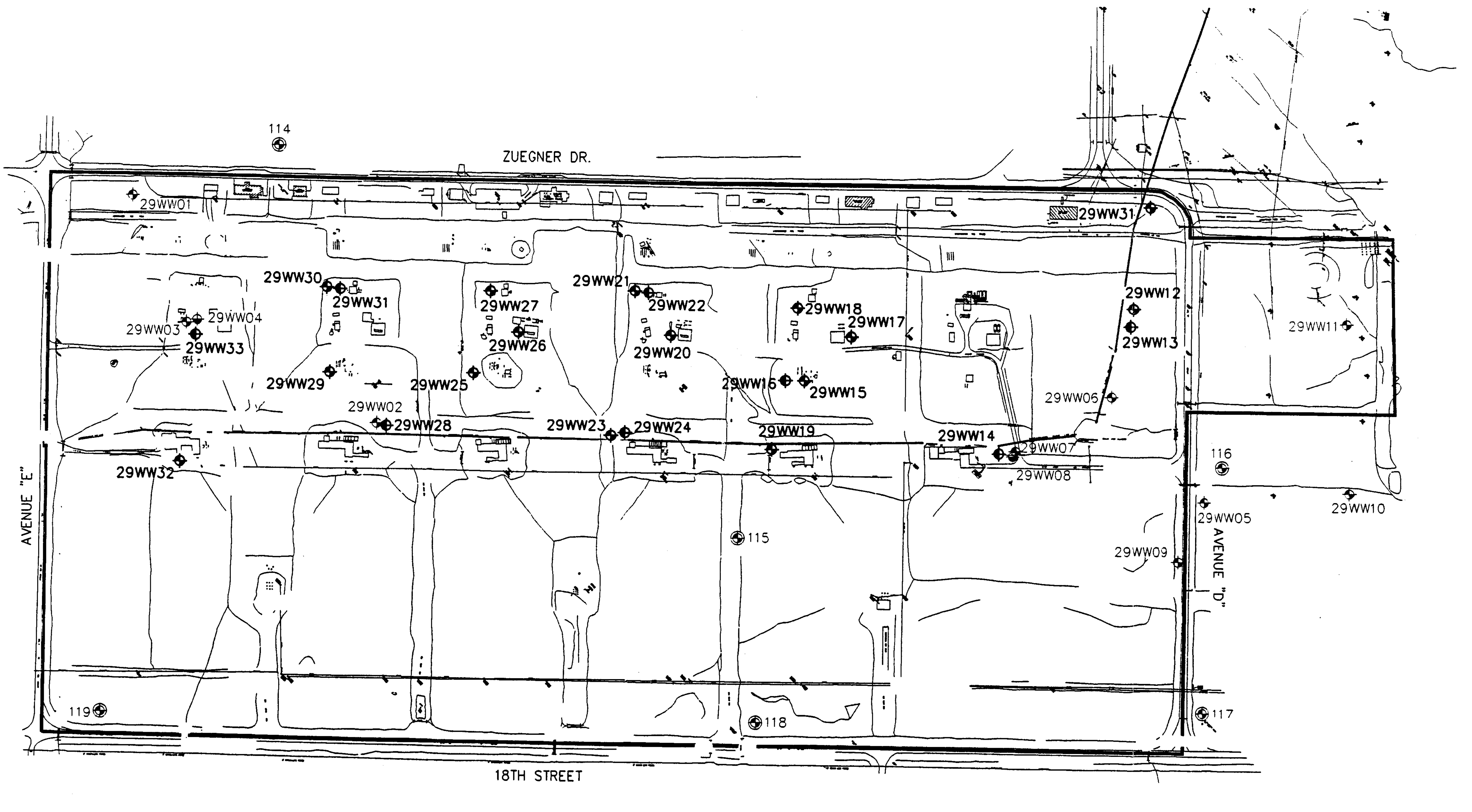

LEGEND

- PROPOSED PHASE III SHALLOW MONITORING WELL
- PROPOSED PHASE III INTERMEDIATE MONITORING WELL
- PHASE II SHALLOW MONITORING WELL
- PHASE II DEEP MONITORING WELL
- PRE-PHASE II SHALLOW MONITORING WELL

US Army Corps of Engineers Tulsa District

Sverdrup ENVIRONMENTAL

SITE 29 - PHASE III
PROPOSED MONITORING WELL LOCATION PLAN
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

DWN: BGC	DES:	PROJECT NO.: 000187
CHKD:	APPD:	FIGURE NO.: 3-9
DATE: OCT 97	REV.:	

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Groundwater samples will be analyzed for VOCs, TAL Metals, Explosives, Common Anions, and Nitrate/Nitrite; see Table 3-12 for specific analytical methods, required sample containers, and preservatives.

Table 3-12

SITE 29 - Groundwater Samples

No. of primary samples	No. of QA/QC Samples	No. of MS/MSD Samples	Parameter	EPA Method(1)	Required Containers(2)	Required Preservative
39	4	2	VOCs	8260A(3)	2x40 ml VOA vial	cooled to 4°C, HCl, pH<2,
39	4	2	Metals(4) (except Hg)	6010A(4)	1L P,G	cooled to 4°C, HNO_3, pH<2
39	4	2	Hg	7470A	w/ Metals	cooled to 4°C, HNO_3, pH<2
39	4	2	Explosives	8330	2x1L AG	cooled to 4°C
39	4	2	Common Anions(5)	300.0(5)	1x1L P,G	cooled to 4°C
39	4	2	Nitrate/Nitrite	353.2	250 ml P,G	cooled to 4°C, H_2SO_4, pH<2

(1) USEPA SW-846 or USEPA 600/4-79-020 methods, most current version acceptable to USACE.
(2) All containers will have Teflon-lined caps or septa. G-glass; AG-Amber glass; P,G-HDPE or glass; B.R.-Boston round
(3) Samples are prepared using method 5030A.
(4) Total Metals are prepared using method 3005A and analyzed using method 6010A except for Hg using 7470A. If PQL requirements for Cd, Sb, As, Se, Pb, or Tl cannot be met, they are determined using 7131A, 7041, 7060A, 7740A, 7421, & 7841 respectively.
(5) Common anions include: chloride & sulfate.

3.4 Slug Tests

A total of thirty seven (37) slug tests will be performed on all the newly installed wells to determine the relative hydraulic conductivity of the screened interval. These values will be used as input for groundwater modeling to be performed on these sites. At a minimum, a rising head test will be performed on each of the newly installed wells. A falling head test may also be performed on each of the newly installed wells which have water levels above their screened and filter packed intervals.

3.5 Surveying

The horizontal and vertical coordinates for the newly installed wells and sampling locations will be determined using the NAD83 standard. The vertical coordinates for each well casing reference point to be used for water level determination will also be determined with the reference point marked with a v-notch on the casing. Any additional borings or sample locations will also have the vertical and horizontal coordinates determined.

3.6 Site Access Improvements

Access improvements into investigation areas at sites 12, 17, and 29 will be performed as required as part of the Phase III field activities. These improvements will include, but are not limited to improving existing roads and removing recent dead fall to facilitate access to sample/drill locations. These improvements should not be considered as permanent improvements but rather improvements necessary to accomplish the desired tasks.

3.7 Surface Resistivity Study

Two weeks of surface resistivity investigations using the StingR1™ will be performed to define variations of subsurface conditions. The number of survey lines at each location will be determined in the field by the quality of data derived from the initial resistivity survey results. Vertical and horizontal coordinates will be surveyed in following the completion of the resistivity investigation.

SECTION 4.0 FIELD OPERATIONS

This section discusses drilling, monitoring well installations, construction, sampling, decontamination, waste disposal, and other field procedures.

4.1 Drilling

An experienced geologist, engineer, or technician will serve as an inspector for all drilling activities. The inspector will prepare and describe samples and cuttings, monitor drilling operations, oversee well installation and construction, record groundwater level data, and prepare well diagrams and geologic logs. Drilling of borings will be advanced by hollow stem augers and conventional rotary methods. These drilling techniques utilize hollow stem augers with a cutting head attached or fluid rotary methods with a blade or tri-cone bit to penetrate the formations. Sampling will be performed by split-spoon or continuous core samplers. Drill pipe, augers, tools and other equipment used below grade for drilling and sampling will be steam cleaned as discussed in Section 4.7. Static water levels will be taken from each completed well following installation.

4.1.1 Soil Sampling Equipment

Sampling equipment used in conjunction with the drilling techniques discussed above is described in this section. Sampling techniques for surface soils and sediments are discussed in Section 4.4.2 Subsurface samples will be taken continuously using a 2-in. inside diameter (ID), 2-ft long split-spoon sampler or 5-ft long continuous core sampler.

A split spoon is a small diameter sampling device driven into the soil with a drive hammer. It is frequently used inside hollow stem augers or other types of casing. The sample is representative of the materials encountered, but is disturbed. Spilt spoon samplers will be used for chemical and physical soil sampling associated with all drilling activities including fluid rotary drilling and/or hollow stem augers.

A continuous core sampler is a sampling device that allows for continuous sampling when drilling with hollow stem augers. It is a 5 ft sample tube with a cutting shoe that extends below the auger cutter head. As the augers are advanced the sample enters the inner split sampler barrel. Plastic or steel liners can be used inside the tube to retain the sample. The sample is representative of the materials encountered, but is disturbed. It will be used for chemical and physical soil samples.

4.1.2 Geological Logs

The strata encountered during drilling will be described in detail, using the USACE drilling log form (Eng Form 1836). The log will provide a record of sample collection location, depth, and drilling procedures. At a minimum, the log will contain the following information:

- Heading Information. (Included will be project name and number, site number, boring number, personnel responsible for drilling and logging the boring, ground surface elevation and coordinates, if available, and date started and completed).
- Depths recorded in feet and tenths of feet.
- Detailed soil description including:
    - Unified Soil Classification Symbol
    - Major soil component
    - Secondary components and estimated percentages
    - Classification
    - Color
    - Consistency/density
    - Moisture content (e.g. dry, moist, wet)
    - Texture
    - Depth/elevation interval
    - Depth/elevation of observed strata changes
    - Presence and general orientation of observed fractures

- Depth at which groundwater is first encountered, depth to static groundwater level, and changes in groundwater level with depth.
- Sampling method.
- Sample drive and recovery.
- Sample numbers.
- Blow counts, hammer weight, and length of fall.
- Total depth of hole.
- Field screening results.
- Equipment details including type of drill rig, drilling method, and type and size of drill bit.

Boring descriptions will be determined from geological logs or from characterization of cuttings and drill action, where samples are not taken. The USACE drilling log form (Eng Form 1836) is shown in Appendix A. It will be used to log all soil boring and monitoring well investigation activities.

4.1.3 Borehole Abandonment

All borings not completed as monitoring wells will be abandoned by backfilling with a cement bentonite grout via tremie line. After the grout has been allowed to solidify for at least 12 hours, any settlement depression will be filled to the ground surface with additional cement bentonite grout or neat cement.

4.2 Wells

4.2.1 Shallow and Intermediate Monitoring Wells

4.2.1.1 Drilling and Installation

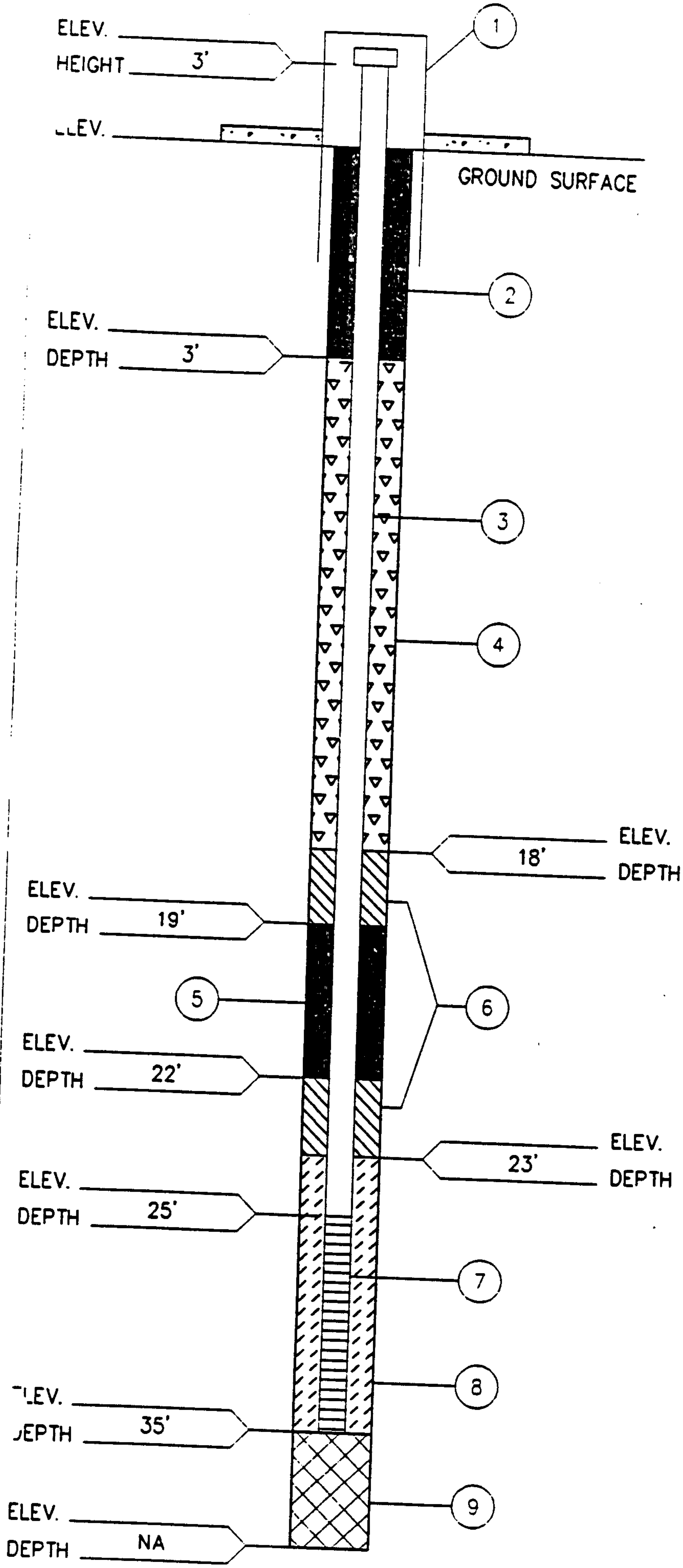
Shallow and intermediate monitoring wells shall be installed in borings dedicated for that purpose. Borings will be drilled with hollow stem auger methods. Shallow monitoring wells will be installed at the base of the first saturated zone and intermediate monitoring wells will be installed at the base of the second saturated zone. The exact depth and location of the monitoring wells will be determined in the field based on lithology and field data. Typical schematics for shallow and intermediate monitoring wells are shown in Figures 4-1 and 4-2.

4.2.1.2 Well Casing

Casing for shallow and intermediate monitoring wells shall consist of new, threaded, flush joint, stainless steel Type 304 casing with a nominal 4-in. ID installed from the top of the screen to approximately 3 ft above the ground surface. Centralizers may be used to keep the casing centered in the boring. A minimum 8-in. diameter borehole will be drilled using hollow stem auger methods.

4.2.1.3 Well Screen

Screens for shallow and intermediate monitoring wells shall consist of new, threaded, flush joint, stainless steel Type 304 4-in. ID continuous wire-wrapped screen. The screen will have a slot size of 0.01 in. The screen for the shallow monitoring wells shall have a length of 10 ft. The screen for the intermediate monitoring wells shall consist of two 5 ft long threaded sections. If site characteristics dictate a need for other more appropriate sizing, the USACE will be notified prior to well installation. Screens will have a bottom plug consisting of new, threaded, flush joint, stainless steel Type 304 4-in. ID.



022322

MONITORING WELL CONSTRUCTION INFORMATION

JOB. NO. LHAAP SITE 29 PHASE III RI/FS

BORING/WELL NO. SHALLOW MONITORING WELLS

DATE

CHIEF UNIT WILCOX

1. PROTECTIVE CASING YES NO

   LOCKING YES NO

2. TYPE OF SURFACE SEAL (IF INSTALLED) CEMENT

3. SOLID PIPE TYPE 4" ID SS TYPE 304

   SOLID PIPE LENGTH 35 ft.

   JOINT TYPE SLIP/GLUED/THREADED

4. TYPE OF BACKFILL CEMENT BENTONITE GROUT

   HOW INSTALLED – TREMIE

   FROM SURFACE

5. TYPE OF LOWER SEAL (IF INSTALLED) BENTONITE CHIPS

6. TYPE OF SECONDARY FILTER PACK SUGAR SAND

7. SCREEN TYPE WRAPPED WIRE SS TYPE 304

   SCREEN LENGTH 10 ft.

   SLOT SIZE 0.010 in.

   SCREEN DIAMETER 4 in.

8. TYPE OF PRIMARY FILTER PACK SILICA SAND

9. TYPE OF BACKFILL NA

10. DRILLING METHOD HSA

WATER LEVEL _____ DATE _____

*ALL DEPTHS MEASURED FROM GROUND SURFACE

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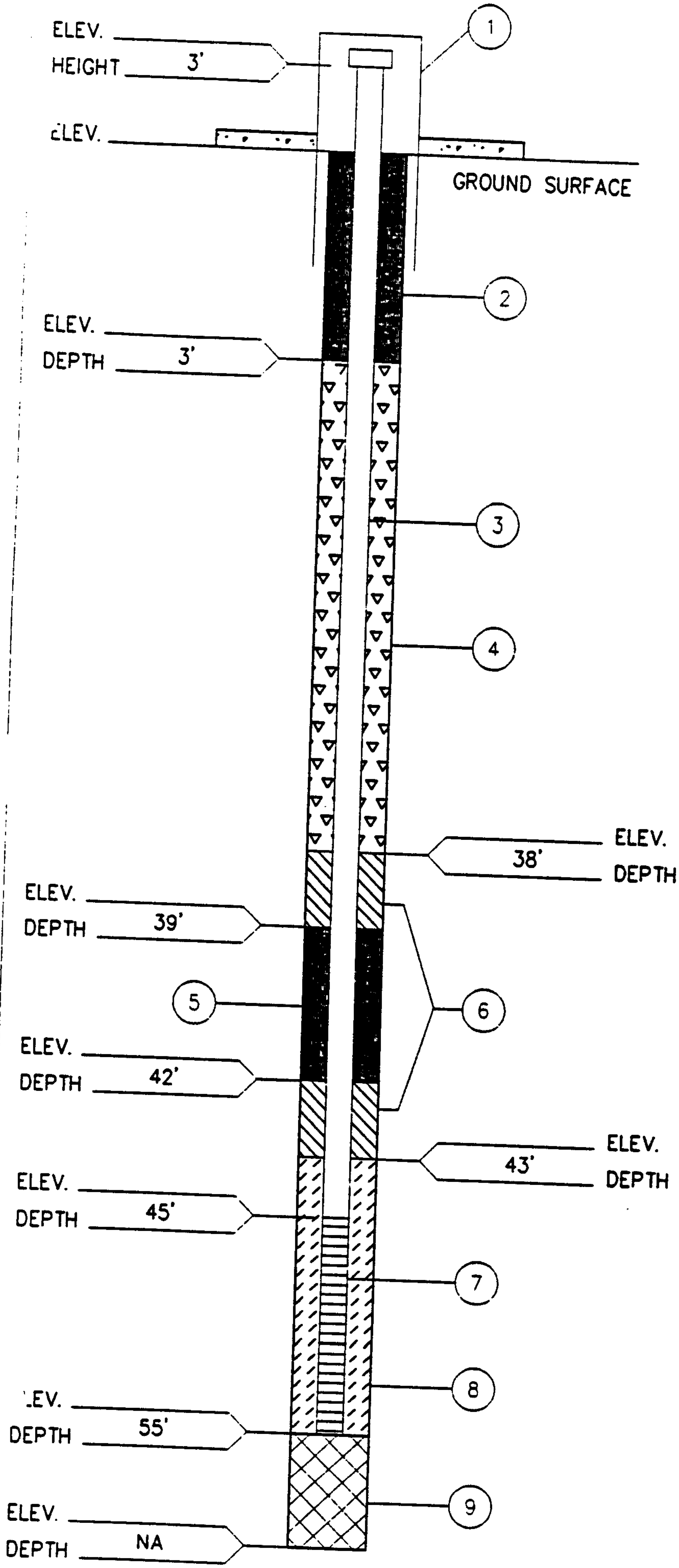
FIGURE 4-1



022323

MONITORING WELL CONSTRUCTION INFORMATION

JOB. NO. LHAAP SITE 29 PHASE III RI/FS

BORING/WELL NO. INTERMEDIATE MONITORING WELLS

DATE ____________

CHIEF UNIT WILCOX

1. PROTECTIVE CASING YES NO
   LOCKING YES NO
2. TYPE OF SURFACE SEAL (IF INSTALLED) CEMENT
3. SOLID PIPE TYPE 4" ID SS TYPE 304
   SOLID PIPE LENGTH 45 ft.
   JOINT TYPE SLIP/GLUED/THREADED
4. TYPE OF BACKFILL CEMENT BENTONITE GROUT
   HOW INSTALLED – TREMIE
   FROM SURFACE
5. TYPE OF LOWER SEAL (IF INSTALLED) BENTONITE CHIPS
6. TYPE OF SECONDARY FILTER PACK SUGAR SAND
7. SCREEN TYPE WRAPPED WIRE SS TYPE 304
   SCREEN LENGTH 2, 5-ft Sections ft.
   SLOT SIZE 0.010 in.
   SCREEN DIAMETER 4 in.
8. TYPE OF PRIMARY FILTER PACK SILICA SAND
9. TYPE OF BACKFILL NA
10. DRILLING METHOD HSA

WATER LEVEL ____________ DATE ____________

*ALL DEPTHS MEASURED FROM GROUND SURFACE

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FIGURE 4-2

4.2.1.4 Filter Packs

A primary filter pack shall be placed in the annulus between the well screen and the borehole from the bottom of the hole to approximately 2 ft above the top of the screen. The primary filter pack material shall be clean, well washed, well graded silica sand conforming to the requirements of American Society of Testing Methods (ASTM) C33 and compatible with the screen slot size. The primary filter pack material will be placed with a slow, continuous stream. Continuous depth soundings of the bottom of the hole will be taken to monitor the level of the sand and detect any bridging of sand. The primary filter pack material will be either bagged or purchased from a batch plant. The size and thickness of the primary filter pack may be adjusted in the field based on the borehole stratigraphy.

A 1-ft thick secondary filter pack shall be placed in the annulus between the well casing and the borehole, above the primary filter pack prior to installation of the bentonite seal. An additional 1-ft thick secondary filter pack shall be placed in the annulus between the well casing and the borehole, above the bentonite seal prior to installation of the grout. Placement of the secondary filter pack above the bentonite seal assists in preventing infiltration of the grout into the bentonite seal. The secondary filter shall be installed in the same manner as the primary filter pack. The secondary filter material shall be clean silica sand with 100 % passing the No. 30 U.S. Standard sieve.

4.2.1.5 Bentonite Seal

An approximately 3 ft thick bentonite seal will be placed in the annulus between the well casing and the borehole, above the first secondary filter pack. This will be accomplished by installing pellets or chips via a tremie pipe or by dropping them directly into the annulus. Bentonite pellets or chips will be hydrated with reagent grade water and allowed to hydrate for approximately 45 minutes before proceeding with the grout installation.

4.2.1.6 Grout

A cement bentonite grout will be used to fill the annulus between the bentonite seal/secondary filter pack and the top of the ground, as well as for borehole abandonment. The cement bentonite grout mixture will consist of a mixture of Portland type cement, bentonite powder, and USACE approved potable water in the proportions of not more than 7 gal of water per 94 lbs (1 bag) of Portland type cement per 6 lbs of bentonite powder. Grouting will be accomplished in an appropriate manner for the specific application. Grout will be pumped through a tremie or poured into the annulus. The quantities of grout used will be recorded in the field log book.

4.2.1.7 Surface Completions

Shallow and intermediate monitoring wells shall have surface completions consisting of a locking protective cover, concrete pad, and steel guard posts. Construction of surface completions will comply with USACE requirements as well as requirements of the USEPA, September 1986, "RCRA Ground Water Monitoring Technical Enforcement Guidance Document".

Approximately 3 ft of well casing will be left above ground and enclosed in a protective steel casing. The protective casing will extend below the ground surface and be anchored in concrete. The protective casing will have a locking cover to prevent entry of rainwater and unauthorized personnel. A 4 ft by 4 ft by 6 in. concrete pad will be poured and centered around the protective casing at the ground surface, and will be sloped away from the protective casing to promote drainage. A drainhole will be drilled near the base of the protective casing. A brass survey marker, to be obtained from USACE, will be set into the concrete pad.

Four concrete filled steel guard post with a minimum outside diameter (OD) of 4 in. shall be equally spaced and radially located 4½ ft from the center of the well. These guard post shall be placed and set in concrete 3 ft below the ground surface, with 4 ft extending above the ground surface. The protective casing and guard post will be primed and painted with "traffic yellow" paint.

4.2.2 Development

No sooner than 48 hours nor longer than 7 days after completion of any well, development of the well by pumping and/or surging, or any other method in compliance with applicable regulations, without the use of acids or dispersing agents shall be performed. Any pumping shall be at a rate approximately equal to or greater than the anticipated purging/sampling rate. Development will consist of a minimum of 3 well volumes and shall continue until pH, temperature, and conductivity readings taken on the development water have stabilized over four consecutive readings. These parameters will be considered stabilized if, for four consecutive readings, temperature is ± 1°C, pH is ± 0.2 units, and conductance is ± 10% of the previous reading. No water or other liquid may be introduced into the well during development other than formation water from that well. If a well bails or pumps "dry" during development prior to removing the required volume, the well will be allowed to recover so that the required minimum volume can be removed. The development process will be supervised and recorded in the field by a geologist or engineer. Groundwater will be disposed of in accordance with the "Comprehensive Investigation Derived Waste Management Plan", Sverdrup, June 1996.

The following data will be recorded by the geologist or engineer during well development:

- Date and time well development was started.
- Initial static water level.
- Volume of water removed.
- Color and turbidity.
- Temperature, pH, and conductance.
- Date and time well development was completed.
- Well development methods and equipment used.

4.2.3 Acceptance

It is the responsibility of the drilling contractor to drill and install a well which meets the criteria. If a well is not constructed of the proper materials by the proper methods, that well shall not be accepted by the USACE.

The following criteria will be used to determine the acceptability of the monitoring well installation:

- Borings must be constructed and casing installed plumb and true to line. The alignment of the well screen and casing is unacceptable unless a straight 10-foot length of PVC pipe can pass freely down the length of the well. The OD of the PVC pipe shall be 1 in. smaller than the ID of the well casing.
- Filter packs and screened intervals will not be cemented.
- Casing and screen must not be collapsed, broken, damaged, obstructed, or contaminated during installation.
- All casing, screens, grout, and filter packs will be set to depths as directed by the contractor.

If the above well acceptance criteria are not met for a particular well, the well will be abandoned following the procedures detailed in Section 4.2.5. A replacement well will then be drilled and installed hydraulically upgradient from the abandoned well by at least 10 feet horizontal distance.

4.2.4 Schematics and Reports

A construction diagram will be prepared for each well and will contain all pertinent information concerning the well. Data recorded on each diagram will include the following:

- Project name/number

- Well number
- Installation date
- Depth, thickness and the USCS classification for each soil stratum
- Depth of static groundwater level and time and date of measurement
- Total depth of boring and completed well
- Depths of screened interval
- Description of well construction materials, including length, diameter, material and manufacturer
- Depths of filter pack, seal, separation sand, and grout
- Type and source of filter pack, seal, and separation sand
- Volumes used of filter pack, granular bentonite, separation sand; and Portland type cement, bentonite powder, and water in grout mixture
- Nominal borehole diameter
- Riser pipe height

For each well, a drilling log, a construction diagram, and a State of Texas Well Report will be prepared, as shown in Appendix A.

4.2.5 Abandonment

Wells to be abandoned due to construction problems or because they are no longer needed will be backfilled in the following manner:

- Construction materials will be removed.
- The hole will be overdrilled.
- The hole will be filled with a bentonite grout using a tremie pipe from the bottom of the boring to the top or poured into the open hole depending which is appropriate for the specific application.

- Any settlement depression will be filled to the ground surface with additional grout or neat cement.

A State of Texas Plugging Report, shown in Appendix A, will be prepared for each abandoned well.

4.3 Groundwater Measurements

4.3.1 Groundwater Level Measurements

Once the well is completed, both the water level and bottom of well will be measured to the nearest 0.01 ft. Additionally, the collection of water levels in existing wells may be required. Measurements will be made from a notch or mark on the north side of the top of the casing and recorded in the field logbook and other appropriate forms. An electronic probe will be used to establish equilibrium water levels. Depth to the bottom of well will also be measured. The probe will be decontaminated between wells as described in Section 4.7.

4.3.2 Slug Tests

Slug tests will be performed to estimate the hydraulic properties of individual strata. The purpose of this test is to measure the hydraulic conductivity of the water-bearing units, taking into account bedding planes, fractures, and other discontinuities. Slug tests will be conducted using the recovery test analytical method introduced by Bouwer and Rice (1976) or an equivalent method. The rising head method will be used; it is preferred over falling head tests for unconfined water-bearing units in which the well screen is placed across the potentiometric surface elevation. In addition, the test data is generally less disturbed when the slug is quickly removed from a stabilized water column as compared to the sudden insertion of the slug into the water column.

Water level data from the slug tests will be collected using a pressure transducer placed beneath the water column near the bottom of the well and connected to a data logger set to record data on a logarithmic sampling schedule. The transducer cable will be firmly attached to the top of the well casing, such that it will be minimally disturbed during introduction and removal of the slug. A slug will be constructed using a length of PVC pipe, filled with sand to allow it to sink into the water column. The pipe will be sealed on both ends using slip caps. An eyebolt will be secured into the top cap, from which nylon rope can be attached. The nominal OD of the slug will be 1-in. less than the ID of the well to be tested. The slug will be of sufficient length to displace a large enough volume of water to successfully complete the test.

After the pressure transducer has been secured within the well, the PVC slug will be lowered into the well until it is fully submerged within the water column. The data logger will be monitored until the potentiometric surface returns to equilibrium. The slug will be removed from the water column while simultaneously starting to record potentiometric data with the data logger. The data logger will be monitored as the potentiometric elevation within the well increases and returns to equilibrium, at which time the test is complete.

4.4 Sampling

4.4.1 Sediment Sampling

Sediment samples will be taken by a stainless steel or inert push tube or equivalent. After extraction from the tube, volatile samples will be collected and containerized first. The upper six inches of sediment will be composited and placed in glass jars with teflon-lined lids for chemical testing. Sample locations will be accessed as dictated by field conditions (small boat, wading, etc.).

At a minimum, the following information will be recorded in a bound field logbook for each sediment sample collected:

- date and time of collection
- sample location

- sample number
- weather conditions
- depth of water (if applicable)
- depth of sample collection and recovery
- number of cores collected to obtain adequate sample volume
- sample type (duplicate, split, field blank if applicable)
- Flame Ionization Detector (FID) or Photoionization Detector (PID) readings
- visual observation of sediment (color, layers, USCS description, etc.)
- instrument calibration check
- sampler's name and personnel present
- remarks on any special problems or observations

The samples will be logged into the chain of custody, packed in iced coolers. The coolers will be secured with custody seals and packing tape. Coolers will be shipped by overnight carrier to a contract laboratory.

4.4.2 Surface Water Sampling

Water samples will be collected directly into the sampling bottle where practical. A Kemmerer sampler, a plexiglass Van Dorn sampler, polypropylene dipper or an equivalent, will be used if the pond/lake sampling point is not accessible from the shore. If water samples are to be collected from drainage ditches and the ditches are dry, sampling will be done after a rainfall event when the ditches contain water.

At a minimum, the following information will be recorded for each surface water sample collected:

- date and time of collection
- sample location

- sample number
- weather conditions
- FID or PID readings (if applicable)
- total depth of water (if feasible)
- depth of sample collection
- approximate distance to point of sampling from bank or shore
- sample type (duplicate, split, field blank if applicable)
- collection method (Kemmerer Sampler, direct immersion, etc.)
- temperature, conductance, and pH of water
- sample preparation and preservation (HNO_3, etc.)
- instrument calibration check
- sampler's name and personnel present
- presence of oil sheen or layers on water (if applicable)
- remarks on any special problems or observations

The samples will be logged into the chain of custody, packed in iced coolers. The coolers will be secured with custody seals and packing tape. Coolers will be shipped by overnight carrier to a contract laboratory.

4.4.3 Soil Sampling

Soil samples from borings will be taken using a split spoon or continuous core samplers, as discussed in Sections 4.1.1. Shallow soil samples will be taken with a clean, stainless steel hand auger equipment.

The volatile soil sample will be collected and containerized first. Samples taken for volatile analysis will not be composites, but discrete samples with as little disturbance as possible. For each soil sample, a composite of the remaining sample interval will then be made for additional laboratory analysis.

