NM - 8

GENERAL CORRESPONDENCE

YEAR(S): 2003-1984

NEW MEXICO ENERGY, MINERALS and NATURAL RESOURCES DEPARTMENT

BILL RICHARDSON
Governor
Joanna Prukop
Cabinet Secretary

October 8, 2003

Lori Wrotenbery
Director
Oil Conservation Division

Link Lacewell
Bureau Of Land Management
620 E. Greene St.
Carlsbad NM 88221-1778

RE: I&W South Site SE/4 SE/4 Section 21, T 17 S, R 30 E, NMPM
I&W South Site #2 SE/4 SW/4 Section 21, T 17 S, R 30 E, NMPM and
Culwin Queen Pit

Dear Mr. Lacewell:

The New Mexico Oil Conservation Division (OCD) has received the Bureau of Land Management's (BLM) E-mail request for OCD support dated September 19, 2003. The OCD would like to address the questions that were raised regarding oilfield exempt verses oilfield non-exempt wastes. In particular as to how the exemption affects the sites that BLM is calling I&W South Site, I&W South Site #2 and Culwin Queen Pit.

The site identified by BLM as **I&W South Site** is located just south of the fence line separating I&W or Double I, Inc. property and BLM property. Based on the historical knowledge as cited below the OCD would classify the waste at this location as exempt oilfield waste based on the treating plant exemption. This waste may be disposed of via landfarming, composting or land filling at an OCD Rule 711 permitted surface waste management facility. The BLM may also potentially landfarm or compost the waste on site.

OCD Records show that Tank Service Company was permitted by OCC order R-4151 on June 7, 1971 to operate an Oil Treating Plant in the SE/4 SW/4 NW/4 SE/4 Section 21, T 17 S, R 30 E, NMPM, Eddy County, NM.

On September 25, 1980 Lowell M. Irby submitted a C-104 to the OCD requesting a change of ownership from Tank Services Inc. to Lowell M. Irby. The location is listed on the C-104 as Unit J, Section 21, T 17 E, R 30 S.

On January 15, 1988 OCD requested an increase to the bond for a treating plant from Double I, Inc. Double I, Inc. responded on February 21, 1991 by supplying a $25,000 bond for a treating plant. The surety, Protective Casualty Insurance Company, went into receivership in 1991.

On April 17, 1991 a letter was sent from the representative of Double I, Inc. George A. Graham, Jr. to the BLM stating that treating plant location in question was owned by Double I, Inc.

Documentation by BLM show that in mid-1986 a BLM inspector observed that sludge from a hot oil treatment had been illegally dumped on BLM land. BLM identifies that some limited action was undertaken at the site by I&W Hot Oil Service, Inc. but that there are no records available as to the work performed. In December 1987 the site was entered into the comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) Docket.

The site identified by BLM as **I&W South Site #2** is located in the SE/4 SW/4 Section 21, T 17 S, R 30 E, NMPM approximately 1200 feet to the southeast of the I&W South Site. Based on the historical knowledge as cited below the OCD would classify the waste at this location as exempt oilfield waste based on its association with production of oil and gas in the SE/4 SW/4 and the SW/4 SW/4 Section 21, T 17 S, R 30 E, NMPM. This waste may be disposed of via landfarming, composting or land filling at an OCD Rule 711 permitted surface waste management facility. The BLM may also potentially landfarm or compost the waste on site.

> BLM has review aerial photos dated October 1, 1973. The photos show a pit in the location of the I&W South Site #2. The photo also shows a pipeline scar from a production location northwest of the pit to the pit.
>
> A letter dated April 22, 1986 from Anadarko to the BLM lists wells 3,4,5,7 of the Federal X Lease are located in the SW/4 of Section 21, T 17 S, R 30 E, NMPM. The letter goes on to state that: "The produced water was piped into a small approved unlined pit with netting over it. Cleanup of the lease was performed in November of 1985 at the request of the BLM. The old pit was covered and a new pit was dug."

The site identified by BLM as **Culwin Queen** was inspected by Mike Stubblefield of the OCD Artesia office and Gene Hunt with the BLM Carlsbad office. This site has been determined to be a blow down pit associated with an old Texas New Mexico Pipeline truck loading station. This location may now be owned by EOTT who has just changed its name to Link. Waste associated with this facility would have been generated after custody transfer thus the waste would be classified as Oilfield Non-exempt and would need to be tested to determine if this waste is characteristically hazardous prior to disposal. If the waste is tested non-hazardous then this waste may be disposed of via landfarming, composting or land filling at an OCD Rule 711 permitted surface waste management facility. The BLM may also potentially landfarm or compost the contaminated soil on site.

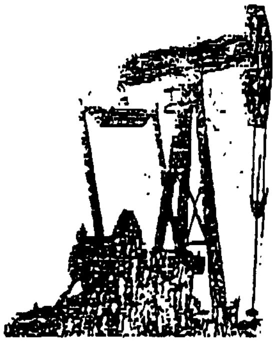
Please let us know if there is anything further that you may need assistance with.

Sincerely,

Roger C. Anderson
Environmental Bureau Chief

RCA/mjk

Xc: Artesia Office



BUREAU OF LAND MANAGEMENT
CARLSBAD FIELD OFFICE
620 EAST GREENE STREET
CARLSBAD, NM 88220
505-234-5972
FAX: 505-234-5927

FLUID MINERALS DIVISION
INSPECTION & ENFORCEMENT

DATE: 10-7-03

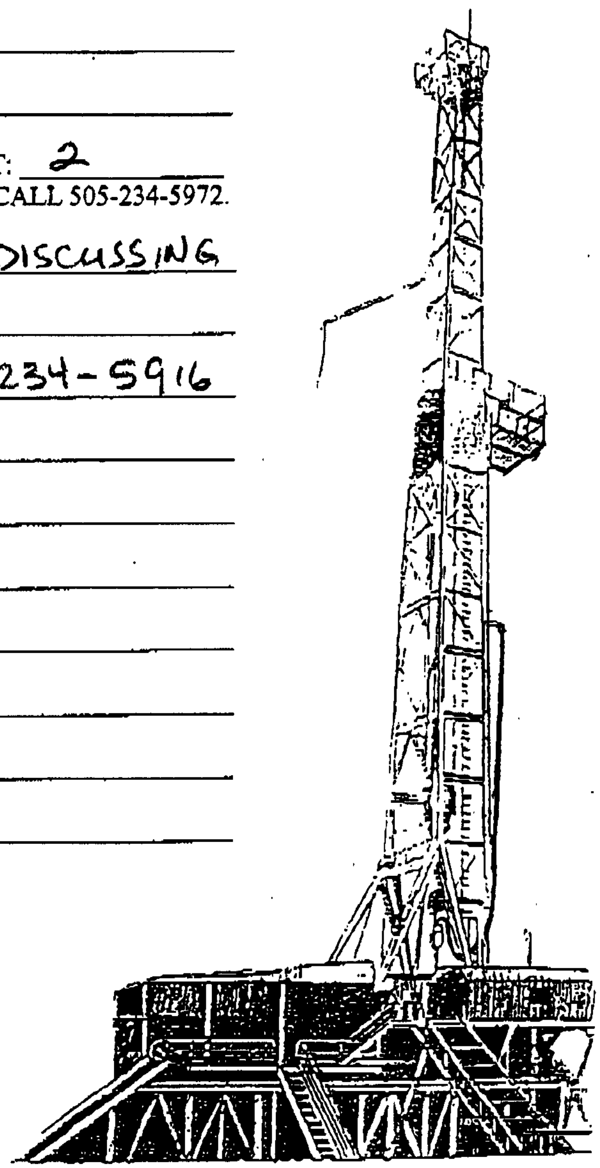
TO: MARTYNE KIELING,

FROM: G. HUNT, BLM

RE: ANADARKO PIT LETTER

NUMBER OF PAGES INCLUDING THIS COVER SHEET: 2
IF YOU DO NOT RECEIVE ALL THE PAGES, PLEASE CALL 505-234-5972.

HOPE THIS HELPS - ENJOYED DISCUSSING
THIS STUFF WITH YOU!
ANY QUESTIONS, CALL 505 234-5916
Gwen Hunt



ANADARKO PRODUCTION COMPANY P.O. DRAWER 130 • ARTESIA, NEW MEXICO 88210 • (505) 748-3368

Anadarko

BUREAU OF LAND MANAGEMENT RECEIVED APR 24 1986

April 22, 1986

Bureau of Land Management
P. O. Box 1778
Carlsbad, New Mexico 88220

Re: Federal X Lease
Sec. 21, T17S, R30E
Eddy County, New Mexico
LC 029342A

Attention: Chief, Minerals Resources

The following information is provided in accordance with NTL - 2B:

Well #	Legal	Sec.	Twp.	Range	BPWPD
3	SE/4 SW/4	21	17S	30E	0
4	SW/4 SW/4	21	17S	30E	0
5	SE/4 SW/4	21	17S	30E	0
7	SW/4 SW/4	21	17S	30E	0

The Federal X lease produces water from the Fren and Grayburg zones in an amount too small to measure. This small amount of produced water is piped into a small approved unlined pit with netting over it.

This lease and pit were cleaned up last November at the request of BLM. The old pit was covered and a new pit was dug.

A water analysis report is attached.

Yours very truly,

Jerry E. Buckles

Jerry E. Buckles
Area Supervisor

JEB/rk

STATE OF NEW MEXICO
ENERGY MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION

MEMORANDUM OF MEETING OR CONVERSATION

✓ Telephone ____ Personal Time 8:00 Am Date 10-1-03

Originating Party .
Mike Stubblefield

Other Parties
Martyne Kieling

Subject Culwin Queen pit Inspection by Mike Stubblefield with the BLM in September 2003.

Discussion This pit was associated with a TexMex Pipeline trucking and loading Station. The Pit was an unlined Blowdown Pit and Had caught Quail. BLM Had Ray Westall Fill in the Pit with 2' of Dirt. (they thought He was the owner) Now it is Known to be a former TexasNewmexico Pipeline Truck Loading Station. The Site is Probably Now owned by EOTT

When originally Found it Had ≈ 6 inches of Liquid that Bubbled in the Summer.

This site would Have Non Exempt oilfield waste And would Need to be tested For TCLP Hazwaste + RCI

Conclusions or Agreements
Will be adding this Determination to BLM October 2003 Letter

Distribution

Signed Marty Kieling

Kieling, Martyne

From: Kieling, Martyne
Sent: Monday, September 29, 2003 2:47 PM
To: 'Billy_Lacewell@nm.blm.gov'
Cc: Wrotenbery, Lori; Anderson, Roger; Stubblefield, Mike
Subject: RE: Exempt O&G Waste

Link,
Sorry to have miss your phone calls last week as I was down in Hobbs on inspections. I modified your last paragraph please see the revised paragraph below.

While talking about I&W I told her of Gandy's opinion that Site 2 was an old pit associated with a battery or pad, and his opinion that Site 1 was results of a commercial hot oil operation. After she explained about the Culwin Queen pit, I asked her if our I&W site might be exempt, beings it now appears tied to production, exploration, treatment, or processing. She thought it could be exempt if tied to a specific company (vs midnight dumping) but would have to review the case again. I asked her if it were exempt then would the state require us to continue incineration of sludge. She said the Oil Conservation Division has three approved landfill facilities for oilfield exempt and non-exempt
non-hazardous waste disposal: Lea Land, Controlled Recovery Inc., and Sundance Services, Inc. I wonder how BLM policy for
using audited facilities (Teris or Safe Harbor) applies to state oilfield exempt facilities.

Link, The web site that I believe we talked about is the New Mexico Public Regulation Commission web site you can also call and get the entire history of the company in question they charge by the page and bill you. But it may be well worth it.
http://www.nmprc.state.nm.us/

Contact / Information

Public Regulation Commission
PO Box 1269
Santa Fe, New Mexico 87504-1269
1-800-947-4722 (NM Residents Only)
(505) 827-4502 and (505) 827-4508
(505) 827-4387 fax

Both Mike Stubblefield and I have been keeping the OCD Director apprised of your situation at the I&W site. I will advise you as to what kind of help we may be able to provide.

Sincerely
Martyne Kieling

-----Original Message-----
From: Billy_Lacewell@nm.blm.gov [mailto:Billy_Lacewell@nm.blm.gov]
Sent: Friday, September 19, 2003 3:32 PM
To: mkieling@state.nm.us
Cc: Mary_Jo_Rugwell@nm.blm.gov; Mark_Blakeslee@nm.blm.gov
Subject: Exempt O&G Waste

Martyne, I am working up new estimates for disposal of the waste at the two locations we call I&W South. As you can imagine, there will be tremendous differences in price if we are not required to incinerate sludge containing high arsenic levels, and we are able to dispose of it at the OCD approved landfill or landfarm in-state. If you could review my e-mail below for accuracy I would appreciate it. Specifically, would the part about waste at the two locations possibly exempt if they originated from a battery location (site #2), and from a commercial hot-oil treatment facility (site #1 in fence), and therefore could be approved by OCD for disposal in-state.

Personally, I am convinced the waste originated as Gandy thinks. We have recently reviewed again the aerial photos from 1962 and can actually see a pit and tankage at site #2. Our files show Anadarko had a lease for that area, we are currently checking legals and footage's against the aerial and USGS topos with GPS. The lease has since been picked up by Mack. As for Site 1 inside the fence, Gandy was very positive such waste does not come from dumping, and explained to me common knowledge about hot oil and pumper business. The quantities we have at the two locations are definitely not from casual midnight dumping. I recall you having a source for determining the ownership history of companies. If you could provide it again I would appreciate it, (in this case we are interested in the predecessors of I&W, reportedly company named I&I).

On another note, after hearing the new information about large quantities of waste and the very plausible explanation of it's origin, the Carlsbad BLM management is inclined to renew an investigation for responsible parties. I have been asked to inquire if the OCD would support us in such investigation and then, provided responsible party were found, to support us in requiring them to perform cleanup.

Thanks, your time and assistance is greatly appreciated as always.

Link Lacewell
Hazmat Coordinator
Carlsbad/Roswell BLM
(505) 234-5904

----- Forwarded by Billy Lacewell/CFO/NM/BLM/DOI on 09/18/03 09:14 AM -----

Billy Lacewell
09/15/03 12:26 PM

To: Mark Blakeslee/NMSO/NM/BLM/DOI@BLM
cc: Eugene Hunt/CFO/NM/BLM/DOI@BLM
Subject: Exempt O&G product

I called Martyne Kieling, Santa Fe OCD, this morning to update her on I&W and brief her on the new Culwin Queen pit. As you are aware, both are similar in appearance and expected to have similar contamination of TPH. BTEX, and metals. I asked her again about the proper protocol and state entity to be working with in these situations.

She sympathized with the new volumes at the I&W site we had discovered after removing 94 yards of sludge. Her suggestions about on-site bioremediation were reiterated, with a new emphasis on onsite 'composting'. We will need to compare onsite alternative to dig-and-haul alternative pretty closely to make a good decision.

Regarding the new pit, Martyne explained that which state bureau we dealt with depended on what type of facility the pit was associated with. If the pit was part of a O&G production or exploration process, then it was exempt from the state hazardous waste requirements and we would deal with OCD. She then went on to say there were also exemptions for O&G treatment and processing facilities, for which we again deal with OCD. She said we would need to get with OCD Mike Stubblefield out of Artesia to for an OCD examination.

While talking about I&W I told her of Gandy's opinion that Site 2 was an old pit associated with a battery or pad, and his opinion that Site 1 was results of a commercial hot oil operation. After she explained about the Culwin Queen pit, I asked her if our I&W site might be exempt, beings it now appears tied to production, exploration, treatment, or processing. She thought it could be exempt if tied to a specific company (vs midnight dumping) but would have to review the case again. I asked her if it were exempt then would the state require us to continue incineration of sludge. She said the state had two EPA approved landfill facilities for exempt hazardous waste disposal: Lea Lands and CRI. I wonder how BLM policy for using audited facilities (Teris or Safe Harbor) applies to state exempt hazardous material.

RECEIVED
DEC 0 9 2002
Environmental Bureau
Oil Conservation Division

FINAL
ENGINEERING EVALUATION/COST ANALYSIS
I&W HOT OIL SERVICE SOUTH
EDDY COUNTY, NEW MEXICO

September 2002

Submitted by:

DYNAMAC CORPORATION

Dynamac Corporation
20440 Century Boulevard
Germantown, Maryland 20874

Submitted to:

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Bureau of Land Management
Carlsbad Field Office
620 East Greene Avenue
Carlsbad, NM 88220

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Carlsbad Field Office
620 E. Greene St.
Carlsbad, New Mexico 88221-1778
Tel. (505) 234-5972
Fax (505) 885-9264

Research Needed
9-8-2000

IN REPLY REFER TO:
1703

RECEIVED
DEC 09 2002
Environmental Bureau
Oil Conservation Division

December 3, 2002

Martyne Kieling
Oil Conservation Division
1220 S. St Francis
Santa Fe, NM 87505

Dear Ms Kieling;

As you are aware, the Bureau of Land Management (BLM) is in the process of undertaking removal action at a hazardous waste site near Loco Hills. This site has been referred to as the "I & W Hot Oil Site" due to its proximity to their facilities and prior involvement. The material is primarily tank bottom waste, which is a by-product from the oil and gas industry.

We have recently completed an engineering evaluation/cost analysis (EE/CA) which considered four alternatives for cleaning up this site. Of the four alternatives the 'Offsite Disposal of Sludge and Offsite Landfarming Of Contaminated Soil' alternative appears to best satisfy the removal objectives and evaluation criteria.

Enclosed is a Fact Sheet which summarizes the EE/CA and a copy of the document. This Fact Sheet, a copy of the Community Relations Plan and the entire EE/CA will be made available at the Artesia and Carlsbad Libraries for public information. We will be releasing a newspaper article soon to inform the public of the EE/CA and solicit their input.

Comments and questions are both welcome and appreciated. Please direct comments and questions to Link Lacewell, Hazardous Material Coordinator, by writing or calling 234-5904.

Roger, How Do you want me to Handle this?

Sincerely,

for Leslie A. Theiss
Field Office Manager

Loco Hills Hot Oil Dump Site
Eddy County, New Mexico
Fact Sheet

YOUR INPUT IS REQUESTED

The U.S Department of Interior, Bureau of Land Management (BLM) is seeking public input on a proposed action to cleanup contaminated soil at a property located near Loco Hills, NM. This cleanup activity is part of the ongoing efforts to address contaminated sites located on federally administered land under the jurisdiction of BLM. The soil is contaminated with oil sludge derived from the hot oil and chemical treatment of tanks, wells, and pipelines. BLM would like comments on the proposed option to excavate the soils and ship them to an approved treatment facility or hazardous waste disposal facility, depending on the nature of the waste.

Comments will be accepted from December 3 2002 to January 3 2003. A Site repository has been established at the Carlsbad and Artesia Municipal Libraries. Copies of the Engineering Evaluation/ Cost Analysis and the Community Involvement Plan may be found at the repository. The Administrative Record for the Site is located at the BLM Carlsbad Field Office.

Site Description and Background

The site is located in Eddy County, New Mexico, within the limits of the town of Loco Hills approximately 48 miles northeast of Carlsbad. It is commonly referred to as 'I&W South Site' due to proximity to this facility. It can be reached by traveling east on US-180/US-62, north on NM-360, and north on County Road 217.

The Site is a trespass and illegal dump on BLM land. Based on the prevalence of oil fields and oil field support companies in the area, and the physical and chemical nature of the wastes, there is relative certainty that the waste is from dumping of oil sludge derived from the hot oil treatment of wells and pipelines.

The Site is a rectangular parcel 300 feet wide by 500 feet long, covering approximately 3.4 acres. There are no structures located on the Site but it is fenced with chain link topped with barbed wire. The site features include a large trench, a pit that contains soil saturated with oily liquid, an overburden pile of soil, and a waste pile of darkly stained soils.

Another area that is being addressed is located approximately 900 feet to the southwest of the fenced parcel. The area is similar in nature in that it appears that oil sludge has illegally been dumped to the ground.

Sampling has indicated the presence of two distinct waste types: sludge and contaminated soil. The sludge at both locations is characterized by highly elevated concentrations of total petroleum hydrocarbons (TPH), heavy metals, and other organic compounds. While the soil is characterized by much lower levels of these contaminants, the concentrations still exceed New Mexico Oil Conservation Division (NMOCD) remediation action levels for TPH.

Cleanup Alternative Analysis

An engineering evaluation/ cost analysis (EE/CA) was developed for the Site to assist in the screening of cleanup options. The EE/CA includes the results of the site characterization, a streamlined risk evaluation and alternative analysis.

