LONGHORN ARMY AMMUNITION PLANT

KARNACK, TEXAS

ADMINISTRATIVE RECORD

VOLUME 3 of 5

1996

Bate Stamp Numbers
017851 - 018014

Prepared for:

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

1996

VOLUME 3 of 5

1996

A. Title: Memorandum - Subject: Review of the Draft Final Remedial Investigation (RI) Report for Group 1 Sites, Longhorn Army Ammunition Plant, Karnack, Texas, April 1996
Group(s): 1
Site(s): 1, 11, XX, 27
Location: Longhorn Army Ammunition Plant
Agency: Department of The Army, U.S. Army Center for Health Promotion & Preventive Medicine
Author(s): Arthur P. Lee, P.E., MAJ, MS, Program Mgr., Environmental Health Risk Assessment & Risk Communication
Recipient: District Engineer, U.S. Army Engineering District, Tulsa, ATTN: CESWT-PP-EA/Ms. Jonna Polk
Date: May 28, 1996
Bate Stamp: 017851

B. Title: Memorandum - Subject: Review of the Draft Final Work Plans, Interim Remedial Action - Landfills 12 & 16 Caps, Longhorn Army Ammunition Plant, Karnack, Texas, 30 April 1996
Group(s): 2
Site(s): 12 & 16 (Landfills)
Location: Longhorn Army Ammunition Plant
Agency: Department of The Army, U.S. Army Center for Health Promotion & Preventive Medicine
Author(s): Arthur P. Lee, P.E., MAJ, MS, Program Mgr., Environmental Health Risk Assessment and Risk Communication
Recipient: District Engineer, U.S. Army Engineering District, Tulsa, ATTN: CESWT-PP-EA/Ms. Jonna Polk
Date: May 28, 1996
Bate Stamp: 017852

C. Title: Memorandum - Subject: Review of the Draft Field Summary Report for Phase 2 Group 2 Sites (12, 16, 17, 18/24, 29, and 32) Remedial Investigation, Longhorn Army Ammunition Plant, Karnack, Texas, May 1996
Group(s): 2
Site(s): 12, 16, 17, 18/24, 29 and 32 (Remedial Investigation/Feasibility Study)
Location: Longhorn Army Ammunition Plant
Agency: Department of The Army, U. S. Army Center for Health Promotion and Preventive Medicine
Author(s): Arthur P. Lee, P.E., MAJ, MS, Program Mgr., Environmental Health Risk Assessment and Risk Communication
Recipient: District Engineer, U. S. Army Engineering District, Tulsa, ATTN: CESWT-PP-EA/Ms. Jonna Polk
Date: June 4, 1996
Bate Stamp: 017853

D. Title: Minutes - Subject: TRC Meeting
Group(s): All
Site(s): All
Location: Longhorn Army Ammunition Plant

Date: June 4, 1996
Bate Stamp: 017854-017855

E. Title: Report - Subject: Final Project Work Plans, Appendix G - Project Specifications, Appendix H - Construction Drawings, Interim Remedial Action, Landfills 12 & 16 Caps
Group(s): 2
Site(s): Landfills 12 & 16
Location: Longhorn Army Ammunition Plant
Agency: OHM Remediation Services Corp.
Author(s): OHM
Recipient: U. S. Army Corps of Engineers
Date: June 6, 1996
Bate Stamp: 017856-017907

F. Title: Letter - Subject: Longhorn Army Ammunition Plant, Group 2 - Time Critical Action at Landfill Site 16 - Draft Design Analysis Report and May 29, 1996 Meeting Handouts - TNRCC Comments (w/enclosure)
Group(s): 2
Site(s): Landfill Site 16
Location: Longhorn Army Ammunition Plant
Agency: Texas Natural Resource Conservation Commission
Author(s): Ms. Diane R. Poteet, Project Mgr., RI/FS II Unit, Superfund Investigation Section, Pollution Cleanup Division
Recipient: Mr. James A. McPherson, Commander's Representative
Date: June 6, 1996
Bate Stamp: 017908-017909

G. Title: Letter - Subject: Final Project Work Plans, Interim Remedial Action, Landfills 12 & 16 Caps, Appendix G - Project Specifications, Appendix H - Construction Drawings (w/enclosure)
Group(s): 2
Site(s): Landfills 12 & 16 Caps
Location: Longhorn Army Ammunition Plant
Agency: Department of The Army, Marshall, TX
Author(s): Mr. James McPherson, Commander's Representative
Recipient: Mr. H. L. Jones, Texas Natural Resource Conservation Commission
Date: June 10, 1996
Bate Stamp: 017910

H. Title: Letter - Subject: Final Project Work Plans, Interim Remedial Action, Landfills 12 & 16 Caps, Appendix G - Project Specifications, Appendix H - Construction Drawings (w/enclosure)
Group(s): 2
Site(s): Landfills 12 & 16 Caps
Location: Longhorn Army Ammunition Plant
Agency: Department of The Army, Marshall, TX
Author(s): Mr. James McPherson, Commander's Representative
Recipient: Mr. Chris Villarreal, U. S. Environmental Protection Agency
Date: June 10, 1996
Bate Stamp: 017911

I. Title: Letter - Subject: Final Project Work Plans, Interim Remedial Action, Landfills 12 & 16 Caps, Appendix G - Project Specifications, Appendix H - Construction Drawings (w/enclosure)
Group(s): 2
Site(s): Landfills 12 & 16 Caps
Location: Longhorn Army Ammunition Plant
Agency: Department of The Army, Marshall, TX
Author(s): Mr. James McPherson, Commander's Representative
Recipient: Ms. Diane Poteet, Texas Natural Resource Conservation Commission
Date: June 10, 1996
Bate Stamp: 017912

J. Title: Letter - Subject: Group IV Sumps Groundwater Monitoring Quarterly Report
Group(s): 4
Site(s): 35 (Wastewater Sumps)
Location: Longhorn Army Ammunition Plant
Agency: Department of The Army, Marshall, TX
Author(s): Mr. James McPherson, Commander's Representative
Recipient: Mr. Chris Villarreal, Superfund Division, U.S. Environmental Protection Agency
Date: June 13, 1996
Bate Stamp: 017913

K. Title: Letter - Subject: Group IV Sumps Groundwater Monitoring Quarterly Report
Group(s): 4
Site(s): 35 (Wastewater Sumps)
Location: Longhorn Army Ammunition Plant
Agency: Department of The Army, Marshall, TX
Author(s): Mr. James McPherson, Commander's Representative
Recipient: Mr. H. L. Jones, Texas Natural Resource Conservation Commission
Date: June 13, 1996
Bate Stamp: 017914

L. Title: Letter - Subject: Group IV Sumps Groundwater Monitoring Quarterly Report
Group(s): 4
Site(s): 35 (Wastewater Sumps)
Location: Longhorn Army Ammunition Plant
Agency: Department of The Army, Marshall, TX
Author(s): Mr. James McPherson, Commander's Representative
Recipient: Ms. Diane Poteet, Superfund Investigation Section, Texas Natural Resource Conservation Commission
Date: June 13, 1996
Bate Stamp: 017915

M. Title: Report - Subject: Group IV Sumps, Groundwater Monitoring Quarterly Report, February 1996 Sampling Round
Group(s): 4
Site(s): 35 (Wastewater Sumps)
Location: Longhorn Army Ammunition Plant
Agency: U.S. Army Corps of Engineers
Author(s): U.S. Army Corps of Engineers
Date: June 1996
Bate Stamp: 017916-017981

N. Title: Letter - Subject: Longhorn Army Ammunition Plant, Final DERPMIS/RMIS Resolution Document
Location: Longhorn Army Ammunition Plant
Agency: Texas Natural Resource Conservation Commission
Author(s): Ms. Diane R. Poteet, Project Mgr., RI/FS II Unit, Superfund Investigation Section, Pollution Cleanup Division
Recipient: Mr. James A. McPherson, Commander's Representative
Date: June 25, 1996
Bate Stamp: 017982

O. Title: Memorandum - Subject: Water Supply for Installation Restoration Program (IRP) Effort at Longhorn Army Ammunition Plant (AAP
Site(s): Installation Restoration Program
Location: Longhorn Army Ammunition Plant
Agency: Department of The Army
Author(s): Mr. Robert J. Radkiewicz, DCS for Environmental Management
Recipient: Commander's Representative, Longhorn Army Ammunition Plant, ATTN: SIOLH-OR (Mr. David Tolbert/Mr. James McPherson)
Date: June 27, 1996
Bate Stamp: 017983-017985

P. Title: Letter - Subject: Agency Consent to Burning Ground #3 Work Plan Amendments and Landfill-16 TCRA Design Issues
Group(s): 2, 3
Site(s): Burning Ground #3 and Landfill 16 (Sites 18/24)
Location: Longhorn Army Ammunition Plant
Agency: Department of The Army, Marshall, TX
Authors(s): Mr. James McPherson, Commander's Representative
Recipient: Ms. Diane Poteet, Texas Natural Resource Conservation Commission, Superfund Investigation Section, Pollution Cleanup
Date: July 10, 1996
Bate Stamp: 017986-017987

Q. Title: Letter - Subject: Longhorn Army Ammunition Plant, Group IV Sumps Groundwater Monitoring Quarterly Report
Group(s): 4
Site(s): Sumps (Site 35)
Location: Longhorn Army Ammunition Plant
Agency: Texas Natural Resource Conservation Commission
Authors(s): Ms. Diane R. Poteet, Project Mgr., RI/FS II Unit, Superfund Investigation Section, Pollution Cleanup Division
Recipient: Mr. James A. McPherson, Commander's Representative
Date: July 12, 1996
Bate Stamp: 017988

R. Title: Letter - Subject: Longhorn Army Ammunition Plant, Final DERPMIS/RMIS Resolution Document (w/enclosure)
Site(s): All
Location: Longhorn Army Ammunition Plant
Agency: Texas Natural Resource Conservation Commission
Authors(s): Ms. Diane R. Poteet, Project Mgr., RI/FS II Unit, Superfund Investigation Section, Pollution Cleanup Division
Recipient: Mr. James A. McPherson, Commander's Representative

Date: July 15, 1996
Bate Stamp: 017989-017991

S. Title: Memorandum - Subject: Group IV Sumps Groundwater Monitoring Quarterly Report
Group(s): 4
Site(s): Sumps (Site 35)
Location: Longhorn Army Ammunition Plant
Agency: Department of The Army, Headquarters, U.S. Army Industrial Operations Command, Rock Island, IL 61299-6000
Authors(s): Mr. Henry Crain, Acting DCS for Environmental Management
Recipient: Mr. David Tolbert, Project Mgr.
Date: July 17, 1996
Bate Stamp: 017992-017993

T. Title: Memorandum - Subject: Draft Final Design Analysis for the Site 16 (Old Landfill) Time Critical Removal Action
Group(s): 2
Site(s): 16 (Old Landfill)
Location: Longhorn Army Ammunition Plant
Agency: Department of The Army, Headquarters, U. S. Army Industrial Operations Command, Rock Island, IL 61299-6000
Authors(s): Mr. James F. Zak, Acting, Deputy Chief of Staff for Environmental Management
Recipient: Mr. David Tolbert, Project Mgr.
Date: July 23, 1996
Bate Stamp: 017994-017995

U. Title: Minutes - Subject: Monthly Manager's Meeting
Group(s): All
Site(s): All
Location: Longhorn Army Ammunition Plant
Date: July 23, 1996
Bate Stamp: 017996-018000

V. Title: Memorandum - Subject: Draft Final Design Analysis Report for the Site 16 (Old Landfill) Time Critical Removal Action (w/enclosures)
Group(s): 2
Site(s): 16 (Old Landfill)
Location: Longhorn Army Ammunition Plant
Agency: Dept. of The Army
Authors(s): Mr. Jeffrey P. Armstrong, Restoration and Oversight Branch
Recipient: Ms. Jonna Polk, U.S. Army Corps of Engineers, Tulsa
Date: July 24, 1996
Bate Stamp: 018001-018005

W. Title: Letter - Subject: Longhorn Army Ammunition Plant, Group 2 - Interim Remedial Action at Landfills 12 & 16, Landfill Caps Project - Draft Final Design Plans and Drawings
Group(s): 2
Site(s): 12 & 16 - Landfills
Location: Longhorn Army Ammunition Plant
Agency: Texas Natural Resource Conservation Commission

Authors(s): Ms. Diane R. Poteet, Project Mgr., RI/FS II Unit, Superfund Investigation Section, Pollution Cleanup Division
Recipient: Mr. James A. McPherson, Commander's Representative
Date: July 30, 1996
Bate Stamp: 018006

X. Title: Letter - Subject: Longhorn Army Ammunition Plant, Group 2 - Time Critical Removal Action at Landfill 16, Draft Final Design Analysis Report (w/enclosure)
Group(s): 2
Site(s): 16 (Old Landfill)
Location: Longhorn Army Ammunition Plant
Agency: Texas Natural Resource Conservation Commission
Authors(s): Ms. Diane R. Poteet, Project Mgr., RI/FS II Unit, Superfund Investigation Section, Pollution Cleanup Division
Recipient: Mr. James A. McPherson, Commander's Representative
Date: July 30, 1996
Bate Stamp: 018007-018009

Y. Title: Memorandum - Subject: Group IV Sumps Groundwater Monitoring Quarterly Report
Group(s): 4
Site(s): Sumps (Site 35)
Location: Longhorn Army Ammunition Plant
Agency: Department of The Army, Headquarters, U. S. Industrial Operations Command, Rock Island, IL 61299-6000
Authors(s): Mr. Henry Crain, Acting DCS for Environmental Management
Recipient: Mr. David Tolbert, Project Mgr.
Date: (No Date)
Bate Stamp: 018010-018011

Z. Title: Minutes - Subject: Monthly Manager's Meeting and Stakeholder's Meeting (w/enclosure)
Group(s): All
Site(s): All
Location: EPA Office, Dallas, TX
Date: August 5, 1996
Bate Stamp: 018012-018014

DEPARTMENT OF THE ARMY
U.S. ARMY CENTER FOR HEALTH PROMOTION AND PREVENTIVE MEDICINE
5158 BLACKHAWK ROAD
ABERDEEN PROVING GROUND, MARYLAND 21010-5422

017851

REPLY TO
ATTENTION OF
MCHB-DC-EHR (40)

28 MAY 1996

MEMORANDUM FOR District Engineer, U.S. Army Engineering District, Tulsa
ATTN: CESWT-PP-EA/Ms. Jonna Polk,
Post Office Box 61, Tulsa, OK 74121-0061

SUBJECT: Review of the Draft Final Remedial Investigation (RI) Report for Group 1 Sites, Longhorn Army Ammunition Plant, Karnack, Texas, April 1996

1. The U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) reviewed the subject document on behalf of the Office of The Surgeon General. Overall, we concur with the findings of the RI and the recommendations for no further action at the Group 1 sites. However, the document should be resubmitted to USACHPPM for review prior to finalization, upon completion of the risk assessment.

2. The scientists reviewing this document were Mr. Mark A. Dossey and Ms. Jacqueline Howard, Environmental Health Risk Assessment and Risk Communication Program. Our point of contact is Mr. Dossey at DSN 584-7282 or commercial (410) 612-7282.

FOR THE COMMANDER:

Dennis E. Druck
for ARTHUR P. LEE, P.E.
MAJ, MS
Program Manager, Environmental Health Risk
Assessment and Risk Communication

CF:
HQDA(DASG-HS-PE)
CDR, USAMEDCOM, ATTN: MCHO-CL-P
CDR, AMC, ATTN: AMCEN-A/Pete Cunanan
CDR, CEMRD, ATTN: CEMRD-ET-EH
CDR, USAEC, ATTN: SFIM-AEC-IRP
CDR, LHAAP, ATTN: SMCLO-EN

DEPARTMENT OF THE ARMY
U.S. ARMY CENTER FOR HEALTH PROMOTION AND PREVENTIVE MEDICINE
5158 BLACKHAWK ROAD
ABERDEEN PROVING GROUND, MARYLAND 21010-5422

017852

REPLY TO ATTENTION OF

MCHB-DC-EHR (40)

28 MAY 1996

MEMORANDUM FOR District Engineer, U.S. Army Engineering District, Tulsa
ATTN: CESWT-PP-EA/Ms. Jonna Polk, Post Office Box 61,
Tulsa, OK 74121-0061

SUBJECT: Review of the Draft Final Work Plans, Interim Remedial Action- Landfills 12 & 16 Caps, Longhorn Army Ammunition Plant, Karnack, Texas, 30 April 1996

1. The U.S. Army Center for Health Promotion and Preventive Medicine reviewed the subject document on behalf of the Office of The Surgeon General. The description of the proposed work plan adequately addresses public health concerns.

2. The scientists reviewing this document were Mr. Mark A. Dossey and Ms. Jacqueline M. Howard, Environmental Health Risk Assessment and Risk Communication Program. Our point of contact is Mr. Dossey at DSN 584-7282 or commercial (410) 612-7282.

FOR THE COMMANDER:

Dennis E. Druck
for ARTHUR P. LEE, P.E.
MAJ, MS
Program Manager, Environmental Health Risk
Assessment and Risk Communication

CF:
HQDA(DASG-HS-PE)
CDR, USAMEDCOM, ATTN: MCHO-CL-P
CDR, CEMRD, ATTN: CEMRD-ET-EH
CDR, USAEC, ATTN: SFIM-AEC-IRP
CDR, LHAAP, ATTN: SMLO-EN

DEPARTMENT OF THE ARMY
U.S. ARMY CENTER FOR HEALTH PROMOTION AND PREVENTIVE MEDICINE
5158 BLACKHAWK ROAD
ABERDEEN PROVING GROUND, MARYLAND 21010-5422

JUN 13 1996
JUN 13 19..

017853

REPLY TO
ATTENTION OF

MCHB-DC-EHR (40)

04 JUN 1996

MEMORANDUM FOR District Engineer, U.S. Army Engineering District, Tulsa
ATTN: CESWT-PP-EA/Ms. Jonna Polk, Post Office Box 61,
Tulsa, OK 74121-0061

SUBJECT: Review of the Draft Field Summary Report for the Phase 2, Group 2 Sites (12, 16, 17, 18/24, 29, and 32) Remedial Investigation, Longhorn Army Ammunition Plant, Karnack, Texas, May 1996

1. The U.S. Army Center for Health Promotion and Preventive Medicine reviewed the subject document without comment on behalf of the Office of The Surgeon General.

2. The scientists reviewing this document were Mr. Mark A. Dossey and Ms. Jacqueline M. Howard, Environmental Health Risk Assessment and Risk Communication Program. Our point of contact is Mr. Dossey at DSN 584-7282 or commercial (410) 612-7282.

FOR THE COMMANDER:

Arthur P. Lee

ARTHUR P. LEE, P.E.
MAJ, MS
Program Manager, Environmental Health Risk
Assessment and Risk Communication

CF:
HQDA(DASG-HS-PE)
CDR, USAMEDCOM, ATTN: MCHO-CL-P
CDR, CEMRD, ATTN: CEMRD-ET-EH
CDR, USAEC, ATTN: SFIM-AEC-IRP
CDR, LHAAP, ATTN: SMLO-EN

017854

TRC MEETING
6-04-96

ATTENDEES

Ira Nathan
David Tolbert
Darrell Chinn
Jeff Armstrong
Oscar Linebaugh
Frank J. Meleton
Tom Walker
Mary Barrett
Rick Michaels
Sherry McAdoo
James McPherson
Bud Jones
Ken Kebbell
Amine Bou Onk
Glen Turney
Bob Speight
Jonna Polk
Chris Villarreal
Ann Montgomery

The meeting was called to order by David Tolbert. David welcomed everyone to the quarterly TRC meeting.

James McPherson noted that there were new people in attendance and everyone introduced themselves.

The basic format was followed by going through the Project Status Report, which was distributed to everyone in attendance. The sites were grouped according to number and locations on the map were pointed out to those present.

It was agreed that draft final reports were to be sent to Wilma Subra and Mary Barrett. The SCAPS System was explained to the group.

The need for more monitoring wells was questioned. It was explained that the most important thing is corrective action. Trenches have been dug around Burning Ground #3. Our commitment is to do everything possible to stop contaminant flow to Harrison Bayou. Have to look at it from the taxpayers standpoint to monitor tax dollars and also stop the problem. Will put in necessary piezometer, additional monitoring wells and then see if that is the right fix. Our commitment to the public is to find the fix and whatever it takes we will do. Finished modeling, ready to start looking at where the four clusters will be.

Interim action not stopping studies. Emergency action designed to prevent plume from moving in.

Local contracting is slowing us down somewhat--may be delayed a week or two. Access road will be built first. Extraction wells will be started in July. Additional extraction wells will be put in by the end of September--completed. In order to get the work done, installation has to have approval from State and EPA. This takes a long time. We are in a good position here because this is a Superfund site.

It was mentioned that we had inherited bad data, but everyone was assured that we will not model based on bad data. From the data available, followed Phase I. Phase II designed based on result of Phase 1. Any concerns should be presented as detailed as possible and go forward from there. Technology has changed drastically in the past six years. If anyone wants to add something we will be glad for you to say so now.

It was noted that no interest was shown in setting up a RAB. If you have something to say perhaps it could be put in writing so it could be documented as submitted.

We have started digging trenches, etc. and we want to make everyone aware of what is going on. It was noted that there is no indication of contamination off this plant.

The next meeting was scheduled for September 10.

Meeting adjourned.

017856

FINAL PROJECT WORK PLANS

APPENDIX G - PROJECT SPECIFICATIONS
APPENDIX H - CONSTRUCTION DRAWINGS

INTERIM REMEDIAL ACTION - LANDFILLS 12 & 16 CAPS
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

Prepared for:

U.S. Army Corps of Engineers
Fort Worth District
280 Miller Road
Bossier City, LA 71112-2505

Prepared by:

OHM Remediation
Services Corp.

225 W. Airtex Boulevard
Houston, Texas 77090
Tel: 713-775-7500 and Fax: 713-775-7639

June 6, 1996

TERC Contract No. DACA56-94-D-0020
Delivery Order No. 0012 - OHM Project No. 17852

017857

APPENDIX G

APPENDIX G

PROJECT SPECIFICATIONS

IFB No. DACA56-94-D-0020

017859

US Army Corps
of Engineers
Tulsa District

Interim Remedial Action
Landfills LHAAP 12 and 16

Longhorn Army Ammunition Plant
Karnack, Texas

Construction Specifications

FINAL

June, 1996

SECTION 01561

017860

ENVIRONMENTAL PROTECTION

PART 1 GENERAL

1.1 SUMMARY (Not Applicable)

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPAPUB	(1992) NPDES (National Pollution Discharge Elimination System) General Permits for Storm Water Discharges from Construction Sites

1.3 DEFINITIONS

For the purpose of this specification, environmental pollution and damage is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to man; or degrade the utility of the environment for aesthetic, cultural, and/or historical purposes. The control of environmental pollution and damage requires consideration of air, water, and land, and includes management of visual aesthetics, noise, solid waste, radiant energy, and radioactive materials, as well as other pollutants.

1.4 SUBMITTALS

Stormwater Control Plan; GA.

The stormwater control plan (SCP) shall address all items in the paragraph STORM WATER POLLUTION PREVENTION PLANS. The plan shall be submitted and approved prior to the beginning of construction.

1.5 ENVIRONMENTAL PROTECTION REQUIREMENTS

Provide and maintain, during the life of the contract, environmental protection. Plan for and provide environmental protective measures to control pollution that develops during normal construction practice. Plan for and provide environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project. Comply with Federal, State, and local regulations pertaining to the environment, including but not limited to water, air, and noise pollution.

1.6 MEETINGS

The Contractor shall meet with representatives of the Contracting Officer to develop mutual understanding relative to compliance with this section of the specifications and administration of the environmental protection program. The Contractor shall be prepared to discuss the program in conferences convened by the Contracting Officer before starting work on each major phase of operation. Approval of the Contractor's plan for environmental protection will not relieve the Contractor of his responsibility for adequate and continuing control of pollutants and protection of environmental features. All Contractor personnel shall be required to attend.

1.7 SUBCONTRACTORS

Assurance of compliance with this section by subcontractors will be the responsibility of the Contractor.

1.8 REGULATORY REQUIREMENTS

The Contractor shall comply with all Federal, State, and local regulatory and statutory requirements.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 PROTECTION OF ENVIRONMENTAL RESOURCES

The environmental resources within the project boundaries and those affected outside the limits of permanent work under this contract shall be protected during the entire period of this contract. The Contractor shall confine his activities to areas defined by the contract drawings or specifications. Environmental protection shall be as stated in the following subparagraphs.

3.1.1 Protection of Land Resources

Prior to the beginning of any construction, the Contracting Officer will identify all land resources to be preserved within the Contractor's work area. The Contractor shall not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, top soil, and land forms without special permission from the Contracting Officer. No ropes, cables, or guys shall be fastened to or attached to any trees for anchorage unless specifically authorized. Where such special emergency use is permitted, the Contractor shall provide effective protection for land and vegetation resources at all times as defined in the following subparagraphs.

3.1.1.1 Work Area Limits

Prior to any construction, the Contractor shall mark the areas where no work is to be performed under this contract. Isolated areas within the general work area which are to be saved and protected shall also be marked or fenced. Monuments and markers shall be protected before construction operations commence and during all construction operations. Where construction operations are to be conducted during darkness, the markers shall be visible during darkness. The Contractor shall convey to his personnel the purpose of marking and/or protection of all necessary objects.

3.1.1.2 Protection of Landscape (NOT USED)

3.1.1.3 Reduction of Exposure of Unprotected Erodible Soils

Earthwork brought to final grade shall be finished as indicated and specified. Side slopes and back slopes shall be protected as soon as practicable upon completion of rough grading. All earthwork shall be planned and conducted to minimize the duration of exposure of unprotected soils. Except in instances where the constructed feature obscures borrow areas, quarries, and waste material areas, these areas shall not initially be cleared in total. Clearing of such areas shall progress in reasonably sized increments as needed to use the areas developed as approved by the Contracting Officer.

3.1.1.4 Temporary Protection of Disturbed Areas

Such methods as necessary shall be utilized to effectively prevent erosion and control sedimentation, including but not limited to the following:

a. Retardation and Control of Runoff

Runoff from the construction site shall be controlled by construction of diversion ditches, benches, and berms to retard and divert runoff to protected drainage courses.

b. (NOT USED)

3.1.1.5 Erosion and Sedimentation Control Devices.

The Contractor shall construct or install all temporary and permanent erosion sedimentation control features. Temporary erosion and sediment control measures such as berms, dikes, drains, grassing, and mulching shall be maintained until permanent drainage and erosion control facilities are completed and operative.

3.1.1.6 Location of Contractor Facilities

The Contractor's field offices, staging areas, stockpiles, storage, and temporary buildings shall be placed in areas selected by Contractor and approved by the Contracting Officer. Temporary movement or relocation of Contractor facilities shall be made only on approval by the Contracting Officer.

3.1.1.7 Borrow Areas

Borrow areas shall be managed to minimize erosion and to prevent sediment from entering nearby water courses or lakes.

3.1.1.8 Disposal Areas

Disposal areas shall be managed and controlled to limit material to areas designated on the contract drawings and prevent erosion of soil or sediment from entering nearby water courses or lakes. Disposal areas shall be developed in accordance with the grading plan indicated on the contract drawings.

3.1.1.9 Temporary Excavation and Embankments

Temporary excavation and embankments shall be controlled to protect adjacent areas from contamination.

3.1.1.10 Disposal of Solid Wastes

Solid wastes (excluding clearing debris) shall be placed in containers which are emptied on a regular schedule. All handling and disposal shall be conducted to prevent contamination. The Contractor shall transport all construction waste off the construction site and dispose of it in compliance with Federal, State, and local requirements for solid waste disposal.

3.1.1.11 Disposal of Chemical Wastes

Chemical wastes shall be stored in corrosion resistant containers, removed from the work area, and disposed of in accordance with Federal, State, and local regulations.

3.1.1.12 Disposal of Discarded Materials

Discarded materials other than those which can be included in the solid waste category shall be handled as directed by the Contracting Officer.

3.2 HISTORICAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

Existing historical, archaeological, and cultural resources within the Contractor's work area will be so designated by the Contracting Officer and precautions shall be taken by the Contractor to preserve all such resources as they existed at the time they were pointed out to the Contractor. The Contractor shall install all protective devices such as off-limit markings, fencing, barricades, or other devices deemed necessary by the Contracting Officer for these resources so designated on the contract drawings and shall be responsible for their preservation during this contract. If during construction, items of apparent archaeological or historical interest are discovered, they shall be left undisturbed and the Contractor shall report the find immediately to the Contracting Officer.

3.3 STORM WATER CONTROL PLANS

The Contractor shall prepare a storm water control plan (SCP) for the construction activity. This plan shall be in accordance with the EPA publication NPDES General Permits for Storm Water Discharges from Construction Sites. The Contracting Officer and the Contractor shall review the SCP to determine the accuracy of the plan. The SCP may be modified to insure that all current measures to prevent offsite migration of pollutants, including soils, are included in the plan.

3.3.1 Contents of the Stormwater Control Plan

The stormwater control plan shall include as a minimum:

(a) a narrative description of potential pollution sources for each construction site through a description of the nature of the construction activity.

(b) the intended phasing of construction activities related to soil disturbance and the storm water control measure proposed for that activity. For each storm water control measure proposed, the SCP shall indicate when the measure will be implemented. Perimeter controls shall be actively maintained until final stabilization of that portion of the site upward of the perimeter control is established.

(c) storm water management controls appropriate for the project, including perimeter controls, and stabilization practices to be employed such as temporary grading to control runoff velocities, temporary seeding and mulching, and permanent seeding and planting. Equivalent control measures may be taken where attainable and after approval by the Contracting Officer.

(d) a description of maintenance procedures to be employed to minimize the offsite discharge of pollutants, and an inspection program to insure that the SCP is effective, or if not, to insure that necessary changes to the plan are made and implemented in a timely manner.

(e) identification for each storm water management measure set forth in the plan, and the Contractor(s) and/or subcontractor(s) that will implement such measures. Contractors and subcontractors identified in the SCP shall sign a certification that they have reviewed the general permit as listed in the paragraph: STORM WATER CONTROL PLANS and understand the terms and conditions therein. All such certifications shall be included in the SCP, which is to be kept on the job side for inspection by EPA or state or local regulatory agencies.

(f) plan for control of offsite vehicle tracking of soils. The Contractor shall make every effort to keep soils onsite. This may be accomplished by including paved or graveled entrances, graveled and dedicated roadways, or vehicle wash stations.

3.3.2 Inspections

Weekly inspections of construction sites shall be conducted by the Contractor to insure that the various controls and components of the SCP are in place. In addition, the Contractor shall make an inspection within 24 hours following a 1/2 inch or greater rainfall event to insure that the controls are working adequately and have not been impacted by the rainfall event.

3.3.3 Stabilization of Disturbed Soils

Stabilization measures shall be initiated on disturbed areas as soon as practicable, but no more than 14 days after the construction activity on a particular portion of the site has temporarily or permanently ceased except as follows:

(a) where construction activities will resume on a portion of the site within 21 days from the time when construction activities temporarily ceased, or

(b) where the initiation of the stabilization measure is precluded by snow cover in which case stabilization measures shall be initiated as soon thereafter as practicable.

3.3.4 Record Keeping

During construction, all records shall be retained onsite. Inspection reports, the SCP, and modifications of the plan shall be retained for 3 years following construction.

3.4 PROTECTION OF WATER RESOURCES

The Contractor shall keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters. Special management techniques as set out below shall be implemented to control water pollution by the listed construction activities which are included in this contract.

Waste waters directly derived from construction activities shall not be allowed to enter water areas. These waste waters shall be collected and placed in retention areas where the suspended materials can be settled out or the water evaporated in order to separate the pollutants from the water.

3.5 PROTECTION OF FISH AND WILDLIFE RESOURCES

The Contractor shall keep construction activities under surveillance, management, and control to minimize interference with, disturbance to, and damage of fish and wildlife.

3.6 PROTECTION OF AIR RESOURCES

The Contractor shall keep construction activities under surveillance, management, and control to minimize pollution of air resources. All activities, equipment, processes, and work operated or performed by the Contractor in accomplishing the specified construction shall be in strict accordance with all Federal and State of Texas emission and performance laws and standards. Special management techniques as set out below shall be implemented to control air pollution by the construction activities which are included in the contract.

3.6.1 Particulates

Dust particles, aerosols, and gaseous by-products from all construction activities, processing, and preparation of materials shall be controlled at all times, including weekends, holidays, and hours when work is not in progress. The Contractor shall maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and all other work areas within or outside the project boundaries free from particulates which would cause the air pollution standards mentioned in the paragraph "PROTECTION OF AIR RESOURCES" to be exceeded or which would cause a hazard or a nuisance. Sprinkling, chemical treatment of an approved type, light bituminous treatment, or other methods will be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated at such intervals as to keep the disturbed area damp at all times. The Contractor must have sufficient competent equipment available to accomplish this task. Particulate control shall be performed as the work proceeds and whenever a particulate nuisance or hazard occurs.

3.6.2 (NOT USED)

3.6.3 Odors

Odors shall be controlled at all times for all construction activities, processing, and preparation of materials.

3.7 TESTS

The Contractor shall establish and maintain quality control for environmental protection operations to assure compliance with contract requirements and maintain records of his quality control for all construction operations. The Contractor shall record on daily reports any problems in complying with laws, regulations, and ordinances and corrective action taken. Three copies of these records and tests, as well as the records of corrective action taken, shall be furnished the Government as directed by the Contracting Officer.

3.7.1 Laws, Regulations, and Ordinances

The Contractor must comply with all Federal, State, and local laws, regulations, and ordinances concerning pollution control.

3.7.2 Protection of Land Resources

The Contractor shall prevent landscape defacement and provide post-construction clean-up.

3.7.3 Protection of Water Resources

The Contractor shall prevent the contamination of lakes, ditches, or other bodies of water with harmful chemicals; the Contractor shall dispose of waste materials; and the Contractor shall provide erosion control.

3.7.4 Pollution Control Facilities

The Contractor shall provide for the maintenance of pollution control facilities.

3.8 INSPECTION

The Contracting Officer will notify the Contractor in writing of any observed noncompliance with the Contractor's stormwater control plan. The Contractor shall, after receipt of such notice, inform the Contracting Officer of proposed corrective action and take such action as may be approved. If the Contractor fails to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken.

3.9 POST CONSTRUCTION CLEANUP

The Contractor shall clean up all areas used for construction.

3.10 RESTORATION OF LANDSCAPE DAMAGE

The Contractor shall restore all landscape features damaged or destroyed during construction operations outside the limits of the approved work areas. Such restoration shall be in accordance with the plans submitted for approval by the Contracting Officer.

3.11 MAINTENANCE OF POLLUTION FACILITIES

The Contractor shall maintain all constructed facilities and temporary stormwater control devices for the duration of the contract or for that length of time construction activities create the particular pollutant.

3.12 TRAINING OF CONTRACTOR PERSONNEL IN POLLUTION CONTROL

The Contractor shall train his personnel in all phases of environmental protection. The training shall include methods of detecting and avoiding pollution, familiarization with pollution standards, both statutory and contractual, and installation and care of facilities (vegetative covers and instruments required for monitoring purposes) to insure adequate and continuous environmental pollution control

-- End of Section --

SECTION 02050

DEMOLITION

PART 1 GENERAL

1.1 REFERENCES (Not Applicable)

1.2 GENERAL REQUIREMENTS

The work includes demolition, salvage of identified items and materials, and removal of resulting rubbish and debris. Rubbish and debris shall be removed from Government property daily, unless otherwise directed, to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the Contracting Officer. In the interest of conservation, salvage shall be pursued to the maximum extent possible; salvaged items and materials shall be disposed of as directed by the Contracting Officer.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only.

Site Work Plan; GA.

The procedures proposed for the accomplishment of the work. The procedures shall provide for safe conduct of the work, careful removal and disposition of materials specified to be salvaged, protection of property which is to remain undisturbed, coordination with other work in progress, and timely disconnection of utility services. The procedures shall include a detailed description of the methods and equipment to be used for each operation, and the sequence of operations. Minor demolition incidental to other work may also be described in the project Site Work Plan.

1.4 DUST CONTROL

The amount of dust resulting from demolition shall be controlled to prevent the spread of dust to occupied portions of the construction site and to avoid creation of a nuisance in the surrounding area. Use of water will not be permitted when it will result in, or create, hazardous or objectionable conditions such as ice, flooding, or pollution.

1.5 PROTECTION

1.5.1 Protection of Existing Property

Before beginning any demolition work, the Contractor shall carefully survey the site and examine the drawings and specifications to determine the extent of the work. The Contractor shall take all necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government, and any damaged items shall be repaired or replaced as approved by the Contracting

Officer. The Contractor shall carefully coordinate the work of this section with all other work.

1.5.2 Protection of Trees

Trees within the project site which might be damaged during demolition and which are indicated to be left in place shall be clearly marked by plastic tape of a color and size approved by the Contracting Officer.

1.5.3 Environmental Protection

The work shall comply with the requirements of Section 01561 - Environmental Protection.

1.6 BURNING

The use of burning at the project site for the disposal of refuse and debris will not be permitted.

1.7 USE OF EXPLOSIVES

Use of explosives will not be permitted.