Samples will be placed in pre-cleaned glass jars with Teflon-lined caps. Each sample shall consist of two jars of soil. The samples will be taken at discrete depths from borings and as composites for shallow soil samples. At a minimum, the following information will be recorded in a bound field logbook for each sediment sample collected:

- date and time of collection
- sample location
- sample number
- weather conditions
- depth of water (if applicable)
- depth of sample collection and recovery
- number of cores collected to obtain adequate sample volume
- sample type (duplicate, split, field blank if applicable)
- FID or PID readings
- visual observation of sediment (color, layers, USCS description, etc.)
- instrument calibration check
- sampler's name and personnel present
- remarks on any special problems or observations

The samples will be logged into the chain of custody, packed in iced coolers. The coolers will be secured with custody seals and packing tape. Coolers will be shipped by overnight carrier to a contract laboratory.

4.4.4 Groundwater Sampling

Groundwater samples for laboratory chemical analysis will be collected from the wells only. Groundwater samples from the wells will be collected no sooner than seven days after well development. All groundwater samples will be collected from each well with precleaned stainless steel bailers or disposable Teflon bailers.

At a minimum, the following information will be recorded in a bound field logbook for each groundwater sample collected:

- date and time of collection
- climatic conditions with ambient air temperature
- well identification number
- sample number
- name of collector
- water level and time of measurement
- total depth and diameter of well
- depth of water column and minimum purge volume
- PID or FID readings
- sample type (duplicate, split, field blank if applicable)
- purging and sampling method (bailer, submersible pump, etc.)
- temperature, conductance, and pH of water during purging until stable readings are obtained
- color or turbidity of sample
- volume purged prior to sampling
- four replicate measurements of pH, temperature, and specific conductance
- sample preparation and preservation (HCl, HNO_3, etc.)
- instrument calibration check
- remarks on any special problems or observations

Monitoring wells will be purged using either a bailer, or submersible pump that is decontaminated between wells as described in Section 4.7. Wells will then be sampled using a precleaned stainless steel or disposable Teflon bailer.

Upon arrival at the well during any sampling event, the Groundwater Monitoring Well Inspection Form, as shown in Appendix A, will be completed. Completed inspection forms will be delivered to the LHAAP Environmental Quality office, who will review them to determine if wells require maintenance.

Prior to sampling, the stagnant water within the well will be removed (three well volumes) so that fresh formation water can enter. The Groundwater Sampling Field Data Form shown in Appendix A contains the formula used to calculate the volume of water to be purged. If a well pumps or bails dry before yielding three volumes, it will be considered purged and ready for sampling as soon as a sufficient volume of water recharges back into the well to allow all sample jars to be appropriately filled. If, after removing three volumes of water, pH, temperature, and conductance have not stabilized, additional water will be removed until parameters stabilize. These parameters will be considered stabilized if, for four consecutive readings, temperature is ± 1°C, pH is ± 0.2 units, and conductance is ± 10% of the previous reading. Handling and disposal of purge water will be conducted in accordance with the "Comprehensive Investigation Derived Waste Management Plan", Sverdrup, June 1996.

The well will be sampled within 24 hours of purging unless the well was pumped or bailed dry. In this case the well will be sampled when a sufficient volume of water recharges into the well to allow all sample jars to be appropriately filled. The sampling crew will record the recharge rate, date, time, rate of purging, and any unusual conditions noted with this operation. All sampling equipment will be decontaminated prior to sampling using the procedures described in Section 4.7.

Monitoring wells will be sampled with a stainless steel bailer. The bailer will be slowly lowered into the well. Each sample bottle will be filled directly from the bailer. A common container will not be used to fill sample bottles. Sampling equipment and containers will be kept from ground contact, and may be laid on plastic sheets on the ground. Where practical and appropriate, upgradient monitoring wells will be sampled before downgradient wells.

Samples of groundwater for chemical analysis are collected and containerized in order of volatilization sensitivity as listed below:

- Volatile Organics
- Total Organic Halogens
- Total Organic Carbon
- Extractable Organics (Including Explosives)
- Total Metals
- Dissolved Metals
- Phenols
- Anions
- Total Hardness
- Field parameters

The sequence of operations for groundwater sampling will be as follows:

- Purge slow-recharging wells (if any) at the outset of the sampling day.
- Purge and sample other wells.
- Sample slow rechargers, if possible.
- Preserve the samples.
- Package and ship the samples to the laboratory.

The samples will be logged into the chain of custody, packed in iced coolers. The coolers will be secured with custody seals and packing tape. Coolers will be shipped by overnight carrier to a contract laboratory and/or the designated QA laboratory. Groundwater samples are to be analyzed for VOCs, high explosives, metals, and anions. See Section 3 for site specific analytical requirements.

4.5 Location Surveys

New soil borings and monitoring wells as well as all shallow soil, sediment and surface water sample locations will be physically located by survey. The survey subcontractor will be required to meet or exceed a Third Order Class 1 survey, with an accuracy of 1 in 10,000. This accuracy equates to approximately 0.01 foot horizontally and vertically. The surveyor will install a reference notch or mark on the north side of the top of casing for all new monitoring wells. The subcontractor will use bench marks set from approved established control monuments in the area. Horizontal control will be in accordance with North American Datum (NAD) 1983, and vertical control will be referenced to the National Geodetic Vertical Datum (NGVD), 1929.

4.6 Site Access Improvements

A bulldozer will be used to regrade and repair existing roads, clear recent dead fall, and place fill dirt and/or gravel. Fill dirt and gravel, if required, will be trucked in from a clean, offsite barrow site as needed to complete improvements. Any new roads required will be constructed only to access new well locations. These will be constructed using fill dirt and/or gravel placed on top of a geotextile base where needed. All improvements will be done in such a manner as to minimize the impact to the existing site conditions.

4.7 Decontamination

4.7.1 Drilling Equipment

Drilling equipment (augers, bits, well casing, split spoons, continuous samplers, rods, and tools) will be steam cleaned or hot water pressure cleaned prior to use in each boring. A decontamination station will be established for the washing of drilling and sampling equipment. This station may be located onsite or nearby in order to serve several sites. Waste wash water will be collected and disposed of in accordance with the "Comprehensive Investigation Derived Waste Management Plan", Sverdrup, June 1996.

4.7.2 Well Casing

Casing and screens used in monitoring well construction will remain in the factory-sealed containers until use. These materials will be placed on a clean, dry tarp or on blocks during assembly. If contact with the ground does occur, the affected sections will be cleaned with potable water.

4.7.3 Sampling Equipment

Non dedicated submersible pumps will be cleaned between uses at different well locations. All sampling equipment will be decontaminated prior to use. The sampling equipment will be transported in sealed, clean containers, and care will be taken to avoid contamination. Sampling equipment will be washed with a non-phosphate detergent, tap water, and rinsed with distilled water, in that order, allowed to air dry, and sealed back into clean containers.

4.8 Field Screening

Each soil sample collected from soil borings and hand auger borings will be initially screened for volatile organics using a PID or a FID. Samples will be screened immediately upon opening or extruding the sample. PID or FID readings, including none detected, will be recorded in the field log books and noted in the boring logs.

Instantaneous air monitoring will be conducted during all drilling and groundwater sampling activities using a PID or FID, and a combustible gas meter. Integrated air sampling will be conducted on a selected basis using sampling pumps and collection media, or passive dosimeters. Air monitoring procedures are described in the SSHP.

Monitoring equipment will be properly calibrated and used according to manufacturer's instructions. Copies of the owner manuals will be kept on-site for reference on the proper calibration, operation, and troubleshooting of equipment.

The calibration of each brand of detector will be according to manufacturers instructions. One hundred (100) parts per million (ppm) isobutylene will be used for calibration of the PIDs. One hundred (100) ppm methane concentration in air will be used to calibrate the FIDs. Calibration of all PIDs or FIDs will be performed daily by attaching the calibration gas to the detector probe and adjusting the span setting or calibrate adjust knob, respectively, to get the desired concentration value on the display. All calibrations of the detectors will be documented in the field logbook. At a minimum, the following information will be recorded:

- Date and time of calibration
- Type and concentration of calibration gas
- Calibration and span settings (include reference gas listed as ppm of isobutylene, methane, etc.)

Once calibration is complete, measurements will be taken by placing the probe near the sample or in the atmosphere of interest and allowing sufficient time for the air to be drawn through and readings to stabilize (usually 5 - 10 seconds).

Triple gas meters will be calibrated according to manufacturer instructions as needed. Adequate operation of the instrument will be checked prior to each use. In a normal atmosphere, the % Lower Explosive Limit (LEL) should equal 0 and the % oxygen should equal 20.9. If readings other than these are obtained, the meter will be checked and calibrated. Pentane is used for % LEL calibration, while clean atmospheric air is used to adjust % oxygen. All calibrations and adjustments will be noted in a field logbook.

The triple gas meter continuously monitors three parameters and has alarm settings for each. The meter will be placed in the work atmosphere and left on during those times when use of a triple gas meter is required or is appropriate. The meters are of the passive type, but if confined space measurements are required, a sample pump and tubing will be attached to the meter to turn it into an active monitoring device.

4.9 Investigation Derived Waste

The "Comprehensive Investigation Derived Waste Management Plan", Sverdrup, June 1996. developed as a separate document, will be referenced as a guide to the handling, staging, characterization, and disposal of all IDW generated during this Phase III investigation at LHAAP.

In general, all IDW including soil cuttings and drilling fluids, are to be segregated by site and containerized in roll-off boxes to be supplied by Radian, Inc. who will be responsible for the characterization and ultimate disposal of these materials.

SECTION 5.0

REMEDIAL INVESTIGATION/FEASIBILITY STUDY REPORTS & DATA SUMMARY/VALIDATION REPORT

Immediately following all field investigation activities, and prior to the development of the Remedial Investigation (RI) report and Feasibility Study (FS) report, a Data Summary/Validation Report is to be prepared for the Group 2 Sites. Work under this Delivery Order will then culminate with the preparation of a Remedial Investigation Report and a Feasibility Study Report for the Group 2 Sites. The RI report will characterize the environmental conditions at the Group 2 sites and evaluate the fate and transport of contaminants of concern for each site. The FS report will present information on possible remedial alternatives and an evaluation of applicable treatment options. The following section presents the process which will be followed in the development of these reports.

5.1 Data Summary/Validation Report

Upon completion of the RI field work and laboratory analyses, Sverdrup will prepare a Sampling and Data Results report. The purpose of the Sampling and Data Results Report will be to verify that the Data Quality Objectives (DQOs) specified in the approved LHAAP RI/FS Work Plan have been met for the areas investigated under this Delivery Order. A review of these analytical results will be used to evaluate the overall quality of the data obtained and to allow for timely completion of the RI/FS report. The Sampling and Data Results Report will be composed of Laboratory Report and a data validation report and shall also include a section on the identification of all applicable, relevant, and appropriate Federal and State Regulations (ARARS) specific to the sites, using the decision logic of U.S. EPA Office of Solid Waste and Emergency Response (OSWER) Directive No. 9234.0-05. This task also includes the downloading of site chemical data into the Environmental Regulatory Management (ERMA) Database.

5.2 Remedial Investigation Report

The Remedial Investigation Report will be prepared in accordance with EPA guidance for conducting Remedial Investigations and Feasibility studies under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and will follow the outline presented below.

General RI Report Format

1.0 Introduction
- *1.1 Purpose of Report*
- *1.2 Site Background*
  - *1.2.1 Site Description*
  - *1.2.2 Site History*
  - *1.2.3 Previous Investigations*
- *1.3 Report Organization*

2.0 Study Area Investigation
- *2.1 Field Activities*
  - *2.1.1 Surface Features (topo mapping etc.) (natural manmade features)*
  - *2.1.2 Contaminant Source Investigations*
  - *2.1.3 Meteorological Investigations*
  - *2.1.4 Surface Water and Sediment Investigations*
  - *2.1.5 Geological Investigations*
  - *2.1.6 Soil and Vadose Zone Investigations*
  - *2.1.7 Groundwater Investigations*
  - *2.1.8 Human Population Surveys*
  - *2.1.9 Ecological Investigations*

3.0 Physical Characteristics of Study Area
- *3.1 Field Activity Results*
  - *3.1.1 Surface Features*
  - *3.1.2 Meteorology*
  - *3.1.3 Surface-Water Hydrology*
  - *3.1.4 Geology and Hydrogeology*
  - *3.1.5 Demography and Land Use*

4.0 Nature and Extent of Contamination
- *4.1 Results of Site Characterization*
  - *4.1.1 Sources*
  - *4.1.2 Soils and Vadose Zone*
  - *4.1.3 Groundwater*
  - *4.1.4 Surface Water and Sediments*
  - *4.1.5 Air*

5.0 Contaminant Fate and Transport
- *5.1 Potential Routes of Migration*
- *5.2 Contaminant Persistence*
  - *5.2.1 Estimated persistence*
- *5.3 Contaminant Migration*
  - *5.3.1 Factors affecting*
  - *5.3.2 Modeling Methods and Results*

6.0 Summary and Conclusions

5.3 Feasibility Study Report

In conjunction with the preparation of the Remedial Investigation Report, a Feasibility Study Report will be prepared which presents information on possible remedial alternatives and evaluates applicable treatment options. The report will be prepared in accordance with the report format outlined in "EPA Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA", EPA/540/G-89/004. The following section presents the feasibility study process which will be followed in the development of this report.

5.3.1 Development and Screening of Alternatives

During the process of developing and screening alternatives, Sverdrup will be conducting the following activities:

- Developing specific remedial action objectives acceptable to the EPA and the Texas Natural Resources Conservation Commission (TNRCC) using all RI generated data. This will be very important as it will set the goals of the Feasibility Study.
- Developing a range of general response actions
- Identifying areas or volumes of the media to be treated, contained and/or subjected to institutional controls
- Identifying, screening, and documenting technologies
- Assembling a number of alternatives depending on the site type and characteristics

- Screening the remedial action alternatives, if necessary, on the basis of effectiveness, implementability, and cost
- Preparing an alternatives array document.

The information developed during these two activities [developing and screening of alternatives] will be used in assembling remedial technologies into alternatives for either the site as a whole or for a specific operable unit. At some sites, a number of potential remedial options will be developed early in the RI/FS process. In such cases, these options will be screened to narrow the list of options that will be evaluated in detail. The screening process will be necessary for two reasons. First, it will streamline the feasibility study process. Second, it will ensure that the most promising alternatives will be considered. During the screening process, Applicable, Relevant and Appropriate Requirements (ARARs) will be given specific attention.

The information available at the time of screening will be used to identify and distinguish any differences among the various alternatives. If screening takes place, the technical memorandum will present the alternatives in such a manner that each alternative will be evaluated with respect to its effectiveness, implementability, and cost and document the rationale for screening out any alternatives. The retained alternatives will be judged as the best or most promising while retaining a range of alternatives broad enough to satisfy requirements of CERCLA and the National Contingency Plan (NCP). These alternatives will be subjected to further consideration and analysis. Alternatives that are screened out will not receive further consideration unless additional information indicates that further evaluation is warranted.

In the event that there are only a limited number of viable alternatives for a particular site, the alternative screening process will be either minimize or eliminated.

5.3.2 Detailed Analysis of Alternatives

Nine evaluation criteria have been developed to address statutory requirements, as well as the technical and policy considerations and have proven to be important for selecting the most appropriate remedial alternatives. These evaluation criteria will serve as the basis for conducting the detailed analyses of alternatives during the FS and for subsequently selecting an appropriate site remedy.

Evaluation Criteria:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Short-term effectiveness
- Reduction of toxicity, mobility, or volume
- Implementability
- Cost
- State acceptance
- Community acceptance.

The detailed analysis process will include an evaluation of each alternative against the nine criteria. Sverdrup will submit a memorandum summarizing the results of the comparative analysis. In addition, a draft FS report will be submitted for review and approval. The report, as adopted or modified, will provide a basis for remedy selection. It will document the development and analysis of remedial alternatives. The final FS report will be bound with the final RI report. Following completion of the RI/FS report and confirmation that there is sufficient information to support the selection of a preferred alternative, the process of remedy selection will begin.

SECTION 6.0 BASELINE RISK ASSESSMENT

For incorporation into the RI/FS report, a Baseline Risk Assessment will be developed in accordance with CERCLA requirements for the Group 2 Sites. The baseline risk assessment process is cumulative in nature: the components of the assessment build on one another. The following documents will be utilized in planning the conduct of the baseline risk assessment, EPA's *Risk Assessment Guidance for Superfund Human Health Evaluation Manual, Superfund Exposure Assessment Manual*, and *Superfund Environmental Evaluation Manual*, Integrated Risk Information System (IRIS), and Public Health Risk Evaluation Data Base.

6.1 General

The Baseline Risk Assessment will be divided into two sections "Human Health Evaluation" and "Ecological Assessment" subsections. The Human Health Evaluation will assess the reasonable and foreseeable current and potential exposures, as well as associated risks in the event no action is taken to remove or treat contaminants and/or prevent their migration. The Ecological Assessment will discuss potential environmental impacts of the contaminants present at each of the Group 2 sites. Specifically, the Ecological Assessment shall discuss the potential for degradation of the surficial aquifer present at the site in the event that no remedial action is taken as well as ecological impacts. All available site information will be used in the preparation of these subsections.

To the full extent possible, based upon the data recovered from the field investigation, the baseline risk assessment will address the following topics:

(1) Identification of contaminants with a summary of the selection basis for chemicals of concern;

(2) Physical and chemical characteristics of substances including toxicity, persistence, and potential for migration;

(3) Hydrogeologic characteristics of the site and potential degradation of the surficial aquifer based on the contaminant migration characteristics;

(4) The quality and quantity of the ground water and direction of groundwater flow;

(5) The total thickness of site overburden;

(6) Thickness of unsaturated zones;

(7) Elevation of site bedrock surfaces;

(8) The potential for migration of contaminants from other sources surrounding the site;

(9) Current and future uses of the ground water in the area;

(10) Identification of actual or potential reasonable and foreseeable routes of exposure, characterization of exposed populations, and determination of the extent of exposure based on anticipated current and future land use;

(11) Estimation of exposure point concentrations based on sampling results or simple analytical modeling;

(12) Presentation of toxicological profiles for chemicals of concern.

(13) Based on the results of chemical analysis for the various media tested and the identification of reasonable foreseeable, and complete exposure pathways, a composite risk analysis will be conducted for both carcinogenic and noncarcinogenic substances. This will be accomplished by comparing analytical and/or modeled receptor point concentrations with regulated levels for public health. For the purposes of this investigation it will be assumed that ground water could be used as an industrial drinking water source from any location investigated. If certain physical parameters of any aquifers encountered negate this possibility, a justification for non-use of an aquifer for a drinking water well will be included

in the report. Exposure pathways related to soil contamination will also be addressed in terms of dermal contact hazards, soil ingestion and inhalation of fugitive dust;

(14) A general discussion and characterization of the uncertainty of results generated for the Baseline Risk Assessment will also be presented;

(15) A contaminant fate and transport model that is capable of modeling contaminant migration to the saturated zone will be selected. The selected model will address the following requirements:
- (a) One dimensional;
- (b) Dispersion and advection;
- (c) Sorption and retardation factor;
- (d) Degradation

(16) The current and future impacts of site contaminants on the ecosystem. As a minimum, the following areas will be addressed:
- (a) Fauna and flora;
- (b) Critical habitats; and
- (c) Any commercial, residential, recreational, and esthetic uses affected by site contaminants;

As specified in the Scope of Work, this task also includes travel to a risk assessment scoping meeting tentatively scheduled for approximately 6 months after field work is completed. This meeting will provide the forum to interact with state and federal regulators to clarify data and report needs for the risk assessment. For costing purposes it is assumed that the meeting will be held in Tulsa and is 2 days in length.

SECTION 7.0 SCHEDULE OF DELIVERABLES

7.1 Schedule of Deliverables

The schedule for delivery of work items to the Technical Manager is in calender days and is shown in Table 7-1. A complete project schedule is presented in Table 7.2.

Table 7.1
SCHEDULE FOR DELIVERY ORDER SUBMITTALS

SUBMITTALS	SCHEDULE	NUMBER OF COPIES
Phase III RI/FS Work Plan (Preliminary Draft)	TBD	7 (For COE Review)
Phase III RI/FS Work Plan (Draft Final)	21 days after A-E receipt of COE comments on Preliminary Draft.	24
Phase III RI/FS Work Plan (Final)	14days after A-E receipt of regulatory comments on Draft Final.	24
Data Summary/Validation Report	197 days after fieldwork is completed.	15
RI and FS Reports (Draft)	120 days after the release of Data Summary/Validation Report	11
RI and FS Reports (Draft Final)	14 days after the receipt of the Army comments on Draft RI/FS Report	20
RI and FS Reports (Final)	14 days after the receipt of regulator comments on Draft Final RI/FS Report.	20
OPTIONS:		
Preliminary Draft Risk Assessment Report	180 days after receipt of Data Summary/Validation Report	10 COE review
Draft Risk Assessment Report	21 days after receipt of Preliminary Draft Risk Assessment Report	15 Army review
Revised Draft Risk Assessment Report	40 days after receipt of Draft Risk Assessment Report	20

TBD - To Be Determined

Table 7.2
Project Schedule

Task Descriptinon	Start	Finish
Contract (Sverdrup)	06-Oct-97	28-Nov-97
Preperattion of Work Plan (Preliminary Draft)	01-Dec-97	26-Dec-97
COE Review Work of Plan (Preliminary Draft)	29-Dec-97	02-Jan-98
Work Plan Comment Resolution (Preliminary Draft)	05-Jan-98	09-Jan-98
Revision of Work Plan (Draft Final)	12-Jan-98	16-Jan-98
Combined Review of Work Plan (Draft Final)	19-Jan-98	18-Feb-98
Work Plan Comment Resolution (Draft Final)	19-Feb-98	23-Feb-98
Revision of Work Plan (Final)	24-Feb-98	04-Mar-98
Regulatory Review and Approval of Work Plan (Final)	05-Mar-98	09-Mar-98
Mobilize to LHAAP	31-Jan-98	02-Feb-98
Field Work	03-Feb-98	04-Jun-98
Data Validation	14-Dec-98	01-Jan-99
Preperation of Data Summary/Validation Report (Preliminary Draft)	04-Jan-99	22-Jan-99
COE Review of Data Summary/Validation Report (Preliminary Draft)	25-Jan-99	05-Feb-99
Data Summary/Validation Report Comment Resolution (Preliminary Draft)	08-Feb-99	12-Feb-99
Revision of Data Summary/Validation Report (Draft Final)	15-Feb-99	19-Feb-99
Combined Review of Data Summary/Validation Report (Draft Final)	22-Feb-99	26-Mar-99
Data Summary/Validation Report Comment Resolution (Draft Final)	29-Mar-99	02-Apr-99
Preperation of Data Summary/Validation Report (Final)	05-Apr-99	09-Apr-99
Regulatory Review and Approval of Data Summary/Validation Report (Final)	12-Apr-99	16-Apr-99
Preperation of RI Report (Preliminary Draft)	03-May-99	28-May-99
COE Review of RI Report (Preliminary Draft)	31-May-99	04-Jun-99
RI Report Comment Resolution (Preliminary Draft)	07-Jun-99	11-Jun-99
Revision of RI Report (Preliminary Draft Final)	14-Jun-99	18-Jun-99
Army Review of RI Report (Preliminary Draft Final)	21-Jun-99	16-Jul-99
RI Report Comment Resolution (Preliminary Draft Final)	19-Jul-99	23-Jul-99
Revision of RI Report (Draft Final)	26-Jul-99	30-Jul-99
Regulatory Review of RI Report (Draft Final)	02-Aug-99	03-Sep-99
RI Report Comment Resolution (Draft Final)	06-Sep-99	10-Sep-99
Revision of RI Report (Final)	13-Sep-99	17-Sep-99
Regulatory Review and Approval of RI Report (Final)	20-Sep-99	24-Sep-99
Preperation of FS Report (Preliminary Draft)	31-May-99	30-Jul-99
COE Review of FS Report (Preliminary Draft)	02-Aug-99	06-Aug-99
FS Report Comment Resolution (Preliminary Draft)	09-Aug-99	13-Aug-99
Revision of FS Report (Preliminary Draft Final)	16-Aug-99	20-Aug-99
Army Review of FS Report (Preliminary Draft Final)	23-Aug-99	17-Sep-99
FS Report Comment Resolution (Preliminary Draft Final)	20-Sep-99	24-Sep-99

Table 7.2 (Continued)
Project Schedule

Task Description	Start	Finish
Revision of FS Report (Draft Final)	27-Sep-99	01-Oct-99
Regulatory Review of FS Report (Draft Final)	04-Oct-99	05-Nov-99
FS Report Comment Resolution (Draft Final)	08-Nov-99	12-Nov-99
Revision of FS Report (Final)	15-Nov-99	19-Nov-99
Regulatory Review and Approval of FS Report (Final)	22-Nov-99	26-Nov-99
Preperation of Risk Assessment Report (Preliminary Draft)	02-Aug-99	03-Sep-99
COE Review of Risk Assessment Report (Preliminary Draft)	06-Sep-99	17-Sep-99
Risk Assessment Report Comment Resolution (Preliminary Draft)	20-Sep-99	24-Sep-99
Revision of Risk Assessment Report (Preliminary Draft Final)	27-Sep-99	01-Oct-99
Army Review of Risk Assessment Report (Preliminary Draft Final)	04-Oct-99	05-Nov-99
Risk Assessment Report Comment Resolution (Preliminary Draft Final)	08-Nov-99	12-Nov-99
Revision of Risk Assessment Report (Draft Final)	15-Nov-99	19-Nov-99
Regulatory Review of Risk Assessment Reoport (Draft Final)	22-Nov-99	24-Dec-99
Risk Assessment Report Comment Resolution (Draft Final)	03-Jan-00	07-Jan-00
Revision of Risk Assessment Report (Final)	10-Jan-00	14-Jan-00
Regulatory Review and Approval of Risk Assessment Report (Final)	17-Jan-00	21-Jan-00

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Sverdrup

Final Sample and Analysis Plan
for the
Group 2 Sites, Phase III Remedial Investigation/Feasiblity Study
at the
Longhorn Army Ammunition
Plant (LHAAP)
Karnack, Texas

Submitted to
U.S. Army Corps of Engineers
Tulsa District
CONTRACT NO. DACA56-97-D-0001
Modification Delivery Order No. 1

Prepared by
Sverdrup Environmental, Inc.
St. Louis, Missouri

April 1998

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LIST OF ACRONYMS and ABBREVIATIONS

ASTM- American Society of Testing Materials
BS- Blank Spike
BSD- Blank Spike Duplicate
COC- Chain of Custody
Chem and IH- Chemistry and Industrial Hygiene Section
DQOs- Data Quality Objectives
FS- Feasibility Study
HTRW-CX- Hazardous, Toxic, and Radioactive Waste-Center of Expertise
LCS- Laboratory Control Samples
LCSD- Lab Control Sample Duplicate
LHAAP- Longhorn Army Ammunition Plant
MS- Matrix Spike
MSD-Matrix Spike Duplicate
%R- Percent Recoveries
QA- Quality Assurance
QC- Quality Control
RPD- Relative Percent Difference
RI- Remedial Investigation
SAP- Sampling and Analysis Plan
SSHP- Site Safety and Health Plan
Sverdrup- Sverdrup Environmental, Inc.
USACE- U.S. Army Corps of Engineers, Tulsa District
USEPA- U.S. Environmental Protection Agency
VOCs- Volatile Organic Compounds

SECTION 1.0 - INTRODUCTION

1.1 GENERAL

The purpose of this Sampling and Analysis Plan (SAP) is to document the procedures required to ensure that all data obtained from the Phase III Remedial Investigation/Feasiblity Study (RI/FS) activities at the Sites 12, 17, and 29 at Longhorn Army Ammunition Plant (LHAAP) are of acceptable quality and detail the process for completing the task outlined in the Work Plan. Quality Assurance (QA) is the Government activity required to assure desired and verifiable levels of quality in all aspects of an investigation. Quality Control (QC) is the functional mechanism to achieve quality data. The QA program, administered by the Government, will ensure that the QC program will result in high quality data. This document will describe the QA/QC procedures for each aspect of the investigations which will meet the data quality objectives (DQOs) of this project and the process for completing the task outlined in the Work Plan. Procedures in this SAP came from Chemical Data Quality Management for Hazardous Waste Remedial Activities, ER-1110-1-263 (Ref. 2), a Corps of Engineers regulation, with additional guidance from Development of an RFI Work Plan and General Considerations for RCRA Facility Investigations, SW-87-001 (Ref. 3), and Minimum Chemistry Data Reporting Requirements for DERP and Superfund HTW, CEMRD-EO-GC Considerations (Ref. 1). DQOs in this SAP came from Data Quality Objectives for Superfund, EPA540-R-93-071 (Ref. 4).

1.2 REPORT ORGANIZATION

This document discusses the data quality procedures and techniques to be used in the investigation at LHAAP. The study will be accomplished through the sampling and analysis of soil, surface soil, sediment, surface water, and groundwater.

Section 2.0 discusses the DQOs for this project; Section 3.0 discusses field operations; Section 4.0 discusses sample handling and testing; Section 5.0 discusses sample integrity; Section 6.0 discusses data reduction, validation and reporting; Section 7.0 discusses audits; Section 8.0 presents corrective actions and Section 10.0 presents references.

1.3 PROJECT QA/QC ORGANIZATION

A quality program has been developed to insure the integrity of the sample methods for both field and analytical procedures for the Phase III RI/FS.

1.3.1 Quality Control Personnel

Program personnel will be responsible for monitoring and reviewing procedures used in each stage of the work to ensure that data generated in the course of execution of the work plan is accurate, complete, precise, and representative of the site studied. An individual on each field crew will be designated as the Quality Control Officer and will be responsible for the proper execution of field QC, as discussed in Section 3.5 of this report.

1.3.2 Quality Assurance Personnel

Quality assurance will be performed by the U.S. Army Corps of Engineers, Tulsa District (USACE), Geotechnical Branch, and the Chemistry and Industrial Hygiene Section (Chem and IH). The Chem and IH Section reports to the Chief of the Geotechnical Branch and will be responsible for performance and system audits of this investigative program, data validation, ongoing reviews of QA procedures, and coordination of QA training for project personnel. Data validation reports will be prepared by Sverdrup Environmental, Inc. (Sverdrup). USACE will add the sections on comparability (based on the QA samples as discussed in section 2.5). USACE will make final decisions regarding data validity and useability based on data received from Sverdrup and comparability study.

1.3.3 Laboratory

Analytical testing and quality control testing will be performed by laboratories selected by Sverdrup. QA testing will be performed by a contract laboratory selected by the USACE. Samples taken by Sverdrup will be sent to their laboratories, with the exception of the QA samples, which will be sent to the USACE selected laboratory. All analytical laboratories used for this work will be validated by the Hazardous, Toxic, and Radioactive Waste-Center of Expertise (HTRW-CX). The validation process involves review of their laboratory quality management manual, laboratory performance on audit sample analyses, and an on-site inspection. This validation process is discussed in detail in Appendix C of ER-1110-1-263 (Ref. 2).

SECTION 2.0 - DATA QUALITY OBJECTIVES

The DQOs of this project have been chosen to meet the goals of site characterization, risk assessment, and remedial design. DQOs are qualitative and quantitative statements which specify the quality of data required to support decisions made during remedial response activities. These DQOs will be used to develop a plan to be used throughout the RI/FS process. Data developed during the study will be used to determine the presence and lateral and vertical extent of contamination in the soil and groundwater, as well as the rate of migration. The evaluation of this data will be used to screen remedial alternatives and to begin remediation. The level of quality required of the collected data to be used for these intended purposes is such that it meets U.S. Environmental Protection Agency (USEPA) "definitive data" standards as defined in "Data Quality Objectives Process for Superfund Interim Final Guidance," USEPA 540-R-93-071, September 1993 (Ref. 4). The method-specific DQOs for precision, accuracy, and sensitivity have been established for each measurement parameter based on prior knowledge of the specific measurement system used and method validation studies employing replicate analyses, spikes, standards, calibrations, recoveries, control charts, and project specific requirements. The minimum internal data reporting requirements (from Ref. 2) which will be required of all analytical laboratories includes the following:

- Sample identification numbers cross-referenced with laboratory ID's and QC sample numbers.

- Problems with arriving samples noted on an appropriate form.
- Each analyte reported as an actual value or less than a specified quantitation limit as listed in Appendix B Tables B.3 to B.6.
- Dilution factors, extraction dates, and analysis dates are reported.
- QC samples to be included as laboratory blanks, surrogate spikes, matrix spikes, laboratory control spikes laboratory duplicates, field duplicates, and field blanks.

The data developed from the investigations described in this SAP will meet the objectives discussed below with respect to precision, representativeness, accuracy, completeness, and comparability. The majority of this data will be developed in the laboratory from the analysis of field samples and the remainder will be measured in the field.

2.1 ACCURACY

Accuracy measures the bias in a measurement system and is very difficult to measure for the entire data collection activity. Potential sources of error are the sampling process, field contamination, preservation, handling, sample matrix, sample preparation and analysis techniques.