Removal action objectives were established in the EE/CA. They were developed to ensure compliance with the State and Federal rules and regulations and to ensure that the actions are protective of human health and the environment. Based on this process, the following objectives were identified:

- Eliminate or reduce human exposure to petroleum hydrocarbons, metals, and other hazardous constituents in the waste source material.
- Eliminate or reduce ecological exposure to petroleum hydrocarbons, metals, and other hazardous constituents in the waste source material.
- Eliminate or reduce offsite migration of petroleum hydrocarbons, metals, and other hazardous constituents via surface runoff and wind dispersion.
- Eliminate or reduce the physical hazards associated with the open trench, pits, and related debris currently onsite.

Based on the removal action objectives, general potential response actions and technologies were assembled into four alternatives that have been analyzed with respect to the evaluation criteria (effectiveness, implementability, and cost). The four alternatives are:

- No Action
- Offsite Disposal of Sludge and Onsite Consolidation of Contaminated Soil
- Offsite Disposal of Sludge and Onsite Landfarming of Contaminated Soil
- Offsite Disposal of Sludge and Offsite Landfarming of Contaminated Soil

Of the four alternatives that have been analyzed, Offsite Disposal of Sludge and Offsite Landfarming of Contaminated Soil appears to satisfy the removal action objectives and evaluation criteria to the greatest degree.

If you have any questions regarding the dump site or the proposed action, feel free to contact:

Billy L. Lacewell
HazMat Coordinator
BLM Carlsbad Field Office
620 E. Greene St.
Carlsbad, NM 88220-6292
(505) 234-5904

FINAL
ENGINEERING EVALUATION/COST ANALYSIS
I&W HOT OIL SERVICE SOUTH
EDDY COUNTY, NEW MEXICO

Prepared For:

U.S. Department of the Interior
Bureau of Land Management
Carlsbad Field Office

Prepared By:

Dynamac Corporation
20440 Century Boulevard
Germantown, MD 20874

Work Assignment No.: BLM4-82R
Date Prepared: 5 November 2002
BLM Contract No.: 1422-N660-C98-3003

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LIST OF FIGURES

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LIST OF ACRONYMS

AOC	Area of Contamination
ARAR	Applicable or Relevant and Appropriate Requirements
bgs	below ground surface
BLM	Bureau of Land Management
CCME	Canadian Council of Ministers of the Environment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
COC	Constituents of Concern
EE/CA	Engineering Evaluation/Cost Analysis
EPA	U.S. Environmental Protection Agency
FSI	Focused Site Investigation
FWS	U.S. Fish and Wildlife Service
GPS	Global Positioning System
HRS	Hazard Ranging System
LTTD	Low-Temperature Thermal Desorption
mg/kg	Milligrams Per Kilogram
NCP	National Contingency Plan
NFRAP	No Further Remedial Action Planned
NMED	New Mexico Environment Department
NMOCD	New Mexico Oil Conservation Division
NPL	National Priorities List
NRCS	Natural Resource Conservation Service
OB	Open Burn
OD	Open Detonation
OSC	On-Scene Coordinator
PA	Preliminary Assessment
PAH	Polynuclear Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
RAL	Remediation Action Level
RAO	Removal Action Objective
RCRA	Resource Conservation and Recovery Act
RMC	Risk Management Criteria
SQL	Sample Quantitation Limit
SVE	Soil Vapor Extraction
SVOC	Semi-Volatile Organic Compound
TBC	To Be Considered
TCLP	Toxicity Characteristic Leaching Procedure
TDS	Total Dissolved Solids
TPH	Total Petroleum Hydrocarbons
TSD	Transfer, Storage, and Disposal
VOC	Volatile Organic Compounds

EXECUTIVE SUMMARY

The U.S. Department of Interior, Bureau of Land Management (BLM), Carlsbad Field Office authorized Dynamac Corporation (Dynamac) to develop an Engineering Evaluation/Cost analysis (EE/CA) for the I&W Hot Oil Service South Site (I&W South) , under Task Order BLM4-82R.

The I&W South Site is located in Eddy County, New Mexico, within the limits of the town of Loco Hills. I&W South is approximately 48 miles northeast of Carlsbad, New Mexico and is reached by traveling east on US-180/US-62, north on NM-360, and north on County Road 217. It is accessible via an unimproved dirt road off of County Road 217 just south of the center of town. In mid-1986, the I&W South Site was discovered by a BLM inspector when it was observed that sludge from hot oil treatment had been illegally dumped. The incident drew a demand for an immediate removal action. As a result, some limited action was undertaken at the Site by I&W Hot Oil Service, Inc., although no exact records are available on the work completed. Nonetheless, in December of 1987 the Site was entered into the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) Docket.

The I&W South Site is a rectangular parcel 300 feet wide by 500 feet long, covering approximately 3.4 acres. There are no structures located on the parcel, but the Site is fenced with chain link topped with barbed wire. Access can be gained through a locked gate located at the northwestern corner. The site features include a large trench and a smaller pit that contains an oily liquid, an overburden pile of soil, and a waste pile of dark stained soils. The trench, which is centrally located in the northern half of the parcel, covers approximately 0.29 acres. Patches of stained soil can be found scattered throughout the length of the trench and along the sidewalls. The stained soils found in the sidewalls lie just above a caliche layer and range in thickness between one and two feet. Otherwise, the trench is sparsely vegetated.

Another area of concern that is associated with I&W South lies approximately 900 feet to the southwest of the fenced parcel. The area is similar in nature to the I&W South Site; that is, it appears that oil sludge has illegally been discharged directly to the ground surface. The "I&W South Site #2" can be divided into two separate zones based on the visual extent of stained soils. The larger of the two areas covers approximately 0.32 acres, while the second more heavily stained area covers approximately 0.07 acres.

Previous investigations have included a Preliminary Assessment (PA) and a Focused Site Investigation (FSI) performed in 1988 and 1994, respectively. Shortly after the preparation of the FSI, the Site was designated as having No Further Remedial Action Planned (NFRAP) in Federal Agency Hazardous Waste Compliance Docket Update #14. Dynamac conducted additional sampling in May 2002 of waste source and contaminated soil to fill data gaps left by the previous investigations and to evaluate potential remedies. The sampling has indicated the presence of two distinct waste types: sludge and contaminated soil. The sludge at both I&W South and I&W South Site #2 is characterized by highly elevated concentrations of total petroleum hydrocarbons (TPH), heavy metals, and purgeable organic compounds. The contaminated soil is characterized by much lower levels of these contaminants, but the concentrations still exceed New Mexico Oil Conservation Division (NMOCD) remediation action levels for TPH. In total, approximately 85 cubic yards of sludge and 365 cubic yards of contaminated soil are estimated to be present onsite.

Removal action objectives (RAOs) were established for the Site, based on the results of the site characterization and streamlined risk evaluation in an effort to construct removal goals which comply with the ARARs and are protective of human health and the environment. Based on this process, the following RAOs were identified:

- Eliminate or reduce human exposure to petroleum hydrocarbons, metals, and other hazardous constituents in the waste source material.
- Eliminate or reduce ecological exposure to petroleum hydrocarbons, metals, and other hazardous constituents in the waste source material.
- Eliminate or reduce offsite migration of petroleum hydrocarbons, metals, and other hazardous constituents via surface runoff and wind dispersion.
- Eliminate or reduce the physical hazards associated with the open trench, pits, and related debris currently onsite.

Based on the RAOs, general potential response actions and technologies were assembled into four Removal Action Alternatives which have been analyzed with respect to the evaluation criteria (effectiveness, implementability, and cost). These alternatives have been developed based on the known nature and extent of soil contamination and results of the human and ecological risk assessments and are described in the paragraphs to follow.

Alternative 1 (No Action) does not address the risks associated with the waste material onsite. It is neither effective in mitigating the human health risk nor does it prevent ecological exposure, offsite transport of contaminants via the surface water or air pathways, or address the volume and toxicity of the contaminants. Since the contaminated soils and sludge remain in their current state under this alternative, they remain a threat to human and ecological receptors which come into contact with it, and the material is still subject to erosion by wind and surface water. This alternative does not meet the response goals or identified ARARs for the project. There are no capital or operating costs associated with the No Action alternative.

Alternative 2 (Offsite Disposal of Sludge and Onsite Consolidation of Contaminated Soil) is moderately effective in mitigating the human health risk by removing the most highly contaminated material and relocating the remaining material into the fenced enclosure at I&W South. However, it does not prevent ecological exposure, offsite transport of contaminants via the surface water or air pathways, and does not address the volume or toxicity of the contaminants remaining onsite. Since the contaminated soil will remain uncovered in this alternative with no additional treatment, it stands to remain a threat to human and ecological receptors which come into contact with it (although the fencing may continue to mitigate much of the human health risk), and is still subject to erosion by wind and surface water. While the removal of the sludge results in meeting the removal goals for metals (camper RMC), the contaminated material that remains onsite does not meet the NMOCD remediation action level requirements for TPH. As a result, the ARARs are not completely satisfied by this alternative. The estimated capital cost associated with this alternative was calculated to be approximately $131,758; operations and maintenance costs are expected to be approximately $3,300 for the first year of operation and approximately $2,400 for each year thereafter.

In Alternative 3 (Offsite Disposal of Sludge and Onsite Landfarming of Contaminated Soil), the sludge is removed from I&W South and I&W South Site #2. In addition, the remaining contaminated material present in excess of the removal goals are consolidated for treatment in a landfarming treatment unit. This landfarm, designed and constructed onsite within the fenced enclosure at I&W South, is expected to treat the waste to well below the removal goals of the EE/CA if properly maintained. Although the removal goals would not be met as immediately as under an alternative involving full offsite disposal, they would be met in under two years if anticipated treatment efficiencies are achieved. Nevertheless, the design, construction, and operation of an onsite landfarm is not expected to be financially beneficial over offsite landfarming due to the presence of several existing facilities in close proximity to the Site. The estimated capital cost associated with this alternative was calculated to be approximately $261,225; annual operations and maintenance costs are expected to be approximately $26,900.

Alternative 4 (Offsite Disposal of Sludge and Offsite Landfarming of Contaminated Soil) involves the complete removal of the sludge and contaminated soil and subsequent transportation and disposal of the materials at appropriate offsite facilities. This alternative completely eliminates the principal threats posed by the sludge and contaminated soil by removing them from areas accessible to potential human and ecological targets and applicable exposure pathways. Alternative 4 provides the highest level of protection to the environment as well as human health. The estimated capital cost associated with this alternative was calculated to be approximately $181,018; operations and maintenance costs are expected to be approximately $1,000 for the first year of operation with no maintenance costs thereafter.

Of the four alternatives that have been analyzed, Alternative 4 (Offsite Disposal of Sludge and Offsite Landfarming of Contaminated Soil) appears to satisfy the evaluation criteria to the greatest degree. Alternative 4 is effective in complying with ARARs and meeting the RAOs, and is more protective of human health and environment than Alternatives 1 and 2. Although Alternative 3 (Offsite Disposal of Sludge and Onsite Landfarming of Contaminated Soil) provides nearly the same degree protection to human health and the environment, the cost of Alternative 4 is lower than Alternative 3. Alternative 4 can effectively eliminate the principle threats posed by the release of contaminants from the Site by reducing offsite transport via all perceived potential exposure pathways in both the short- and long-term.

1.0 INTRODUCTION

The U.S. Department of Interior, Bureau of Land Management (BLM), Carlsbad Field Office authorized Dynamac Corporation (Dynamac) to develop an Engineering Evaluation/Cost Analysis (EE/CA) for the I&W Hot Oil Service South Site (I&W South or I&W South Site), under Task Order BLM4-82R. This EE/CA has been prepared in accordance with the criteria established under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), sections of the National Contingency Plan (NCP) applicable to removal actions (40 CFR § 300.415 (b)(4)(I)). The document is also consistent with the U.S. Environmental Protection Agency (EPA) document, *Guidance on Conducting Non-Time Critical Removal Actions Under CERCLA*.

The goals of this EE/CA are to:

- Interpret and verify the results of previous studies at the I&W South;
- Address data gaps necessary to satisfy environmental review requirements and document the need for removal actions to address contamination onsite;
- Conduct streamlined human health and ecological risk assessments to determine the potential threats posed by contamination originating at the Site;
- Provide a framework for the evaluation and selection of potential response actions and applicable technologies; and,
- Satisfy administrative record requirements for improved documentation of removal action selection.

This EE/CA is based on a review of analytical and site specific data gathered during the performance of previous investigations and on additional sampling performed by Dynamac Corporation in May 2002. To evaluate the site conditions, Dynamac reviewed the following documents from the BLM case file: *Preliminary Assessment, Final Report, September 30, 1988* prepared by ICF Technology Incorporated; and *Focused Site Investigation (FSI), I & W Hot Oil Service South, May 18, 1994* prepared by ATL, Incorporated.

2.0 SITE CHARACTERIZATION

2.1 Site Description and Background

2.1.1 Site Location

The I&W South Site is located in Eddy County, New Mexico, within the limits of the town of Loco Hills. I&W South is approximately 48 miles northeast of Carlsbad, New Mexico and is reached by traveling east on US-180/US-62, north on NM-360, and north on County Road 217. It is accessible via an unimproved dirt road off of County Road 217 just south of the center of town. The legal description of the Site is Township 17 South, Range 30 East, Section 21, New Mexico Principal Meridian, with coordinates of 32°49'05" north latitude and 103°58'45" west longitude. The location of the Site is shown in Figure 1.

2.1.2 Type of Facility and Operational Status

The Site is a trespass and illegal dump on federally administered land under the jurisdiction of BLM. As a result, there are no records available that would indicate the type of facility or operation that existed. Interviews conducted by BLM Special Agents in 1993 failed to uncover any additional information on how the trespass occurred or who may have been responsible; however, a potentially responsible party was tentatively identified in 1999. Based on the preponderance of oil fields and oil field support companies in the area, and the physical and chemical nature of the wastes, there is relative certainty that the illegal dump resulted from disposing of oil sludge derived from the hot oil treatment of wells and pipelines. The Site is bordered by work yards owned by oil field service companies.

2.1.3 Structures/Topography

The I&W South Site is a rectangular parcel 300 feet wide by 500 feet long, covering approximately 3.4 acres. There are no structures located on the parcel, but the Site is fenced with chain link topped with barbed wire. Access can be gained through a locked gate located at the northwestern corner. The site features include a large trench, a pit that contains soil saturated with oily liquid, an overburden pile of soil, and a waste pile of darkly stained soils. The trench, which is centrally located in the northern half of the parcel, covers approximately 0.29 acres. Patches of stained soil can be found scattered throughout the length of the trench and along the sidewalls. The stained soils found in the sidewalls lie just above a caliche layer and range in thickness between one and two feet. Otherwise, the trench is sparsely vegetated by creosote bush (*Larrea tridentata*), mesquite (*Prosopis sp.*), and black grama (*Bouteloua eriopoda*).

The liquid waste pit, which is located approximately 50 feet to the southeast of the trench, is approximately 80 feet long and 20 feet wide, and covers approximately 0.04 acres. As is common with soil saturated with petroleum hydrocarbons, the soil in the liquid waste pit tends to solidify during periods of cool temperatures and becomes considerably more liquified when warmed by sunlight. As a result, the liquid waste pit can be both stable enough to support the weight of a human on its surface and quicksand-like with considerable amounts of ponded oily waste over the course of the same day. No stands of vegetation have been established in the bottom of the pit, although the pit is surrounded by a dense growth of yucca (*Yucca sp.*), black grama, and mesquite.

An overburden pile is located adjacent to the southeastern corner of the trench and covers approximately 0.03 acres. Although the pile is fairly well vegetated with creosote brush, yucca, and black grama, scattered patches of stained soil can be found throughout the pile.

A waste pile of stained soils is located 50 feet south of the trench and covers approximately 0.04 acres. From its placed appearance, the waste materials must have been excavated and repositioned at its present location. The waste matrix is comprised of a mixture of heavy hydrocarbons and soil, with more pronounced staining and a general lack of vegetation.

Another area of concern that is associated with I&W South lies approximately 900 feet to the southwest of the fenced parcel. The area is similar in nature to the I&W South Site; that is, it appears that oil sludge has illegally been discharged directly to the ground surface. The "I&W South Site #2" can be divided into two separate zones based on the visual extent of stained soils. The larger of the two areas covers approximately 0.32 acres, while the second more heavily stained area covers approximately 0.07 acres. These two areas which compose the Site are shown in greater detail in Figures 2 and 3. For the purposes of nomenclature in this EE/CA, I&W South and I&W South Site #2 will frequently be referred to individually; in cases that merit a discussion of the two sites collectively, they will be referred to together as the "Site." Photographs of the prominent features of both I&W South and I&W South Site #2 may be found in Attachment A.

The natural terrain across the parcel is characterized by small dunes that support various stands of vegetation including black grama, creosote brush, scrub oak (*Quercus ilicifolia*), mesquite, broom-snake weed (*Gutierrezia sp.*), and yucca. The topography slopes gently to the south and southeast at a grade between 1.4 to 5 percent.

2.1.4 Geology/Soils

Geology

Stratigraphically, uncertainties abound about the underlying units in Eddy County. In general, Eddy County is underlain by Quaternary-aged deposits, Permo-Triassic sandstones associated with the Dockum Group, and sequences of gypsum, anhydrite, and dolomite of the Permian Rustler Formation. Locally, the Quaternary deposits consist of eolian sands, silty sands, clay, and caliche layers. The Quaternary deposits are underlain by the Santa Rosa Formation of the Dockum Group which is comprised mainly of a 200 to 300 foot sequence of thick beds of grey and red sandstone interbedded with minor units of siltstone, silty clay, and laterally discontinuous clay layers. The stratigraphic uncertainty lies in whether or not the sandstone sequences, known locally as "redbeds", are actually part of the Dockum Group or belong to the Permian Dewey Lake Formation. Nevertheless, the lithologic properties of the two units appear somewhat similar and the presence or absence of either unit would not significantly affect the outcome of this project. The redbeds are underlain by the Permian Rustler Formation, which is composed of an upper member predominantly comprised of gypsum and anhydrite and a lower member comprised predominantly of dolomite and anhydrite. Together, the two members range in thickness between 250 and 450 feet. Reportedly, the Rustler Formation is said to have collapsed or to have erosional features suggesting karst development. or karst development in the underlying Permian Salado Formation.

Hydrogeology

Locally, the uppermost aquifer is expected to be found in the basal member of the Rustler Formation. Based on drill logs from a study to support a New Mexico Ground Water Discharge Permit application done in the area, groundwater was first encountered at a depth of approximately 330 below the ground surface (bgs). Shallower groundwater was not found in the Santa Rosa Formation (ATL, 1994), and this fact has fueled speculation that the Santa Rosa lies above the regional water table. Supporting information was obtained when a deep boring was drilled near I&W South in June 1993 to a depth of 200 feet bgs that failed to detect groundwater (ATL, 1994).

Locally, groundwater flow in the basal member of the Rustler Formation is reported to be to the southeast, while regionally it is believed to be to the south and southwest, regionally. The local southeast gradient has been reported to be approximately 25 to 30 feet per mile. There is no available information on the hydraulic conductivity of the Rustler Formation aquifer; however, there is data for the shallow claystones in the Santa Rosa Formation that suggest vertical migration beneath the Site would be minimal.

Water quality data collected during the Reed study indicates that, generally, groundwater in the area is of poor quality and not suitable for human consumption. High concentrations of total dissolved solids (TDS) and chlorides limit use to stock watering, at best. The residents of Loco Hills obtain their potable water supplies via the Double Eagle Pipeline that carries water from a well field located in the Town of Maljamar fifteen miles to the east. The Maljamar wells are completed in the Ogalalla Formation which has been truncated by erosion and does not extend to the Loco Hills area.

Soils

The local soils are comprised of a surficial component of reddish-brown silty sand and a subsurface component of calcareous tan to white sandy clay. Across the site, the depth of the surface soils is variable ranging in depth between 2 and 9 feet. The subsurface component ranges in depth from 2 feet bgs to 14 feet bgs. The soils data was obtained from boring logs contained in the FSI (ATL, 1994).

2.1.5 Hydrology

There are no surface water bodies located onsite or perennial surface water bodies in the immediate vicinity. Locally, surface water flow occurs only during heavy precipitation events, typically during the summer months. Surface water is transported by adjacent arroyos to the east to a closed basin where the water either infiltrates and/or evaporates.

2.1.6 Surrounding Land Use and Populations

Per the Eddy County Administrative Center located in Carlsbad, Loco Hills is an unincorporated town. The precinct of Loco Hills has a population of 179, according to a 2000 census. There are approximately 87 structures within one mile of the I&W South Site and I&W South Site #2. The local economy is driven largely by the oil and natural gas extraction industry and associated support services. Oil fields, including the Premier, Greyburg, Loco Hills, and Anderson, completely surround the town. Livestock production is also a contributor to the local economy. Artesia, located 25 miles to the west, is the nearest town of any size.