1.8 AVAILABILITY OF WORK AREAS

Areas in which the work is to be accomplished will be available upon issue of notice to proceed.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 EXISTING STRUCTURES (NOT APPLICABLE)

3.2 UTILITIES

Existing utilities shall be removed as indicated. When utility lines are encountered that are not indicated on the drawings, the Contracting Officer shall be notified prior to further work in that area.

3.3 FILLING

Holes and other hazardous openings shall be filled in accordance with Section 02210 - GRADING.

3.4 DISPOSITION OF MATERIAL

Demolition debris will be disposed of in the lower lifts of the grading layer fill materials in Landfills 12 and 16.

3.4.1 Salvageable Items and Materials

Contractor shall salvage items and materials to the maximum extent possible.

3.4.1.1 Material Salvaged for the Contractor

Material salvaged for the Contractor shall be stored as approved by the Contracting Officer and shall be removed from the project site before completion of the contract. Material salvaged for the Contractor shall not be sold on site.

3.4.1.2 Items Salvaged for the Government

Salvaged items to remain the property of the Government shall be removed in a manner to prevent damage and packed to protect the items from damage while in storage or during shipment. Items damaged during removal or storage shall be repaired or replaced to match existing items. Containers shall be properly identified as to contents.

3.4.2 Unsalvageable Materials

Concrete, masonry, and other noncombustible materials, except concrete permitted to remain in place, shall be disposed of in the lower lifts of the grading layer fill materials in Landfills 12 and 16. Combustible materials shall be disposed of off the site.

3.5 CLEAN-UP

Debris shall be removed and transported in a manner that prevents spillage on streets or adjacent areas. Local regulations regarding hauling and disposal shall apply.

-- End of Section --

SECTION 02110

CLEARING AND GRUBBING

PART 1 GENERAL

1.1 REFERENCES (Not Applicable)

1.2 SUBMITTALS (NOT APPLICABLE)

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 CLEARING

Clearing of commercially valuable timber will be performed by others and is excluded form this Work. Additional incidental clearing by the Contractor may include the felling, trimming, and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal, including down timber, snags, brush, and rubbish occurring in the areas to be cleared. Trees and vegetation to be left standing shall be protected from damage incident to clearing, grubbing, and construction operations. Clearing shall also include the removal and disposal of structures that obtrude, encroach upon, or otherwise obstruct the work.

3.2 GRUBBING

Stumps, roots, logs and other organic or metallic debris not suitable for foundation purposes, shall be removed to a depth of not less than 18 inches below the original surface level in areas indicated. Depressions made by grubbing shall be filled and graded to conform with the adjacent surface.

3.3 DISPOSAL OF MATERIALS

Refuse from the clearing and grubbing operations shall be chipped and stored onsite for re-use as mulch.

-- End of Section --

SECTION 02221

COVERSOIL AND TOPSOIL

PART 1 GENERAL

1.1 SCOPE

The work covered by this section consists of the placing of coversoil, and topsoil to be used in establishing turf.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 2487	(1993) Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Coversoil

Suitable coversoil shall consist of approved material from an onsite source. Such material shall be any material classified as SC, SM, CL, CH, or SC-SM. Suitable coversoil shall be free from roots, stones, and other materials that may damage the geosynthetic liner, or hinder planting, and maintenance operations, and shall be as free as possible from objectionable weed seeds and free from toxic substances.

2.1.2 Topsoil

Suitable topsoil shall consist of approved material from an offsite source. Such material shall be any material classified as SC, SM, CL, or SC-SM. Suitable topsoil shall be free from roots, stones, and other materials that hinder grading, planting, and maintenance operations, and as free as possible from objectionable weed seeds and free from toxic substances.

PART 3 EXECUTION

3.1 STOCKPILING

Areas for use in stockpiling, if required, shall be as approved by the Contracting Officer. Size of stockpiles shall be as approved by the Contracting Officer.

3.2 PLACEMENT OF SOIL

3.2.1 Placement of Coversoil

Coversoil shall be distributed uniformly and spread evenly to a thickness of 18 inches as shown on the drawings. Coversoil shall not be placed when the subgrade is frozen, excessively wet, or extremely dry. Coversoil shall be placed in two 12-inch loose lifts. The first lift shall be compacted by a bulldozer or other construction equipment approved by the Contracting Officer. The first lift shall not be scarified. The second lift shall be compacted to 90% of maximum density as determined by ASTM D 698 (Standard Proctor) at a moisture content within 3% of optimum. Prior to placement of topsoil, coversoil shall be scarified to a minimum depth of 4 inches by disking or plowing.

3.2.2 Placement of Topsoil

After spreading, topsoil shall be compacted using 1 complete pass of an approved crawler tractor.

3.3 THICKNESS TOLERANCE

Thickness of the complete coversoil and topsoil areas shall be the nominal thickness shown on the drawings with a tolerance of plus 2 inches, minus 0 inches.

--End of Section --

SECTION 02271 ''17874

GEOMEMBRANE

PART 1 - GENERAL

This Specification Section is applicable in its entirety if a geomembrane liner is installed as a separate layer; i.e. not part of a composite geosynthetic clay liner (GCL). If the geomembrane is furnished as an integral component of the composite GCL, the installation paragraphs of this Specification Section will not apply. Specifically, joining of composite GCL sheets or panels will be by overlapping as described in Specification Section 02442 - Geosynthetic Clay Liner (GCL), instead of welding as described herein.

1.1 REFERENCES

The publications listed below form a part of the specification to the extent referenced. The publications are referenced in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 638	(1989) Test Method for Tensile Properties of Plastics
ASTM D 746	(1987) Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
ASTM D 751	(1989) Standard Methods of Testing Coated Fabrics
ASTM D 1004	(1988) Test Method for Initial Tear Resistance of Plastic Film and Sheeting
ASTM D 1693	(1988) Test Method for Environmental Stress-Cracking of Ethylene Plastics
ASTM D 4437	(1988) Practice for Determining the Integrity of Field Seams Used in Joining Flexible Polymeric Sheet Geomembranes

NATIONAL SANITATION FOUNDATION (NSF)

NSF Standard 54	(1991) Standard for Flexible Membrane Liners

GEOSYNTHETIC RESEARCH INSTITUTE (GRI)

GRI GM4	(1991) Three Dimensional Geomembrane Tension Test

GRI GM7 (1991) Accelerated Curing of Geomembrane Test Strip Seams Made by Chemical Fusion Methods

FEDERAL TEST METHOD STANDARDS (FTMS)

FTMS 101 C 2065.1 Puncture Resistance and Elongation Test

1.2 QUALIFICATIONS

1.2.1 Manufacturer

The manufacturer is the corporation hired by the Contractor who is responsible for producing the geomembrane sheets. Manufacturer shall have produced the proposed geomembrane sheets for at least five completed projects having a total minimum area of two million square feet.

1.2.2 Fabricator

The fabricator is the corporation hired by the Contractor who is responsible for seaming geomembrane sheets into panels. Fabricator shall have fabricated the proposed geomembrane panels for at least five completed projects having a total minimum area of two million square feet.

1.2.3 Installer

The installer is the person or corporation hired by the Contractor who is responsible for field handling, deploying, seaming, anchoring, and field quality control testing of the geomembrane. The installer shall have installed the proposed geomembrane material for at least five completed projects having a total minimum area of two million square feet. At least one seamer shall have experience seaming a minimum of 500,000 square feet of the proposed geomembrane using the same type of seaming equipment and geomembrane mil thickness specified for this project.

1.2.4 Inspector

The inspector is the quality assurance person or corporation who is responsible for monitoring and documenting activities related to the quality assurance of the geomembrane from manufacturing through installation. Inspector shall have provided quality assurance inspection during installation of the proposed geomembrane material for at least five completed projects having a total minimum area of two million square feet.

1.2.5 Testing Laboratory

The testing laboratory is the quality assurance laboratory who is responsible for laboratory quality assurance geomembrane testing. The testing laboratory shall have provided quality control and/or quality assurance testing of the proposed geomembrane seams for at least five completed projects having a total minimum area of two million square feet.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation, submittals having an "FIO" designation are for information only.

1.3.1 Materials; FIO

Manufacturer's certified raw material and sheet material data sheets along with a copy of quality control certificates.

1.3.2 Layout and Detail Drawings; FIO

Geomembrane panel layout and penetration detail drawings a minimum of 30 days prior to delivery of geomembrane to the site.

1.3.3 As-built Drawings; FIO

Final as-built drawings of geomembrane installation showing panel/sheet numbers, seam numbers, and location of patches, destructive seam samples, and penetrations.

1.3.4 Tests, Inspections, and Verifications; FIO

Manufacturer's quality control manual. Fabricator's quality control manual.

1.3.5 Field Seaming; FIO

Installer's quality control manual.

1.3.6 Qualifications; FIO

Manufacturer's, fabricator's, installer's, inspector's, and independent laboratory's qualification statements including resumes of key personnel involved in the project.

1.3.7 Warranty; FIO

1.3.8 Tests, Inspections, and Verifications; FIO

Manufacturer's certified quality control test results. Fabricator's certified quality control test results.

1.3.9 Field Seaming; FIO

Installer's certified quality control test results.

1.3.10 Tests, Inspections, and Verifications; FIO 017877

One 12 inch minimum size geomembrane sample.

1.4 DELIVERY, STORAGE AND HANDLING

Geomembrane shall not be off-loaded unless the Inspector is present. The geomembrane shall be protected from puncture, abrasion, excessive heat or cold, material degradation, adhesion of individual layers or other damaging circumstances. Damaged geomembrane shall be removed from the site.

1.5 WEATHER LIMITATIONS

Geomembrane shall be deployed and field-seamed only when the geomembrane is dry and winds are low. In marginal conditions, seaming shall cease unless tests confirm that satisfactory seam strengths are being obtained.

1.6 WARRANTY

Written warranties for geomembrane material and installation workmanship shall be submitted. The manufacturer's warranty shall state that the installed material meets all requirements of the contract documents and that under typical local atmospheric conditions, the sheet material is warranted for 20 years. The installer's warranty shall state that the geomembrane field seams will not fail within 20 years of the installation.

1.7 EQUIPMENT

All equipment used in performance of the work shall be in accordance with the geomembrane manufacturer's recommendations and shall be maintained in satisfactory working condition.

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 Raw Materials

Resin used in manufacturing polyethylene geomembranes shall have a broad molecular weight distribution and no more than 6% of a higher density resin added which is a carrier for the required 2 to 3% carbon black. In addition, resins shall not contain fatty acid residues, epoxy, or secondary plasticizers. Materials which have been used previously will not be allowed. The materials used to manufacture geomembrane sheets shall contain no more than 2 percent regrind ingredients that originate from the same formulation and the same production lot and which are clean and free of any foreign contaminants.

2.1.2 Sheet Materials

A sheet is defined as a manufactured seamless geomembrane unit with a width equal to or greater than 5 feet. Geomembrane sheets shall be non-reinforced and uniform in color, thickness, and surface texture. The sheets shall also be free of and resistant to fungal or bacterial attack and they shall be free of cuts, abrasions, holes, blisters, contaminants and other imperfections.

2.1.3 Geomembrane Physical Properties

Sheets and factory seams shall conform to the minimum physical requirements listed in NSF STANDARD 54 and Table 1. Test values shown in Table 1, except when specified as minimum or maximum, are typical test values. If materials are not included in NSF STANDARD 54, manufacturer's property specifications shall be substituted. Manufacturer's property specifications shall be submitted a minimum of 30 days prior to delivery of geomembrane to the site.

2.1.4 Factory Seams

Geomembrane sheets shall be manufactured as wide as possible to minimize factory and field seams. Panels are factory or field fabricated geomembrane units which are composed of several geomembrane sheets seamed together. Factory seaming shall be by methods approved by the geomembrane manufacturer. Seams shall meet the minimum shear and peel strength requirements shown in Table 1. Factory seams shall extend to the end of the sheet so that no unbonded edges greater than 1/8 inch wide are present (top side only).

2.2 TESTS, INSPECTIONS, AND VERIFICATIONS

2.2.1 Manufacturing, Sampling, and Testing

2.2.1.1 Resin Materials

Resin shall be tested in accordance with the approved geomembrane manufacturer's quality control manual. Any resin which fails to meet the geomembrane manufacturer's specified physical properties shall not be accepted for manufacturing the sheet. Polyethylene seaming rod and pellets shall be manufactured of resin which is essentially identical to that used in the geomembrane sheet. Seaming rods and pellets shall be tested for density, melt index and carbon black content in accordance with the approved geomembrane manufacturer's quality control manual. Seaming rods and pellets which fail to meet the corresponding property values required for the sheet material shall be rejected.

2.2.1.2 Geomembrane Sample

One 12 inch by 12 inch minimum size geomembrane sample, along with appropriate identification, shall be provided for quality assurance testing and permanent record of actual furnished material. Samples not meeting the minimum requirements specified shall result in the rejection of the applicable sheets.

2.2.1.3 Multiaxial Tensile Test

As a minimum, one multi-axial tensile test shall be run per 100,000 square feet of geomembrane used. Testing shall be conducted prior to installation in accordance with GRI GM4.

2.2.2 Fabrication, Sampling, and Testing

2.2.2.1 General

Prior to or during factory seaming, roll goods shall be visually inspected on both sides for defects and impurities. Defects and impurities shall be removed and repaired prior to completion of the fabrication process.

2.2.2.2 Non-Destructive Factory Seam Testing

Non-destructive seam testing shall be conducted in accordance with the fabricator's approved quality control manual. Continuous visual inspection shall be performed on the seams during fabrication. Defective seams shall be repaired, retested and approved prior to continuation of the seaming process.

2.2.2.3 Destructive Factory Seam Testing

During fabrication, a minimum of one destructive test sample shall be taken per 750 feet of factory seam length. Where possible, these samples shall be taken from extra material at the beginning or end of panel seams such that the panel is not damaged and the panel geometry is not altered. The samples shall be a minimum of 12 inches wide by 24 inches long with the seam centered lengthwise. Each sample shall be cut into two equal pieces with one piece retained by the fabricator and one piece given to the Contracting Officer for quality assurance testing and permanent record. Each sample shall be tagged to identify: (1) manufacturer's roll number; (2) date cut; (3) panel from which cut; (4) location in panel; (5) top sheet; (6) visual inspection comments; and (7) quality control inspector's name. The fabricator's seam samples shall be tested for shear strength and peel adhesion in accordance with ASTM D 4437. To be acceptable, four out of five replicate test specimens must meet specified seam strength requirements. Certified test results on factory seams shall be submitted and approved by the Inspector prior to delivery of any panels to the site.

PART 3 - EXECUTION

017880

3.1 PREPARATION

3.1.1 Surface Preparation

If the geomembrane is furnished separately from the GCL, the geomembrane shall be placed on the GCL liner. The GCL liner surface shall be inspected for debris, stones and other objectionable matter prior to approving the surface for installation of geomembrane.

If the geomembrane is furnished as a component of a composite GCL/geomembrane, the subgrade surface shall be inspected for debris, stones and other objectionable matter prior to approving the surface for installation of the composite GCL/geomembrane.

3.2 Panel/Sheet Deployment

The geomembrane shall be placed with minimum handling. The procedures and equipment used shall not damage the geomembrane. Geomembrane damaged during installation shall be removed or repaired, at the Inspector's discretion and as specified in paragraph Defects and Repairs. Only those panels/sheets that can be anchored and seamed together the same day shall be deployed. Adequate ballast (e.g., sand bags) shall be placed on the geomembrane to prevent uplift by wind without damaging the geomembrane. No vehicular traffic will be allowed directly on the geomembrane. The method used to unroll the panels/sheets shall not scratch, crimp or excessively elongate the geomembrane and shall not detrimentally rut the subgrade soil as determined by the Inspector. Seams shall be oriented parallel to the line of maximum slope. Where seams can only be oriented across the slope, the upper panel shall be lapped over the lower panel.

3.2.1 Wrinkles

The method used to place the panels/sheets shall minimize wrinkles; however, the geomembrane manufacturer and installer shall coordinate efforts to provide the proper amount of slack in the deployed geomembrane so as to compensate for contraction due to local temperature extremes.

3.2.2 Thickness Measurement

For non-textured material, a minimum of five thickness readings shall be taken along the edge across each panel/sheet width and at least two thickness measurements shall be taken along each panel/sheet length in accordance with ASTM D 751. A minimum of two additional readings shall be taken across the width at any point where the panel/sheet has been cut. Panels/sheets whose mil thickness falls below the specified minimum value shall be rejected and replaced at no additional cost to the Government.

3.3 FIELD SEAMING

3.3.1 Test Seams

Test seams shall be made on test strips of geomembrane to verify that seaming conditions are adequate. They shall be made in the area to be seamed and in contact with the subgrade. Test seams shall be made each day prior to production seaming, whenever there is a change in seaming personnel or seaming equipment and at least once every five hours, by each seamer and each piece of seaming equipment used that day. One sample shall be obtained from each test seam. This sample shall be at least 36 inches long by 20 inches wide with the seam centered lengthwise. Ten specimens 1 inch wide shall be cut from the sample. The Installer shall field test 5 seam specimens for shear strength and 5 seam specimens for peel adhesion using an approved quantitative tensiometer. Jaw separation speed shall be 2 inches per minute. Where necessary, accelerated curing of test strip seams made by chemical fusion methods, shall be conducted in accordance with GRI GM7. To be acceptable, four out of five replicate test specimens must meet specified seam strength requirements. If the field tests fail to meet these requirements, the entire operation shall be repeated. If the additional test seam fails, the seaming apparatus or seamer shall not be accepted or used for seaming until the deficiencies are corrected by the Installer and two consecutive successful test seams are achieved.

3.3.2 Field Seams

3.3.2.1 General Requirements

All panels/sheets shall be overlapped a minimum of 3 inches. In corners and odd-shaped geometric locations, the number of field seams shall be minimized. Seaming shall extend to the outside edge of panels/sheets to be placed in anchor and/or drainage trenches. Seaming shall not be conducted in the presence of standing water and/or soft subgrades as determined by the Inspector. Wet surfaces shall be thoroughly dried and soft subgrades compacted and approved by the Installer and Inspector prior to seaming. The seam area shall be cleaned of all dust, dirt, and foreign material prior to and during seaming.

3.3.2.2 Polyethylene Seams

Polyethylene geomembranes shall be seamed by hot wedge methods. Extrusion welding shall be allowed only for patching and seaming around appurtenances. If seam overlap grinding is required, the procedure used shall not damage the geomembrane. Grinding marks shall be oriented perpendicular to the seam direction and no marks shall extend more than 1/8 inch beyond the extrudate after placement. The depth of the grinding marks shall be no greater than 10% of the sheet thickness. Where extrusion fillet welds are temporarily terminated long enough to cool, they shall be ground prior to applying new extrudate over the existing seam.

3.3.3 Field Sampling and Testing

3.3.3.1 Non-Destructive Field Seam Testing

Field seams shall be non-destructively tested over their full length in accordance with the Installer's approved quality control manual. Seam testing shall be performed as the seaming work progresses, not at the completion of field seaming. Any seams which fail shall be documented and repaired in accordance with paragraph Defects and Repairs.

3.3.3.2 Destructive Field Seam Testing

A minimum of one destructive test sample per 500 feet of field seam shall be obtained at locations specified by the Inspector. Sample locations shall not be identified prior to seaming. Samples shall be a minimum of 12 inches wide by 48 inches long with the seam centered lengthwise. Each sample shall be cut into three equal pieces with one piece retained by the Installer, one piece given to the Testing Laboratory, and the remaining piece given to the Contracting Officer for quality assurance testing and permanent record. Each sample shall be numbered and cross referenced to a field log which identifies: (1) panel/sheet number; (2) seam number; (3) top sheet; (4) date and time cut; (5) ambient temperature; (6) seaming unit designation; (7) name of seamer; and (8) seaming apparatus temperature and pressures (where applicable). A minimum of four 1-inch wide replicate specimens shall be cut from the Installer's sample. A minimum of 2 specimens shall be tested for shear strength and 2 for peel adhesion using an approved field quantitative tensiometer. Jaw separation speed shall be 2 inches per minute. To be acceptable, all replicate test specimens must meet the specified seam strength requirements. If the field tests pass, 5 specimens shall be tested at the Testing Laboratory for shear strength and 5 for peel adhesion in accordance with ASTM D 4437. To be acceptable, 4 out of 5 replicate test specimens must meet specified seam strength requirements. If the field or laboratory tests fail, the seam shall be repaired in accordance with paragraph REPAIR PROCEDURES. In addition, destructive seam sample holes shall be repaired the same day as cut. Certified test results on field seams shall be submitted to and approved by the Contracting Officer prior to acceptance of the seam.

3.3.4 Defects and Repairs

3.3.4.1 Identification

Immediately prior to covering the geomembrane, seams and non-seam areas shall be visually inspected by the Inspector and Contracting Officer for defects, holes, or damage due to weather conditions or construction activities. At the Contracting Officer's discretion, the surface of the geomembrane shall be brushed, blown, or washed by the Installer if the amount of dust, mud, or foreign material inhibits inspection or functioning of the overlying material.

3.3.4.2 Evaluation

Each suspect location shall be non-destructively tested. Each location that fails non-destructive testing shall be repaired and re-tested by the Installer until it passes.

3.3.4.3 Repair Procedures

Defective seam areas may be overlaid with a strip of new material and seamed (cap stripped). Alternatively, the seaming path shall be retraced to an intermediate location a minimum of 10 feet on each side of the failed seam location. At each location a 12 inch by 12 inch minimum size seam sample shall be taken for 2 additional shear strength and 2 additional peel adhesion tests using an approved quantitative field tensiometer. If these tests pass, then the remaining seam sample portion shall be sent to the Testing Laboratory for 2 shear strength and 2 peel adhesion tests in accordance with ASTM D 4437. If these laboratory tests pass, then the seam shall be cap stripped between that location and the original failed location. If field or laboratory tests fail, then the process is repeated. After cap stripping, the entire cap stripped seam shall be non-destructively tested. Certified test results on all repaired seams shall be submitted and approved by the Contracting Officer prior to covering the seamed areas.

3.3.4.4. Patches

Tears, holes, blisters and areas with undispersed raw materials or foreign material contamination shall be repaired with patches. Patches shall have rounded corners, be made of the same geomembrane, and extend a minimum of 6 inches beyond the edge of defects. Minor localized flaws shall be repaired by spot welding or seaming as determined by the Inspector. Repairs shall be non-destructively tested. The Inspector may also elect to perform a destructive seam test on a suspect area.

3.4 PENETRATIONS

Geomembrane penetration details shall be as recommended by the geomembrane manufacturer, fabricator or installer, and as approved by the Contracting Officer. Factory fabricated boots shall be used wherever possible. All tailored area field seams shall be non-destructively tested.

3.5 CAP SYSTEM COMPLETION

The geomembrane shall be covered with the required materials within 5 days of acceptance. Folding over of geomembrane wrinkles will not be allowed prior to or during placement of cover materials.

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TABLE 1. GEOMEMBRANE PHYSICAL PROPERTIES

PROPERTY	TEST METHOD	TEST VALUE
Thickness, mils, (nominal)	ASTM D 751	40
Thickness, mils, (minimum) (**NOTE**: Geomembrane installed as a layer separate from the GCL must be seamed by welding. Installer may elect to furnish a geomembrane thicker than the minimum in order to weld the seams)	ASTM D 751	36
Tensile Strength at Break, lbs/in. width	ASTM D 638	150
Elongation at Break, percent	ASTM D 638	500
Multi-axial Tensile Strain at rupture, percent, (minimum)	GRI-GM4	20
Tear Resistance, lbs.	ASTM D 1004 Die C	30
Puncture Resistance, lbs.	FTMS 101C 2065.1	50
Environmental Stress Crack, hours (minimum)	ASTM D 1693	1500
Low Temperature Brittleness, degrees F	ASTM D 746	-15
Seam Shear Strength, lbs./in. width (minimum). Note 1	ASTM D 4437	80
Seam Peel Adhesion, lbs./in. width, (minimum). Note 2	ASTM D 4437	50

Note 1: (Required only if geomembrane is installed as a layer separate from the GCL layer.) Test results shall be considered passing if the minimum shear strength value is reached or the geomembrane elongates greater than 12 inches without failing regardless of the shear strength value.

Note 2: (Required only if geomembrane is installed as a layer separate from the GCL layer.) Seams tested for peel adhesion must fail in the Film Tear Bond mode. This is a failure in the ductile mode of one of the bonded sheets by tearing or breaking prior to complete separation of the bonded area. Where applicable, both tracks of a double hot wedge seam shall be tested for peel adhesion.

--End of Section --

SECTION 02442

GEOSYNTHETIC CLAY LINER (GCL)

PART 1 GENERAL

This Specification Section is sufficient in itself if a geosynthetic clay liner (GCL) liner is installed as a separate layer; i.e. not part of a composite geosynthetic clay liner. If the GCL is furnished as a composite with a geomembrane, the materials paragraphs of Specification Section 02271 - Geomembrane are appropriate and will apply to the geomembrane component of the composite GCL.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 638	(1989) Test Method for Tensile Properties of Plastics
ASTM D 751	(1989) Standard Methods of Testing Coated Fabrics
ASTM D 1193	(1991) Reagent Water
ASTM D 1505	(1985; R 1990) Density of Plastics by the Density-Gradient Technique
ASTM D 2216	(1992) Laboratory Determination of Water (Moisture) Content of Soil, and Rock
ASTM D 4632	(1991) Grab Breaking Load and Elongation of Geotextiles
ASTM D 4643	(1993) Determination of Water (Moisture) Content of Soil by the Microwave Oven Method
ASTM D 5261	(1992) Test Method for Measuring Mass Per Unit Area of Geotextiles
ASTM D 5321	(1992) Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method

GEOSYNTHETIC RESEARCH INSTITUTE (GRI)

GRI Std GCL 2	(1993) Permeability of Geosynthetic Clay Liners (GCLs)

AMERICAN PETROLEUM INSTITUTE (API)

API Spec 13A	(1993) Drilling-Fluid Materials

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only.

1.2.1 GCL Properties; FIO

Manufacturer's certified raw and roll material data sheets. The certified data sheets shall be attested to by a person having legal authority to bind the GCL manufacturing company. Certified test results shall be submitted to the Contracting Officer prior to delivery of GCL to the site.

1.2.2 Layout and Detail Drawings; FIO

GCL panel layout and penetration detail drawings a minimum of 30 days prior to delivery of GCL to the site.

1.2.3 As-Built Drawings; FIO

Final as-built drawings showing panel numbers and the location of patches and penetrations.

1.2.4 Tests, Inspections, and Verifications; FIO

Manufacturer's quality control (QC) manual which describes testing procedures, frequency of testing and acceptance/rejection criteria for quality control testing.

1.2.5 Qualifications; FIO

Manufacturer's, installer's, inspector's (when used), and independent laboratory's qualification statements including resumes of key personnel involved in this project.

1.2.6 Tests, Inspections, and Verifications; FIO

Friction test results including description of equipment and test methods. Test results shall be submitted to the Contracting Officer prior to delivery to the site.

1.2.7 Site Verification Sampling and Testing; FIO

Independent laboratory test results including description of equipment and test methods.

1.2.8 Site Verification Sampling and Testing; FIO

Two samples (one sample from Site 12 and one sample from Site 16) collected by cutting the full-width of the GCL sheet, 1 meter (3 feet) long.

1.3 QUALIFICATIONS

1.3.1 Manufacturer

Geosynthetic clay liner shall be the product of a recognized GCL manufacturer who has produced the proposed GCL using the same bentonite, polyethylene geomembrane, geotextiles, sewing thread, and adhesive for at least 5 completed projects totaling a minimum of 186,000 square meters. (2,000,000 square feet.)

1.3.2 Installer

The installer shall have successfully installed GCL at a minimum of 5 projects of comparable scope and complexity totaling a minimum of 93,000 square meters. (1,000,000 square feet.)

1.3.3 Inspector

The Contractor shall provide an inspector who shall serve as a Quality Assurance (QA) person. The inspector shall be an individual or company who shall be responsible for monitoring and documenting activities related to the QA of GCL from manufacturing through installation. The Inspector shall have provided QA for the installation of the proposed or similar GCL for at least 5 completed projects totaling a minimum of 93,000 square meters. (1,000,000 square feet.)

1.3.4 Testing Laboratory

Laboratory testing of GCL shall be performed by a laboratory, hired by the Contractor who is responsible for laboratory testing of GCL. The laboratory shall have provided QC and/or QA testing of the proposed or similar GCL for at least 5 completed projects totaling a minimum of 93,000 square meters. (1,000,000 square feet.)

1.4 DELIVERY, STORAGE, AND HANDLING

GCL shall be shipped, stored, and handled ensuring that no damage occurs and the GCL is kept free of moisture, dirt or any other foreign material. Rolls shall be packaged in an opaque, waterproof, protective covering and shall be wrapped around a central core which is structurally capable of supporting the weight of the roll without excessive bending under normal handling conditions. The central core shall remain accessible during storage for ease of handling. Equipment used to move GCL shall have bars which extend through the central core. Rolls shall be labeled with the manufacturer's name, product identification, lot number, roll number, roll dimensions, roll weight, and date manufactured. Rolls of GCL shall be continuously supported during storage and shall be kept in their original, unopened, protective covering. GCL shall be stored indoors until transported to the construction site. Field storage shall be in flat dry areas where water cannot accumulate or the rolls shall be elevated off the ground. Storage, placement and stacking of rolls shall be performed to avoid thinning of the product at points of contact.

PART 2 PRODUCTS

2.1 GCL PROPERTIES

GCL shall be a manufactured product consisting of a sodium montmorillonite clay (bentonite) layer evenly distributed between two geotextiles or attached to a polyethylene geomembrane. The exposed surface of the polyethylene membrane shall be textured. GCL shall conform to the property requirements listed in Table 1 and shall be free of tears, holes, or other defects which may affect its serviceability. Encapsulating geotextiles shall be either woven or nonwoven and shall be mechanically bonded using a needle punch or stitching process. If needle punching or stitch bonding is used in construction of GCL, the GCL shall be continuously inspected for broken needles using an in-line metal detector and broken needles shall be removed. The minimum manufactured GCL sheet width shall be 13.5 feet and the minimum manufactured GCL sheet length shall be 100 feet.

TABLE 1 - GCL PROPERTIES

PROPERTY	TEST METHOD	TEST VALUE
BENTONITE		
Swell Index Test, minimum	Note 1	24 mL
Filtrate Volume, maximum	API Spec 13A, Sec.4	18 mL
GEOMEMBRANE		
Thickness, minimum	ASTM D 751	18 mil
Sheet Density, minimum	ASTM D 1505	0.94 g/cc
COMPOSITE		
Bentonite Mass/Unit Area, MARV, Note 2	ASTM D 5261	0.95 psf

Tensile Strength, minimum, Note 3	ASTM D 638	40 ppi
Mid-Plane Shear Strength (hydrated), minimum	ASTM D 5321	0.37 psi
Permeability, maximum	GRI Std GCL 2	0.05 nm/sec
Interface Friction Angle (hydrated), minimum at a normal stress of 1.5 psi	ASTM D 5321	14 degrees

Note 1: Swell Index Test is described under paragraph TESTS, INSPECTIONS, AND VERIFICATIONS.

Note 2: Bentonite mass/unit area is based on a GCL moisture content of 25 percent as determined by ASTM D 2216 or ASTM D 4643. Bentonite mass/unit area is exclusive of glues added to the bentonite. MARV Minimum average roll value.

Note 3: Represents yield strength for geomembrane backed materials.

2.2 TESTS, INSPECTIONS, AND VERIFICATIONS

2.2.1 Manufacturing Sampling and Testing

GCL, its components, and bentonite used for repairs shall be sampled and tested in accordance with the manufacturer's approved quality control manual. Test results not meeting the requirements specified in Table 1 shall result in the rejection of applicable rolls. The manufacturer's quality control manual shall describe procedures used to determine rejection of applicable rolls. As a minimum, rolls produced immediately prior to and immediately after the failed roll shall be tested for the same failed parameter. Testing shall continue until a minimum of two successive rolls on both sides of the original failing roll pass the failed parameter.

2.2.2 Friction Testing

One set of mid-plane and interface friction tests shall be performed in accordance with ASTM D 5321. Both interfaces of the GCL shall be tested, if the GCL is furnished as a separate layer. GCL furnished in a composite with a geomembrane will be tested for friction only on the exposed GCL surface. The hydration fluid shall be distilled water. Samples shall be allowed to hydrate for a minimum of 3 days prior to shear testing. Normal stresses of 1, 3, and 5 psi shall be used during hydration and shearing. The shear rate shall be 0.04 inches/minute. GCL and adjacent geosynthetics shall be oriented such that the shear force is parallel to the downslope orientation of the geosynthetics in the field. Modifications to this test procedure must be submitted and approved prior to use. Test method for GCL furnished as a composite with a geomembrane will be submitted for approval by the

Contracting Officer. 017891

2.2.3 Swell Index Test

Bentonite shall be sampled and tested in accordance with the following procedure:

(1) A 2.00 gram bentonite sample shall be pulverized to at least 70 percent passing the 0.075 mm 200 mesh sieve, dried to a constant weight in laboratory oven at 105 plus or minus 5 degrees C, and allowed to cool to room temperature in a desiccator before testing. A laboratory balance with an accuracy of +1 to - 0.01 grams shall be used.

(2) Distilled or deionized water in accordance with ASTM D 1193, Type I, II, or III in the amount of 90 mL shall be added to a clean 100 mL graduated cylinder. The graduated cylinder shall be 180 mm in height and have 1 mL subdivisions.

(3) A 0.1 gram increment of bentonite shall be carefully "dusted" over the entire surface of water in the graduated cylinder over a period of approximately 30 seconds. A funnel that may concentrate the bentonite in a thicker agglomerate shall not be used. The bentonite shall be allowed to wet, hydrate and settle to the bottom of the graduated cylinder. A minimum of 10 minutes must pass before any additional increments of bentonite are added.

(4) Additional increments of the bentonite powder shall be added following the details in step number 3, until the entire 2.00 gram sample has been added.

(5) After the final increment has settled, a wash bottle shall be used to carefully rinse adhering particles from the sides of the cylinder into the water, raising the water volume to the 100 mL mark.

(6) The graduated cylinder shall be capped with a ground glass stopper and allowed to stand undisturbed for a minimum of 2 hours from last increment addition.

(7) After 2 hours, the hydrating bentonite shall be inspected. If the settled bentonite does not appear homogeneous, the cylinder shall be tipped at a 45 degree angle and rolled slowly to homogenize the settled bentonite mass. The graduated cylinder shall be allowed to remain undisturbed for 24 hours before recording the volume of the hydrated mass.

(8) After the 24 hour hydration period from the last increment addition, the volume level shall be recorded in mL at the top of the settled bentonite to the nearest 0.5 mL. The distinct change in density at the upper surface of the settled bentonite shall be read and recorded. Low density flocculated material (sometimes lighter in coloration) shall be ignored for this measurement.

(9) Results shall be reported as mL/2 g Swell index of bentonite to the nearest 0.5 mL.

PART 3 EXECUTION

3.1 Site Verification Sampling and Testing

Samples shall be collected by the Contractor at approved locations upon delivery to the site at a frequency of one test sample per 100,000 square feet. Samples shall be identified by manufacturer's name, product identification, lot and roll number. The machine direction shall also be noted on the sample with a waterproof marker. The testing laboratory shall determine swell index, filtrate volume, and bentonite mass per unit area. Permeability and tensile strength shall be tested at the request of the Contracting Officer. Tests not meeting the requirements specified in Table 1 shall result in the rejection of applicable rolls. Determination of applicable rolls shall be as described in paragraph Tests, Inspections and Verifications.

3.2 INSTALLATION

3.2.1 Surface Preparation

The subgrade surface shall be smooth and free of ruts, erosion rills, or protrusions greater than 0.5 inches in depth or height, or as recommended by the manufacturer. The subgrade shall be compacted in accordance with Section 02444. Each day during placement of GCL, the Inspector and Installer shall inspect the surface on which GCL is to be placed and certify in writing that the surface is acceptable.

3.2.2 Placement

The Inspector and Contracting Officer shall be present during the handling, placement and covering of GCL. GCL shall be installed as soon as practical after completion and approval of the subgrade. GCL which has been hydrated prior to being covered by the overlying geomembrane or a minimum of 12 inches of cover soil shall be removed and replaced. Hydrated GCL is defined as material which has become soft as determined by squeezing the material with finger pressure, material which has exhibited swelling, or material which has a moisture content greater than 100 percent as determined by ASTM D 2216 or ASTM D 4643. If the subgrade is soil, construction equipment may be used to deploy GCL. If the subgrade is a geosynthetic, GCL shall be deployed by hand or by use of approved light weight equipment on pneumatic tires having a low ground contact pressure. On side slopes, GCL shall be anchored at the top and rolled down the slope to minimize wrinkles. Dragging of GCL panels over the ground surface will not be allowed. Edges shall be pulled tight to maximize contact and to smooth out wrinkles or creases. Construction equipment shall not operate directly on the surface of the placed GCL. Construction equipment shall be permitted to operate over GCL when the GCL has been covered by the geomembrane and a 12-inch loose lift of cover soil. Personnel working on the GCL surface shall wear footgear with soft soles and will take due care to avoid damaging the GCL.

3.2.3 Anchor Trench

Where anchor trenches are required, they shall be placed a minimum of 36 inches back from the edge of slopes to be covered. Anchor trenches shall be a minimum of 36 inches deep and 36 inches wide. The GCL shall extend to the back wall of the anchor trench. Soils used for backfill shall have a maximum particle size of 0.5 inches and shall be placed in two lifts. Compaction and testing requirements are described in Section 02444.