Accuracy objectives for laboratory performance are expressed as percent recoveries (%R) of a known concentration of reference material added to a field sample matrix or a standard matrix. Every batch of samples analyzed shall include matrix spikes (MS/MSD), laboratory control samples (LCS) and surrogate spikes (for organic analyses only). Matrix spike results are used to evaluate the ability of the analytical method to measure the analytes of interest in the actual sample matrix and to verify analyses are conducted within control limits. Laboratory control sample results are used in conjunction with matrix spike results to verify analyses are conducted within control limits when matrix spike recoveries are out of control. Surrogate spike compounds will be added to every sample analyzed for organic parameters. Surrogate spike recoveries are used to provide method performance indicators with respect to each individual sample matrix analyzed for organic compounds. Matrix spike and laboratory control samples will be analyzed at a frequency of one per analytical batch or every 5% of samples, whichever is more frequent. If sample volumes are not sufficient to conduct MS/MSD analyses, a blank spike/blank spike duplicate sample (BS/BSD) or a lab control sample duplicate (LCSD) will be prepared and analyzed.

Analytical accuracy will be assessed through the use of known QC samples and spiked samples and will be presented as a percent recovery. Accuracy determined by percent recovery is calculated as follows:

$$Percent\ Recovery = \frac{(C_2 - C_1)}{C_0} \times 100\%$$

where C_0 = amount of analyte added to the sample matrix,
C_1 = amount of analyte present in the unspiked sample matrix (equal to zero for the standard matrix), and
C_2 = amount of spiked material recovered in the analysis.

2.2 PRECISION

Precision is a measure of the degree of reproducibility of an analytical value and is used as a check on the quality of the sampling and analytical procedures. Precision is determined by analyzing replicate samples. The significance of a precision measurement depends on whether the sample is a field replicate, lab replicate, or a matrix spike replicate. Field replicates are taken at the rate of 10% or one per batch (each daily shipment of samples from a site), whichever is greater. Precision of the analytical method, at each stage, is determined by calculation of a relative percent difference (RPD) between duplicate analytical recoveries of a sample component, relative to the average of those recoveries:

$$RPD = \frac{|C_2 - C_1|}{(C_2 + C_1)/2} \times 100\%$$

where C_1 = analyte concentration in the sample,
C_2 = analyte concentration in the sample replicate, and
$|\;|$ = an absolute value (It is customary to express RPD as a positive number).

These calculations are usually performed on MS/MSD samples. If sample volumes are not sufficient to conduct MS/MSDs, calculations will be performed on BS/BSD samples or LCS/LCSDs.

Precision will be further evaluated by comparing the analytical results of the field sample with its quality control duplicate sample. Multiplicative factors shall be used to determine the significance of differing concentration values. For water samples, should the field sample and its QC duplicate samples differ in value by greater than a factor of 2, minor disagreement between the values exists. If the values differ by a factor greater than 5, a major disagreement between the values exists. For soil and sediment samples, the factors shall be 5 and 10, respectively. In the special case where one or both sample results are less than 5 times the reported detection limit, a difference of ± 3 times the reported detection limit is used as the evaluation criteria.

Most importantly, data found in disagreement are examined to determine if the disagreement is an isolated occurrence or if any trends exist. Trends may indicate systematic errors made in sampling, handling, or analytical procedures or may also indicate the selection of an inappropriate protocol. If a trend exists, associated data are evaluated carefully to determine their validity. The significance, or impact, upon data quality will be discussed in the laboratory Data Validation Report as outlined in Section 6.3.

2.3 COMPLETENESS

The overall project completeness is a comparison between the total number of measurements made which are judged to be valid to the number of measurements planned. The results will be calculated following data validation and reduction. Completeness C is determined by:

$$C = \frac{P_1}{P_0} \times 100\%$$

where P_1 = number of valid measurements
P_0 = number of planned measurements

A value of 90% or higher is the goal. For values less than 90%, problems in the sampling or analytical procedures will be examined and possible solutions explored.

2.4 REPRESENTATIVENESS

Representativeness expresses the degree to which sample data accurately and precisely represent actual site conditions. The determination of the representativeness of the data will be performed by:

- Comparing actual sampling procedures and chain of custody forms to those described in the work plan,
- Identifying and eliminating nonrepresentative data in site characterization activities,
- Evaluating holding times and condition of samples on arrival at the laboratory,
- Examining blanks for cross contamination.

Representativeness is a qualitative determination. The representativeness objective of this work plan is to eliminate all nonrepresentative data.

2.5 COMPARABILITY

Comparability is a qualitative measure of the confidence with which one data set can be compared to another. These data sets include data generated by different laboratories performed under this work plan, data generated by laboratories in previous investigative phases, data generated by the same laboratory over a period of several years, or data obtained using differing sampling techniques or analytical protocols. The comparability objectives of this work plan are (1) to generate consistent data using standard test methods; and (2) to salvage as much previously generated data as possible. Comparability will be evaluated by comparing the QA sample analyzed by an independent laboratory to its field replicate. Multiplicative factors shall be used to determine the significance of differing concentration values. For water samples, should the field sample and its QA duplicate samples differ in value by greater than a factor of 2, minor disagreement between the values exists. If the values differ by a factor greater than 5, a major disagreement between the values exists. For soil and sediment samples, the factors shall be 5 and 10, respectively.

The USACE Tulsa District will prepare a USACE Chemical Quality Assurance Report (CQAR), which includes comparison of field/QA sample results. The USACE CQAR will be included as an Appendix to the final Data Validation Report.

2.6 SENSITIVITY

Sensitivity is a general term which refers to the calibration sensitivity and analytical sensitivity of a piece of equipment. Calibration sensitivity is the slope of the calibration curve evaluated in the concentration range of interest. Analytical sensitivity is the ratio of the calibration sensitivity to the standard deviation of the analytical signal at a given analyte concentration. The detection limit, which is based on the sensitivity of the analysis, is the smallest reported concentration in a sample within a specified level of confidence. Quantitation limits represent the sum of all of the uncertainties in the analytical procedure plus a safety factor. The detection limit is a part of the quantitation limit. Quantitation limits are given in Appendix B Tables B.3 to B.6.

2.7 FIELD MEASUREMENTS

Field measurements will be performed to Level I standards. These will include measurements of pH, temperature, conductance, and turbidity on groundwater samples. Precision on field measurements will be assessed by four replicate measurements to determine reproducibility. These consecutive readings should be ± 1°C for temperature, ± 0.2 units for pH, ± 10% for conductance, and ± 10% for turbidity.

SECTION 3.0 - FIELD OPERATIONS

This section provides an outline of field activities included in the Phase III RI/FS and have been detailed in the Work Plan. Field activities include: surface soil and sediment sampling, access improvement, surface resistivity study, slug tests, surveying, monitoring wells and extraction wells, groundwater sampling, decontamination, waste disposal, other field procedures, and field QA/QC.

To further investigate potential contamination with volatile organic compounds (VOCs), high explosives, and metals, the Phase III RI/FS includes the following:

Site 12

- Collection of five sediment and five surface water samples.
- Installation of 4 shallow (30') and 3 intermediate (70') monitoring wells.
- Collection of groundwater samples from 8 existing wells and 7 new wells.

Site 17

- Collection of five sediment and five surface water Samples.
- Collection of 20 surface soil samples.
- Installation of 5 shallow (30') and 3 intermediate (70') monitoring wells.
- Collection of groundwater samples from 9 existing wells and 8 new wells.

Site 29

- Collection of ten sediment and ten surface water samples.
- Collection of five surface soil samples.
- Installation of 14 shallow (30') and 8 intermediate (70') monitoring wells.
- Collection of 60 groundwater samples using the geoprobe.
- Collection of groundwater samples from 14 existing wells and 22 new wells

Each of these field activities is designed to obtain site-specific data to best characterize both the physical and chemical characteristics for Sites 12, 17, and 29. Sampling and analyses described in this plan of investigation will be performed in accordance with the procedures outlined in the Work Plan and Site Safety and Health Plan (SSHP).

3.1 COLLECTION OF SEDIMENT AND SURFACE WATER SAMPLES

The investigation at Site 12 will include the collection of five sediment and five surface water samples for confirmation sampling of previous detections and around the border of the site to define the extent of the impacted area. The investigation at Site 17 will include the collection of five sediment and five surface water samples to confirm previous sampling results in the northeast portion of site. The investigation at Site 29 will include the collection of ten sediment and ten surface water samples which includes testing runoff pathways between site and Goose Prairie Creek to the east. The proposed locations are shown on Figure 3-1 for Site 12, Figure 3-3 for Site 17, and Figure 3-6 for Site 29. These samples will be analyzed for VOCs, high explosives, and TAL metals.

3.2 COLLECTION OF SURFACE SOIL SAMPLES

Twenty shallow soil samples will be collected from 10 locations at Site 17 at depth intervals of (0'-0.5') and (2.5'-3.0'). These surface soil samples will be analyzed for high explosives and will be used to define area of apparent incinerated explosive ash disposal area north and northwest of monitoring well 17WW03. Five Shallow Soil samples will be collected at Site 29 and tested for the VOCs, SVOCs, TAL metals, High explosives, pesticides/PCBs, and dioxins/furans. The placement of the samples at Site 29 will be used for the preparation of a risk assessment of the site. The proposed locations are shown on Figure 3-4 for Site 17, and Figure 3-7 for Site 29.

3.3 COLLECTION OF GROUNDWATER SAMPLES

A total of fifteen groundwater samples will be collected from seven newly installed wells and from eight existing wells at Site 12. Seventeen groundwater samples will be collected form eight newly installed wells and from nine existing wells at Site 17. Thirty six groundwater samples will be collected from twenty two newly installed wells and from fourteen existing wells at Site 29. All groundwater samples will be analyzed for VOCs, high explosives, TAL metals, and anions. Monitoring well location for Site 12 are shown on Figure 3-2, for Site 17 on Figure 3-5, and on Figure 3-9 for Site 29.

3.4 DIRECT PUSH SAMPLING

Direct push technology will be used at 60 locations to collect groundwater samples around former production facilities. Groundwater samples will be analyzed for high explosives and VOCs.

3.5 FIELD QUALITY ASSURANCE QUALITY CONTROL PROCEDURES

QA/QC samples for groundwater, surface soils, sediments, and surface water will be used to verify that the sampling and analytical techniques are being performed properly. QC samples are taken in the field and analyzed with the field samples by the same laboratory. QA samples are analyzed by a USACE selected laboratory to check the performance of the contract laboratory. QC samples required for soils and water sampling include travel blanks, equipment blanks, and replicates. QA samples also include replicates. QA/QC samples are described below.

3.5.1 Travel Blanks

Travel blanks consist of American Society of Testing Materials (ASTM) Type II reagent water sealed into a sample vial in the field. The blank is not opened again until it is received in the laboratory. One travel blank will be prepared for each shipment of water samples containing volatiles, all of which are shipped in the same cooler to the laboratory each day. Travel blanks measure cross contamination during shipment and contamination sources contacted during shipment. They are only analyzed for volatiles.

3.5.2 Equipment Blanks

Equipment blanks for water or soil samples will consist of ASTM Type II water which has been poured over or through non-dedicated sampling equipment such as augers, knives, spoons, or bailers. They will be shipped in the cooler with the associated samples from the site. Equipment blanks will be prepared and preserved in the same manner as a water sample. Equipment blanks measure the effectiveness of equipment decontamination. Equipment blanks are taken at a rate of one for every twenty samples and are analyzed for the same constituents as the associated soil or water samples.

3.5.3 Replicate Samples

Replicate samples or splits are extra samples as identical as possible to the original. They may consist of a composite or as a series of grab samples from the same source. Every tenth sample is taken in triplicate. One of each set of these replicates will be sent to the QA Lab as an audit sample (QA sample) for the contract laboratory, and the other two samples will be sent to the contract analytical lab as a field sample and a QC sample, each with a unique sample number. In cases where only sufficient sample exists for a duplicate set, every fifth sample is a duplicate. This duplicate alternates as a QC and QA sample.

SECTION 4.0 - SAMPLE HANDLING AND TESTING

4.1 SAMPLE NUMBERING SYSTEM

Sample numbers are assigned by the project manager and are unique to each site. Sample numbers identify the site, well or boring, and type of blank or replicate. Sample numbers are assigned as follows:

LHss - xx - yy ( ) - bb [comments]

where:

LH	=	Longhorn Army Ammunition Plant		*ss*	=	Unit Site Number
xx	=	Sample Type				
where:	*WW*	=	Monitoring Well (Group 1, 2, & 5)	*EW*	=	Extraction Well
	SS	=	Shallow/Surface Soil	*SB*	=	Soil Boring
	SD	=	Sediment	SW	=	Surface Water
yy	=	Location Number				
( )	=	Depth range of sample or matrix type				
where:	(*zz - zz*)	=	Depth range, in feet below ground surface			
	(*Water*)	=	Water			
	(*000.0*)	=	Depth of soil sample, the number assigned represents the upper-most depth of the particular sample depth interval			
bb	=	QA/QC Modifier, when needed				
where:	*QA*	=	QA field replicate sample for USACE Laboratory analysis			
	QC	=	QC field replicate of contract Laboratory analysis			
	TB	=	Trip Blank			
	EB	=	Equipment Rinsate			

The sample designated for MS (matrix spike) and MSD (matrix spike duplicate) will be noted in the comment section of the chain-of-custody form.

4.2 PREPARING SAMPLES

When samples are taken in the field, they will be preserved according to Appendix Table B.1. They will be then placed in a ice cooler in styrofoam inserts which have cutouts to accommodate the jars. The cooler will be filled with ice and the chain of custody form and field data form will be placed inside in a zip-lock plastic bag placed on top of the ice. The cooler will be filled with ice and the chain of custody form and field data form will be placed inside in a zip-lock plastic bag and taped to the under side of the cooler lid. The cooler will be wrapped with strapping tape, and a chain-of-custody seal is placed on the strapping. The samples will be then delivered to the shipper. Samples collected for chemical analysis will be shipped on the day they are sampled, if possible, but in no event kept onsite longer than 48 hours.

4.3 RECEIVING SAMPLES

After the ice coolers are received at the laboratory, the samples are logged in, the COC is signed, and a cooler receipt form is filled out. This form documents the condition of the samples as received. The samples are checked for breakage or leakage and the temperature of the ice bath is checked. If the temperature exceeds 4 °C or if any other problems are noted, this information is recorded on the COC and the District office is notified of the problem. Samples are repackaged and shipped to contract laboratories using similar procedures as described in Section 4.2.

4.4 LABORATORY PROCEDURES

Laboratory analytical procedures come from the following source: USEPA (SW 846 and EPA-600, Refs. 6 and 8), and Standard Methods (Ref. 1). Analytical methods from these sources are given in Appendix B Table B.1 and B.2. Quantitation limits are given in Appendix Tables B.3 through B.6. Quantitation limits, however, are dependent on the concentration of the components in the matrix to be analyzed.

SECTION 5.0 - SAMPLE INTEGRITY

The quality of analytical data is suspect if the integrity of the sample cannot be ensured. Integrity includes the procedures and written records which, when taken together, verify that the sample is as represented.

5.1 SECURITY

Security involves procedures which ensure sample integrity. Security is required until final disposal of the sample after laboratory analysis is complete. Aspects of sample security are discussed below.

5.1.1 Security of the Well and Samples in the Field

Each well will have a locking cap and keys will be given out only to those authorized to access the wells. Samples, once taken, will be in the possession of the sampling crew or secured in the field office. QA and QC samples will be taken, which, when analyzed, will also document the integrity of the sample.

Each member of the drilling/sampling crew will don a new pair of gloves before drilling/sampling each soil boring/sampling location. The person taking the samples will wear disposable plastic gloves and will change them between each sampling interval. Used gloves will be bagged and disposed of in a manner which meets RCRA guidelines, as discussed in the "Comprehensive Investigative Derived Waste Management Plan", June, 1996.

5.1.2 Security of the Sample in the Lab

Samples will be stored in a secure area in the laboratory with limited access to authorized laboratory personnel. Upon receipt of the ice cooler, laboratory personnel will check the temperature of the ice bath, the condition of the samples, and the accuracy of the accompanying paperwork.

5.2 CUSTODY

Custody consists of formal records which document integrity. These records are described below.

5.2.1 Chain of Custody Form

The chain of custody (COC) form is a record which describes the sample, the date, time, and method of sampling, and the analyses requested, with specific analyte and analytical method number included. The COC will also have the name and telephone number of the USACE Chem and IH point of contact. It has spaces for signatures of those receiving and relinquishing the samples. The form is normally signed by the individual preparing the samples for shipment and the receiving individual at the laboratory. The individual preparing the samples for shipment maintains a copy. The original COC is incorporated into the hard copy laboratory report, where it is placed on file. An example of this form is given in Appendix A.

5.2.2 Laboratory Traffic Report

Samples which are sent from the QA Lab to a contract lab are sent with this form. It is a laboratory COC form which gives the sampling date, the analyses to be performed and the date the results are needed. Because various fractions of the sample might be sent to several contract labs, the original COC cannot be used. The traffic reports are incorporated into the hard copy laboratory reports.

5.2.3 Bill of Lading

A bill of lading (bus bill or air bill) documents receipt of the samples by the carrier. It is not possible for the carrier's representative to sign the COC since it is sealed in the ice cooler. Bills of lading are maintained by Sverdrup and submitted to USACE Tulsa District with the laboratory data documentation.

5.2.4 Cooler Receipt Form

The cooler receipt form is completed by the laboratory and documents the condition of the samples as received by the lab. This form is available in the hard copy laboratory report.

5.3 SAMPLE TRACKING AND IDENTIFICATION

The following subsections outline the documentation, in addition to the items listed in Section 5.2, required to demonstrate sample integrity.

5.3.1 Field Log Book

The field log book is a bound record with consecutively numbered pages, kept by the drilling/sampling crew(s), in which sampling information is recorded with water-proof ink. It is taken to the sample sites to record necessary sampling data and other items of interest. The full name and corresponding initials of each field crew will also be recorded. It is used in the field to record preservation and preparation procedures for shipment. It is also used to record equipment calibration and decontamination of sampling equipment. The information for the COC and field data form comes from the field log book. The field log book is discussed in detail in section 5.5.1 of the Work Plan.

5.3.2 Field Data Form

Field data forms transmit necessary information about the sample to the lab. Field measurements such as pH, conductance, and water levels as well as problems with the location or the sample are noted on this form. Field data forms are taken for all sampling events. Blank field data forms are shown in Appendix A.

5.3.3 Sample Labels

Labels on each jar contain the well or boring number or surface sample location, the sample number, preservation (if any), the analysis to be performed, and the sampler's initials. Examples are provided in Appendix A.

SECTION 6.0 - DATA REDUCTION, VALIDATION, AND REPORTING

6.1 ANALYTICAL DATA

6.1.1 Field Data

Field data from the Phase III, Group II investigation shall consist of data obtained during monitorting well purging prior to sampling. The field data collected will at a minimum include the following parameters: pH, conductivity, and temperature. The field data collected from each well during this sampling events will be presented in the Remedial Investigation/Feasibility Study Report.

6.1.2 Laboratory Data

Laboratory data are produced at the contract laboratory, which generates a laboratory report containing the analytical data, field and quality control duplicate data comparisons, and lab quality control data. USACE Tulsa District performs a QA validation and generates a summary report, which is submitted to the project staff. Laboratory deliverables include the following:

a. Case narratives which discuss QC deficiencies and other problems encountered during analyses.

b. Results of field samples, laboratory blanks, surrogate spikes, surrogate recoveries, matrix spikes, laboratory control samples, laboratory duplicates, matrix spike duplicates, relative percent differences, field duplicates, and field blanks.

c. Sample identification numbers will be cross-referenced with laboratory ID's and QC sample numbers. Table(s) which cross reference field samples with associated method blanks, matrix spikes and matrix spike duplicate samples.

d. Legible copies of the fully executed chain-of-custody forms and cooler receipt forms on which the laboratory has documented the condition of the samples on arrival.

e. Each analyte will be reported as an actual value or less than a specified quantitation limit. Actual sample results, sample quantitation limits, and practical quantitation limits will be reported in tabular format. Data qualifiers will be used to address sample/analytical anomalies associated with an analyte.

f. Soil samples will be reported on a dry weight basis with moisture content. Dilution factors, extraction data, and analysis dates will also be reported.

Calibration and internal standards information, raw data (which includes equipment/analyst worksheets/logbooks, mass spectra, GC/MS tuning calibrations, chromatographs, sample extraction volumes, etc.), and all instrumentation graphs and traces will be available from the laboratory, if needed.

6.2 TECHNICAL DATA

Technical data refers to data of several types, such as groundwater flow calculations, stratigraphic maps generated from geologic and geophysical field data, isopleth profiles of contaminants, and groundwater models. Technical data will be reduced, validated, and reported by the project staff.

6.3 DATA VALIDATION REPORT

Validation procedures will follow appropriate Functional Guidelines for Data Validation (USACE, USEPA federal, or USEPA regional) based upon project objectives to accomplish this task. Data validation reports will address a detailed discussion of the DQOs (Section 2.0); accuracy, precision, completeness, and representativeness of each analysis. The following evaluation procedures will be included:

- Review of laboratory testing methods, detection limits, holding times, data qualifiers, etc.
- Review of data summaries and reports for transcriptional and typographical errors.
- Review to compare the data against the field and trip blanks to detect contamination from sampling.
- Review to compare field sampling duplicates.
- Review of laboratory QC including laboratory blanks, spike recovery, and duplicates.

- Review of chain-of-custody forms to evaluate sample receipt data, damaged sample containers, etc.

- Qualify unusable data as rejected and attach appropriate qualifiers to usable data.
- The report shall conclude whether or not the data is suitable for its intended purpose and meets the data quality objectives as specified in this SAP. Identification of specific data results which should be rejected or qualified as estimated will be summarized in the report conclusion for each parameter.

- ASCII or DBASE format data files, submitted per Table B.7, "Guidance for Submittal of Data of Electronic Media for the USACE HTRW Project Database."

Data reports will be provided to USACE in permanently-bound volumes arranged by type of chemical parameter and sampling episode.

6.4 USACE CHEMICAL QUALITY ASSURANCE REPORT

The USACE CQAR, which will address comparability and contain the comparison of the field sample(s) and its (their) quality assurance duplicate sample(s), will also include a review of the contractor's report and a judgement as to the suitability of the data. This complete report shall constitute acceptance or rejection of the data.

SECTION 7.0 - AUDITS

Audits, which are QA procedures designed to meet the data quality objectives discussed in Section 3, are of two basic types as discussed below. Table 7.1 gives the audit elements for the LHAAP RI.

7.1 SYSTEMS AUDITS

A systems audit is a qualitative evaluation of all components of a project to determine if each component is properly performed. Systems audits are generally performed at the outset of investigations and periodically during the life of a project. Systems audits for office and field work will be performed by the USACE, and system audits for laboratory work will be performed by the HTRW-CX Lab. These audits consist primarily of site inspections.

7.2 PERFORMANCE AUDITS

Performance audits are quantitative evaluations of the components of a project. These consist of audit samples to be checked by HTRW-CX as a part of the laboratory validation process, QA replicates taken as a part of the sampling process and analyzed by the desiginated QA Lab, and laboratory QA procedures as specified by the analytical method.

TABLE 7.1 AUDIT ELEMENTS FOR LHAAP REMEDIAL INVESTIGATIONS

ELEMENT	BY / FREQUENCY
Laboratory site inspection	MRD Lab at laboratory selection and then every 18 months
Field inspections	USACE at least monthly at first less frequently thereafter
Technical data inspections	USACE as needed
Laboratory check samples	HTRW-CX Lab at laboratory selection and then every 18 months
Analysis of field replicates	QA Lab every 10 samples
Lab QA summary report	QA Lab one for each lab report

SECTION 8.0 - CORRECTIVE ACTION

8.1 FIELD ACTIVITIES

Field activities which are improper will be corrected as quickly as possible. The inspector or crew chief will be responsible to see that corrective action is initiated and documented whenever the error has the potential to compromise the quality of the data being generated or whenever there is a possibility that the error might be repeated.

8.2 FIELD DATA

Corrective action for poor field data quality (as determined by replicate measurements or prior expectation) consists of remeasurement until four successive readings agree within reasonable limits. Examples of frequently made measurements and limits to which they should agree include:

- pH - Measurements should agree within 0.2 pH unit.
- Conductance - Measurements should agree within 10 percent.
- Depth and water level measurements - Readings should agree within 0.01 ft.

If remeasurement is not successful, then instrument calibration and operation and the user's technique will be evaluated.

8.3 LABORATORY

Laboratory corrective action is described in the analytical method for that analysis.

8.4 IMPLEMENTING AND REPORTING

Corrective action should be initiated at the lowest level possible. Corrective action which involves correcting a mistake for little potential of repetition need not be reported as long as the error was not reported. For example, an erroneous water level measurement, such as 40 ft in a 30 ft well, would be corrected by making several additional readings which agreed with each other and looked reasonable. It would not be necessary to report this error.

Corrective action involving a potentially repetitive error or one which had been reported should be documented in writing. For example, an erroneous water level measurement due to a low battery in the water level indicator, should be documented because previous suspect water levels may need to be flagged and/or checked. The corrective action report would state the nature of the problem and the potential ramifications as well as what actions have been taken. In this case, the corrective action would be to replace the battery and check the last several days of readings taken using the indicator. This report will be sent to the project manager.

SECTION 9.0 - REFERENCES

1. U. S. Army Corps of Engineers, August 1989, "Minimum Chemistry Data Reporting Requirements for DERP and Superfund HTW Projects", CEMRD-ED-GC Memorandum.

2. U. S. Army Corps of Engineers, January 1990, "Chemical Data Quality Management for Hazardous Waste Remedial Activities", ER-1110-1-263.

3. U. S. Environmental Protection Agency, 1987, "Development of an RFI Work Plan and General Considerations for RCRA Facility Investigations", SW-87-001.

4. U. S. Environmental Protection Agency, September 1993, "Data Quality Objectives Process for Superfund", EPA540-R-93-071.

APPENDIX B
ANALYTICAL TABLES

RECEIVED 022389

FEB 1 0 1998

INDUSTRIAL & HAZARDOUS WASTE
CORRECTIVE ACTION SECTION

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS, TX 75202-2733

January 28, 1998

FEB 0 9 1998

PCD / TSS-CONTRACTS

Mr. Allan Posnick, Chief
Federal Facilities Team
Pollution Cleanup Division
Texas Natural Resource Conservation Commission
P.O. Box 13087
Austin, TX 78711-3087

Re: Investigations for perchlorate at Federal Facilities

Dear Mr. Posnick:

EPA and State environmental agencies have recently identified measurable perchlorate contamination in about 70 drinking water wells throughout Region 9. Perchlorate contamination exceeding the California Provisional Drinking Water Standard (18ppb) was identified at 23 of these wells. Perchlorate contamination has also been found at 10ppb in Lake Mead, a major drinking water source for Los Angeles and Las Vegas.

Ammonium and potassium perchlorate is an inorganic salt manufactured almost exclusively for use as an oxidant in solid rocket fuel and explosives. Perchlorate salts are highly soluble, dissociating into an ion which adsorbs poorly to soils, is very mobile, and persistent in the environment. Perchlorate is a human thyroid inhibitor and has been shown to cause fatal bone marrow conditions. Treatment options for large volumes of water contaminated with perchlorate are limited and costly. EPA and State agencies are currently collecting further toxicological and treatment data.

Department of Defense (DoD) and National Aeronautics and Space Administration (NASA) facilities and their contractors have been identified as primary potential sources of perchlorate contamination. Kerr-McGee, one of the largest manufacturers of perchlorate, provided us with an inventory of facilities in Region 6 that have received or stored perchlorate. Among the facilities in Texas are Alliant Tech at McGregor Naval Weapons Reserve Plant, Harrison Jet Guns in Kennedale, and Longhorn Army Ammunition Plant in Karnack. Longhorn is currently being investigated under CERCLA statutes.

EPA recommends that ground and surface waters around facilities which have used or manufactured perchlorates be tested for this contaminant. Information including the perchlorate analytical methodology currently in use by the California Department of Health Services (DHS) has been forwarded to Mr. Mark Arthur of your staff. This method has the lowest available detection limit (4ppb) and is waiting EPA approval. If you require additional information, please contact Mr. David Vanlandingham at (214) 665-2254 or e-mail to Vanlandingham.David-S@epamail.epa.gov.

Sincerely,

David W. Neleigh, Chief
New Mexico and Federal
Facilities Section

022591

COE/Contractor/LHAAP Meeting Minutes
Longhorn AAP
11 February 1998

1. The participants were:

Ira Nathan, LHAAP
David Tolbert, LHAAP
Oscar Linebaugh, EAO
Bryan Smith, Radian
Chris Edgmon, Radian
Vic Heister, Tulsa District
Yolane Hartsfield, Tulsa District

2. Pad at ~~G~~SWTP being removed. Clean soils being used as backfill at BG3. Are planning to revegetate area. Concrete debris from pad delivered to on-site construction landfill (Site 19). 2/3

3. GWTP. TNRCC verbally concurred with our actions with respect to isolated report of ultra-trace concentrations of dioxins (the resampling/analysis confirmation of the absence of these compounds from the groundwater stream). TNRCC verbally okayed release of treated water; regulator getting concurrence from management at TNRCC. Radian will store treated water for as long as possible awaiting word from TNRCC.

4. There was discussion about biotoxicity testing. Elizabeth West will be asked to procure minnows. Test is scheduled for 18 February.

5. Mr. Tolbert queried Radian about letter from Calgon underscoring our understanding that the carbon units on-stream at the GWTP will remove ultra-trace concentrations of dioxins and furans if they were present in the treated water stream. Mr. Linebaugh to continue follow-up. TNRCC requests a copy of the letter when it becomes available.

6. Interceptor Collection Trenches. All direct burial cableing is in place. Radian expects 11 or 12 wells to be on-line today. All 28 are expected to be on-line by the end of February.

7. Radian to begin sampling of 48 monitoring wells at BG3 prior to start of ICT system. During first month of operation, Radian to sample 28 ICT wells for analysis. POPs test (24 hour) will occur in March/April 1998. Scheduling with regulators will be done during 18 February Monthly Managers' Meeting.

8. All IDW drums have been emptied, crushed, and properly disposed. Mr. Tolbert reported that funding request for IDW management for Group2 RI/FS effort has been submitted to IOC for approval and action. There was discussion about the type of

29 ACD

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roll-offs needed for this effort and consensus reached--no hard cover roll-offs will be required. –

9. Repair of the surface-damaged monitoring well continues. The outside square tubing is to be installed over the casing extension.–

10. Radian is to receive prices by next Tuesday (17 February) for repairs to monitoring wells listed by H. L. "Bud" Jones.

11. Mr. Heister reported that Radian was in possession of the scope of work and request for proposal for work to be performed at the GWTP and surrounds. Radian response is due back to the COE by 4 March 1998. Radian concurrred.

12. There being no further business, the meeting was adjourned.

Yolane Hartsfield, Project Manager

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Monthly Managers' Meeting
Longhorn Army Ammunition Plant
18 February 1998

1. The participants were:

James McPherson, LHAAP	Wilma Subra, Uncertain Audubon
Ira Nathan, LHAAP	Bryan Smith, Radian
David Tolbert, LHAAP	Glen Turney, OHM
Cyril Onewokae, IOC	Lou Martino, Argonne Nat'l Laboratory
Jeff Armstrong, AEC	Mark Zappi, Mississippi State University
Chris Villarreal, EPA	Bob Norris, Eckenfelder
Diane Poteet, TNRCC	Cliff Murray, Tulsa District
H. L. "Bud" Jones, TNRCC	Steve Nolen, Tulsa District
Ruth Culver, Uncertain Audubon	Yolane Hartsfield, Tulsa District

2. James McPherson opened the meeting, thanked all the participants for attending.

3. The previous month's minutes were reviewed and approved. Yolane Hartsfield reviewed the executive summary.

4. The Group 1 "No Further Action" ROD has been fully executed and returned to LHAAP for inclusion in the Administrative Record. Group 1 will be dropped from the Executive Summary Sheets effective 1 March 1998.

5. Group 5. On 17 February 1998 the Team with technical support from Radian International and Sverdrup Environmental made a site visit to Site 63. Five trenches were dug at locations selected by Chris Villarreal to depths ranging from 6' to about 9'. There was no observable indication of discoloration, ash layer, or debris. The trench sites were selected based upon aerial photography and were located on both sides of the road that intersects Site 63. The Team present included David Tolbert, Cyril Onewokae, Chris Villarreal, Diane Poteet, Wilma Subra, Steve Nolen, Cliff Murray, David Bockelmann, and Yolane Hartsfield. Mr. Villarreal agreed to provide written comments based upon the site visit to which LHAAP will respond with a letter to the regulators requesting permission to close Sites 52 and 63 at the end of the Site Investigation Phase which has been completed.

6. Group 2 RI/FS Work Plans are under review (includes Work Plan for Risk Assessment) and revision. Sverdrup has geoprobe and surface resistivity lines being conducted at Site 29. Mr. Jones asked about the status of the detailed topographic map of Group 2 sites to assist in selecting sample locations. Mr. Murray is to check on obtaining (is not already in hand) the most recent aerial photography of the facility. Ruth Culver suggested also checking with staff at TNRCC who are involved with the Clean Rivers Act (under the auspices of which this area has recently been reflown), and

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the Surface Waters' Protection Act for aerial photography of this area. Mr. Jones expressed his desire not to overkill the issue but wanted to underscore how important this tool could be. Mr. McPherson asked Mr. Jones for his assistant is completion of this map and evaluation of same. Ms. Poteet agreed to see about the TNRCC mapping availability.