2.1.7 Sensitive Ecosystems

The State of New Mexico has listed five threatened species that are known to reside within Eddy County (NMDGF, 2000). These include the Pecos pyrg (*Pyrgulopsis pecosensis*), ovate vertigo (*Vertigo ovata*), gray-banded kingsnake (*Lampropeltis alterna*), sand dune lizard (*Sceloporus arenicolus*), and the varied bunting (*Passerina versicolor*). With the possible exception of the sand dune lizard, there are no threatened species believed to be present at or in the vicinity of the Site. This assumption is based on the lack of suitable habitat preferred by the listed species.

Federally listed threatened species that may occur as transient species in Eddy County, within the Loco Hills area, include bald eagle (*Haliaeetus leucocephalus*), piping plover (*Charadrius melodus*), mountain plover (*Charadius montanus*), and Mexican spotted owl (*Strix occodentalis lucida*). It is unlikely that these species will be found on or near the Site. A Federally listed endangered specie that may occur in Eddy County, within the Loco Hills area, is the Aplomado falcon (*Flaco femoralis septentrionalis*). It is unlikely that this specie will be found on or near the Site.

2.1.8 Cultural Resources

A review of the project files did not indicate the presence of cultural or historical significance associated with the Site, and as a result, it appears as if no additional historic documentation or management planning associated with cultural resources is necessary for the Site. However, BLM policy towards cultural and historic assessments should be reviewed prior to implementation of removal activities associated with this EE/CA to insure compliance.

2.1.9 Meteorology

The climate of the area is generally dry throughout the year, although intense precipitation events are common during the summer months. Temperatures can be quite warm during the summer, but are relatively mild throughout the rest of the year. According to data obtained from the Western Regional Climate Center for Artesia, New Mexico the average annual minimum and maximum temperature is 43.7 °F and 76.9 °F, respectively (wrcc@dri.edu). Average summer temperatures range from 61.7 °F to 94.7 °F, while winter temperatures average 23.3 °F to 57.9 °F. The total annual precipitation averages 11.88 inches, while average annual snowfall is 6.4 inches.

2.2 Site Waste Characteristics

Since the contamination at the I&W South Site was the result of illegal dumping, there are no specific records of the types of wastes present. Nonetheless, it is accepted that the contamination is associated with oil field wastes that are probably derived from the hot oil treatment of wells and pipelines. This is based primarily on the physical nature of the wastes (i.e., oily sludge) and analytical results from previous investigations.

Generally, crude oil as pumped from a well is an emulsified mixture of oil, gas, gas liquids, water, and basic sediments. During the extraction process, the untreated crude product, or produced fluid, undergoes a series of treatments to separate out the waste fractions. The produced fluid can be passed through one or a combination of treatment units including separators, free-water knockouts, and heater treaters. After treatment, the produced fluid is stored in tanks where, depending on residence time, additional density separation can occur. The bottom-most layer in the storage tanks is comprised of an unusable accumulation of heavy hydrocarbons, paraffins, solids, sand, and heavy emulsions commonly known as tank bottoms.

Regardless of the origin of the waste fractions, the chemical makeup is somewhat similar in that it comprises a complex combination of hydrocarbons and non-hydrocarbon organic compounds with traces of inorganic compounds. The hydrocarbon fraction includes alkanes, alkenes, alkynes, cyclic aliphatic hydrocarbons, and aromatic compounds, such as benzene, xylene, ethylbenzene, and toluene. Inorganic compounds include sulfur compounds, such as mercaptans and alkyl sulfides, and trace metals. The analytical results from previous investigations revealed the presence of chain hydrocarbons. This information is discussed in greater detail in the Section 2.3 to follow.

2.3 Previous Investigations

In mid-1986, the I&W South Site was discovered by a BLM inspector when it was observed that sludge from hot oil treatment had been illegally dumped. The incident drew a demand for an immediate removal action. As a result, some limited action was undertaken at the Site by I&W Hot Oil Service, Inc., although no exact records are available on the work completed. Nonetheless, in December of 1987 the Site was entered into the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) Docket. The CERCLIS Docket number is NM 8141199978.

In 1988, BLM authorized ICF Technology, Inc. to conduct a Preliminary Assessment (PA) at the Site with the objectives of determining whether or not hazardous wastes were present, and if so, to qualify the potential for contaminant migration, and identify whether or not additional activities would be warranted. BLM later authorized ATL, Inc. to conduct a FSI at the property. The objectives of the investigation were to characterize hazardous substances released at the site, investigate pathways of concern, identify local targets, and to gather sufficient information to assess any threat posed to human health and the environment. Additionally, ATL evaluated the Site for inclusion on the National Priorities List (NPL) by performing a Hazard Ranking System (HRS) PREscore.

In July 1994, ATL prepared and submitted to BLM a separate document entitled *Final Solutions Report, Focused Site Investigation, I & W Hot Oil Service South* in which recommendations were provided identifying followup actions. In essence, the report briefly discussed remediation efforts that included landfarming and/or *in-situ* capping. At this time, the site was designated as having No Further Remedial Action Planned (NFRAP).

In 1998, BLM initiated a removal action at the I&W South Site in which 2,672 cubic yards were excavated and transported to a landfarm disposal facility; however, due to a funding shortfall, some of the waste material was left onsite. Contaminated material volumes are discussed in additional detail in Section 3.3.

3.0 SOURCE, NATURE, AND EXTENT OF CONTAMINATION

3.1 Waste Source and Soil Sampling

A total of three sampling events are known to have taken place at the I&W South Site. In 1988, surface soil sampling was conducted as part of the performance of the PA by ICF Technology, Inc. In 1994 as part of the FSI, ATL, Inc. collected background, surface, and subsurface soil samples. Also included in the FSI activities was the installation of a deep soil boring.

To address the data gaps outlined in the *Summary of Data Gaps Report* prepared by Dynamac Corporation in February 2002, additional samples were collected as part of field activities in May 2002. Unlike the two previous investigations, the May 2002 event involved sampling at both the I&W South Site and I&W South Site #2, and this involved the first known sampling of I&W South Site #2. The purpose of these field activities was to:

1) Fully characterize the waste source material(s) at both I&W South and I&W South Site #2 according to the geotechnical and environmental parameters required to complete the development of the removal action alternatives.
2) Obtain geotechnical and environmental data necessary to characterize the local indigenous soil for incorporation into the removal action alternatives.
3) Conclusively identify the constituents of concern (COCs).
4) Conduct a limited onsite survey for the purpose of waste volume estimation.

To accomplish these goals, geotechnical, agronomic, and environmental samples were collected at both I&W South and I&W South Site #2 from contaminated soil and potential waste source material. Environmental samples were collected from locations with different degrees of apparent visible contamination in order to establish the range into which the contaminant concentrations for the majority of the material would fall for disposal purposes. A total of five waste source samples were collected. In addition to this environmental sampling, geotechnical and agronomic samples were collected of both contaminated and unimpacted soil in and around the I&W South and I&W South Site #2 areas. A summary of the number, location, and objectives of the samples associated with the current investigation is presented in Table 3-1, and the sample locations are shown in Figure 4.

3.2 Waste Source and Soil Analytical Results

3.2.1 Previous Investigations

The PA involved the collection of two surface soil samples. A review of the analytical results revealed detectable concentrations of arsenic (5-8 mg/kg), chromium (6.2-9.4 mg/kg), lead (23-52 mg/kg), zinc (41-45 mg/kg), ethylbenzene (0.05 mg/kg), and phenanthrene (7.1 mg/kg). The detection and reporting of inorganic and organic compounds was marginally useful, at best, since baseline values were not established through the collection of background samples. More importantly, however, was the detection of relatively high concentrations of hydrocarbon chains in the C15 to C28 range, which are indicative of the presence of oil field wastes. The PA recommended that additional characterization work be completed and further recommended the installation of a fence to limit incidental contact by human or ecological targets with the contaminated soil. As a result of the recommendations found in the PA, a six-foot chain link fence topped with barbed wire was installed some time in 1991.

In the spring of 1993, ATL mobilized to the Site and began the field characterization activities to complete the FSI. This work included the collection of 12 soil samples (including both surface and subsurface), 3 background surface soil samples, and the drilling of an exploratory deep boring. The environmental media samples were analyzed for volatile and semi-volatile organic compounds (SVOCs), organochlorine and organophosphate pesticides, polychlorinated biphenyls (PCBs), metals, and a full hazardous waste analysis using the toxicity characteristic leaching procedure (TCLP). A review of the analytical results revealed detectable levels of both total inorganic and organic compounds, but the concentrations of the contaminants were found in concentrations similar to those found in the background samples. Subsequently, the FSI reported that releases from the site into the surrounding environment, as defined by the HRS guidance criteria, had not taken place and that the Site did not pose a potential threat to human health or the environment. HRS guidance defines an "observed release" as when "a sample measurement equals or exceeds the sample quantitation limit (SQL) and is at least three times above the background level, and available information attributes some portion of the release of the hazardous substance to the site." Furthermore, the findings of the deep boring revealed that groundwater was not present under the Site within 200 feet of the surface and that soil samples collected from the boring did not contain leachable concentrations (i.e., by TCLP) of hazardous constituents.

As part of Dynamac's overall review of the PA and FSI analytical data, a comparison of the PA soil data to the FSI background soil results was conducted in an effort to assess the nature and extent of contamination. This review revealed comparable concentrations in the environmental samples and the background samples, further corroborating the FSI conclusions that a release had not taken place. The data collected during these two previous investigations is summarized in Table 3-2 (PA Soil - Inorganics), Table 3-3 (PA Soil - Organics), Table 3-4 (FSI Background Samples), and Table 3-5 (FSI Soil Borings). More detailed discussions, including the location and rationale for the samples collected as part of the PA and FSI, are contained in the individual reports for each investigation.

3.2.2 Current Investigation

To address the data gaps which existed at the time of the start of the EE/CA, additional sampling was conducted by Dynamac under the supervision of BLM personnel in May 2002. The subsequent sections briefly describe the sampling strategy and methods employed during this investigation; however, more detail is available in the *Final Sampling and Analysis Plan For the Engineering Evaluation/Cost Analysis, I&W Hot Oil Service South*, prepared by Dynamac Corporation and dated 10 May 2002.

3.2.2.1 Environmental Analyses

Previous sampling efforts had focused on determining whether or not releases had occurred and, consequently, focused on collecting environmental samples from preferential migration pathways (i.e., drainage pathways) and other downgradient areas. Soil samples collected both during the PA and FSI were selected from locations adjacent to the waste sources and not from within the impacted areas themselves. The consequences of such an approach was that the analytical results did not provide the full range of contamination and did not evaluate the waste material relative to appropriate on- and offsite disposal options. Moreover, the waste source material had not yet been characterized in accordance with the Resource Conservation and Recovery Act (RCRA). During the planning stages of the EE/CA, it was considered likely that an offsite disposal alternative would be evaluated; therefore, hazardous waste determination by toxicity characteristic leaching procedure (TCLP) analysis was also deemed necessary.

Additional laboratory analyses were also needed to fully characterize the chemical characteristics of the waste source material and in order to meet the requirements of the New Mexico Oil Conservation Division (NMOCD) document *Guidelines For Remediation of Leaks, Spills, and Releases*. Section IV.A.2.b of this document indicates that the concentrations of the following compounds are to be used to determine the removal goals of the EE/CA: total benzene, toluene, ethyl benzene, and total xylenes (BTEX) and total petroleum hydrocarbons (TPH). Based on these NMOCD requirements, these analyses were conducted as part of the EE/CA. Other analyses were employed to further refine the list of COCs and included metals and polynuclear aromatic hydrocarbons (PAHs).

The analytical methods which were employed during this investigation may be summarized as follows:

1) EPA SW-846 Method 1311 - Toxicity Characteristic Leaching Procedure (With subsequent analysis of the leachate for: RCRA metals by EPA Method 6010; semi-volatile organic compounds [SVOCs] by EPA Method 8270C; and volatile organic compounds [VOCs] by EPA Method 8260B.)
2) EPA SW-846 Method 6010 - RCRA Metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver).
3) EPA SW-846 Method 8015 - Total Petroleum Hydrocarbons (TPH).
4) EPA SW-846 Method 8021 - Halogenated Volatiles (Total Benzene, Toluene, Ethyl Benzene, and Total Xylenes).
5) EPA SW-846 Method 8310 - Polynuclear Aromatic Hydrocarbons.

The results of the May 2002 waste source and soil environmental sampling are summarized in Table 3-6 (Inorganics), Table 3-7 (Purgeable Organics and TPH), Table 3-8 (PAHs), and Table 3-9 (TCLP). The raw analytical data for this sampling event may be found in Attachment B.

A review of the inorganics analytical results reveals that arsenic, barium, chromium, and lead were consistently found in the contaminated soil and waste source material at both I&W South and I&W South Site #2. Selenium was also detected in the sludge found at both sites, but not in the surrounding contaminated soil. A single occurrence of mercury was detected in the I&W South liquid waste pit. In Table 3-6, all metals results are compared to human risk management criteria (HRMC) values taken from the BLM Technical Note, *Risk Management Criteria For Metals at BLM Mining Sites* (Attachment C). As there are no dwellings onsite, the camper HRMC is used for comparative purposes. Also in Table 3-6, the inorganics results are compared to the New Mexico Environment Department (NMED) soil screening levels (SSLs). Using the same rationale as discussed in reference to the BLM HRMCs, the residential SSLs are inappropriate for use at I&W South; therefore, the industrial worker SSLs have been selected. Arsenic was detected in the sludge at I&W South at a concentration of nearly 36 mg/kg (sample IW-WS-1), and was detected at a concentration of 275 mg/kg in the sludge at IW South Site #2 (IW2-WS-2). Both exceed the corresponding camper HRMC value of 20 mg/kg and NMED industrial worker SSL of 17 mg/kg; by approximately two times in the case of the material at I&W South, and over ten times by the material at I&W South Site #2. Lead values at the same locations were on the order of 150 mg/kg, nearly one tenth of the corresponding camper HRMC and NMED SSL for this metal. Similarly, the selenium and mercury concentrations observed in the waste material were found to be well below the HRMCs and NMED SSLs. The observed detections of chromium and barium cannot be compared to HRMCs as no criteria have been established for these COCs, but the observed concentrations were significantly lower than the NMED SSLs for both compounds. The implications of the onsite metals contaminations and the HRMCs are discussed in detail in Section 4.

The purgeable organics (i.e., BTEX compounds) and TPH values presented in Table 3-7 are consistent with those typically associated with oil and gas industry sites. The sampling results in Table 3-7 are compared to recommended Remediation Action Levels (RALs) developed by the NMOCD and the NMED industrial worker SSLs, where applicable. All but one of the samples exceeded the NMOCD action level for TPH. The samples collected from the areas of highest suspected contamination (IW-WS-1 and IW2-WS-2) range from 20 times to over 90 times the TPH standard of 5,000 mg/kg. The samples collected at I&W South from an area of significantly less visible contamination (IW-WS-2 and IW-WS-3) also exceeded the NMOCD TPH standard by over three times. Of the five waste source and contaminated soil samples, only the sample from the area of highest contamination at I&W South Site #2 (IW2-WS-2) exhibited concentrations of BTEX compounds in excess of the NMOCD standard, but at this location, the exceedences for benzene and total BTEX were substantial. The material in the liquid waste pit at I&W South was below the NMOCD action levels for both benzene and total BTEX, but exceeded the NMED SSL for benzene by approximately 50 percent.

Results of the analyses for PAHs are presented in Table 3-8, and compared to the NMED SSLs for these compounds. The results indicate the presence of naphthalene compounds (typically associated with diesel fuel contamination) in this family of analytes in the waste material at the Site. The naphthalene result for the sample collected at the area of highest visible contamination at I&W South Site #2 was approximately 120 mg/kg. Since NMOCD has not established a remediation action level for naphthalene compounds, the value was compared to the NMED SSL. The detected value was found to be nearly three times greater than the NMED industrial worker SSL; therefore, it appears as if PAH compounds, and naphthalene in particular, may be of concern in the highly contaminated area at I&W South Site #2.

To further document the degree of contamination at the Site, the analytical results from the current investigation have been compared to the background samples collected during the FSI activities conducted in May 1993. In general, the waste source samples exhibit concentrations of the COCs which are on the order of ten times greater than the concentrations shown in the background samples. This is particularly true of lead (maximum background concentration 4.2 mg/kg; average waste source sample concentration 61 mg/kg) and arsenic (maximum background concentration 1.2 mg/kg; average waste source sample concentration 66 mg/kg). It appears possible to conclude, therefore, that the elevated levels of contaminated may be linked to onsite activities and are not representative of the indigenous soils at and near the Site.

TCLP results were obtained for the two waste units onsite that potentially represent the high end of the contamination that will be encountered to determine whether or not the material needs to be considered a hazardous waste for disposal purposes, should off-site disposal be deemed appropriate. The toxicity characteristic of a hazardous waste is defined in RCRA (40 CFR Part 261.24, Table 1), and the corresponding regulatory levels are provided along with the leachate concentrations for the samples analyzed as part of this investigation in Table 3-9. As shown in the table, the sample of material from the area of high visible contamination at I&W South Site #2 (IW2-WS-2) exceeded the corresponding TCLP threshold for benzene. Therefore, this waste material will be considered a hazardous waste under RCRA by virtue of its toxicity characteristic. The waste material in the liquid waste pit at I&W South did not exceed any of the toxicity characteristic regulatory thresholds.

Based on the results of the May 2002 sampling as discussed in this section, the liquid waste pit at I&W South and the area of high visible contamination at I&W South Site #2 exceed risk management criteria and/or regulatory thresholds for metals, BTEX, and/or TPH. Though both highly contaminated when compared to the other waste material onsite, the results differ enough as to suggest different origins. Based on discussions with BLM personnel, the material in the liquid waste pit at I&W South is typical of sludge from hot oil treatment, whereas the material at I&W South Site #2 appears to be more likely associated with tank maintenance or retirement activities at a produced water disposal site where the removal of paraffin can be much more of an operational concern. Chemical stripping agents are sometimes used in addition to the typical methods involving the use of elevated operational temperatures; however, no evidence of stripping compounds was observed at the Site or demonstrated in the analytical results. At I&W South Site #2, the material was characterized by a paraffin layer which was several inches in thickness, but no such layer was observed in the sludge at I&W South. It is also believed that the highly contaminated material at I&W South Site #2 was dumped far more recently than the sludge in the liquid waste pit at I&W South.

3.2.2.2 Geotechnical Parameters

Physical property data for the contaminated soil and surrounding unimpacted native soil was collected to identify any characteristics which would impact potential removal action alternatives. To fill these data needs, the geotechnical properties of the onsite soil was tested in accordance with the following American Society for Testing and Materials (ASTM) test methods:

1) Moisture content using ASTM Method D2216-92 (e).
2) Liquid and plastic limits using ASTM Method D4318-95a.
3) Particle size using ASTM Method 422-63 (1990).

The raw analytical data is presented in Appendix B, and a summary of the results of these analyses is presented in Table 3-10. All of the samples indicate that the soil at the Site is silty sand, which is characterized as a course grained soil with between 12% and 50% passing a #200 sieve and greater than 50% of the course fraction passing a #4 sieve. As is typical with course grained soils, the soil at the site is non-plastic, indicating that even when wet, the soil is not sticky or binding. The moisture content at the time of sampling ranged between 0.9% and 1.6%, and this parameter will be a consideration later in the EE/CA as many of the potential onsite treatment technologies are dependant upon soil moisture.

3.2.2.3 Agronomic Analyses

In order to evaluate the ability for the soil found at the Site to support landfarming activities, samples of both contaminated and unimpacted native soils from nearby areas were analyzed for a suite of agronomic parameters including the following characteristics:

- Total Nitrogen;
- Percent organic matter;
- pH;
- Soluble salts;
- Conductance;
- Sodium adsorption ratio (SAR); and
- Alkalinity.

The results of the agronomic analyses are presented in Table 3-11. Two samples (IW-AG-3 and IW-AG-4) were collected at I&W South and two were collected at I&W South Site #2 (IW2-AG-1 and IW2-AG-2). All of these samples, with the exception of IW2-AG-2, were of unimpacted material which was deemed potentially suitable for use in a landfarming operation, if proposed, or as backfill material to be used as a substrate for revegetation after removal of contaminated material. Sample IW-AG-2, on the other hand, was collected from the area of visible contamination at I&W South Site #2 to determine how the agronomic qualities differed from the unimpacted native soil.

The contaminated soil was understandably different from the unimpacted native soil based on a comparison between a number of the agronomic parameters. The contaminated soil was slightly more acidic with an electrical conductance and soluble salt content (calcium, magnesium, sodium, and potassium) on the order of three times greater than the native soil. Of most significant relevance to the potential removal action alternatives which may be proposed in this EE/CA are the percent organic matter and total nitrogen values. The percent organic matter in the contaminated soil was on the order of five times the native soil, and the total nitrogen was ten times higher in the contaminated soil than in the unimpacted native soil. This indicates that the contaminated material is a preferred substrate in this environment for bacterial growth, a factor that is of significance in determining suitable onsite treatment options later in the EE/CA.