Additional run-out length may be provided at the tops of slopes as an alternative to anchor trenches. Run-out length shall be adequate to develop anchorage equivalent to an anchor trench.

3.2.4 Seams

On side-slopes, GCL shall be placed with seams oriented parallel to the line of maximum slope and shall be free of tension or stress upon completion of the installation. Panels shall be positioned with the overlap recommended by the manufacturer, but not less than 6 inches after shrinkage for panel sides or 24 inches after shrinkage for panel ends. Dirt or other foreign matter shall be removed from the overlap area immediately prior to seaming. If GCL is manufactured using a needle punched nonwoven geotextile, granular bentonite of the same type as the bentonite used for the GCL shall be placed along the entire overlap width at a minimum rate of 0.25 lbs. per linear foot or as recommended by the manufacturer. Construction adhesive or other approved seaming methods recommended by the manufacturer shall be used for horizontal seams on slopes. Overlaps which occur on slopes shall be constructed with the up slope GCL shingled over the down slope GCL.

3.2.5 PROTECTION

Adequate ballast (e.g. sand bags) shall be placed on GCL to prevent uplift by wind. Only those GCL panels which can be anchored and covered in the same day shall be unpackaged and installed. If exposed GCL cannot be covered before the end of a working day, it shall be temporarily covered with plastic or other waterproof material and ballasted until construction can resume. Trimming of GCL and placement of granular bentonite shall be done to avoid contamination of drainage materials by bentonite particles.

3.3 REPAIRS

Holes or tears in GCL shall be repaired by placing a patch of GCL extending a minimum of 12 inches beyond the edges of the hole or tear. If the GCL contains a needle punched nonwoven geotextile, granular bentonite of the same type as the bentonite within the GCL shall be placed along the entire overlap width at a minimum rate of 0.25 lbs. per linear foot or as recommended by the manufacturer. Patches shall be secured with a construction adhesive or other approved methods as recommended by the manufacturer.

3.4 PENETRATIONS

Penetration details shall be as recommended by the GCL manufacturer. As a minimum, pipe penetrations shall incorporate a collar of GCL wrapped around the pipe and securely fastened. Dry bentonite or bentonite paste shall be placed around the penetration for additional protection.

3.5 COVERING

GCL shall not be covered prior to inspection and approval by the Contracting Officer. The overlying material shall not be deployed such that tensile stress is mobilized in GCL.

-- End of Section --

SECTION 02444

SUBGRADE LAYER

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 698	Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5-lb (2.49-kg) Rammer and 12-in (305-mm) Drop
ASTM D 1556	(1990) Density of Soil in Place by the Sand-Cone Method
ASTM D 2216	(1992) Laboratory Determination of Water(Moisture) Content of Soil and Rock
ASTM D 2487	(1992) Classification of Soils for Engineering Purposes
ASTM D 2922	1991) Density of Soil and Soil-Aggregatein Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

1.2 SUBMITTALS

Submittals having an "FIO" designation are for information only.

1.2.1 Testing; FIO

Within 24 hours of conclusion of physical tests, 2 copies of test results, including calibration curves and results of calibration tests.

1.2.2 Qualifications; FIO

Qualifications of the commercial testing laboratory or Contractor's testing facilities.

1.3 DEGREE OF COMPACTION

Degree of compaction is a percentage of the maximum laboratory dry density obtained by the test procedure presented in ASTM D 698 (Standard Proctor). Degree of compaction shall be expressed as a percentage of the maximum laboratory dry density obtained by the appropriate procedure as defined above. Percentage of maximum laboratory dry density has been abbreviated hereinafter as percent maximum density.

PART 2 PRODUCTS

2.1 MATERIALS:

2.1.1 Satisfactory Materials

Satisfactory materials shall comprise any materials classified by ASTM D 2487, as SM, SW, SP, SC, SM-SC, CL, and CH and shall be free of trash, debris, roots, or other organic matter, or stones larger than 2 inches in any dimension.

2.1.2 Unsatisfactory Materials

Unsatisfactory materials shall comprise any materials classified by ASTM D 2487, as GW, GC, PT, OH, OL, ML and MH.

2.1.3 Foundation (Grading Layer) Material

Foundation (grading layer) material shall consist of any satisfactory material as specified above.

PART 3 EXECUTION

3.1 BORROW MATERIAL

Borrow material shall be selected to meet the requirements and conditions of the particular fill for which it is to be used.

All excavated material shall be used as initial fill material in the foundation layer.

3.2 PREPARATION OF GROUND SURFACE FOR FILL

Partially buried, contaminated objects in the area to receive foundation material shall not be disturbed.

3.3 FILL PLACEMENT

To the extent practical, demolition debris shall be placed in the lower lifts of fill and surrounded by compacted material.

Satisfactory materials shall be used in bringing fills and backfills to the lines and grades indicated on the design drawings. Satisfactory materials shall be placed in horizontal layers not exceeding 8 inches in loose thickness, or 6 inches in thickness when compacted with hand-operated compaction equipment.

After placing, each layer shall be plowed, disked, or otherwise broken up, moistened or aerated as necessary, thoroughly mixed, and compacted to 85 percent maximum density in accordance with ASTM D 698.

Density requirements will not be required for the first lift of the foundation layer. The first lift shall be compacted by a minimum of 5 passes of a 40,000 pound roller.

3.4 FILL PROTECTION

During construction, fills shall be kept shaped and drained.

3.5 TESTING

Testing shall be performed by an approved commercial testing laboratory or may be performed by the Contractor subject to approval. If the Contractor elects to establish testing facilities, no work requiring testing will be permitted until the Contractor's facilities have been inspected and approved by the Contracting Officer. In-place fill density shall be measured by ASTM D 2922 (nuclear method)at a rate of 1 test per 10,000 square feet per lift. A laboratory QC check of in-place density will be made using ASTM D 1556 (sand cone method)at a rate of 1 test per 10 nuclear density tests. In-place moisture content shall be measured by ASTM D 3017 (nuclear method) when density is tested. A laboratory QC check of in-place moisture content shall be made using ASTM D 2216 (laboratory method) when the sand cone samples are laboratory tested for density. The sand cone test shall be performed adjacent to the location where a nuclear density test was performed to insure a proper correlation is established between the two density test procedures. When test results indicate, as determined by the Contracting Officer, that compaction is not as specified, the material shall be removed, replaced and recompacted to meet specification. Tests on recompacted areas shall be performed to determine conformance with specification requirements. The following number of tests, if performed at the appropriate time, shall be the minimum acceptable for each type operation.

3.5.1 Moisture Content

Moisture content shall be determined on materials obtained from each density sample location. Moisture content shall be +/- 2% of optimum moisture as determined by ASTM 698.

3.5.2 Field In-Place Density Tests:

One test per 10,000 square feet per lift of compacted fill material, or fraction thereof.

3.5.3 Optimum Moisture and Laboratory Maximum Dry Density

The laboratory maximum dry density shall be determined from materials using—ASTM D 698. The optimum moisture content shall also be determined. A laboratory maximum dry density test shall be run at a rate of 1 test per source or soil type, and 1 test per 10,000 compacted cubic yards thereafter.

3.5.4 Soil Classification

Soils shall be classified in accordance with ASTM D 2487 at a rate of once per source or soil type.

--End of Section --

SECTION 02671

GROUND-WATER MONITORING WELLS

PART 1 GENERAL

1.1 (NOT USED)

1.2 MEASUREMENT AND PAYMENT (not applicable)

1.3 SYSTEM DESCRIPTION (not applicable)

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation, submittals having an "FIO" designation are for information only.

1.4.1 Description of well abandonment procedures.

1.4.2 Documentation and Quality Control Reports; FIO

Documentation and quality control reports as described in paragraph DOCUMENTATION AND QUALITY CONTROL REPORTS.

1.4.3 Qualifications; FIO

Qualification documentation in accordance with paragraph QUALIFICATIONS.

1.4.4 Permits and Licenses; FIO

Permits and licenses in accordance with paragraph Permits and Licenses.

1.5 QUALIFICATIONS

A geologist, geotechnical engineer, or qualified technician with at least 3 years experience in hazardous waste projects, soil and rock logging, and monitoring well installation and abandonment shall be on site and responsible for all geophysical and bore hole logging, drilling, and well abandonment activities. The driller must be licensed in the state of Texas, according to the state requirements. The Contractor shall have a minimum of 3 years of monitor well installation and abandonment experience.

1.6 REGULATORY REQUIREMENTS

1.6.1 Permits and Licenses

Local, state, or federal permits or licenses required to perform the work included in this contract shall be obtained prior to commencing drilling and monitoring well installation operations.

1.6.2 Statutes and Regulations

Work included in this contract shall be conducted in strict compliance with applicable local, state and federal regulations, statutes, and codes. Compliance shall be the responsibility of the Contractor.

1.6.3 Notification

The Contracting Officer shall be notified 5 days prior to drilling and abandonment activities. The Contractor shall be responsible for contacting the State of Texas in accordance with the applicable reporting requirements.

1.6.4 Disposal

Drill cuttings and return fluids resulting from drilling and well abandonment activities, and fluids from material/equipment decontamination activities shall be disposed of in accordance with paragraph Disposition of Drill Cuttings.

1.7 DELIVERY, STORAGE, AND HANDLING (not applicable)

1.8 SITE CONDITIONS

Access to each monitoring well site is the responsibility of the Contractor. The Contractor shall visit each well location to observe any condition that may hamper transporting drilling or other equipment or personnel to the site. If clearing is necessary, the Contractor and the Contracting Officer, or his representative, shall agree on a suitable clearing plan and the location of any required access road.

1.8.1 Existing Conditions

The Contractor shall protect and maintain existing survey monuments, and all existing monitoring wells not scheduled for abandonment, from damage from equipment and vehicular traffic. Any items damaged by the Contractor shall be repaired by the Contractor at its expense, with no increased cost of time or money to the Government. Wells scheduled for abandonment shall also be protected from damage so that abandonment may be performed according to these specifications.

1.9 SEQUENCING AND SCHEDULING

1.9.1 Plan Submittals

Work shall be completed before the installation of the GCL liner.

1.10 TESTS, INSPECTIONS, AND VERIFICATIONS (not applicable)

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Cement and Bentonite Grout

Cement grout shall be a mixture of a maximum of 6 gallons of approved water per 94 lb bag of portland cement, which conforms to ASTM C 150, Type I. Not more than 5 percent by weight of bentonite powder shall be added to form cement/bentonite grout to reduce shrinkage and to hold the cement in suspension prior to the grout set. High-solids bentonite grout shall be made from sodium bentonite powder and/or granules. Water from an approved source shall be mixed with these powders or granules to form a thick bentonite slurry. The slurry will consist of a mixture of bentonite and the manufacturer's recommended volume of water to achieve an optimal seal. The slurry must contain at least 20 percent solids by weight and have a density of 9.4 lb per gallon of water or greater.

2.1.2 Disposition of Drill Cuttings

Cuttings from the drilling and abandonment operations shall be be uniformily spread on the site to receive the geomembrane and geocomposite clay cover.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Decontamination

The drill rig, drill rods, drill bits, augers, temporary casing, well developing equipment, tremie pipes, grout pumping lines, and all other associated equipment shall be cleaned with high-pressure hot water/steam prior to drilling at each existing monitoring well location. Decontamination will be done in accordance with ASTM D 5088. Decontamination shall be performed at a central decontamination station. Cleaning shall be performed in an area that is remote from, and cross- or down gradient from the well being drilled.

3.1.2 Decontamination Station

The Contractor shall construct a temporary decontamination pad on-site. The pad shall be bermed and slightly inclined towards a sump located in one of the back corners of the pad. Plastic sheeting shall line the pads and berms to contain decontamination water. Plywood sheeting, exterior grade, shall be placed over the plastic sheeting to prevent damage to the plastic and allow the drill rig and heavy equipment to use the pad. The minimum dimensions of the pad shall be the length and width of the drill rig, plus four feet per side to allow access and steam cleaning. Yellow ribbon shall be used to encircle the decontamination pad. Water collected in the sump shall be pumped using a trash pump to transfer water to a 55 gallon drum labeled "Decontamination Pad Sump Water." Solid waste shall be transferred to a separate 55 gallon drum labeled "Decontamination Pad Sump Sludge."

3.2 INSTALLATION (NOT APPLICABLE)

3.3 SURVEYS (not applicable)

3.4 WELL ABANDONMENT

All wells to be abandoned under this contract shall be abandoned according to the requirements of the State of Texas, and in accordance with ASTM D 5299, and the requirements of these specifications. Well abandonment includes the removal of all materials including backfill materials, casing, screen, bentonite seal, grout, filter pack, and any other materials. Wells to be abandoned shall be grouted from the bottom to within 4 feet of the top of the ground surface. A non-shrinking cement grout shall be mechanically mixed in accordance with paragraph Cement and Bentonite Grout, and placed in one continuous operation into the well cavity to within 4 feet of the ground surface. Grout injection shall be in accordance with ASTM D 5092. If the interval to be grouted is less than 15 feet, the grout may be placed either by pouring or pumping. The tremie pipe shall be thoroughly cleaned with high pressure hot water/steam before use in each well. The bottom of the tremie pipe shall be constructed so as to direct the discharge to the sides rather than downward. The discharge end of the tremie pipe shall be submerged at all times. Additional grout shall be added from the surface to maintain the level of the grout near the land surface as settlement occurs. The top 4 feet shall be backfilled with compacted uncontaminated clay soil. The Contractor shall maintain a well abandonment record as specified in paragraph Well Abandonment Records. Ground water levels shall be measured in all borings prior to removing the casing. These water levels shall be included in the well abandonment records.

3.5 WELL ACCEPTANCE (not applicable)

3.6 SITE CLEANUP

After completion of the work, tools, appliances, surplus materials, temporary drainage, rubbish, and debris incidental to work shall be removed.

3.7 DOCUMENTATION AND QUALITY CONTROL REPORTS

The Contractor shall establish and maintain documentation and quality control reports for well abandonment to record the desired information and to assure compliance with contract requirements, including, but not limited to, the following:

3.7.1 Well Abandonment Records.

Abandonment records shall include, as a minimum, the following:

3.7.1.1 Project name.

3.7.1.2 Well number.

3.7.1.3 Well/boring location, depth and diameter.

3.7.1.4 Date of abandonment.

3.7.1.5 Method of abandonment.

3.7.1.6 All materials used in the abandonment procedure and the interval in which test materials were placed.

3.7.1.7 Casing, and or other items left in hole by depth, description, and composition.

3.7.1.8 Description and total quantity of grout used initially.

3.7.1.9 Description and daily quantities of grout used to compensate for settlement.

3.7.1.10 Water or mud level (specify) prior to grouting and date measured.

3.7.1.11 The reason for abandonment of the monitoring well.

3.7.2 Texas Natural Resource Conservation Commission

A TNRCC multi-purpose completion report shall be completed for each well abandonment.

-- End of Section --

017903

SECTION 02930

ESTABLISHMENT OF TURF

PART 1 GENERAL

1.1 SCOPE

This section covers the establishment of turf as indicated on the drawings. Turfing work shall be accomplished only when satisfactory results can be expected. When drought, excessive moisture, high winds, or other factors prevail to such an extent that satisfactory results are not likely to be obtained, the turfing operations shall stop. All turfing operations shall be conducted across the slopes.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ASSOCIATION OF OFFICIAL ANALYTICAL CHEMISTS (AOAC)

Official Methods of Analysis.

FEDERAL SPECIFICATION (FS)

FS O-F-241 (Rev. D) Fertilizers, Mixed, Commercial

Texas Department of Transportation

Standard Specifications for Construction of Highways and Bridges

U.S. DEPARTMENT OF AGRICULTURE (USDA)

USDA-01 (1939) Federal Seed Act of August 9, 1939
(53 Stat. 1275) Rules and Regulations

1.3 SUBMITTALS

Submittals having an "FIO" designation are for information only.

1.3.1 Statements, FIO

The Contracting Officer shall be furnished six signed copies of statement from vendor, stating that each container of seed delivered is labeled in accordance with the Federal Seed Act, USDA-01, and State seed laws, and is at least equal to requirements previously specified.

1.3.2 Invoices, FIO

Six signed copies of invoices for fertilizer shall be submitted to the Contracting Officer. Invoices shall show quantities and grade of each fertilizer furnished.

1.3.3 Certificates of Compliance; FIO.

Prior to the delivery of materials, certificates of compliance for the materials listed below shall be submitted certifying that materials meet the requirements specified.

a. Seed: Mixture percentage, pure live seed, weed seed content, germination.

b. Sprigs: Genetic purity.

1.3.4 Material for Vegetative Mulch; FIO.

Representative samples of the material proposed for use as vegetative mulch shall be submitted for approval.

PART 2 PRODUCTS

2.1 FERTILIZER

Fertilizer shall be in accordance with Fed. Spec. FS O-F-241 and shall be 16-20-0 grade, Type 1, Class 2, or equal, pelleted, uniform in composition, free-flowing, and suitable for application with approved equipment. The fertilizer shall be delivered to the site in bags or other convenient containers, each fully labeled, conforming to the applicable State fertilizer laws, and bearing the name, trade name or trademark, and warranty of the producer. In lieu of bags or containers, fertilizer may be furnished in bulk. Bulk deliveries shall be accompanied by a certificate giving net pounds furnished, chemical analysis, name, tradename, and warranty of the supplier of the fertilizer.

2.2 SEED

Seed labeled in accordance with U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act shall be furnished. Seed shall be furnished in sealed, standard containers unless written exception is granted. Seed that is wet or moldy or that has been otherwise damaged in transit or storage will not be acceptable. The seed shall be free of field bindweed, hedgeweed, and nutgrass seed. Seed shall not contain other noxious weed seed in excess of the limits allowable under the Federal Seed Act and applicable State seed laws. Seed labeled as mixture or pasture mixture will not be acceptable. Each seed container shall bear the date of the last germination which date shall be within a period of six months prior to commencement of planting operations.

Seed mix shall conform to Texas Department of Transportation Standard Specifications for Construction of Highways and Bridges, Item 164.2 - Seeding For Erosion Control - Materials, and Item 164.3 - Construction Methods. Table 2 of the referenced specification lists the following mix for warm season planting between February 1 and May 15 in the vicinity of LHAAP:

Green Spangletop 0.7 lbs pure live seed/acre

Contracting Officer. Such resampling and retesting shall be made by or under the supervision of the Government. If these retests reveal the seed to be below the specified pure live seed content, the Contractor shall be required to plant additional seed to compensate for the deficiency. The seed retest will be conducted by the State Seed Laboratory.

3.1.3 Vegetative Mulch

At least 10 days prior to first placement, the Contracting Officer shall be notified of sources from which mulch materials are available and the quantities thereof.

3.2 APPLICATION OF FERTILIZER

Fertilizer shall be applied not more than 24 hours in advance of tilling operations. The fertilizer distributor box shall be equipped with baffle plates to prevent downward movement of fertilizer when operating on the slope. Fertilizer shall be distributed with a fertilizer distributor (Ezee Flow) or approved equal. Fertilizer shall be uniformly distributed at the rate of 500 pounds of 16-20-0 or equal per acre prior to tilling.

3.3 PREPARATION OF GROUND SURFACE

3.3.1 General

Equipment, in good condition, shall be provided for the proper preparation of the ground. Equipment shall be subject to approval before work is started.

3.3.2 Clearing

Prior to grading and tilling, vegetation that may interfere with operations shall be mowed, grubbed, and raked. The collected material shall be removed from the site. The surface shall be cleared of stumps, and stones larger than 1-inch in diameter. Roots and other materials that might hinder the work or subsequent maintenance shall also be removed.

3.3.3 Grading

Previously established grades shall be maintained on the areas to be treated in a true and even condition, and necessary repairs shall be made to previously graded areas. All surfaces shall be left in a smooth condition to prevent formation of depressions.

3.3.4 Tillage

After the areas have been brought to the grades shown, tillage shall be accomplished in such manner as to destroy existing vegetation and to prepare an acceptable seed bed. The Contractor shall utilize tractors with adequate horsepower and heavy duty tillage equipment in accomplishing the specified tillage operations. Depth of tillage shall be 4 inches.

017906

APPENDIX H

017907

APPENDIX H

CONSTRUCTION DRAWINGS

017908

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

June 6, 1996

CERTIFIED MAIL
P 836 901 729
RETURN RECEIPT REQUESTED

James A. McPherson, Commander's Representative
Longhorn/Louisiana Army Ammunition Plant
Attn: SIOLH-CR
P.O. Box 30058
Shreveport, LA 71130-0058

Re: Longhorn Army Ammunition Plant
Group 2 - Time Critical Removal Action at Landfill Site 16
Draft Design Analysis Report and May 29, 1996 Meeting Handouts - TNRCC Comments

Dear Mr. McPherson:

The Texas Natural Resource Conservation Commission (TNRCC) staff has completed our review of the above referenced document, which was received on May 20, 1996 and further discussed in a meeting on May 29, 1996. Our comments are enclosed. If you have any questions or comments 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-AT)
Jonna Polk, COE Tulsa District (CESWT-PP-EA)

Longhorn Army Ammunition Plant
Group 2 - Time Critical Removal Action for Landfill 16
Draft Design Analysis Report and May 29, 1996 Meeting Handouts
TNRCC Comments (Diane Poteet and Peter Waterreus)

No.	Section/Page	Comment
1	4.1/4-1, 5.1/5-1 & 2, and 5/29/96 cross section (see Attachment I)	Please note that the second sentence of the first paragraph states the following: "...a shallow saturated sand zone consisting of..., and is at first dry to moist and then generally becoming saturated at depths of 15-20 feet (BGS)." Also, please note that on the 5/29/96 cross section (Attachment I), the water level marks (▼) for the shallow aquifer are not above the aquifer. Both of these indicate that the shallow aquifer is an unconfined aquifer (not fully saturated). Please clarify both here and in Section 5/1, pages 5-1 and 5-2. Was the saturated thickness or the sand thickness used to find the aquifer thickness for the Hantush equations? Since the Hantush (1960) equations were used to determine aquifer parameters for a semi-confined aquifer, than Neuman's or some similar equation should be considered for an unconfined aquifer.
2	5/29/96 cross section	Is the water level of the intermediate water-bearing zone (layer 4) shown? Since a cross section like this is needed in the report (the report is very confusing without it), please show/label the water levels for both zones on this cross section and include it in the report. Vertical gradients need to be determined and shown. Is there an upward gradient from the intermediate water-bearing zone to the shallow water-bearing zone?
3	4.1/4-2	Second sentence, first paragraph: Please add that the six nested piezometer pairs are arranged in a straight line configuration. Also, with a linear arrangement, how were the shapes of the radii of influence determined? Were they assumed to be circular?
4	4.2.1/4-3	If the pneumatic pumps must cycle on and off, where is the contamination going when the pumps cycle off? Is the contamination passing the wells? Are the pumps cycling off together? It was stated that the model was based on steady state conditions, if so, how does the model take into account the cycling on and off of the pneumatic pumps? Also, if dewatering occurs (steady state conditions no longer exist) from long term pumping, can the contamination move pass the wells?

017909

DEPARTMENT OF THE ARMY
LONGHORN/LOUISIANA ARMY AMMUNITION PLANTS
MARSHALL, TEXAS 75671-1059

REPLY TO
ATTENTION OF

June 10, 1996

SIOLH-CR

017910

Mr. H.L. Jones
Texas Natural Resource Conservation
Commission
2916 Teague Drive
Tyler, TX 75701

SUBJECT: Final Project Work Plans, Interim Remedial Action Landfills 12 & 16 Caps, Appendix G - Project Specifications, Appendix H - Construction Drawings

Enclosed is one copy of the subject document.

If you have any questions, please contact Mr. David Tolbert, at 903-679-2728.

Sincerely,

James McPherson
Commander's Representative

Enclosure

DEPARTMENT OF THE ARMY
LONGHORN/LOUISIANA ARMY AMMUNITION PLANTS
MARSHALL, TEXAS 75671-1059

REPLY TO
ATTENTION OF

June 10, 1996

SIOLH-CR

017911

Mr. Chris Villareal
Superfund Division (6SF-AT)
U.S. Environmental Protection Agency
1445 Ross Avenue
Dallas, Texas 75202-2733

SUBJECT: Final Project Work Plans, Interim Remedial Action Landfills 12 & 16 Caps, Appendix G - Project Specifications, Appendix H - Construction Drawings

Enclosed are two copies of the subject document.

If you have any questions, please contact Mr. David Tolbert, at 903-679-2728.

Sincerely,

James McPherson
Commander's Representative

Enclosures

DEPARTMENT OF THE ARMY
LONGHORN/LOUISIANA ARMY AMMUNITION PLANTS
MARSHALL, TEXAS 75671-1059

REPLY TO
ATTENTION OF

June 10, 1996

017912

SIOLH-CR

Ms. Diane Poteet
Superfund Investigation Section
Texas Natural Resource Conservation Commission
Post Office Box 13087
Austin, Texas 78711-3087

SUBJECT: Final Project Work Plans, Interim Remedial Action Landfills 12 & 16 Caps, Appendix G - Project Specifications, Appendix H - Construction Drawings

Enclosed are three copies of the subject document.

If you have any questions, please contact Mr. David Tolbert, at 903-679-2728.

Sincerely,

James McPherson
Commander's Representative

Enclosures

DEPARTMENT OF THE ARMY
LONGHORN/LOUISIANA ARMY AMMUNITION PLANTS
MARSHALL, TEXAS 75671-1059

REPLY TO
ATTENTION OF

June 13, 1996

SIOLH-CR

017913

Mr. Chris Villareal
Superfund Division (6SF-AT)
U.S. Environmental Protection Agency
1445 Ross Avenue
Dallas, Texas 75202-2733

SUBJECT: Group IV Sumps Groundwater Monitoring Quarterly Report

Enclosed are two copies of the subject document. Please submit comments by July 15, 1996.

If you have any questions, please contact Mr. David Tolbert, at 903-679-2728.

Sincerely,

James McPherson
Commander's Representative

Enclosures

DEPARTMENT OF THE ARMY
LONGHORN/LOUISIANA ARMY AMMUNITION PLANTS
MARSHALL, TEXAS 75671-1059

REPLY TO
ATTENTION OF

June 13, 1996

SIOLH-CR

017914

Mr. H.L. Jones
Texas Natural Resource Conservation
Commission
2916 Teague Drive
Tyler, TX 75701

SUBJECT: Group IV Sumps Groundwater Monitoring Quarterly Report

Enclosed is one copy of the subject document. Please submit comments by July 15, 1996.

If you have any questions, please contact Mr. David Tolbert, at 903-679-2728.

Sincerely,

David Tolbert
for James McPherson
Commander's Representative

Enclosure

DEPARTMENT OF THE ARMY
LONGHORN/LOUISIANA ARMY AMMUNITION PLANTS
MARSHALL, TEXAS 75671-1059

REPLY TO
ATTENTION OF

June 13, 1996

SIOLH-CR

017915

Ms. Diane Poteet
Superfund Investigation Section
Texas Natural Resource Conservation Commission
Post Office Box 13087
Austin, Texas 78711-3087

SUBJECT: Group IV Sumps Groundwater Monitoring Quarterly Report

Enclosed are two copies of the subject document. Please submit comments by July 15, 1996.

If you have any questions, please contact Mr. David Tolbert, at 903-679-2728.

Sincerely,

James McPherson
Commander's Representative

Enclosures

916410
017916

LONGHORN
ARMY AMMUNITION PLANT

GROUP IV SUMPS
GROUNDWATER MONITORING
QUARTERLY REPORT

FEBRUARY 1996 SAMPLING ROUND

JUNE 1996

U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT

017917

U.S. ARMY

LONGHORN ARMY AMMUNITION PLANT

KARNACK, TEXAS

GROUP IV SUMPS
GROUNDWATER MONITORING
QUARTERLY REPORT

FEBRUARY 1996 SAMPLING ROUND

Prepared by:

U.S. Army Corps of Engineers
Tulsa District
P.O. Box 61
Tulsa, Oklahoma 74121-0061

JUNE 1996

017918

EXECUTIVE SUMMARY

Phase I and Phase II of a multi-phase investigation of 125 underground sumps and 20 waste rack sumps located throughout the Longhorn Army Ammunition Plant (LHAAP) production area has been performed by the U.S. Army Corps of Engineers (USACE), Tulsa District. Phase I of the investigation, conducted in June -August 1993, consisted of drilling subsurface borings to investigate potential soil contamination adjacent to all 145 sumps. Analytical results from the first phase of the investigation indicated the presence of several organic contaminants in the subsurface soil. Based on these findings, a second phase of remedial investigations was conducted to determine if groundwater had been impacted. During the Fall of 1994, a total of 71 monitoring wells were installed in the uppermost water bearing zone within the Cypress Aquifer as part of the phase II investigations. Samples from each of the monitoring wells were collected in November 1994 and analyzed for metals, explosives, volatile organics compounds(VOCs), and semi-volatile organic compounds (SVOCs). Selected wells were also sampled for total petroleum hydrocarbons (TPH) and cyanide. The results indicated that VOCs, primarily trichloroethene (TCE), 1,2-dichloroethene (1,2-DCE), and tetrachloroethene (PCE), had been released to the groundwater. A second groundwater sampling round was conducted in February 1996. This document presents the results of the February 1996 sampling of the Sumps monitoring wells.

In February 1996, depths to water ranged from 5.00 ft below ground surface (bgs) at LHSMW-57 located in the South Plant 3 area to 20.26 ft bgs at LHSMW-61 located in the Y area. Water table elevations ranged from 234.44 feet at LHSMW-14 in the Plant 400 area to 171.49 feet, National Geodetic Vertical Datum (NGVD) at LHSMW-71 in the Static Test area. When compared to the December 1994 sampling round, groundwater elevations were lower in 67 of 72 monitoring wells during the February 1996 sampling round. The greatest change in groundwater elevation between the December 1994 and the February 1996 sampling round occurred in monitoring well LHSMW-26 where the static water level decreased by 2.19 feet. Monitoring wells LHSMW-40 and LHSMW-48 were dry during the February 1996 sampling round. The water table generally conformed to topography. The predominant groundwater flow direction is generally from west to east-northeast toward Caddo Lake, although locally there are components of groundwater flow to the southeast. Overall, the groundwater gradient decreases from west to east and has an average hydraulic gradient of 0.0037 feet per foot. Hydraulic gradient is steepest in the Plant Production 400 area (0.033 feet per foot) reflecting, in part, the steeper surface topography in this area. In the Y and Static Test areas on the east side of the plant, nearer to Caddo Lake, the gradient flattens to 0.0018 feet per foot.

No pesticides/PCBs or herbicides were detected in the wells selected for analysis. Cyanide was not detected in any of the wells selected for analysis. TPH analysis identified two large organic peaks in the gasoline range in monitoring well LHSMW-43 at a concentration of 12.9 mg/l. This was the only TPH detection in the wells selected for TPH analysis.

TCE, PCE, 1,1,1-trichloroethane, 1,1-dichloroethane, 1,1-dichloroethene, 1,2-DCE, vinyl chloride, and dichlorodifluoromethane are identified as the VOC contaminants of potential concern (COPCs) for the February 1996 sampling round. TCE was detected nearly three times as often (21 detections versus 8 detections) as 1,2-DCE, the next most frequently detected VOC contaminant. Given that 1,2-DCE, as well as other VOC COPCs, may be TCE degradation by-products, it is apparent that TCE is the dominant groundwater contaminant. With few exceptions, all other VOC COPCs were detected only when TCE was also detected. A total of ten SVOCs were detected in the February 1996 sampling round. The predominant SVOCs, Bis(2-ethylhexyl)phthalate and Di-n-octyl-phthalate, were determined to be a result of laboratory contamination and not present in the groundwater. No SVOCs were detected above their sample quantitation limit (SQL) in more than one sample and were therefore not considered COPCs. The maximum concentration of any SVOC was 7.5 ug/l for pentachlorophenol (LHSMW-47).

Numerous detections of high explosives (HE) were reported for the February 1996 sampling round. However, all of the concentrations were reported to be less than 1 ug/l and the majority of detections were "J" qualified because they were detected at concentrations below their respective detection limits (SQL). The high explosives tetryl, 3-nitrotoluene, 2,6-dinitrotoluene, 2-amino-4,6,-dinitrotoluene, 4-amino-2,6-dinitrotoluene, and nitrobenzene are considered COPCs. 3-Nitrotoulene was the most frequently detected high explosive. Reported concentrations for 2-nitrotoluene, and nitrobenzene are less than two times the detection limit and are therefore likely a result of instrument noise.

Metals exceeding their UTLs include barium (1 exceedance in 72 samples), calcium (1 exceedance in 72 samples), chromium (15 exceedances in 72 samples), nickel (28 exceedances in 72 samples) selenium (10 exceedances in 72 samples), strontium (1 exceedance in 72 samples), and thallium (2 exceedances in 72 samples). Based on the fact that barium, calcium, and strontium were each detected at a concentration exceeding their respective UTL in only one sample, they are not considered to be COPCs. Therefore chromium, nickel, selenium and thallium are the metals COPCs for the February 1996 sampling round.

Analysis of the distribution of VOC detections suggests that eight separate VOC groundwater contaminant plumes may be present in the Plant Production area. Downgradient and lateral extent of only one plume can be determined with existing monitoring well control. The largest contiguous area of VOC contamination, based on number and density of wells is the plume located in the center of the Plant 3 area. Plume maps of the primary metals COPCs show that the majority of elevated chromium and nickel concentrations are found in the Plant 3 area. The other locations where chromium and nickel concentrations are elevated include the area east of the Shop and 200 Areas and the Y and Static Test Areas.

Based on analytical findings, groundwater contaminant site characterization for the Sumps area at LHAAP is not complete. Additional monitoring wells are recommended to fully delineate the horizontal extent of groundwater contamination within the uppermost water bearing zone of the Cypress Aquifer. It is recommended that groundwater monitoring be continued on a semi-annual basis. In addition, it is recommended that, contingent upon on the results of the next sampling round, to include any phase III wells, the analyte list be modified to include only VOCs, HEs and selected metals. Monitoring well LHSMW-43 should also continue to be sampled for TPH.

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SECTION 1.0 INTRODUCTION

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1.1 Background

Phase I and Phase II of a multi-phase investigation of 125 underground sumps and 20 waste rack sumps located throughout the Longhorn Army Ammunition Plant (LHAAP) production area has been performed by the U.S. Army Corps of Engineers (USACE), Tulsa District. Phase I of the investigation, conducted in June -August 1993, consisted of drilling subsurface borings to investigate potential soil contamination adjacent to all 145 sumps. Analytical results from the first phase of the investigation indicated the presence of several organic contaminants in the subsurface soil. Based on these findings, a second phase of remedial investigations was conducted to determine if groundwater had been impacted. During the Fall of 1994, a total of 71 monitoring wells were installed in the uppermost water bearing zone within the Cypress Aquifer as part of the phase II investigations. Samples from each of the monitoring wells were collected in November 1994 and analyzed for metals, explosives, volatile organics compounds(VOCs), and semi-volatile organic compounds (SVOCs). Selected wells were also sampled for total petroleum hydrocarbons (TPH) and cyanide. The results indicated that VOCs, primarily trichloroethene (TCE), 1,2-dichloroethene (1,2-DCE), and tetrachloroethene (PCE), had been released to the groundwater. A second groundwater sampling round was conducted in February 1996. This document presents the results of the February 1996 sampling of the Sumps monitoring wells.

1.2 Purpose and Scope

This quarterly report provides an evaluation of the groundwater quality data obtained in February 1996 and represents the second quarterly monitoring event conducted in the sumps monitoring wells at LHAAP. The site geologic and hydrogeologic conditions are briefly summarized, the field and analysis procedures and results of the groundwater monitoring program are discussed, and recommendations for future groundwater monitoring are presented. Detailed discussions of site geologic and hydrogeologic conditions, the monitoring well system, and the initial groundwater quality investigation and monitoring activities are presented in the reports Final Hydrogeological Assessment (USACE, May 1995), and Phase II Investigations of 125 Waste Process Sumps and 20 Waste Rack Sumps (USACE, September 1995).

1.3 Site Location and History

LHAAP is located in the sparsely populated Piney Woods region of East Texas, just north of the small community of Karnack in the northeast part of Harrison County. The nearest major cities are Marshall, Texas, approximately 14 miles to the southwest, and Shreveport, Louisiana, approximately 40 miles to the east (Figure 1-1). Facility boundaries enclose 8,493 acres between State Highway 43 and the southwest shore of Caddo Lake, a fresh water lake that straddles the Texas–Louisiana State line.

LHAAP is a government owned, contractor operated (current prime operating contractor is Thiokol Corporation) industrial facility operated under the jurisdiction of the U.S. Army Armament, Munitions, and Chemical Command. The facility was founded in 1942 to produce 2,4,6-trinitrotoluene (TNT) flake, an activity which continued until the end of World War II. From 1945 until 1952, the plant was deactivated and placed on standby status. After re-activation in February 1952, LHAAP operations included the production of pyrotechnic and illumination ammunition and rocket engines. Current operations consist of compounding pyrotechnic and propellant mixtures as well as general shipping and receiving and facility maintenance activities.

Because of suspected environmental problems associated with past production operations, LHAAP was placed on the National Priorities List (NPL) on 30 August 1990. On 30 December 1991, LHAAP entered into a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 120 Federal Facilities Agreement (FFA) with State and Federal environmental agencies to conduct remedial investigations and to perform appropriate actions necessary for proper site remediation.