7. Mr. Bockelmann reported that he had spent much time in the previous 2 weeks walking the Group 2 Sites.

8. Group 4 work plan documentation is still being developed and assembled. Submittal for review and comment is expected in early Spring 98.

9. Burning Grounds No. 3. The Groundwater Treatment Plant is operating and with the completion of the ICT system a 24-hour Proof of Performance (POPs) test for air emissions only is scheduled for the third week in March. Regulators requested a copy of the POPs test Plan be submitted for EPA and TNRCC's air, et al, people to review and approved prior to the test. Radian to provide through COE to LHAAP to EPA and TNRCC. Ms. Subra asked for a copy of the analytes in the POPs test protocol. Radian to provide.

10. The wells in the ICT system are continuing to be brought on line. The second biotoxicity test was collected on 17 February 1998. The test takes 7 days.

11. Mr. Tolbert reported that on 2 February 1998 water from LF16 extraction well EW01 reflected ultra trace concentrations of dioxins (in the 10E-12). The well was resampled and the outfall from the GWTP was sampled and analyzed for dioxins and furans. The method blank associated with the resamples reported the same concentration of dioxins/furans as the field samples, again in ultra trace concentrations. The resamples were evaluated and determined that no dioxins were present, that the concentrations reported were due to laboratory contamination. However, future samples will be sent to another analytical laboratory. TNRCC requested we resample at the outfall and reanalyze. Mr. McPherson agreed.

12. Mr. Turney reported that at Landfill 16 the subgrade layer is 61% completed. LHAAP staff is working with OHM to locate useable topsoil on-site. Mr. Villarreal noted that he had seen some erosion of the cap at Landfill 12 due to weather. OHM plans to repair this Spring when they vegetate the cap with spring and summer grasses. Some potential topsoil locations were then discussed. If on-site topsoil can be located and subsequently used, a cost savings of $90,000 could be realized.

13. Mr. Jones noted that the Sverdrup map reflected a direct linear relationship between Landfill 16 and the seep at Harrison Bayou. He thought the transport mechanism could be a Paleo-pointbar deposit (water sand) which is controlling the movement of TCE downgradient of the Landfill. Mr. Jones proposed that we at least look and see if we can locate sources in the Landfill before the capping is complete to evaluate possible source removal or pump and treat. He felt that bioremediation would

not be an effective tool in the in-situ Wilcox soils though somewhat effective in disturbed soils. Mr. Turney noted that OHM had looked at the cost/benefit ratio with respect to source removal previously, and noted that LHAAP records of what was disposed in the Landfill are "just not there." Mr. McPherson noted that the Team recognized that the landfill cap and pump and treat system is not the final solution. Mr. McPherson stated that now is the time, and that we do need to go back and reassess where we are on capping the landfill as well as impacts to the IRA schedule/budget if we stopped now to investigate.

14. Mr. Jones suggested that if there are no records, or if the records do not show the information we need, we drill 2 or 3 test wells inside the Landfill footprint. Mr. Bockelmann noted that in the plume emanating from the landfill they have seen 30,000 ppm at 30 feet depth. Mr. Armstrong asked if we know where the greatest source in the landfill resides. Further is queried if the RI/FS effort underway will address these questions and issues. Mr. Onewokae noted that Sverdrup has some qualitative data from the Phase 1 and 2 RI/FS efforts. Mr. McPherson said he wanted this as the top item on our priority list, work this issue next. OHM stated their plans are to begin placing the liner by the end of April. Mr. McPherson said he wanted Mr. Armstrong to be a part of this issue resolution. Ms. Poteet stated that a cross section of needs to be prepared very quickly.

15. Mr. McPherson tasked Mr. Tolbert to have a meeting on Monday, February 23, with Mr. Jones and Mr. Bockelmann . (Note: The meeting was held on 23 February. The outcome was the following. Using OHM's grid of the east half of Landfill 16, geoprobe 44 primary locations with an additional 16 points to be drilled based on the results from the initial 44 points. The probe would be pushed to 15 feet then pulled back to 10 feet. The 5 foot interval's head space would be the sample. The head-space sample would be tested in the field for volatile organic compounds.)

16. Mr. Bockelmann revisited the dioxin issue. He will revisit the data considering TNRCC request to resample outfall and Ms. Subra's request to resample the wells. He noted that EW01 reported TCDD concentration was 0.12 picograms/liter and the duplicate was 0.14 picograms/liter. The EPA soil standard is 1 ppb. He noted that wells 16 and 30 have historically reflected the highest VOC concentrations and showed some dioxin/furans present--but not TCDD. There was discussion about sampling soils and sediments at surface seeps close in to the landfill footprint.

17. Mr. Nathan noted that the DERA Sumps Closure Report has had no change in status. THE TNRCC has the document under review for approval.

18. Mr. Armstrong passed out copies of the new DoD Technical Assistance for Public Participation (TAPP) Program.

19. The next meeting is the TRC. It will be at the INF Trailer on 10 March at 1000. Ms. Subra requested that time be set aside to enable the Team to visit the Group 4 Sites.

20. Mr. Bockelmann then presented Sverdrup's conceptual plan for a bioremediation of groundwater downgradient of Landfill 16 (See Handout in file).

21. Mr. Tolbert and Ms. Hartsfield led the discussion on reviewing for comment the Group 2 RI/FS Work Plans.

a). Site 12. Mr. Nolen said that as a result of his visit to the Site, he had concluded that the area referenced in the Risk Assessment Work Plans as a "wetlands" was indeed a wetland area, but that it was not special in that it was the same as the several other wetland areas along the Bayou. At Site 12 monitoring wells MW01, MW05, and MW12 will be tested for semivolatile organic compounds (SVOCs), pesticides, PCBs, and dioxins and furans. No soils will be tested per EPA. Surface water and sediments--we will use historical data for subsurface as needed, since Landfill 12 is capped. Sediment sample locations SD16, SD17, and SD18 will be tested for volatile organic compounds (VOCs), SVOCs, high explosives (HE), TAL metals, pesticides, PCBs, and dioxins and furans.

b). Site 16. The risk will be assessed as if there were no IRA in place. Monitoring wells MW16 and MW36, along with EW01, will be sampled for SVOCs in April 1998.

c). Site 17. The shallow monitoring well, MW13, will be moved from NW corner to middle of E/2 of Site. Proposed--twenty surface soil (SS) samples are proposed (0-6"), subsurface (2.5'-3') to be analyzed for HE only. It was noted that SB01 (soil boring number 1) located in the center of the east side has historical evidence of SVOCs. An additional surface soil sample location (SS31) will be located in the area marked "burning pit" (located on the southernmost east/west line of the E/2 of the Site). Sample location SS26 will be shifted to the north to cover SVOCs found in SBO1, and SS30 will be shifted a little north of its current proposed location. Three surface soil samples SS22, SS26, and SS30 will be tested for the following additional parameters: SVOCS, PCBs, pesticides, and dioxins and furans. Surface water and sediments--additional parameters SVOCs, PCBs, pesticides, and dioxins and furans SD10, SD11, and SD14. It was agreed to move SD14 closer to SD07 (between SD02 and SD07). It was agreed to move SD12 to on-site ditch mid-point on west side in ditch area. Groundwater--MW01, MW13, and MW130 will add SVOCs, PCBs, pesticides, and dioxins and furans to analysis protocol. It was agreed to move MW07 and MW08 east to south of burning pit area on outside of Site footprint.
EPA and TNRCC agreed to have their risk assessors revisit the issue of sample depth intervals for all soil samples. In addition they are reviewing our proposal to composite soils taken from the subsurface intervals (i.e. if the augered depth is to 3', then composite the soil sample from 0.5' through 3').

d). Sites 18, 24, and 32. Tabled until information about kits is obtained and map with surface structures is provided.

e) Site 29. On as-built drawings structures were found on south side south of SD04. North of MW115 and south of SD07 geoprobe investigation has found HE and VOCs.

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It was reported that about 25% of the geoprobes have been "dry holes." Have geoprobed both end and moved geoprobe to inside cells.

d). Ms. Hartsfield agreed after discussion to research the cost of field kits for HE.

e). Site 29 and 32. Located sumps and drains. There was discussion about sampling the contents and surrounds much like the RCRA sumps' closure/removal action and Group 4 sumps removal action. For the risk assessment, soil samples--grid each area and select random sample locations. Add additional 3 sites in the process area on South side of Site 29 and in the toluene storage area(s) at Site 29. Using Sverdrup Figure 3-6 for Site 29, move locations SW/SD23, 25, and 28 to souther part of Site along 18th Street. Also use these locations for risk assessment's additional parameter list (SVOCs, PCBs, pesticides, and dioxins and furans). Groundwater--MW03, MW05, and new shallow monitoring well in VOC area will be tested for the additional parameters (SVOCs, PCBs, pesticides, dioxins and furans). Soil sampling was tabled.

f). Background for streams and bayous--**Parameter list for surface water includes TCL organics, dioxins and furans, TAL metals, anions (chlorides, sulfate, nitrites/nitrates); sediments include Total Organic Carbon, TCL organics, dioxins and furans, grain size, and metals.** Goose Prairie Creek will acquire a new sampling station near Site 32. Samples will be collected from surface waters during both wet and dry seasons. It was proposed to collect 4 wet samples and 4 dry samples per stream for a total of 8 samples/stream (sediments will be collected during dry events because they will be less disturbed due to the absence of turbulent water flow creating suspended solids from the sediment materials). Saunders Branch and Harrison Bayou may be combined and treated as a single unit due to their "common" drainage area(s) and geology if Mr. Murray confirms that the combining is appropriate. Additional analytical parameters may be added.

g). For risk assessment purposes the Bayous associated with LHAAP and Caddo Lake will be modeled for fate and transport/future use scenarios. Mr. Nolen briefed the team on the discussion of modeling Caddo Lake he had with USACHPPM. Mr. Nolen asked EPA and TNRCC to provide the Team information about what models they use for similar projects. He suggested modeling that would involve groundwater to surface water, then surface water to the Lake, then the Lake proper. There was discussion about modeling site by site, then all the sites combined with a focus on future impacts to aquatic ecosystems.

22. There being no further business, the meeting was adjourned.

Yolane Hartsfield
Project Manager

022393

Technical Review Committee Meeting
Longhorn Army Ammunition Plant
10 March 1998
Karnack, Texas

1. The following is a list of participants:

James McPherson, LHAAP
David Tolbert, LHAAP
Dudley Beene, EAO
H. L. "Bud" Jones, TNRCC
Oscar Linebaugh, EAO
Bryan Smith, Radian
Dave Bockelmann, Sverdrup
Cliff Murray, Tulsa District
Ira Nathan, LHAAP
Jeff Armstrong, AEC
Chris Villarreal, EPA
Diane Poteet, TNRCC
Frank Meleton, EAO
Glen Turney, OHM
Yolane Hartsfield, Tulsa District

2. The meeting was brought to order by Mr. James McPherson. General introductions were made and guests were recognized.

3. Mr. Tolbert called attention to the agenda with February Managers' Meeting minutes and Executive Summary attached. The minutes were reviewed.

4. Mr.McPherson queried if the ROD for Group 1 had been incorporated into the Administrative Record. Mr. Tolbert responded that it was in the process of being incorporated.

5. Mr. Villarreal reported that he was drafting a report for his supervisor's signature on the trenching at Site 63 performed in February 1998. This report with pictures of the activity will be forthcoming.

6. In the February meeting Mr. Bud Jones asked about the availability of topographic maps or stereoptic aerial photographs of the facility. Mr. Murray reported that he had checked on purchasing aerial photos, but delivery would be at least a month after purchase. Mr. McPherson queried if we needed to pursue this. Mr. Jones affirmed the action stating that he thinks it is important since we are looking at specific locations with respect to nodes (low lying areas), and the aerials could help us locate them more effectively and efficiently. Mr. Shellman noted that the area had been recently overflown and that the scientific data generated might be available to the team. Mr. Villarreal noted that he might also have access to some information, as did Ms. Poteet. Mr. McPherson decided to put a hold on ordering maps/photos until we hear back from Chris, Dwight, Diane, and Bud. It was thought that by the latter part of next week we will be able to make decision about ordering additional maps/photos.

7. To item (7) of February's minutes add Chris, Wilma, and Diane's names as they

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were all out walking.
8. Sverdrup reported that Group 4 Work Plans would be submitted 24 March 1998.

9. The POPs test Work Plans were available and submitted to the team members by Mr. Tolbert.

10. Mr. Tolbert reported that the outfall from the GWTP had been resampled for a dioxins/furans analysis last week. We are awaiting results and will have by next meeting.

11. Meeting minutes items (13)-(15) will be discussed later by Sverdrup. Item (18) will be addressed more completely by Mr. Armstrong.

12. Mr. Tolbert reported that after the Managers' Meeting the Team met to discuss Group 2 Work Plans, as reported in the meeting minutes beginning with item (21[a]). Have updated Risk Assessment/Field Work Plans that directs Sverdrup with the exception of Sites 29 and 32.

13. Mr. Shellman requested addition information on item (21[g]). Mr. Bockelmann explained the modeling as discussed in the February meeting. Mr. Armstrong queried when we would be modeling. Mr. Bockelmann said it would be a component of the Baseline Risk Assessment, and would be started in about 6 to 10 months depending upon on-going field efforts.

14. Mr. Tolbert then reviewed the Executive Summary for the Team. Mr. Bockelmann noted that on Site 29, Group 2 Sites, Sverdrup had eliminated the surface resistivity action in certain areas due to soil saturation and its negative impact on resistivity data. He reported that Sverdrup had installed 10 shallow monitoring wells and 2 intermediate monitoring wells using the data from the 60 geoprobe sampling points.

15. Mr. Bockelmann reported that volatile organic compounds had been discovered at Site 2 from the geoprobes analyses results.

16. Geoprobe technology was also used at Goose Prairie Creek (35 points). The mobile laboratory has been demobilized and is off-site.

17. Mr. Shellman and Mr. Armstrong queried about the modeling as discussed in the minutes for the Group 4 Sites, since the modeling will be done in conjunction with the Group 2 Baseline Risk Assessment work. Mr. Bockelmann responded that the modeling is part and parcel to the Risk Assessment effort. Mr. Armstrong asked what models we will be using. Mr. Bockelmann responded that Weston is getting with, or had already gotten with, the EPA for their input into acceptable modeling programs.

18. Group 5. Mr. Tolbert reported that Team members had gone to Site 63 to resolve EPA's concerns about adequacy of completed investigations there. During trip to Site 63, trenches in likely areas of contamination were dug. (See more detail above.)

19. Burning Grounds No. 3. Chris Edgmon reported that the GWTP had passed the second toxicity test with the report due in about 14 days. There was 100 percent survival of both daphnia and fathead minnows.
20. All ICT wells are on line, and Radian is currently doing step draw-down tests. Still finding some slurry water in extracted groundwater, and Radian is working to clean-up the wells as required. Still on schedule to go on-line first week in April.

21. The Proof of Performance test is scheduled for 24 March (Tuesday). Chris reported that EPA personnel on site could include Mark Hanson, himself, and perhaps Earl Hendrick. TNRCC reported that Mark Hudson and Bud Jones would be present. Oscar Linebaugh will represent the Corps.

22. Glen Turney reported that OHM is actively hauling and placing soils at Landfill 16. OHM is awaiting update of location of clean topsoil on-site to use as borrow material. Y-Area was suggested getting with Lanis for approval prior to borrow removal. Mr. Nathan asked about using berm material. There was general discussion. Mr. McPherson stated he does not like nor will he approve "scapping" the ground thus leaving barren areas that would prompt questions in the future about possible contamination due to barren look. He stated he wants OHM to concentrate on berms at the magazine areas (earthen covers and magazine sidings). Mr. Turney stated that OHM would leave untouched areas within borrow areas to minimize the size of any barren areas. Mr. Turney reported that about 60% of the subgrade had been placed (with 105,000 cubic yards total subgrade planned). He stated that OHM was looking at 30 April for the beginning of liner placement.

23. Mr. McPherson noted that now we know what window we have to make decision about potential work at Landfill 16.

24. Analyses' results from LF16 accelerated RI/FS are pending. Mr. Murray reminded the group that he had distributed the Goose Prairie Creek results at the last meeting. Other results in District being validated. He reported that we sampled for perchlorate in the surface waters of the sampled creeks and did find perchlorate concentrations in the waters. He passes out a map and presented the following: perchlorate, parts per billion

Sample Point 1	-- 6.8	Sample Point 7	-- not detected
2	-- 190	8	-- did not sample
3	-- 200	15	-- 11,000
4	-- 180	10	-- 460
5	-- 200	12	-- 12
6	-- 210		
9	-- 11.0		

Sample point 12 is not on map, but is upstream of Sample point 7 and is an outfall of Site 29.

Mr. Murray noted that the California drinking water level is 18 ppb. Mr. Villarreal noted

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that EPA is looking at risk from perchlorates currently. He stated that EPA confirms that the compound readily degrades in water that has high biological activity. Mr. Armstrong asked what is the problem with perchlorate, and Mr. Villarreal referred him to previously submitted handouts. Mr. Murray noted that there are websites with information wrt perchlorates in waters.

Mr. Murray reported that the sampling had been done on 10 February during a dry period. Then it rained--heavy. So the samplers returned to Building 25C (Blue Dot) Ammonium perchlorate grinding building and in a low area with rainwater running in sheets off ground surface collected the rain runoff. This sample reported the 11,000 ppb concentration of perchlorate. The low area was in an area that had visible, significant browned vegetation. Team will visit site after meeting.

25. Mr. Murray reported that we want to add perchlorate analyses to the Group 4 wells. He also noted the constant concentration of perchlorate between sampling points 2 and 6. The run off went into a ditch along road. There was general discussion. Mr. Villarreal stated that he would get update on California research and information on recommended action levels. Mr. McPherson and Mr. Tolbert asked EPA and TNRCC to find out what do we do next. Mr. Murray noted that perchlorate has not been found in the perimeter wells, that occurrence appears very localized.

26. Mr. Murray reported that additional samples from the creek were taken the next day, but they were not sampled for perchlorate.

27. Mr. Villarreal inquired if we could halt run-off from this area. Mr. Nathan responded that he had begun operations to close/seal manholes on base. This would reduce infiltration of water into storm/sewer pipage. Ms. Subra voiced concern that if we halt run-off and/or block manholes we do not know what would happen to the water then; we could create other problems by this action. Mr. McPherson asked Mr. Villarreal to look at site and get with others at EPA for direction as to further action if necessary.

28. Bioremediation Study. Mr. Tolbert reported that the Army had had experts at the last Managers' Meeting for the Sverdrup presentation on a bioremediation project at Landfill 16. He queried Mr. Armstrong if we had heard anything from them. Mr. Armstrong stated that Drs. Zappi and Martino were interested in the results from the Landfill 16 sampling, had requested a copy of data from the geoprobe investigation. Mr. Tolbert asked if we could FedEx the data to them. The response was yes. Mr. Tolbert asked Mr. Armstrong if he had a schedule on when we could expect a response from Drs. Zappi and Martino, with Mr. Armstrong stating he though we probably could be hearing some information by the end of March. Mr. Jones again raised his concerns about the efficacy of such an action considering the geology of the Wilcox in the Site area. He stated that unless we commit to removing source material, we are committed to a very long term remedial operation. Mr. McPherson queried if bioremediation was "doable." Mr. Armstrong commented that that was the question Drs. Zappi and Martino were considering. There was then discussion with Mr. Jones noting that given the geology, field studies would have to be conducted because laboratory microcosm

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studies would not be comparable. Mr. McPherson tasked the Team to continue to provide information and asked Mr. Armstrong to follow-up with respect to Drs. Zappi and Martino. Mr. McPherson stated that every thing we do at LHAAP that costs taxpayers dollars must be carefully considered and we are reaching a point on this issue where we must decide whether to "go or no go."

29. Mr. Jones asked if we would look at excavation to remove source material based on our ability to identify the location of the source material. Mr. Turney noted that these same issues were brought up during the IRA ROD development and execution. He stated that the same technology in effect then is in effect today. Mr. McPherson queried, "Can we look at a permanent fix at Landfill 16?" Mr. Jones stated that the cap is not the final solution as in the Wilcox the water will pass through the landfill, and his experience shows that water can mound under the cap. The capping of the landfill, in his opinion, will not reduce or lower the water table. Mr. Mead noted that the landfill is in the flood plain of the bayou. He suggested a slurry wall as a potential final solution. There was general discussion.

30. After a short break, Mr. Bockelmann presented the soil gas survey results from Landfill 16 Site. Reported that Sverdrup had used existing OHM grid marks for the survey, a 100' x 100' grid (44 sampling points). Sixteen points were positioned in the center of the grid cells that were selected based on results from the 44 primary points. Mr. Bockelmann reported that the shape of soil gas detections may reflect zones of cleaner sands or not and may be driven by topography at time of deposition or some other effector. Mr. Armstrong asked if we had seen higher concentrations in the Phase II work effort. There was discussion. Mr. Bockelmann noted that the geoprobes pushed 5' to 15' depending upon where groundwater was encountered. He reported that 300,000 ppb total volatile organic compounds were found in monitoring well 16MW16.

31. Mr. Jones gave a general description of the soil gas plume in relationship with dissolved phase plume (shape and size), then discussed the relationship between the dissolved phase plume and possible point source--with the soil gas plume being larger and more extensive that the dissolved phase plume, and the dissolved phase plume being larger and more extensive that the point source plume. He is absolutely convinced that there is a point source within the landfill footprint He believes the data reflects that the top of sand is at 20' to 25' outside the landfill and that it will get higher as it goes towards the landfill. Mr. Jones stated that he would go in there and put a well or pit in place and aggressively and vigorously pump the groundwater zone(s). He said that we would be required to characterize excavated soils for contamination, treatment, and disposal. There was general discussion. Mr. McPherson asked, "What does it take to get us to a point that we know what is going on?" Mr. Jones suggested using a cone penetrometer at center of mapped plumes to characterize bottom of landfill geology and characterize groundwater.

32. Mr. Turney stated that the soil gas survey is a "snap-shot" of the conditions and that could have 300,000 cubic yards of soil to characterize and treat. Mr. Jones

suggested 4 borings in the eastern part of the landfill to obtain soil samples. He explained that he would suggest placing 2 borings on the east side (I think noting location on map). Mr. Bockelmann reported that 5 borings were done in the northeast quarter of the southeast quadrant, composited horizontally and were about 5 feet apart. He reported that these boring samples had indicated contamination. Mr. McPherson asked that we look at costs to do additional testing and the time frame envisioned. He directed the team to include cost of OHM stopping capping operations for 6 months to 1 year, as well as the cost to remove the cap and then do the work. It was noted by Mr. Tolbert that IOC had pulled all funding until April. Taskers: a) OHM--cost impact(s) if we stop on landfill cap liner installation; b) consider cost estimate for installation and then removal and replacement; and, c) instead of source removal, cost of additional extraction wells for pump and treat (unit costs). Taskers were then amended to include additional testing costs. Mr. McPherson set deadline of end of March for this information to be generated and distributed. Mr. Beene brought up that delay would impact current completion schedules. Mr. McPherson acknowledged this and stated that in his opinion this is a "time critical" process.

33. Mr. Jones suggested we consider the idea of using a clay cap procedure in lieu of the geotextile liner. Mr. Villarreal stated that EPA would not be supportive of this alternative as clay cap liners have been shown to be less effective as geotextile liners; Mr. Mead concurred.

34. The status of the Sumps' Closure Report remains unchanged.

35. Mr. Tolbert noted that the map of Landfill 16 on the table was undated and unsigned. This map was found in a drawer at the Burning Grounds No. 3 area. There was general discussion comparing information on this map with other similar maps.

36. Mr. Shellman talked about natural resource damage(s) and the impacts of Landfill 16 with respect to that damage to groundwater and Caddo Lake. He noted that there are other actors on the fringes that must be kept in mind with respect to what we are doing and will do on LHAAP.

37. Mr. Armstrong gave a brief overview of the Army's Technical Assistance to the Public Program. Gave out brochures from DoD and Army to participants. Said monies acquired through TAPP were to be used to facilitate studies and programs directed at clean-up efforts. He said the money could not be used for time spent in document review or similar work efforts, but would be useful for educating members of RABs, TRCs, or communities with respect to environmental laws, technologies, and processes. He said that by law the Army must let concerned citizens know about the TAPP. He stated that there was a $25,000 cap, and that requests for funding must come from individuals, not groups or organizations. Mr. Tolbert noted that there were 21 people listed as official members of the LHAAP TRC, and that any of them could apply for funding. Mr. Shellman and Ms. Subra inquired if money could be used to hire technical people. The response was yes provided that approval for such action being made by the facility's commander with input from the contracting officer(s) would be

needed.

38. Mr. Jones said he would check on the TNRCC putting together a flyer for distribution to local citizens about how the TNRCC works to assure water quality through oversight, monitoring, inspection, and testing.

39. Mr. Jones asked if the Team had a base map that showed public water wells. Mr. Bockelmann said he believed that there was one included in the administrative record. Both Ms. Subra and Mr. Jones requested copies. It was suggested that the map may be in the hydrogeologic assessment sections.

40. The next meeting is scheduled for 21 April 1998 at Karnack at 0900. The next TRC is scheduled for 09 June 1998 at 1000. There being no further business, the meeting was adjourned.

Yolane Hartsfield, Project Manager

022405

TECHNICAL REVIEW COMMITTEE MEETING
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
10 March 1998
10:00 a.m. (1000 hrs.)

Name	Work Station	Telephone/Fax
James McPherson	Commander's Rep.	318-459-5100
Ira Nathan	~~LAAP~~/LHAAP	318-459-5103
Dwight Shellman	Caddo Lake Inst.	903/789-3247
Wilma Subra	UNCERT. Rev.	318-367-2216
Jeff Armstrong	USAEC	410-671-1510
Dave Bockelmann	Sverdrup	314-770-4673
Tony N. Williams	City of Marshall	903-935-4418
Judy VanDeventer	Caddo Lake Water Supply	903-679-3449
Clift Murray	COE, Tulsa District	918-669-7573
David Tolbert	LHAAP	318-459-5109

TECHNICAL REVIEW COMMITTEE MEETING
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
10 March 1998
10:00 a.m. (1000 hrs.)

Name	Work Station	Telephone/Fax
CHRIS VILLARREAL	EPA-DALLAS	(214) 665-6758 FAX (214) 665-6660
Diane Poteet	TNRCC-AUSTIN	512-239-2502
H.L. "Bud" Jones	TNRCC-Tyler	903-535-5144
Randel Mead	COE-TULSA	918-669-7153
GLEN TURNEY	OHM REMED. CORP	281-775-7658
Earney L. Funderburg	OHM Remed. Corp.	903-679-3329
DUDLEY BEENE	COE-Ft. WORTH	(318) 676-3365
FRANK MELETON	COE-FT WORTH	(318) 676-3365
CHRIS EDGMON	RADIAN INTERNATIONAL	(903) 679-3448

022407

Amended

Technical Review Committee Meeting
Longhorn Army Ammunition Plant
10 March 1998
Karnack, Texas

1. The following is a list of participants:

James McPherson, LHAAP	Judy VanDeventer, Caddo Lake Water Supply
Ira Nathan, LHAAP	Dudley Beene, EAO
David Tolbert, LHAAP	Frank Meleton, EAO
Jeff Armstrong, AEC	Randel Mead, Tulsa District
Chris Villarreal, EPA	Cliff Murray, Tulsa District
Diane Poteet, TNRCC	Glen Turney, OHM
H. L. "Bud" Jones, TNRCC	Ernie Funderburg, OHM
Wilma Subra, Uncertain Audubon	Chris Edgmon, Radian
Dwight Shellman, Caddo Lake Institute	Dave Bockelmann, Sverdrup
Tony Williams, City of Marshall (teleconf.)	Yolane Hartsfield, Tulsa District

2. The meeting was brought to order by Mr. James McPherson. General introductions were made and guests were recognized.

3. Mr. Tolbert called attention to the agenda with February Managers' Meeting minutes and Executive Summary attached. The minutes were reviewed.

4. Mr.McPherson queried if the ROD for Group 1 had been incorporated into the Administrative Record. Mr. Tolbert responded that it was in the process of being incorporated.

5. Mr. Villarreal reported that he was drafting a report for his supervisor's signature on the trenching at Site 63 performed in February 1998. This report with pictures of the activity will be forthcoming.

6. In the February meeting Mr. Bud Jones asked about the availability of topographic maps or stereoptic aerial photographs of the facility. Mr. Murray reported that he had checked on purchasing aerial photos, but delivery would be at least a month after purchase. Mr. McPherson queried if we needed to pursue this. Mr. Jones affirmed the action stating that he thinks it is important since we are looking at specific locations with respect to nodes (low lying areas), and the aerials could help us locate them more effectively and efficiently. Mr. Shellman noted that the area had been recently overflown and that the scientific data generated might be available to the team. Mr. Villarreal noted that he might also have access to some information, as did Ms. Poteet. Mr. McPherson decided to put a hold on ordering maps/photos until we hear back from

022408

Chris, Dwight, Diane, and Bud. It was thought that by the latter part of next week we will be able to make decision about ordering additional maps/photos.

7. To item (7) of February's minutes add Chris, Wilma, and Diane's names as they were all out walking.

8. Sverdrup reported that Group 4 Work Plans would be submitted 24 March 1998.

9. The POPs test Work Plans were available and submitted to the team members by Mr. Tolbert.

10. Mr. Tolbert reported that the outfall from the GWTP had been resampled for a dioxins/furans analysis last week. We are awaiting results and will have by next meeting.

11. Meeting minutes items (13)-(15) will be discussed later by Sverdrup. Item (18) will be addressed more completely by Mr. Armstrong.

12. Mr. Tolbert reported that after the Managers' Meeting the Team met to discuss Group 2 Work Plans, as reported in the meeting minutes beginning with item (21[a]). Have updated Risk Assessment/Field Work Plans that directs Sverdrup with the exception of Sites 29 and 32.

13. Mr. Williams requested addition information on item (21[g]). Mr. Bockelmann explained the modeling as discussed in the February meeting. Mr. Armstrong queried when we would be modeling. Mr. Bockelmann said it would be a component of the Baseline Risk Assessment, and would be started in about 6 to 10 months depending upon on-going field efforts.

14. Mr. Tolbert then reviewed the Executive Summary for the Team. Mr. Bockelmann noted that on Site 29, Group 2 Sites, Sverdrup had eliminated the surface resistivity action in certain areas due to soil saturation and its negative impact on resistivity data. He reported that Sverdrup had installed 10 shallow monitoring wells and 2 intermediate monitoring wells using the data from the 60 geoprobe sampling points.

15. Mr. Bockelmann reported that volatile organic compounds had been discovered at Site 2 from the geoprobes analyses results.

16. Geoprobe technology was also used at Goose Prairie Creek (35 points). The mobile laboratory has been demobilized and is off-site.

17. Mr. Shellman and Mr. Armstrong queried about the modeling as discussed in the minutes for the Group 4 Sites, since the modeling will be done in conjunction with the Group 2 Baseline Risk Assessment work. Mr. Bockelmann responded that the modeling is part and parcel to the Risk Assessment effort. Mr. Armstrong asked what models we will be using. Mr. Bockelmann responded that Weston is getting with, or

had already gotten with, the EPA for their input into acceptable modeling programs.

18. Group 5. Mr. Tolbert reported that Team members had gone to Site 63 to resolve EPA's concerns about adequacy of completed investigations there. During trip to Site 63, trenches in likely areas of contamination were dug. (See more detail above.)

19. Burning Grounds No. 3. Chris Edgmon reported that the GWTP had passed the second toxicity test with the report due in about 14 days. There was 100 percent survival of both daphnia and fathead minnows.

20. All ICT wells are on line, and Radian is currently doing step draw-down tests. Still finding some slurry water in extracted groundwater, and Radian is working to clean-up the wells as required. Still on schedule to go on-line first week in April.

21. The Proof of Performance test is scheduled for 24 March (Tuesday). Chris reported that EPA personnel on site could include Mark Hanson, himself, and perhaps Earl Hendrick. TNRCC reported that Mark Hudson and Bud Jones would be present. Oscar Linebaugh will represent the Corps.

22. Glen Turney reported that OHM is actively hauling and placing soils at Landfill 16. OHM is awaiting update of location of clean topsoil on-site to use as borrow material. Y-Area was suggested getting with Lanis for approval prior to borrow removal. Mr. Nathan asked about using berm material. There was general discussion. Mr. McPherson stated he does not like nor will he approve "scapping" the ground thus leaving barren areas that would prompt questions in the future about possible contamination due to barren look. He stated he wants OHM to concentrate on berms at the magazine areas (earthen covers and magazine sidings). Mr. Turney stated that OHM would leave untouched areas within borrow areas to minimize the size of any barren areas. Mr. Turney reported that about 60% of the subgrade had been placed (with 105,000 cubic yards total subgrade planned). He stated that OHM was looking at 30 April for the beginning of liner placement.