3.2.2.4 Quality Assurance/Quality Control Samples

In addition to the samples discussed previously in this section, a suite of quality assurance/quality control (QA/QC) samples were collected in accordance with the Final Sampling and Analysis Plan and EPA guidance. Based on the findings associated with the QA/QC samples, the data was found to be within accepted laboratory QC parameters. A detailed discussion of the results and implications of the QA/QC samples relative to the precision, accuracy, representativeness of true nature, comparability, and completeness may be found in the Data Validation Report (Attachment B).

3.3 Waste Volumes

In order to evaluate potential removal alternatives and develop cost estimates during the EE/CA process, it was necessary to determine the volumes of the onsite waste units. As part of the May 2002 sampling event, a limited survey (using hand augers, shovels, or other equipment, as appropriate) was conducted at the five major waste units at the Site. Using the nomenclature specified in Figure 3, these waste units are: (1) waste pile at I&W South; (2) waste along trench remaining from previous removal at I&W South; (3) liquid waste pit at I&W South; (4) area of visible contamination at I&W South Site #2; and (5) area of high visible contamination at I&W South Site #2. At each location, boreholes or other probes were advanced at the approximate center of the contaminated area and at the edge(s) to develop an approximate subsurface profile. Global Positioning System (GPS) data and other measurements obtained in the field were used to estimate the approximate surface area and average depth of each of the waste units. The estimated waste unit surface areas, depths, and volumes are presented in Table 3-12. It should be noted that the approximate extents of the contaminated areas shown in Figure 4 are not necessarily truly representative of the actual footprints of the waste units. The actual dimensions used to make the calculations shown in Table 3-12 were derived from refinements made of the original data shown in Figure 4.

As shown in Table 3-12, it is estimated that a total of approximately 450 cubic yards of contaminated material is present onsite. Of this volume, 214 cubic yards is believed to be present at I&W South; the remaining 236 cubic yards are located at I&W South Site #2. The waste at each of these locations may be further divided according to the degree of contamination, both on a visual basis and as documented by the analytical results discussed earlier in this section. At I&W South, it is estimated that approximately 36 cubic yards of highly contaminated material is present in the liquid waste pit, and the remaining 178 cubic yards present at this location in the waste pile and trench area has considerably lower concentrations of the COCs, particularly TPH, metals, and BTEX compounds. Similarly at I&W South Site #2, the area of high visible contamination is estimated to contain approximately 50 cubic yards of material which is far more contaminated than the remaining 186 cubic yards at this location. Based on this analysis, the total volume of highly contaminated material at I&W South and I&W South Site #2 is estimated to be 86 cubic yards, and the remaining, less contaminated waste is estimated to be present at approximately 364 cubic yards.

3.4 Groundwater

No groundwater samples were collected during the May 2002 field activities; however, as part of the FSI, a deep soil boring was installed to a depth of 200 feet. The boring was located approximately 1,000 feet east of I&W South in an area between the Site and the Loco Hills Municipal Landfill. During this boring installation, groundwater was not encountered; therefore, no groundwater data exists for the Site.

4.0 STREAMLINED RISK EVALUATION

The I&W South Site and I&W South Site #2 are believed to be the result of illegal dumping of wastes derived from the hot oil treatment of wells and pipelines. The Site is bordered by work yards owned by oil field service companies. Trespassers, nearby residents, recreational users and workers at the work yards adjacent to the Site are at risk from exposure to contaminants onsite. Additionally, local wildlife may be at risk from ingesting contaminated plant material, soil, or animal matter onsite.

To address these issues, BLM developed acceptable multi-media risk management criteria (RMC) for the COCs as they relate to human use and wildlife habitat on or near BLM lands. The primary objective of this section is to perform a streamlined risk assessment for the site and to establish the magnitude of risk to human health and wildlife. The COCs and migration pathways were identified from historical information and site characterization (Section 3). Potential receptors, receptor exposure routes, and exposure scenarios were identified from onsite visits and discussions with BLM personnel. Representative wildlife receptors at risk were chosen using a number of criteria, including likelihood of inhabitation and availability of data.

4.1 I&W South Site

To determine whether or not there is current or potential risk to human and ecological receptors from contaminants at or adjacent to the I&W South Site, a Conceptual Site Model was developed and a screening assessment was performed. The site model for human and ecological receptors at the I&W South Site is follows:

Potential sources of contamination:
- Liquid waste pit
- Waste pile
- Trench area

Potentially affected media:
- Surface soil
- Subsurface soil
- Surface water after a precipitation event

Potential migration routes:
- Leaching from the liquid waste pit
- Leaching from the waste and overburden piles
- Offsite transport of contaminants during or after a precipitation event

Exposure routes:
- Ingestion of soil, sludge, or contaminated plant/animal matter
- Dermal contact with soil or sludge
- Inhalation of airborne soil particles
- Dermal contact and ingestion of contaminated surface water

4.1.1 Human Health Risk Screening

Potential human receptors at or near the Site primarily include recreational users (campers) and industrial outdoor workers. There are no residents living onsite, although homes do exist within 500 to 1000 feet of the Site, and a work yard borders the northern boundary of I&W South. Surface water that pools after a precipitation event may pose a risk, but exposure to contaminated groundwater is not expected to be a concern, due to the depth to groundwater (see Section 2.1.4).

4.1.1.1 Sources of Human Health Screening Values

The maximum concentration of each constituent detected in contaminated soil or sludge was screened against BLM HRMCs, EPA Region 6 Human Health Medium-Specific Screening Levels, and NMED soil screening levels (Tables 4-1 and 4-2). BLM screening levels only pertain to inorganic constituents; as a result, EPA screening levels were used for applicable organic constituents. The BLM camper HRMC was selected as the most conservative recreational receptor group that is likely to be exposed to contaminants at the Site. The camper criterion assumes 14 days exposure per year, the longest exposure period assumed for any BLM recreational group. Although the Site is enclosed by an 8-foot high chain link fence, trespassers remain a possibility. The EPA Region 6 industrial outdoor worker was selected as the most likely receptor group for organic constituents, as residential screening values were deemed not applicable due to the lack of residential dwellings onsite. The NMED soil screening levels for an industrial/occupational worker were used; this receptor is also referred to as commercial/industrial Worker. The industrial/occupational worker is assumed to spend most of his or her workday outdoors and is exposed to soil at depths of zero to two feet below ground surface. Based on the types of personnel who routinely access I&W South and I&W South Site #2, these screening values were deemed most appropriate.

4.1.1.2 Results of Screening

All soil constituents which were part of the May 2002 field activities laboratory analysis are below the screening values for the BLM camper, EPA Region 6 industrial outdoor worker with dermal exposure, and NMED's industrial occupational worker. TPH and chromium were identified in soil samples. There is no BLM, EPA, or NMED human health screening value for TPH in soil. Similarly, there is no BLM or EPA screening value for chromium, however, the NMED reports a soil screening level of 1.0×10^5 mg chromium III per kilogram of soil for the industrial/occupational worker. The screening level for chromium III, though less conservative than the chromium VI screening level, was selected because chromium VI is more often associated with ingestion of surface water, which is not typically present at I&W South. The NMED screening levels for benzo(a)anthracene, dibenzo(a,h)anthracene, benzo(a)pyrene, and naphthalene are below the method detection limits for the analytical methods used for these compounds; therefore, it is not possible to evaluate the risk by these compounds to human receptors.

All sludge constituents are below the screening values for the BLM camper, EPA Region 6 industrial outdoor worker with dermal exposure, and NMED industrial/occupational worker, with the exception of arsenic and benzene. Screening values for soil were used to assess the risk posed by contaminants in the sludge, the occurrence of which was isolated to the liquid waste pit. The arsenic concentration in the single sample of sludge was 17.8 times higher than the EPA Region 6 screening value for the industrial outdoor worker with dermal exposure, 1.78 times higher than the BLM camper soil screening value, and 2.1 times higher than the NMED industrial/occupational worker soil screening value. The EPA Region 6 screening value for arsenic represents a cancer endpoint. Benzene occurred in the sludge at a concentration of 8.16 mg/kg, nearly twice NMED SSL for an industrial worker. 1-Methylnaphthalene was also identified in the sludge. However, there is no BLM, EPA, or NMED human health screening value for 1-methylnaphthalene, a polynuclear aromatic hydrocarbon.

4.1.1.3 Risk Characterization

No risks are associated with exposure to soil for campers, industrial outdoor workers with dermal exposure, or industrial/occupational workers. Risk of exposure to arsenic in the sludge is minimal for the camper unless exposure occurs on a chronic level. Based on the manner in which the screening values are calculated, an industrial outdoor worker with dermal exposure is at a higher risk of exposure to arsenic in sludge than is a camper or NMED's industrial/occupational worker. This is due primarily to the fact that the industrial worker is assumed to be exposed regularly over the course of a regular work week. Chromium was identified in a soil and sludge sample. The NMED chromium SSL for an industrial/occupational worker is not exceeded by either the soil or sludge samples, and BLM and EPA screening levels for chromium do not exist for the identified receptors.

4.1.2 Ecological Risk Screening

Potential ecological receptors at or near the Site include local wildlife in the area. Species common to the site include spotted ground squirrel, a variety of mice and rats, gray fox, spotted skunk, bobcat, coyote, roadrunner, various hawks and owls, cactus wren, lark sparrow, lark bunting, scissor-tailed flycatcher, mourning dove, scaled quail, and various lizards and snakes. The threatened sand dune lizard may also be found at or near the site. Mule deer and cattle may find ways to enter through the chain link fence, and they may be affected by contaminated soil particles that have been moved or blown offsite. Surface water that pools after a precipitation event may also pose a risk as accumulated water often attracts wildlife and may be ingested.

4.1.2.1 Sources of Ecological Screening Values

The maximum concentrations of the COCs detected in the soil or sludge were screened against BLM Wildlife (i.e., deer mouse, cottontail, and mule deer) and Cattle RMC for soil; the U.S. Fish and Wildlife Service (FWS) screening values for soil; Oak Ridge National Laboratory, Oakridge, Tennessee, screening values for soil; the Canadian Council of Ministers of the Environment (CCME) screening values for soil; and the Dutch Ministry Standards' screening values for soil (Tables 4-3 and 4-4). Five sources of ecological screening values were used because BLM has not established criteria for all of the potential COCs that were identified at the Site. The five sources are grouped in a column titled "Other", in Tables 4-7 and 4-8. Screening levels identified by sources other than BLM indicate COC concentrations for a "clean" site. These levels are conservative, but provide some reference.

4.1.2.2 Results of Screening

Aside from cadmium, all soil constituents from the May 2002 sampling were below the screening values. The analytical method utilized for cadmium analysis have a detection limit of 0.50 mg/kg. The BLM screening values for cottontail and mule deer are 0.3 and 0.2 mg/kg, respectively; therefore it is not possible to evaluate whether or not cottontail and mule deer are at risk due to cadmium exposure. Conservative assumptions would indicate that cottontail and mule deer would be affected by the cadmium concentrations at the Site; however, due to the results of previous sampling events and historical knowledge of the Site, it is not believed that cadmium is a COC.

Six constituents exceeded the BLM and/or other risk criteria in the sludge. Arsenic, present at a concentration of 35.6 mg/kg, was 3.56 times greater than the screening level indicated by the Oak Ridge National Laboratory (10 mg/kg). Barium, present at a concentration of 421 mg/kg, was 2.55 times greater than the screening level indicated by the Dutch Ministry Standards (165 mg/kg). Chromium, present at a concentration of 34.0 mg/kg, was 2.92 times greater than the screening level indicated by Oak Ridge National Laboratory. Lead, present at a concentration of 146 mg/kg, exceeded the BLM RMC for deer mouse, cottontail, mule deer, and cattle by 1.11, 1.51, 3.32, and 1.06, respectively. Lead also exceeded the Oak Ridge National Laboratory screening value by a factor of 2.92. Mercury, present at a concentration of 0.72 mg/kg, was 1.8 and 1.2 times greater than the BLM screening levels for cottontail and mule deer, respectively. Mercury also exceeded the Dutch Ministry Standards by a factor of 2.4. TPH and 1-methylnaphthalene were detected in sludge samples; however, no ecological screening values were reported for this chemical by the six sources used to evaluate risk in this EE/CA.

4.1.2.3 Risk Characterization

Lead and mercury in the onsite soil may pose a threat to mouse and rat species due to inadvertent ingestion, and as a result, coyote, bobcat, foxes, skunks, hawks, and owls may be affected by the ingestion of mice and rats that have lead and mercury bioaccumulated in their tissues. Onsite concentrations of lead and mercury may also pose a threat to mule deer if they gain access to the enclosed area, and it is believed that this is possible, despite the presence of the fence. Access to the site by cattle is less likely, but if this were to occur, the animals would be at risk due to the concentrations of lead which were observed.

In the sludge, arsenic exceeds the RMC defined by the Oak Ridge National Laboratory. Additionally, chromium, lead, and mercury exceed the criteria defined by the Dutch Ministry Standards. Lead presents a moderate risk to deer mouse, cottontail, mule deer, and cattle, according to BLM's Technical Note, *Risk Management Criteria for Metals at BLM Mining Sites*.

It is unclear whether or not the level of cadmium present in the soil and sludge will affect rabbits and mule deer due to the reasons discussed in Section 4.1.2.2. Likewise, it is unclear what effect the elevated levels of TPH and 1-methylnaphthalene will have on animal species present at or near the Site due to the fact that there are no BLM ecological risk criteria for these chemicals, nor are there risk criteria defined by the other sources referenced.

4.2 I&W South Site #2

Using a procedure analogous to the one used for the I&W South Site, a Conceptual Site Model was developed for I&W South Site #2 and a screening assessment was performed. The site model for human and ecological receptors at the I&W South Site is follows:

Potential sources of contamination:
- Area of high visible contamination
- Area of visible contamination

Potentially affected media:
- Surface soil
- Subsurface soil
- Surface water after a precipitation event

Potential migration routes:
- Leaching from the liquid waste pit
- Leaching from the waste and overburden piles
- Offsite transport of contaminants during or after a precipitation event

Exposure routes:
- Ingestion of soil or sludge
- Dermal contact with soil or sludge
- Inhalation of airborne soil particles
- Dermal contact and ingestion of contaminated surface water

4.2.1 Human Health Risk Screening

The risks to human health at I&W South Site #2 are quite similar in scope to those for I&W South, as discussed in Section 4.1.1. At I&W South Site #2, potential human receptors will most likely include recreational users (campers) and industrial outdoor workers. As shown in Figure 3, I&W South Site #2 is farther away from the town center of Loco Hills (closest buildings or homes are within 200 to 800 yards). However, this site is not protected by a fence like the one found at I&W South, so the greater distance may not necessarily result in reduced risk of exposure. As was discussed in Section 4.1.1, surface water that pools after a precipitation event may pose a risk, but exposure to contaminated groundwater is not believed to be a concern, due to the depth to groundwater (see Section 2.1.4).

4.2.1.1 Sources of Human Health Screening Values

The maximum concentration of each constituent detected in the soil or sludge was screened against BLM HRMCs, the EPA Region 6 Human Health Medium-Specific Screening Levels, NMED soil screening levels (Tables 4-5 and 4-6). BLM screening levels only pertain to inorganic constituents; as a result, EPA screening levels were used for applicable organic constituents. The BLM camper HRMC was selected as the most likely and most conservative recreational receptor group likely to be exposed to contaminants at the Site. The camper criterion assumes 14 days of exposure per year, the longest exposure period assumed for any BLM recreational group. The EPA Region 6 industrial outdoor worker with dermal exposure was selected as the most likely receptor group for the organic constituents as residential screening values were deemed not to apply because of the lack of dwellings of any kind onsite. As for the I&W South Site, the NMED soil screening levels for an industrial/occupational worker were also used in the screening process.

4.2.1.2 Results of Screening

All soil constituents are below the screening levels for the BLM camper and EPA Region 6 industrial outdoor worker with dermal exposure, with the exception of arsenic. Arsenic, present at a concentration of 7.3 mg/kg, was 3.65 times greater than the EPA screening level for an industrial outdoor worker (cancer endpoint of 2.0 mg/kg). Ethylbenzene, present in a soil sample at a concentration of 107 mg/kg, was 1.6 times greater than the NMED screening value (68 mg/kg) for an industrial/occupational worker. Xylene, present in a soil sample at a concentration of 248 mg/kg, was 3.9 times greater than the NMED screening value (63 mg/kg) for an industrial/occupational worker. Naphthalene, present in a soil sample at a concentration of 118 mg/kg, was 2.7 times greater than the NMED screening value (43 mg/kg) for an industrial/occupational worker.

TPH and chromium were identified in one or more soil samples, but there is no BLM, EPA, or NMED human health screening value for TPH in soil. Similarly, there is no BLM or EPA screening level for chromium, however, the NMED reports a soil screening level of 1.0×10^5 mg Chromium III per kilogram soil for the industrial/occupational Worker. The NMED screening levels for benzo(a)anthracene, dibenzo(a,h)anthracene, and benzo(a)pyrene are below the method detection limits for the analytical methods used for these compounds; therefore, it is not possible to evaluate the risk by these compounds to human receptors.

Screening levels for soil were used to assess the risk posed by contaminants in the sludge. In the sludge, only arsenic and benzene were in excess of the screening levels specified in Section 4.2.1.1. The arsenic concentration in the single sample of sludge (275 mg/kg) was 137.5 times higher than the EPA Region 6 screening value for the industrial outdoor worker with dermal exposure (2.0 mg/kg), 13.75 times higher than the BLM camper soil screening value (20 mg/kg), and 16.2 times higher than the NMED industrial/occupational worker. The EPA Region 6 screening value for arsenic represents a cancer endpoint. Benzene occurred in the sludge at a concentration of 70.6 mg/kg, over ten times greater than the NMED SSL for an industrial worker. Chromium and naphthalene were detected in the sludge at levels below the NMED screening levels; there are no BLM or EPA screening values for human health for these constituents. 1-Methylnaphthalene, 2-methylnaphthalene, and TPH were also detected in the sludge sample, however, there are no BLM, EPA, or NMED human health screening values for these constituents.

4.2.1.3 Risk Characterization

The risk of exposure to arsenic in soil is relatively low when compared to the risk posed by arsenic in the sludge, but neither can be truly discounted. Risk associated with an exposure to arsenic in sludge is high for the camper and even higher for the NMED industrial/occupational worker and EPA industrial outdoor worker with dermal exposure. In soil, ethylbenzene, xylene, and naphthalene pose a risk to industrial workers according to the NMED SSLs. The I&W South Site #2 is easily accessible to the public, as it is unfenced and less than a half of a mile from the town of Loco Hills. Moreover, I&W South Site #2 is adjacent to a frequently traveled road which is easily accessed from County Road 217, the main route between Carlsbad and Loco

Hills. 1-Methylnaphthalene, and 2-methylnaphthalene, and TPH were identified in samples; however, BLM, EPA, and NMED screening levels do not exist for the identified receptors. As a result, the risks associated with these chemicals cannot be assessed.

4.2.2 Ecological Risk Screening

Due to the close proximity to I&W South, ecological receptors at I&W South Site #2 are the same as those discussed in Section 4.1.2. Commonly encountered wildlife is expected to include mule deer, cattle, spotted ground squirrel, a variety of mice and rats, coyote, bobcat, gray fox, spotted skunk, roadrunner, various hawks and owls, cactus wren, lark sparrow, lark bunting, scissor-tailed flycatcher, mourning dove, scaled quail, and various lizards and snakes. Since no fence is present at I&W South Site #2 there are no obstructions to restrict wildlife contact with the contaminated material.

4.2.2.1 Sources of Ecological Screening Values

Using a process similar to the one outlined in Section 4.1.2.1, the maximum concentration of each constituent detected in the soil or sludge was screened against BLM Wildlife and RMC for deer mouse, cottontail, mule deer, and cattle, for soil; the FWS screening levels for soil; Oak Ridge National Laboratory, screening levels for soil; the CCME screening levels for soil; and the Dutch Ministry Standards' screening levels for soil (Tables 4-7 and 4-8). Five sources of ecological screening levels were used because BLM has not established criteria for all constituents identified at the site. The five sources are grouped in a column titled "Other", in Tables 4-7 and 4-8. Screening levels identified by sources other than BLM indicate constituent concentrations for a "clean" site. These levels are conservative, but provide some reference.

4.2.2.2 Results of Screening

All soil constituents were below the screening levels, except for cadmium. However, the analytical method utilized for analysis of cadmium has a detection limit of 0.50 mg/kg, and the BLM screening values for cottontail and mule deer are 0.3 and 0.2 mg/kg, respectively; therefore it is not possible to evaluate whether or not cottontail and mule deer are at risk due to cadmium exposure. Conservative assumptions would indicate that cottontail and mule deer would be affected by the cadmium concentrations at the Site; however, due to the results of previous sampling events and historical knowledge of the Site, it is not believed that cadmium is a COC.