1.4 Sumps Project Area and Description

The scope of the sumps investigation includes all sumps associated with past and present plant operations. The majority of the plant's sumps are located in areas of the facility known as the Plant Production Area (PPA) and the Y and Static Test areas which cover a large portion of the northern half of the facility (Figure 1-2). The majority of the monitoring wells installed to investigate releases from the sumps are located within the PPA. Covering about 1,180 acres, the PPA is located in the northwest quarter of the facility and is generally bounded plant boundaries on the north and west and by Goose Prairie Creek to the south, and by Karnack Avenue to the east. By comparison, only a few monitoring wells are located in the Y and Static Test areas. Located southeast of the main production area and southwest of Caddo lake, the Y and Static Test areas cover approximately 350 acres. A small number of sumps are located at the Burning Grounds site, located southeast of the PPA, however, this site is not included as part of the Sumps groundwater investigation because it is part of separate, on going investigations.

017925

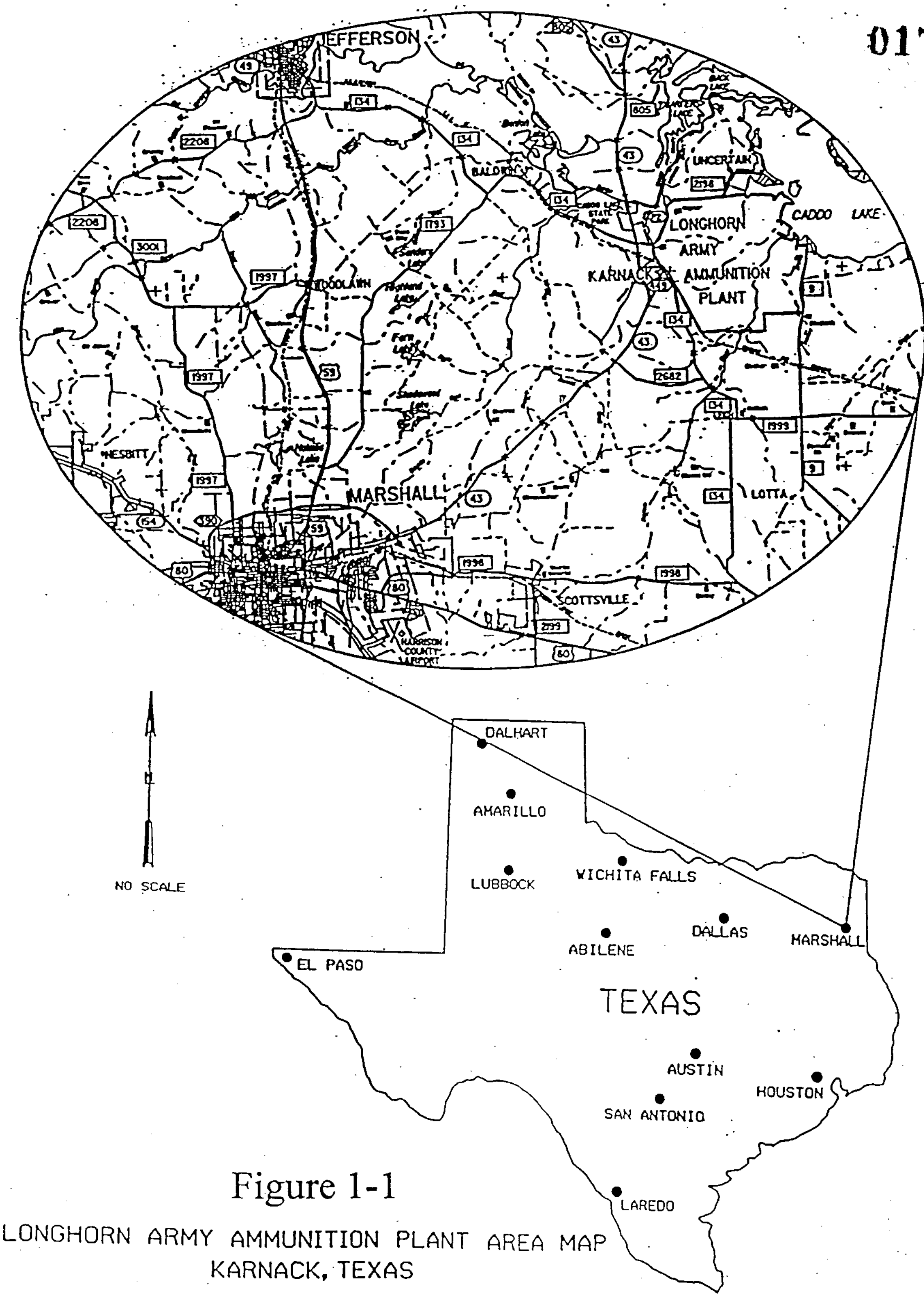

Figure 1-1

LONGHORN ARMY AMMUNITION PLANT AREA MAP
KARNACK, TEXAS

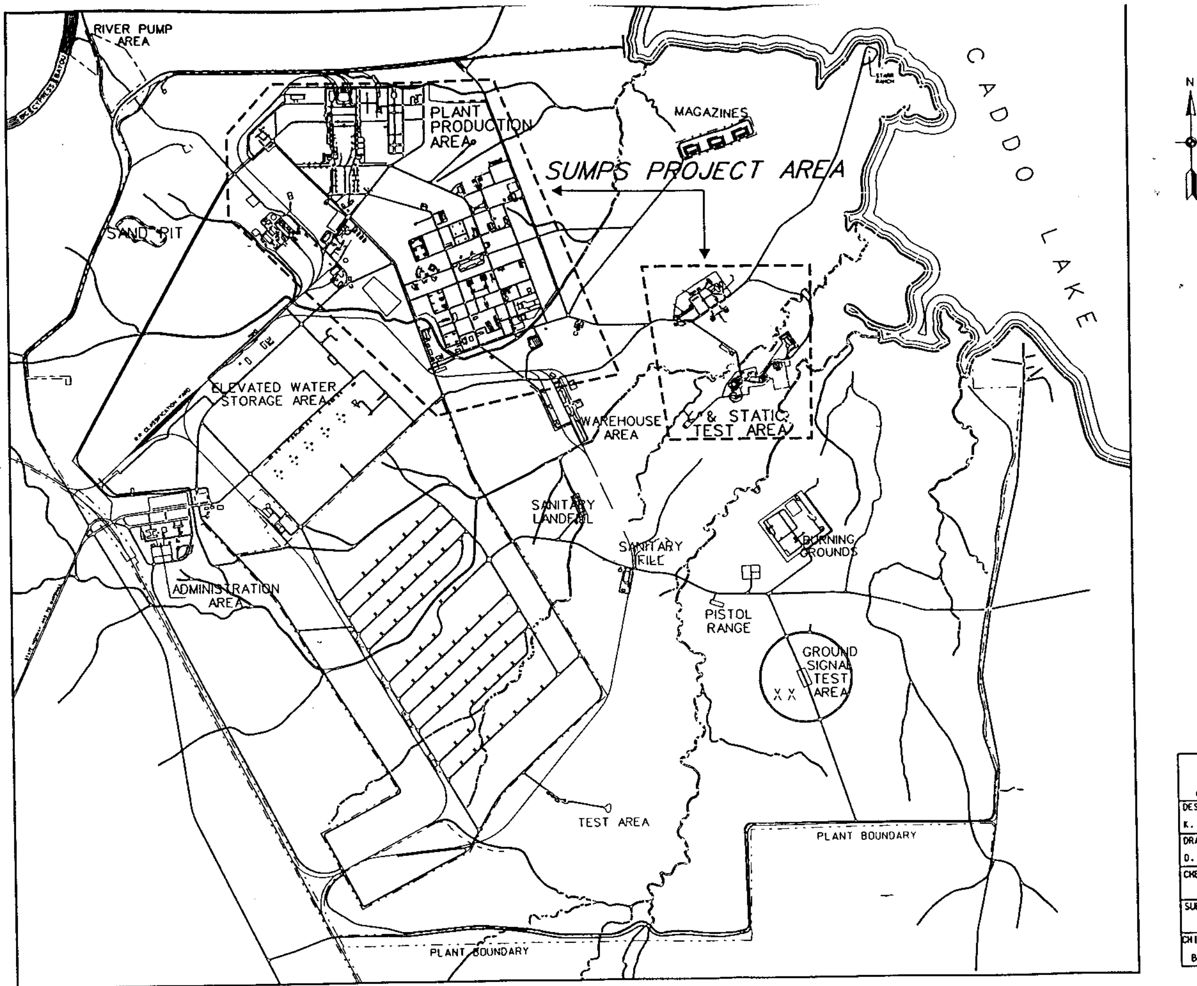

FIGURE 1-2

	U. S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS TULSA, OKLAHOMA
DESIGNED BY: K. KEBBELL	LONGHORN ARMY AMMUNITION P KARNAC, TEXAS SUMP PROJECT AREA LOCATION
DRAWN BY: D. WILKINS	
CHECKED BY:	
SUBMITTED BY: CHIEF, GEOTECHNICAL BRANCH	SCALE: AS SHOWN DATE: 9/95 DWG CODE:

SHEET REFERENCE NUMBER	INVIT DACW5 CONTR DACA5 SHEET

017926

017927

SECTION 2.0
GEOLOGY

This section summarizes the East Texas regional surface and subsurface geologic and hydrogeologic features. Much of the discussion concerning regional aspects of LHAAP was derived from the Phase II Sumps Investigation (USACE, September 1995) a summary report of the regional hydrogeology (USACE, May 1995) and a Site Characterization Report prepared by Sverdrup Environmental, Inc. (August 1995).

2.1 Geologic Setting

LHAAP is located on gently rolling, forested land with an average slope of about 3% towards the northeast (Environmental Protection Systems, 1984). Surface elevation ranges from 335 feet, NGVD in the northwest to about 165 feet along Caddo Lake in the northeast. Essentially all surface waters at LHAAP drain northeasterly through a series of perennial and intermittent streams that comprise the four principal drainage systems that cross the facility and empty into Caddo Lake.

The facility generally overlies strata of the Wilcox Group that gently dip 20–30 feet/mile (about 0.3 degree) to the west, towards the East Texas basin. Soil types present at LHAAP generally consist of heterogeneous mixtures of clays, silts, and sands that are generally indistinguishable from the underlying Wilcox sediments. Depending on their origin, soils at LHAAP can be broadly classified as either residual or alluvial. Residual soils are typically finer grained, composed mainly of silty or sandy clay occasionally interbedded with sand strata and reflect the nature of the underlying Wilcox. Alluvial soils, derived from drainage systems that cross the installation, are generally coarser-grained as sands, silts, and interbedded clays. Compared to residual soils, alluvial soils typically have a high sand and low clay content. Shallow subsurface geologic units of interest at LHAAP include the Eocene Wilcox and the underlying Paleocene Midway groups. The essential characteristics of each group are given below.

Wilcox Group. Stratigraphic thickness of the Wilcox ranges from a maximum 350 feet in the northwest corner of LHAAP to approximately 130 to 140 feet along the east side of the plant near Caddo Lake. The Wilcox consists of fine- to medium-grained sands, silts, and clays that are variously light gray, red, brown, and/or tan and contains occasional seams of lignite. Sands (mostly clayey sand, silty sand, and sandy silt) comprise about 50% of the aquifer, and the remainder consists mainly of various clays and silts. Based on regional studies, sands were deposited mainly in alluvial channels that flowed to the south and south-southwest across eastern Harrison

County. Although sand beds up to 50 feet thick are present locally, individual beds are generally thinner and highly erratic having little horizontal extent. Sands are usually interbedded with and in places largely surrounded by lower permeability saturated clays and silts that pinch out or grade into each other over short distances and are difficult to correlate between wells. The Wilcox Group is underlain by the Midway Group.

Midway Group. The Midway Group consists almost entirely of blue-gray to dark-gray plastic clay. These thick, laterally continuous clays of the Midway comprise the major aquiclude that underlies the main regional aquifer. Few wells in the LHAAP area have actually penetrated the Midway; as a result, there are no cores and few reliable lithologic logs of the Wilcox/Midway contact. Data from closely spaced wells (600 to 1,200 feet apart) drilled at the Burning Grounds (southeast of the sumps project area) show that the elevation of the top of the Midway varied up to 62 feet over a small horizontal distance.

2.2 Hydrogeologic Setting

In the LHAAP area, the Wilcox Group has been identified as the basal unit of the Cypress aquifer (also known as the Carrizo–Wilcox aquifer) by the Texas Water Development Board (Broom and Myers, 1966). The Cypress aquifer outcrops over most of Harrison County. Strata comprising the Cypress aquifer are (in ascending order) the Wilcox Group, Carrizo Sand, Reklaw Formation, and Queen City Sand. These units are believed to be hydraulically connected. At LHAAP, the Cypress aquifer consists only of the lower Wilcox Group due to an erosional unconformity.

Based on limited data, the saturated thickness ranges from about 280 feet at the west end of LHAAP to about 120 feet in the east. Decreasing saturated thickness results mainly from erosional thinning of the Wilcox Group in an easterly direction across LHAAP. Although characteristically discontinuous, Wilcox sands appear to be hydraulically interconnected as evidenced by saturated clays. Groundwater, whether in alluvial or Wilcox materials, generally occurs under unconfined conditions. Recharge is primarily by precipitation infiltration from the surface.

In a November 1994 facility-wide survey of groundwater elevations in monitoring wells, depths to water were commonly measured between 12 to 16 ft below ground surface (bgs) and ranged from 1.2 to 69.8 ft bgs (USACE, May 1995). Based on water level measurements taken since 1989, the water table commonly fluctuates by 1–3 feet annually with a maximum difference in individual wells of about 5 feet. Groundwater generally flows west to east across the plant toward Caddo Lake. Based mostly on slug test hydraulic conductivity data, the groundwater velocity is variable (depending on lithology and gradient) and is estimated to range from 2 to 150 feet/year.

2.3 Groundwater Elevations

Based on evidence from regional studies and monitoring well data, groundwater within the uppermost portion of the Cypress Aquifer appears to occur under unconfined conditions. Static water level measurements were collected, via electronic probe, from the sump wells during the December 1994 and the February 1996 sampling round. Table 2-1 presents reference elevations, depth to water, and groundwater elevations in the LHAAP Sump monitoring wells for both sampling rounds. In February 1996, depths to water ranged from 5.00 ft bgs at LHSMW-57 located in the South Plant 3 area to 20.26 ft bgs at LHSMW-61 located in the Y area. Water table elevations ranged from 234.44 feet at LHSMW-14 in the Plant 400 area to 171.49 feet, NGVD at LHSMW-71 in the Static Test area. When compared to the December 1994 sampling round, groundwater elevations were lower in 67 of 72 monitoring wells during the February 1996 sampling round. The greatest change in groundwater elevation between the December 1994 and the February 1996 sampling round occurred in monitoring well LHSMW-26 where the static water level decreased by 2.19 feet. Monitoring wells LHSMW-40 and LHSMW-48 were dry during the February 1996 sampling round. The water table generally conformed to topography.

A contour map of the uppermost potentiometric surface using available water level data from February 1996 measurements is shown in Figure 2-1. The predominant groundwater flow direction, as indicated by the arrows, is generally from west to east-northeast toward Caddo Lake, although locally there are components of groundwater flow to the southeast. Differences in hydraulic gradient, suggesting varying groundwater velocity, are indicated by variable contour spacing. Overall, the gradient decreases from west to east and has an average hydraulic gradient of 0.0037 feet per foot. Hydraulic gradient is steepest in the Plant Production 400 area (0.033 feet per foot) reflecting, in part, the steeper surface topography in this area. In the Y and Static Test areas on the east side of the plant, nearer to Caddo Lake, the gradient flattens to 0.0018 feet per foot.

2.4 Groundwater Flow Velocity

During phase II investigations, slug tests were performed at 27 groundwater monitoring wells located in and around the Plant 3, Y, Plant 2, and Static Test areas of LHAAP. The purpose of the slug tests was to determine hydraulic conductivity of the shallow, unconfined Cypress aquifer. Both falling head "slug-in" and rising head "slug-out " tests were performed for each well. Hydraulic conductivity was calculated using the Bower-Rice method. Field data, calculations, and plots for each test were previously presented in the (Final)

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TABLE 2-1 LHAAP SUMPS AREA GROUNDWATER ELEVATION SUMMARY

Well No.	State Plane Coordinates				December 1994 Measurements				February 1996 Measurements				Change in Groundwater Elevation (ft)
	Easting X	Northing Y	Grd.Elev. (ft)	Ref. Elev. (ft)	GW Depth(ft)	GW Elevation (ft)	TD (ft)	TD Elevation	GW Depth (ft)	GW Elevation (ft)	TD (ft)	TD Elevation	
LHS-MW-1	3030214.35	386160.03	211.18	214.42	7.09	207.33	18.00	196.42	6.88	207.54	17.98	196.44	0.21
LHS-MW-2	3029831.57	386141.56	212.42	214.80	8.80	206.00	19.20	195.60	10.07	204.73	19.06	195.74	-1.27
LHS-MW-3	3029648.78	386947.21	214.14	217.16	15.01	202.15	35.35	181.81	15.80	201.36	35.33	181.83	-0.79
LHS-MW-4	3029535.29	387192.30	214.05	216.96	14.95	202.01	31.05	185.91	15.80	201.16	31.01	185.95	-0.85
LHS-MW-5	3029215.73	387171.20	215.12	217.54	14.98	202.56	24.39	193.15	15.78	201.76	24.40	193.14	-0.80
LHS-MW-6	3028766.65	387095.70	219.93	223.25	15.38	207.87	23.50	199.75	15.45	207.80	23.50	199.75	-0.07
LHS-MW-7	3028543.98	386859.18	218.57	221.30	15.20	206.10	30.45	190.85	15.50	205.80	30.46	190.84	-0.30
LHS-MW-8	3030765.13	388320.27	204.33	207.69	13.52	194.17	35.31	172.38	15.24	192.45	35.32	172.37	-1.72
LHS-MW-9	3030491.41	388072.27	207.37	210.04	10.30	199.74	26.50	183.54	10.33	199.71	26.51	183.53	-0.03
LHS-MW-10	3029812.34	387865.82	211.29	214.54	14.14	200.40	23.08	191.46	15.34	199.20	23.11	191.43	-1.20
LHS-MW-11	3029939.66	388107.65	209.90	212.92	13.54	199.38	27.18	185.74	15.40	197.52	27.18	185.74	-1.86
LHS-MW-12	3030171.55	388388.90	206.06	209.10	9.66	199.44	16.97	192.13	10.48	198.62	17.08	192.02	-0.82
LHS-MW-13	3030158.82	388756.57	206.39	209.41	7.31	202.10	18.41	191.00	7.60	201.81	18.40	191.01	-0.29
LHS-MW-14	3028092.88	389622.77	241.27	244.38	9.80	234.58	20.22	224.16	9.94	234.44	20.41	223.97	-0.14
LHS-MW-15	3028613.24	389649.58	223.80	226.77	16.05	210.72	25.15	201.62	16.60	210.17	25.13	201.64	-0.55
LHS-MW-16	3028339.68	389748.11	229.39	232.28	8.25	224.03	24.90	207.38	9.96	222.32	24.88	207.40	-1.71
LHS-MW-17	3030078.96	389323.46	211.40	214.48	11.24	203.24	27.02	187.46	13.15	201.33	27.00	187.48	-1.91
LHS-MW-18	3030078.92	389575.36	212.30	215.27	13.68	201.59	27.89	187.38	15.07	200.20	27.88	187.39	-1.39
LHS-MW-19	3030024.94	389942.22	209.74	212.90	11.15	201.75	30.03	182.87	12.35	200.55	30.02	182.88	-1.20
LHS-MW-20	3030471.91	390274.65	206.03	209.11	12.60	196.51	25.05	184.06	12.84	196.27	25.07	184.04	-0.24
LHS-MW-21	3030670.41	390618.19	204.54	207.55	10.92	196.63	29.75	177.80	11.70	195.85	29.76	177.79	-0.78
LHS-MW-22	3030536.87	389764.54	206.16	209.35	13.89	195.46	28.97	180.38	15.08	194.27	28.98	180.37	-1.19
LHS-MW-23	3030626.06	389443.93	205.70	208.72	15.53	193.19	42.16	166.56	17.02	191.70	42.18	166.54	-1.49
LHS-MW-24	3031220.16	390090.85	200.46	203.78	11.90	191.88	28.85	174.93	13.84	189.94	28.85	174.93	-1.94
LHS-MW-25	3031426.05	390248.08	199.10	202.00	15.75	186.25	42.60	159.40	17.10	184.90	42.68	159.32	-1.35
LHS-MW-26	3031597.33	389385.40	201.57	204.76	15.30	189.46	37.75	167.01	17.49	187.27	37.85	166.91	-2.19
LHS-MW-27	3031416.71	389166.37	199.23	202.13	12.19	189.94	20.43	181.70	14.05	188.08	20.48	181.65	-1.86
LHS-MW-28	3031829.95	387915.44	201.82	204.68	13.40	191.28	19.71	184.97	15.10	189.58	19.73	184.95	-1.70
LHS-MW-29	3032213.26	387852.85	200.36	203.09	13.61	189.48	22.58	180.51	14.76	188.33	22.66	180.43	-1.15
LHS-MW-30	3032433.95	387856.00	200.17	203.23	14.99	188.24	21.58	181.65	16.10	187.13	21.63	181.60	-1.11
LHS-MW-31	3033113.89	388136.66	197.82	200.76	13.79	186.97	30.97	169.79	15.03	185.73	30.99	169.77	-1.24
LHS-MW-32	3033129.05	388359.89	196.94	199.92	12.48	187.44	18.63	181.29	14.34	185.58	18.62	181.30	-1.86
LHS-MW-33	3033480.16	388261.11	196.39	199.51	13.55	185.96	20.45	179.06	14.79	184.72	20.48	179.03	-1.24
LHS-MW-34	3033484.89	388465.29	195.77	198.51	12.66	185.85	25.48	173.03	13.87	184.64	25.48	173.03	-1.21
LHS-MW-35	3033521.89	388657.49	195.42	198.39	12.90	185.49	24.85	173.54	13.80	184.59	24.86	173.53	-0.90
LHS-MW-36	3033729.91	388842.84	193.72	196.51	11.87	184.64	29.33	167.18	12.90	183.61	29.34	167.17	-1.03
LHS-MW-37	3033861.73	389030.83	192.24	195.19	11.14	184.05	36.21	158.98	11.48	183.71	36.48	158.71	-0.34
LHS-MW-38	3032334.71	388488.79	197.65	200.65	12.38	188.27	28.55	172.10	13.60	187.05	28.54	172.11	-1.22
LHS-MW-39	3034050.74	387679.88	195.71	198.64	13.95	184.69	21.00	177.64	14.69	183.95	20.96	177.68	-0.74
LHS-MW-40	3034093.23	387380.36	196.80	199.89	16.51	183.38	16.91	182.98	Dry	Dry			
LHS-MW-41	3033863.33	387480.92	197.00	199.75	13.97	185.78	38.20	161.55	14.74	185.01	38.21	161.54	-0.77
LHS-MW-42	3033796.16	387324.43	197.17	200.28	14.14	186.14	22.10	178.18	14.86	185.42	22.10	178.18	-0.72

TABLE 2-1 LHAAP SUMPS AREA GROUNDWATER ELEVATION SUMMARY

Well No.	State Plane Coordinates				December 1994 Measurements				February 1996 Measurements				Change in Groundwater Elevation (ft)
	Easting X	Northing Y	Grd.Elev. (ft)	Ref. Elev. (ft)	GW Depth(ft)	GW Elevation (ft)	TD (ft)	TD Elevation	GW Depth (ft)	GW Elevation (ft)	TD (ft)	TD Elevation	
LHS-MW-43	3033769.67	386977.31	197.38	200.32	13.56	186.76	22.92	177.40	14.28	186.04	22.94	177.38	-0.72
LHS-MW-44	3033437.98	387277.74	197.48	200.39	12.72	187.67			13.50	186.89	39.30	161.09	-0.78
LHS-MW-45	3033277.35	387120.69	198.83	201.48	13.38	188.10	39.39	162.09	14.02	187.46	39.39	162.09	-0.64
LHS-MW-46	3033524.14	386732.35	198.48	201.74	13.53	188.21	19.93	181.81	14.26	187.48	19.93	181.81	-0.73
LHS-MW-47	3033467.88	386575.60	197.87	200.49	11.71	188.78	19.09	181.40	12.50	187.99	19.10	181.39	-0.79
LHS-MW-48	3033571.22	386321.21	199.14	201.90	13.07	188.83	15.95	185.95	Dry	Dry			
LHS-MW-49	3033153.55	386451.65	198.67	201.46	10.36	191.10	18.84	182.62	11.00	190.46	18.84	182.62	-0.64
LHS-MW-50	3032592.23	386064.37	201.89	204.73	12.90	191.83	30.42	174.31	13.69	191.04	30.46	174.27	-0.79
LHS-MW-51	3031624.91	386176.60	205.35	208.25	16.08	192.17	21.80	186.45	17.08	191.17	21.84	186.41	-1.00
LHS-MW-52	3032740.17	385428.32	202.50	205.81	12.83	192.98	25.33	180.48	14.00	191.81	25.36	180.45	-1.17
LHS-MW-53	3034022.21	385062.42	194.99	197.76	10.68	187.08	17.00	180.76	11.01	186.75	17.02	180.74	-0.33
LHS-MW-54	3034660.33	385496.67	191.08	193.71	8.03	185.68	45.50	148.21	8.30	185.41	45.56	148.15	-0.27
LHS-MW-55	3034299.19	386007.72	196.36	199.65	13.58	186.07	20.38	179.27	13.82	185.83	20.39	179.26	-0.24
LHS-MW-56	3034694.19	385970.30	195.43	198.66	13.17	185.49	21.97	176.69	13.10	185.56	21.98	176.68	0.07
LHS-MW-57	3034528.24	386396.21	197.68	200.65	4.82	195.83	17.45	183.20	5.00	195.65	17.46	183.19	-0.18
LHS-MW-58	3032223.93	385018.15	200.18	203.54	9.96	193.58	35.16	168.38	11.21	192.33	35.18	168.36	-1.25
LHS-MW-59	3032000.89	385104.29	201.06	204.17	10.81	193.36	51.42	152.75	11.80	192.37	51.44	152.73	-0.99
LHS-MW-60	3033565.88	384916.86	195.59	198.73	10.02	188.71	29.00	169.73	10.58	188.15	29.62	169.11	-0.56
LHS-MW-61	3037307.33	385482.12	195.42	198.48	19.52	178.96	28.62	169.86	20.26	178.22	28.62	169.86	-0.74
LHS-MW-62	3038668.34	385956.87	188.96	192.10	15.80	176.30	29.48	162.62	16.35	175.75	29.50	162.60	-0.55
LHS-MW-63	3038493.38	386109.86	190.92	193.97	16.88	177.09	22.16	171.81	17.18	176.79	22.18	171.79	-0.30
LHS-MW-64	3039042.80	386008.65	188.21	191.40	15.49	175.91	27.78	163.62	15.70	175.70	27.81	163.59	-0.21
LHS-MW-65	3039095.41	386182.42	191.74	194.25	16.07	178.18	20.48	173.77	16.73	177.52	20.50	173.75	-0.66
LHS-MW-66	3038943.49	386422.07	192.13	195.01	16.53	178.48	20.48	174.53	17.34	177.67	20.50	174.51	-0.81
LHS-MW-67	3039815.64	384271.64	182.60	185.53	11.38	174.15	22.70	162.83	11.79	173.74	22.72	162.81	-0.41
LHS-MW-68	3039600.11	384027.71	186.46	189.42	14.83	174.59	24.68	164.74	13.66	175.76	24.70	164.72	1.17
LHS-MW-69	3039381.98	384261.82	180.37	183.48	8.96	174.52	51.85	131.63	8.57	174.91	51.90	131.58	0.39
LHS-MW-70	3040650.91	384936.89	180.45	183.53	10.78	172.75	24.65	158.88	10.69	172.84	24.68	158.85	0.09
LHS-MW-71	3040956.67	385111.76	180.90	183.63	11.61	172.02	19.54	164.09	12.14	171.49	19.54	164.09	-0.53
MW-105	3034206.00	387296.00	196.32	199.07	Not sampled				16.38	182.69	27.48	171.59	
MW-106	3040704.00	386109.00	174.56	177.96	Not sampled				6.98	170.98	24.32	153.64	
MW-107	3040764.00	384617.00	174.97	177.97	Not sampled				6.90	171.07	22.52	155.45	

Table 2-2 Summary of the Sumps Monitoring Well Slug Test Results.

LONGHORN ARMY AMMUNITION PLANT SUMPS MONITORING WELLS SLUG TEST RESULTS*				
Well Number	**Plant Location**	**Top Of Screen (ft, Bgs)**	**Screened Lithology (% sand range)**	**Average Hydraulic Conductivity (cm/sec)**
LHS-MW01	Power	4.5	CH (2% - 25%)	3.5E-05
LHS-MW04	Shop	18.2	SC & CL (28% - 69%)	1.4E-03
LHS-MW07	Shop	17.0	CH, CL, & SC (1% - 58%)	7.9E-04
LHS-MW08	Plant 2	23.3	CL, & CH (13% - 37%)	2.1E-03
LHS-MW10	200	8.5	CL & SC (16% - 63%)	1.9E-03
LHS-MW13	Plant 2	4.9	CH (3% - 26%)	1.6E-04
LHS-MW15	400	11.6	CH, SC, & CL (5% - 75%)	1.8E-04
LHS-MW19	Plant 2	16.6	CH, SC, & CL (2% - 57%)	2.1E-04
LHS-MW21	Plant 2	16.6	CH, SC, & CL (1% - 56%)	2.1E-04
LHS-MW23	Plant 2	18.4 (20 ft)	CL, SC, & CH(11% - 71%)	5.6E-04
LHS-MW25	Mod	19.2 (20 ft)	CL (22% - 48%)	4.5E-04
LHS-MW26	Mod	13.5 (20 ft)	CL, & SC (31% - 60%)	2.0E-03
LHS-MW30	North Plant 3	8.5	CL (2% - 49%)	9.6E-05
LHS-MW31	North Plant 3	17.5	CL (8% - 48%)	2.1E-03
LHS-MW34	North Plant 3	12.0	CL & SC (15% - 74%)	2.1E-03
LHS-MW36	North Plant 3	15.0	CL & CH (3% - 44%)	7.0E-04
LHS-MW39	North Plant 3	7.5	CL, SM, &, CH (4% - 76%)	3.4E-04
LHS-MW44	North Plant 3	15.5 (20 ft)	SM & CL (43% - 60%)	3.5E-04
LHS-MW46	South Plant 3	6.8	CL & SM (21% - 74%)	4.1E-05
LHS-MW50	South Plant 3	18.0	CL, ML, & SM (15% - 76%)	1.9E-03
LHS-MW53	South Plant 3	3.5	CH, SM, & CL (6% - 59%)	6.5E-05
LHS-MW56	South Plant 3	7.7	CH, SM, ML, & CL (10% - 62%)	1.1E-04
LHS-MW58	South Plant 3	23.5	SM & CL (26% - 79%)	6.4E-04
LHS-MW61	Y	16.0	CL & SC (10% - 68%)	3.1E-04
LHS-MW65	Y	7.5	CL, SM, & CH (1% - 83%)	3.8E-05
LHS-MW68	Static	11.5	SM, CL, & CH (4% - 83%)	2.8E-04
LHS-MW71	Static	7.0	CL, SM, & CH (6% - 26%)	1.1E-03

NOTES:
* Falling head method, Bower-Rice analysis and calculation.
Hydraulic conductivity presented is the average of slug-in and slug-out results.
BGS - Below ground surface.
Screened interval is 10 feet unless otherwise noted.
CH - Fat Clay, CL - Lean Clay, ML - Sandy Silt, SC - Clayey Sand, and SM - Silty Sand

Phase II Sumps Investigation Slug Test Report (WESTON, 1995). Table 2-2 presents the average calculated hydraulic conductivity derived from slug-in and slug-out tests conducted at each well. Slug test results indicate that the hydraulic conductivity of the uppermost water- bearing zone in the wells tested ranges from a minimum of 3.5E-5 cm/sec at LHSMW-01 in the Plant Production Power area to a maximum of 2.1E-3 cm/sec at two wells (LHSMW-31 and LHSMW-34) in the North Plant 3 area. The average hydraulic conductivity of all the wells was 7.47E-4 cm/sec, which is within the expected range of hydraulic conductivity for silts, sandy silts, and silty sands (USACE, September, 1995).

The groundwater flow velocity was calculated using the formula: $V = ki/n$

where: V = groundwater flow velocity

k = hydraulic conductivity

i = hydraulic gradient

n = effective porosity

Groundwater velocity was calculated using an average hydraulic conductivity of 7.47 E-4 cm/sec calculated from slug tests, assuming an effective porosity of 0.20, and area specific hydraulic gradients. Calculations and a map showing the individual groundwater gradients used for the calculations can be found in Appendix B. Groundwater flow velocity ranged from approximately 7 feet per year at the Y and Static Test area, 11 feet per year in the south Plant 3/Sewage Disposal area, 37 feet per year in the Plant 2 area and 127 feet per year in the Plant 400 area. Using the average gradient and the average hydraulic conductivity, the average flow velocity across the Sumps Project area is approximately 14 feet per year. Taking into account these very low groundwater velocity estimates, orientation of any contaminant plumes is not expected to exhibit a large degree of change between sampling events. These calculations do not take into account the effect of the vertical gradient on horizontal flow or possible small scale preferential pathways of higher hydraulic conductivity.

SECTION 3.0
SAMPLE COLLECTION AND ANALYSIS

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3.1 Monitoring Well System

The present LHAAP Sumps monitoring well system consists of 71 wells (LHSMW-1 through LHSMW-71) drilled during the Phase II Sumps investigation and three additional wells MW105, MW106 and MW107 located throughout the production areas. The locations of the monitoring wells are shown in Figure 3-1. Geologic logs and well construction schematics of wells are presented in the Phase II Sumps report (USACE, September, 1995).

3.2 Analytical Parameters

All groundwater samples were analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), high explosives, and selected metals (aluminum, antimony, arsenic, barium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, strontium, thallium, vanadium and zinc) using EPA SW846 approved analytical methods (Table 3-1). Groundwater samples from monitoring wells LHSMW-1, LHSMW-5, LHSMW-16, LHSMW-19, LHSMW-25, LHSMW-28, LHSMW-35 LHSMW-43, LHSMW-51, LHSMW-56, LHSMW-58, LHSMW-62, LHSMW-63, and LHSMW-69 were additionally analyzed for pesticides/PCBs, herbicides, TPH, and cyanide based on process knolwledge and potential wastes managed in nearby sumps

3.3 Field Quality Assurance/Quality Control (QA/QC) Sampling

For the February 1996 sampling round, field quality assurance/quality control (QA/QC) procedures for the groundwater samples involved collecting the appropriate QA/QC samples, preserving and handling the samples in an appropriate manner, and decontaminating the sampling equipment between uses.

Field duplicate samples were collected at a 10% frequency for each chemical analysis. The QC samples were analyzed with the field samples by the Corps of Engineers Southwestern Division Laboratory (SWD) and the Environmental Chemical Corporation Laboratory. The QA samples were initially sent to the Corps of Engineers SWD Laboratory. The SWD Lab sent the QA samples to Inchcape Testing Services, USACE Missouri River Division Laboratory and the Continental Analytical Services for analyses.

Equipment blanks were collected at a 20% frequency for each chemical analysis. These samples consisted of ASTM Type II water poured over or through the various non-dedicated sampling equipment as

TABLE 3-1 LONGHORN ARMY AMMUNITION PLANT FEBRUARY 1996 ANALYTICAL PARAMETERS	
PARAMETER	**EPA SW846 METHOD NUMBER**
Volatile Organics	8240
Semi-Volatile Organics	8270
High Explosives	8330
Pesticides/PCBs / Herbicides	8080/8150
TPH	8015M
Cyanide	9012
Arsenic	7060
Aluminum, Antimony, Barium, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Magnesium, Manganese, Nickel, Potassium, Silver, Strontium, Vanadium, Thallium, Zinc	6010
Lead	7421
Mercury	7740
Selenium	7740
Anions (Chloride, Nitrite, Nitrate, Sulfate)	300.0

the final rinse. The final rinse was drained off into the appropriate sample containers. Travel blanks were included with each cooler containing samples for volatile organic analysis. Travel blanks were sealed vials of ASTM Type II reagent water prepared in the field and sent to the laboratory with the applicable sample shipment.

3.4 Data Validation

Data validation reports for the February 1996 sampling round which describe QA/QC procedures for laboratory analysis of the groundwater samples were prepared and are found in Appendix A of this report. The overall evaluation indicated that sampling procedures and laboratory procedures have been properly conducted. With few exceptions (covered in later sections of this report), analytical data from the February 1996 sampling round are considered valid and acceptable.