23. Mr. McPherson noted that now we know what window we have to make decision about potential work at Landfill 16.

24. Analyses' results from LF16 accelerated RI/FS are pending. Mr. Murray reminded the group that he had distributed the Goose Prairie Creek results at the last meeting. Other results in District being validated. He reported that we sampled for perchlorate in the surface waters of the sampled creeks and did find perchlorate concentrations in the waters. He passes out a map and presented the following: perchlorate, parts per billion

Sample Point 1 --	6.8	Sample Point 7 --	not detected
2 --	190	8 --	did not sample
3 --	200	9 --	11.0
4 --	180	10 --	460
5 --	200	12* --	12

022410

6 -- 210	15 -- 11,000

Sample point 12 is not on map, but is upstream of Sample point 7 and is an outfall of Site 29.

Mr. Murray noted that the California drinking water level is 18 ppb. Mr. Villarreal noted that EPA is looking at risk from perchlorates currently. He stated that EPA confirms that the compound readily degrades in water that has high biological activity. Mr. Armstrong asked what is the problem with perchlorate, and Mr. Villarreal referred him to previously submitted handouts. Mr. Murray noted that there are websites with information wrt perchlorates in waters.

Mr. Murray reported that the sampling had been done on 10 February during a dry period. Then it rained--heavy. So the samplers returned to Building 25C (Blue Dot) Ammonium perchlorate grinding building and in a low area with rainwater running in sheets off ground surface collected the rain runoff. This sample reported the 11,000 ppb concentration of perchlorate. The low area was in an area that had visible, significant browned vegetation. Team will visit site after meeting.

25. Mr. Murray reported that we want to add perchlorate analyses to the Group 4 wells. He also noted the constant concentration of perchlorate between sampling points 2 and 6. The run off went into a ditch along road. There was general discussion. Mr. Villarreal stated that he would get update on California research and information on recommended action levels. Mr. McPherson and Mr. Tolbert asked EPA and TNRCC to find out what do we do next. Mr. Murray noted that perchlorate has not been found in the perimeter wells, that occurrence appears very localized.

26. Mr. Murray reported that additional samples from the creek were taken the next day, but they were not sampled for perchlorate.

27. Mr. Villarreal inquired if we could halt run-off from this area. Mr. Nathan responded that he had begun operations to close/seal manholes on base. This would reduce infiltration of water into storm/sewer pipage. Ms. Subra voiced concern that if we halt run-off and/or block manholes we do not know what would happen to the water then; we could create other problems by this action. Mr. McPherson asked Mr. Villarreal to look at site and get with others at EPA for direction as to further action if necessary.

28. Bioremediation Study. Mr. Tolbert reported that the Army had had experts at the last Managers' Meeting for the Sverdrup presentation on a bioremediation project at Landfill 16. He queried Mr. Armstrong if we had heard anything from them. Mr. Armstrong stated that Drs. Zappi and Martino were interested in the results from the Landfill 16 sampling, had requested a copy of data from the geoprobe investigation. Mr. Tolbert asked if we could FedEx the data to them. The response was yes. Mr. Tolbert asked Mr. Armstrong if he had a schedule on when we could expect a response from Drs. Zappi and Martino, with Mr. Armstrong stating he though we probably could be hearing some information by the end of March. Mr. Jones again raised his concerns about the efficacy of such an action considering the geology of the Wilcox in the Site

area. He stated that unless we commit to removing source material, we are committed to a very long term remedial operation. Mr. McPherson queried if bioremediation was "doable." Mr. Armstrong commented that that was the question Drs. Zappi and Martino were considering. There was then discussion with Mr. Jones noting that given the geology, field studies would have to be conducted because laboratory microcosm studies would not be comparable. Mr. McPherson tasked the Team to continue to provide information and asked Mr. Armstrong to follow-up with respect to Drs. Zappi and Martino. Mr. McPherson stated that every thing we do at LHAAP that costs taxpayers dollars must be carefully considered and we are reaching a point on this issue where we must decide whether to "go or no go."

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31. Mr. Jones gave a general description of the soil gas plume in relationship with dissolved phase plume (shape and size), then discussed the relationship between the dissolved phase plume and possible point source--with the soil gas plume being larger and more extensive that the dissolved phase plume, and the dissolved phase plume being larger and more extensive that the point source plume. He is absolutely convinced that there is a point source within the landfill footprint He believes the data

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33. Mr. Jones suggested we consider the idea of using a clay cap procedure in lieu of the geotextile liner. Mr. Villarreal stated that EPA would not be supportive of this alternative as clay cap liners have been shown to be less effective as geotextile liners; Mr. Mead concurred.

34. The status of the Sumps' Closure Report remains unchanged.

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40. The next meeting is scheduled for 21 April 1998 at Karnack at 0900. The next TRC is scheduled for 09 June 1998 at 1000. There being no further business, the meeting was adjourned.

Yolane Hartsfield,
Project Manager

Barry R. McBee, *Chairman*
R. B. "Ralph" Marquez, *Commissioner*
John M. Baker, *Commissioner*
Dan Pearson, *Executive Director*

022414

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

March 11, 1998

Mr. James McPherson
Commander's Representative
Longhorn Army Ammunition Plant
P.O. Box 658
Karnack, TX 75661

Dear Mr. McPherson:

On behalf of the CLEAN TEXAS 2000 pollution prevention program, I want to thank you for applying for a 1998 Texas Environmental Excellence Award. We received more than 250 applications this year and are impressed by all the hard work that's being done to take care of the Texas environment.

Each application has been reviewed and scored by up to five Texas Natural Resource Conservation Commission professional staff. Projects that scored the highest have been named finalists and forwarded to the Governor's Blue Ribbon Selection Committee for judging. This committee, which is made up of representatives of industry, local government, civic organizations, schools, and environmental groups from around the state, will recommend winners to the governor and TNRCC Commissioners.

Although your project was not judged to be a finalist, we are very impressed by the efforts you are taking to preserve and protect the Texas environment. We hope you will consider applying for the 1999 Environmental Excellence Award. You will receive an application in the mail this summer.

In recognition of your outstanding efforts this year, you will receive a 1998 CLEAN TEXAS 2000 Partner certificate. Thanks for participating in the CLEAN TEXAS 2000 program. Remember--Take Care of Texas. (It's the only one we've got.)

Sincerely,

Andrew Neblett, Director
Office of Pollution Prevention and Recycling

1998 TEXAS ENVIRONMENTAL EXCELLENCE AWARDS
Finalists

AGRICULTURE (3)
- Department of Agricultural Sciences, Texas A&M University/On-Site In-Vessel, Mechanical Composting of Animal Waste and Food Residuals - Commerce
- Odem Ranch Area Farmers, Texas Agricultural Experiment Station/Assessment of Best Management Practices for Sediment, Nutrients, and Chemicals from Agricultural Croplands - Edroy
- USAg Recycling/Crop Protection Container Collection and Recycling Project - Pasadena

CIVIC/NON-PROFIT (6)
- Caddo Lake Institute/Cypress Bayou Watershed Study - Texarkana
- Colonias Unidas/Cleaning Las Lomas - Rio Grande City
- Fort Worth Clean City, Inc./Camp EARTH - Fort Worth
- Household Hazardous Materials Collection Day Steering Committee/Community and Industry Team Keeping Texas Clean and Green - Deer Park
- San Angelo Friends of the Environment/Information Center, Magazine Exchange, and Teachers' Workshop - San Angelo
- The SemiCycle Foundation/Plastic Tray and Reel Recycling Program - Austin

EDUCATION (8)
- Big Thicket National Park/Big Thicket Resource Education Program - Beaumont
- Brazosport ISD/Wetlands/Wildlife Conservation Collaborative - Freeport
- Cypress-Fairbanks ISD/Nature Trails - Houston
- Deer Park Educational Foundation/Summer Enrichment Institutes - Deer Park
- Permian High School/ Botanical Garden - Odessa
- Texas Forest Service/Best Management Practices - Lufkin
- Upper Pecos SWCD and Ward County Extension Service/Texas Water Camp - Monahans
- Weatherford ISD/Weatherford Assistance through Youth Service (WAYS) - Weatherford

GOVERNMENT (4)
- City of College Station/Comprehensive Environmental Program - College Station
- Fort Hood/Recycling Program - Killeen
- City of Smithville/Marhill Brownfield Cleanup - Smithville
- Texas Department of Transportation/Road to Recycling - Austin

INDIVIDUAL (1)
- Hal Flanders - Alpine

INNOVATIVE TECHNOLOGY (4)
- Lower Colorado River Authority Thomas C. Ferguson Power Plant /Greenhouse Gas and Plant Emission Reduction - Marble Falls
- Newpark Shipbuilding and Repair, Inc./Sediment Control on Drydocks - Houston
- Occidental Chemical Corp./Udex Ion Exchange Project - Alvin
- Specified Fuels & Chemicals, LLC/Cryogenic Vapor Recovery System - Channelview

LARGE BUSINESS / NON-TECHNICAL (6)

- Cargill Foods/Water Matters, at Home, at Work, and in the Community - Saginaw
- Central and South West Services/Renewable Energy Project - Dallas
- Dell Computer Corporation/Dell Metric 12 R3 Recycling and Reuse Program - Round Rock
- Houston Lighting & Power Co./HL&P-The Environmental Partner - Houston
- Motorola-Ed Bluestein Plant/Environmental Leadership Program - Austin
- Sea World of Texas/Sea World Environmental Action Team (SWEAT) - San Antonio

LARGE BUSINESS / TECHNICAL (5)

- Abbott Laboratories/Optimizing the Printed Circuit Board Manufacturing Process - Irving
- Carrier Corporation/Comprehensive Environmental Program - Tyler
- E.I. du Pont de Nemours & Co./Copper Catalyst Recovery - La Porte
- Occidental Chemical Corp./Plant Reliability Improvement & Water Conservation Projects - Corpus Christi
- Raytheon E-Systems, Inc./Environmentally Friendly Aircraft Paint Stripping - Greenville

SMALL BUSINESS (4)

- Environmental Light Recyclers/Recycling of Fluorescent and other Mercury-Containing Lamps and Lighting Ballasts - Fort Worth
- Multiplex Technologies/Waste Minimization and Process Optimization - Houston
- Precision Clean Piping/Source Reduction, Water Conservation, and Pollution Prevention Project - Houston
- Thelin Recycling Co., LLC/Asphalt Shingle Recycling - Southlake

YOUTH (5)

- American Institute for Learning/Casa Verde Builders - Austin
- American Institute for Learning/ Environmental Corps - Austin
- Live Oak Elementary/Save The Shade, Inc. - Round Rock
- Students Preserving Our Environment-SPOE/Preserve the Future-Recycle the Past - Richardson
- United South High School/Environmental Science Club - Laredo

022416

Teleconference
Longhorn Army Ammunition Plant
16 March 1998

1. Participants:

James McPherson, LHAAP
David Tolbert, LHAAP
Cyril Onewokae, IOC
Jeff Armstrong, AEC

H. L. "Bud" Jones, TNRCC
Cliff Murray, Tulsa District
Vic Heister, Tulsa District
Yolane Hartsfield, Tulsa District

2. The teleconference was convened to discuss Landfill 16 issues. Mr. Murray compiled rough cost estimates for alternatives at Landfill 16.

3. Mr. Armstrong **stated that he felt that we need to follow the CERCLA process, which is on-going, unless there is a demonstrable risk to justify a "time critical action." He felt that the Army had taken sufficient steps with interim actions at Site 16, and proposed that we continue the path we are on.** He queried if we had identified one source of contamination in the landfill, or if we believed there to be multiple source locations within the footprint of the landfill. Mr. Murray responded that the soil gas analyses are not definitive as they are influenced by the technique used and the sample point surrounds. Mr. Jones concurred.

4. Mr. Tolbert asked that we look at the cost benefit relationship. If the soil gas survey located 50% of the sources, and we excavated them, the slurry wall technology is protective without excavation of soils and is more cost effective. Excavation, even limited, could easily cost 2 times the cost of the slurry wall.

5. Mr. Onewokae queried whether this was discussed at the TRC and what had initiated this teleconference. Mr. Armstrong and Mr. Tolbert provided the background to update Mr. Onewokae.

6. Mr. Armstrong stated that the Army is looking for the final solution to the management of contaminants in Landfill 16. He believes that we have taken sufficient interim measures. He stated that we **were today evaluating** 3 choices: a) hold the capping construction while we investigate the east half of the landfill; b) let construction continue and go back into the landfill as needed at a future date; or, c) cap the landfill and construct a slurry wall/trench system to contain remaining contaminants in landfill.

7. Mr. Tolbert queried whether anyone had any ideas as to the quantity of material we would be removing if excavated and what and where we would address treatment/disposal of same.

8. Mr. Onewokae asked if the Feasibility Study, as part of Phase III, was being done. The response was yes. Is it finished, he asked. The answer was no. Mr. Armstrong

said that Mr. Jones was asking us to take a look at a removal action of source material now before the cap is completed, and the questions are: have we identified the source(s), or will an excavation action grow as we perform the action; is the removal worth the money it will cost--will we have gained enough removal to impact contamination in the landfill? He added that if this is a "critical action" do we need to stop capping operations, and what will the costs associated with stopping coupled with removal actions be. Worst case, several million dollars.

9. Mr. Jones asked if the Army wanted to spend money at this time to do a detailed investigation to determine the location of the source. Mr. Onewokae asked if this was related to some information that Mr. Tolbert had faxed to him early the same day. Mr. Armstrong stated that we needed the cost to delay OHM capping action and the cost to go back into the capped area, with subsequent repair to cap.

10. Mr. McPherson summed the discussion by saying that we may have determined some hot spots with the soil gas survey for $60,000. If we investigate further we need to make the decision real quick, need to do the investigation real quick, and need the money real quick. Queried if all that was possible. There was discussion.

11. The slurry wall idea was discussed. Proposed depth in the discussion was 60-65 feet (or to bedrock/aquitard). The possibility that contamination might continue to migrate or diffuse deeper than the trench and then outside the trench/wall perimeter was discussed. The technology itself was discussed. Mr. Armstrong **and Ms. Hartsfield had reviewed the Landfill 12 and 16 Capping** ROD **determine if excavation had been considered as part of that** interim remedial action. **Mr. Armstrong read from the ROD the language explaining why it did** not include excavation of source material.

12. There was additional discussion about the lithology of the landfill area, the Wilcox formation interaction with contaminant fate and transport, costs, source identification and location, plume behavior, DNAPL behavior, groundwater flow and behavior, current data gaps.

13. The resolution to the discussion was to request from OHM the cost to core at least 2 locations, picked using soil gas survey data, maps, and aerial photos. The cores will go into any encountered sand channels or to 20 to 25 feet, whichever is lesser. The information from the cores will be used to help identify locations for future extraction wells inside the landfill footprint. OHM will be tasked to perform the coring activities in such a manner as to prohibit the creation of a new pathway for contaminants to reach groundwater. The capping activity will not be delayed. The slurry wall system appears to be a good candidate for the final solution if used in conjunction with the capping of the landfill and extraction wells to manage contaminated groundwater.

14. Mr. Heister was tasked to work with OHM to secure the above. Mr. Murray was tasked to put together as detailed and accurate a map of Landfill 16, and its possible contents, as is possible given with the quality of the available information.

15. There being no further discussion, the teleconference was concluded.

Yolane Hartsfield, Project Manager

022419

AMENDED
Teleconference
Longhorn Army Ammunition Plant
16 March 1998

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Yolane Hartsfield, Project Manager

Site 16 Options Estimates

3/16/98
12:01 PM

	Design Investigation for Slurry Wall Design/Bid						
		Field Work (Penetrometer/Drill Rig)					
	20 penetrometer pushes around perimeter of landfill. 10 Auger holes to a depth of up to 65' for sample collection.				Days	Day Rate	
				Penetrometer/ Drill Rig	16	$3,000	$48,000
					Number of Samples	Analytical Rate	
				Analytical Testing	10	$500	$5,000
					hours	Hourly Rate	
				Engineering Design	120	$60	$7,200
				Cutoff Wall Area(sq ft)	Installation Cost $/cu ft	Mob/Demob Cost	Total Cost
	Slurry Wall Installation			240500	$6	$100,000	$1,543,000
				Total Slurry Wall Cost			$1,603,200
Extraction Wells							
					No. of Wells	Cost Per Well	Total Extraction Well Costs
Wells with tie-in to the landfill cap liner material.					4	$20,000	$80,000

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Site 16 Options Estimates

3/16/98
12:01 PM

	Source Removal							
	Small (conservative) Volume							
		Width of Excavation	Length of Excavation	Depth of Excavation	Volume Multiplier	Soil Volume (cu. Yd.)	Cost per unit volume ($/cu yd)	Total Cost
	Excavation	15	35	20	1.2	467	$10	$4,667
	Treatment and Disposal	15	35	15	1.2	350	$700	$245,000
				Total Removal Cost for small area				**$249,667**
	Large Volume (2 sites)							
		Width of Excavation	Length of Excavation	Depth of Excavation	Volume Multiplier	Soil Volume (cu. Yd.)	Cost per unit volume ($/cu yd)	Total Cost
Southern Site (enlarged)	Excavation	30	190	20	1.2	5067	$10	$50,667
	Treatment and Disposal	30	190	15	1.2	3800	$700	$2,660,000
								$2,710,667
.thern Site (enlarged)	Excavation	40	60	20	1.2	2133	$10	$21,333
	Treatment and Disposal	40	60	15	1.2	1600	$700	$1,120,000
								$1,141,333
				Total Removal Cost for large area				**$3,852,000**

475/day

$57K

[redacted]

Case 3
(Capping w/source investigation and source removal)

The landfill will be capped after the source investigation and after the source removal. The landfill capping operations will be delayed by an estimated 4 months. A slurry wall would not be installed around the landfill. Infiltration of rainwater into the landfill debris will be reduced by the landfill cap. However, any contaminated groundwater remaining in the landfill will be transported downgradient uninhibited. Capping operations will be put on hold during source removal operations.

Additional Cost: $310,000.

Case 4
(Capping, source investigation, slurry wall, and extraction well(s))

Following the source investigation, the landfill will be capped. After the capping has been completed a slurry wall and extraction wells will be installed. Landfill capping operations will not be impacted. The source of contamination in the landfill will remain in the landfill material. Infiltration of rainwater into the landfill debris will be reduced by the landfill cap. Any contaminated groundwater remaining in the landfill will be inhibited from moving downgradient.

Additional Cost: $1.74M.

Case 5
(Capping, source investigation, source removal, slurry wall, and extraction well(s))

Following the source investigation, the contaminated soil material will be removed, then the landfill will be capped. After the capping has been completed a slurry wall and extraction wells will be installed. Landfill capping operations will delayed by an estimated 4 months during the material excavation and rebuilding of the landfill profile. Infiltration of rainwater into the landfill soils will be reduced by the landfill cap. Any contaminated groundwater remaining in the landfill will be inhibited from moving downgradient.

Additional Cost: $2.0M-$5.6M.

Extraction Well(s): (Estimated Cost $80,000)

An extraction well or wells will be needed to remove water from within the landfilled area to reduce the hydraulic gradient. This is especially necessary with the installation of a slurry cutoff wall around the landfill. The extraction well(s) will create a hydraulic cone of depression within in the landfill area to prevent residual contaminated groundwater from flowing out of the landfill. Groundwater will be transported to the Burning Ground 3 water treatment plant via the existing pipeline from the existing extraction wells. The wells would be drilled through the landfill cap with cap liner material placed around the well housing and cemented to the existing capping material and the well housing to insure a seal around the well.

The cost was estimated upon 4 wells, 2 shallow (25') and 2 intermediate (50') depth.

Landfill Cap: (No additional costs)

Capping the landfill is currently ongoing at Site 16.

Slurry (Cutoff) Wall: (Estimated Cost $1.6M)

To prevent the flow of groundwater through the upper groundwater interval below the landfill, a cutoff wall could be installed around the landfill boundary. The cutoff wall would be tied in to the landfill cap to prevent water infiltration around the landfill boundary.

For estimation purposes, the wall would be installed to a depth of 65 feet. A wall length of 3,700 feet was used for the cost estimate.

Included in this estimate are costs for the design of the wall. Included in the design would be investigation of the subsurface and the actual design. The subsurface investigation would entail penetrometer soil classification pushes around the path of the proposed slurry wall and soil samples collected with an auger rig to analyze for soil strength. For this estimate, soil class pushes would be considered at a rate of one every 150' of trench length. Soil samples would be collected based on the soil classification results. Approximately 10 soil samples would be collected.

Case 1
(Status Quo)

Continuation of the current capping operations. This case would require no changes in ongoing activities.

No Additional Costs.

Case 2
(Capping with source investigation performed)

The source investigation will be performed prior to the continuation of capping operations. Infiltration of rainwater into the landfill debris will be reduced by the landfill cap. However, any contaminated groundwater remaining in the landfill will be transported downgradient uninhibited. Capping operations will not be impacted.

Additional cost: $60,000.

Site 16 Treatment Options

The treatment techniques to be considered will first be discussed with their applications used in the scenario options to follow.
Assumptions used for the cost estimations are included in the following text.

Source Investigation: (Estimated Cost $60,000)

Determining the source of contamination indicated by the soil gas survey would require an estimated 2 to 3 weeks to perform, depending upon weather conditions, extent of contamination, and debris encountered while drilling. The investigation would entail collecting soil samples using either hollow stem augers or cone penetrometer rig (SCAPS). The SCAPS rig might be limited in the landfill area due to concrete debris that was placed on the east half of the landfill prior to the commencement of capping operations. If the drill rig is required for sample collection, productivity will decline due to requirement of a more restrictive PPE and management of IDW.

Weather permitting, the soil classification capabilities of the SCAPS unit will be used to define soil conditions within and northeast of the landfill to identify potential preferential pathways for contaminant migration.

Soil samples collected within the landfill will be analyzed for volatile organic compounds to define potential contaminant sources. Rapid turnaround analysis will be required.

Source Removal: (Estimated Cost $250,000-$3.9M)

Source removal would include the excavation, containerization, transportation, treatment and disposal of contaminated soil as determined by the source investigation. For this estimate, a range of soil volumes will be used to calculate the cost. The volume outlines are based on the TCE contours based on the assumption that the byproducts of TCE [chloroethene (1,1/cis-1,2 / or trans-1,2) and vinyl chloride] would be more widely distributed than TCE and would thus over-estimate the contaminated soil volume. It will be assumed that the upper 5 feet of soil will be considered as uncontaminated and will be set aside to be re-placed on top of the backfilled material leaving only 15' feet to remove and dispose.

The smaller volume of removal is a 15'x35' box around soil gas sample point 16SGV where the highest concentrations were found during the soil gas survey. The higher volume of removal is represented by two boxes around the areas of highest TCE concentration as indicated on the attached plat.

The cost for disposal of the removed material could vary dependent upon contaminant characteristics. The transportation and disposal costs could range from $200/ton to $700/ton. For this estimate a cost of $700/cu. yd. was used which is equivalent to a cost of approximately $520/ton.

Extraction Well(s): (Estimated Cost $80,000)

An extraction well or wells will be needed to remove water from within the landfilled area to reduce the hydraulic gradient. This is especially necessary with the installation of a slurry cutoff wall around the landfill. The extraction well(s) will create a hydraulic cone of depression within in the landfill area to prevent residual contaminated groundwater from flowing out of the landfill. Groundwater will be transported to the Burning Ground 3 water treatment plant via the existing pipeline from the existing extraction wells. The wells would be drilled through the landfill cap with cap liner material placed around the well housing and cemented to the existing capping material and the well housing to insure a seal around the well.

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For estimation purposes, the wall would be installed to a depth of 65 feet with a slot width of 3'.

Included in this estimate are costs for the design of the wall. Included in the design would be investigation of the subsurface and the actual design. The subsurface investigation would entail penetrometer soil classification pushes around the path of the proposed slurry wall and soil samples collected with an auger rig to analyze for soil strength. For this estimate, soil class pushes would be considered at a rate of one every 150' of trench length. Soil samples would be collected based on the soil classification results. Approximately 10 soil samples would be collected.

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Case 3
(Capping w/source investigation and source removal)

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Additional Cost: $310,000.

Case 4
(Capping, source investigation, slurry wall, and extraction well(s))

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Additional Cost: $1.74M.

Case 5
(Capping, source investigation, source removal, slurry wall, and extraction well(s))

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Additional Cost: $2.0M-$5.6M.

Case 4
(Source investigation, source removal)

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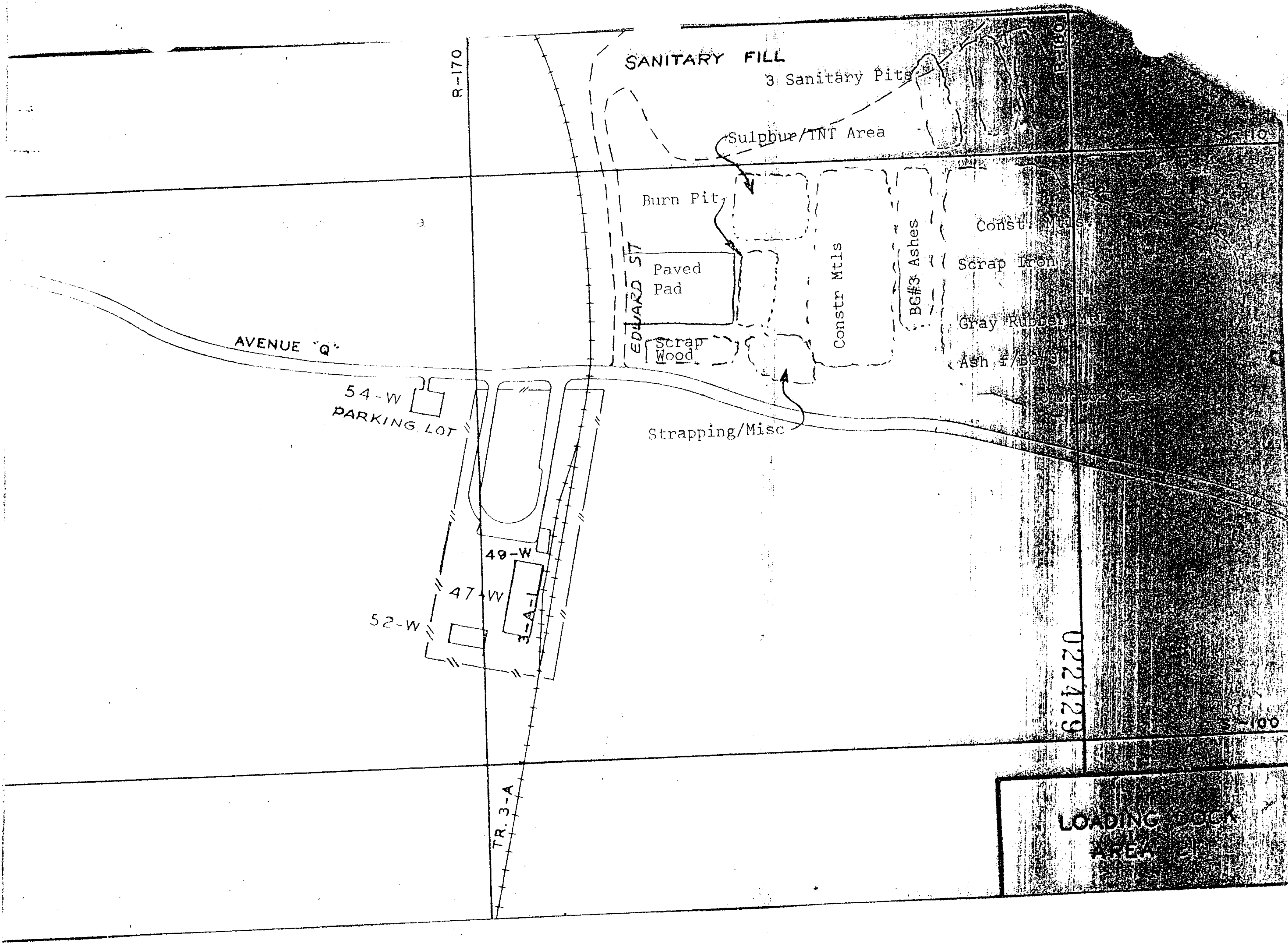


SANITARY FILL
3 Sanitary Pits
Sulphur/TNT Area
Burn Pit
Paved Pad
EDWARD ST
Scrap Wood
Constr Mtls
BG#3 Ashes
Scrap Iron
Strapping/Misc
AVENUE "Q"
54-W
PARKING LOT
49-W
47-W
52-W
3-A-1
R-170
R-180
TR. 3-A
LOADING DOCK AREA
022429

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS, TX 75202-2733

022430

March 30, 1998

VIA REGULAR MAIL AND FACSIMILE

James A. McPherson, Commander's Representative
Longhorn/Louisiana Army Ammunition Plant
Attn: SIOLH-CR
P.O. Box 658
Doyline, LA 71023

Re: Longhorn Army Ammunition Plant
Group 2 Baseline Risk Assessment Work Plan

Dear Mr. McPherson:

Please find enclosed a copy of a memorandum outlining EPA's comments on the ecological risk assessment section of the Group 2 Baseline Risk Assessment Work Plan for the Longhorn Army Ammunition Plant.

If you have any questions, please contact me at (214) 665-6758.

Sincerely,

Chris G. Villarreal

Chris G. Villarreal
Project Manager

Enclosure

cc: Yolane Hartsfield, COE Tulsa District
Diane Poteet, TNRCC (MC-143)
Oscar Linebaugh, Jr., COE Fort Worth District

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS, TX 75202-2733

022431

MEMORANDUM

SUBJECT: Group 2 Baseline Risk Assessment Work Plan for Longhorn AAP

FROM: Susan Roddy

TO: Chris Villarreal

DATE: March 27, 1998

I have reviewed the ecological risk assessment section of the Group 2 Baseline Risk Assessment Work Plan for Longhorn AAP, and have the following comments:

1) Pages 4-4, 4-19, and 3-18-3-19: Regarding modelling of surface water and sediment concentrations in Caddo Lake, there is concern that there will be an underestimate of concentrations (especially of sediment) as proposed, and that, therefore, the risk assessment will be underprotective. As previously recommended, sampling of Caddo Lake is recommended.

2) Pages 4-1 and 4-3: The workplan needs to more specifically describe using all 8 steps of the Superfund ecological risk assessment guidance (to the extent possible prior to conducting the screening ecological risk assessment). In particular, it should be mentioned that a problem formulation will be provided for both the screening ecological risk assessment (step 1) and the definitive ecological risk assessment (step 3) assuming the screen indicates that further evaluation is necessary. Specifically, it should be clarified that for the screening problem formulation, maximum exposure concentrations and exposure dose estimations based on conservative exposure assumptions will be used. Also, see page 4-18, second paragraph, and Section 4.3.2.2.

3) Page 4-18: Regarding Section 4.3.2.1, it should be clarified that a site-wide ecological risk assessment will be conducted. For the definitive site-wide ecological risk assessment, remaining hotspot area concentrations should not be excluded from the concentrations used to determine exposure for the selected guild receptor representative within its home range size. Please eliminate the next-to-last sentence in the first paragraph on page 4-18. Independent evaluation of hotspot maximum concentrations is appropriate in the screening ecological risk assessment.

4) Page 4-30, Section 4.6 (Approach for Developing Ecological Screening Levels): This Section provides the approach for determining backcalculated media concentrations based on using screening ecotoxicity values. There is concern because the Superfund guidance states that

requiring cleanup based on the screen (with its conservative assumptions) would not be technically defensible. The purpose of the screen is to determine whether further evaluation is necessary. Also, the location of this Section at the end of the chapter is confusing since it appears that no further evaluation is intended beyond the screen, yet, Section 4.5.2 describes possible field studies. And, there were no backcalculations proposed for sediment. Section 4.6 needs to be moved back towards the front of the document and included in a Section on the screening ecological risk assessment, and the wording needs to be clarified to address these concerns.

5) Page 4-4: In the first bullet, it should be clarified that the adequacy of detection limits will be determined for detected contaminants as well as undetected contaminants.

6) Pages 4-6 and 4-8: Group 4 should be corrected to Group 2.

7) Page 4-13, Section 4.3.5, Ecotoxicity of Contaminants: Birds and mammals are mentioned. However, should there be other classes proposed in the problem formulation, what other ecotoxicity databases will be consulted?

8) Page 4-14: The second bullet at the top of the page should read "susceptibility to exposure and sensitivity to toxicity".

9) Page 4-16: In the first bullet, the word "potentially" should be inserted between the words "that" and "occur".

10) Page 4-20: The algorithm at the bottom of the page does not and should include sediment ingestion.

11) Pages 4-21 (Section 4.4.1, Literature Review of Toxicity Data), 4-24 and 4-32 (Section 4.6.2): Regarding the use of the Oak Ridge ecotoxicity database, original values may be used, however, it should be noted that Region 6 does not accept the Oak Ridge practice of adjusting the ecotoxicity value to allow a 20% reduction in reproduction, growth, etc. as acceptable.

12) Page 4-24: Clarification and discussion is needed regarding the extrapolation factors mentioned that may be used.

13) Page 4-24, Section 4.5: The words "nature and extent" should be eliminated in the last line.

14) Page 4-25, Table 4-3: Safety factor should be renamed Extrapolation Factor for the last column.

15) Page 4-26: The first sentence after the algorithms should be eliminated. Also, in the next sentence, the word "screening" should be inserted between the words "calculated" and "hazard".