Five constituents exceeded the BLM and/or other risk criteria in the sludge. Arsenic, present at a concentration of 275 mg/kg, was 5.29, 2.25, 3.35, and 1.42 times greater than the screening levels indicated by BLM for deer mouse, cottontail, mule deer, and cattle, respectively. Arsenic was present at a concentration which exceeded the Oak Ridge National Laboratory screening level by a factor of 27.5. Chromium, present at a concentration of 48.5 mg/kg, was 1.52 times greater than the screening level indicated by Oak Ridge National Laboratory. Lead, present at a concentration of 124 mg/kg, exceeded the BLM RMC for cottontail and mule deer by factors of 1.28 and 2.82, respectively. Lead also exceeded the Oak Ridge National Laboratory screening value by a factor of 2.48. Selenium, present at a concentration of 1.6 mg/kg, was 1.98 times greater than the screening level for Oak Ridge National Laboratory.

4.2.2.3 Risk Characterization

Arsenic poses a moderate threat to mouse, rat, and rabbit species onsite, and as a result, coyotes, bobcats, foxes, skunks, hawks and owls may be affected by the ingestion of mice, rats, and rabbits that have arsenic concentrations in their tissues. Onsite concentrations of arsenic pose a moderate risk to mule deer and cattle. Humans may be exposed to arsenic concentrations by consuming cattle which ingest contaminated soil while grazing on plant matter growing in the vicinity of the contaminated soil. Lead concentrations pose a moderate risk to rabbit species and mule deer. The lead concentration exceeds the Oak Ridge National Laboratory's definition of a "clean" site by a factor of 2.48.

4.3 Uncertainty Analysis

A number of uncertainties were identified in both the human health and ecological risk screening. In some circumstances, the uncertainties slightly overestimate the risk to ecological receptors that frequent the two sites. The uncertainties with the greatest impact on the assessment of risk at the sites are:

1) Only a small number of soil and sludge samples were collected for sample analyses for each site. However, soil and sludge samples were collected from areas that were expected to be representative, ranging from the most contaminated to areas that are largely typical. Nevertheless, since the highest results are used in the screening, and since this material represents only a small percentage of the total contamination, it is possible that an overestimate of the risk for the entire site may occur.

2) Human health and/or ecological soil screening levels do not exist for several of the constituents at the I&W South Site and I&W South Site #2 for the identified receptors. The human health and ecological risks of these constituents (e.g., TPH, naphthalene compounds) cannot be assessed. When possible, risk from these constituents was evaluated by comparison to risks to other receptors and by comparison to screening criteria that indicate constituent concentrations for a "clean" site. As a result, the assessment may under- or overestimate the risk posed by these constituents.

3) For ecological receptors, the screening values are based on the assumption that the receptor spends all its time and obtains all of its food from the Site. This assumption is not typical of reality, but is used in the industry for developing screening values. As a result, risks may be overestimated.

4) Risk criteria typically do not account for carnivorous animals. These animals may be at risk from bioaccumulation of constituents (particularly metals) by consuming contaminated mammals.

5) For some constituents, the identified concentration is equal to or less than the analytical laboratory's reporting limit, but greater than the screening level. In such cases, it is unclear whether or not the constituent poses a risk to the identified receptors.

4.4 Removal Action Criteria

At the I&W South Site, arsenic is the constituent which poses the greatest risk to human receptors. Due to the presence of arsenic in the sludge, this material poses a risk to campers, industrial outdoor workers with dermal exposure, and industrial/occupational workers (1.78, 17.8, and 2.1 times greater than the comparative screening levels, respectively). At the same location, barium, chromium, and mercury exceed the conservative ecological screening levels indicative of a "clean" site. Lead poses a moderate risk to mouse and rabbit species, and mule deer and cattle. Mercury poses a moderate risk to rabbit species and mule deer, according to the BLM screening criteria.

At I&W South Site #2, arsenic in the soil and sludge exceeds the screening level for an industrial outdoor worker with dermal exposure, with levels that are 2 and 137.5 times greater than the risk criteria, respectively. In the sludge at I&W South Site #2, arsenic poses a high risk to both a camper and an industrial/occupational worker. In soil, ethylbenzene, xylenes, and naphthalene pose a risk to industrial workers. Arsenic concentrations at this location pose a moderate threat to mouse, rat, and rabbit species, as well as mule deer and cattle. Lead concentrations pose a moderate risk to rabbit species and mule deer.

Based on the results of the risk assessment, there is a moderate degree of confidence that contamination of both the I&W South Site and I&W South Site #2 poses a risk to the human receptors that are most likely to access the Site (i.e., camper and industrial worker) and come into contact with the contaminated material. In addition, moderate risk to ecological receptors are present at both sites.

Based on the discussion in this section, and to be most protective of human health and the environment, it is recommended that the camper RMC for metals) be used as the removal criteria based solely on a risk perspective. It is likely that additional removal criteria will be established in the later sections of this EE/CA in order to ensure compliance with applicable or relevant and appropriate requirements (ARARs).

5.0 IDENTIFICATION OF REMOVAL ACTION SCOPE, GOALS, AND OBJECTIVES

The Removal Action Objectives (RAOs) to be discussed in Section 5.1 have been developed based on an analysis of the known sources of contamination, the nature and extent of contamination, the results of the human health and ecological risk assessments, and the ARARs that have been identified. The RAOs have generally been developed to control the contamination sources and to eliminate the potential for exposure of human and ecological receptors to onsite contamination.

5.1 Definition of Removal Action Objectives

The general evaluation criteria for the analysis of potential removal actions, as defined in the EPA document *Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA* (1993), are effectiveness, implementability, and cost. These criteria are discussed in greater detail in Section 6.2. To define the RAOs for the Site, the results of the site characterization and streamlined risk evaluation are examined in an effort to construct removal goals which comply with the ARARs and are protective of human health and the environment. Based on this process, the following RAOs were identified:

- Eliminate or reduce human exposure to petroleum hydrocarbons, metals, and other hazardous constituents in the waste source material.
- Eliminate or reduce ecological exposure to petroleum hydrocarbons, metals, and other hazardous constituents in the waste source material.
- Eliminate or reduce offsite migration of petroleum hydrocarbons, metals, and other hazardous constituents via surface runoff and wind dispersion.
- Eliminate or reduce the physical hazards associated with the open trench, pits, and related debris currently onsite.

The proposed removal action must address the RAOs, and the future land use of the property must be consistent with these objectives. As a result, both the proposed removal action and the potential future land use alternatives will be evaluated in subsequent sections to determine the extent to which they meet these RAOs. Although immediate and 100% attainment of the RAOs is not required for a removal action, it is considered to be a goal which is desirable pending availability of effective technologies and funding.

5.2 Removal Action Schedule

The BLM has determined that a non-time-critical removal action is appropriate at the Site. The removal could commence within six to twelve months following approval of this EE/CA. Based on past experience with the implementation of removal action technologies similar to those proposed in this EE/CA, it is estimated that any removal action undertaken can be completed within one year, provided adequate funding is available.

5.3 Applicable or Relevant and Appropriate Requirements

The lead Federal agency or designated on-scene coordinator (OSC) is responsible for the identification of ARARs and all Federal, State, and local environmental regulations that pertain to the CERCLA removal action. As defined in the *Guidance on Consideration of ARARs During Removal Actions* (EPA, 1991):

> "Applicable requirements are cleanup standards, standards of control, and other substantive requirements, criteria or limitations promulgated under Federal environmental or State environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstances found at a CERCLA site.
>
> Relevant and appropriate requirements are cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that, while not 'applicable' to a hazardous substance, pollutant, contaminant, remedial action, location or other circumstances at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site and are well-suited to the particular site.
>
> ...Other information To Be Considered (TBC) generally falls within three categories: health effects information with a high degree of credibility; technical information on how to perform or evaluate site investigations or response actions; and policy.

The ARARs presented and evaluated for this EE/CA are presented in three groups as follows:

- Chemical specific standards established for specific chemicals found on the site;
- Location specific standards based on New Mexico, Eddy County, or other local regulations; and,
- Action specific limitations on any proposed activities that will be part of the removal action at the Site.

The matrix presented in Tables 5-1, 5-2, and 5-3 identify the major Federal, State, and local environmental laws but may not be entirely inclusive. Although the ARARs have been developed based on communication with BLM, it is recommended that the designations suggested in this EE/CA (i.e., applicable, relevant, appropriate, or TBC) be used as guidance when working with Federal, State, and local regulators if involved in the implementation of the alternative that is selected.

6.0 IDENTIFICATION AND ANALYSIS OF MANAGEMENT AND TREATMENT TECHNOLOGIES

6.1 Introduction

According to 40 CFR 300.415, the purpose of an EE/CA is to analyze potential Removal Action Alternatives based on current site conditions to address contamination present at the Site. The alternatives are evaluated and developed through the criteria suggested in the EPA document, *Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA*. Specifically, the Removal Action Alternatives have been developed and analyzed against the RAOs defined in Section 5.1 and the evaluation criteria defined in Section 6.2.

The development and analysis of Removal Action Alternatives involves four steps. In Section 6.3.1, the general categories of potential response actions are identified and described. The broad array of technologies which may apply to each category are then identified and screened in Section 6.3.2. This preliminary screening procedure has been conducted to identify those technologies that are judged to be applicable to the Site, and which may be potentially effective in meeting the RAOs. Although many of the technologies discussed in Section 6.3.2 are not applicable to the Site, they are presented to document that they were identified and considered. In Section 6.3.3, the potential response actions and technologies retained from the screening process in Section 6.3.2 have been assembled into Removal Action Alternatives. Finally, the Removal Action Alternatives have been analyzed against the criteria of effectiveness, implementability, and cost.

6.2 Evaluation Criteria

The criteria which are used to analyze Removal Action Alternatives in an EE/CA are defined in the EPA guidance document previously cited. The three general criteria are effectiveness, implementability, and cost. The specific components of each criteria, are defined as follows:

Effectiveness Evaluation

- Overall protectiveness of human health and environment
- Ability to achieve RAOs/ARARs
- Short-/long-term effectiveness

Implementability Evaluation

- Technical feasibility
- Administrative feasibility
- Availability of materials and sources
- Community applicability

Cost Analyses

- Capital cost
- Post removal control cost
- Present worth cost
- Maintenance and monitoring costs

6.3 Removal Action Alternatives

6.3.1 Description of Broad Categories of Potential Response Actions

The broad categories of potential removal response actions include:

- No action
- Institutional controls
- Management and/or treatment of waste material

No Action

As a potential response action, "No Action" leaves the contaminated materials at the Site in their current condition and assumes that no further intervention will occur. Although this approach will not actively meet the RAOs for the Site, its consideration and evaluation is required. Other potential response actions will be compared to the baseline provided by "No Action," under which, no removal activities or monitoring would occur.

Institutional Controls

Institutional controls include administrative land use restrictions, site access restrictions (such as fencing), and/or relocation of potential receptors to attempt to minimize the potential for exposure to site contamination. In general, institutional controls do not actively address site contamination, but attempt to meet the RAOs by reducing the potential for human and ecological exposure to the contaminants. However, these controls do not address the mobility of the contamination or offsite transport of contaminated materials.

Management and/or Treatment of Waste Material

Management or treatment of the waste material includes options that can be conducted *in-situ* or *ex-situ*. These options include restricting potential exposure by capping, stabilizing the contamination in place, or using innovative technologies to remove the contaminants without physically removing the soil such as: containment, thermal treatment, landfarming (onsite or offsite), soil vapor extraction (vapor venting), bioventing (active soil aeration), composting (biopiles), and offsite disposal. Section VI.A.2 of the NMOCD publication *Guidelines For Remediation of Leaks, Spills, and Releases* provides a listing of options for onsite treatment and offsite disposal options for contaminated soils similar to those found at the I&W South and I&W South #2 sites. The potential options which were identified and screened are presented in Section 6.3.2, and were derived, in part, from the preferred options discussed in the aforementioned NMOCD document.

6.3.2 Identification and Screening of Management and Treatment Technologies

No Action

The No Action Alternative does not require the employment of any management or treatment technologies.

Site Specific Evaluation: Although this potential Removal Action Alternative will not meet the RAOs, it is used for comparison purposes and as a baseline against which the performance of other alternatives are measured. For this reason, it is retained for further evaluation.

Institutional Controls

Institutional controls are used to restrict access or control use of a site. Institutional controls may include one or more of the following: construction of barriers, installation of fences, gates, moats, warning signs, hostile vegetation, and deed restrictions.

Site Specific Evaluation: Institutional controls are currently in place at the I&W South Site in the form of the eight foot chain link fence with a locked gate, but no such controls are present at I&W South Site #2. While institutional controls are more effective in meeting the RAOs than the No Action Alternative, they are not expected to be completely effective as a long-term solution. Fencing can be partially effective to deter and/or limit trespasser access, but it generally does not limit ecological exposure, nor does it address the potential for offsite migration of contaminants. Because of these shortfalls, institutional controls alone will not be considered for further analysis in Section 6.3.4. However, it is entirely possible that institutional controls will be retained as part of other alternatives that involve leaving some or all of the waste material onsite.

Management and/or Treatment of Waste Material

This section provides a brief description of the management and treatment alternatives for the site waste materials. Based on the site characterization data, the primary contaminants are petroleum hydrocarbons and heavy metals. Based on the presence of these contaminants, the potential management and treatment alternatives are:

- Containment
- Onsite Thermal Treatment
- Landfarming
- Soil Vapor Extraction (Vapor Venting)
- Bioventing (Active Soil Aeration)
- Composting (Biopiles)
- Solidification
- Offsite Disposal

Containment

Containment technologies for application at contaminated sites include landfill covers (caps), vertical barriers such as slurry walls, and horizontal barriers. Capping systems reduce surface water infiltration, control fugitive dust emissions, improve aesthetics, serve as a barrier between contaminants and potential receptors, and provide a stable surface over the waste. Cap construction costs depend on the number of components in the final cap system. *In-situ* vertical barriers such as slurry walls constitute an impermeable barrier situated perpendicular to the ground surface and groundwater flow to minimize the movement of contaminated groundwater offsite or limit the flow of uncontaminated groundwater onsite. Containment is most likely to be applicable to: (1) wastes that are low-hazard or immobile; (2) wastes that have been treated to produce low hazard or low mobility waste for onsite disposal; and, (3) wastes whose mobility must be reduced as a temporary measure to mitigate risk until a permanent remedy can be tested and implemented (EPA, 1997).

The most important advantages of containment are: (1) surface caps and slurry walls are relatively simple and rapid to implement at low cost and can be more economical than excavation and removal of very large volumes of waste, (2) caps and slurry walls can be applied to large areas or volumes of waste where relatively flat topography permits, (3) engineering control is achieved, and may be a final action if contaminants are well immobilized and potential receptors are distant, and, (4) in some cases it may be possible to create a land surface that can support vegetation and/or be applicable for other purposes. Disadvantages of containment include: (1) uncertain design life, (2) contamination remains onsite and is available to migrate should containment fail, and (3) long-term inspection, maintenance and monitoring is required.

To be seriously considered practical for implementation of containment systems, the potential site must be suitable for a variety of heavy construction equipment. When capping systems are being utilized, onsite storage areas are often necessary for the materials to be used in the cover. For large jobs, onsite borrow areas to provide the materials necessary for constructing the cap are generally required to make this type of alternative cost effective.

This technology often involves the excavation, relocation, and placement of waste material in an engineered onsite repository which is constructed specifically to hold the subject materials. Under this technology, the contaminated materials are excavated from the source and adjacent areas, and transferred to an onsite repository, placed and compacted. The extent of excavation to be performed depends on the extent to which it is desired that the RAOs and ARARs are to be met. Following placement, the repository containing the waste material is capped, thereby establishing a barrier which eliminates the potential for exposure to human and ecological receptors. Likewise, the potential for offsite transport of the contaminants via the surface water and air pathways will be eliminated.

Site Specific Evaluation: The relatively flat site topography and availability of large open areas with the potential for use as material staging areas are characteristics of the Site that would make containment an appropriate management technology. However, containment is typically more appropriate for low mobility contaminants such as heavy metals and not for volatile organic contaminants prevalent at both I&W South and I&W South Site #2. Repositories and other containment structures also require significant long term monitoring which tends to be cost effective only when dealing with waste volumes that are much larger than those present at the Site. The RAOs would be expected to be met, but since NMOCD guidelines are a primary

ARAR to be considered under this EE/CA, it is also important to note that containment is not one of the recommended management technologies of this agency. For these reasons, containment is not retained for further evaluation.

Onsite Thermal Treatment

Under thermal treatment processes, heat is used to increase the separation, decomposition, destruction, or immobilization of contaminants. Thermal desorption and hot gas decontamination are used to separate the contaminants from the substrate, whereas incineration, open burn/open detonation, and pyrolysis are used to destroy contaminants outright. The most commonly used thermal processes for treating petroleum hydrocarbon wastes are incineration and low-temperature thermal desorption (LTTD).

Under the incineration process, high temperatures are used to combust organic constituents in the waste. Off gases and combustion residuals (e.g., ash) generally require subsequent treatment or disposal. Incineration can be used to remediate soils contaminated with volatile heavy metals such as mercury, explosives, and hazardous wastes, particularly those containing petroleum and chlorinated hydrocarbons. Incineration of wastes tends to be restricted to stationary facilities and the number and location of suitable facilities can be limiting factors in using this type of treatment as costs can quickly escalate well beyond other management technologies unless the waste volume is very small.

LTTD involves heating the waste to volatilize water and organic compounds at which point a carrier gas or vacuum system transports the volatilized water and organics to a secondary treatment system prior to release to the atmosphere. LTTD is only applicable for use on wastes that are comprised of small (<2 inch diameter) particles; larger particles require preprocessing by either shredding or crushing prior to treatment. After treatment, TPH and BTEX concentrations are typically reduced to below 10 mg/kg and 100 mg/kg, respectively, and treated soil can typically be returned to the site for use as backfill. Thermal desorption processes are applicable to VOCs, SVOCs, volatile metals, PAHs, polychlorinated biphenyls (PCBs), and pesticides, and process equipment is available skid-mounted so that it may be transported to sites where large treatment volumes merit the cost of mobilization.

Site Specific Evaluation: LTTD is an established treatment method which can easily meet the removal goals proposed under this EE/CA and is an acceptable method according to NMOCD guidance. While the possibility exists for bringing a mobile LTTD unit to the Site, the mobilization cost for such a unit can be over $300,000. For this reason, only very large waste volumes can be economically treated using a mobile LTTD. Based on this discussion, thermal treatment processes are not retained for subsequent consideration in this EE/CA.

Landfarming

Landfarming is an "out of hole" treatment method; that is, landfarming operations occur above ground and are typically applied to soil in a prepared location after the contaminated material is excavated from its original location. Almost exclusively used for treating soil contaminated with petroleum hydrocarbons, landfarming reduces the concentration of contaminants via microbial activity which is stimulated by aeration (typically achieved by tilling or plowing), the addition of moisture, the addition of nutrients, or a combination of these amendments. Landfarming is applicable to the full range of hydrocarbon products, but lighter weight substances such as gasoline and diesel require less treatment time than do heavier products like heating or lubricating oils.

Landfarming systems are typically among the simplest of potential treatment options to design and implement for VOC contaminated soil. As a result, costs associated with this treatment type are generally relatively low. However, very high concentrations of TPH (> 50,000 mg/kg) or high concentrations of heavy metals will tend to interfere with the microbes that are largely responsible for the degradation, so consideration must be given to the waste characteristics prior to implementation. Because landfarming treatment units involve the placement of the contaminated soil in relatively thin lifts to insure sufficient aeration, large land areas are required. Soil characteristics such as moisture content, soil pH, microbial population density, texture, and nutrient concentrations all play a part in determining how quickly contaminants will degrade in landfarm systems. Excessively acidic or basic soils, excessively dry or wet soils, and clayey soils may require soil amendments or other periodic maintenance to insure successful treatment. Treatment under such conditions may still be possible, but will tend to be slower than systems operating under more optimal conditions.

Site Specific Evaluation: Landfarming is a very common treatment method for petroleum contaminated soil in southeastern New Mexico, primarily due to the fact that large tracts of inexpensive land are readily available. The number of successful landfarming operations in the vicinity of the Site suggests that such treatment can be effective. This success is likely due to the fact that the higher organic matter and other nutrient concentrations which characterize petroleum contaminated soil are more able to support bacterial growth than the surrounding unimpacted native soils rather than treatment times or the use of soil amendments. The highly contaminated sludge found at both I&W South and I&W South Site #2 contain higher concentrations of contaminants (e.g., inorganics and TPH) than can be effectively treated using landfarming, so it is likely that this material will require alternative treatment. However, the vast majority of the contaminated material appears to be suitable for landfarming, pending a biotreatability evaluation. Landfarming is an acceptable treatment method according to NMOCD guidance, and an acceptable offsite facility is located approximately 30 miles from the Site. Design and construction of an onsite landfarming facility is also a possibility that merits evaluation due to the availability of suitable areas onsite. If constructed onsite, a landfarming treatment unit may require installation of a liner, although migration of contaminants to groundwater is not believed to be a concern at this time. Due to these factors, landfarming (both onsite and offsite) is retained for consideration.