3.5 Analytical Data Screening

The purpose of data screening and analysis was to establish the presence or absence of target analytes that may be potential contaminants in groundwater. For this report, a simple procedure was used to screen groundwater analytical data. Based on a detailed review of raw laboratory data, all analytes reported in detectable quantities were tabulated for each well. To be "screened out" (assumed not present in groundwater) and eliminated from further consideration, all reported values for a given analyte must be less than the standard quantitation limit (SQL) or detection limit. Additionally, If the constituent was detected above its SQL in only one sample it was not considered a COPC. Following this rationale, analytes not exceeding their respective SQL were dropped from further consideration. If the analyte exceeded its SQL and was detected more than once, the compound was considered a contaminant of potential concern (COPC) and was retained for additional analysis and mapping. Because many metal target analytes are naturally occurring, they were compared to calculated upper tolerance limits (UTLs) as defined in the Final Groundwater Background Concentration Report, (USACE, June 1995). Metals exceeding either UTL in more than one sample were considered COPCs and are discussed in the following sections

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SECTION 4.0
QUARTERLY GROUNDWATER MONITORING RESULTS

This section presents the results of the February 1996 groundwater sampling round in the Sumps monitoring wells at LHAAP. Sampling was conducted between 29 January and 13 February 1996.

4.1 Analytical Results

The analytical results from the February 1996 sampling round at LHAAP are summarized in Tables 4-1 through 4-5. Only those constituents with measured concentrations, or measured concentrations above detection limits are shown. For Tables 4-1 and 4-5, where analytical results contain a combination of detects and non-detects for individual wells, results below detection limits are designated with a less than (<) symbol. Included in the tables, for comparison, are the current EPA risk based concentrations and Primary Remediation Goals (PRG) as well as the State of Texas Risk Reduction Rule #2 standards for all applicable constituents. A complete listing of the chemical analyses performed is presented in the data validation reports found in Appendix A. Analytical data qualified in the data validation are noted on tables 4-1 through 4-5 with a (J) if the sample concentration is estimated below the detection limit (or SQL) or with a (B) if the chemical constituent was detected in both the field sample and its associated blank. A discussion of the analytical results and their significance is presented below.

4.2 Nature of Contamination

Based on the data screening, VOC, SVOC, High Explosive (HE) and metals constituents were identified as COPCs present in the groundwater underlying the sumps area of investigation. No pesticides/PCBs or herbicides were detected in the wells selected for analysis. Cyanide was not detected in any of the wells selected for analysis. TPH analysis identified two large organic peaks in the gasoline range in monitoring well LHSMW-43 at a concentration of 12.9 mg/l. This was the only TPH detection in the wells selected for TPH analysis. Metals, because they are naturally occurring, tend to be found throughout the Sumps project area. However only the following metals exceeded UTLs; barium, calcium, chromium, nickel, selenium, strontium and thallium. Based on the data screening results, Table 4-6 lists the groundwater COPCs for the February 1996 sampling round. Discussions on each identified COPC follows.

TABLE 4-1 GROUNDWATER METALS SUMMARY
(ug/L)

	ALUMINUM	ANTIMONY	ARSENIC	BARIUM	BERYLLIUM	CADMIUM	CALCIUM	CHROMIUM	COBALT	COPPER	IRON	LEAD
TNRCC RRS#2		6	50	2000	4	5		100				15
MCL		6	50	2000		5		100				
UCL	8000	100	10	900		18	207000	30	30	20	39000	290
UTL	28400	50	30	3300		90	478000	160	390	200	148000	2310
LHS-MW-1	400	<25.0	<2.0	18.0	0.56	<0.2	345000	16.0	3.1	5.9	240	<1.0
LHS-MW-2	2010	<60.0	<2.0	33.0	<5.0	<50.0	285000	33.0	<10.0	<10.0	2860	<150
LHS-MW-3	24000	<60.0	<2.0	375.0	<5.0	<10.0	8010	63.0	13.0	25.0	29800	<30.0
LHS-MW-4	12500	<60.0	<2.0	244.0	<5.0	<10.0	24800	**348.0**	14.0	27.0	20800	<30.0
LHS-MW-5	1900	<25.0	<2.0	69.0	1.9	2.0	283000	40.0	230.0	15.0	3300	<1.0
LHS-MW-6	1350	<60.0	<2.0	49.0	<5.0	<10.0	134000	16.0	<10.0	<10.0	2240	<30.0
LHS-MW-7	1720	<60.0	<2.0	30.0	<5.0	<10.0	**714000**	39.0	<10.0	<10.0	1590	<30.0
LHS-MW-8	1080	<60.0	<2.0	42.0	<5.0	<10.0	30000	<10.0	<10.0	<10.0	1430	60.0
LHS-MW-9	2570	<60.0	<2.0	90.0	<5.0	<10.0	3440	<10.0	12.0	13.0	3990	<30.0
LHS-MW-10	536	<60.0	<2.0	**3690.0**	<5.0	<10.0	76100	**271.0**	130.0	31.0	1660	99.0
LHS-MW-11	573	<60.0	<2.0	51.0	<5.0	<10.0	165000	36.0	117.0	18.0	670	43.0
LHS-MW-12	6970	<60.0	<2.0	110.0	<5.0	<10.0	11000	44.0	11.0	14.0	14600	<30.0
LHS-MW-13	3640	<60.0	6.3	26.0	<5.0	<10.0	9640	<10	14.0	<10	4930	<30.0
LHS-MW-14	3060	<60.0	<2.0	52.0	<5.0	<10.0	2830	19.0	<10.0	10.0	3990	<30.0
LHS-MW-15	1650	<300.0	9.0	30.0	<25.0	<50.0	309000	<50.0	<50.0	<50.0	1800	<150.0
LHS-MW-16	450	<25.0	<2.0	190.0	<0.21	<0.2	82400	4.4	<2.5	8.1	610	<1
LHS-MW-17	5210	<60.0	<2.0	91.0	<5.0	<10.0	14300	10.0	<10.0	42.0	7050	<30.0
LHS-MW-18	1480	<60.0	<2.0	35.0	<5.0	<10.0	140000	16.0	18.0	39.0	3400	<30.0
LHS-MW-19	310	<25.0	<2.0	160.0	<0.21	0.3	84000	5.3	<2.5	3.6	360	1.5
LHS-MW-20	1110	<60.0	9.9	48.0	<5.0	<10.0	232000	11.0	16.0	20.0	3920	<30.0
LHS-MW-21	1020	<60.0	9.4	36.0	<5.0	<10.0	337000	<10.0	<10.0	<10.0	1740	<30.0
LHS-MW-22	3000	<60.0	11.1	56.0	<5.0	<10.0	332000	74.0	36.0	20.0	6340	<30.0
LHS-MW-23	120	<60.0	12.6	34.0	<5.0	<10.0	313000	21.0	14.0	21.0	2400	<30.0
LHS-MW-24	1310	<60.0	14.7	63.0	<5.0	<10.0	402000	105.0	10.0	83.0	2170	<30.0
LHS-MW-25	570	40.0	<2.0	170.0	<0.21	0.8	243000	72.0	<2.5	6.6	2000	<1.0
LHS-MW-26	7660	<60.0	<2.0	68.0	<5.0	<10.0	70300	92.0	<10.0	28.0	10100	<30.0
LHS-MW-27	10700	<60.0	3.1	103.0	<5.0	<10.0	3730	<10.0	11.0	17.0	14200	82.0
LHS-MW-28	6500	<25.0	5.0	160.0	0.3	0.3	5400	**500.0**	8.8	22.0	12300	6.8
LHS-MW-29	3590	<60.0	5.0	70.0	<5.0	<10.0	171000	58.0	<10.0	40.0	4080	<30.0
LHS-MW-30	3180	<60.0	2.4	82.0	<5.0	<10.0	114000	**194.0**	17.0	25.0	6290	<30.0
LHS-MW-31	1130	<60.0	4.8	51.0	<5.0	<10.0	42200	62.0	<10.0	31.0	4400	<30.0
LHS-MW-32	4030	<60.0	<2.0	88.0	<5.0	<10.0	3140	25.0	11.0	24.0	5640	<30.0
LHS-MW-33	1250	<60.0	<2.0	97.0	<5.0	<10.0	34100	**2720.0**	46.0	50.0	17800	<30.0
LHS-MW-34	1000	<60.0	<2.0	228.0	<5.0	<10.0	25200	49.0	<10.0	32.0	1900	<30.0
LHS-MW-35	690	<25.0	2.1	74.0	<0.21	<0.2	16600	**170.0**	<2.5	6.7	2500	<1.0
LHS-MW-36	1700	<60.0	<2.0	133.0	<5.0	<10.0	30500	14.0	<10.0	27.0	2500	<30.0
LHS-MW-37	1040	<60.0	<2.0	57.0	<5.0	<10.0	32300	<10.0	14.0	15.0	1040	52.0
LHS-MW-38	3010	<60.0	<2.0	81.0	<5.0	<10.0	4490	30.0	<10.0	29.0	6330	<30.0
LHS-MW-39	1330	<60.0	<2.0	39.0	<5.0	<10.0	59500	16.0	13.0	25.0	2240	78.0
LHS-MW-40	DRY	-	-	-	-	-	-	-	-	-	-	-
LHS-MW-41	251	<60.0	<2.0	241.0	<5.0	<10.0	99900	<10.0	<10.0	28.0	367	36.0
LHS-MW-42	1390	<60.0	<2.0	49.0	<5.0	<10.0	89200	86.0	29.0	37.0	1900	85.0
LHS-MW-43	230	<25.0	<2.0	31.0	<0.21	0.8	48100	70.0	22.0	11.0	1400	<1.0
LHS-MW-44	6770	<60.0	3.9	293.0	<5.0	<10.0	46800	26.0	18.0	11.0	8010	109.0
LHS-MW-45	489	<60.0	<2.0	96.0	<5.0	<10.0	61700	<10.0	<10.0	26.0	771	88.0
LHS-MW-46	9410	<60.0	<2.0	69.0	<5.0	<10.0	2800	31.0	12.0	24.0	8550	67.0
LHS-MW-47	1120	<60.0	<2.0	37.0	<5.0	<10.0	40200	39.0	29.0	61.0	1670	136.0
LHS-MW-48	DRY	-	-	-	-	-	-	-	-	-	-	-
LHS-MW-49	21500	<60.0	<2.0	288.0	<5.0	<10.0	3000	41.0	13.0	13.0	17700	<30.0
LHS-MW-50	2210	<60.0	2.7	47.0	<5.0	<10.0	66600	**260.0**	11.0	26.0	6840	63.0
LHS-MW-51	3100	<25.0	<2.0	110.0	<0.21	<0.2	304000	**1700.0**	23.0	13.0	12200	<1.0
LHS-MW-52	3370	<60.0	<2.0	78.0	<5.0	<10.0	8210	36.0	<10.0	29.0	4520	47.0
LHS-MW-53	620	<60.0	3.7	194.0	<5.0	<10.0	146000	**713.0**	311.0	74.0	10200	41.0
LHS-MW-54	300	<60.0	<2.0	231.0	<5.0	<10.0	54600	11.0	<10.0	30.0	471	<30.0
LHS-MW-55	825	<60.0	<2.0	118.0	<5.0	<10.0	60300	**207.0**	19.0	25.0	3300	<30.0
LHS-MW-56	300	<25.0	4.4	78.0	<0.21	0.6	16500	18.0	<2.5	2.5	860	1.2
LHS-MW-57	583	<60.0	<2.0	34.0	<5.0	<10.0	1660	<10.0	<10.0	14.0	891	<30.0
LHS-MW-58	490	<25.0	<2.0	83.0	<0.21	0.3	3300	4.3	<2.5	3.3	1200	<1.0
LHS-MW-59	336	<60.0	<2.0	299.0	<5.0	<10.0	40700	<10.0	<10.0	23.0	343	<30.0
LHS-MW-60	1010	<60.0	<2.0	35.0	<5.0	<10.0	28000	<10.0	<10.0	16.0	2320	<30.0
LHS-MW-61	1520	<60.0	<2.0	149.0	<5.0	<10.0	18900	**517.0**	26.0	33.0	4780	<30.0
LHS-MW-62	1300	<25.0	<2.0	53.0	<0.21	<0.2	12300	13.0	4.0	80.0	2200	1.6
LHS-MW-63	4000	<25.0	<2.0	110.0	<0.21	0.4	3100	**3200.0**	13.0	40.0	14900	4.7
LHS-MW-64	532	<60.0	5.8	251.0	<5.0	<10.0	9140	<10.0	<10.0	18.0	23800	96.0
LHS-MW-65	15000	<60.0	<2.0	125.0	<5.0	<10.0	3240	**510.0**	10.0	53.0	20900	<30.0
LHS-MW-66	6340	<60.0	<2.0	130.0	<5.0	<10.0	2690	45.0	<10.0	24.0	9270	<30.0
LHS-MW-67	19000	<60.0	5.0	126.0	<5.0	<10.0	6510	**549.0**	21.0	29.0	20200	49.0
LHS-MW-68	2500	<60.0	<2.0	41.0	<5.0	<10.0	1060	33.0	<10.0	<10.0	2930	150.0
LHS-MW-69	390	<25.0	3.5	66.0	<0.21	<0.20	9200	5.5	4.1	5.5	7000	1.8
LHS-MW-70	970	<60.0	<2.0	36.0	<5.0	<10.0	1420	101.0	38.0	80.0	2270	56.0
LHS-MW-71	2600	<60.0	<2.0	143.0	<5.0	<10.0	23400	**3630.0**	52.0	58.0	16000	69.0
MW-105	3550	<60.0	<2.0	41.0	<5.0	<10.0	317000	<10.0	<10.0	30.0	3970	<30.0
MW-106	5270	<60.0	<2.0	44.0	<5.0	<10.0	2920	<10.0	<10.0	18.0	3480	<30.0
MW-107	915	<60.0	<2.0	104.0	<5.0	<10.0	11100	<10.0	15.0	22.0	2230	<30.0

Notes: Bolded Values Exceed UTLs

TNRCC RRS #2: Risk Reduction Standard 2 values from the Texas Natural Resources Conservation Commission (TNRCC) Industrial and Hazardous Waste Division Risk Reduction Rules.
UTL and UCL: Values from Final Groundwater Background Concentration Report, U.S. Army Corps of Engineers, June 1995
MCL - EPA Maximum Conataminant Level For Drinking Water

TABLE 4-1 GROUNDWATER METALS SUMMARY (CONT.)
(ug/L)

	MAGNESIUM	MANGANESE	MERCURY	NICKEL	POTASSIUM	SELENIUM	SILVER	STRONTIUM	THALLIUM	VANADIUM	ZINC
TNRCC RRS#2			2	100		50	183		2		
MCL			2	100		50			2		
UCL	149000	4600	0.5	50	5600	3	10	4500	50		140
UTL	277000	11800	1	90	9400	5	30	10000	100		1620
LHS-MW-1	187000	1500.0	<0.2	**120.0**	1400.0	<2.0	<0.4	7500.0	<1.7	<1.7	<1.9
LHS-MW-2	122000	158.0	<0.2	15.0	1780.0	**10.1**	<10.0	4840.0	<90.0	<10.0	34.0
LHS-MW-3	7210	208.0	<0.2	47.0	3200.0	2.8	<10.0	188.0	<90.0	56.0	119.0
LHS-MW-4	14800	330.0	<0.2	74.0	2640.0	<2.0	<10.0	729.0	<90.0	30.0	79.0
LHS-MW-5	182000	4600.0	<0.2	**340.0**	1200.0	<2.0	0.7	5400.0	<1.7	<1.7	45.0
LHS-MW-6	70600	1040.0	<0.2	51.0	1160.0	**8.4**	<10.0	2790.0	<90.0	<10.0	39.0
LHS-MW-7	124000	134.0	<0.2	50.0	7500.0	**65.8**	<10.0	**19200.0**	<90.0	<10.0	42.0
LHS-MW-8	21200	259.0	<0.2	<15.0	896.0	**5.0**	<10.0	617.0	<90.0	<10.0	29.0
LHS-MW-9	2030	129.0	<0.2	18.0	787.0	2.1	<10.0	56.0	<90.0	<10.0	48.0
LHS-MW-10	53400	2870.0	<0.2	**1090.0**	2590.0	<2.0	<10.0	1470.0	<90.0	<10.0	40.0
LHS-MW-11	83600	1180.0	<0.2	64.0	1780.0	**12.2**	<10.0	2670.0	<90.0	<10.0	23.0
LHS-MW-12	7620	322.0	<0.2	78.0	1020.0	4.1	<10.0	161.0	<90.0	13.0	56.0
LHS-MW-13	7480	376.0	<0.2	<15	621.0	3.0	<10.0	160.0	<90.0	<10.0	36.0
LHS-MW-14	1610	56.0	<0.2	20.0	724.0	<2.0	<10.0	53.0	<90.0	<10.0	24.0
LHS-MW-15	135000	1760.0	<0.2	**125.0**	1730.0	<2.0	<50.0	4170.0	<450.0	<50.0	<75.0
LHS-MW-16	72100	72.0	<0.2	46.0	390.0	**6.5**	1.9	1500.0	<1.7	2.8	6.5
LHS-MW-17	11300	202.0	0.2	17.0	1610.0	<2.0	<10.0	221.0	<90.0	<10.0	40.0
LHS-MW-18	108000	2490.0	0.2	**165.0**	1720.0	<2.0	<10.0	1990.0	<90.0	<10.0	48.0
LHS-MW-19	23800	76.0	<0.2	19.0	6200.0	<2.0	<0.4	3300.0	<1.7	<1.7	14.0
LHS-MW-20	217000	3750.0	<0.2	63.0	4140.0	<2.0	10.0	3550.0	<90.0	<10.0	57.0
LHS-MW-21	196000	625.0	<0.2	43.0	3730.0	2.0	<10.0	4170.0	<90.0	<10.0	26.0
LHS-MW-22	269000	4870.0	<0.2	**317.0**	3750.0	<2.0	<10.0	5180.0	<90.0	<10.0	97.0
LHS-MW-23	227000	1020.0	<0.2	75.0	3110.0	<2.0	<10.0	4480.0	<90.0	10.0	60.0
LHS-MW-24	243000	2930.0	<0.2	**200.0**	2680.0	<2.0	<10.0	5650.0	**105.0**	<10.0	61.0
LHS-MW-25	185000	170.0	<0.2	61.0	4200.0	<2.0	3.0	5200.0	<1.7	<1.7	10.0
LHS-MW-26	48300	188.0	<0.2	37.0	2850.0	<2.0	<10.0	1280.0	<90.0	18.0	44.0
LHS-MW-27	3030	110.0	0.62	28.0	1330.0	<2.0	<10.0	58.0	93.0	21.0	46.0
LHS-MW-28	3600	380.0	<0.2	**240.0**	840.0	<2.0	<0.4	94.0	<1.7	17.0	48.0
LHS-MW-29	80900	731.0	<0.2	**137.0**	1190.0	4.1	<10.0	3250.0	<90.0	<10.0	33.0
LHS-MW-30	83700	1000.0	<0.2	**902.0**	1910.0	<2.0	<10.0	2840.0	<90.0	<10.0	31.0
LHS-MW-31	36100	123.0	0.3	**113.0**	1790.0	<2.0	<10.0	1100.0	<90.0	<10.0	27.0
LHS-MW-32	2000	201.0	<0.2	40.0	876.0	<2.0	<10.0	49.0	<90.0	<10.0	46.0
LHS-MW-33	29400	989.0	<0.2	**2690.0**	2030.0	<2.0	<10.0	743.0	<90.0	10.0	35.0
LHS-MW-34	17500	158.0	0.4	47.0	939.0	<2.0	<10.0	765.0	<90.0	<10.0	28.0
LHS-MW-35	12100	120.0	<0.2	81.0	4100.0	<2.0	<0.4	520.0	<1.7	<1.7	24.0
LHS-MW-36	10900	161.0	<0.2	26.0	2700.0	<2.0	<10.0	774.0	<90.0	<10.0	31.0
LHS-MW-37	20400	727.0	<0.2	27.0	1800.0	<2.0	<10.0	828.0	<90.0	<10.0	36.0
LHS-MW-38	2810	139.0	<0.2	40.0	833.0	<2.0	<10.0	90.0	<90.0	<10.0	30.0
LHS-MW-39	43600	641.0	<0.2	47.0	2350.0	<2.0	<10.0	1200.0	<90.0	<10.0	42.0
LHS-MW-40	-	-	-	-	-	-	-	-	-	-	-
LHS-MW-41	39900	73.0	<0.2	25.0	6750.0	<2.0	<10.0	5600.0	<90.0	<10.0	21.0
LHS-MW-42	40400	968.0	<0.2	**452.0**	832.0	<2.0	<10.0	1210.0	<90.0	<10.0	48.0
LHS-MW-43	42400	1300.0	0.2	**420.0**	1400.0	<2.0	<0.4	990.0	<1.7	<1.7	34.0
LHS-MW-44	18400	838.0	<0.2	33.0	5920.0	<2.0	<10.0	2900.0	<90.0	18.0	49.0
LHS-MW-45	37400	1100.0	<0.2	21.0	1400.0	3.2	<10.0	1320.0	<90.0	<10.0	52.0
LHS-MW-46	2000	170.0	<0.2	72.0	1390.0	<2.0	<10.0	50.0	<90.0	18.0	48.0
LHS-MW-47	29800	960.0	<0.2	**196.0**	1080.0	<2.0	<10.0	759.0	93.0	<10.0	30.0
LHS-MW-48	-	-	-	-	-	-	-	-	-	-	-
LHS-MW-49	3010	138.0	<0.2	44.0	1480.0	<2.0	<10.0	69.0	<90.0	29.0	79.0
LHS-MW-50	48600	288.0	<0.2	**270.0**	1540.0	<2.0	<10.0	1890.0	<90.0	<10.0	47.0
LHS-MW-51	235000	2200.0	<0.2	**1800.0**	2100.0	<2.0	<0.4	5800.0	<1.7	7.7	21.0
LHS-MW-52	4270	267.0	0.22	**93.0**	1060.0	<2.0	<10.0	158.0	<90.0	<10.0	33.0
LHS-MW-53	125000	5710.0	<0.2	**4810.0**	1040.0	**15.6**	<10.0	2230.0	<90.0	<10.0	114.0
LHS-MW-54	28400	429.0	<0.2	88.0	7870.0	2.4	<10.0	1100.0	<90.0	<10.0	43.0
LHS-MW-55	27100	1490.0	<0.2	**1840.0**	2190.0	**24.4**	<10.0	776.0	<90.0	<10.0	40.0
LHS-MW-56	10200	360.0	<0.2	**130.0**	1100.0	<2.0	<0.4	260.0	<1.7	<1.7	12.0
LHS-MW-57	1050	27.0	<0.2	<15.0	525.0	<2.0	<10.0	<20.0	<90.0	<10.0	32.0
LHS-MW-58	1400	67.0	<0.2	<7.6	670.0	<2.0	<0.4	96.0	<1.7	3.2	35.0
LHS-MW-59	17700	201.0	<0.2	68.0	1850.0	2.4	<10.0	1570.0	<90.0	<10.0	21.0
LHS-MW-60	17400	136.0	<0.2	**166.0**	1180.0	<2.0	<10.0	491.0	<90.0	<10.0	35.0
LHS-MW-61	12900	953.0	<0.2	**533.0**	3280.0	**6.3**	<10.0	412.0	<90.0	<10.0	34.0
LHS-MW-62	7200	320.0	<0.2	**170.0**	600.0	<2.0	<0.4	160.0	<1.7	2.7	26.0
LHS-MW-63	1800	150.0	<0.2	**580.0**	840.0	<2.0	1.2	41.0	<1.7	17.0	41.0
LHS-MW-64	8590	446.0	<0.2	<15.0	361.0	<2.0	<10.0	206.0	**178.0**	<10.0	18.0
LHS-MW-65	2180	220.0	<0.2	**162.0**	2200.0	<2.0	<10.0	49.0	92.0	25.0	72.0
LHS-MW-66	1880	97.0	<0.2	44.0	1380.0	**6.5**	<10.0	45.0	<90.0	<10.0	44.0
LHS-MW-67	39900	286.0	0.3	**248.0**	1520.0	<2.0	<10.0	121.0	<90.0	<10.0	65.0
LHS-MW-68	1240	21.0	<0.2	19.0	880.0	<2.0	<10.0	16.0	<90.0	<10.0	30.0
LHS-MW-69	4300	550.0	<0.2	<7.6	990.0	<2.0	0.8	120.0	<1.7	2.3	54.0
LHS-MW-70	674	563.0	<0.2	38.0	479.0	<2.0	<10.0	15.0	<90.0	<10.0	44.0
LHS-MW-71	20100	546.0	<0.2	**1150.0**	1830.0	<2.0	<10.0	429.0	<90.0	<10.0	67.0
MW-105	211000	323.0	<0.2	18.0	2820.0	<2.0	<10.0	7190.0	<90.0	<10.0	63.0
MW-106	2980	52.0	<0.2	<15.0	923.0	<2.0	<10.0	62.0	<90.0	<10.0	51.0
MW-107	8110	267.0	0.2	<15.0	1810.0	<2.0	<10.0	197.0	<90.0	<10.0	34.0

Notes: Bolded Values Exceed UTLs

TNRCC RRS #2: Risk Reduction Standard 2 values from the Texas Natural Resources Conservation Commission (TNRCC) Industrial and Hazardous Waste Division Risk Reduction Ru

UTL and UCL: Values from Final Groundwater Background Concentration Report, U.S. Army Corps of Engineers, June 1995

MCL - EPA Maximum Contaminant Level For Drinking Water

017940

TABLE 4-2 GROUNDWATER EXPLOSIVES SUMMARY (EPA 8330, ug/L)

	RDX	Tetryl	2-Nitro toluene	3-Nitro-toluene	4-Nitro-toluene	2,4-Dinitro-toluene	2,6-Dinitro-toluene	2-Amino-4,6-dinitrotoluene	4-Amino-2,6-dinitrotoluene	2,4,6-Trinitrotoluene	Nitrobenzene	1,3-Dinitro-benzene	1,3,5-Trinitro-benzene
TNRCC RRS #2	26.07		10207	10207	10207						18.3	3.65	1.83
MCL													
EPA Reg III RBC			61	61	61	73	37			2.2	3.4	3.7	1.8
EPA REG IX PRG	0.81			370	370	73	37			2.2	18	3.7	1.8
Well No.	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96
LHS-MW-1													
LHS-MW-2													
LHS-MW-3				0.67								0.16	
LHS-MW-4		0.17		0.77									
LHS-MW-5													
LHS-MW-6													
LHS-MW-7													
LHS-MW-8													
LHS-MW-9													
LHS-MW-10			0.17 (J)										
LHS-MW-11													
LHS-MW-12													
LHS-MW-13													
LHS-MW-14	0.32			0.13 (J)		0.067 (J)							
LHS-MW-15				0.15 (J)		0.073 (J)							
LHS-MW-16													
LHS-MW-17	0.19 (J)												
LHS-MW-18													
LHS-MW-19													
LHS-MW-20													
LHS-MW-21													
LHS-MW-22													
LHS-MW-23				0.15 (J)							0.21		
LHS-MW-24													
LHS-MW-25													
LHS-MW-26			0.19 (J)										
LHS-MW-27			0.13 (J)	0.15 (J)	0.14 (J)								
LHS-MW-28													
LHS-MW-29				0.13 (J)									
LHS-MW-30									0.69				
LHS-MW-31										0.82			
LHS-MW-32		0.32											
LHS-MW-33													
LHS-MW-34		0.15											
LHS-MW-35				0.34									
LHS-MW-36		0.23											
LHS-MW-37													
LHS-MW-38													
LHS-MW-39					0.47	0.1 (J)							
LHS-MW-40													
LHS-MW-41													
LHS-MW-42			0.18 (J)	0.20 (J)							0.20		
LHS-MW-43													
LHS-MW-44	0.25 (J)		0.16 (J)	0.15 (J)									
LHS-MW-45									0.94				
LHS-MW-46													
LHS-MW-47													
LHS-MW-48													
LHS-MW-49													
LHS-MW-50			0.25 (J)										

017941

TABLE 4-2 GROUNDWATER EXPLOSIVES SUMMARY (EPA 8330, ug/L)

	RDX	Tetryl	2-Nitro toluene	3-Nitro-toluene	4-Nitro-toluene	2,4-Dinitro-toluene	2,6-Dinitro-toluene	2-Amino-4,6-dinitrotoluene	4-Amino-2,6-dinitrotoluene	2,4,6-Trinitrotoluene	Nitrobenzene	1,3-Dinitro-benzene	1,3,5-Trinitro-benzene
TNRCC RRS #2	26.07		10207	10207	10207						18.3	3.65	1.83
MCL													
EPA Reg III RBC			61	61	61	73	37			2.2	3.4	3.7	1.8
EPA REG IX PRG	0.81			370	370	73	37			2.2	18	3.7	1.8
Well No.	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96
LHS-MW-51													
LHS-MW-52				0.20 (J)									
LHS-MW-53							0.20	0.33					
LHS-MW-54	0.15 (J)			0.17 (J)		0.59							
LHS-MW-55				0.15 (J)			0.56	0.86	0.11 (J)				
LHS-MW-56													
LHS-MW-57				0.19 (J)									0.21 (J)
LHS-MW-58		0.41											
LHS-MW-59		0.72 (J)										0.10 (J)	
LHS-MW-60													
LHS-MW-61													
LHS-MW-62				0.15 (J)		0.094 (J)	0.28	0.44					
LHS-MW-63		1.0											
LHS-MW-64													
LHS-MW-65							0.089 (J)	0.64	0.13 (J)				
LHS-MW-66				0.24 (J)									
LHS-MW-67													
LHS-MW-68													
LHS-MW-69			0.28										
LHS-MW-70													
LHS-MW-71				0.26 (J)			0.62	0.95					
MW-105													
MW-106													
MW-107				0.14 (J)									

Notes:

(J): Estimated value below detection limit.
(B): Detected in both sample and blank.

TNRCC RRS #2: Risk Reduction Standard 2 values from the Texas Natural Resources Conservation Commission (TNRCC) Industrial and Hazardous Waste Division Risk Reduction Rules.
EPA Reg III RBC: Values from the EPA Region III Risk-Based Concentration Tables, February 9, 1995.
EPA Reg IX PRG: Values from the EPA Region IX Preliminary RemediationGoals First Half 1995, February 1, 1995.
MCL - EPA Maximum Contaminant Levels for Drinking Water

017942

TABLE 4-3 GROUNDWATER VOC SUMMARY
(EPA 8260, ug/L)

	TCE	PCE	1,1,1-TCA	1,1,2-TCA	1,1-DCA	1,2-DCA	1,1-DCE	Total 1,2-DCE	Vinyl Chloride	Chloroform	Dichloro-difluoro-methane	Trichloro fluoro-methane	Benzene	Chloro-benzene	Carbon Disulfide	tert-Butyl-benzene	Total Chlorinated Aliphatic Hydrocarbons
TNRCC RRS#2	5	5	200	5	3650	5	7	70 (cis)	2	100	7300	11000	5	100	3650		N/A
MCL	5	5	200	5		5	7	70 (cis)	2				5				N/A
EPA Reg III RBC	1.6	1.1	1300	0.19	810	0.12	0.044	61 (cis)	0.019	0.15	390	1300	0.36	39	21		N/A
EPA Reg IX PRG	1.6	1.1	1300	0.20	810	0.12	0.048	61 (cis)	0.02	0.18	390	1300	0.39	39	21		N/A
Well No.	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96
LHS-MW-1																	0
LHS-MW-2																	0
LHS-MW-3		4															4
LHS-MW-4																	0
LHS-MW-5	99	4884															4983
LHS-MW-6					4												4
LHS-MW-7	24	7		8	144	3	1341	16	10				1				1553
LHS-MW-8																	0
LHS-MW-9																	0
LHS-MW-10																	0
LHS-MW-11																	0
LHS-MW-12																	0
LHS-MW-13																	0
LHS-MW-14																	0
LHS-MW-15																	0
LHS-MW-16																	0
LHS-MW-17																	0
LHS-MW-18	21						1.7	11									33.7
LHS-MW-19	77																77
LHS-MW-20																	0
LHS-MW-21																	0
LHS-MW-22	1	1			4			1									7
LHS-MW-23																	0
LHS-MW-24																	0
LHS-MW-25																	0
LHS-MW-26																	0
LHS-MW-27																	0
LHS-MW-28																	0
LHS-MW-29																	0
LHS-MW-30																	0
LHS-MW-31																	0
LHS-MW-32																	0
LHS-MW-33											8.4						8.4
LHS-MW-34	7.5	13.8						35.9			69						127
LHS-MW-35											59						59
LHS-MW-36																	0
LHS-MW-37																	0
LHS-MW-38																	0
LHS-MW-39	2				7		29										38
LHS-MW-40																	NA
LHS-MW-41	8							8									16
LHS-MW-42																	0
LHS-MW-43	29140	168					18	1840	9	4							31179
LHS-MW-44	83						2	21									106
LHS-MW-45	4							16									20
LHS-MW-46	23							15									38
LHS-MW-47	20							4									24
LHS-MW-48																	NA
LHS-MW-49	115							28									143
LHS-MW-50																	0

017943

TABLE 4-3 GROUNDWATER VOC SUMMARY
(EPA 8260, ug/L)

	TCE	PCE	1,1,1-TCA	1,1,2-TCA	1,1-DCA	1,2-DCA	1,1-DCE	Total 1,2-DCE	Vinyl Chloride	Chloroform	Dichloro-difluoro-methane	Trichloro fluoro-methane	Benzene	Chloro-benzene	Carbon Disulfide	tert-Butyl-benzene	Total Chlorinated Aliphatic Hydrocarbons
TNRCC RRS#2	5	5	200	5	3650	5	7	70 (cis)	2	100	7300	11000	5	100	3650		N/A
MCL	5	5	200	5		5	7	70 (cis)	2				5				N/A
EPA Reg III RBC	1.6	1.1	1300	0.19	810	0.12	0.044	61 (cis)	0.019	0.15	390	1300	0.36	39	21		N/A
EPA Reg IX PRG	1.6	1.1	1300	0.20	810	0.12	0.048	61 (cis)	0.02	0.18	390	1300	0.39	39	21		N/A
Well No.	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96
LHS-MW-51																	0
LHS-MW-52																	0
LHS-MW-53																	0
LHS-MW-54	11																11
LHS-MW-55																	0
LHS-MW-56	13				30			744	100								887
LHS-MW-57																	0
LHS-MW-58	9	8	12				18	1.8						1			49
LHS-MW-59	249	16															265
LHS-MW-60																	0
LHS-MW-61																	0
LHS-MW-62	9		2													2	11
LHS-MW-63																	0
LHS-MW-64																	0
LHS-MW-65																	0
LHS-MW-66																	0
LHS-MW-67	7							8									15
LHS-MW-68																	0
LHS-MW-69	2																2
LHS-MW-70																	0
LHS-MW-71																	0
MW-105																	0
MW-106																	0
MW-107																	0

Notes:

(J): Estimated value below detection limit.
(B): Detected in both sample and blank.

TNRCC RRS #2: Risk Reduction Standard 2 values from the Texas Natural Resources Conservation Commission (TNRCC) Industrial and Hazardous Waste Division Risk Reduction Rules.
EPA Reg III RBC: Values from the EPA Region III Risk-Based Concentration Tables, February 9, 1995.
EPA Reg IX PRG: Values from the EPA Region IX Preliminary RemediationGoals First Half 1995, February 1, 1995.
MCL - EPA Maximum Contaminant Level For Drinking Water

017944

TABLE 4-4 GROUNDWATER SVOC SUMMARY
(EPA 8260, ug/L)

	bis (2-Ethylhexyl) phthalate	Phenol	Diethyl-phthalate	Di-n-octyl-phthalate	Pentachloro-phenol	Naphthalene	2-Methyl-naphthalene	Acenaphthene	Dibenzofuran	Fluorene
TNRCC RRS #2	6.08	21900	29200	730	1	1460		2190		1460
MCL										
EPA Reg III RBC	4.8	22000	29000	730	0.56				150	
EPA Reg IX PRG	4.8	22000	29000	730	0.56				150	
Well No.	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96
LHS-MW-1										
LHS-MW-2										
LHS-MW-3										
LHS-MW-4										
LHS-MW-5										
LHS-MW-6										
LHS-MW-7										
LHS-MW-8	3.5									
LHS-MW-9	2.2									
LHS-MW-10	0.62 (J)									
LHS-MW-11	2.1									
LHS-MW-12	2.1									
LHS-MW-13										
LHS-MW-14	2.1									
LHS-MW-15										
LHS-MW-16										
LHS-MW-17	0.47 (J)									
LHS-MW-18										
LHS-MW-19	3.5									
LHS-MW-20	2.3									
LHS-MW-21	2.7									
LHS-MW-22	2.4									
LHS-MW-23	2.8									
LHS-MW-24	3.0									
LHS-MW-25	2.3									
LHS-MW-26										
LHS-MW-27										
LHS-MW-28										
LHS-MW-29	0.74 (J)									
LHS-MW-30										
LHS-MW-31	1.1			1.0 (J)						
LHS-MW-32										
LHS-MW-33	0.63 (J)									
LHS-MW-34										
LHS-MW-35						1.6				
LHS-MW-36	0.78 (J)									
LHS-MW-37	1.1			1.2 (J)						
LHS-MW-38	1.1			0.74 (J)						
LHS-MW-39						0.39 (J)				
LHS-MW-40										
LHS-MW-41										
LHS-MW-42	0.52 (J)									
LHS-MW-43										
LHS-MW-44										
LHS-MW-45	0.63 (J)			2.1						
LHS-MW-46										
LHS-MW-47					7.5					
LHS-MW-48										
LHS-MW-49	0.85 (J)									
LHS-MW-50	1.1			3.1						

017945

TABLE 4-4 GROUNDWATER SVOC SUMMARY
(EPA 8260, ug/L)

	bis (2-Ethylhexyl) phthalate	Phenol	Diethyl-phthalate	Di-n-octyl-phthalate	Pentachloro-phenol	Naphthalene	2-Methyl-naphthalene	Acenaphthene	Dibenzofuran	Fluorene
TNRCC RRS #2	6.08	21900	29200	730	1	1460		2190		1460
MCL										
EPA Reg III RBC	4.8	22000	29000	730	0.56				150	
EPA Reg IX PRG	4.8	22000	29000	730	0.56				150	
Well No.	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96	FEB 96
LHS-MW-51										
LHS-MW-52	0.46 (J)									
LHS-MW-53	0.58 (J)									
LHS-MW-54				2.3						
LHS-MW-55	0.73 (J)									
LHS-MW-56	0.49 (J)									
LHS-MW-57										
LHS-MW-58	1.0			1.6						
LHS-MW-59	1.4			3.4						
LHS-MW-60										
LHS-MW-61										
LHS-MW-62										
LHS-MW-63	0.92 (J)						0.77	0.92	2.0	2.9
LHS-MW-64	0.64 (J)									
LHS-MW-65										
LHS-MW-66										
LHS-MW-67										
LHS-MW-68										
LHS-MW-69		3.9	0.57 (J)	0.60 (J)						
LHS-MW-70										
LHS-MW-71	0.62(J)									
MW-105										
MW-106										
MW-107										

Notes:

(J): Estimated value below detection limit.
(B): Detected in both sample and blank.