16) Page 4-27: At the end of the top paragraph, a sentence should be added regarding the need for further evaluation (i.e., empirical field studies) if screening hazard quotients exceed unity.

022433

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

April 1, 1998

James A. McPherson, Commander's Representative
Longhorn/Louisiana Army Ammunition Plant
Attn: SIOLH-CR
P.O. Box 658
Doyline, LA 71023

CERTIFIED MAIL
Z 746 032 987
RETURN RECEIPT REQUESTED

Re: **Longhorn Army Ammunition Plant**
Group 2 - Baseline Risk Assessment Work Plan

Dear Mr. McPherson:

The Texas Natural Resource Conservation Commission (TNRCC) staff has completed its review of the above referenced document, which we received on January 20, 1998. We provided draft comments to the Army at the February 2, 1998 meeting held at the U. S. Environmental Protection Agency's (EPA's) offices in Dallas, Texas. Since this meeting and in subsequent meetings with the Army and the EPA, we have had further discussions on this work plan and on the accompanying investigation work plan because the two plans did not agree. After further consideration, we have now revised and finalized our comments, which are enclosed. In accordance with Section VIII. B. of the Federal Facilities Agreement, the TNRCC requests that the Army provide responses to our comments.

Please take special note of "General Comment #1" regarding the Ecological Risk Assessment. Under 30 Texas Administrative Code (TAC) Chapters 335 Subchapters K and S, a remedial investigation/feasibility study (RI/FS) and a baseline risk assessment are defined. A RI/FS is to be designed so as "to determine the nature and extent of a release or threatened release of hazardous substances, and as appropriate, its impact on air, soils, ground-water, and surface water, both within and beyond the boundaries of the facility...". A baseline risk assessment "describes the potential adverse effects under both current and future conditions caused by the release of contaminants in the absence of any actions to control or mitigate the release". It is in the TNRCC's opinion that the Army must sample Caddo Lake (water and sediments) in order to be compliant with the TNRCC rules cited above. If you have any questions regarding this matter, please call me at (512) 239-2502.

Sincerely,

Diane R. Poteet

Diane R. Poteet, Project Manager (MC-143)
Superfund Cleanup Section
Pollution Cleanup Division

Enclosure

cc: Chris Villarreal, EPA Region 6 (6SF-AP)
Yolane Hartsfield, COE Tulsa District (CESWT-PP-EA)
Oscar Linebaugh, COE Eastern Area Office (CESWF-AD-E)

Texas Natural Resource Conservation Commission (TNRCC) Comments
Group 2 Baseline Risk Assessment Work Plan
Longhorn Army Ammunition Plant (LHAAP)

A. **Human Health Risk Assessment:**

1) It is stated that the risk assessment for site 16 will not include soils within the area to be capped. The Risk Assessment Work Plan (the Work Plan) indicates that for site 18/24, the groundwater modeling will take into account the decreases in groundwater concentrations that take place as a result of the pump and treat system. Engineering controls should not be considered in the risk assessment, even if they are in place prior to the conduct of the risk assessment. Engineering controls may, however, be considered later in the process during the risk management phase.

2) On page 2-2, it is stated that only data from the Phase I and Phase II Remedial Investigations (RIs) will be used in the risk assessment except for site 18/24. Some justification for this decision should be provided. Based on the summary of data, it does appear that the contaminants are moving from one media to another, particular the high explosives (HE). If the basis for eliminating the data is that samples collected during the 1980's are not likely to adequately represent current concentrations that should be stated in the Work Plan. Alternatively, if the analytical methods used in the 1980's resulted in data that are not suitable for combining with data generated from methods used in the 1990's due to detection limits or procedures, it would help to have that information in the Work Plan. The primary concern is that there were apparently 35 soil samples collected prior to the Phase I RI for Site 29. Good technical justification for eliminating these samples should be provided given the limited amount of soil samples available for the site.

3) No information regarding the analytical methods that were used was provided in the Work Plan. Therefore, two additional documents were reviewed briefly in order to ascertain the quality of the data proposed for use in the risk assessment. Those two documents were the *Sampling and Data Results Report* and the *Laboratory Data Validation Report* for the Phase 2 Group 2 sites. No information was provided for the Phase I sampling effort. Based on the limited review conducted the following general comments are provided:

    a) It is unclear from the Work Plan or the *Sampling and Data Results Report* to what extent broad spectrum analyses for semi-volatiles were performed at any of the sites. The lack of data on semi-volatile organic compounds represents a significant data gap for the risk assessment particularly considering that a number of sites were burning grounds where polycyclic aromatic hydrocarbons (PAHs) would be expected. Other sites were used as landfills and little information currently exists regarding what types of materials were deposited in those landfills. Clearly, additional semi-volatile organic analyses are needed before a technically-defensible risk assessment can be conducted.

b) According to the Work Plan, the only sites at which polyaromatic hydrocarbons (PAHs) were detected are Sites 17 (in soil) and 18/24 (in sediments only). The apparent lack of PAHs in the soil at Site 18/24 is somewhat suspicious given that it was used as a burning ground. Based on the description of the sampling effort during the pre-Phase I study, samples were taken along the *suspected* burn pits. The fact that PAHs were not detected in soils suggests that either they missed the pits or perhaps their detection limits were not satisfactory. Given that waste practices at Site 12 are almost completely unknown, data for semi-volatile organic constituents should be collected at this site.

c) The data provided (in the *Sampling and Data Results Report*) for have been censored at reporting limits. These reporting limits were not defined in the Work Plan or the *Sampling and Data Results Report*. A clear description of the reporting limits and how they were calculated should be provided in the Work Plan. In general, however, it is preferable that data be reported down to a method detection limit (MDL). Censoring of data at arbitrary limits makes it difficult to summarize and compare data sets and can lead to biased estimates of means and variances when calculating exposure concentrations. According to Chapter 14 of *Statistical Methods for Environmental Pollution Monitoring* (Gilbert, 1987), reporting of estimated concentrations below specified quantitation limits is a better approach than censoring the data, even though estimated concentrations below quantitation/detection limits will be uncertain. Similar recommendations are also made by the EPA (EPA, 1980) and American Society of Testing Materials (ASTM, 1984). If the analytical tapes have been archived, LHAAP should try and obtain the data in an uncensored format from their laboratory if they are going to be used in the risk assessment. Otherwise, the censoring of the data that has occurred will require that proxy values be assigned for all chemicals that are reported as less than (<) values prior to calculating exposure concentrations for the risk assessment. If uncensored data are not obtained, the standard approach would be to assign a value equal to the reporting limit or ½ of the reporting limit. For compounds that are reported as "not detected" or as less than (<) values, the reporting limit should be lower than the concentration of concern for that medium so that use of reporting limit as a proxy in the in the risk assessment does not drive risks (i.e., result in risks that exceed *de* *minimis* levels for chemicals that were not detected) at the site. However, based on the limited review conducted on the Phase II Data, the reporting limits for many of the compounds are not as low as they should be, given that the data are to be used in a risk assessment. For example, many of the reporting limits are either at or above the corresponding chemical-specific health-based limit for that media, a possible outcome being that excessive risk may be attributed to compounds that were not detected at the site if these data are used in the risk assessment.

The reporting limits for the metal analyses appear to be sample-specific (i.e., they vary from analyte to analyte). However, it does not appear that the reporting limits for the volatile organics and HE are sample-specific (it is possible that significant sample dilution occurred during analysis which caused the reporting limits to be artificially uniform). According to both the *Guidance for Data Useability in Risk Assessment* (EPA, 1992) and the *Risk Assessment Guidance for Superfund (RAGS) Volume I (Part A): Human Health Evaluation Manual* (EPA, 1989), sample detection or quantitation limits (SDLs or SQLs) is the most useful limit to risk assessors because they take into account sample-specific dilutions, aliquot size, and other sample-specific adjustments. If the analytical tapes have been archived, LHAAP should try and obtain SDLs and SQLs as these limits are more appropriate for assigning proxy values for non-detects.

4) A number of data reduction steps are outlined on page 2-41. It is acknowledged that the data reduction procedures described are those which are commonly accepted for use in risk assessment. However, because a number of the reporting limits provided in the *Sampling and Data Results Report* exceed corresponding health-based limits, the data reduction procedures are not necessarily appropriate in all cases. Before eliminating chemicals from the risk assessment because they were not detected, all of the criteria below should be met:

   a) there should be no reason to expect that the chemical would be present at LHAAP (i.e., high explosives should not be eliminated even if they are never detected at a particular sampling site given their widespread use and distribution at this site);

   b) the chemical should be not detected in any other media that could serve as a source of intermedia transfer (i.e., leachable organics and high explosives that are detected in soil at the site should <u>not</u> be eliminated from the groundwater pathway, even if they are never detected in groundwater);

c) chemicals for which the reporting limits either meets or exceeds health-based limits for a particular medium should not be eliminated from any pathway where exposure to that media occurs, even if that chemical is never detected

4) On page 3-7, the Work Plan indicates that the site will not be developed for residential use. Unless there is a clear understanding that the property will be deed recorded to prohibit residential development, LHAAP should evaluate a future on-site residential scenario.

5) On page 3-4, it is stated that the finalized list of COPCs will be prepared for the risk assessment based on a comparison with background using a t-test. For this test, the null hypothesis (H_0) will be defined as: the site concentration is greater than or equal to the background concentration ($S \geq B$) with a 5% significance level.

6) On page 3-5, it is stated that essential nutrients will be eliminated from the risk assessment. Prior to eliminating essential nutrients from the risk assessment, it should be demonstrated that they are not present at concentrations that would be injurious to human health since all metals are toxic at high levels. Comparisons with the recommended daily allowance (RDA) can be used as a screening tool. Any metal below the RDA could be safely eliminated from the risk assessment. However, for essential nutrients that exceed the RDA, a more detailed evaluation should be performed.

7) Pages 3-7 and 3-8 describe drinking water use in the area. The Work Plan gives depths but does not name the drinking water aquifer or indicate whether it is a distinct aquifer (from the one where the shallow groundwater samples have been taken). We (the TNRCC, the Army, and the EPA) know that the shallow aquifer from which most of the groundwater samples have been taken is not used for drinking water but this is not stated in the Work Plan. Thus, for others who will read the Work Plan, please provide the information regarding the degree of separation between the two aquifers. The Work Plan addresses how the groundwater data are to be combined horizontally (e.g., results from different wells may be combined if they are not significantly different) but does not address whether the groundwater data are to be combined vertically (e.g., whether they plan to combine data from two aquifers or two separate producing layers) for purposes of evaluating the drinking water pathway in the risk assessment.

Additional TNRCC Recommendations:
Estimating exposure concentrations in groundwater using models can be a complex task because of the many physical and contaminant processes that may affect transport and transformation in groundwater. The extent to which the hydrogeologic properties of the aquifer are characterized may significantly impact the estimation of risk from groundwater. Therefore, groundwater samples need to be collected in such a way that the contaminant plume, with respect to potential exposure points, is adequately defined. The most practical groundwater data for risk assessment reflect the reasonable maximum concentrations of contaminants in the aquifer of concern. Therefore, statistical methods should not be used to determine representative contaminant concentrations across groundwater wells (inter-well).

The ideal placement of wells for determining reasonable maximum concentrations is near the apparent center of the plume (USEPA, 1991). While the center of the plume may not be readily identifiable, a reasonable approximation would be the monitoring well containing the maximum detected concentrations. When time series data are available, a trend analysis should be performed to determine directional trends and determine the data set that is most appropriate for use in the risk assessment. If concentrations are stable or decreasing, the most recent data set (e.g., data collected over the last two years) should be used. Otherwise, the maximum detected concentration over all sampling events should be used. Since the maximum detected concentration for individual contaminants may occur within different wells, the maximum detected concentration amongst all of the sampled wells for each individual contaminant of concern should be used as the exposure point concentration.

While statistical methods may not be used to estimate representative concentrations across wells, they may be used to determine representative concentrations within an individual well (intra-well). As mentioned above, the uncertainty associated with estimating true average concentrations necessitates the calculation of a 95% UCL on the mean. The variance estimators that are often used in risk assessment require that the data are independent or uncorrelated. Certain types of repeated samples, such as those from groundwater wells, are time-series data that may be correlated. In other words, the concentration measured in a groundwater well on one day will depend, in part, on concentrations detected in the past since they are partially dependent on well-specific characteristics (i.e., well construction, pump rate, etc.). To reduce the dependence caused by seasonal variability, intra-well sampling should be separated in time. Otherwise, if time series data that are correlated are assumed to be random and are used to calculate a 95% UCL, the confidence limits will be underestimated (USEPA, 1989a). Data collected over at least four consecutive quarters from an individual well should be required for calculating a 95% UCL. In this circumstance, it is not necessary to require a minimum of 10 samples for calculating a 95% UCL. Given that the norm is to collect a single sample during each quarter over a year, to require 10 samples for each well would extend the sampling out to two and a half years and delay site decisions and progress. It is undesirable to collect multiple samples within a well during quarterly sampling for use in calculating a 95% UCL because the data points would be correlated and, therefore, inappropriate for use in calculating a 95% UCL.

8) The hunter and trespasser should not be combined into a single receptor. While hunters are probably most likely to be adults, it seems more likely that a trespasser would be a child or adolescent. Assuming that the trespasser is an adult when, in fact, they are more likely to young adolescents could underestimate the non-cancer hazard index or overestimate cancer risk and will increase uncertainty in the risk assessment.

9) It is stated that ingestion of game will not be assessed for the sportsman/trespasser scenario because of the limited nature of hunting on site (e.g., only on weekends, during deer season, and restricted to LHAAP employees) and because the chemicals detected on site do not bioaccumulate. However, metals, phthalates, and nitrogenated compounds which have been detected in the soil and surface water at a number of sites have known bioaccumulation potential and would be accessible to deer in both surface water and soil. In addition, while hunting activities on site may currently be limited, they may not be in the future. While it is understood that limitations are placed on the number of deer that can be harvested by a single individual and that those limitations would serve to limit exposure, exposure could still potentially be significant if the meat were processed for consumption by a single family. If LHAAP maintains that a current deer hunter still does not need to be evaluated in the risk assessment, additional justification for that position should be provided. Useful information might include limitations on the number of deer that can be harvested by a single individual in the area and the amount of meat that would be available for consumption (after processing) from the maximum allowable deer harvest.

10) The Work Plan only proposes evaluating a recreational fisher. Justification for ruling out the *subsistence* fisher as possible receptor at Caddo Lake should be provided. Employees at the park should be consulted regarding the potential for subsistence activities.

11) On page 3-16, it is stated that the distribution of the data will be reviewed to determine if "hot spots" exist. According to the Work Plan, if they are found, the *data* will be evaluated separately. Please describe how "hot spots" will be identified (i.e., calculating a coefficient of variation, using some multiple of the average concentration as a comparison point, etc.). In addition, please indicate more clearly how "hot spots" would be treated in the risk assessment, assuming that they are found.

12) On page 3-23, it is stated that a soil ingestion rate of 50 mg/day will be assumed for the on-site maintenance worker. This value is not appropriate for evaluating risks to individuals employed in dusty occupations, such as a maintenance worker and construction workers (the value was actually developed for office workers). In addition, this assumption is inconsistent with other assumptions proposed for the maintenance worker. The Work Plan proposes that it should be assumed that soil is excavated (e.g., soil concentrations are averaged from 0 to 5 ft) for purposes of evaluating risks to an on-site maintenance worker. Presumably, the maintenance worker may be doing the excavating and, therefore, would be likely to ingest more soil than an office worker.

The most reasonable approach would be to evaluate an on-site maintenance worker and a construction worker or line layer (may occasionally excavate soil) as two separate receptors. This would allow choosing exposure parameters and depths over which soil concentrations should be averaged that are more appropriate given the likely activities of that worker. A soil ingestion rate of 480 mg/day should be used for the construction worker and soil ingestion rate of 100 mg/day should be used for the maintenance worker. For the commercial/industrial scenarios, the TNRCC Risk Reduction Rules (RRR) (found at 30 TAC Chapter 335 Subchapter S) requires evaluating the upper two feet of soil. Either the maximum detected concentration in the upper two feet of soil or the 95% UCL from the more contaminated of the zero to six inch or six inch to two foot depth intervals should be used in estimating an exposure point concentration for the maintenance worker. For the construction worker scenario, a 95% UCL may be calculated across depth intervals within the exposure area or the maximum detected concentration for the most contaminated depth interval should be used in calculating an exposure point concentration.

13) It is understood that the *Supplemental Region VI Risk Assessment Guidance* still supports evaluating inhalation risks by calculating intake rates in mg/kg-day. However, the TNRCC does not support this approach. In January of 1991, the U.S. EPA made the decision to replace inhalation reference doses for non-carcinogenic constituents and inhalation slope factors for carcinogenic constituents with reference concentrations and inhalation unit risk factors, respectively. The decision was based on two major factors:

- The U.S. EPA believes that it is more accurate to base toxicity values directly on air concentrations instead of making the metabolic pharmacokinetic and/or surface area adjustments required to estimate a dose; and

- There are compounds that can elicit route-of-entry effects where the toxic effect is to the respiratory system. As such, a measure of an internal dose may imply effects to other organ systems or effects from other exposure routes.

To correct for these potential problems, the inhalation toxicity values in the Integration Risk Information System (IRIS) are now expressed in terms of concentration in air (on a $\mu g/m^3$ or mg/m^3 basis) rather than in terms of dose. If inhalation risks are to be evaluated by calculating daily intakes in mg/kg-day, the inhalation toxicity values in IRIS would have to be converted to benchmark levels in corresponding units. The TNRCC suggests that the inhalation pathway be evaluated by making direct comparisons to measured or modeled air concentrations rather than conversions to internal doses (e.g., mg/kg-day) as this approach is less labor intensive and more technically defensible.

The total inhalation exposure cancer risk and hazard index should be calculated using the most current toxicity values and the information contained in the risk assessment. The following algorithms should be used to address the inhalation route of exposure:

<u>Inhalation of Volatiles</u>

Risk Due to Inhalation of Carcinogenic Compounds $= \dfrac{(\text{URF})(\text{Soil conc.})(10^3\,\text{ug/mg})(\text{EF})(\text{ED})(1/\text{VF})}{(\text{AT})(365\ \text{d/yr})}$

Soil concentration (mg/kg)
EF = exposure frequency (d/yr)
ED = exposure duration (yr)
PEF = particulate emission factor (m^3/kg)
AT = averaging time (yr)

Hazard Due to Inhalation of Non-carcinogenic Compounds$= \dfrac{(\text{Soil conc.})(10^3\,\text{ug/mg})(\text{EF})(\text{ED})(1/\text{PEF})}{(\text{RfC})(\text{AT})(365\ \text{d/yr})}$

RfC = Reference Concentration (mg/m^3)
Soil concentration (mg/kg)
EF = exposure frequency (d/yr)
ED = exposure duration (yr)
PEF = particulate emission factor (m^3/kg)
AT = averaging time (yr)

Inhalation of Particulates

Risk Due to Inhalation of Carcinogenic Compounds $= \dfrac{(\text{URF})(\text{Soil conc.})(10^{3}\ \text{ug/mg})(\text{EF})(\text{ED})(1/\text{PEF})}{(\text{AT})(365\ \text{d/yr})}$

URF = Unit Risk Factor $(\mu g/m^3)^{-1}$
Soil concentration (mg/kg)
EF = exposure frequency (d/yr)
ED = exposure duration (yr)
PEF = particulate emission factor (m^3/kg)
AT = averaging time (yr)

Hazard Due to Inhalation of Non-carcinogenic Compounds$= \dfrac{(\text{Soil conc.})(10^{3}\ \text{ug/mg})(\text{EF})(\text{ED})(1/\text{PEF})}{(\text{RfC})(\text{AT})(365\ \text{d/yr})}$

RfC = Reference Concentration (mg/m^3)
Soil concentration (mg/kg)
EF = exposure frequency (d/yr)
ED = exposure duration (yr)
PEF = particulate emission factor (m^3/kg)
AT = averaging time (yr)

14) On page 3-27, it is indicated that a model which evaluates multiple non-ingestion water use intakes will be used for the maintenance worker. Given that laundering and dish washing are not activities likely to be undertaken by an on-site maintenance worker, it may be more appropriate to consider using the model developed by Andelman *et al.* (1986), which only considers showering, as opposed to adjusting for lesser exposure using the model proposed in the Work Plan. The reference for the Andelman model is:

> Andelman, J.B., Crouch, A., and Thurston, W.W., (1986). "Inhalation Exposure in Indoor Air to Trichloroethylene from Shower Water", Chapter 16 in *Environmental Epidemiology*. pp 201-213.

15) On page 3-31, it is stated that it will be assumed that children ingest one-half the fish ingested by adults. Pao *et al.* is an old source and the 1997 *Exposure Factors Handbook* is probably a better source for obtaining accurate information on child fish ingestion rates.

16) Regarding page 3-33: Note that the Toxicology and Risk Assessment Section (TARA) recommends that the most recent toxicity equivalency factors (TEFs) recognized by the

World Health Organization (WHO) be used in calculating a 2,3,7,8-TCDD toxicity equivalency quotient (TEQ). The only revisions are to the TEFs for OCDD, OCDF, and PeCDD. The revised TEF for OCDD and OCDF is 0.0001 and the revised TEF for PeCDD is 1 (17th International Symposium on Chlorinated Dioxins and Related Compounds, August 25-29, 1997, Indianapolis, Indiana).

17) On page 3-34, a justification for not using the IEUBK lead model is provided. Unless it is agreed that the property will be deed recorded to prohibit residential development, future childhood lead exposure should be evaluated using the IEUBK model. Regardless of whether an agreement is reached to deed record the property, *in-utero* lead exposure should be evaluated using the adult lead model for the current on-site maintenance worker scenario.

18) General comments regarding soil sampling under structures and risk assessing:

a) If soil samples underneath concrete structures, such as at sites 29 and 32, and core samples from these structures are not proposed, then how will the Army assess the risk of these soils and concrete structures? When contaminates leak out, they tend to leak out from the bottom of a tank rather than the sides.

b) Even though the Baseline Risk Assessment for the Group 4 sites has been approved, a similar comment comes to mind regarding this same type of problem: Will soil samples underneath the buildings in Group 4 be proposed? If not, how does the Army intend to assess the risk to future workers at these sites? If the buildings are demolished in the future, workers may be exposed to contaminates left in the soils.

19) General comment regarding future land use:

In response to the Army's request, which was made at the May 7, 1996 project manager's meeting, the TNRCC provided a letter regarding future land use determination. During the January 1996 project managers' meeting in Tulsa, Oklahoma, and in a letter to the Army dated January 25, 1996 regarding comments on the Group 1 Risk Assessment, the TNRCC requested that future land use scenarios at the Longhorn Army Ammunition Plant be established in order to facilitate the remedial investigation (RI) process in accordance with state and federal regulations. TNRCC regulations found at 30 TAC §335.8 (a) (2) and §335.563 (e) require that for sites subject to 30 TAC Subchapter K (state "superfund"), media cleanup levels be based on a future residential land use unless a person demonstrates, to the satisfaction of the Executive Director, that another land use scenario is appropriate. We also recommended that the Army refer to the criteria for justifying alternate land use presented in *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual* (EPA/540/1-89/002) (RAGS), Chapter 6, Section 6.2.2.

This supporting documentation may include, *but is not limited to*, letters/communications from the city planners and the Census Bureau which have information on population growth and projections, copies of comprehensive community master plan, and copies of applicable zoning laws and maps. The accessibility of the site to existing public utilities, current institutional controls in place at the site, and the site's relative location to residential, industrial, commercial, urban, suburban, agricultural and recreational areas can be documented as well. *Historical information can be used to document past use of the site.* The EPA's directive on "Land use in the CERCLA Remedy Selection Process," which has also been provided to the Army, presents additional information for considering land use in making remedy selection decisions under CERCLA at National Priorities List (NPL) sites.

20) EPA has recommended 0.2 mg/cm^2 as a central tendency estimate of the dermal adherence factor. The EPA Superfund Dermal Risk Assessment Workgroup is in the process of developing a revised approach for estimating dermal adherence factors for various exposure scenarios. However, until further guidance is available, a dermal adherence factor of 0.2 mg/cm^2 should be used in evaluating dermal exposure for all receptors.

21) TNRCC recommends use of the 1992 EPA Dermal Exposure Assessment document (EPA, 1992), hereafter referred to as the 1992 Dermal document, for procedures and equations used to evaluate dermal exposure to contaminants in water. In some cases, there have been updates to the 1992 Dermal document, and those updates, as well as additional TNRCC recommendations are outlined below.

<u>Updates to the 1992 Dermal Document</u>:
The equation used for predicting permeability coefficients, K_p (cm/hr), for organics (Equation 5.11 in the 1992 Dermal document) has been updated based on information published in several papers (Kim Hoang, 1997). TARA recommends the use of the following equation:

$$\log K_p = -2.80 + 0.67 \log K_{ow} - 0.0056\, MW \qquad (r^2 = 0.66)$$

where:

K_p=Permeability coefficient
log K_{ow}=Log of the octanol/water partition coefficient (please contact TARA for the most recent values)
MW=Molecular weight of the compound

However, for compounds with very high or very low K_{ow} values (log K_{ow} < -1, MW < 100; log K_{ow} > 5, MW >150), the above equation should not be used, as the predictive capabilities of the regression equation are exceeded for these compounds. Instead, the following equation, derived from Kasting and Robinson, 1995, which predicts the upper limit on skin permeability ($K_{p[upper\ limit]}$) should be used:

$$K_{p(upper\ limit)} = \frac{1}{\frac{1}{K_p} + \frac{1}{0.3} + \frac{1}{0.93}}$$

where:

$K_{p(upper\ limit)}$=permeability coefficient
0.3 cm/hr=Upper limit for K_p in aqueous layer
0.93 cm/hr=Upper limit for blood limited steady-state K_p (calculated as the low-limited value F/S, where F is the total capillary blood flow and S is the corresponding skin SA for a 70 kg man; F= 4.64 cm^3/sec = 16,700 cm^3/hr; SA = 18,000 cm^2)

The equation used for calculating the stratum corneum diffusion coefficient, D_{sc} (cm^2/hr), for organics (Equation 5.13 in the 1992 Dermal document, EPA 1992) is based on Equation 5.11 in the 1992 Dermal document and has also been updated. The following equation should be used:

$$Log\ \frac{D_{sc}}{l_{sc}} = -2.80 - 0.0056\ MW$$

(assuming that $l_{sc} = 10^{-3}$ cm)

The second equation used to calculate the dose absorbed per unit area per event, DA_{event} (mg/cm^2-event) for organics (Equation 5.21 in the 1992 Dermal document) contained a where:

K_p=Permeability coefficient
log K_{ow}=Log of the octanol/water partition coefficient (please contact TARA for the most recent values)
MW=Molecular weight of the compound

However, for compounds with very high or very low K_{ow} values (log K_{ow} < -1, MW < 100; log K_{ow} > 5, MW >150), the above equation should not be used, as the predictive capabilities of the regression equation are exceeded for these compounds. Instead, the following equation, derived from Kasting and Robinson, 1995, which predicts the upper limit on skin permeability ($K_{p[upper\ limit]}$) should be used:

$$K_{p(upper\ limit)} = \frac{1}{\frac{1}{K_p} + \frac{1}{0.3} + \frac{1}{0.93}}$$

where:

$K_{p(upper\ limit)}$=permeability coefficient
0.3 cm/hr=Upper limit for K_p in aqueous layer
0.93 cm/hr=Upper limit for blood limited steady-state K_p (calculated as the low-limited value F/S, where F is the total capillary blood flow and S is the corresponding skin SA for a 70 kg man; F= 4.64 cm^3/sec = 16,700 cm^3/hr; SA = 18,000 cm^2)

The equation used for calculating the stratum corneum diffusion coefficient, D_{sc} (cm^2/hr), for organics (Equation 5.13 in the 1992 Dermal document, EPA 1992) is based on Equation 5.11 in the 1992 Dermal document and has also been updated. The following equation should be used:

$$Log \frac{D_{sc}}{l_{sc}} = -2.80 - 0.0056\ MW$$

(assuming that $l_{sc} = 10^{-3}$ cm)

The second equation used to calculate the dose absorbed per unit area per event, DA_{event} (mg/cm^2-event) for organics (Equation 5.21 in the 1992 Dermal document) contained a typographical error and has been corrected (Kim Hoang, 1997). Please use the following equation:

$$\log K_p = -2.80 + 0.67 \log K_{ow} - 0.0056\, MW \qquad (r^2 = 0.66)$$

where:

K_p=Skin permeability constant (cm/hr)
C_w=Chemical concentration in water (mg/cm^3)
τ=Lag time, unitless
t_{event}=Exposure duration (hr); TNRCC recommends 2 hr
t^*=Time to reach steady-state (hr)
B=Unitless ratio measuring the permeability of the stratum corneum relative to the epidermis

Additional TNRCC Recommendations:
Exposure via the dermal route is estimated in terms of an absorbed dose, while oral toxicity values are typically expressed in terms of an administered dose. As few compounds are absorbed completely from the GI tract, it may be necessary to adjust toxicity values derived from oral data to reflect internal dose when evaluating the dermal exposure pathway to avoid underestimating the risk associated with a dermal exposure. The TNRCC recommends adjusting the oral toxicity values when there is evidence to suggest that the GI absorption of a specific compound is significantly less than 100%. The TNRCC defines "significantly less than 100%" as a GI absorption fraction (ABS_{GI}) less than 50%. Adjustment of the oral reference dose or slope factor for chemicals with an ABS_{GI} greater than or equal to 50% would result in a negligible difference and no adjustment is deemed necessary.

In an effort to appropriately use the available chemical-specific data on GI absorption, the TNRCC recommends the approach developed by Bast and Borges, 1996 to account for GI absorption when estimating risk/hazard based on dermal exposure. By modifying the oral toxicity values by chemical-specific ABS_{GI} values, when the ABS_{GI} is significantly less than 100%, the administered doses (oral RfDs and SFs) are converted into absorbed doses for use in dermal exposure pathway calculations. Although this approach introduces uncertainties, it utilizes moderate assumptions, rather than the extremes of always assuming 5% or 100% GI absorption, which could overestimate or underestimate the risk, respectively. The EPA (1989) has developed a method for adjusting RfDs and SFs for dermal absorption. The following equations should be used to adjust oral toxicity values for carcinogens and non-carcinogens, respectively.

$$\textit{For carcinogens:}\quad SF_d = \frac{SF_o}{ABS_{GI}}$$

$$\textit{For non-carcinogens:}\quad RfD_d = RfD_o \; ABS_{GI}$$

where:

Sf_d=Dermal slope factor (i.e., internal dose cancer slope factor) $(mg/kg\text{-}day)^{-1}$
Sf_o=Oral cancer slope factor $(mg/kg\text{-}day)^{-1}$
RfD_d=Dermal reference dose (i.e., internal reference dose) (mg/kg-day)
RfD_o=Oral reference dose (mg/kg-day)
ABS_{GI}=GI absorption fraction (unitless)

The TNRCC recommends use of the ABS_{GI} values provided in Bast and Borges (1996). For cadmium, however, the TNRCC recommends an ABS_{GI} of 2.5% for soil pathways and 5% for water pathways for calculating an internal reference dose in order to correspond to the assumptions made by the EPA in calculating the oral RfD (IRIS, 1996). TNRCC staff have evaluated the appropriateness of the recommended values (Bast and Borges 1996) for the compounds and chemical classes for which there are experimentally derived dermal absorption fractions. Comparison of the recommended values with the information presented in ATSDR Toxicological Profiles for each respective compound indicates that the recommended ABS_{GI} values are within the range of the experimental data presented in the Toxicological Profiles.

When ABS_{GI} data are not available either in Bast and Borges (1996) or in the scientific literature, the following default ABS_{GI} values should be used: 80% for volatile organics, 50% for semivolatile and nonvolatile organics, and 20% for inorganics. It is not necessary to adjust the oral RfDs or SFs if the default ABS_{GI} value of 80% for volatile organics is used.

22) An soil ingestion rate of 480 mg/day is more appropriate for use with a maintenance worker/construction worker instead of the 50 mg/day proposed on page 3-43.

23) <u>Target Risk Level</u>

TNRCC RRR §335.563(b) begins with the statement: "For known or suspected carcinogens, media cleanup levels shall be established at concentrations which represent an excess upperbound lifetime risk of between one in 10,000 and one in one million." This first sentence is introductory and is followed by the following specific statement: "The executive director will use one in one million as a goal in establishing such concentration limits." The preamble to the RRR elaborates on this specific goal: "This means that a risk level of one in one million will be used as a starting point (or initial protectiveness goal) for determining media cleanup levels that remedies will attain. The use of one in one million as the starting point for a risk level expresses the Texas Water Commission's [TNRCC predecessor agency] preference for media cleanup levels that result in risks at the more protective end of the risk range."