Soil Vapor Extraction (Vapor Venting)

Soil vapor extraction (SVE) is a treatment technology that involves forced volatilization of petroleum products in soil. This process occurs *in-situ*; that is, no excavation of the contaminated material is typically required. Instead, extraction wells are installed throughout the contaminated media, and a vacuum is applied to create a negative pressure environment in the subsurface which forces the volatilized contaminants into the wells. The extracted vapors may then be treated, if necessary to fulfill regulatory requirements, and released to the atmosphere or back into the subsurface. Due to the fact that SVE relies exclusively on volatilization to provide treatment, this process is only suitable for highly volatile petroleum products such as gasoline. Diesel, kerosene, oils, or other less volatile products are generally not amenable to SVE. Since the entire process of SVE can occur without excavating the contaminated material, this treatment method is often desirable for sites with extremely large waste volumes or where the material cannot be safely excavated, such as beneath buildings. Low permeability or stratified soils may present difficulties in the implementation of SVE systems, as can the presence of groundwater at a depth at or near the bottom depth of contamination.

Site Specific Evaluation: Due to the fact that the waste material at both I&W South and I&W South Site #2 is not associated with gasoline, it is probably not volatile enough to support effective SVE treatment. Moreover, the majority of the site contamination appears to be relatively shallow (i.e., less than two feet bgs), so the installation of extraction wells will not necessarily have a pronounced impact on the cost effectiveness of the project when compared to simple excavation. Due to these considerations, SVE will not be retained for possible implementation under this EE/CA.

<u>Bioventing (Active Soil Aeration)</u>

Like SVE, bioventing involves an *in-situ* process based around the installation of extraction wells into areas of contaminated subsurface soil. But whereas SVE solely involves the extraction of vapor in a process that involves enhanced volatilization, bioventing induces enhanced microbial degradation of petroleum hydrocarbons by forcing air or oxygen into the vadose zone. Often further enhanced by the addition of nutrients, this process is not limited to the treatment of gasoline and other highly volatile compounds like SVE. Diesel fuel, kerosene, and other heavier hydrocarbons are readily treated in bioventing systems; however, the heavier the product, the longer treatment time that is required. Bioventing shares some of the advantages of SVE without this important limitation: no excavation is required and it may be implementable in areas that are inaccessible to more conventional treatment methods. However, bioventing is not an effective treatment for highly contaminated wastes or wastes which contain high concentrations of heavy metals as these conditions may be toxic to the microorganisms. High clay content can also have a negative impact on bioventing treatment units because it prevents free movement of oxygen and nutrients within the soil matrix. Like other treatment methods that rely on the presence of microorganisms, soil characteristics such as moisture content, soil pH, microbial population density, texture, and nutrient concentrations are also of critical importance.

Site Specific Evaluation: Although bioventing is more appropriate than SVE for the mid-weight petroleum contaminants found at I&W South and I&W South Site #2, the fact that the contamination is quite shallow seems to indicate that the costs associated with the installation and operation of the extraction/injection wells and nutrient delivery system will be considerably higher than other more conventional treatment methods. Based on this rationale, bioventing will not be considered for implementation.

<u>Composting (Biopiles)</u>

Composting is a treatment process that is very similar to landfarming in that it involves the *ex-situ* consolidation of petroleum contaminated soil in treatment cells and occasionally involves the addition of moisture or nutrients. However, whereas aeration in landfarming operations is typically achieved by tilling, mechanical turning, or plowing, biopiles are aerated by forced air systems which are installed throughout the pile. While the purchase and installation of the piping, fans, and compressors necessary for a biopile treatment unit is an expense that is not present in landfarms, biopiles require less land area and tend to treat contaminants more rapidly than landfarms. In addition, biopiles can be operated as closed systems that capture vapor in areas where regulations require emissions controls.

Like landfarming, very high concentrations of TPH (> 50,000 mg/kg) or high concentrations of heavy metals may interfere with the microbes that are largely responsible for the degradation, so consideration must be given to the operational needs of the treatment prior to implementation. However, because volatilization is a major mechanism in composting treatment, some level of treatment of light weight VOCs may still occur under these conditions. Soil characteristics such as moisture content, soil pH, microbial population density, texture, and nutrient concentrations all play a part in determining how quickly contaminants will degrade in biopile systems. Biopiles are not as susceptible as landfarms to fluctuations in temperature and moisture associated with climate. Excessively acidic or basic soils, excessively dry or wet soils, and clayey soils may inhibit proper air flow through the soil matrix. Treatment under such conditions may still be possible, but will tend to be slower than systems operating under more optimal conditions.

Site Specific Evaluation: Although offering some additional benefits over landfarming, the benefits do not appear to offer enough value to merit consideration of this technology type. Since there is sufficient land area available at the Site to support landfarming activities, the additional expense associated with the installation of the piping and other equipment necessary to maintain a biopile treatment unit seems unwarranted. When time and space is limited for treatment, composting is a solid option, but neither appear to be major considerations at the Site. Based on these factors, composting will not be retained for additional consideration in the EE/CA.

Solidification

Solidification technology, commonly referred to as stabilization, is frequently used to prevent leaching of contaminants from waste material. This is accomplished by mixing the waste material with a binding agent that stabilizes and solidifies inorganic and organic hazardous wastes into a concrete-like, high-strength, leach-resistant mass. A wide variety of binding agents are available for use in solidification treatment processes, ranging from the widely available Portland cement to more esoteric proprietary reagents. Solidification is applicable for use on hazardous soils, sludge, and wastewater contaminated with inorganics, including most metals and cyanide, and organics, including halogenated aromatics, PAHs, and aliphatic compounds. Treatability testing is usually required to determine the proper amount of the selected reagent necessary for proper solidification. Prior to treatment, contaminated soil must be screened or crushed into small particles to ensure adequate contact with the binding agent. Once handled in this manner, the waste can be inserted into a batch plant where the binding agent is added. The resulting mixture is deposited in a pug mill or ready-mix cement truck for thorough blending and then poured into either pits located onsite or into curing forms for offsite disposal.

Solidification technologies change the physical structure of the waste material and: (1) improve the physical characteristics of the waste by producing a solid from liquid or semiliquid wastes; (2) reduce contaminant solubility by the formation of sorbed species or insoluble precipitates; (3) decrease the exposed surface area across which mass transfer loss of contaminants may occur; and, (4) limit the contact between transport fluids and contaminants by reducing the material's permeability. These characteristics are particularly beneficial if there is a concern of contaminant migration to groundwater.

Stabilization of waste can either be done onsite or at another location following excavation and transport. For sites with large waste volumes, it is almost always more economical to mobilize the treatment units onsite. For smaller volumes, offsite transport is typically more cost effective. Regardless, implementation costs of solidification treatment programs are generally high relative to the other technologies being considered under this EE/CA.

Site Specific Evaluation: The costs associated with solidification make this technology inappropriate for use at the Site. The protectiveness of groundwater associated with this remedy are not of value at the Site because of the depth of groundwater in the vicinity. For these reasons, solidification is not retained for further consideration.

Offsite Disposal

If managed in a manner that involves offsite disposal of the waste material, the sludge and contaminated soil at the site will be excavated and transported to an appropriate disposal facility. Since a small fraction of the waste has been determined as hazardous and the remainder is considered non-hazardous, it is likely that these two waste types will be treated separately and will likely be sent to different disposal facilities. Offsite disposal facilities which are suitable for petroleum contaminated soils range from municipal landfills to hazardous waste treatment, storage, and disposal (TSD) facilities. Offsite disposal facilities may also include privately or publicly owned landfarms, compost facilities, thermal treatment units, or other facilities that utilize the technology types discussed in this section. The only commonality which connects these potential scenarios is the concept that the waste which is currently onsite will be removed and treated or disposed elsewhere.

Offsite disposal offers significantly reduced maintenance activities, threat of release of contaminants, and liability concerns than does any of the management options involving onsite treatment and disposal. However, this additional level of protectiveness to the environment and human health often comes at a much higher price than do the onsite treatment and disposal methods. For large waste volumes, offsite disposal is typically the last resort as excavation and transport of wastes across great distances is very expensive. Proximity to acceptable treatment and disposal facilities also plays an important role in determining whether or not offsite disposal is appropriate for a given situation.

Site Specific Evaluation: It is expected that the sludge will require offsite disposal due to its hazardous characteristics and due to the findings of the risk assessment, regardless of how the remaining waste is handled. For the purposes of considering offsite disposal for implementation at the Site, it is assumed that three major facility types will be most likely to be considered for receiving the wastes at the Site: thermal treatment, landfarming, and land disposal (landfilling). Incineration meets the RAOs of this project because it involves the full removal and subsequent treatment of the contaminated material. As a result of the high costs associated with the transportation and subsequent treatment via incineration, this process is typically only appropriate for very small waste volumes or unless no other alternatives are available. LTTD treatment at a stationary offsite facility has the same disadvantages as incineration, as transportation costs are expected to be very high. Landfarming is an attractive offsite disposal option for the contaminated soil as several NMOCD permitted facilities are within 50 miles of the Site. Land disposal of non-hazardous petroleum contaminated soil is also a common offsite management method; however, it is not typically recommended by NMOCD guidance. Based on this rationale, offsite disposal of the contaminated soil by landfarming will be retained for consideration. Offsite disposal by incineration will also be retained, but only for the sludge which is not suitable for landfarming. The sludge has also been determined unacceptable to land disposal TSD facilities (i.e., hazardous waste landfills) due to its high total VOC concentrations. Most land disposal TSD facilities are unable to accept material with total VOC concentrations greater than 500 parts per million, and the sludge exceeds this value.

A summary of the results of the screening of management and treatment technologies is presented in Table 6-1.

6.3.3 Assembly of Removal Action Alternatives

The retained potential response actions and technologies from Section 6.3.2 have been assembled into four Removal Action Alternatives which have been tailored to the specific needs of the removal action as defined by the site characterization, RAOs, and ARARs. In this section, the four Removal Action Alternatives will be analyzed with respect to the evaluation criteria as defined in EPA guidance and in Section 6.3.1: effectiveness, implementability, and cost. These alternatives have been developed based on the known nature and extent contamination and the results of the human and ecological risk assessments.

- Alternative 1: No Action
- Alternative 2: Offsite Disposal of Sludge and Onsite Consolidation of Contaminated Soil
- Alternative 3: Offsite Disposal of Sludge and Onsite Landfarming of Contaminated Soil
- Alternative 4: Offsite Disposal of Sludge and Offsite Landfarming of Contaminated Soil

A comparative analysis of the four Removal Action alternatives with respect to the effectiveness, implementability, and cost criteria is presented in Attachment D.

Alternative 1: No Action

This alternative involves no further action to assess or correct the contamination identified at the Site. Retention and analysis of this alternative are required according to the EPA document, *Guidance on Conducting Non-Time Critical Removal Actions Under CERCLA.*

Effectiveness Evaluation

The No Action Alternative will not be effective in protecting human health or the environment, will not attain ARARs, and will not meet the RAOs. Short and long-term risks to environmental resources, as well as potential human health risks would continue to exist. No action continues to provide pathways for contaminants to move offsite and affect human or ecological health, particularly through ingestion or inhalation of the contaminated material. Toxicity, mobility and volume of contaminants would not be reduced under the No Action Alternative.

Implementability Evaluation

While it is nominally implementable from a technical standpoint. it may not be acceptable to regulators or local residents who are concerned about protection of human health and the environment. Technical and administrative feasibility criteria do not apply to the No Action Alternative.

Cost Analysis

There are no direct capital or operating costs associated with this alternative. However, leaving the waste materials onsite and available for direct or incidental contact to contaminants by human or ecological targets may provide a future liability cost for the BLM which cannot be estimated.

Alternative 2: Offsite Disposal of Sludge and Onsite Consolidation of Contaminated Soil

This alternative involves the removal and offsite disposal of the sludge at both I&W South and I&W South Site #2, which is the material that poses the greatest risk to human health and ecological targets. It also includes an onsite effort to consolidate the remaining contaminated material in the existing fenced enclosure at I&W South. By doing so, all of the remaining waste at the Site will be relocated to a more controlled location so as to reduce the threat of offsite transport of contaminants and incidental contact by nearby residents, trespassers, or workers in the area.

For the sludge to be disposed of offsite, the actions proposed under this alternative represent a complete removal of the waste source material which presents the greatest environmental threat to the potential human and ecological targets in the vicinity of the Site. As discussed in Section 3.2.2.1, the sludge at I&W South Site #2 is considered a hazardous waste based on the results of the TCLP analysis. Although the sludge at I&W South is not a hazardous waste, the sludge for the two sites will be lumped together as a single waste stream for cost estimating purposes in this EE/CA. It is expected that the specific options associated with the disposal of the sludge from the two sites will be more fully explored and evaluated in the design phase of this removal action, should this alternative be selected. In total, and as shown in Table 3-12, there is approximately 85 cubic yards of sludge present at I&W South and I&W South #2. Under this alternative, it is assumed that the sludge will be transported to a TSD facility that is permitted to accept such materials. Dynamac has identified the nearest acceptable TSD facility to the Site as the Laidlaw Environmental Services, Inc. incinerator, located in Deer Park, Texas. Costs specified under this alternative are based on discussions with and quotes received from Laidlaw.

After removal of the sludge from I&W South and I&W South Site #2, this alternative involves the consolidation of the remaining contaminated soil from I&W South Site #2 into the fenced enclosure at I&W South. The guiding concept of this alternative is that the sludge presents the greatest risk to human health and the environment, and that risk associated with the remaining material is not great enough to merit additional treatment. Under this alternative, the visibly contaminated soil will be removed from I&W South Site #2 and hauled the short distance to I&W South where the existing institutional controls could be utilized or enhanced to prevent incidental contact by human or ecological targets. Once this material is relocated, it will be blended soil into the existing soil, and the surface will be regraded to match the surrounding terrain and revegetated. In this alternative, "blending" with onsite soils and natural attenuation are the only "treatment" for the contamination that is left onsite, and the duration or effectiveness of this process is indeterminate. In total, approximately 186 cubic yards of material from I&W South Site #2 will be consolidated with approximately 418 cubic yards of contaminated soil from I&W South.

Under this alternative, an administrative area closure is recommended because of the close proximity to Loco Hills and because potential waste source material remains exposed. A site closure as administered by BLM would help to reduce potential exposure from contact with the contaminants which will remain onsite under this alternative. Operations and maintenance activities under this alternative are expected to be minimal, and would consist of periodic surveillance and inspections, as well as minor repairs to the fence, gates, and any signage that is posted to discourage trespassers.

Effectiveness Evaluation

The design concepts comprising this alternative provide a moderate level of environmental protection considering that the most contaminated waste material is disposed offsite and the remaining waste with significantly lower contamination and associated risk is contained onsite in a fenced area. Due to the close proximity of the Site to a well-traveled county road and the relatively high accessability associated with it, there will be a residual risk of exposure to humans and wildlife under this alternative since the waste material will remain onsite and exposed.

The components of this alternative address all of the RAOs, but not to a degree that completely eliminates all risk associated with offsite transport of pollutants or exposure to potential human and ecological targets. Fencing may be partially effective in limiting trespasser access, but will likely not limit ecological exposure, nor does it completely address the potential for offsite migration of the contaminated material by either the air or surface water pathways. Because some of the contaminated soil remains onsite and exposed, the ARARs for soil would not be met by this alternative. Specifically, the NMOCD remediation action level for TPH (5,000 mg/kg) is exceeded by the contaminated soil at I&W South which, as shown in Table 3-7, was found to contain approximately 15,000 mg/kg TPH. As such, this alternative does not entirely address the volume, toxicity, or accessibility of the waste material but seeks to limit onsite exposure to human targets.

It is anticipated that there may be several short-term mitigable impacts to the environment during implementation. Impacts could include wildlife disturbance through noise and human activity during construction, but are not expected to result in any significant or long-term effects.

Implementability Evaluation

The actions required for the implementation of this alternative are technically feasible using standard methods and procedures. The concepts are based on normal excavation and access control design practices; however, excavation of the sludge is expected to be more time consuming and more difficult than typical earthwork. The necessary equipment, personnel, and services are available to support implementation of this alternative. NMOCD administrative requirements would likely not be met removing only the sludge from the two sites because the remaining contaminated material exceeds the NMOCD remedial action level for TPH.

Cost Analysis

Because this alternative involves only the removal of sludge and consolidation of the remaining visibly contaminated material, capital costs are lower than Alternative 3 (Offsite Disposal of Sludge and Onsite Landfarming of Contaminated Soil) and Alternative 4 (Alternative 4: Offsite Disposal of Sludge and Offsite Landfarming of Contaminated Soil), each of which involve treatment. Operations and maintenance costs for this alternative are expected to be near negligible and considerably lower than Alternative 3. The anticipated capital cost for this alternative is $131,758; annual O&M costs are expected to be $3,300 for the first year and $2,400 thereafter.

Alternative 3: Offsite Disposal of Sludge and Onsite Landfarming of Contaminated Soil

As under Alternative 2 (Offsite Disposal of Sludge and Onsite Consolidation of Contaminated Soil), this alternative involves the offsite disposal of the sludge currently located at I&W South and I&W South Site #2 at the hazardous waste incinerator in Deer Park, Texas. It also involves the consolidation of the remaining contaminated material within the fenced enclosure at I&W South; however, Alternative 3 takes the process one step farther by implementing an onsite landfarming operation to treat the contaminated soil and thereby reduce the levels of TPH and other organic constituents.

The primary elements of this alternative include:

- Removal of approximately 85 cubic yards of sludge from I&W South and I&W South Site #2 to a permitted TSD facility;
- Excavation and stockpiling of contaminated soil from I&W South and I&W South Site #2 in preparation for landfarm treatment unit construction;
- Clearing, grubbing, and regrading of I&W South to create appropriate area for the landfarm.
- Construction of the landfarm;
- Placement of contaminated soil from I&W South (approximately 418 cubic yards) and I&W South Site #2 (approximately 186 cubic yards) into the landfarm;
- Terracing of the contaminated soil in the landfarm into windrows;
- Construction of earthen berms or drainage ditches around the perimeter of the landfarm to prevent runon of stormwater during precipitation events;
- Installation of an access ramp to allow aeration equipment to pass over the perimeter berms or ditches;
- Regrading and revegetation of excavated areas at I&W South and I&W South Site #2;
- Modification or enhancement, as necessary, to the exiting fencing to preclude or minimize disturbance of the landfarm by humans or wildlife; and,
- Implementation of an operations and maintenance program which is expected to include the application of water and nutrients to optimize operating efficiency.

Based on volume estimates presented in Table 3-12, the landfarm will need to be sized to accommodate approximately 605 cubic yards of contaminated soil. The contaminated soil will be placed to a maximum thickness of 18 inches to ensure that commonly available tilling equipment will be able to provide adequate aeration. To accommodate the known volume of soil at this thickness, a landfarm surface area of approximately 1,210 square yards is required. To achieve this surface area, the landfarm will have approximate dimensions of a 35 yard by 35 yard square, and the fenced enclosure at I&W South is sufficiently large to make this landfarm footprint feasible. It is anticipated that a suitable location for the landfarm is near the center of the enclosure in the approximate current location of the waste pile (a flat area that will allow access from all sides), but it is expected that the exact location will be finalized after a Removal Action Alternative is selected. Once an area within the I&W South enclosure is selected, it will be cleared of vegetation and graded to a flat surface. After the landfarm footprint has been prepared, the contaminated soil from I&W South and I&W South Site #2 will be relocated to this location. After relocation, construction equipment will be utilized to terrace the contaminated material into windrows to minimize air erosion, and earthen berms or drainage channels will be installed around the perimeter to minimize erosion via surface water runon and runoff. At this time, it is believed that simple earthen berms or ditches will be sufficient to manage the surface water that is expected at the Site; however, riprap or other additional erosion protection mechanisms may be installed if deemed necessary during the early operation period of the landfarm.

The results of the geotechnical sampling which took place as part of this EE/CA indicate that the need for physical pretreatment of the soil (e.g., shredding, screening, or crushing) is not anticipated. As part of a landfarm design, the contaminated soil to be treated typically undergoes a biotreatability evaluation prior to construction to insure that the soil conditions are fully compatible with the landfarming process; however, based on the established success of landfarms in the vicinity of the Site on similarly contaminated materials, no biotreatability study is being assumed in this EE/CA for cost estimating purposes. Nevertheless, during the design process, a biotreatability evaluation may be proposed as a conservative measure to help validate the effectiveness of the proposed treatment and, therefore, the success of this alternative.