TNRCC RRS #2: Risk Reduction Standard 2 values from the Texas Natural Resources Conservation Commission Industrial and Hazardous Waste Division Risk Reduction Rules.
EPA Reg III RBC: Values from the EPA Region III Risk-Based Concentration Tables, February 9, 1995.
EPA Reg IX PRG: Values from the EPA Region IX Preliminary RemediationGoals First Half 1995, February 1, 1995.
MCL - EPA Maximum Contaminant Level For Drinking Water

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TABLE 4-5 GROUNDWATER GENERAL CHEMISTRY SUMMARY

	CHLORIDE mg/L	NITRITE mg/L	NITRATE mg/L	SULFATE mg/L	pH	CONDUCTIVITY mmhos/cm
LHS-MW-1	2020.0	<0.5	<0.5	454.0	8.24	6.91
LHS-MW-2	635.0	<0.5	<0.5	473.0	8.78	4.45
LHS-MW-3	4.8	<0.5	<0.5	10.0	8.96	0.28
LHS-MW-4	280.0	<0.5	<0.5	31.0	8.03	1.28
LHS-MW-5	1390.0	<0.5	<0.5	1422.0	7.24	7.03
LHS-MW-6	635.0	<0.5	<0.5	473.0	6.36	14.10
LHS-MW-7	2605.0	<0.5	<0.5	2550.0	8.29	11.80
LHS-MW-8	112.0	<0.5	1.4	127.0	6.61	1.14
LHS-MW-9	19.0	<0.5	<0.5	22.0	5.64	0.18
LHS-MW-10	1456.0	<0.5	<0.5	3.0	4.98	4.45
LHS-MW-11	1537.0	<0.5	<0.5	115.0	5.89	4.89
LHS-MW-12	47.0	<0.5	<0.5	111.0	6.30	0.65
LHS-MW-13	14.0	<0.5	<0.5	72.0	6.22	0.37
LHS-MW-14	3.6	<0.5	<0.5	<2.0	5.77	0.13
LHS-MW-15	835.0	<0.5	<0.5	1664.0	6.22	4.90
LHS-MW-16	152.0	<0.5	<0.5	96.0	6.85	1.81
LHS-MW-17	7.0	<0.5	<0.5	179.0	5.84	4.95
LHS-MW-18	394.0	<0.5	<0.5	1044.0	5.80	3.07
LHS-MW-19	173.0	<0.5	<0.5	221.0	6.60	1.31
LHS-MW-20	281.0	<0.5	<0.5	1830.0	6.22	3.67
LHS-MW-21	507.0	<0.5	3.0	1236.0	6.69	4.35
LHS-MW-22	1023.0	<0.5	<0.5	1929.0	5.70	6.11
LHS-MW-23	149.0	<0.5	1.0	1664.0	6.43	5.55
LHS-MW-24	1861.0	<0.5	<0.5	1084.0	6.38	7.16
LHS-MW-25	791.0	<0.5	<0.5	384.0	6.60	3.48
LHS-MW-26	226.0	<0.5	<0.5	335.0	6.64	1.78
LHS-MW-27	17.0	<0.5	<0.5	52.0	6.05	0.31
LHS-MW-28	73.0	<0.5	1.0	9.6	5.79	0.32
LHS-MW-29	1168.0	<0.5	<0.5	301.0	6.34	4.08
LHS-MW-30	980.0	<0.5	<0.5	269.0	6.60	3.79
LHS-MW-31	263.0	<0.5	<0.5	258.0	7.07	1.96
LHS-MW-32	15.0	<0.5	<0.5	12.0	5.10	0.10
LHS-MW-33	560.0	<0.5	<0.5	88.0	6.49	2.44
LHS-MW-34	245.0	<0.5	<0.5	16.0	6.48	1.23
LHS-MW-35	159.0	<0.5	<0.5	46.0	6.86	1.08
LHS-MW-36	38.0	<0.5	<0.5	18.0	6.53	0.40
LHS-MW-37	5.0	<0.5	<0.5	226.0	5.76	0.59
LHS-MW-38	6.9	<0.5	0.8	5.1	5.30	0.81
LHS-MW-39	692.0	<0.5	1.0	486.0	6.30	3.47
LHS-MW-40	DRY	-	-	-	-	-
LHS-MW-41	248.0	1.9	<0.5	308.0	7.03	2.37
LHS-MW-42	795.0	<0.5	<0.5	390.0	6.49	3.66
LHS-MW-43	379.0	1.3	<0.5	566.0	5.86	2.25
LHS-MW-44	305.0	<0.5	<0.5	242.0	6.61	1.95
LHS-MW-45	492.0	<0.5	<0.5	477.0	6.99	3.62
LHS-MW-46	14.0	<0.5	<0.5	64.0	5.70	0.30
LHS-MW-47	604.0	<0.5	<0.5	419.0	5.85	2.61
LHS-MW-48	DRY	-	-	-	-	-
LHS-MW-49	5.0	<0.5	<0.5	18.0	6.16	0.18
LHS-MW-50	483.0	<0.5	<0.5	330.0	7.02	2.97
LHS-MW-51	620.0	<0.5	<0.5	465.0	6.28	6.81
LHS-MW-52	46.0	<0.5	<0.5	53.0	6.45	0.44
LHS-MW-53	1773.0	2.0	<0.5	128.0	5.65	5.50
LHS-MW-54	267.0	<0.5	<0.5	89.0	7.59	1.47
LHS-MW-55	548.0	<0.5	<0.5	215.0	6.24	2.42
LHS-MW-56	185.0	<0.5	<0.5	36.0	6.72	1.15
LHS-MW-57	17.0	<0.5	<0.5	11.0	5.13	0.10
LHS-MW-58	3.0	<0.5	0.6	17.0	5.86	0.13
LHS-MW-59	57.0	<0.5	2.0	89.0	7.03	0.68
LHS-MW-60	152.0	<0.5	<0.5	293.0	6.35	1.33
LHS-MW-61	384.0	<0.5	<0.5	54.0	5.90	1.70
LHS-MW-62	130.0	<0.5	<0.5	132.0	7.29	0.55
LHS-MW-63	20.0	<0.5	0.7	29.0	6.04	0.18
LHS-MW-64	16.7	<0.5	<0.5	2.8	7.22	0.52
LHS-MW-65	6.5	<0.5	<0.5	8.0	6.68	0.15
LHS-MW-66	4.7	<0.5	<0.5	4.9	5.77	0.11
LHS-MW-67	62.0	<0.5	<0.5	37.0	7.71	0.44
LHS-MW-68	7.0	<0.5	<0.5	9.6	5.63	0.05
LHS-MW-69	79.0	<0.5	<0.5	81.0	6.62	0.52
LHS-MW-70	36.0	<0.5	<0.5	23.0	6.22	0.20
LHS-MW-71	752.0	<0.5	<0.5	163.0	6.83	2.87
MW-105	833.0	<0.5	<0.5	2029.0	6.83	5.94
MW-106	22.0	<0.5	<0.5	94.0	5.20	0.24
MW-107	198.0	<0.5	<0.5	23.0	5.59	0.50

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TABLE 4-6 LONGHORN ARMY AMMUNITION PLANT FEBRUARY 1996 SAMPLING ROUND *GROUNDWATER CONTAMINANTS OF POTENTIAL CONCERN*			
Parameter	**# Detections***	**Max Concentration (ug/l)**	**Min Concentration (ug/l)**
Volatile Organics			
1,1,1-Trichloroethane	2	12	2
1,1-Dichloroethene	6	1341	1.7
Total 1,2-Dichloroethene	14	1,840	1
1,1-Dichloroethane	5	144	4
Dichlorodiflouromethane	3	69	8.4
Trichloroethene (TCE)	21	29,140	1
Tetrachloroethene (PCE)	8	4,884	1
Vinyl Chloride	3	100	9
High Explosives			
2,6-Dinitrotoluene	4	0.62	0.20
2-Amino-4,6,-dinitrotoluene	5	0.95	0.33
3-Nitrotoluene	3	0.77	0.34
4-Amino-2,6-dinitrotoluene	2	0.94	0.69
Nitrobenzene	2	0.21	0.20
Tetryl	6	1	0.15
Metals			
Chromium	15	3,630	4.3
Nickel	28	4,810	15
Selenium	10	65.8	2.0
Thallium	2	178	92

Note: * does not include (J) values

4.2.1 Volatile Organics

TCE was the most frequently detected VOC in the February 1996 sampling round with a maximum concentration of 29,140 ug/l in monitoring well LHSMW-43. Based on the number of occurrences and maximum concentrations, TCE, PCE, 1,2-DCE, and 1,1-DCE are the four primary VOCs present in the groundwater underlying the sumps area of investigation. Other VOCs detected include 1,1,1-trichloroethane (1,1,1-TCA), 1,1,2-trichloroethane (1,1,2-TCA), 1,1-dichloroethane (1,1-DCA), 1,2-dichloroethane (1,2-DCA), vinyl chloride, chloroform, dichlorodifluoromethane, benzene, chlorobenzene, and tert-butyl-benzene. Table 4-3 lists the detected VOCs from the February 1996 sampling round. Based on the screening criteria discussed in section 3.5, TCE, PCE, 1,1,1-TCA, 1,1-DCA, 1,1-DCE, 1,2-DCE, vinyl chloride, and dichlorodifluoromethane are identified as the VOC COPCs for the February 1996 sampling round (see Table 4-6). TCE was detected nearly three times as often (21 detections versus 8 detections) as 1,2-DCE, the next most frequently detected VOC contaminant. Given that 1,2-DCE, as well as other VOC COPCs may be TCE degradation by-products, it is apparent that TCE is the dominant groundwater contaminant. With few exceptions, all other VOC COPCs were detected only when TCE was also detected.

When compared to the December 1994 sampling round, with very few exceptions, the same VOC contaminants were detected. However, the VOC concentrations for the February 1996 sampling round were generally higher. Specifically, significant increases were observed in the VOC concentrations for monitoring wells LHSMW-5, LHSMW-7, LHSMW-39, LHSMW-43 and LHSMW-59. Carbon disulfide was not detected in any of the samples during the February 1996 sampling round. This confirms that the carbon disulfide detections reported in the December 1994 sampling round were likely false positive detections. During the February 1996 sampling round, there were no VOCs detected in monitoring wells LHSMW-28, LHSMW-30, LHSMW-63, and LHSMW-66 where low concentrations of VOCs had previously been detected in December 1994.

4.2.2 Semi-Volatile Organics

A total of ten semi-volatile organic constituents (SVOC) were detected in the February 1996 sampling round.. Table 4-4 lists the detected SVOCs from the February 1996 sampling round. Bis(2-ethylhexyl)phthalate was the most frequently detected SVOC with a maximum concentration of 3.5 ug/ll in monitoring well LHSMW-19. Based on the number of occurrences, bis(2-ethylhexyl)phthalate and di-n-octyl-phthalate are the two predominantly detected SVOCs in the February 1996 sampling round. However, based on data validation findings, both are attributed to laboratory method blank contamination and are therefore not considered indicative of groundwater contamination. Other SVOCs detected include phenol, pentachlorophenol, naphthalene, 2-methylnaphthalene, acenaphthene, dibenzofuran and fluorene. Because none of these SVOCs were detected above their SQL in more than one sample they are not considered COPCs. The maximum concentration of any SVOC was 7.5 ug/l for pentachlorophenol (LHSMW-47). As with the February 1996 sampling round, there were no SVOC COPCs identified in the December 1994 sampling round.

4.2.3 High Explosives

Numerous detections of high explosives (HE) were reported for the February 1996 sampling round. However, all of the concentrations were reported to be 1 ug/l or less and the majority of detections were "J" qualified because they were detected at concentrations below their respective detection limits (SQL). Table 4-2 lists the detected high explosives from the February 1996 sampling round. Based on the criteria outlined in section 3.5 of this report, the high explosives tetryl, 3-nitrotoluene, 2,6-dinitrotoluene, 2-amino-4,6,-dinitrotoluene, 4-amino-2,6-dinitrotoluene, and nitrobenzene are considered COPCs. 3-Nitrotoulene was the most frequently detected high explosive. Reported concentrations for 2-nitrotoluene, and nitrobenzene are less than two times the detection limit and are therefore likely a result of instrument noise. None of the high explosive concentrations exceeded the TNRCC or EPA risk based standards. In the December 1994 sampling round high explosives were not detected in the Sumps project monitoring wells.

4.2.4 Metals

Table 4-1 lists the detected metals from the February 1996 sampling round. Metals, because they are naturally occurring, tend to be found throughout the Sumps project area. Metals exceeding their UTLs include barium (1 exceedance in 72 samples), calcium (1 exceedance in 72 samples), chromium (15 exceedances in 72 samples), nickel (28 exceedances in 72 samples) selenium (10 exceedances in 72 samples), strontium (1 exceedance in 72 samples), and thallium (2 exceedances in 72 samples). Based on the fact that barium, calcium and strontium were each detected at a concentration exceeding their respective UTL in only one sample they are likely not indicative of groundwater contamination and are therefore not considered to be COPCs. Therefore chromium, nickel, selenium and thallium are considered metals COPCs for the February 1996 sampling round.

4.2.5 General Chemistry

Groundwater samples from the Sumps monitoring wells were analyzed for the inorganic constituents chloride, nitrate, nitrite and sulfate. Table 4-5 lists the general chemistry and field analysis results for the monitoring wells. Chloride and sulfate were detected in measurable concentrations in all wells with the exception of sulfate reported as a non-detect in LHSMW-14. Nitrates and nitrates were detected in only a few monitoring wells.

Chloride was detected in all monitoring wells, at concentrations ranging from 3.0-2,605 mg/L. The highest chloride concentration was found in monitoring well LHSMW-07 located in the shop area. Thirty three of the 72 wells sampled had chloride concentrations higher than the EPA secondary drinking water MCL standard of 250 mg/L. Six wells (LHSMW-1, LHSMW-7, LHSMW-10, LHSMW-11, LHSMW-24, and LHSMW-53) had chloride concentrations which were above the maximum background concentration of 1416 mg/l for LHAAP.

Nitrates were detected at low concentrations (<5 mg/l) in 9 of the 72 wells sampled. Nitrites were detected at low concentrations (≤ 2.0 mg/l) levels in 3 of the 72 monitoring wells sampled.

Sulfate was detected in all monitoring wells sampled, with the exception of LHSMW-14, at concentrations ranging from 2.8-2,550 mg/L. The highest concentration was again reported in monitoring well LHSMW-7. Twenty seven of the 72 wells sampled had reported sulfate concentrations were greater than the EPA secondary drinking water MCL standard of 250 mg/l. All sulfate concentrations were below the maximum background concentration of 3,475 mg/l for LHAAP.

4.2.6 Field Parameters

Four replicate measurements of pH and specific conductance were taken and recorded at each monitoring well prior to collecting samples for laboratory analysis. The average replicate measurement for each indicator parameter at each well was listed in Table 4-5.

The lowest and highest of the pH field values are 4.98 (in well LHSMW-10) and 8.96 (in well LHSMW-3), respectively. The EPA secondary MCL for pH is from 6.5-8.5, therefore the February 1996 pH measurements fall outside of this range. Background ranges for pH at LHAAP are 5.2 to 6.8 therefore the pH measurements recorded during the February 1996 sampling round at LHAAP also fall outside of this range.

The average specific conductance of the field replicate measurements ranged from .010 mmhos/cm in well LHSMW-57 to 14.1 mmhos/cm in well LHSMW-6.

4.3 Distribution of Contaminants

In order to assess the distribution of COPCs from the February 1996 sampling round, several groundwater plume maps were developed for the COPCs which have sufficient contaminant concentrations and distribution to reasonably contour. Plume maps for the primary VOC and metals COPCs were developed. Because of the low concentrations of high explosive contaminants (maximum concentration < or equal to 1 ug/l)and their sporadic occurrences, plume maps of high explosives were not prepared.

Distribution of VOC contamination was evaluated by plotting total chlorinated aliphatic hydrocarbon concentrations on a map showing monitoring well locations (Figure 4-1). In addition, separate plume maps of the three predominant VOC COPCs, TCE (Figure 4-2), PCE (Figure 4-3) and 1,2-DCE (Figure 4-4), were also developed to illustrate the contribution of these contaminants to the overall VOC plume distribution.

Preliminary analysis of the distribution of VOC detections suggests that eight separate groundwater plumes may be present in the Plant Production area. Postulated plume boundaries are shown in Figure 4-1. As indicated on the maps, the extent of the VOC contamination has not been defined by the February 1996 data. Based on hydraulic gradient, plume geometry is inferred to be elongated downgradient to the east-northeast. Due to closely-spaced multiple sources (the sumps), depicted plumes may represent one larger individual plume. The largest contiguous area of VOC contamination, based on concentration and number of wells, is the plume located in the center of the Plant 3 area. This plume is defined by nine wells including the well in which total VOC concentrations of 31,179 ug/l were detected (MW-43). Based on monitoring well control, only the extent of the plume in the Plant 2 area may be reasonably determined based on the February 1996 sampling data.

Plume maps of the primary metals COPCs, chromium (Figure 4-5) and nickel (Figure 4-6), were developed. Because chromium is a naturally occurring metal, it is found throughout the groundwater at LHAAP. Figure 4-5 indicates where chromium concentrations are the greatest. The majority of elevated chromium concentrations are found in the Plant 3 area. The other locations where chromium concentrations are elevated include the area east of the Shop and 200 Areas and the Y and Static Test areas.

Nickel, like chromium, is naturally occurring and is found throughout the groundwater beneath LHAAP. Figure 4-6 indicates where Nickel concentrations are the greatest. Like chromium, the majority of elevated nickel concentrations are found in the Plant 3 area. The other locations where nickel concentrations are elevated include the area east of the Shop and 200 Areas and the Y and Static Test areas. Plume maps for Selenium and Thalium were not developed due to the sporadic and limited number of detections.

SECTION 5.0
SUMMARY OF FINDINGS AND RECOMMENDATIONS

Based on the information presented, the findings of the February 1996 groundwater sampling round include the following:

(1) Depths to water ranged from 5.00 ft bgs at monitoring well LHSMW-57 located in the South Plant 3 area to 20.26 ft bgs at LHSMW-61 located in the Y area. Water table elevations ranged from 233.44 ft at LHSMW-14 in the Plant Production 400 area to 171.49 ft, NGVD at LHSMW-71 in the Static Test area. The water table generally conforms to topography.

(2) The predominant groundwater flow direction is generally from west to east-northeast toward Caddo Lake. Overall, the gradient decreases from west to east and has an average hydraulic gradient of 0.0037 feet per foot. Hydraulic gradient is steepest in the Plant Production 400 area (0.033 feet per foot) reflecting, in part, the steeper surface topography in this area. In the Y and Static Test areas on the east side of the plant, nearer to Caddo Lake, the gradient flattens to 0.0018 feet per foot.

(3) Overall groundwater movement is slow. Groundwater flow velocity ranged from approximately 7 feet per year at the Y and Static Test area, 11 feet per year in the south Plant 3/Sewage Disposal area, 37 feet per year in the Plant 2 area and 127 feet per year in the Plant 400 area. Using the average gradient and the average hydraulic conductivity, the average flow velocity across the Sumps Project area is approximately 14 feet per year. Taking into account these very low groundwater velocity estimates, the orientation of any contaminant plume is not expected to exhibit a large degree of change between sampling events.

(4) Preliminary review of the data validation report for the initial groundwater sampling round in February 1996 indicated that, overall, the analytical data can be considered valid. Significant exceptions included detected concentrations of SVOCs (phthalates) that were attributed to laboratory contamination. No pesticides/PCBs or herbicides were detected in the wells selected for analysis. Cyanide was not detected in any of the wells selected for analysis. Gasoline range at a concentration of 12.9 mg/l in monitoring well LHSMW-43 was the only TPH detection in the wells selected for TPH

analysis.

(5) Tricloroethene (TCE), tetrachloroethene (PCE), 1,1,1-trichloroethane, 1,1-dichloroethane, 1,1-dichloroethene, 1,2-dichloroethene, vinyl chloride, and dichlorodifluoromethane are identified as the VOC COPCs for the February 1996 sampling round. TCE was detected nearly three times as often (21 detections versus 8 detections) as 1,2-DCE, the next most frequently detected VOC contaminant. Given that 1,2-DCE, as well as other VOC COPCs, may be TCE degradation by-products, it is apparent that TCE is the dominant groundwater contaminant. With few exceptions, all other VOC COPCs were detected only when TCE was also detected.

(6) A total of ten semi-volatile organic constituents (SVOC) were detected in the February 1996 sampling round. Bis(2-ethylhexyl)phthalate and Di-n-octyl-phthalate were determined to be a result of laboratory contamination and not present in the groundwater. No SVOCs were detected above their SQL in more than one sample and were therefore not considered COPCs. The maximum concentration of any SVOC was 7.5 ug/l for pentachlorophenol (LHSMW-47).

(7) Numerous detections of high explosives (HE) were reported for the February 1996 sampling round. However, all of the concentrations were reported to be less than 1 ug/l and the majority of detections were "J" qualified because they were detected at concentrations below their respective detection limits (SQL). The high explosives tetryl, 3-nitrotoluene, 2,6-dinitrotoluene, 2-amino-4,6,-dinitrotoluene, 4-amino-2,6-dinitrotoluene, and nitrobenzene are considered COPCs. 3-Nitrotoulene was the most frequently detected high explosive. Reported concentrations for 2-nitrotoluene, and nitrobenzene are less than two times the detection limit and are therefore likely a result of instrument noise.

(8) The metals aluminum, barium, calcium, chromium, cobalt, copper, iron, nickel, potassium, selenium and strontium exceeded maximum background levels. Metals exceeding their UTLs include barium (1 exceedance in 72 samples), calcium (1 exceedance in 72 samples), chromium (15 exceedances in 72 samples), nickel (28 exceedances in 72 samples) selenium (10 exceedances in 72 samples), strontium (1 exceedance in 72 samples), and thallium (2 exceedances in 72 samples). Based on the fact that barium, calcium, and strontium were each detected at a concentration exceeding their respective UTL in only one sample, they are not considered to be COPCs. Therefore chromium,

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nickel, selenium and thallium are the metals COPCs for the February 1996 sampling round.

(9) Analysis of the distribution of VOC detections suggests that eight separate VOC groundwater contaminant plumes may be present in the Plant Production area. Downgradient and lateral extent of only one plume can be determined with existing monitoring well control. The largest contiguous area of VOC contamination, based on concentration and number of wells is the plume located in the center of the Plant 3 area. Plume maps of the primary metals COPCs show that the majority of elevated chromium and nickel concentrations are found in the Plant 3 area. The other locations where chromium and nickel concentrations are elevated include the area east of the Shop and 200 Areas and the Y and Static Test Areas.

Based on analytical findings, groundwater contaminant site characterization for the Sumps area at LHAAP is not complete. Additional monitoring wells are recommended to fully delineate the horizontal extent of groundwater contamination within the uppermost water bearing zone of the Cypress Aquifer. Following the installation and sampling of the phase III monitoring wells and all of the Sumps wells concurrently, it is recommended that groundwater monitoring be continued on a semi-annual basis. In addition, it is recommended that, contingent upon on the results of the next sampling round, including any phase III wells, the analyte list be modified to include only VOCs, HEs and selected metals. Monitoring well LHSMW-43 should also continue to be sampled for TPH.

SECTION 6.0

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APPENDIX A

FEBRUARY 1996 DATA VALIDATION REPORTS

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APPENDIX B

FEBRUARY 1996 GROUNDWATER VELOCITY CALCULATIONS

017958

CESWT-EC-GC

11 April 1996

MEMORANDUM THRU Chief, Geotechnical Branch

FOR CESWT-GC-GS (Mr. Jim Martell)

SUBJECT: Data Validation, SWD Report 16474, Various Sites, Longhorn Army Ammunition Plant, Karnak, TX

1. On 31 January and 1 February 1996 eleven groundwater samples, one quality assurance sample, one quality control sample, one equipment blank and two travel blanks were collected from various sites at Longhorn Army Ammunition Plant. These samples were analyzed for metals (methods 6010, 7470, 7060, 7421, 7841, and 7740), volatile organics (method 8260), semivolatile organics (method 8270), anions (method 300.0), and explosives (method 8330). Samples MW-1 and MW-5 were also analyzed for cyanide (method 9010), purgeable TPH (8015M), pesticides/PCBs (8330), and herbicides (8150). A Chain of Custody Synopsis is enclosed. I have reviewed the chemical data generated through the analysis of those eight parameters.

2. A review and evaluation of the cooler receipt forms indicates that two volatiles samples arrived with bubbles and one sample vial arrived without being marked with the well number. However, the other markings on the bottle correspond to MW-4. The nitrite and nitrate analyses for samples MW-6, MW-8, MW-8EB, MW-8QA, MW-8QC, MW-9, MW-11, and MW-12 was outside of holding time. Shipment of the samples was impaired by poor weather. Sample chains of custody were incomplete and did not mention that the risk assessment samples were to use appendix IX methods. A corrected list was faxed to the laboratory to correct the omission. Samples MW-1, MW-2, MW-3, MW-5, MW-7, for nitrite/nitrate were analyzed outside of holding time because of instrument problems. Samples MW-2, MW-7, MW-8, and MW-9 for strontium will have to be reanalyzed because of instrument problems. Sample MW-8QA was analyzed for anions using method 9056 instead of the requested method 300.0. The results are comparable. Nitrite/nitrate for sample MW-8QA was not analyzed due to the missed holding time. Samples MW-1 and MW-5 were analyzed using method 9012 instead of the requested method 9010. The methods are comparable.

3. The equipment blank, MW-8EB, detected calcium, iron, magnesium, and selenium. The matrix spike (MS), matrix spike duplicate (MSD), blank spike (BS), and blank spike duplicate (BSD) were all outside of control limits for sample MW-8QA for TNT. The TNT results for this sample should be considered estimated. Insufficient spike concentration was added to the magnesium MS and MSD which caused the recoveries and the relative percent difference (RPD) to be outside of control limits for sample MW-8QA. The MS/MSD RPD for calcium was outside of control

limits for sample MW-8QA. The method blank analyzed with samples MW-8QA contained 500 μg/L calcium, however, this amount is negligible in comparison to the concentration found in the sample. Because of the negligible amount found in the method blank and because the MS, MSD, and laboratory control spike (LCS) recoveries are within the control limits, no qualification is required for calcium for this sample. The sample duplicate for beryllium for samples MW-1 and MW-5 was outside of control limits. The MS, MSD, and LCS recoveries were within control limits; therefore no qualifications are required for these samples. Aluminum and calcium were found in low concentrations in the method blank analyzed with samples MW-1 and MW-5. The concentration of calcium in the method blank was negligible in comparison to the samples, so no qualification is required. The concentration of aluminum in the samples was not large enough to rule out method contamination and these samples are considered estimated. The MS/MSD RPD for samples MW-1 and MW-5 for herbicides was outside of control limits. However, the MS and MSD recoveries and the surrogate recoveries were acceptable; and the data does not require qualification.

4. There were two disagreements between the quality assurance sample, the quality control sample and the respective field sample. The field sample and the quality assurance sample did not agree for the compounds lead and chloroform. Because of the disagreement in the lead concentrations the data for lead is considered estimated. Chloroform was not detected in any other sample and is detected in only low concentrations in the quality assurance sample. The presence of this compound in the sample is not considered representive of site condition.

5. The data does meet the general requirements of data quality and is considered valid and acceptable with the qualifications as listed above.

6. The point of contact is Penni Walker, ext 7074.

Rex Ostrander

ENCL

REX OSTRANDER, P.E.
Chief, Chemistry and IH Section

CF:
CESWT-EC-G
CESWT-EC-GC

u17960

Chain of Custody Synopsis

Sample ID:	Matrix	Chemical Analytical Methods: 6010 7470 7060 7421 7740 7841	8260	8270	300.0	8015M	8080A	8150	9010A	8330
Samples collected on 31 January and 1 February 1996										
MW-1TB	water		2							
MW-1	water	1	2	1	2	1	1	1	1	1
MW-2	water	2	2	1						1
MW-3	water	2	2	1	2					1
MW-4	water	2	2	1	2					1
MW-5	water	1	2	1	2	1	1	1	1	1
MW-6	water	2	2	1	2					1
MW-6TB	water		2							
MW-7	water	2	2	1	2					1
MW-8	water	2	2	1	2					1
MW-8QC	water	2	2	1	2					1
MW-8QA	water	3	3	3	3					3
MW-8EB	water	2	2	1	2					1
MW-9	water	2	2	1	2					1
MW-11	water	2	2	1	2					1
MW-12	water	2	2	1	2					1

1 - Environmental Chemical Corporation
2 - Southwestern Division Laboratory
3 - Inchcape Testing Services

017961

CESWT-EC-GC

16 May 1996

MEMORANDUM THRU Chief, Geotech Branch BE

FOR CESWT-EC-GS (Cliff Murray)

SUBJECT: Review and Evaluation of Chemical Data, Sumps Risk Assessment, Longhorn AAP, Karnack, Texas

1. The subject chemical data has been reviewed and evaluated. A Chemical Quality Assurance Report (CQAR) has been prepared. None of the chemical data has been rejected; however, a limited amount of field sample data has been qualified as estimated due to quality control deficiencies. The qualified data and the associated deficiencies are identified in Table 13-1 of the enclosed CQAR.

2. Please contact Mr. Jim Horn at ext. 7075 if you have questions or need further information.

Rex Ostrander

Encl

REX OSTRANDER, P.E.
Chief, Chemistry and IH Section

CF:
CESWT-PP-EA (Polk)
CESWT-EC-G
CESWT-EC-GC (Hartsfield)
CESWT-EC-GC

017962

LONGHORN ARMY AMMUNITION PLANT

SUMPS RISK ASSESSMENT

U.S. Army Corps of Engineers

Chemical Quality Assurance Report

Prepared by: Tulsa district U.S. Army Corps of Engineers

May 1996

1.0 INTRODUCTION.

As part of a risk assessment of the sump sites located at Longhorn Army Ammunition Plant (LHAAP), Karnack, Texas, groundwater samples were collected by a Tulsa District Corps of Engineers (COE) sampling crew. The groundwater samples were collected during the month of February 1996 and sent to the U.S. Army COE Southwestern Division Laboratory (SWD) for dispersal and analysis.

Groundwater samples collected by COE personnel consisted of sixty-one groundwater samples, fourteen travel blanks, six quality control replicate samples, six quality assurance replicate samples, and three equipment blank (EB) samples. Results of the chemical analyses for this sampling protocol can be found in SWD Laboratory Report Nos. 16474-1 thru 16474-6.

A synopsis of the samples collected, travel blanks, dates, SWD report numbers, the various chemical analyses performed and the performing laboratories are provided in section 2.0. Following section 2.0 are lists of acronyms, abbreviations and laboratory qualifiers. Parameter-specific discussions of the data, with respect to Data Quality Objectives, are given in sections 3.0 - 11.0. Field form and labeling deficiencies are discussed in section 12.0. A Summary and Conclusions discussion regarding the data's validity with respect to Data Quality Objectives, is provided in section 13.0.

Details of this data validation including actual holding times, recoveries of spikes and surrogates, relative percent differences (RPDs), chromatograms, GC/MS performance standards, and blank summaries are available on data validation check sheets, or other sources, from the Tulsa District COE, Chemistry & Industrial Hygiene Section upon request.

017964

2.0 CHAIN OF CUSTODY SYNOPSIS

TABLE 2-1

Chemical Parameters and Analytical Methods										
Sample ID: (LHAAP/LHS-)	SWD ID: (S60-)	VOC 8260	SVOC 8270	EXPL. 8330	METALS*	ANIONS* 300.0	PEST/PCB 8080	HERB. 8150	TPH 8015M	CYANIDE 9012
Samples collected 2/6/96 - SWD Laboratory Report No. 16474-1										
MW-13-TB	071-1	1								
MW-13	071-2	1	2	2	1	1				
MW-14	071-3	1	2	2	1	1				
MW-15	071-4	1	2	2	1	1				
MW-23	071-5	1	2	2	1	1				
MW-16	072-1	1	2	2	2	1	2	2	2	2
MW-19	072-2	1	2	2	2	1	2	2	2	2
Samples collected on 2/7/96 - SWD Laboratory Report No. 16474-1										
MW-22-TB	077-1	1								
MW-22	077-2	1	2	2	1	1				
MW-20	077-3	1	2	2	1	1				
MW-21	077-4	1	2	2	1	1				
MW-24	077-5	1	2	2	1	1				
MW-25	078-1	1	2	2	2	1	2	2	2	2
MW-25-QC	078-3	1	2	2	2	1	2	2	2	2
MW-25-QA	078-2	4	4	4	3	3	4	3	3	4
Samples collected on 2/8/96 - SWD Laboratory Report No. 16474-2										
MW-27-TB	083-1	1								
MW-27	083-2	1	2	2	1	1				
MW-47	083-3	1	2	2	1	1				
MW-46	083-4	1	2	2	1	1				
MW-57	083-5	1	2	2	1	1				
MW-57-QC	083-7	1	2	2	1	1				
MW-57-QA	083-6	4	4	4	5	3				
MW-37	083-8	1	2	2	1	1				
MW-44	083-9	1	2	2	1	1				
MW-35	084-1	1	2	2	2	1	2	2	2	2

2.0 CHAIN OF CUSTODY SYNOPSIS

TABLE 2-1 (continued)

Chemical Parameters and Analytical Methods										
Sample ID: (LHAAP/LHS-)	SWD ID: (S60-)	VOC 8260	SVOC 8270	EXPL. 8330	METALS*	ANIONS* 300.0	PEST/PCB 8080	HERB. 8150	TPH 8015M	CYANIDE 9012
Samples collected 2/9/96 - SWD Laboratory Report No. 16474-2										
MW-70-TB	091-1	1								
MW-70	091-2	1	2	2	1	1				
MW-68	091-3	1	2	2	1	1				
MW-67	091-4	1	2	2	1	1				
MW-41-TB	092-1	1								
MW-41	091-5	1	2	2	1	1				
MW-50	091-6	1	2	2	1	1				
MW-60	091-7	1	2	2	1	1				
MW-49	091-8	1	2	2	1	1				
MW-52	091-9	1	2	2	1	1				
MW-10	091-10	1	2	2	1	1				
Samples collected on 2/9/96 - SWD Laboratory Report No. 16474-3										
MW-69	092-2	1	2	2	2	1	2	2	2	2
MW-49-TB	092-1	1								
MW-43	092-3	1	2	2	2	1	2	2	2	2
MW-56	092-4	1	2	2	2	1	2	2	2	2
Samples collected on 2/10/96 - SWD Laboratory Report No. 16474-3										
MW-71-TB	093-1	1								
MW-71	093-2	1	2	2	1	1				
MW-53-TB	094-1	1								
MW-55	093-3	1	2	2	1	1				
MW-53	093-4	1	2	2	1	1				
MW-59	093-5	1	2	2	1	1				
MW-45	093-6	1	2	2	1	1				
MW-39	093-7	1	2	2	1	1				
MW-58	094-2	1	2	2	2	1	2	2	2	2

2.0 CHAIN OF CUSTODY SYNOPSIS

TABLE 2-1 (continued)

		Chemical Parameters and Analytical Methods								
Sample ID: (LHAAP/LHS-)	SWD ID: (S60-)	VOC 8260	SVOC 8270	EXPL. 8330	METALS*	ANIONS* 300.0	PEST/PCB 8080	HERB. 8150	TPH 8015M	CYANIDE 9012
Samples collected 2/11/96 - SWD Laboratory Report No. 16474-4										
MW-66-TB	097-1	1								
MW-66	097-2	1	2	2	1	1				
MW-65	097-3	1	2	2	1	1				
MW-64-EB	097-4	1	2	2	1	1				
MW-64	097-5	1	2	2	1	1				
MW-64-QC	097-6	1	2	2	1	1				
MW-64-QA	097-7	4	4	4	5	3				
MW-61	097-8	1	2	2	1	1				
MW-62	098-4	1	2	2	2	1	2	2	2	2
MW-63	098-3	1	2	2	2	1	2	2	2	2
MW-42-TB	098-1	1								
MW-42	097-9	1	2	2	1	1				
MW-29	097-10	1	2	2	1	1				
MW-29-QC	097-12	1	2	2	1	1				
MW-29-QA	097-11	4	4	4	5	3				
MW-29-EB	097-13	1	2	2	1	1				
MW-28	098-2	1	2	2	2	1	2	2	2	2
Samples collected on 2/12/96 - SWD Laboratory Report No. 16474-5										
MW-30-TB	102-1	1								
MW-18	102-2	1	2	2	1	1				
MW-17	102-3	1	2	2	1	1				
MW-26	102-4	1	2	2	1	1				
MW-30	102-5	1	2	2	1	1				
MW-38	102-6	1	2	2	1	1				
MW-31	102-7	1	2	2	1	1				
MW-32	102-8	1	2	2	1	1				
MW-54-TB	103-1	1								
MW-54-EB	103-2	1	2	2	1	1				

2.0 CHAIN OF CUSTODY SYNOPSIS

TABLE 2-1 (continued)

Sample ID: (LHAAP/LHS-)	SWD ID: (S60-)	VOC 8260	SVOC 8270	EXPL. 8330	METALS*	ANIONS* 300.0	PEST/PCB 8080	HERB. 8150	TPH 8015M	CYANIDE 9012
Samples collected 2/12/96 - SWD Laboratory Report No. 16474-5 (continued)										
MW-54	103-3	1	2	2	1	1				
MW-54-QC	103-4	1	2	2	1	1				
MW-54-QA	103-5	4	4	4	4	3				
Samples collected on 2/13/96 - SWD Laboratory Report No. 16474-6										
MW-51-TB	108-1	1								
MW-51	108-2	1	2	2	2	1	2	2	2	2
MW-106	106-2	1	2	2	1	1				
MW-107	106-3	1	2	2	1	1				
MW-33-TB	106-1	1								
MW-33	106-4	1	2	2	1	1				
MW-34	106-5	1	2	2	1	1				
MW-34-QC	106-7	1	2	2	1	1				
MW-34-QA	106-6	4	4	4	5	3				
MW-36	106-8	1	2	2	1	1				
MW-105	106-9	1	2	2	1	1				

Notes:

1 - Southwestern Division Laboratories (SWD)
2 - Environmental Chemical Corporation (ECC)
3 - Inchcape Testing Services (ITS)
4 - Missouri River Division Laboratory (MRD)
5 - Continental Analytical Services, Inc. (CAS)

* Metals - Aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese,mercury, nickel, potassium, selenium, silver, strontium, thallium, vanadium & zinc. Methods - 6010, 7060, 7421, 7470 & 7740.