§335.563(b) concludes by specifying that "the cumulative excess risk to exposed populations (including sensitive subgroups) shall not be greater than one in ten thousand." TNRCC RRR §335.563(d) states that additional considerations to address the following may be required: multiple contaminants in a medium, exposure to multiple contaminated media, reasonable expected future exposure conditions at the facility, and the technical limitations, effectiveness, practicability, or other relevant features of available remedies. These rules establish a process in §335.563(d) (4) whereby technical feasibility issues such as the technical limitations, effectiveness, practicability, or other relevant features of available remedies may be taken into account to determine whether it is necessary to raise the risk level for an individual carcinogen above the goal of 10^{-6}. The rule also indicates that when the background concentration for a contaminant is greater than the risk-based level, then the background value shall serve as the cleanup level. Thus, for carcinogens, the cleanup level for an individual contaminant would be initially established at a 10^{-6} risk level and could only be raised based on a consideration of either technical feasibility or background considerations. The application of the 10^{-6} criteria to individual constituents is agency policy and is neither a new requirement not is it inconsistent with other program areas. Please revise all sections of the report accordingly. Section 5.0 should clearly state and discuss the contaminants posing a risk greater than 10^{-6} or a hazard index greater than 1 along with the pathway and media involved.

B. Ecological Risk Assessment:

Overall, the ecological risk assessment (ERA) portion of this Work Plan (Section 4) is well-written and incorporates many of the issues outlined in the previous TNRCC/EPA comments on Group 4 sites. However, there are a few areas which need to be addressed or clarified and these are presented below:

General Comments:

1. It is recognized that the modeling approach proposed for evaluating surface water and sediment concentrations in Caddo Lake for the Group 2 Sites is the same approach which was proposed for the Group 4 Sites. However, TNRCC's position has always been that actual surface water and sediment samples need to be collected from Caddo Lake (see previous TNRCC comments on Groups 1 and 4). Without this empirical information, particularly the sediment data, it is not possible to accurately determine the full extent of contamination. We realize that other sources of contaminants to the lake exist; however, this does not preclude sampling. The Army has stated that funds cannot be expended to sample in off-site areas unless there is strong evidence of an off-site release. We have several responses to this position. First, CERCLA/SARA defines "facility" as "...any site or area where a hazardous substance has been deposited, stored, disposed of, or placed, or otherwise come to be located..." (Section 101 (9)). Similarly, the NCP (40 CFR Part 300.5) defines "on-site" as "... the areal extent of contamination...". Caddo Lake may well be "on-site" depending on sampling results. Second, given the known documented past releases of contaminants into Goose Prairie Creek and Harrison Bayou and the probable unknown releases, it is likely that contaminants have been flushed into the lake. Finally, the hits of contaminants - although at low levels - in Goose Prairie Creek up to the lake prove that these feeder streams are contaminant pathways to the lake.

   Furthermore, the modeling of surface water/sediment exposure in Caddo Lake in lieu of actual sampling is not technically justified. For instance, how will sediment-partitioning modeling, the input of which is itself based on modeled current surface water concentrations, be used to estimate sediment concentrations which have probably fluctuated widely over the years? It is likely that over the years, lake sediments have acted as a sink for many contaminants. It is also likely that contaminant concentrations from the site were greater in the past than they are now; yet, the sediment "sink" may still contain those higher concentrations to which benthic organisms are being exposed. Based on the above, TNRCC strongly encourages the Army to reconsider its position on the sampling of Caddo Lake.

2. Although the Work Plan discusses the concepts of evaluating feeding guilds and indicator species from all habitats, there are some inconsistencies. For example, there are places (see Specific Comments # 4 and 6) where it appears that indicator species are already being limited to birds and small mammals. In general, it is advisable to initially select receptors (indicator species) from all feeding guilds supported by site habitats and address all complete exposure pathways. Some of these receptors/pathways can then be methodically eliminated from consideration based on relative contaminant sensitivities and/or exposures or other factors. A decision to not evaluate some feeding guilds removes these receptors from considerations of exposure, sensitivity, and possible food chain effects.

3. The ERA methodology described in the Work Plan appears to be a compilation of the referenced guidance documents, rather than adhering to any particular one. This is okay provided that some kind of a screening-level ERA is conducted initially in order to eliminate incomplete exposure pathways and contaminants which do not pose a risk. As written, a "desk-top" ERA is to be performed, but it is unclear how this is to be differentiated from any quantitative efforts which may be needed and why the approach for developing the screening tools appears at the end of the Work Plan. Please clarify. Also see Specific Comment # 9.

4. It is understood that data from each of the Group 2 sites will be evaluated independently in order to facilitate remedial actions. However, if the ERA is also to be conducted site-by-site within Group 2, a more definitive statement to that effect is needed. Additionally, if applicable, a statement is needed regarding ecological risk from a larger perspective (i.e., will there be an estimate of sitewide ecological risk ?).

5. The Work Plan should reflect that TNRCC approval/concurrence on deliverables/decisions is needed in addition to that from EPA. Also see Specific Comments # 7 and 8.

Specific Comments:

1. P. 4-1, §4.1; Please state (or cross-reference) the following: 1) the site location and history, and 2) the rationale for the "grouping" of the sites within Group 2.

2. P. 4-4, 3rd bullet; A reference to the document(s) used to establish background locations should be made here.

3. P. 4-5, bullet; The referenced guidance is for human health and may not apply equally to ecological receptors. Concentrations of "essential nutrients" could be present in sufficient levels which would pose risk to ecological receptors and should therefore be compared to ecotoxicity benchmarks.

4. P. 4-13, §4.2.5; Where available, ecotoxicological data for species other than mammals and birds should also be listed.

5. P. 4-15 (and 4-16), last sentence; The words "and sensitivity" should be added to the end of this sentence.

6. P. 4-16, 1st paragraph below bullets and P. 31, last paragraph; Again, an indication is made that only birds and small mammals will be evaluated. Please clarify.

7. P. 4-17, last sentence; TNRCC should also be consulted with regard to the identification of hot spots.

8. P. 4-19, reference to §3.3.4 (P. 3-18,19); TNRCC concurrence on the selection of appropriate surface water and sediment-partitioning models is needed.

9. P. 4-30, §4.6; Since this section discusses the development of ecological screening levels, it would be more appropriate to move it toward the front of the Work Plan where a discussion of the screening-level (desk-top) ERA should occur.

10. P. 4-30, §4.6.1; In developing soil screening levels, risk to invertebrates and plants should also be considered.

022453

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

April 3, 1998

Mr. David Tolbert, Project Manager
Longhorn Army Ammunition Plant
P.O. Box 658
Doyline, LA 71023-0658

Re: NRDA Trustee Contact for the Longhorn Army Ammunition Plant

Dear Mr. Tolbert:

This letter is written to provide notification to the Army of a change in the point of contact at the Texas Natural Resource Conservation Commission (TNRCC) with respect to Natural Resource Damage Assessment (NRDA) activities at the Longhorn Army Ammunition Plant.

Please note that Ms. Ginny King left the TNRCC on March 2, 1998. I have assigned Charles Brigance TNRCC Trustee representative for the Longhorn Army Ammunition Plant. Please direct all future correspondence relative to NRDA activities at the above-mentioned site to Mr. Brigance. He may be reached by telephone at (512) 239-2238. The address remains the same.

I encourage the United States Department of the Army to continue to pursue a cooperative NRDA process with the Trustees in the state of Texas. I know Mr. Brigance will further the efforts to date of the Texas Trustees to obtain a Memorandum of Agreement (MOA) with the Department of the Army.

Sincerely,

Richard Seiler

Richard Seiler, Program Manager
Natural Resource Trustee Program
Site Assessment Section
Texas Natural Resource Conservation Commission

RDS/CEB/ok

cc: Scott M. Farley, U.S. Department of Army
Don Pitts, TPWD, Austin, Texas
Peter Samuels, GLO, Austin, Texas
Steve Spencer, DOI, Albuquerque, New Mexico

Longhorn Army Ammunition Plant
Draft Monthly Manager's Meeting Minutes
23 April 1998

1. The 23 April Monthly Manager's Meeting convened at 9:00 a.m. The following topics were discussed during the meeting.

2. Welcome: James McPherson, Commander's Representative, welcomed meeting attendees. David Tolbert announced the recent change in Corps of Engineers Project Manager – Jonna Polk is the new PM. Per the Federal Facility Agreement, formal notification of this change will be provided to EPA and TNRCC.

3. Executive Summary: The Executive Summary was reviewed and discussed as submitted with additional discussion regarding the following:

- Group 5 – EPA will provide concurrence on Group 5 recommendations the week of 27 April
- Burning Ground GWTP – David Tolbert requested additional testing of the GWTP with respect to mechanical functions such as pumps to ensure that the GWTP is capable of running for extended periods of time (24-40hrs) at design capacity (300gpm). COE and Radian will monitor rainfall and identify a time period within the next 6 weeks when flows in Harrison Bayou can accept sustained effluent from the GWTP in order to accomplish this testing. At that time, the additional testing at sustained design capacity will be conducted.
- Landfill Caps (Sites 12 and 16) - Bud Jones, TNRCC, asked about the status of plans to complete two borings into Landfill 16 at suspected source points. The COE stated that they were still working on contracting this work, and expressed concerns and questions regarding the ultimate intent of gathering the data, safety and liability issues for the Army in this type of intrusive work in a landfill, and the inconsistency of conducting this type of work when considering current EPA policy and written guidance. Ms. Polk apologized for raising these issues after the previous decision to complete the borings, but felt that the team should be aware of concerns expressed by both government and contract personnel. Bud Jones stated that the borings should be completed at this time so that the information can be gathered prior to placement of the landfill liner in mid-May. He said that there has been concern expressed within his local TNRCC office that there may be a deeper aquifer under the landfill which is hydraulically connected to Caddo Lake. He expressed a desire to gather the data so that extraction wells could be placed at source points. Ms. Culver, UAS, and Ms. Poteet, TNRCC, expressed their support of Mr. Jones' position. Mr. Jones also suggested review of aerial photos and soil gas surveys for placement of boring locations. Mr. Villareal stated that he was unsure of the purpose of conducting the borings since there may not be risk associated with the site, and risk will ultimately determine

whether remedial action is required. Mr. McPherson concluded the discussion with a commitment from the Army to gather the aerial photos and review them as Mr. Jones had suggested. After completing review of the photos, the Army will discuss their findings with Mr. Jones during the week of 27 April.

4. Site 32 Investigation: Mr. Bockelman, Sverdrup, explained that the results of two previous investigations conducted at Site 32 had been reviewed. These prior investigations included sampling and analysis of soil, groundwater and surface water, with analytes which included volatile organics (VOC), semivolatile organics (SVOC), metals, and high explosives (HE). Analysis of soil samples from two borings which had previously been collected showed the presence of low concentrations of high explosives, but no VOCs. A few phthalate compounds were detected. Two previously collected grab groundwater samples showed elevated total organic chloride (TOX) concentrations. Based on review of previous results, the work plan addendum submitted the week of 20 April proposes two monitoring wells and four borings. Soil samples collected will include samples collected at depths of 0-6 inches. (A detailed account of proposed investigations has been provided to team members in the work plan addendum)

5. Group 2 Risk Assessment Investigations: Mr. Bockelman, Sverdrup, stated that two issues remain outstanding with regard to risk assessment data needs. All others have been resolved, incorporated into the work plan addendum, and his contract has been modified to include that work. The two outstanding issues are sampling depths in borings, and Harrison Bayou sampling / Caddo Lake modeling. EPA does not agree with plans for modeling, and suggested taking sediment samples in Harrison Bayou at the edge of LHAAP property to assess current and past conditions. Ms. Poteet and the Army agreed with this plan, and all EPA and TNRCC agreed to consult experts within their agencies for guidance regarding sediment sample depths. COE expressed hopes that these issues would be resolved expeditiously allowing Sverdrup to conduct the sampling prior to completion of the current field effort, thus avoiding additional contractor mobilization costs. Mr. Jones suggested that Dr. Mary Barrett and her students may have already gathered some sedimentation rate data for Caddo Lake, and this information could be used in determining an appropriate sample depth dating the duration of operation of LHAAP. COE will check with Dr. Barrett regarding this information.

6. Additional Items: Ms. Subra referenced an action item from the last meeting regarding a plan for assessing contamination due to surface runoff of perchlorates. The COE did not have this information available, but will present a plan at the next monthly meeting. The Army agreed that future selected analyses on the installation would include perchlorates (excluding perimeter wells).
Ms. Subra also expressed concern regarding sumps inside buildings. Mr. McPherson explained that the Army is procuring a "liquidator" contract, and that all contamination within the confines of buildings will be the responsibility of the liquidator contractor. Ms. Subra asked about the potential situation of migration of contaminants from a building source into underlying soils and groundwater. Mr. McPherson said that

underlying soils and groundwater will be addressed under the current LHAAP team process, and that the installation will coordinate activities and information between the liquidator contractor and the LHAAP team.

7. Meeting Schedule: The next Monthly Manager's meeting is scheduled for 19 May in conjunction with a partnering meeting on 20 May in Richmond, VA.

DEPARTMENT OF THE ARMY
TULSA DISTRICT, CORPS OF ENGINEERS
P. O. BOX 61
TULSA, OKLAHOMA 74121-0061

022457

REPLY TO
ATTENTION OF:

April 30, 1998

Programs and Project Management Division
Military/Environmental Branch

Mr. James McPherson
Longhorn/Louisiana Army Ammunition
Plant
Post Office Box 658
Doyline, LA 71023

Dear Mr. McPherson:

In accordance with the Federal Facility Agreement which has been established for Longhorn Army Ammunition Plant, I am pleased to inform you of a new project manager assignment for your installation. Ms. Jonna Polk will serve as your project manager for the Environmental Restoration Efforts. She can be reached at 918-669-7482.

Please feel free to contact me at 918-669-7672 if you have any questions or concerns about this assignment.

Russ K Hole

Russell K. Holeman, P.E.
Director, Military/Environmental
Project Management

Copy Furnished:

Mr. Chris Villareal
U.S. Environmental Protection Agency
1445 Ross Avenue
Dallas, TX 75202-2733

Ms. Diane Poteet
Texas Natural Resource Conservation
Commission
Post Office Box 13087
Austin, TX 78711-3087

CF:
CESWF-PM-J (Larry Rogers)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS, TX 75202-2733

022459

May 11, 1998

VIA REGULAR MAIL AND FACSIMILE

Mr. James A. McPherson, Commander's Representative
Longhorn/Louisiana Army Ammunition Plant
Attn: SIOLH-CR
P.O. Box 658
Doyline, LA 71023

Re: Longhorn Army Ammunition Plant
Group 5 Final Site Characterization Investigation Report

Dear Mr. McPherson:

The Environmental Protection Agency (EPA) has completed its review of the *Final Site Characterization Investigation Report for the Group 5 Sites (50,52,60, and 63) Site Investigation* (report)(Sverdrup, June 1997). At EPA's request, the Army performed trenching activities at Site 63 (Former Burial Pits). Site 63 trenching activities were conducted at former soil sample/boring locations on February 17, 1998. At all trench locations, native soils were found to approximately eight feet below ground surface with no visible indication of former disposal activities (see enclosed digital photographs). Based on EPA's review of the report and the results of the Site 63 trenching activities, the EPA concurs with the following report findings, conclusions, and Army recommendations:

- Site 52 (Magazine Washout Area) was a washout area for the transport vehicles operation in the Magazine Area located near Plant 1. The Magazine Area contains 58 Richmond-type magazines and two above ground magazines, all of which were used for the storage of TNT. The standpipe at this location was presumed to have provided a water source for the washout of trucks used to transport TNT to and from this area. It is unknown if solvents were used in truck washout activities. Washout waste waters from these activities were reported to have been discharged onto the ground surface.

- At Site 52, acetone (15 μg/kg) was found in one of five surface soil samples. Subsurface soil samples contained two volatile organic compounds, p-isopropyltoluene (16 μg/kg) and acetone (20 μg/kg), and two semivolatile organic compounds , bis(2-ethyhexyl)phthalate (197 μg/kg to 878 μg/kg) and butyl benzyl phthalate (392 μg/kg). Acetone is a chemical used in laboratory procedures and its presence at the given concentrations (15 and 20 μg/kg) is reasonably considered attributable to laboratory contamination. The presence of bis(2-ethylhexyl)phthalate and butyl benzyl phthalate, which are commonly used plasticizers that can be found in laboratory equipment, coupled with the ranges of concentration detected, lead to the conclusion that their presence was attributable to laboratory contamination. No explosive compounds were detected in the surface or subsurface samples.

- Site 63 was identified as pits that were used for the detonation and burial of Plant 3 reject materials of unknown composition. It is assumed that no burning occurred within the pits, therefore, fuels or solvents normally used to burn materials are not anticipated contaminants of concern. A review of aerial photography of LHAAP taken in 1954, 1958, 1963 and 1970 revealed indications of surface soil disturbance. It is assumed that the burial pits area was developed sometime between May 1954 and March 1958. The period of operation is unknown.

- At Site 63 (Former Burial Pits), acetone (31 μg/kg) and naphthalene (6 μg/kg) were detected in one of five surface soil samples. Acetone is a chemical used in laboratory analytical procedures and its presence is generally considered to be a result of laboratory induced contamination. Bis(2-ethylhexyl)phthalate was detected in nine of fifteen soil samples at concentrations ranging from 206 μg/kg to 890 μg/kg. The presence of bis(2-ethylhexyl)phthalate, coupled with the range of concentration detected, lead to the conclusion that their presence was attributable to laboratory contamination. No explosive compounds were detected in the surface or subsurface samples.

The investigations at Sites 52 and 63 leads to the conclusion that no discernable concentrations of chemical compounds reflecting a release into the environment is present at these two sites. Therefore, the EPA concurs with the Army's recommendation that no further action is warranted at Sites 52 and 63.

In regards to Site 50 (Sump Water Storage Tank) and Site 60 (Former Storage Buildings 411 and 714), results of site investigation sampling indicate that additional investigation is necessary to better determine the extent of contaminants present at these sites. In an effort to expedite the investigations of these sites, the EPA concurs with the Army's recommendation to move Sites 50 and 60 from the Group 5 Sites into the Group 4 Sites investigation (scheduled for FY98). This will result in closure of Comprehensive Environmental Response Compensation and Liability Act activities for the Group 5 Sites.

If you have any questions, please contact Chris Villarreal at (214) 665-6758.

Sincerely,

WKHonker

William K. Honker, P.E.
Chief, AR/OK/TX Branch
Superfund Division

Enclosure

022461

cc: Jonna Polk, COE Tulsa District
Diane Poteet, TNRCC (MC-143)
Oscar Linebaugh, Jr., COE Fort Worth District

022462

LONGHORN ARMY AMMUNITION PLANT
Karnack, Texas
Group 5 - Site 63 - Former Burial Grounds
February 17, 1998 - 4:10 p.m.

Site 63 trenching activities. Trenching at former soil sample/boring location 63SB05/63SS05. Native soils found to approximately 8' below ground surface - no visible indication of former disposal activities. (Photograph taken by Chris Villarreal - EPA RPM).

022463

LONGHORN ARMY AMMUNITION PLANT
Karnack, Texas

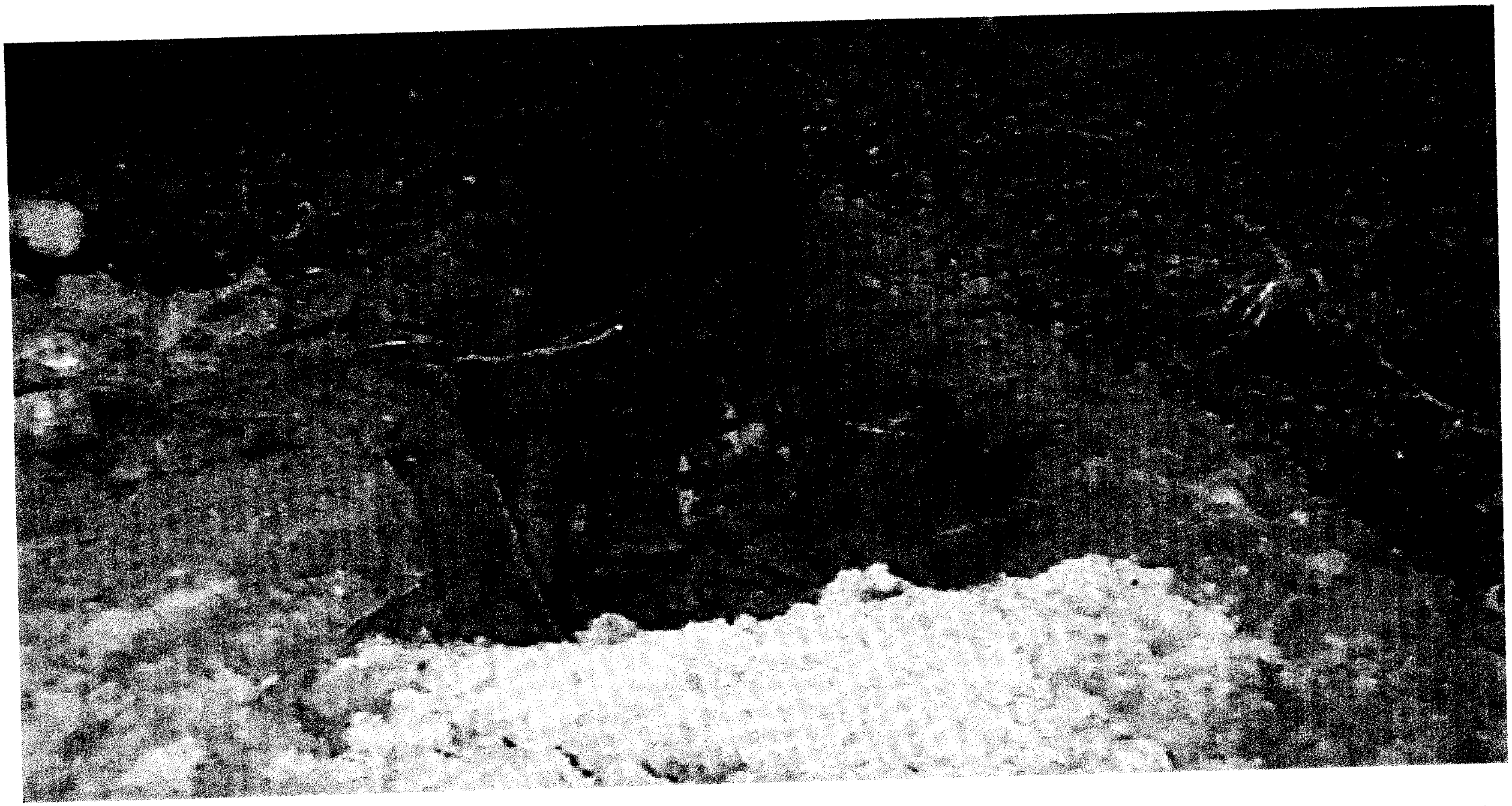
Group 5 - Site 63 - Former Burial Grounds
February 17, 1998 - 4:30 p.m.

Site 63 trenching activities. Trenching at former soil sample/boring location 63SB02/63SS02. Native soils found to approximately 8' below ground surface - no visible indication of former disposal activities. (Photograph taken by Chris Villarreal - EPA RPM).

022464

LONGHORN ARMY AMMUNITION PLANT
Karnack, Texas

Group 5 - Site 63 - Former Burial Grounds
February 17, 1998 - 4:30 p.m.

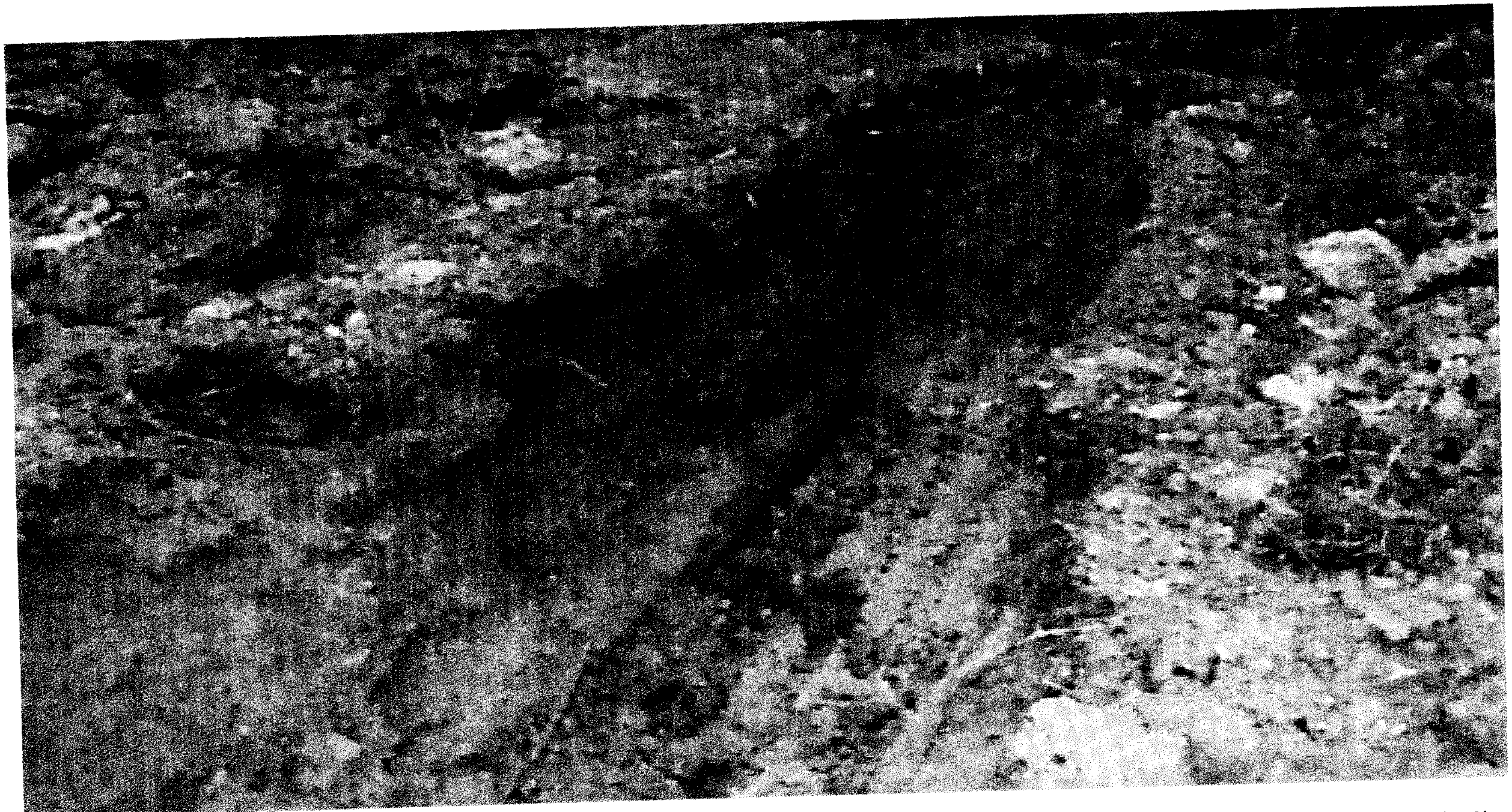


Site 63 trenching activities. Trenching at former soil sample/boring location 63SB02/63SS02. Native soils found to approximately 8' below ground surface - no visible indication of former disposal activities. (Photograph taken by Chris Villarreal - EPA RPM).

022465

LONGHORN ARMY AMMUNITION PLANT
Karnack, Texas

Group 5 - Site 63 - Former Burial Grounds
February 17, 1998 - 4:45 p.m.

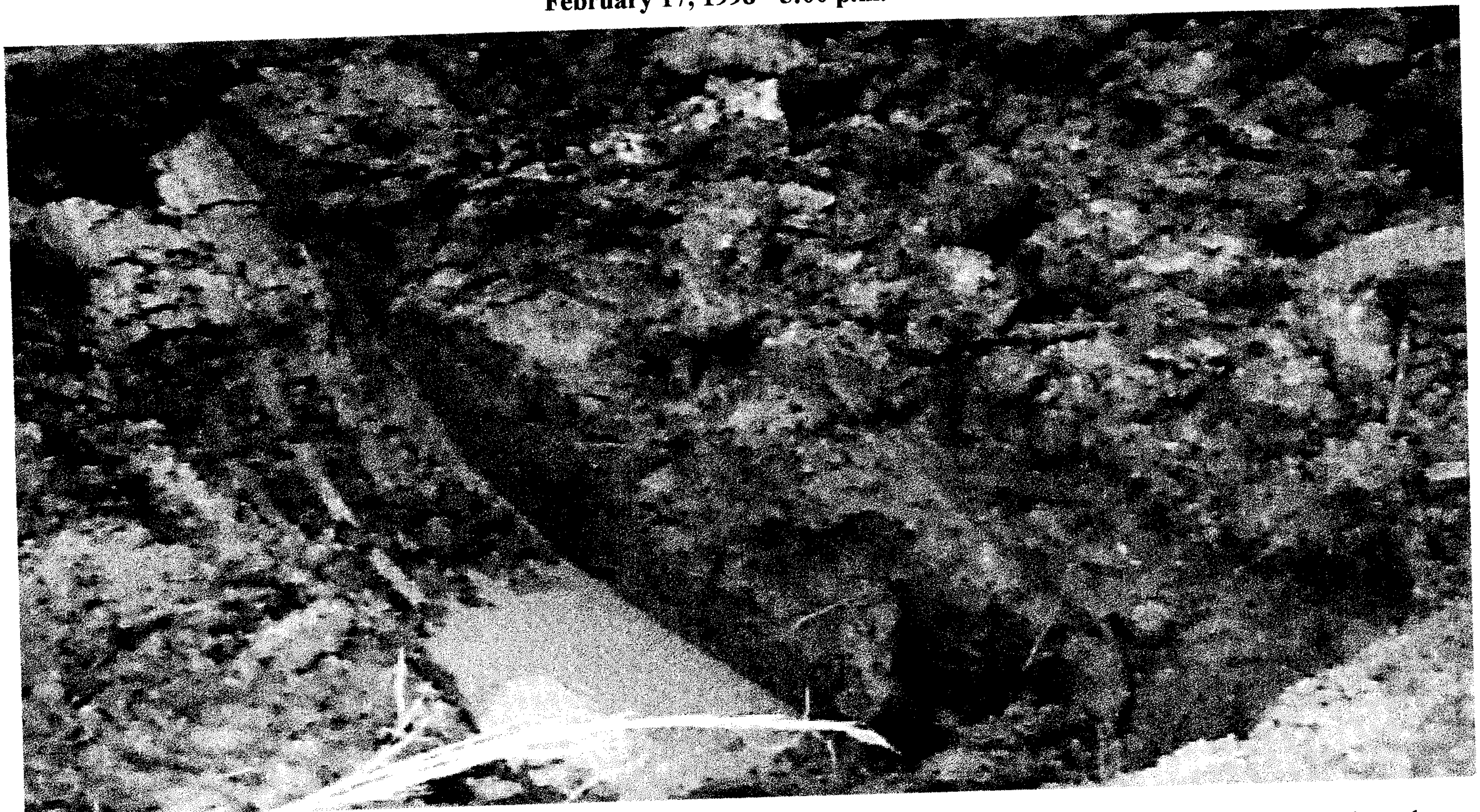


Site 63 trenching activities. Trenching at former soil sample/boring location 63SB04/63SS04. Native soils found to approximately 8' below ground surface - no visible indication of former disposal activities. (Photograph taken by Chris Villarreal - EPA RPM).

022466

LONGHORN ARMY AMMUNITION PLANT
Karnack, Texas

Group 5 - Site 63 - Former Burial Grounds
February 17, 1998 - 5:00 p.m.



Site 63 trenching activities. Trenching at former soil sample/boring location 63SB01/63SS01. Native soils found to approximately 8'2 below ground surface - no visible indication of former disposal activities. (Photograph taken by Chris Villarreal - EPA RPM).

022467

LONGHORN ARMY AMMUNITION PLANT
Karnack, Texas

Group 5 - Site 63 - Former Burial Grounds
February 17, 1998 - 5:00 p.m.

Site 63 trenching activities. Trenching at former soil sample/boring location 63SB01/63SS01. Native soils found to approximately 8' below ground surface - no visible indication of former disposal activities. (Photograph taken by Chris Villarreal - EPA RPM).

022468

022469

FACSIMILE TRANSMITTAL

U.S. EPA REGION 6
HAZARDOUS WASTE MANAGEMENT DIVISION
1445 ROSS AVENUE
DALLAS, TEXAS 75202-2733

TO: David Tolbert, U.S. Army	
MACHINE NUMBER: (318) 459-5112	VERIFICATION NUMBER: ( )
FROM: Chris G. Villarreal Project Manager	
PHONE: (214) 665-6758	MAIL CODE: 6SF-AP
OFFICE: Superfund, Texas Section	
DATE: May 12, 1998	PAGES, INCLUDING COVER SHEET: 4
PLEASE NUMBER ALL PAGES	
INFORMATION FOR SENDING FACSIMILE MESSAGES	
OUR EQUIPMENT	FACSIMILE NUMBER
PANAFAX UF-766	(214) 665-6660

COMMENTS:

Longhorn Army Ammunition Plant
Group 5 Final Site Characterization Investigation Report

EPA concurrence letter without enclosure.

If you have any questions or need additional information, please call.