Anions - chloride, nitrite, nitrate & sulfate
Method - 300.0

LIST OF ACRONYMS AND ABBREVIATIONS

BS	-	blank spike
BSD	-	blank spike duplicate
EB	-	equipment blank
IRP	-	Installation Restoration Program
LCS	-	laboratory control spike
LCSD	-	laboratory control spike duplicate
MD	-	matrix duplicate
MS	-	matrix spike
MSD	-	matrix spike duplicate
ug/L	-	micrograms per liter
mg/L	-	milligrams per liter
MB	-	method blank
PCBs	-	polychlorinated biphenols
QC	-	quality control
QA	-	quality assurance
RPD	-	relative percent difference
RCRA	-	Resource Conservation and Recovery Act
RS	-	reagent spike
RSD	-	reagent spike duplicate
SVOC	-	semivolatile organic compounds
SW	-	Solid Wastes
SWD	-	Southwestern Division Laboratories
TB	-	travel blank
TIC	-	tentatively identified compound
TRPH	-	total recoverable petroleum hydrocarbons
VOC	-	volatile organic compounds

LABORATORY QUALIFIERS

< - Indicates compound was analyzed for but was not detected.

B - Indicates analyte was detected in method blank as well as sample.

J - Indicates an estimated value.

E - Indicates analyte's concentration exceeded upper calibration range.

D - Indicates analyte was diluted and reanalyzed due to high analyte concentrations.

3.0 VOLATILE ORGANIC ANALYSIS.

A volatile organic analysis was requested for the samples using SW-846 Method 8260.

3.1 Accuracy. Surrogate, matrix spike (MS), reagent spike (RS), and laboratory control spike (LCS) recoveries were generally complete and within quality control limits with the following exceptions concerning sample MW-57-QA: (1) Three surrogate recoveries for the MS and matrix duplicate samples; (2) Two surrogate recoveries for the LCS sample; (3) MS recovery for dichloroethene; and (4) LCS recoveries for chloroform and 1,2-dichloroethane.

3.2 Precision. Matrix spike duplicate (MSD) and reagent spike duplicate (RSD) recoveries, associated relative percent differences (RPDs) and matrix duplicate (MD) RPDs were generally within acceptable quality control limits with the following exceptions: (1) MSD recovery for dichloroethene (sample MW-57-QA); and (2) matrix duplicate RPD for batch 960222W1 (sample MW-58). A comparison between the six field samples and their quality control replicate samples reflected no significant differences.

3.3 Representativeness. The volatile analyses were all performed within the required holding times. All method, trip and equipment blanks were free of contamination except for trip blanks MW-53-TB and MW-30-TB which contained methylene chloride (1.5-2.0 ug/L). The corresponding field samples were not similarly contaminated. The samples arrived at the performing laboratories in good condition, except for 20 vials which contained bubbles less than 6 millimeters in diameter. Since volatile samples are collected in triplicate, a total of 270 vials were sent to SWD Laboratory for volatiles analysis. Consequently, there were sufficient vials available, which did not contain bubbles, to allow completion of acceptable volatile analysis for each sample source.

3.4 Comparability. The units between the primary and quality assurance laboratories were consistent. The QA laboratory (all samples except MW-25-QA) analyzed the sample utilizing method 8240 rather than the requested method 8260. Four analytes (dichlorofluoromethane, cis-1,2-dichloroethene, tetrachloroethene and trichloroethene) were detected in field sample MW-34 at levels of 7.5-69 g/L. Three analytes (1,2-dichloroethene (total), tetrachloroethene and trichloroethene) were detected in sample MW-34-QA at levels of 9.1-37 ug/L. Dichlorofluoromethane and cis-1,2-DCE are not standard analytes in method 8240. A comparison between the MW-34 field and QA sample results for tetrachloroethene and trichloroethene reflected no significant differences. A comparison between the other five field samples and their corresponding QA replicate samples also indicated no significant differences.

4.0 SEMIVOLATILE ORGANIC ANALYSIS.

A semivolatile organic analysis was requested for the samples using SW-846 Method 8270.

4.1 <u>Accuracy.</u> Surrogate recoveries were generally acceptable and within QC limits with the exception of one surrogate (2-fluorobiphenyl) in sample MW-58. Reagent spike, MS, and LCS recoveries were within quality control limits with the following exceptions: (1) LCS recoveries for diethyl phthalate (samples MW-25-QA, MW-29-QA & MW-64-QA); and (2) LCS recoveries for hexachlorobenzene, isophorone, 2,4-dichlorophenol, 1,2,4-trichlorobenzene, 2,4,6-trichlorophenol and 2-chloronaphthalene and the MS recoveries for 1,2,4-trichlorobenzene and 4-trinitrophenol (samples MW-34-QA, MW-54-QA & MW-57-QA).

4.2 <u>Precision.</u> All RSD and MSD recoveries, associated RPDs and MD RPDs were generally acceptable and within QC limits with the following exceptions: (1) MSD recovery for 4-nitrophenol (samples MW-25-QA, MW-29-QA & MW-64-QA); and (2) MSD recoveries for 1,2,4-trichlorobenzene and 4-nitrophenol (samples MW-34-QA, MW-54-QA & MW-57-QA). A comparison between the six field samples and their quality control replicate sample reflected no significant differences.

4.3 <u>Representativeness.</u> All samples were analyzed within the required holding times. The equipment blanks and most of the method blanks were free of contamination. Bis(2-ethylhexyl)-phthalate (B2EHPH) and Di-n-octylphthalate (DNOPH) were identified in some of the method blanks at estimated levels below the method detection limits which ranged from 0.92 to 5.0 ug/L. B2EHPH was also identified in 15 samples at levels (0.9-3.5 ug/L) slightly above the detection limits and in 25 samples at estimated levels below the detection limits. Di-n-octylphthalate was also identified in 6 samples at levels (1.2-3.2 ug/L) slightly above the detection limits and in 4 samples at estimated levels below the detection limits. Both of these analytes are common laboratory contaminants. The samples arrived at the laboratory in good condition.

4.4 <u>Comparability.</u> The units between the primary and quality assurance laboratories were consistent. A comparison between the six field samples and their quality assurance replicate samples reflected no significant differences.

5.0 EXPLOSIVES.

An explosives analysis was requested for the samples using SW-846 Method 8330.

5.1 Accuracy. BS/BSDs were analyzed rather that MS/MSDs (QA samples MW-29, MW-34, MW-54 & MW-64). Surrogate, MS, BS, RS, and LCS recoveries were generally complete and within quality control limits with the following exceptions: (1) Surrogate recoveries were below QC limits in samples MW-20, MW-30, MW-33, MW-55, MW-55 and MW-71; and (2) Surrogate recovery for the MSD (QA samples MW-25 & MW-57) was above QC limits since it was apparently "double spiked" by the QA laboratory.

5.2 Precision. BSD, RSD amd MSD recoveries, associated RPDs and MD RPDs were generally within acceptable quality control limits with the exception of the MD RPD for QA samples MW-29, MW-34, MW-54 & MW-64. A comparison between the six field samples and their quality control replicate samples reflected no significant differences.

5.3 Representativeness. The explosives analyses were all performed within the required holding times. All method and equipment blanks were free of contamination. The samples arrived at the performing laboratories in good condition.

5.4 Comparability. The units between the primary and quality assurance laboratories were consistent. A comparison between field sample MW-54 and its corresponding QA replicate sample indicated that 2,4-dinitrotoluene (24DNT) was detected at a level of 0.59 ug/L in the field sample but was not detected in the QA sample at a detection limit of 0.02 ug/L. The detection limit for the field sample analysis (0.13 ug/L) was significantly higher than the detection limit for the QA sample analysis. Consequently, these results cannot be considered significantly different since the field sample result is within a factor of 5 times the detection limit. A comparison between the other five field samples and their corresponding QA replicate samples also reflected no significant differences.

6.0 METALS.

A metal analysis was completed for the samples using the following SW-846 methods. QC deficiencies have been tabulated in Table 6-1. The item numbers referenced in the following discussions are those shown in this table.

Method	Constituents (Analytes)
6010	Aluminum, Barium, Beryllium, Calcium, Cobalt, Iron, Magnesium, Manganese, Nickel, Potassium, Strontium, Vanadium & Zinc
6010 or 7042	Antimony
7060	Arsenic
6010 or 7131	Cadmium
6010 or 7211	Copper
7421	Lead

Method	Constituents
7470	Mercury
7740	Selenium
6010 or 7761	Silver
6010 or 7841	Thallium

6.1 Accuracy. MS recoveries were generally within QC limits with the following exceptions: (1) Selenium, silver, chromium, copper, mercury and lead in 1 batch each due to matrix interferences (Items 4 & 21); (2) Calcium and strontium in one batch each since the analyte levels were higher than the spike levels (Items 5 & 22); and (3) Barium and Thallium in one batch each (Items 3 & 20). All BS and LCS recoveries were generally within QC limits.

6.2 Precision. MSD recoveries, MS/MSD RPDs and MD RPDs were generally within QC limits except for the following: (1) MSD recoveries and MS/MSD RPDs for selenium, silver, chromium, copper, mercury and lead in 1 batch (Item 5); (2) Calcium in 3 batches and iron, chromium and strontium in one batch each since the analyte levels were higher than the spike levels (Items 10, 15, 22 & 23); (3) MSD recoveries and MS/MSD RPDs for barium and chromium in 1-2 batches (Items 3, 13 & 17); (4) MD RPDs for aluminum and lead in five batches each, selenium in three batches and copper, cobalt, iron, manganese & nickel in 1-2 batches each (Items 6-9, 11-12, 14, 16, 18 & 19). All BSD recoveries and BS/BSD RPDs were, within QC limits. A comparison between the six field samples and their quality control replicate samples reflected significant difference for aluminum for MW-57 (Item 30).

6.3 Representativeness. All metal analyses were performed within the required holding times. Two method blanks were contaminated with low levels (0.0009 mg/L) of chromium (Items 27 & 30). All equipment blanks contained low levels of metals contamination as shown in Table 6-2 (Items 25, 26 & 28). The higher level of calcium contamination detected in sample MW-54-EB was not considered since the calcium contamination in the other equipment blanks closely agreed. The equipment blank contamination for all analytes except iron was less than a factor of five times that analyte's detection limit. Consequently, only the iron contamination is considered significant. Iron analyte results (MW-16, 41, 45, 54, 54QC, 54QA, 57, 57QC, 57QA & 59) which are less than five times (935 ug/L) the average blank contamination level are questionable and considered estimates. The samples arrived at the laboratories in good condition.

TABLE 6-1
QC DEFICIENCIES - METALS ANALYSES

#	ANALYTE	SWD #	BATCH/SAMPLE #	QC DEFICIENCY
1	Selenium	16474-1	MW-13,14,15,20, 21,22,24	Results preliminary due to matrix interference - samples will be reanalyzed
2	Strontium	16474-1	MW-13	Results preliminary due to instrument problems - samples will be reanalyzed
3	Barium	16474-1	ITS Batch I-11W96	MS & MS/MSD RPD outside QC limits
4	Ag,Cr,Cu,Hg Pb,Se	16474-1	MW-25-QA	MS & MSD out due to matrix interference
5	Ca & Fe	16474-1	MW-25-QA	MS & MSD out-analyte level > spike level
6	Pb & Ni	16474-1	MW-25 & 25-QC	MD RPD outside QC limits
7	Fe,Mn,Al,Cu Ni & Pb	16474-2	SWD Batch I-12W96	MD RPD outside QC limits
8	Lead	16474-2	MW-35	MD RPD outside QC limits
9	Selenium	16474- 3,4 & 5	SWD Batch 6-14W	MD RPD out due to matrix interference
10	Calcium	16474-3	SWD Batch I-13W96	MS/MSD RPD outside QC limits
11	Al & Cobalt	16474-3	SWD Batch I-13W96	MD RPDs outside QC limits
12	Lead	16474-3	MW-58 & 69	MD RPD outside QC limits
13	Chromium	16474-3	MW-58 & 69	MSD & MS/MSD RPD outside QC limits
14	Al & Cobalt	16474-4	SWD Batch I-13W96	MD RPDs outside QC limits
15	Calcium	16474-4	SWD Batch I-13W96	MS/MSD RPD outside QC limits
16	Lead	16474-4	MW-28, 62 & 63	MD RPD outside QC limits
17	Chromium	16474-4	MW-28, 62 & 63	MSD & MS/MSD RPD outside QC limits
18	Aluminum	16474-5	SWD Batch I-14W96	MD RPD outside QC limits
19	Aluminum	16474-6	SWD Batch I-14W96	MD RPD outside QC limits
20	Thallium	16474-6	MW-51	MS run using method of standard additions was outside QC limits
21	Mercury	16474-6	MW-51	MS outside QC limits - matrix interference
22	Chromium	16474-6	MW-51	MS/MSD out since sample analyte level higher than spike level
23	Fe & Sr	16474-6	MW-51	MSD out since sample analyte level higher than spike
24	Chromium	16474-3	ECC method blank	Low level contamination - 0.0009 mg/L

TABLE 6-1 (continued)
QC DEFICIENCIES - METALS ANALYSES

#	ANALYTE	SWD #	BATCH/SAMPLE #	QC DEFICIENCY
25	Al,Ba,Ca,Cr Cu,Fe,K,Se	16474-4	MW-64-EB	Equipment blank contamination
26	Ca,Cu,Fe,Pb Mg,Mn & Sb	16474-4	MW-29-EB	Equipment blank contamination
27	Chromium	16474-4	ECC method blank	Low level MB contamination - 0.0009 mg/L
28	Al,Ca,Cu, & Fe	16474-5	MW-54-EB	Equipment blank contamination
29	Cr, Fe & Ca	16474-6	ECC method blank	Low level MB contamination: Ca = 0.028 mg/L; Fe = 0.0042 mg/L; Cr = 0.0006 mg/L
30	Aluminum	16474-2	MW-57 & 57-QC	Field/QC replicate sample results disagree: Field = 583 vs. QC replicate = 278 ug/L
31	Aluminum & Lead	16474-4	MW-27,27-QA, 64 & 64-QA	Field/QA replicate sample results disagree: MW-27: Aluminum - Field=3,590 vs. QA=1,300 ug/L MW-64: Aluminum - Field=532 vs. QA = <100 ug/L MW-64: Lead - Field = 96 vs. QA = <3 ug/L
32	Barium & Chromium	16474-6	MW-34 & 34-QA	No QA replicate sample results provided for barium Field/QA replicate sample results disagree for Chromium - Field = 49 ug/L vs. QA = 20 ug/L

TABLE 6-2
METALS CONTAMINATION - EQUIPMENT BLANKS (ug/L)

METAL	MW-64-EB	MW-29-EB	MW-54-EB	AVERAGE	DETECTION LIMIT
Aluminum	384	<200	245	217	200
Barium	10	<5	<5	7	5
Calcium	749	3,520*	761	755*	200
Chromium	13	<10	<10	11	10
Iron	333	97	132	187	25
Potassium	229	<200	<200	210	200
Selenium	7.5	<2	<2	3.8	2
Lead	<30	56	<30	39	30
Manganese	<10	13	<10	11	10
Strontium	<10	58	<10	26	10

* Value not considered when average contamination was calculated since contamination levels for other blanks closely agreed.

6.4 <u>Comparability.</u> The units between the primary and quality assurance laboratories were not consistent. The primary laboratory reports the results in units of ug/L, however, the QA laboratory reported results in units of mg/L. A comparison between the six field samples and their quality assurance replicate samples reflected significant differences for aluminum in two sample sets and chromium and lead in one sample set each (Items 31 & 32).

7.0 ANIONS ANALYSIS.

An anions analysis was requested for the samples using SW-846, 300 series Methods. Method 9056 was utilized for the anion analytes concerning the QA sample, however, these results are similar and comparable for validation purposes.

7.1 <u>Accuracy.</u> The field and QC sample results for chloride (sample MW-34-QA) are considered preliminary by the QA laboratory. the sample will be reanalyzed and revised results, if any, will be provided as soon as possible. All field/QC replicate and other QA replicate reagent spike, MS and LCS recoveries were generally complete and within quality control limits.

7.2 <u>Precision.</u> RSD and MSD recoveries, associated RPDs and MD RPDs were generally acceptable and within QC limits with the following exceptions: (1) MSD for sulfate and reagent duplicate RPD for chloride - Field/QC replicate samples collected on 6-7 February 1996 (Batch 022996H); and (2) MSD for nitrite - Field/QC replicate samples collected on 11 February 1996 (Batch 021296H). A comparison between the six field samples and their quality control replicate samples, reflected no significant differences.

7.3 <u>Representativeness.</u> All anion analyses were performed within the required holding times with the exception of nitrite/nitrate for sample MW-25-QA. For additional details, see paragraph 7.4 below. The method and equipment blanks were free of anion analyte contamination. The samples arrived at the laboratory in good condition.

7.4 <u>Comparability.</u> The units between the primary and quality assurance laboratories were consistent. Due to a log-in error by the QA laboratory, the nitrite and nitrate analyses initially performed for sample MW-25-QA were by General Chemistry method 351.1 When this error was noted, the samples were submitted for the requested Ion Chromotography method 9056, however, this analysis was performed outside the recommended holding time. The results of both analyses are provided in SWD Laboratory Report 16474-1 and are considered to be similar and comparable for validation purposes. A comparison between the six field samples and their quality assurance replicate samples reflected no significant differences.

8.0 PESTICIDES AND PCB ANALYSIS

A pesticides and PCB analysis was requested for the samples labeled "Risk Assessment Special Parameters" using SWD-846 Method 8080.

8.1 Accuracy. Due to shortages in sample volumes, LCS/LCSDs were analyzed rather that MS/MSDs for the samples collected on 8-11 February 1996. Surrogate, MS, RS, and LCS recoveries were generally complete and within quality control limits except for 2 surrogate recoveries during analysis of sample MW-25-QA.

8.2 Precision. RSD, MSD and LCSD recoveries, associated RPDs and MD RPDs were generally within acceptable quality control limits. Only one field/QC replicate sample set was analyzed for this special parameter. A comparison between this field sample (MW-25) and its quality control replicate sample reflected no significant differences.

8.3 Representativeness. The analyses were all performed within the required holding times. All method and equipment blanks were free of contamination. The samples arrived at the performing laboratories in good condition.

8.4 Comparability. The units between the primary and quality assurance laboratories were consistent. Only one field/QA replicate sample set was analyzed for this special parameter. A comparison between this field sample (MW-25) and its quality assurance replicate sample reflected no significant differences.

9.0 HERBICIDE ANALYSIS

A herbicide analysis was requested for the samples labeled "Risk Assessment Special Parameters" using SWD-846 Method 8150.

9.1 Accuracy. Due to shortages in sample volumes, BS/BSDs were analyzed rather that MS/MSDs for the sample MW-25-QA. Surrogate, MS, BS, RS, and LCS recoveries were generally complete and within quality control limits.

9.2 Precision. MSD, BSD, and RSD recoveries, associated RPDs and MD RPDs were generally within acceptable quality control limits. A comparison between field sample MW-25 and its quality control replicate sample reflected no significant differences.

9.3 Representativeness. The analyses were all performed within the required holding times. All method and equipment blanks were free of contamination. The samples arrived at the performing laboratories in good condition.

9.4 Comparability. The units between the primary and quality assurance laboratories were consistent. A comparison between field sampleMW-25 and its quality assurance replicate sample reflected no significant differences.

10.0 TOTAL RECOVERABLE PETROLEUM HYDROCARBONS (TRPH).

A TRPH analysis was requested for the samples labeled "Risk Assessment Special Parameters" using SW-846 Method 8015 modified (both volatile and extractable fractions).

10.1 Accuracy. Surrogate recoveries were generally acceptable. Due to shortages in sample volumes, LCS/LCSDs were analyzed for TRPH-Extractables rather than MS/MSDs for most of the field/QC replicate samples. The TPRH-Volatiles result for sample MW-43 was high due to two large gasoline-related organic peaks, howeever, the sample did not exhibit a gasoline pattern. Therefore, the results are considered questionable. All reagent spike, MS, and LCS recoveries were generally complete and within QC limits for all samples.

10.2 Precision. MSDs were not analyzed for most of the field/QC replicate samples. For details, see paragraph 10.1 above. All RSD, MSD, and LCSD recoveries and associated RPDs were generally acceptable and within QC limits. A comparison between the TRPH results for field sample MW-25 and its quality control replicate sample reflected no significant differences.

10.3 Representativeness. The analyses were performed within the required holding times. All equipment and method blanks were free of contamination. The samples arrived at the laboratories in good condition.

10.4 Comparability. The units between the primary and quality assurance laboratories were not consistent regarding TRPH-Volatiles analysis. The primary laboratory reported results in units of mg/L, however, the QA laboratory reported results in ug/L. A comparison between the extractable and volatile TRPH results for the field sample MW-25 and its quality assurance replicate sample reflected no significant differences.

11.0 CYANIDE ANALYSIS

A cyanide analysis was requested for the samples labeled "Risk Assessment Special Parameters" using SWD-846 Method 9010, however, Method 9012 was actually utilized by both the primary and QA laboratories. The results produced by these methods are comparable.

11.1 Accuracy. MS and LCS recoveries were generally complete and within quality control limits.

11.2 Precision. MSD recoveries, MS/MSD RPDs and MD RPDs were generally within acceptable quality control limits. A comparison between field sample MW-25 and its quality control replicate sample reflected no significant differences.

11.3 Representativeness. The analyses were all performed within the required holding times. All method and equipment blanks were free of contamination. The samples arrived at the performing laboratories in good condition.

11.4 Comparability. The units between the primary and quality assurance laboratories were consistent. A comparison between field sample MW-25 and its quality assurance replicate sample reflected no significant differences.

12.0 FORMS.

Forms were generally complete and within requirements except for some minor discrepancies regarding the sample labels. The laboratory resolved these problems without adversely affecting the validity of the analytical results.

13.0 SUMMARY AND CONCLUSIONS.

The chemical parameters/analytes and groundwater samples which are qualified and considered estimates are listed in Table 13-1.

TABLE 13-1
QUALIFIED ANALYTICAL DATA

PARAMETER	ANALYTES	SAMPLES AFFECTED	QC DEFICIENCY
PEST/PCBs	All analytes	MW-25-QA**	Surrogates out - sample & QC batch
VOC	All analytes	MW-57-QA**	Surrogates out - MS/MSD & LCS
SVOC	1,2,4-TCB*	MW-34QA, 54QA & 57QA**	MS/MSD & LCS Recov. out
SVOC	B2EHPH & DNOPH*	All Samples	Method Blank Contamination
Explosives	All analytes	MW-23, 30, 33, 55 & 71	Surrogates out (low)
Metals	Iron	MW-16, 41, 45, 54, 54QC, 54QA, 57, 57QC, 57QA & 59	Equipment Blank Contamination

* TCB - Trichlorobenzene; B2EHPH - Bis(2ethylhexyl)phthalate; DNOPH - Di-nitro-octylphthalate

** Qualification of this QA data does not apply to the corresponding field/QC replicate samples

017979

All other data results for this sampling event are considered to fully comply with applicable Data Quality Objectives and are considered to be valid and acceptable.

Submitted by,

JAMES A. HORN, P.E.
Environmental Engineer

REX OSTRANDER, P.E.
Chief, Chemistry & IH Section

LHAAP FEBRUARY 1996 GROUNDWATER VELOCITY CALCULATIONS

G.W. Velocity = Ki/n   Where: K - hydraulic Conductivity
i- hydraulic gradient
n - effective porosity

Assumptions: Average hydraulic conductivity is 7.47E-4 cm/sec
Effective Porosity (n) = 20%
Hydraulic Gradients derived from February 1996 Groundwater Map (Figure B1)

Velocity calculations are approximate. The velocity of groundwater depends on the tortuosity of the flowpath through the aquifer.

PLANT 2 AREA:

Gradient = 0.0097   V = (7.47E-4 cm/sec x 0.0097)/ 0.20
V = 3.62E-5 cm/sec
V = 37 Ft/yr

200 AREA:

Gradient = 0.0053   V = (7.47E-4 cm/sec x 0.0053)/0.20
V = 1.98E-5 cm/sec
V = 20 Ft/yr

EAST SHOP AREA:

Gradient = 0.0038   V = (7.47E-4 cm/sec x 0.0038)/0.20
V = 1.42E-5 cm/sec
V = 15 Ft/yr

017981

WEST POWER AREA:

Gradient = 0.0064

V = (7.47E-4 cm/sec x 0.0064)/0.20
V = 2.39E-5 cm/sec
V = 25 Ft/yr

NORTH PLANT 3 AREA

Gradient = 0.0030

V = (7.47E-4 cm/sec x 0.0030)/0.20
V = 1.12E-5 cm/sec
V = 12 Ft/yr

SOUTH PLANT 3 AREA/ SEWAGE DISPOSAL AREA

Gradient = 0.0029

V= (7.47E-4 cm/sec x 0.0029)/0.20
V = 1.08E-5 cm/sec
V = 11 Ft/yr

Y-AREA/STATIC TEST AREA

Gradient = 0.0018

V = (7.47E-4 cm/sec x 0.0018)/0.20
V = 6.72E-6 cm/sec
V = 7 Ft./yr

400 AREA

Gradient = 0.033

V = (7.47E-4 cm/sec x 0.033)/0.20
V = 1.23E-4 cm/sec
V = 127 Ft/yr

017982

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

June 25, 1996

CERTIFIED MAIL
P 836 901 730
RETURN RECEIPT REQUESTED

James A. McPherson, Commander's Representative
Longhorn/Louisiana Army Ammunition Plant
Attn: SIOLH-CR
P.O. Box 30058
Shreveport, LA 71130-0058

Re: Longhorn Army Ammunition Plant
Final DERPMIS/RMIS Resolution Document

Dear Mr. McPherson:

In accordance with Section VIII. G. 2 of the Federal Facility Agreement, the TNRCC staff is notifying the Army that a twenty-day extension will be needed in order to provide a more thorough review and comment of the above referenced project. Comments will be provided by July 19, 1996 instead of the current due date of June 29, 1996. 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-AT)
Jonna Polk, COE Tulsa District (CESWT-PP-EA)

DEPARTMENT OF THE ARMY
HEADQUARTERS, U.S. ARMY INDUSTRIAL OPERATIONS COMMAND
ROCK ISLAND, ILLINOIS 61299-6000

017983

REPLY TO
ATTENTION OF

AMSIO-EQ (200-1a)

27 JUN 1996

MEMORANDUM FOR Commander's Representative, Longhorn Army Ammunition Plant, ATTN: SIOLH-OR (Mr. David Tolbert/Mr. James McPherson), Marshall TX 75670-1059

SUBJECT: Water Supply for Installation Restoration Program (IRP) Effort at Longhorn Army Ammunition Plant (AAP)

1. References:

a. Facsimile copy of Defense Environmental Restoration Account (DERA) Funding Request Form and Alternative 8 (Construct New Pipeline/Treatment Plant from Existing Pump Station at Black Cypress River, Use Existing Tanks), 30 May 96 (encl 1).

b. Funding Request form ($738,044) for RMIS 12 & 16 (Alternative Water Supply) and Supporting Documents, 20 Jun 96 (encl 2).

c. Facsimile of O & M Actual Cost, 25 Jun 96 (encl 3).

d. Facsimile Draft Engineering Evaluation and Cost Analysis for Alternative Water and Wastewater Treatment Strategies, Longhorn AAP, dated 23 May 96 (encl 4).

e. Facsimile Summary of Preliminary Cost Estimates Potable Water Treatment and Distribution System, Alternative 9A, 26 Jun 96 (encl 5).

2. The reference 1a funding request was not approved because of the capital cost ($821,000) and the annual O & M cost ($244,000) exceed the preferred alternative.

3. The reference 1b funding request was not approved because of the $738,044 cost and the annual O & M cost ($233,964) exceed the preferred alternative.

4. The reference 1c actual O & M cost is justification for not selecting the operation of the existing water treatment plant at Longhorn AAP. Further, there is a lot of water seepage in the water lines which will be expensive to maintain.

5. The seven alternatives listed at reference 1d were reviewed. The recommendation is to pick the first alternative which is cost effective. The capital cost is $545,500 and the annual O & M cost is $87,900. The alternative 1 is to switch to groundwater source.

6. Longhorn AAP has decided to go with alternative 9A, which is at reference 5 (encl 5). The capital cost is $338,900 and the annual O & M cost is $307,964. The IOC, AMSIO-EQ, does not concur with Longhorn AAP, for the following reasons:

a. The DERA funds cannot support this infrastructure at Longhorn AAP. The DERA funds should be used for cleanup of contaminated sites.

b. The draft document at reference 1d indicates that it is cost effective to select alternative 1 (groundwater source). Alternative one should provide all the water required for the IRP effort at Longhorn AAP.

c. The water plant at Longhorn AAP has serious water seepage problems in its piping system. It will be too costly to maintain the water plant with DERA funds.

d. Further, Longhorn AAP has not provided adequate justification to support their choice for the 9A alternative. The IRP cannot support other efforts not directly related to IRP cleanup at Longhorn AAP.

7. This office has temporarily approved the operations of the existing water plant at Longhorn AAP for 3 months as a temporary fix. The operation of the water plant is to provide potable water for the IRP effort in progress.

8. On 26 June 1996 we approved and processed your funding request for the operations of the water plant for 3 months. Request that funding request for long-term alternative 1 be submitted ASAP.

017985

AMSIO-EQ
SUBJECT: Water Supply for Installation Restoration Program (IRP) Effort at Longhorn Army Ammunition Plant (AAP)

9. The POC for this action is Mr. Cyril Onewokae, AMSIO-EQE, (309) 782-1350, DSN 793-1350, E-mail conewoka@ria-emh2.army.mil.

FOR THE COMMANDER:

Robert J. Radkiewicz
ROBERT J. RADKIEWICZ
DCS for Environmental Management

5 Encls
as

CF (wo/encls):
Commander, Tulsa District, Corps of Engineers, CESWT-PP-E
(Mrs. Jonna Polk) Post Office Box 61, Tulsa, OK 74121-0061

DEPARTMENT OF THE ARMY
LONGHORN/LOUISIANA ARMY AMMUNITION PLANTS
MARSHALL, TEXAS 75671-1059

REPLY TO
ATTENTION OF

July 10, 1996

017986

Ms. Diane Poteet
Texas Natural Resource Conservation Commission
Pollution Cleanup Division
Superfund Investigation Section
12100 Park 35 Circle, Building D
Austin, TX 78753

SUBJECT: Agency Consent to Burning Ground #3 Work Plan Amendments and Landfill-16 TCRA Design Issues

Dear Ms. Poteet:

Longhorn Army Ammunition Plant (LHAAP) is requesting concurrence with written approval for two amendments to the Burning Ground #3 Final Work Plan and for two Landfill-16 TCRA design issues anticipated relative to the TCRA work plan currently under development. Detailed discussions and justifications for each of the Burning Ground No. 3 work plan amendments were previously submitted in writing to the TNRCC under separate cover. The design issues at Landfill-16 have been previously discussed via phone conference with you on several occasions. Each item for which the Army is seeking TNRCC concurrence and written approval is briefly summarized below.

Amendment No. 1 to the Burning Ground No.3 work plan requests that a mechanical filter press rather than a sand filter bed be allowed for sludge dewatering operations. As discussed in the original request, use of the filter press is technically comparable yet will result in a significant cost savings to the project and will in no way adversely affect air, soil, or groundwater media. Amendment No. 2 requests that the use of a trenching machine be allowed as an optional alternative technology for the construction of the interceptor collection trenches (ICT) and that the soils generated from the construction of the ICT be temporarily stockpiled at the site. Stockpiling of excavated soils is necessary because the excavation rate of the ICTs will be faster than the maximum process rate of the soil treatment unit. Allowing the temporary stockpiling of soils (in accordance with 40 CFR 264.250) will result in decreased construction time and provide additional cost savings.

LHAAP is also requesting written confirmation of the previous verbal approval given on two issues relative to the Landfill-16 TCRA groundwater extraction system. The first issue concerns the type of containment around the 50,000 gallon extraction water holding tank. It is requested that the proposed tank containment system consist of a 40 mil liner and a soil berm, to be constructed and maintained in accordance with 40 CFR 265 Subpart

J. The other issue concerns the mixing of waters from Landfill-16 and Burning Ground No. 3 at the 300,000 gallon storage tank located at the groundwater treatment plant. Previously submitted results of biotoxicity testing of the mixed waters (15 to 1 ratio based on relative extraction rates) show that acceptable survival rates are achieved. Allowing the mixing of waters will result in greater operational flexibility and lower project costs by eliminating the need for a separate storage tank for Landfill-16 water at the groundwater treatment plant.

If you have any questions or require additional information please contact Mr. David Tolbert at 903-679-2728.

Sincerely,

David Tolbert

for James McPherson
Commander's Representative

017988

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

July 12, 1996

CERTIFIED MAIL
P 836 901 731
RETURN RECEIPT REQUESTED

James A. McPherson, Commander's Representative
Longhorn/Louisiana Army Ammunition Plant
Attn: SIOLH-CR
P.O. Box 30058
Shreveport, LA 71130-0058

Re: Longhorn Army Ammunition Plant
Group IV Sumps Groundwater Monitoring Quarterly Report
February 1996 Sampling Round

Dear Mr. McPherson:

The Texas Natural Resource Conservation Commission (TNRCC) staff have completed their review of the above referenced report, which was received on June 14, 1996. We have no comments and concur with the Army's report. 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

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

017989

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

July 15, 1996

CERTIFIED MAIL
P 836 901 733
RETURN RECEIPT REQUESTED

James A. McPherson, Commander's Representative
Longhorn/Louisiana Army Ammunition Plant
Attn: SIOLH-CR
P.O. Box 30058
Shreveport, LA 71130-0058

Re: Longhorn Army Ammunition Plant
Final DERPMIS/RMIS Resolution Document

Dear Mr. McPherson:

The Texas Natural Resource Conservation Commission (TNRCC) staff have completed our review of the above referenced document, which was received on May 29, 1996. We appreciate the Army's efforts to revise the above referenced document based on past comments; however, your revisions for the attached listed sites require further consideration, particularly with regard to certain Applicable or Relevant and Appropriate Requirements (ARARs).

First, it is to be noted that in accordance with 30 TAC §335.167, corrective action must be instituted for all releases of hazardous waste or constituents from any solid waste management unit, regardless of the time at which waste was placed in such a unit. Second, under Section II.B. of the Federal Facility Agreement (FFA), all corrective action obligations that are required under the Resource Conservation and Recovery Act (RCRA), and which relate to the releases of hazardous wastes will be addressed in accordance with the FFA. In order for the Army to be consistent with these ARARs, the TNRCC recommends that the following language or some similar wording be used for the attached list of sites:

"[After the general description of the site...] This site was identified as a Solid Waste Management Unit in the RFA, and the TNRCC determined that there were no additional investigations required at this site. After performing a preliminary assessment of the site in [date], the Army has also determined that no releases have occurred and no further investigation is needed at this site. This is an active unit, therefore, it is not eligible for DERA funding. ~~If any future actions are found necessary they will be addressed under RCRA.~~ "

017990

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-AT)
Jonna Polk, COE Tulsa District (CESWT-PP-EA)
Oscar Linebaugh, COE Eastern Area Office (CESWF-AD-E)

SPECIAL SITE LIST FROM DERPMIS/RMIS RESOULUTION DOCUMENT

Site Name	LHAAP #	RFA #
Vacuum Truck Overnight Parking Lot	2	2
Building 722 Paint Shop	3	3
Pilot Waste Water Treatment Plant	4	4
Power House Boiler Pond	5	5
Building 54F	6	6
Building 50G Drum Processing	7	7
Sewage Treatment Plant	8	9
Building 31-W Drum Storage	9	10
Area 49W Drum Storage	15	15
Construction Materials Landfill	19	26
Building 707 Storage Area for PCBs	23	31
Building 701 PCB Storage	34	33
Explosive Waste Pads	36	35
QA Lab Building 29A	37	8
Magazine Area	45	28

DEPARTMENT OF THE ARMY
HEADQUARTERS, U.S. ARMY INDUSTRIAL OPERATIONS COMMAND
ROCK ISLAND, ILLINOIS 61299-6000

AUG 1996

017992

17 JUL 1996

REPLY TO ATTENTION OF

AMSIO-EQE (200-1a)

MEMORANDUM FOR Commander, Longhorn Army Ammunition Plant, ATTN: SIOLH-EV (Mr. David Tolbert), Marshall TX 75670-1059

SUBJECT: Group IV Sumps Groundwater Monitoring Quarterly Report

1. Reference memorandum, Tulsa District Corps of Engineers, CESWT-PP-EA, 13 Jun 96, SAB and enclosure thereto.

2. The subject report has been reviewed, and the following comments are offered:

a. General:

(1) We should handle the sumps the same as UST remediation/removal or closure. Request that the sumps and sump sites that do not show or exceed background levels or risk based concentration or primary remedial goals for contaminants of concern (COC) be closed ASAP and no further studies conducted at these sump sites.

(2) This report does not explain why we have elevated levels of COC when compared to the last data or report. The analysis, conclusion, and recommendation should address the reasons for the sudden elevation for the likely COCs.

(3) Request that sampling data analysis results be compared to the background level if the background level is higher than MCL/risk based concentration/primary drinking water standards/primary remedial goals (PRG). The chloride background concentration is 1416 mg/l, while the secondary drinking water MCL is 250 mg/l. We should not compare the chloride level to secondary drinking water standard/MCL when the background level (1416 mg/l) is higher than the drinking water MCL.

(4) Change the words "high explosives" to "explosives" and delete the acronym "HE" for high explosives in the entire report.

b. Executive Summary:

(1) Page ES2, lines 1-2 - The sentence "TPH analysis identified ... monitoring well LHSMW-43 at a concentration of

12.9 mg/l", should read as follows, "TPH reading in well LHSMW-43 is 12.9 mg/l". What is the acceptable level of TPH? Why do we need to know about the peaks in this report?

(2) Page ES2, line 5 - Delete the word "potential" and change the acronym "COPC" in the entire report to the familiar acronym "COC".

c. Paragraph 1.3 Site Location and History, page 2, lines 6-7: The name "U.S. Army Armament, Munitions, and Chemical Command" should be changed to "U.S. Army Industrial Operations Command" in this report and all future reports.

d. Paragraph 4.2 Nature of Contamination, page 17, lines 4-5 (fourth sentence) - The same TPH comments as in paragraph 2.b.1 of this memorandum.

e. Paragraph 4.2.5 General Chemistry:

(1) Page 30, lines 1-4 - The comparison for chloride levels should be compared to the chloride (1416 mg/l background level), and not the EPA's secondary drinking water MCL (250 mg/l). Please re-write this portion and delete the information on the EPA's secondary drinking water MCL.

(2) Page 30, lines 7-11 - The comments in paragraph 2.e.1 above also applies to the sulfate.

f. Section 5.0, page 40, last paragraph - Request that the recommendation specify that sumps and sump sites that do not show elevated levels of COCs be certified clean and closed ASAP.

3. The POC for this action is Mr. Cyril Onewokae, AMSIO-EQE, (309) 782-1350, DSN 793-1350, E-mail conewoka@ria-emh2.army.mil.

FOR THE COMMANDER:

HENRY CRAIN
Acting DCS for Environmental
Management

CF:
Commander, U.S. Army Corps of Engineers District, Tulsa, ATTN: CESWT-PP-E/(Ms. Jonna Polk) Post Office Box 61, Tulsa, OK 74121-0061

DEPARTMENT OF THE ARMY
HEADQUARTERS, U.S. ARMY INDUSTRIAL OPERATIONS COMMAND
ROCK ISLAND, ILLINOIS 61299-6000

017994

REPLY TO
ATTENTION OF

AMSIO-EQ (200-1a) 23 JUL 1996

MEMORANDUM FOR Commander, Longhorn Army Ammunition Plant, ATTN: SIOLH-EV (Mr. David Tolbert), Marshall, TX 75670-1059

SUBJECT: Draft Final Design Analysis Report for the Site 16 (Old Landfill) Time Critical Removal Action

1. Reference memorandum, Tulsa District Corps of Engineers, CESWT-PP-EA, 28 Jun 96, SAB.

2. The subject report has been reviewed, and the following comments are offered:

a. General:

(1) This report should be written in the past tense throughout the entire document.

(2) Was contamination by explosive compounds at Site 16 ever verified?

b. Paragraph 1.0, Introduction, page 1-1, 2d paragraph, the last sentence is not accurate.

c. Paragraph 2.1, Site Description, page 2-1, lines 1 and 2: The location of the site is explained by " . . . Avenue Q and adjacent to the former retail sales area . . . ," and refers to Figure 2-1 in Appendix I. However, this map refers to Q Avenue, and the former retail sales area is not shown.

d. Paragraph 2.2 Site History, page 2-1, line 1: The sentence "The site history was reconstructed from . . . " should read as follows, "The site history is based on . . . "

e. Paragraph 2.3, Previous Investigations, page 2-3, lines 4 and 5: Please explain the statement "Vertically composited samples were then composited horizontally within a given quadrant to yield one sample for each depth interval sampled."

f. Paragraph 2.4.2, Phase I RI:

(1) State MCLs and SMCLs before stating detection concentrations; and explain results using terms such as "above" or "below" limits, not "meets" limits.

(2) Page 2-7, paragraph 3, lines 5 and 6: What is the reasoning behind the sentence "The grab sample was taken from a stiff, gravelly clay with black staining."

g. Paragraph 2.4.4, Post Phase II Sampling - Surface Water and Sediment Sample Results, page 2-10, 2d paragraph, lines 1 and 2: The sentence "The sample location from which these surface water and sediment samples HBW-1, HBW-1B, HBS-1, and HBS-1B is adjacent to a groundwater . . . " should read as follows, "Surface water and sediment samples HBW-1, HBW-1B, HBS-1, and HBS-1B were taken at a location adjacent to a groundwater . . . "

h. Paragraph 4.1, Site Geology, paragraph 1, page 4-1, lines 3 and 4: The sentence " . . . containing some silt and clay lenses and are at first dry, to moist, then generally become saturated at . . . " should read as two sentences as follows " . . . containing some silt and clay lenses. At the surface the sand is dry and gradually becomes saturated at . . . "

i. Paragraph 6.0, Recommendation, page 6-1, 2d paragraph, lines 15, 16, and 17 contradict the statement in Paragraph 6.0, Recommendation, page 6-2, 2d paragraph, lines 4, 5, 6, 7, and 8.

3. The POCs for this request are Mr. Cyril Onewokae, AMSIO-EQE, DSN 793-1350 or Ms. Kerri Fiedler, AMSIO-EQE, DSN 793-4006.

FOR THE COMMANDER:

JAMES F. ZAK
Acting, Deputy Chief of Staff
for Environmental Management

CF:
Commander, U.S. Army Corps of Engineers District, Tulsa, ATTN: CESWT-PP-EA (Ms. Jonna Polk), Post Office Box 61, Tulsa, OK 74121-0061

Monthly Manager's Meeting
Longhorn Army Ammunition Plant
July 23, 1996
Austin, TX

017996

1. The following is a list of participants:

David Tolbert - LHAAP
Chris Villarreal - EPA
Bud Jones - TNRCC
Larry Champagne - TNRCC
John Smith - TNRCC
Jonna Polk - Tulsa District, USACE
Randy Bratcher - Tulsa District, USACE
Oscar Linebaugh - USACE, EAO
Ira Nathan - LHAAP
Diane Poteet - TNRCC
Peter Waterreus - TNRCC
Kelly Holligan - TNRCC
Scott Mgebroff - TNRCC
Ken Kebbell - Tulsa District, USACE
Jim Martell -Tulsa District, USACE
Dave Bockelmann - Sverdrup

2. The following is a list of topics discussed (in order of discussion):

Opening Remarks and Review and Transmittal of Meeting Minutes: On behalf of LHAAP, Ira Nathan welcomed all attendees to the July 1996 Monthly Manager's Meeting held at the TNRCC offices in Austin, TX. The June 1996 meeting minutes were reviewed and accepted without revision or comment.

Landfill-16 Groundwater Biotoxicity Test: Preliminary review of Draft biotoxicity test results suggest that the constituent causing yellow tint is non-toxic. The TNRCC (Diane Poteet) requested that the results of biotoxicity test be submitted for agency review. Assuming the constituent causing yellow tint to water is shown to be non-toxic, TNRCC stated concurrence with the installation's previous request allowing water from LF-16 be mixed with potable water in order for treated water to comply with the color requirement of discharge permit.

Landfill-16 TCRA Design Analysis: TNRCC representatives raised questions concerning the groundwater modeling aspect of the design analysis. Questions relating to model validation, source of model parameters and ultimate purpose of the TCRA were asked. Sverdrup and Corps of Engineers representatives addressed these question and reviewed the entire groundwater modeling effort. Based on the responses given, TNRCC accepted the design analysis. The TNRCC requested that LHAAP submit an interim report after 6 months of sustained system operation which updates the groundwater model using new data and analysis system effectiveness.

Group 1 Ecological Risk Assessment: TNRCC expressed concern that ecological risk may not have been adequately evaluated due to lack of sampling at Caddo Lake and insufficient documentation to justify marker species. LHAAP and the USACE responded that current Department of Defense regulations do not allow the Army to conduct sampling activities outside installation boundaries. Given the long-term disagreement concerning selection of marker species among regulatory agencies, LHAAP and USACE believe that the potential for ecological risk at Group 1 was fairly evaluated using the best information available. The EPA recommended that, rather than a series of site by site evaluations of ecological risk, a single plant-wide ecological risk assessment be performed. The benefits of such a study are that consistent, regulatory accepted, criteria will be used to evaluate risk and that it may reduce costs compared to the site by site approach. This initiative was accepted by the group. EPA proposed a meeting in September at LHAAP to start the process.

BG-3 Air Monitoring Plan (AMP): Based on verbal comments received by LHAAP from John Gott with the TNRCC suggesting that the current AMP may be "overkill" and recent a cost estimate to implement that is much larger than is currently budgeted, the installation requested that the AMP be reviewed by EPA and TNRCC. LHAAP stated that the goal of the review would be to reduce costs thru simplified and more efficient implementation and sampling procedures and still meet regulatory requirements. Among the initial EPA and TNRCC suggestions were eliminating the field GC requirement, reducing sampling requirements from initial frequency after establishing a baseline for comparison, and combining samples for less analytical costs. A meeting to explore these issues in greater detail with appropriate air monitoring regulatory personnel, contractors, USACE, and LHAAP was scheduled for 6 August 1996 in Dallas, TX at the EPA offices.

Monthly Meeting Schedule: The next monthly managers meeting will be held on 5 August at the EPA offices in Dallas, TX. The next TRC will be held on 10 September at LHAAP.

LONGHORN ARMY AMMUNITION PLANT
IRP STATUS SUMMARY

As Of 5 August 1996

PROJECT NAME	PROJECT PHASE	PROJECT STATUS	NEXT MAJOR MILESTONE(S)
Group #1 (Sites 1, 11, XX, and 27)	Remedial Investigation/ Feasibility Study	- Draft Final RI Report submitted (without the risk assessment) 16 Apr 96. - TNRCC comments provided 16 May 96. - Meeting to discuss Risk Assessment and tour sites was held at LHAAP 10 June with EPA, COE, USACHPPM and LHAAP. - Additional surface soil samples (22) and one (1) GW sample are required to finalize RA.	- Comments on Draft Final RI Report due 17 May 96. (Comment date reflects extension, as requested.) - Response to regulator comment delayed till week of 5 August. - Additional RA sampling by COE tentatively scheduled for mid August. - Final RI will be submitted 31 December.
Group # 2 (Sites 12, 16, 17, 18, 24, 29, and 32)	Remedial Investigation/ Feasibility Study	- Data Summary Report for Group 2, Phase II was submitted to on 6 March. - Draft Final Data Summary Report submitted for review on 17 July. - Quarterly sampling and analysis of perimeter wells was completed 16 May. - Draft Site Wide Plans (SSHP, CDAP, and IDWMP) submitted 5 July for regulator and Army review.	- Submittal of Annual 1995 Perimeter Well Groundwater Sampling Report in September Manager's meeting. - Comments on Draft Final Field Summary Report due on 19 August. - Comments on Draft Site Wide Plans due 12 August.
Group # 4 Wastewater Sumps	Remedial Investigation/ Feasibility Study	- Draft Final Risk Assessment Work Plan was submitted 25 April - SCAPS field work began 6 May and was completed on 24 May. - Groundwater PDP for second sampling round submitted 15 June 96 for regulator and Army comment.	- Results of SCAPS investigation and Phase III SOW were presented at July Manager's meeting. - Comments on Groundwater Data Summary were due 15 July. - Regulator comments on Risk Assessment Work Plan are due. -Semi-annual GW sampling round scheduled for mid August.
Group # 5 (Sites 50, 52, 60, and 63)	Site Investigation	- Field Work is complete. - Draft Sampling Analysis and Data Validation Report submitted 10 June for Army review. - Army comments on Draft Sampling Analysis and Data Validation Report received 8 July.	- Draft Site Investigation report due 7 Aug 96 for Army review.

017998

LONGHORN ARMY AMMUNITION PLANT
IRP STATUS SUMMARY

As Of 5 August 1996

PROJECT NAME	PROJECT PHASE	PROJECT STATUS	NEXT MAJOR MILESTONE(S)
Burning Grounds #3 (Group # 2, Sites 18 and 24)	Interim Remedial Action	- Work Plans are Final. Written approval of AMP was given on 15 May 96. - Initiation of groundwater treatment may be delayed due to problems in obtaining an electrical / instrumentation subcontractor. - Received written TNRCC concurrence for Work Plan amendments #1 and #2. - Draft letter to revise ROD analyte list (to include LF-16 analytes) was submitted for Army review on 26 June.	- Commencement of soil treatment projected for Oct 96.
Landfill Caps (Group # 2, Sites 12 and 16)	Interim Remedial Action	- Draft Final Work Plan, including responses to comments, submitted for review on 29 April. Additional comments received from TNRCC on 17 May. - Comment resolution meeting with TNRCC held on 22 May in Austin. - Work Plan approval letter received from EPA on 15 May. - Recieved Final Work Plan 7 June. - Verbal approval recieved from TNRCC (Richard Anderson) to use 20 mil (non-weld) cover.	- Texas PE stamp on drawings submitted 23 July. TNRCC approval received. - Field mobilization began in Jul 96.
Landfill Site 16 Time Critical Removal Action (TCRA)	TCRA	- Decision Document signed on 2 Jan 96. - Field work completed 21 March. System operation continues. - Constituent of yellow color in water identified as tricarbonyl iron. Bio-toxicity studies are currently being performed thru DOW. - Draft Final TCRA Design Analysis submitted 28 June. - Received written approval from EPA to mix LF-16 water at BG-3 GWTP. - Harrison Bayou re-sampled 12 June.	- Received bio-toxicity test results, and results will be submitted 7 August.

U17993

LONGHORN ARMY AMMUNITION PLANT
IRP STATUS SUMMARY

As Of 5 August 1996

PROJECT NAME	PROJECT PHASE	PROJECT STATUS	NEXT MAJOR MILESTONE(S)
DERA SUMPS	Removal Action	- Contract awarded 25 Mar 96. - Construction coordination meeting was held on 2 Apr 96. Work Plan preparation began 4 Apr. - Sump sampling and analysis meeting and TNRCC field demonstration held 3 June. - Sampling of sump contents was completed 28 June.	- Analytical results received in mid July. - Removal scheduled to begin in August.
Alternative Water Supply	Study	- Contract awarded to Environeering on 16 April. - Kick-off meeting held on 2 May. - Draft AWS EECA submitted and reviewed at 23 May meeting.	- Review meeting held on 23 May. - Draft Final EECA submitted 25 July.

SCHEDULED MEETINGS AND VISITS TO LHAAP			
Date / Time	**Purpose of Meeting / Visit**	**Location**	**Location**
5 Aug / 0930/1330	August LHAAP Manager's Meeting	EPA	Austin, TX
10 September / 0900	TRC	LHAAP	LHAAP

u18000

018001

SFIM-AEC-RPO (715) 24 July 1996

MEMORANDUM FOR Commander, U.S. Army Corps of Engineers, Tulsa District, ATTN: CESWT-PP-EA (Ms. Jonna Polk), P.O. Box 61, Tulsa, OK 74121-0061

SUBJECT: Draft Final Design Analysis Report for the Site 16 (Old Landfill) Time Critical Removal Action

1. Enclosed are the comments from U.S. Army Environmental Center Geologists, Chemists, and Program Management Oversight personnel on the subject matter.

2. The point of contact for this action is the undersigned at (410) 671-1510.

Encl

JEFFREY P. ARMSTRONG
Restoration and Oversight Branch

GENERAL COMMENTS

1. Statements to the effect that there has been an "impact" to Harrison Bayou have been made. Two surface water measurements at the same location along Harrison Bayou indicate that the Federal Safe Drinking Water Act standard for TCE has been exceeded. Is this water normally used for drinking water at this location? What attempts using risk based analysis have been made to quantify risk?

2. This document supports a long term hydraulic control instead of a time critical (i.e., quick response) removal action. A more appropriate removal action for this problem is outlined in section 300.415,para (d)(4), of the National Contingency Plan (NCP), "Removal Action" - page 499, which discusses capping of contaminated soils. A landfill cap at Site 16 is already scheduled to begin implementation this summer. Have the results of such a cap on the proposed system been assessed? If so, what are the results?

3. Information provided from the Design Analysis Report indicate very low sustainable pumping rates for the two extraction wells (1.5 gpm for 16EW01 and 0.1 gpm for 16EW02). The reported maximum drawdown values (Tables 4.1 and 4.2) do not lend confidence to a "cone of influence" solution for controlling groundwater contamination flowing toward Harrison Bayou since the adjacent piezometers have negligible drawdown. Additional extraction wells might not provide significant control impact.

4. The next suggested step of implementing an impermeable slurry cutoff wall would require an expensive and elaborate pump and treat system for a negative downstream gradient to avoid the inevitable "bathtub" effect where contaminated water flows around, under or over the cutoff wall. If you implement a pump and treat system with negative gradient, a slurry cutoff wall is not required. The time to implement this inevitable succession of concepts will necessitate EE/CAs per the NCP.

5. If a hydraulic control is the desired goal, it is recommended that it be carefully planned and located closer to the source material. It is expected that the $2 million and/or 12 month rule outlined in the NCP will be exceeded if the current plan is pursued. What is the current status of Ecological Risk Assessment (ERA) with regards to determining risks at Harrison Bayou and Caddo Lake? What provisions have been made to perform an EE/CA for the hydraulic control? Since the TCRA seems to be occuring on a trial and error basis, what provisions, consistent with the NCP, have been made to ensure an orderly transition from removal to remedial response activities?

6. It is the Army's goal that natural attenuation be considered in every removal/remedial action, even if it is only used as a benchmark or baseline. The Petroleum Industry has successfully argued that bayous provide excellent natural cleansing effects on many environmental contaminants. Have the effects of natural attenuation ever been addressed?

7. The long term Operation and Maintenance (O&M) requirements for a hydraulic control have not been addressed. The Deputy Under Secretary of Defense for Environmental Security has expressed an acute awareness over the increasing percentage of DERA dollars used for long term O&M costs. Please address the O&M aspect.

SPECIFIC COMMENTS

1. Section 1.0, para 2: What has been the demonstrated impact of groundwater contamination to Harrison Bayou? Are there elevated levels of contamination found in the biota? What are the specific details of the supporting data?

2. Section 2.3: Data from previous investigations should be tabulated for comparative purposes. Validation procedures should be identified.

3. Section 2.4.4, para 1: Sampling dates should be 1995. Also, please explain why analysis was limited to VOCs.

4. Section 2.4.4, para 2: Since no report is cited, it is imperative that fully detailed results, sample dates, and validation procedures (including detection limits) should be tabulated. The table should also clarify the sample labels with the sample locations listed in figure 2-3.

5. Section 2.2.2, para 2: Surface water samples HBW-1 and HBW-1B are the only MCL exceedances per EPA's SDWA, having reported concentrations of 113 and 9.27 micrograms/L, respectively. What is the difference between the two samples; i.e., are they both actually surface water from the same location (a.k.a. duplication), or is one from a boring, or another explanation? Another important question is the level of accuracy in the reported values; i.e., one value (113) is to the nearest ppb, while the other value (9.27) is to the nearest ten parts per trillion. What is the confidence level and range of the confidence level for the reported values?

6. Section 3.5: Which analytical lab performed chemical analysis? What validation procedures were used?

7. Table 3.3: Results are misleading since heavy dilution in the lab does not permit accurate measurement of VOC degradation products (i.e., vinyl chloride is detected at 21 times the MCL in LH16EW01A, but is diluted in all other samples). Incorrect interpretation of analytical results can result in an ineffective treatment design.

8. Section 4.2: States that pumping tests were conducted across the "shallow saturated sand zone." Reported low pump test results appear to be inconsistent with this description. It is the Army's experience that the tidal-deltaic fines in many sand lenses found in the Wilcox formation of Lone Star AAP represent an aquiclude or aquitard. Please clarify the description of the sand zone.

9. Section 4.2.1, para 3: Does the discussion on the amount of fines mean that the formation has low permeability or that the well screen size selection was not good?

10. Table 4.1: The reported pumping rates are very low. This raises concerns over the long term sustainable pumping rates. How have seasonal fluctuations and drought/flood conditions been addressed in design considerations?

11. Table 4.1: Maximum drawdown measurements are reported to the nearest one one thousandth (1/1000) of a foot. What is the accuracy of surveyed surface elevations?

12. Table 4.2: Maximum drawdown values in piezometers raise the same concerns as in specific comment 10 and 11.

13. Section 4.4: The text gives the impression that TCE daughter compounds were detected in only the first sample. Due to dilutions of subsequent samples it is not possible to determine if daughter compounds are present and at what concentration. Since vinyl chloride was detected in the first sample at 21 times the MCL, the concentration of this compound should have been tracked.

14. Section 4.4: No information is presented concerning laboratory control samples or surrogate recoveries. Without this information it is impossible to determine if the changes in TCE concentration are real or are the result of variability in the purging efficiency.

15. Section 4.4: No data was provided concerning the results of laboratory or field blanks. Some hits in the samples may be the results of sample contamination, but without the blank results this cannot be determined.

018005

16. Chapter 5.0, 6.0 and 7.0: A meeting between LHAAP, Tulsa District, Sverdrup Environmental and AEC hydrogeologists has been proposed to discuss the groundwater flow model and parameter assumptions. Since this directly affects the identification and screening of alternatives, a meeting should be scheduled at your earliest convenience.

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

U18006

July 30, 1966

CERTIFIED MAIL
P 836 901 736
RETURN RECEIPT REQUESTED

James A. McPherson, Commander's Representative
Longhorn/Louisiana Army Ammunition Plant
Attn: SIOLH-CR
P.O. Box 30058
Shreveport, LA 71130-0058

Re: Longhorn Army Ammunition Plant
Group 2 - Interim Remedial Action at Landfills 12 & 16
Landfill Caps Project - Draft Final Design Plans and Drawings

Dear Mr. McPherson:

The Texas Natural Resource Conservation Commission (TNRCC) staff have completed our review of the above referenced work plan (which was received on June 14, 1996) and drawings (which were received on July 23, 1996). We concur with the Army's drawings (which show that a 40 mil geomembrane liner has been incorporated into the design) and work plans. Additionally, we would still like to see the Plug and Abandonment tasks placed on the schedule in Figure 6-1 (see previous comments), and if at all possible, we would like to have smaller sets of drawings which fit the work plan notebooks as initially intended. 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

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

013007

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

July 30, 1996

CERTIFIED MAIL
P 836 901 735
RETURN RECEIPT REQUESTED

James A. McPherson, Commander's Representative
Longhorn/Louisiana Army Ammunition Plant
Attn: SIOLH-CR
P.O. Box 30058
Shreveport, LA 71130-0058

Re: Longhorn Army Ammunition Plant
Group 2 - Time Critical Removal Action at Landfill 16
Draft Final Design Analysis Report

Dear Mr. McPherson:

The Texas Natural Resource Conservation Commission (TNRCC) staff have completed our review of the above referenced document, which was received on July 1, 1996. Our comments are enclosed. In addition, it was agreed in the July 23, 1996 Monthly Manager's meeting that an interim report will be submitted to the TNRCC for review (approximately six months after the new extraction wells are installed). The TNRCC requests that the Army revise the project schedule to reflect this submittal. 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-AT)
Jonna Polk, COE Tulsa District (CESWT-PP-EA)
Oscar Linebaugh, COE Eastern Area Office (CESWF-AD-E)

018008

Longhorn Army Ammunition Plant
Group 2 - Time Critical Removal Action at Landfill 16
Draft Final Design Analysis Report
TNRCC Comments

Comment No.	Section	Comment
1	General and Section 5.0	Please state in writing in this document what the remediation goal for the extraction system is. Is the system designed to contain contaminants to a specified concentration? Figures 5-4 and 5-5 depict iso-concentration lines for some contaminant but do not specify which.
2	Section 4.0	Please provide more justification as to how it was determined that the aquifer was semi-confined.
3	Section 4.0	Are there drawdown curves for the condition when both pumping wells are used? Please provide.
4	Section 4.2.2	Regarding the equation used to determine "β": One of the confining layers (aquitards) has been deleted from the equation (the upper one?). If the shallow aquifer is considered to be semi-confined, why delete part of the equation? Also, please provide the values for all the model parameters (e.g., K', S', D').
5	Section 4.2.2	Please provide the water level data for the intermediate zone piezometers.
6	Section 4.2.2	With respect to drawdown curves generated for 16EW02, the only curve that appears appropriate is the curve showing a Transmissivity value of 0.02114 $feet^2/minute$. This value is somewhat suspect due to the use of a pneumatic pump which can be difficult to regulate and thus not provide a constant drawdown. This difficulty was elaborated on by Sverdrup on page 4-8 and 4-9, but is not included in the calculation of the mean.
7	Section 5.0	Calibration of the flow model was performed by varying hydraulic conductivity and recharge (i.e., precipitation). The Help model suggest 8.5 inches/year and the final value selected by Sverdrup is 3.4 inches/year. What is the justification for decreasing recharge by 60%? How are you able to determine the reasonableness of this value for the Karnack area?

Comment No.	Section	Comment
8	Section 5.0	Regarding Storativity, pumping test data suggests that layer 2 has a Storativity greater than 1E-6. Why are all layers given the same Storativity values given the site stratigraphy? How were the values of Storativity and Specific Yield determined? How are both of these parameters incorporated into the model?
9	Section 5.0	Figures 5-4 and 5-5 show the flownets for the proposed extraction system. Do these figures represent the potentiometric surfaces with the shallow and intermediate aquifers being pumped concurrently?
10	General	The TNRCC requests the Army to evaluate the operating extraction system soon after the installation. If the evaluation indicates that the model is incorrect, a new model should be constructed so evaluation of the effectiveness of the extraction system with respect to contaminant removal and containment of the plume can be performed.
11	General	Will the Army perform aquifer testing to determine hydraulic conductivity and Storativity of the newly installed extraction wells? If not, why not and how will these parameters be determined?

U18010

DEPARTMENT [illegible]
HEADQUARTERS, U.S. ARMY INDU[illegible]
ROCK ISLAND, ILLI[illegible]

OPTIONAL FORM 99 (7-90)

FAX TRANSMITTAL # of pages ▶

To JONNA POLK	From D Tolbert
Dept./Agency	Phone #
Fax #	Fax #

NSN 7540-01-317-7368 5099-101 GENERAL SERVICES ADMINISTRATION

REPLY TO ATTENTION OF

AMSIO-EQE (200-1a)

MEMORANDUM FOR Commander, Longhorn ~~Army Ammunition Plant~~,
ATTN: SIOLH-EV (Mr. David Tolbert), Marshall
TX 75670-1059

SUBJECT: Group IV Sumps Groundwater Monitoring Quarterly Report

1. Reference memorandum, Tulsa District Corps of Engineers, CESWT-PP-EA, 13 Jun 96, SAB and enclosure thereto.

2. The subject report has been reviewed, and the following comments are offered:

a. General:

(1) We should handle the sumps the same as UST remediation/removal or closure. Request that the sumps and sump sites that do not show or exceed background levels or risk based concentration or primary remedial goals for contaminants of concern (COC) be closed ASAP and no further studies conducted at these sump sites.

(2) This report does not explain why we have elevated levels of COC when compared to the last data or report. The analysis, conclusion, and recommendation should address the reasons for the sudden elevation for the likely COCs.

(3) Request that sampling data analysis results be compared to the background level if the background level is higher than MCL/risk based concentration/primary drinking water standards/primary remedial goals (PRG). The chloride background concentration is 1416 mg/l, while the secondary drinking water MCL is 250 mg/l. We should not compare the chloride level to secondary drinking water standard/MCL when the background level (1416 mg/l) is higher than the drinking water MCL.

(4) Change the words "high explosives" to "explosives" and delete the acronym "HE" for high explosives in the entire report.

b. Executive Summary:

(1) Page ES2, lines 1-2 - The sentence "TPH analysis identified ... monitoring well LHSMW-43 at a concentration of

12.9 mg/l", should read as follows, "TPH reading in well LHSMW-43 is 12.9 mg/l". What is the acceptable level of TPH? Why do we need to know about the peaks in this report?

(2) Page ES2, line 5 - Delete the word "potential" and change the acronym "COPC" in the entire report to the familiar acronym "COC".

c. Paragraph 1.3 Site Location and History, page 2, lines 6-7: The name "U.S. Army Armament, Munitions, and Chemical Command" should be changed to "U.S. Army Industrial Operations Command" in this report and all future reports.

d. Paragraph 4.2 Nature of Contamination, page 17, lines 4-5 (fourth sentence) - The same TPH comments as in paragraph 2.b.1 of this memorandum.

e. Paragraph 4.2.5 General Chemistry:

(1) Page 30, lines 1-4 - The comparison for chloride levels should be compared to the chloride (1416 mg/l background level), and not the EPA's secondary drinking water MCL (250 mg/l). Please re-write this portion and delete the information on the EPA's secondary drinking water MCL.

(2) Page 30, lines 7-11 - The comments in paragraph 2.e.1 above also applies to the sulfate.

f. Section 5.0, page 40, last paragraph - Request that the recommendation specify that sumps and sump sites that do not show elevated levels of COCs be certified clean and closed ASAP.

3. The POC for this action is Mr. Cyril Onewokae, AMSIO-EQE, (309) 782-1350, DSN 793-1350, E-mail conewoka@ria-emh2.army.mil.

FOR THE COMMANDER:

HENRY CRAIN
Acting DCS for Environmental
Management

CF:
Commander, U.S. Army Corps of Engineers District, Tulsa,
ATTN: CESWT-PP-E/(Ms. Jonna Polk) Post Office Box 61, Tulsa,
OK 74121-0061

Longhorn Army Ammunition Plant
Monthly Manager's and Stakeholder's Meeting
August 5, 1996
Dallas, TX

U18012

1. The following is a list of participants:

David Tolbert - LHAAP
Chris Villarreal - EPA
Bud Jones - TNRCC
Cliff Murray -Tulsa District, USACE
Yolane Hartsfield - Tulsa District, USACE
Steve Brunton - Sverdrup
Wilma Subra - Uncertain Audubon Soc.
Dudley Beene - Ft. Worth District, USACE
Ira Nathan - LHAAP
Diane Poteet - TNRCC
Jonna Polk - Tulsa District, USACE
Dave Bockelmann - Sverdrup
Ruth Culver - Uncertain Audubon Soc.
Randy Bratcher - Tulsa District, USACE
Oscar Linebaugh - Ft. Worth District, USACE

2. The following is a list of topics discussed (in order of discussion):

Opening Remarks and Review and Transmittal of Meeting Minutes: On behalf of LHAAP, Ira Nathan welcomed all attendees to the Monthly Manager's and Stakeholder's Meeting held at the EPA offices in Dallas, TX. The July 1996 program manager's meeting minutes were reviewed and accepted without revision or comment.

Landfill-16 TCRA

Groundwater Biotoxicity Test: Biotoxicity test results were summarized. Failure of the toxicity tests was attributed to the higher concentrations of chlorides and sulfates in the water from Site 16. LHAAP will approach TNRCC regarding elevation of the discharge standard for chlorides/sulfates in the BG3 Record of Decision..

Harrison Bayou Sampling: Preliminary results of the most recent surface water and sedimant sampling were discussed. The results will be presented in the September meeting with a map showing the sampling location. In the future, LHAAP will note rain events as they relate to the sampling event. Additionally, samples will be collected both before and after a rain event, for comparison of data.

DERPMIS Report

In response to TNRCC comments, additional site visits will be made to those sites which were identified as "Active" in the DERPMIS reports. An evaluation of those active sites will be included in the DERPMIS Report, and the report will be submitted for final review.

LHAAP/LAAP Mailing Address

The new mailing address for Longhorn and Louisiana Army Ammunition Plants is:

P.O. Box 658
Doyline, LA 71023

Monthly Meeting Schedule: The TRC will be held on 10 September at LHAAP.

LONGHORN ARMY AMMUNITION PLANT
IRP STATUS SUMMARY

As of 10 September 1996

PROJECT NAME	PROJECT PHASE	PROJECT STATUS	NEXT MAJOR MILESTONE(S)
Group #1 Site 1:Inert Burning Grounds Site 11:Suspected TNT Burial Site Site XX:Ground Signal Test Area Site 27:South Test Area	Remedial Investigation/ Feasibility Study	Two phases of investigation have been completed. The Draft Final Remedial Investigation (RI) Report was submitted for review, and additional data needs were identified by EPA for purposes of risk assessment. The additional sampling was conducted in August, and test results are being prepared for incorporation into the risk assessment and Final RI Report. No further action is anticipated for these sites.	The risk assessment will be revised to include the additional data, and the RI Report will be submitted on December 31, 1996.
Group # 2 Site 12:Active Landfill Site 16:Old Landfill Site 17:Burning Ground No. 2 Site 18:Burning Ground No. 3 Site 24:Unlined Evaporation Pond Site 29:Former TNT Production Site 32:Former TNT Waste Disposal Plant	Remedial Investigation/ Feasibility Study	Two phases of investigation have been completed. The Draft Final Phase II Field Summary Report was submitted to EPA and TNRCC in July 1996.	Scoping for Phase III of the RI is planned for October 1996.
Group # 4 Wastewater Sumps	Remedial Investigation/ Feasibility Study	Two phases of investigation have been completed. A preliminary plan for Phase III of the RI has been prepared and presented to EPA and TNRCC.	A SOW for the Phase III RI will be submitted for review in October 1996.

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LONGHORN ARMY AMMUNITION PLANT
IRP STATUS SUMMARY

As of 10 September 1996

PROJECT NAME	PROJECT PHASE	PROJECT STATUS	NEXT MAJOR MILESTONE(S)
Group # 5 Site 50:Sump Water Storage Tank Site 52:Magazine Area Washout Site 60:Former Storage Buildings 411 and 714 Site 63:Former Burial Pits	Site Investigation	Field work was completed in February 1996. The Draft Site Investigation Report has been prepared and is under review by the Army.	Draft Final Site Investigation Report will be submitted to EPA and TNRCC for review in October 1996.
Burning Ground No. 3	Interim Remedial Action	Final Work Plans were approved by EPA and TNRCC in March 1996.	Groundwater treatment plant startup scheduled for September 1996. Soil treatment projected for October 1996.
Landfill Caps Site 12:Active Landfill Site 16:Old Landfill	Interim Remedial Action	Work Plan approved by EPA and TNRCC in March 1996 and July 1996, respectively..	Contractor mobilized to begin work in July 1996. Work scheduled to be complete in September 1997.
Landfill Site 16 Time Critical Removal Action (TCRA) Site 16:Old Landfill	TCRA	Groundwater extraction from two wells began in February 1996 and has continued. The Draft Final Design Analysis was submitted for review on June 28, 1996. Reviews completed by TNRCC and EPA. Project currently under review by Army Environmental Center.	Additional biotoxicity data being gathered by the Army at TNRCC request.
DERA SUMPS	Removal Action	Sampling of sumps contents has been completed, and results have been received. Results are being reviewed to determine appropriate disposition of sump contents.	TNRCC requires closure of sumps by December 1997.

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