Copies to: Oscar Linebaugh, Jr., COE Fort Worth District
Jonna Polk, COE Tulsa District
Diane Poteet, TNRCC (MC-143)

022470

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS, TX 75202-2733

May 11, 1998

VIA REGULAR MAIL AND FACSIMILE

Mr. James A. McPherson, Commander's Representative
Longhorn/Louisiana Army Ammunition Plant
Attn: SIOLH-CR
P.O. Box 658
Doyline, LA 71023

Re: Longhorn Army Ammunition Plant
Group 5 Final Site Characterization Investigation Report

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- At Site 52, acetone (15 μg/kg) was found in one of five surface soil samples. Subsurface soil samples contained two volatile organic compounds, p-isopropyltoluene (16 μg/kg) and acetone (20 μg/kg), and two semivolatile organic compounds, bis(2-ethyhexyl)phthalate (197 μg/kg to 878 μg/kg) and butyl benzyl phthalate (392 μg/kg). Acetone is a chemical used in laboratory procedures and its presence at the given concentrations (15 and 20 μg/kg) is reasonably considered attributable to laboratory contamination. The presence of bis(2-ethylhexyl)phthalate and butyl benzyl phthalate, which are commonly used plasticizers that can be found in laboratory equipment, coupled with the ranges of concentration detected, lead to the conclusion that their presence was attributable to laboratory contamination. No explosive compounds were detected in the surface or subsurface samples.

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If you have any questions, please contact Chris Villarreal at (214) 665-6758.

Sincerely,

WKHonker

William K. Honker, P.E.
Chief, AR/OK/TX Branch
Superfund Division

Enclosure

cc: Jonna Polk, COE Tulsa District
Diane Poteet, TNRCC (MC-143)
Oscar Linebaugh, Jr., COE Fort Worth District

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS, TX 75202-2733

022473

May 14, 1998

VIA REGULAR MAIL AND FACSIMILE

Mr. James A. McPherson, Commander's Representative
Longhorn/Louisiana Army Ammunition Plant
Attn: SIOLH-CR
P.O. Box 658
Doyline, LA 71023

Re: Longhorn Army Ammunition Plant (LHAAP)
Final Work Plan and Sampling and Analysis Plan
Group 2 Sites, Phase III Remedial Investigation/Feasibility Study

Dear Mr. McPherson:

The U.S. Environmental Protection Agency (EPA) has completed its review of the LHAAP *Final Work Plan (Part I) and Sampling and Analysis Plan (Part II) for the Group 2 Sites, Phase III Remedial Investigation/Feasibility Study* (Sverdrup, April 1998). Enclosed please find EPA's comments on these plans. If you have any questions, please contact me at (214) 665-6758.

Sincerely,

Chris G. Villarreal

Chris G. Villarreal
Remedial Project Manager
Superfund Division

Enclosure

cc: Oscar Linebaugh, Jr.
U.S. Army Corps of Engineers, Fort Worth District

Jonna Polk
U.S. Army Corps of Engineers, Tulsa District

Diane Poteet
Texas Natural Resource Conservation Commission (MC-143)

EPA's Comments on the Longhorn Army Ammunition Plant (LHAAP) Final Work Plan (Part I) and Sampling and Analysis Plan (Part II) Group 2 Sites, Phase III Remedial Investigation/Feasibility Study (April 1998)

FINAL WORK PLAN (PART 1) COMMENTS

1. **Section 3.1.1 SITE 12 - Active Landfill Sediment and Surface Water Sampling, page 3-2:**

Text states:
"Sediment samples will be collected from a depth interval of 0 - ½ ft and analyzed for VOCs, TAL Metals, and Explosives."

EPA Comment:
As was discussed and agreed to in the February 18, 1998 meeting and documented in the same meeting notes (copy enclosed), sediment sample locations 12SD16, 12SD17, and 12SD18 will also be tested for semivolatile organic compounds (SVOCs), pesticides, PCBs, and dioxin and furans. Text and Table 3-1 (SITE 12 - Sediment Samples) need to be revised to include the additional analytical parameters for the specified sampling locations.

2. **Section 3.1.3 SITE 12 - Groundwater Sampling, page 3-5:**

Text states:
"Groundwater samples will be analyzed for VOCs, TAL Metals, Explosives, Common Anions, and Nitrate/Nitrite; see Table 3-3 for specific analytical methods, . . ."

EPA Comment:
As was discussed and agreed to in the February 18, 1998 meeting and documented in the same meeting notes (copy enclosed), Site 12 monitoring wells 12MW01, 12MW05, and 12MW12 will also be tested for SVOCs, pesticides, PCBs, and dioxin and furans. Text and Table 3-3 (SITE 12 - Groundwater Samples) need to be revised to include additional analytical parameters for the specified monitoring well samples.

3. **Section 3.2.1 SITE 17 - Burning Ground No.2/Flash Area, Sediment and Surface Water Sampling, page 3-7:**

Text states:
"Sediment samples will be . . . analyzed for VOCs, TAL Metals, and Explosives; see Table 3-4 for specific analytical methods . . . Surface water samples will be . . . analyzed for VOCs. TAL Metals, Explosives, Common Anions, and Nitrate/Nitrite; see Table 3-5 for specific analytical methods . . ."

EPA Comment:
As was discussed and agreed to in the February 18, 1998 meeting and documented in the same meeting notes (copy enclosed), sediment samples 17SD10, 17SD11, and 17SD14 will also be analyzed for SVOCs, PCBs, pesticides, and dioxin and furans. Surface water samples 17SW10, 17SW11, and 17SW14 will also be analyzed for SVOCs, PCBs, pesticides, and dioxin and furans. Text and Tables 3-4 (Site 17 - Sediment Samples) and 3-5 (Site 17 - Surface Water Samples) need to be revised to include additional analytical parameters for the specified sampling locations.

4. **Section 3.2.2 SITE 17 - Burning Ground No. 2/Flash Area, Shallow Soil Samples, page 3-10:**

Text states:
"A total of twenty (20) depth discrete shallow soil samples will be collected from 10 locations (designated 17SS21 through 17SS30) at Site 17 . . ."

EPA Comment:
As was discussed and agreed to in the February 18, 1998 meeting and documented in the same meeting notes (copy enclosed), an additional surface soil sample location (17SS31) will be located in the area marked "burning pit" (located on the southernmost east/west line of the eastern half of Site 17). Text needs to be revised to include additional surface soil sample location (17SS31).

Text states:
"Shallow soil samples will be . . . analyzed for high explosives; see Table 3-6 for specific analytical methods . . ."

EPA Comment:
As was discussed and agreed to in the February 18, 1998 meeting and documented in the same meeting notes (copy enclosed), three surface soil samples 17SS22, 17SS26, and 17SS30 will be tested for the following additional parameters: SVOCs, PCBs, pesticides, and dioxins and furans.

Text and Table 3-6 (Site 17 - Shallow Soil Samples) need to be revised to include additional analytical parameters for the specified shallow soil sample locations.

5. **Section 3.2.4 SITE 17 - Burning Ground No. 2/Flash Area, Groundwater Sampling, page 3-12:**

Text states:
"Groundwater samples will be analyzed for VOCs, TAL Metals, Explosives, Common Anions, and Nitrate/Nitrite; see Table 3-7 for specific analytical methods . . ."

EPA Comment:
As was discussed and agreed to in the February 18, 1998 meeting and documented in the same meeting notes (copy enclosed), wells 17MW01, 17MW13, and 17MW130 will also be analyzed for SVOCs, PCBs, pesticides, and dioxin and furans. Text and Table 3-7 (SITE 17 - Groundwater Samples) need to be revised to include additional analytical parameters for the specified groundwater monitoring well samples.

6. **Section 3.3.1 SITE 29 - Former TNT Production Area, Sediment and Surface Water Sampling, page 3-15:**

Text states:
"Sediment samples will be . . . analyzed for VOCs, TAL Metals, and Explosives; see Table 3-8 for specific analytical methods . . ."

EPA Comment:
As was discussed and agreed to in the February 18, 1998 meeting and documented in the same meeting notes (copy enclosed), sediment samples from 29SD23, 29SD25, and 29SD28 will also be analyzed for SVOCs, PCBs, pesticides, and dioxins and furans. However, instead of 29SD25, use 29SD30 for the additional analysis. Text and Table 3-8 (SITE 29 - Sediment Samples) need to be revised to include additional analytical parameters for the specified sediment sample locations.

Text states:
"Surface water samples will be . . . analyzed for VOCs, TAL Metals, and Explosives, Common Anions, and Nitrate/Nitrite; see Table 3-9 for specific analytical methods . . ."

EPA Comment:
As was discussed and agreed to in the February 18, 1998 meeting and documented in the same

meeting notes (copy enclosed), surface water samples from 29SW23, 29SW25, and 29SW28 will also be analyzed for SVOCs, PCBs, pesticides, and dioxins and furans. However, instead of 29SW25, use 29SW30 for the additional analysis. Text and Table 3-9 (SITE 29 - Surface Water Samples) need to be revised to include additional analytical parameters for the specified surface water sample locations.

7. **Section 3.3.2 SITE 29 - Former TNT Production Area, Shallow Soil Sampling, page 3-18:**

Text states:
"A total of five (5) shallow soil samples (designated 29SS01 through 29SS05) will be collected at Site 29 . . ."

EPA Comment:
As was discussed and agreed to in the February 18, 1998 meeting and documented in the same meeting notes (copy enclosed), for the risk assessment, soil samples – grid each area and select random sample locations. For this 85 acre site, add three additional soil sampling sites in the process area on the southern part of Site 29 and in the toluene storage area(s) at Site 29.

At the meeting, there was also discussions regarding the sumps and drains found in Sites 29 and 32. Specifically about sampling the contents and surrounds of the sumps and drains much like the RCRA sumps' closure/removal action and Group 4 sumps removal action. The potential use of field kits for HE was also discussed and COE representatives indicated that this would be looked into. What is the status of these items?

8. **Section 3.3.5 SITE 29 - Former TNT Production Area, Groundwater Sampling, page 3-24:**

Text states:
"Groundwater samples will be analyzed for VOCs, TAL Metals, Explosives, Common Anions, and Nitrate/Nitrite; see Table 3-12 for specific analytical methods . . ."

EPA Comment:
As was discussed and agreed to in the February 18, 1998 meeting and documented in the same meeting notes (copy enclosed), monitoring wells 29WW03, 29WW05 and the new shallow monitoring well in VOC area will also be tested for SVOCs, PCBs, pesticides, dioxins and furans. Text and Table 3-12 (SITE 29 - Groundwater Samples) need to be revised to include the additional analytical parameters for the specified sample locations.

9. **Section 4.4.4 Groundwater Sampling, page 4-20:**

Text states:
"Groundwater samples are to be analyzed for VOCs, high explosives, metals, and anions."

EPA Comment:
Revised text to include the following additional analytical parameters: SVOCs, pesticides, PCBs, dioxins and furans, and Nitrate/Nitrite.

SAMPLING AND ANALYSIS PLAN (PART II) COMMENTS

10. **Section 1.2 Report Organization, page 1-2:**

Typo Section ~~10.0~~ 9.0 presents references.

11. **Section 3.0 - Field Operations, pages 3-1 :**

Text states:
"To further investigate potential contamination with volatile organic compounds (VOCs), high explosives, and metals, the Phase III RI/FS includes the following:"

EPA Comment:
Revised text to include the following additional analytical parameters: SVOCs, pesticides, PCBs, and dioxins and furans.

Text states:

"Site 17
Collection of 20 surface soil samples."

EPA Comment:
As discussed in comment #4, an additional surface soil sample location (117SS31) to be located in the area marked "burning pit" (located on the southernmost east/west line of the eastern half of Site 17) is required. Revise text to include reflect additional sampling location (i.e., Collection of 22 surface soil samples).

12. Section 3.0 Field Operations, pages 3-2 :

Text states:
"Site 29
Collection of five surface soil samples."

EPA Comment:
As discussed in comment #7, three additional soil sampling sites in the process area on the southern part of Site 29 and in the toluene storage area(s) at Site 29. Revise text to include additional samples.

13. Section 3.1 Collection of Sediment and Surface Water Samples, page 3-2:

Text states:
"These samples will be analyzed for VOCs, high explosives, and TAL metals."

EPA Comment:
Revised text to include the following additional analytical parameters: SVOCs, pesticides, PCBs, dioxins and furans, and Nitrate/Nitrite.

14. Section 3.2 Collection of Groundwater Samples, page 3-3:

Text states:
"Twenty shallow soil samples will be collected from 10 locations at Site 17 . . ."

EPA Comment:
Revised text to read, "Twenty-two shallow soil samples will be collected from 11 locations at Site 17 . . ."

Text states:
"Five Shallow Soil samples will be collected at Site 29 . . ."

EPA Comment:
Revise text to read, "Eight Shallow Soil Samples will be collected at Site 29 . . ."

15. Section 3.3 Collection of Groundwater Samples, page 3-3:

Text states:
"All groundwater samples will be analyzed for VOCs, high explosives, TAL Metals and anions."

EPA Comment:
Text needs to be revised to reflect that specified groundwater samples will also be analyzed for SVOCs, PCBs, pesticides, dioxin and furans, and Nitrate/Nitrite.

022478

Monthly Managers' Meeting
Longhorn Army Ammunition Plant
18 February 1998

1. The participants were:

James McPherson, LHAAP
Ira Nathan, LHAAP
David Tolbert, LHAAP
Cyril Onewokae, IOC
Jeff Armstrong, AEC
Chris Villarreal, EPA
Diane Poteet, TNRCC
H. L. "Bud" Jones, TNRCC
Ruth Culver, Uncertain Audubon
Wilma Subra, Uncertain Audubon
Bryan Smith, Radian
Glen Turney, OHM
Lou Martino, Argonne Nat'l Laboratory
Mark Zappi, Mississippi State University
Bob Norris, Eckenfelder
Cliff Murray, Tulsa District
Steve Nolen, Tulsa District
Yolane Hartsfield, Tulsa District

2. James McPherson opened the meeting, thanked all the participants for attending.

3. The previous month's minutes were reviewed and approved. Yolane Hartsfield reviewed the executive summary.

4. The Group 1 "No Further Action" ROD has been fully executed and returned to LHAAP for inclusion in the Administrative Record. Group 1 will be dropped from the Executive Summary Sheets effective 1 March 1998.

5. Group 5. On 17 February 1998 the Team with technical support from Radian International and Sverdrup Environmental made a site visit to Site 63. Five trenches were dug at locations selected by Chris Villarreal to depths ranging from 6' to about 9'. There was no observable indication of discoloration, ash layer, or debris. The trench sites were selected based upon aerial photography and were located on both sides of the road that intersects Site 63. The Team present included David Tolbert, Cyril Onewokae, Chris Villarreal, Diane Poteet, Wilma Subra, Steve Nolen, Cliff Murray, David Bockelmann, and Yolane Hartsfield. Mr. Villarreal agreed to provide written comments based upon the site visit to which LHAAP will respond with a letter to the regulators requesting permission to close Sites 52 and 63 at the end of the Site Investigation Phase which has been completed.

6. Group 2 RI/FS Work Plans are under review (includes Work Plan for Risk Assessment) and revision. Sverdrup has geoprobe and surface resistivity lines being conducted at Site 29. Mr. Jones asked about the status of the detailed topographic map of Group 2 sites to assist in selecting sample locations. Mr. Murray is to check on obtaining (is not already in hand) the most recent aerial photography of the facility. Ruth Culver suggested also checking with staff at TNRCC who are involved with the Clean Rivers Act (under the auspices of which this area has recently been reflown), and the Surface Waters' Protection Act for aerial photography of this area. Mr. Jones expressed his desire not to overkill the issue but wanted to underscore how important this tool could be. Mr. McPherson asked Mr. Jones for his assistant is completion of

this map and evaluation of same. Ms. Poteet agreed to see about the TNRCC mapping availability.

7. Mr. Bockelmann reported that he had spent much time in the previous 2 weeks walking the Group 2 Sites.

8. Group 4 work plan documentation is still being developed and assembled. Submittal for review and comment is expected in early Spring 98.

9. Burning Grounds No. 3. The Groundwater Treatment Plant is operating and with the completion of the ICT system a 24-hour Proof of Performance (POPs) test for air emissions only is scheduled for the third week in March. Regulators requested a copy of the POPs test Plan be submitted for EPA and TNRCC's air, et al, people to review and approved prior to the test. Radian to provide through COE to LHAAP to EPA and TNRCC. Ms. Subra asked for a copy of the analytes in the POPs test protocol. Radian to provide.

10. The wells in the ICT system are continuing to be brought on line. The second biotoxicity test was collected on 17 February 1998. The test takes 7 days.

11. Mr. Tolbert reported that on 2 February 1998 water from LF16 extraction well EW01 reflected ultra trace concentrations of dioxins (in the 10E-12). The well was resampled and the outfall from the GWTP was sampled and analyzed for dioxins and furans. The method blank associated with the resamples reported the same concentration of dioxins/furans as the field samples, again in ultra trace concentrations. The resamples were evaluated and determined that no dioxins were present, that the concentrations reported were due to laboratory contamination. However, future samples will be sent to another analytical laboratory. TNRCC requested we resample at the outfall and reanalyze. Mr. McPherson agreed.

12. Mr. Turney reported that at Landfill 16 the subgrade layer is 61% completed. LHAAP staff is working with OHM to locate useable topsoil on-site. Mr. Villarreal noted that he had seen some erosion of the cap at Landfill 12 due to weather. OHM plans to repair this Spring when they vegetate the cap with spring and summer grasses. Some potential topsoil locations were then discussed. If on-site topsoil can be located and subsequently used, a cost savings of $90,000 could be realized.

13. Mr. Jones noted that the Sverdrup map reflected a direct linear relationship between Landfill 16 and the seep at Harrison Bayou. He thought the transport mechanism could be a Paleo-pointbar deposit (water sand) which is controlling the movement of TCE downgradient of the Landfill. Mr. Jones proposed that we at least look and see if we can locate sources in the Landfill before the capping is complete to evaluate possible source removal or pump and treat. He felt that bioremediation would not be an effective tool in the in-situ Wilcox soils though somewhat effective in disturbed soils. Mr. Turney noted that OHM had looked at the cost/benefit ratio with respect to source removal previously, and noted that LHAAP records of what was disposed in the Landfill are "just not there." Mr. McPherson noted that the Team recognized that the landfill cap and pump and treat system is not the final solution. Mr. McPherson stated that

now is the time, and that we do need to go back and reassess where we are on capping the landfill as well as impacts to the IRA schedule/budget if we stopped now to investigate.

14. Mr. Jones suggested that if there are no records, or if the records do not show the information we need, we drill 2 or 3 test wells inside the Landfill footprint. Mr. Bockelmann noted that in the plume emanating from the landfill they have seen 30,000 ppm at 30 feet depth. Mr. Armstrong asked if we know where the greatest source in the landfill resides. Further is queried if the RI/FS effort underway will address these questions and issues. Mr. Onewokae noted that Sverdrup has some qualitative data from the Phase 1 and 2 RI/FS efforts. Mr. McPherson said he wanted this as the top item on our priority list, work this issue next. OHM stated their plans are to begin placing the liner by the end of April. Mr. McPherson said he wanted Mr. Armstrong to be a part of this issue resolution. Ms. Poteet stated that a cross section of needs to be prepared very quickly.

15. Mr. McPherson tasked Mr. Tolbert to have a meeting on Monday, February 23, with Mr. Jones and Mr. Bockelmann . (Note: The meeting was held on 23 February. The outcome was the following. Using OHM's grid of the east half of Landfill 16, geoprobe 44 primary locations with an additional 16 points to be drilled based on the results from the initial 44 points. The probe would be pushed to 15 feet then pulled back to 10 feet. The 5 foot interval's head space would be the sample. The head-space sample would be tested in the field for volatile organic compounds.)

16. Mr. Bockelmann revisited the dioxin issue. He will revisit the data considering TNRCC request to resample outfall and Ms. Subra's request to resample the wells. He noted that EW01 reported TCDD concentration was 0.12 picograms/liter and the duplicate was 0.14 picograms/liter. The EPA soil standard is 1 ppb. He noted that wells 16 and 30 have historically reflected the highest VOC concentrations and showed some dioxin/furans present--but not TCDD. There was discussion about sampling soils and sediments at surface seeps close in to the landfill footprint.

17. Mr. Nathan noted that the DERA Sumps Closure Report has had no change in status. THE TNRCC has the document under review for approval.

18. Mr. Armstrong passed out copies of the new DoD Technical Assistance for Public Participation (TAPP) Program.

19. The next meeting is the TRC. It will be at the INF Trailer on 10 March at 1000. Ms. Subra requested that time be set aside to enable the Team to visit the Group 4 Sites.

20. Mr. Bockelmann then presented Sverdrup's conceptual plan for a bioremediation of groundwater downgradient of Landfill 16 (See Handout in file).

21. Mr. Tolbert and Ms. Hartsfield led the discussion on reviewing for comment the Group 2 RI/FS Work Plans.

a). Site 12. Mr. Nolen said that as a result of his visit to the Site, he had concluded that the area referenced in the Risk Assessment Work Plans as a "wetlands" was indeed a wetland area, but that it was not special in that it was the same as the several other wetland areas along the Bayou. At Site 12 monitoring wells MW01, MW05, and MW12 will be tested for semivolatile organic compounds (SVOCs), pesticides, PCBs, and dioxins and furans. No soils will be tested per EPA. Surface water and sediments--we will use historical data for subsurface as needed, since Landfill 12 is capped. Sediment sample locations SD16, SD17, and SD18 will be tested for volatile organic compounds (VOCs), SVOCs, high explosives (HE), TAL metals, pesticides, PCBs, and dioxins and furans.

b). Site 16. The risk will be assessed as if there were no IRA in place. Monitoring wells MW16 and MW36, along with EW01, will be sampled for SVOCs in April 1998.

c). Site 17. The shallow monitoring well, MW13, will be moved from NW corner to middle of E/2 of Site. Proposed--twenty surface soil (SS) samples are proposed (0-6"), subsurface (2.5'-3') to be analyzed for HE only. It was noted that SB01 (soil boring number 1) located in the center of the east side has historical evidence of SVOCs. An additional surface soil sample location (SS31) will be located in the area marked "burning pit" (located on the southernmost east/west line of the E/2 of the Site). Sample location SS26 will be shifted to the north to cover SVOCs found in SBO1, and SS30 will be shifted a little north of its current proposed location. Three surface soil samples SS22, SS26, and SS30 will be tested for the following additional parameters: SVOCS, PCBs, pesticides, and dioxins and furans. Surface water and sediments--additional parameters SVOCs, PCBs, pesticides, and dioxins and furans SD10, SD11, and SD14. It was agreed to move SD14 closer to SD07 (between SD02 and SD07). It was agreed to move SD12 to on-site ditch mid-point on west side in ditch area.
Groundwater--MW01, MW13, and MW130 will add SVOCs, PCBs, pesticides, and dioxins and furans to analysis protocol. It was agreed to move MW07 and MW08 east to south of burning pit area on outside of Site footprint.
EPA and TNRCC agreed to have their risk assessors revisit the issue of sample depth intervals for all soil samples. In addition they are reviewing our proposal to composite soils taken from the subsurface intervals (i.e. if the augered depth is to 3', then composite the soil sample from 0.5' through 3').

d). Sites 18, 24, and 32. Tabled until information about kits is obtained and map with surface structures is provided.

e) Site 29. On as-built drawings structures were found on south side south of SD04. North of MW115 and south of SD07 geoprobe investigation has found HE and VOCs. It was reported that about 25% of the geoprobes have been "dry holes." Have geoprobed both end and moved geoprobe to inside cells.

d). Ms. Hartsfield agreed after discussion to research the cost of field kits for HE.

e). Site 29 and 32. Located sumps and drains. There was discussion about sampling the contents and surrounds much like the RCRA sumps' closure/removal action and Group 4 sumps removal action. For the risk assessment, soil samples--grid each area and select random sample locations. Add additional 3 sites in the process area on South side of Site 29 and in the toluene storage area(s) at Site 29. Using Sverdrup Figure 3-6 for Site 29, move locations SW/SD23, 25, and 28 to souther part of Site along 18th Street. Also use these locations for risk assessment's additional parameter list (SVOCs, PCBs, pesticides, and dioxins and furans). Groundwater--MW03, MW05, and new shallow monitoring well in VOC area will be tested for the additional parameters (SVOCs, PCBs, pesticides, dioxins and furans). Soil sampling was tabled.

f). Background for streams and bayous--**Parameter list for surface water includes TCL organics, dioxins and furans, TAL metals, anions (chlorides, sulfate, nitrites/nitrates); sediments include Total Organic Carbon, TCL organics, dioxins and furans, grain size, and metals.** Goose Prairie Creek will acquire a new sampling station near Site 32. Samples will be collected from surface waters during both wet and dry seasons. It was proposed to collect 4 wet samples and 4 dry samples per stream for a total of 8 samples/stream (sediments will be collected during dry events because they will be less disturbed due to the absence of turbulent water flow creating suspended solids from the sediment materials). Saunders Branch and Harrison Bayou may be combined and treated as a single unit due to their "common" drainage area(s) and geology if Mr. Murray confirms that the combining is appropriate. Additional analytical parameters may be added.

g). For risk assessment purposes the Bayous associated with LHAAP and Caddo Lake will be modeled for fate and transport/future use scenarios. Mr. Nolen briefed the team on the discussion of modeling Caddo Lake he had with USACHPPM. Mr. Nolen asked EPA and TNRCC to provide the Team information about what models they use for similar projects. He suggested modeling that would involve groundwater to surface water, then surface water to the Lake, then the Lake proper. There was discussion about modeling site by site, then all the sites combined with a focus on future impacts to aquatic ecosystems.

22. There being no further business, the meeting was adjourned.

Yolane Hartsfield
Project Manager

022431

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

May 21, 1998

James A. McPherson, Commander's Representative
Longhorn/Louisiana Army Ammunition Plant
Attn: SIOLH-CR
P.O. Box 658
Doyline, LA 71023

CERTIFIED MAIL Z 746 032 986
RETURN RECEIPT REQUESTED

Re: Longhorn Army Ammunition Plant
Group 5 - Final Site Characterization Report

Dear Mr. McPherson:

The Texas Natural Resource Conservation Commission (TNRCC) staff completed its review of the document referenced above, which was received on June 2, 1997, and provided comments on this document on July 14, 1997. On February 17, 1998, the Army continued their investigation of Site 63 by trenching in suspected areas as requested by U.S. Environmental Protection Agency (EPA). After this investigation, the EPA stated their conclusions regarding the Group 5 Sites in a letter dated May 11, 1998, which we received on May 12, 1998. The TNRCC was present during the trenching activities at Site 63 and we have reviewed the EPA's May 1998 letter. Both the EPA and the Army agreed that no further action was necessary for Sites 52 and 63, and that investigations should continue for Sites 50 and 60. The TNRCC concurs with the EPA's and the Army's conclusions. If you have any further questions regarding this matter, please call me at (512) 239-2502.

Sincerely,

Diane R. Poteet

Diane R. Poteet, Project Manager
Superfund Cleanup Section
Remediation Division

DRP/mmw

Enclosure

cc: Chris Villarreal, EPA Region 6 (6SF-AP)
Jonna Polk, COE Tulsa District (CESWT-PP-EA)
Oscar Linebaugh, COE Eastern Area Office (CESWF-AD-E)

022482

LONGHORN ARMY AMMUNITION PLANT
IRP STATUS SUMMARY

As Of 5 May 1998

PROJECT NAME	PROJECT PHASE	PROJECT STATUS	NEXT MAJOR MILESTONE(S)
Group # 2 (Sites 12, 17, 18, 24, 29, and 32)	Remedial Investigation/ Feasibility Study	Final Phase III RI Work Plans and Addendum was distributed week of 20 April. Comments received on Risk Assessment Work Plan. Work Plan is being finalized.	Field work scheduled to be complete in July 1998.
Group # 4 Wastewater Sumps and Sites 50 & 60	Remedial Investigation/ Feasibility Study	Draft Phase III RI Work Plans reviewed by COE, and comments provided to Sverdrup.	Draft Final Work Plan to be submitted for team review on 15 May 1998. Field work scheduled for Spring/Summer 1998.
Group # 5 (Sites 52 and 63)	Site Investigation	Received Final Site Characterization Report, and circulated to team. Recommendation for Sites 52 and 63 is no further action. Trenches were dug at Site 63 on 18 February 1998.	Awaiting regulator concurrence on recommendations.
Burning Ground #3 (Sites 18 and 24)	Interim Remedial Action	-POPs test successfully completed and passed 25 March 1998. -GWTP operations began first week of April 1998.	-Contract modification award by 7 May. - Additional proof of performance for mechanical system on GWTP to be scheduled after rainfall.
Landfill Caps (Sites 12 and 16)	Interim Remedial Action	-Site 16 Landfill clay cover nearly complete. Liner has been received, and placement of the liner will begin in mid-May.	- Aerial photographs have been ordered as discussed in 23 April meeting. Photographs will be reviewed week of 4 May. Borings at landfill scheduled for week of 11 May - Capping of Landfill 16 scheduled to be completed November 1998.
Landfill Site 16 Accelerated RI	RI/FS	-Second quarter sampling completed for Harrison Bayou, Goose Prairie Creek, and perimeter wells. Analytical results have been received and validated. -Proposed Bioremediation study being evaluated.	-Third sampling round of selected wells to be conducted mid-May 1998.

022483

LONGHORN ARMY AMMUNITION PLANT
IRP STATUS SUMMARY

As Of 5 May 1998

SCHEDULED MEETINGS AND VISITS TO LHAAP		
Date / Time	**Purpose of Meeting / Visit**	**Location**
19 April 1998/0800	Monthly Managers Meeting	Telecon
11 June 1998/0900	Technical Review Committee Meeting	LHAAP

01	Inert Burning Grounds	24	Washout &Unlined Evaporation Pond	60	Former Storage Bldg. 411 & 714
11	Suspected TNT Burial Grounds at Ave P&Q	27	South Test Area	XX(54)	Ground Signal Test Area
12	Landfill 12	29	Former TNT Production Area	52	Magazine Area
16	Landfill 16	32	Former TNT Disposal Area	63	Burial Pits
17	Burning Ground 2/Flashing Area	35	Process Wastewater Sumps		
18	Burning Ground 3	50	Former Waste Disposal Facility		

022434

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

CERTIFIED MAIL
Z 746 032 645
RETURN RECEIPT REQUESTED

May 20,1998

James A. McPherson, Commander's Representative
Longhorn/Louisiana Army Ammunition Plant
Attn: SIOLH-CR
P.O. Box 658
Doyline, LA 71023

Re: **Longhorn Army Ammunition Plant**
Group 2 - Final Work Plan for Phase III Remedial Investigation/Feasibility Study

Dear Mr. McPherson:

The Texas Natural Resource Conservation Commission (TNRCC) staff has completed its review of the above referenced document, which we received on April 22, 1998. Our comments are enclosed. If you have any questions regarding this matter, please call me at (512) 239-2502.

Sincerely,

Diane R. Poteet

Diane R. Poteet, Project Manager (MC-143)
Superfund Cleanup Section
Remediation Division

Enclosure

cc: Chris Villarreal, EPA Region 6 (6SF-AP)
Jonna Polk, COE Tulsa District (CESWT-PP-EA)
Oscar Linebaugh, COE Eastern Area Office (CESWF-AD-E)

022485

Longhorn Army Ammunition Plant
Final Work Plan for the Group 2 Sites, Phase III Remedial Investigation/Feasibility Study
TNRCC Comments

No.	Section/Page	Comment
1	1.1 Purpose/page 1-2	It is stated that the site specific DQO's identified involve delineating the extent of groundwater contamination for Sites 12, 17, and 29, defining the extent of impacted area for Site 12, and defining the area of apparent incinerated explosive ash for Site 17. How will the Army determine when they have met their objectives? What will be the concentration limits for determining when the boundaries of the ground water plumes are delineated, or the edges of the impacted area are defined or the edges of the area of apparent incinerated explosive ash are defined?
2	Figure 1.1/page 1-6	Yolane Hartsfield is listed as the USACE Project Manager.
3	Figures 2-3, and 3-1, 3-3, and 3-6	According to my notes, during the February 2, 1998 meeting, it was discussed that these figures were lacking in detail because the sediment and surface water samples appear to be floating in space and that better figures would be supplied. For example, Figure 2-4 has an improved map compared to Figure 3-3 for Site 17. Please replaced them.
4	Sections 3.1.1, 3.2.1, and 3.3.1 Sediment and Surface Water Sampling/pages 3-2, 3-7, and 3-15	Sediment samples should be collected at depths between 0 to 6 inches and 6 to 12 inches as appropriate depending on the depth of the biotic zone, sedimentation rates, and location of sample (lake vs. bayou).
5	3.2.2 Shallow Soil Samples/page 3-10	It is stated that shallow soil samples will be collected from depth intervals of 0 to 0.5 feet and 2.5 to 3.0 feet. For risk assessment purposes, 3.0 to 5.0 feet should also be sampled for the short term construction workers in an industrial scenario or residential scenario.
6	4.9 Investigation Derived Waste/page 4-23	SVERDRUP's comprehensive Investigative Derived Waste (IDW) Management Plan (1996) is stated as being developed as a separate document from the work plan and that Radian will be responsible for segregating and disposing of the waste. This implies that Radian will be using SVERDRUP's IDW plan. Because TNRCC and the Army have had several discussions regarding IDW plans for the work that Radian will be doing, it should be stated that there is another plan. Also, all IDW plans should be incorporated into or appended to this work plan to make it complete.