Based on the minimal potential impacts to groundwater and discussions with NMOCD, a liner system is not required as part of the landfarm design. Similarly, the need for water management, leachate collection, or other design features above and beyond the earthen berms around the landfarm perimeter are not anticipated. Vapor emissions controls such as covers or mechanical means to control volatile organic emissions are also not expected to be required based on NMOCD guidance, and therefore, these features are not included in this alternative.

After the construction of the landfarm is concluded, the disturbed areas of I&W South and I&W South Site #2 will be regraded to match the surrounding terrain and revegetated using carefully selected seed native to the area of the Site. Temporary sedimentation and erosion control measures such as silt fences and/or hay bales will be implemented as necessary to minimize offsite transport of sediments resulting from the construction activities. Following establishment of the new vegetation, these erosion control measures will be removed.

Operations and maintenance activities under this alternative will be primarily linked to the aeration of the contaminated soil during treatment and application of water and nutrients to enhance the biodegradation of the contaminants. The most common method for aeration of landfarms is the use of farm equipment towing a discing device. Although the length of treatment that will be required cannot be accurately determined at this time without a biotreatability study, typical treatment times range from six months to two years. To be conservative, this EE/CA will assume a treatment time of two years. Aside from the regular aeration, operations and maintenance activities are expected include the application of nutrients and water, and for cost estimating purposes, it is assumed that this will take place eight times per year (no watering will occur during the winter months). In addition, minor repair to the berms/ditches will be needed based on the results of periodic surveillance and inspections, as well as minor repairs to the fence, gates, and any signage that is posted to discourage trespassers are the only tasks that are anticipated. At the conclusion of the treatment phase, the fencing may be removed and revegetation of the former landfarm area can commence.

Effectiveness Evaluation

The design concepts under this alternative provide the framework for achieving a high level of environmental protection, both through the removal and offsite disposal of the most contaminated waste material and the treatment of the remaining contaminated soil in an onsite landfarm. While there will be some residual risk of exposure to humans and wildlife during the treatment phase under this alternative, the risk will be greatly reduced as organic contaminant concentrations are reduced during treatment.

A successfully implemented landfarm will address all of the RAOs by significantly reducing or eliminating the risk associated with offsite transport of pollutants or exposure to potential human and ecological targets. Based on normal treatment efficiency for landfarming, the ARARs for soil would be met by this alternative after six months to two years of treatment. The NMOCD remediation action level for TPH (5,000 mg/kg) is well within the expected efficiency as landfarms can often treat petroleum hydrocarbons to 10 mg/kg or below if maintained properly.

It is anticipated that there may be several short-term mitigable impacts to the environment during implementation of this alternative in the form. Impacts could include fugitive dust and wildlife disturbance through noise and human activity during construction and regular landfarm maintenance, but are not expected to result in any significant or long-term effects. In addition, during construction and operation of the landfarm, there is an increased potential for offsite sediment transport from the disturbed or excavated areas (prior to revegetation) via surface water during precipitation events. Once the treatment phase of this alternative is completed, the Site can be revegetated and returned to its natural state.

Implementability

The actions required for the implementation of this alternative are technically feasible using standard methods and procedures. The concepts are based on normal excavation and access control design practices; however, excavation of the sludge is expected to be more time consuming and more difficult than typical earthwork. The necessary equipment, personnel, and services (including the identified TSD facility) are readily available to support implementation of this alternative. Because of the intensive O&M activities that are required to maintain the needed treatment efficiency, BLM will require additional labor, either via its own personnel or through contracting. As a result, this alternative is more difficult to implement than Alternative 4 (Offsite Landfarming). According to NMOCD guidance, landfarming is an acceptable method of managing and treating soil contaminated with petroleum hydrocarbons, so administrative requirements are expected to be met.

Cost Analysis

The capital costs associated with this alternative are the highest of any of the alternatives considered in this EE/CA due to the labor associated with the design and construction of the landfarm. Landfarm construction is one of the least expensive onsite treatment options available, but the availability of existing permitted landfarms near the Site still makes offsite treatment a more financially attractive alternative. Operations and maintenance costs for this alternative are also the highest of the four alternatives and the associated tasks are the most intense being considered until treatment of the contaminated soil is completed. The anticipated capital cost for this alternative is $261,225; annual O&M costs are expected to be approximately $26,900 until the conclusion of the treatment phase, which is expected to two years in duration.

Alternative 4: Offsite Disposal of Sludge and Offsite Landfarming of Contaminated Soil

Like Alternative 3 (Offsite Disposal of Sludge and Onsite Landfarming of Contaminated Soil), this alternative involves the offsite disposal of the sludge currently located at I&W South and I&W South Site #2 at the hazardous waste incinerator in Deer Park, Texas. But unlike the other three alternatives discussed in this EE/CA, this alternative involves the complete removal of all contaminated material identified in excess of the cleanup goals which include the camper RMC for metals and the NMOCD remediation action levels for TPH and BTEX compounds.

Offsite disposal of the identified waste materials is a comprehensive effort determined to meet RAOs and ARARs for this project by completely removing the waste source material from the Site, rather than attempting to treat or manage the material in place. Under this alternative, all contaminated soil remaining after the sludge disposal will be removed and disposed in an appropriate offsite disposal facility, so that contaminant sources identified in excess of the removal goals are eliminated. Based on the location of the Site and NMOCD guidance, the most appropriate scenario involves excavation of the material and shipping to the Lea Land, Inc. commercial landfarm located approximately 30 miles away.

The primary elements of this alternative include:

- Removal of approximately 85 cubic yards of sludge from I&W South and I&W South Site #2 to a permitted TSD facility;
- Excavation, hauling, and disposal of contaminated soil from I&W South (approximately 418 cubic yards) and I&W South Site #2 (approximately 186 cubic yards) at local NMOCD permitted commercial landfarm;
- Regrading and revegetation of excavated areas at I&W South and I&W South Site #2;
- Removal of existing fencing if desired as part of site closure; and,
- Implementation of an operations and maintenance program to insure success of revegetation.

After the removal of the contaminated soil and sludge, the disturbed areas of I&W South and I&W South Site #2 will be regraded to match the surrounding terrain and revegetated using a seed mix native to the area of the Site. Temporary sedimentation and erosion control measures such as silt fences and/or hay bales will be implemented as necessary to minimize offsite transport of sediments from areas undergoing revegetation. Following establishment of the new vegetation, these erosion control measures will be removed.

Operations and maintenance activities for this alternative would be relatively short in duration as compared to the other alternatives and would likely include a six to twelve month period of inspection, watering, and other care required to insure the success of the new vegetation and additional placement of seed in areas of unsuccessful revegetation during the initial attempt.

<u>Effectiveness Evaluation</u>

By removing the entire volume of waste material to appropriate permitted offsite locations, the potential for offsite transport of the contaminants is entirely eliminated for all exposure pathways, the potential for exposure to human or ecological targets is eliminated, and the need for long-term maintenance or monitoring is drastically reduced.

The design concepts comprising this alternative provide the highest possible level of environmental protection considering the chemical and physical characteristics of the waste materials. Removal and offsite disposal of the sludge and contaminated soil will meet all identified ARARs and RAOs for the Site.

Short-term disturbance during the construction activities proposed under this alternative may include impacts from fugitive dust associated with the removal activities. Such disturbance is expected to be minimal if proper standard engineering controls are implemented.

Implementability

The actions required for the implementation of this alternative are technically feasible using standard methods and procedures. Implementation of this alternative involves the use of heavy equipment which is expected to be readily available; however, excavation of the sludge is expected to be more time consuming and more difficult than typical earthwork. The necessary equipment, personnel, and services are readily available to support implementation of this alternative. According to NMOCD guidance, landfarming is an acceptable method of managing and treating soil contaminated with petroleum hydrocarbons, so administrative requirements are expected to be met.

Suitable disposal facilities have been identified which can accept the sludge and contaminated soil to be removed under this alternative. This alternative is expected to be administratively feasible; State and community acceptance of this alternative will be determined through the public involvement portion of the BLM community relations effort associated with the EE/CA process.

Cost Analysis

The capital costs associated with the implementation of this alternative are higher than the No Action Alternative and Alternative 2 (Offsite Disposal of Sludge and Onsite Consolidation of Contaminated Soil), but are lower than Alternative 3 (Offsite Disposal of Sludge and Onsite Landfarming of Contaminated Soil). This is due to the fact that excavation and offsite disposal at the nearby Lea Land landfarm is less expensive than the costs associated with the design and construction of a similar landfarm onsite. Operations and maintenance costs under this alternative are expected to be negligible after the revegetation operations have been deemed successful after the first six to twelve months following construction. The anticipated capital cost for this alternative is $181,018; annual O&M costs are expected to be $1,000, and will no longer be necessary after the first year.

7.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

A comparative analysis of the four Removal Action alternatives with respect to the effectiveness, implementability, and cost criteria is presented in Table 7-1. This chart summarizes the detailed analysis presented in Attachment D. All of the removal action alternatives are expected to be technically implementable. Excluding the No Action Alternative, which requires no equipment or services for implementation, the remaining three alternatives all involve proven technologies and equipment, and the necessary services are expected to be readily available.

Alternative 1 (No Action) does not address the risks associated with the waste material onsite. It is neither effective in mitigating the human health risk nor does it prevent ecological exposure, offsite transport of contaminants via the surface water or air pathways, or address the volume and toxicity of the contaminants. Since the contaminated soils and sludge remain in their current state under this alternative, they remain a threat to human and ecological receptors which come into contact with it, and the material is still subject to erosion by wind and surface water. This alternative does not meet the response goals or identified ARARs for the project.

Alternative 2 (Offsite Disposal of Sludge and Onsite Consolidation of Contaminated Soil) is moderately effective in mitigating the human health risk by removing the most highly contaminated material and relocating the remaining material into the fenced enclosure at I&W South. However, it does not prevent ecological exposure, offsite transport of contaminants via the surface water or air pathways, and does not address the volume or toxicity of the contaminants remaining onsite. Since the contaminated soil will remain uncovered in this alternative with no additional treatment, it stands to remain a threat to human and ecological receptors which come into contact with it (although the fencing may continue to mitigate much of the human health risk), and is still subject to erosion by wind and surface water. While the removal of the sludge results in meeting the removal goals for metals (camper RMC), the contaminated material that remains onsite does not meet the NMOCD remediation action level requirements for TPH. As a result, the ARARs are not completely satisfied by this alternative.

In Alternative 3 (Offsite Disposal of Sludge and Onsite Landfarming of Contaminated Soil), the sludge is removed from I&W South and I&W South Site #2. In addition, the remaining contaminated material present in excess of the removal goals are consolidated for treatment in a landfarming treatment unit. This landfarm, designed and constructed onsite within the fenced enclosure at I&W South, is expected to treat the waste to well below the removal goals of the EE/CA if properly maintained. Although the removal goals would not be met as immediately as under an alternative involving full offsite disposal, they would be met in under two years if anticipated treatment efficiencies are achieved. Nevertheless, the design, construction, and operation of an onsite landfarm is not expected to be financially beneficial over offsite landfarming due to the presence of several existing facilities in close proximity to the Site.

Alternative 4 (Offsite Disposal of Sludge and Offsite Landfarming of Contaminated Soil) involves the complete removal of the sludge and contaminated soil and subsequent transportation and disposal of the materials at appropriate offsite facilities. This alternative completely eliminates the principal threats posed by the sludge and contaminated soil by removing them from areas accessible to potential human and ecological targets and applicable exposure pathways. Alternative 4 provides the highest level of protection to the environment as well as human health.

8.0 RECOMMENDED REMOVAL ACTION ALTERNATIVE

As directed by EPA guidance, the four Removal Action Alternatives presented in this EE/CA have been evaluated against the following three general criteria: effectiveness, implementability, and cost. The specific components of each criteria, are defined as follows:

Effectiveness Evaluation

- Overall protectiveness of human health and environment
- Ability to achieve RAOs/ARARs
- Short-/long-term effectiveness

Implementability Evaluation

- Technical feasibility
- Administrative feasibility
- Availability of materials and sources
- Community applicability

Cost Analyses

- Capital cost
- Post removal control cost
- Present worth cost
- Operations, maintenance and monitoring costs

Of the four alternatives that have been analyzed, Alternative 4 (Offsite Disposal of Sludge and Offsite Landfarming of Contaminated Soil) appears to satisfy the evaluation criteria to the greatest degree. Alternative 4 is effective in complying with ARARs and meeting the RAOs, and is more protective of human health and environment than Alternatives 1 and 2. Although Alternative 3 (Offsite Disposal of Sludge and Onsite Landfarming of Contaminated Soil) provides nearly the same degree protection to human health and the environment, the cost of Alternative 4 is lower than Alternative 3. Alternative 4 can eliminate the potential liability associated with keeping the contaminated material onsite and can effectively eliminate the principle threats posed by the release of contaminants from the Site by reducing offsite transport via all perceived potential exposure pathways in both the short- and long-term.

REFERENCES

ATL, Inc., May 1994. Narrative Report Focused Site Investigation, I & W Hot Oil Service South, Eddy County, New Mexico. ATL Job No. 192063.

ATL, Inc., July 1994. Final Solutions Report Focused Site Investigation, I & W Hot Oil Service South, Eddy County, New Mexico. ATL Job No. 192063.

ATL, Inc., November 1993. I & W South Site Hazardous Ranking System II. ATL Job No. 192063.

Beyer, W.N., 1990. Evaluation Soil Contamination. United States Fish and Wildlife Service, Biological Report 90 (2).

CCME, 1998a. Canadian Sediment Quality Guidelines. Canadian Council of Ministers of the Environment, Winnipeg, Manitoba. (http://www.ec.gc.ca/ceqg-rcqe/sediment.htm).

CCME, 1998b. Canadian Soil Quality Guidelines. Canadian Council of Ministers of the Environment, Winnipeg, Manitoba. (http://www.ec.gc.ca/ceqg-rcqe/soil.htm).

CCME, 1998c. Canadian Water Quality Guidelines. Canadian Council of Ministers of the Environment, Winnipeg, Manitoba. (http://www.ec.gc.ca/ceqg-rcqe/water.htm).

Crommentuijn, T., D.F. Kalf, M.D. Polder, R. Posthumus, and E.J. van de Plassche, 1997. Maximum Permissible Concentrations and Negligible Concentrations for metals, taking background concentration into account. RIVM Report No. 601501001.

Dynamac Corporation, 2002. Final Sampling and Analysis Plan For the Engineering Evaluation/Cost Analysis, I&W Hot Oil Service South.

Efroymson, R.A., M.E. Will, G.W. Suter, and A.C. Wooten, 1997a. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision. Oak Ridge National Laboratory, Oak Ridge, TN. ES/ER/TM-95/R4. (http://www.hrsd.ornl.gov/ecorisk/reports.html).

Efroymson, R.A., M.E. Will, and G.W. Suter, 1997b. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heteratrophic Process: 1997 Revision. Oak Ridge National Laboratory, Oak Ridge, Tennessee. ES/ER/TM-126/R2. (http://www.hrsd.ornl.gov/ecorisk/reports.html).

ICF Technology Incorporated, September 1988. I & W Hot Oil Service Sites Preliminary Assessment Final Report.

Karl Souder and Associates, Inc., July 1990. Phase II Soil Sampling Plan for the I & W Hot Oil Site, Loco Hills, New Mexico.

Larson, Jon E., Senior Editor, 2002. RS Means Environmental Remediation Cost Data - Unit Price. RS Means Company, Kingston, Massachusetts.

MHSPE, 1994. Intervention Values and Target Values - Soil Quality Standards. Directorate-General for Environmental Protection, Department of Soil Protection, The Hague, The Netherlands.

New Mexico Department of Game and Fish, September 2000. Threatened and Endangered Species of New Mexico, Biennial Review and Recommendations, Revised Draft.

New Mexico Environment Department, Hazardous Waste Bureau and Ground Water Quality Bureau Voluntary Remediation Program, December 2000. Technical Background Document for Development of Soil Screening Levels.

New Mexico State Oil Conservation Division, August 1993. Guidelines For Remediation of Leaks, Spills, and Releases.

U.S. Department of Agriculture, 2000. National Resource Conservation Service, Plant Profiles. http://plants.usda.gov/.

U.S. Department of the Interior, Bureau of Land Management, December 1996. Risk Management Criteria for Metals at BLM Mining Sites. Technical Note 390 rev.

U.S. Environmental Protection Agency, 1993. Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA, Office of Solid Waste and Emergency Response, EPA 540-R-93-057.

U.S. Environmental Protection Agency, 1993. Wildlife Exposure Factors Handbook. Office of Research and Development. EPA/600/R-93/187a.

U.S. Environmental Protection Agency, 1995. How to Evaluate Alternative Cleanup Technologies for Underground Storage Tank Sites, Office of Solid Waste and Emergency Response, EPA 510-B-95-007.

U.S. Environmental Protection Agency, 1996. Soil Screening Guidance: Technical Background Document, OSWER Directive 9355.4-17A.

U.S. Environmental Protection Agency, 1997. Best Management Practices for Soils Treatment Technologies, Office of Solid Waste and Emergency Response, EPA530-R-97-007

U.S. Environmental Protection Agency, 1997. Technology Alternatives for the Remediation of Soils Contaminated With As, Cd, Cr, Hg, and Pb, EPA/540/S-97/500.

U.S. Environmental Protection Agency, 2002. EPA Region 6 - Human Health Medium-Specific Screening Levels. (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/01r6tableformat.pdf)

Waier, Philip R., Senior Editor, 2002. RS Means Building Construction Cost Data, 60th Annual Edition. RS Means Company, Kingston, Massachusetts.

Western Regional Climatic Center, 2002. http://www.wrcc.sage.dri.edu/.

FIGURES

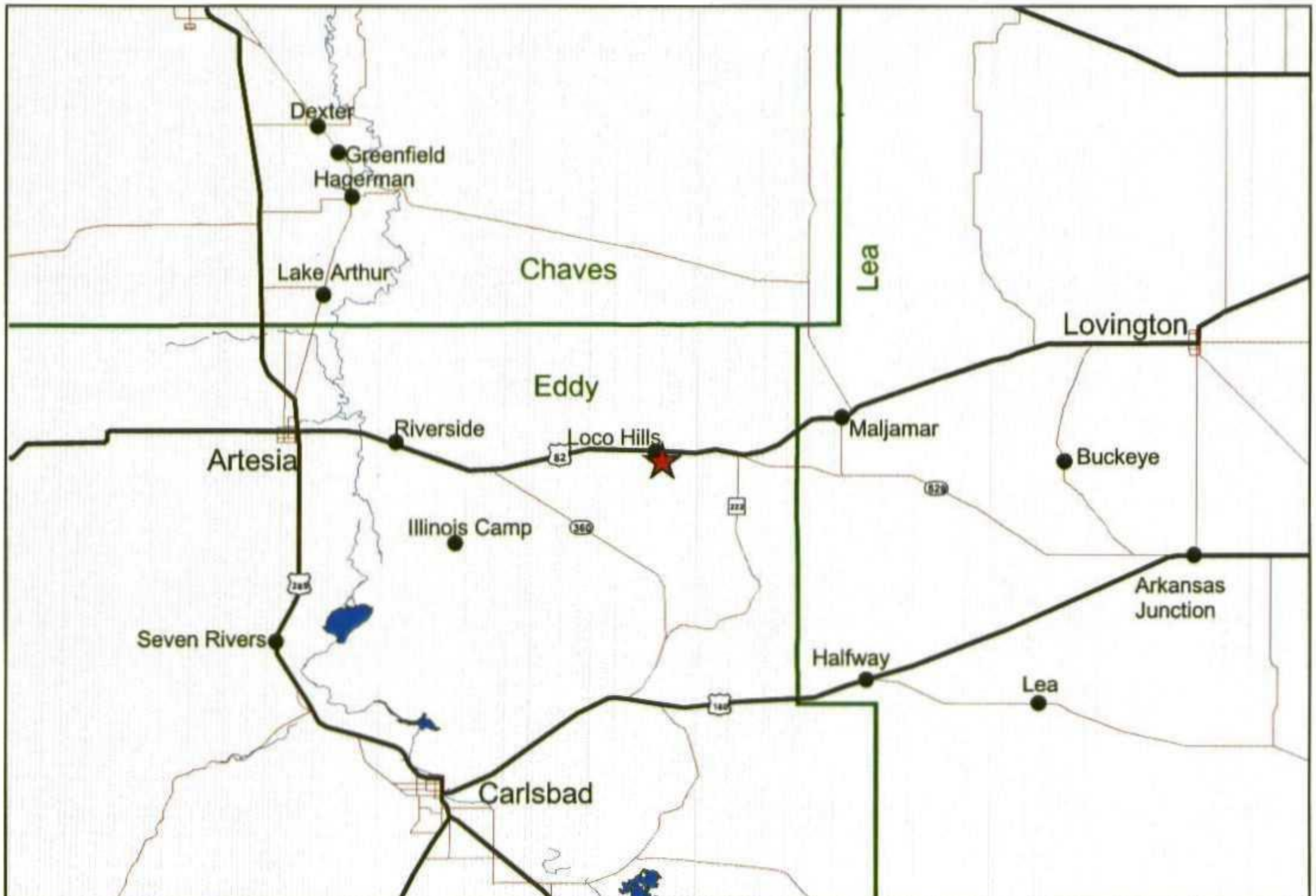

Figure 1: Site Location Map

Date: November 2002

Scale:

10 0 10 20 30 40 50 60 Miles

Legend:

- I&W Site Location
- Town
- River
- Water
- Highway
- Primary Road
- Secondary Road
- Local Road
- County Boundary

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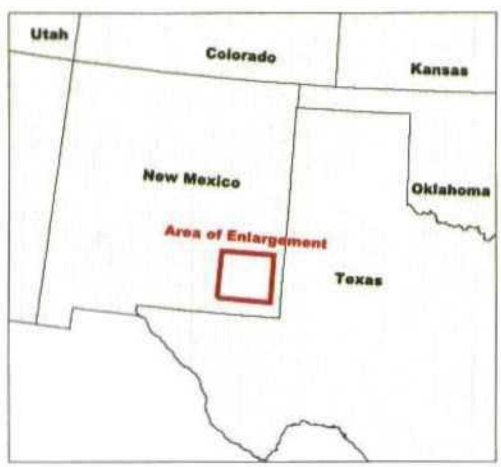
Orientation Map:



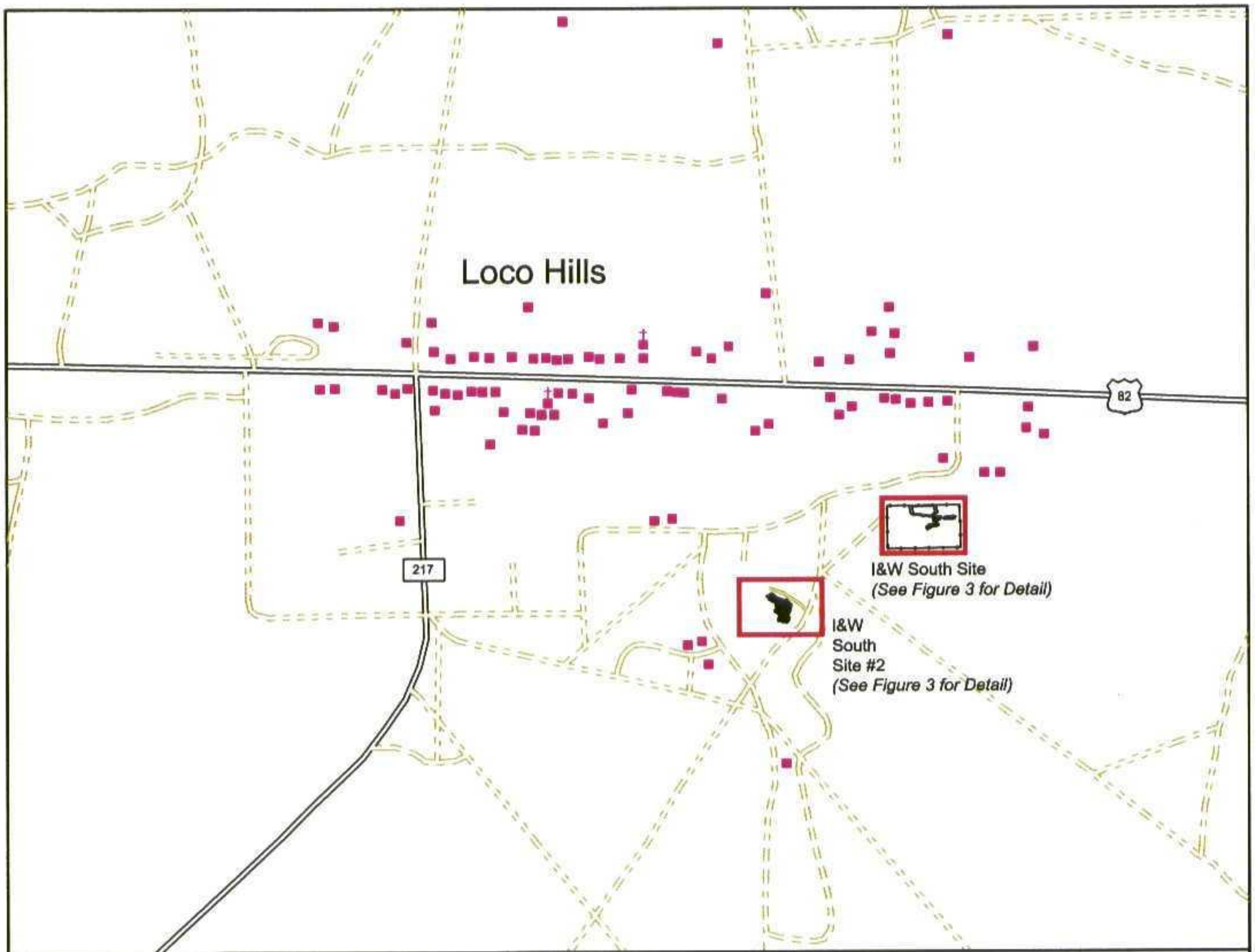


Figure 2: Site Map

Date: November 2002

Scale: 0 1/4 1/2 3/4 1 Mile

Legend:

- Paved Road
- Dirt Road
- Building
- Fence
- I&W Hot Oil Service Sites

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Source: Roads and Structures for this Map were Digitized from the USGS 7.5 Minute Quadrangle Entitled, "Loco Hills, New Mexico, Provisional Edition 1985" Additional Site Data was Collected by GPS on September 2001.

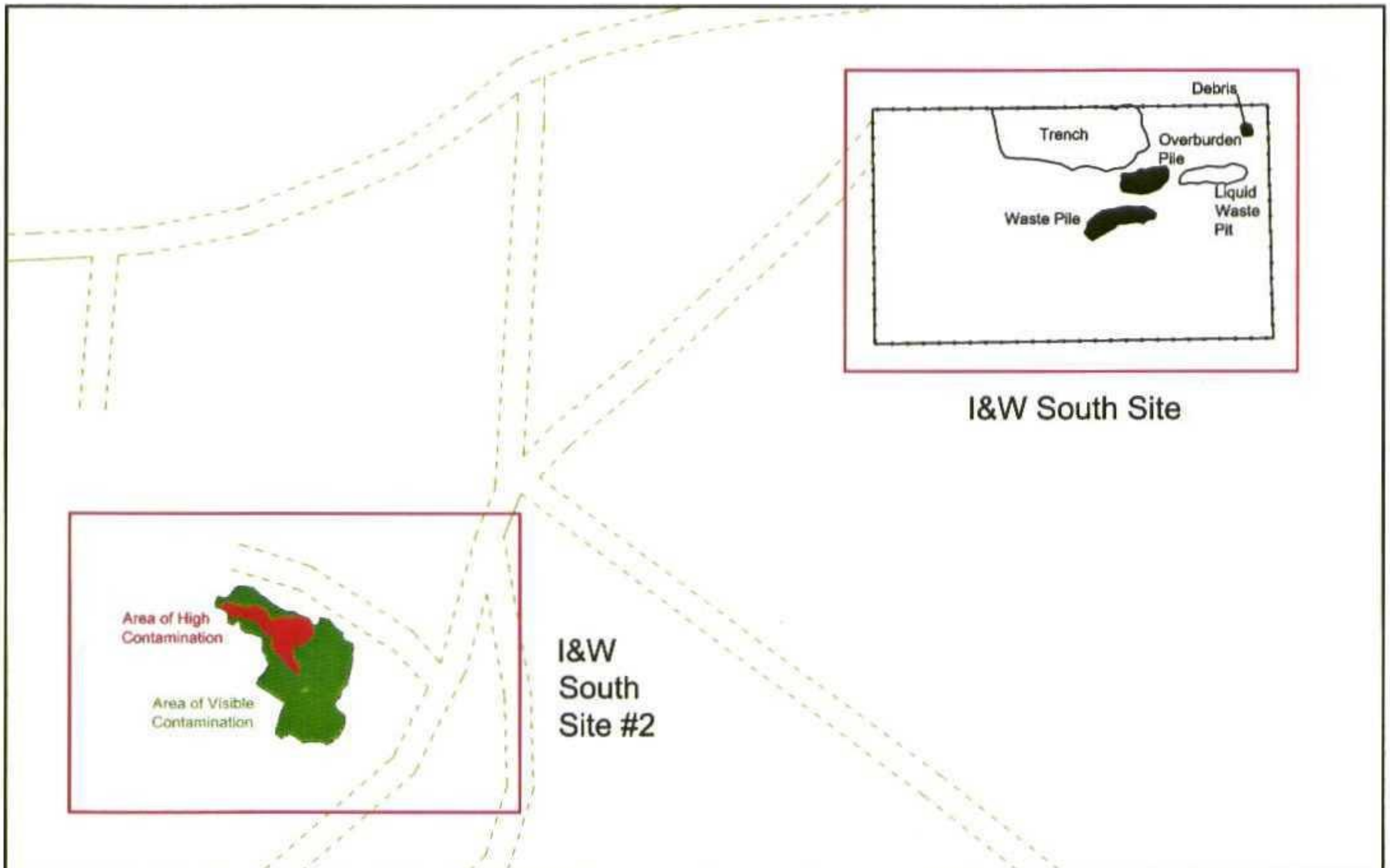

Figure 3: Site Detail Map

Date: November 2002

Scale: 0 100 200 300 400 500 600 700 800 900 1,000 feet

Legend:

- Dirt Road
- Fence
- I&W Hot Oil Service Sites

DYNAMAC CORPORATION Environmental Services

Source: Roads and Structures for this Map were Digitized from the USGS 7.5 Minute Quadrangle Entitled, "Loco Hills, New Mexico, Provisional Edition 1985." Additional Site Data was Collected by GPS on September 2001.

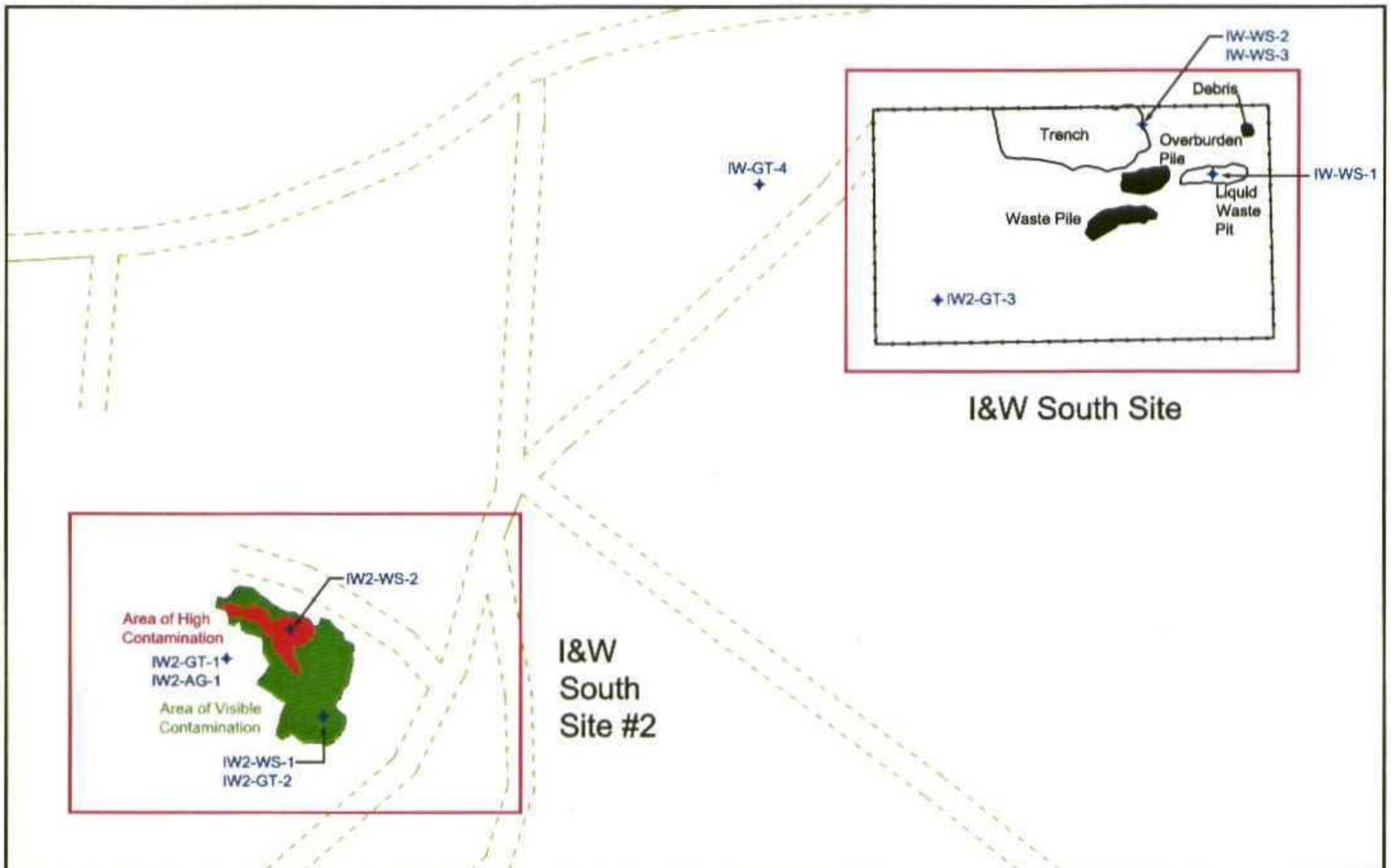

Figure 4: Sample Location Map	Date: November 2002

Scale: 0 100 200 300 400 500 600 700 800 900 1,000 feet

Legend:

- Dirt Road
- Fence
- I&W Hot Oil Service Sites
- IW-GT-4 ✦ Sample Location

DYNAMAC CORPORATION
Environmental Services

Source: Roads and Structures for this Map were Digitized from the USGS 7.5 Minute Quadrangle Entitled, "Loco Hills, New Mexico, Provisional Edition 1985." Additional Site Data was Collected by GPS on September 2001.

TABLES

Table 3-1: Waste Source and Soil Sampling Summary

Sample Number	Sample Type	Location/Rationale	Date	Time
IW-WS-1	Sludge	Sample collected from liquid waste pit (I&W South) to determine concentrations of RCRA metals, PAHs, BTEX compounds, and TPH for COC identification and quantificiation. Hazardous waste determination via TCLP used for evaluating disposal options. The material is believed to be have some of the highest contaminant concentrations onsite.	5/14/2002	1055
IW-WS-2	Waste material/soil	Sample collected from eastern edge of trench (I&W South) to determine the concentrations of BTEX compounds, metals, and TPH in the material exhibiting visible contamination to a lesser degree than the material in the liquid waste pit.	5/14/2002	1130
IW-WS-3	Waste material/soil	Replicate sample of IW-WS-2 collected for QA/QC purposes.	5/14/2002	1130
IW2-WS-1	Waste material/soil	Sample collected from the area of visible contamination at I&W South Site #2 and analyzed to determine concentrations of TPH and metals in the material exhibiting less visible contamination than the sludge at this location.	5/14/2002	0835
IW2-WS-2	Sludge	Collected from the area of high visible contamination at I&W South Site #2. to determine concentrations of RCRA metals, PAHs, BTEX compounds, and TPH for COC identification and quantificiation. Hazardous waste determination via TCLP used for evaluating disposal requirements. This material is believed to be representative of material with some of the highest contaminant concentrations onsite.	5/14/2002	0900
IW2-GT-1	Soil	Sample collected from an area of unimpacted native soil adjacent to I&W South Site #2. Analyzed using a suite of geotechnical tests to determine any limiting factors which may impact alternative development.	5/14/2002	0950
IW2-GT-2	Waste material/soil	Sample collected from the area of visible contamination at I&W South Site #2 and subjected to geotechnical analyses to assess the physical properties of the contaminated material.	5/14/2002	1000
IW-GT-3	Waste material soil	Sample collected from an area of unimpacted native soil within the fenced area at I&W South to evaluate the physical properties of clean onsite soil in the event that it is necessary for use as borrow material.	5/14/2002	1338
IW-GT-4	Soil	Sample collected from an area of unimpacted native soil outside the fenced area at I&W South to evaluate the physical properties of nearby offsite soil in the event that it is necessary for use as borrow material.	5/14/2002	1334
IW2-AG-1	Soil	Sample collected from an area of unimpacted native soil adjacent to I&W South Site #2. Analyzed using a suite of agronomic tests to determine suitability for use in landfarming operations and/or revegetation.	5/14/2002	0950
IW2-AG-2	Waste material/soil	Sample collected from the area of visible contamination at I&W South Site #2, and subjected to agronomic analyses to determine whether or not landfarming activities are possible for treatment of this material.	5/14/2002	1000
IW-AG-3	Soil	Sample collected from an area of unimpacted native soil within the fenced area at I&W South. Analyzed using a suite of agronomic analyses to determine suitability for use in landfarming operations and/or revegetation.	5/14/2002	1339
IW-AG-4	Soil	Sample collected from an area of unimpacted native soil adjacent to I&W South. Analyzed using a suite of agronomic analyses to determine suitability for use in landfarming operations and/or revegetation.	5/14/2002	1330

Table 3-2: Preliminary Assessment Soil Sampling Analytical Results (Inorganics)

Compound	Sample	Concentration (ppm)
Antimony	27 IW-S	ND
	28 IW-S	0.6 J
	29 IW-S	ND
Aresenic	27 IW-S	8
	28 IW-S	5
	29 IW-S	6
Beryllium	27 IW-S	ND
	28 IW-S	ND
	29 IW-S	ND
Cadmium	27 IW-S	ND
	28 IW-S	ND
	29 IW-S	ND
Chromium	27 IW-S	9.4
	28 IW-S	6.2
	29 IW-S	6.4
Copper	27 IW-S	4.6
	28 IW-S	5.3
	29 IW-S	17
Lead	27 IW-S	52
	28 IW-S	23
	29 IW-S	24
Mercury	27 IW-S	0.23 JN
	28 IW-S	0.07 JN
	29 IW-S	0.1 JN
Nickel	27 IW-S	12 E
	28 IW-S	3.6 JE
	29 IW-S	6.2 E
Selenium	27 IW-S	ND
	28 IW-S	ND
	29 IW-S	ND
Silver	27 IW-S	ND
	28 IW-S	ND
	29 IW-S	ND
Thallium	27 IW-S	0.03 J
	28 IW-S	0.09 J
	29 IW-S	0.05 J
Zinc	27 IW-S	45
	28 IW-S	41
	29 IW-S	68

J = Estimate (Cadium and Mercury could be as high as 1.4 times and 1.5 times, respectively, greater than the reported values).

N = Spike recovery problems.

E = Interferences.

ND = Below quantitation limit.

Table 3-3: Preliminary Assessment Soil Sampling Analytical Results (Organics)

Compound	Sample	Concentration (ppm)
Acetone	27 IW-S	TR, B
	28 IW-S	ND
	29 IW-S	ND
Toluene	27 IW-S	0.09 B
	28 IW-S	ND
	29 IW-S	ND
Ethylbenzene	27 IW-S	ND
	28 IW-S	0.05
	29 IW-S	ND
Napthalene	27 IW-S	ND
	28 IW-S	ND
	29 IW-S	ND
2-Methylnapthalene	27 IW-S	ND
	28 IW-S	ND
	29 IW-S	ND
Fluorene	27 IW-S	ND
	28 IW-S	ND
	29 IW-S	ND
Phenanthrene	27 IW-S	7.1
	28 IW-S	ND
	29 IW-S	3.8
Di-N-butylphthalate	27 IW-S	ND
	28 IW-S	ND
	29 IW-S	ND
Chrysene	27 IW-S	ND
	28 IW-S	ND
	29 IW-S	ND

TR = Compound detected in unquantifiable trace amount.
B = Compound found in the laboratory reagent blank.
J = Indicates an estimated value.
ND = Below quantitation limit.

Table 3-4: Focused Site Investigation Background Sampling Analytical Results

Parameter	Location	Sample Result	Detection Limit	Dilution Factor
Solids (%)	4004	99.1	0.10	--
	4005	99.3	0.10	--
	4006	99.4	0.10	--
1,1,2-Trichloroethane (ug/kg)	4004	ND	5.00	--
	4005	ND	5.00	--
	4006	6	5	1
Arsenic, Total (mg/kg)	4004	ND	10	--
	4005	0.99	0.91	1.0
	4006	1.2	0.89	1.0
Bicarbonate (mg/kg)	4004	321	10.0	--
	4005	231	10.0	--
	4006	231	10.0	--
Bis(2-ethylhexyl)phthalate (ug/kg)	4004	ND	3000	--
	4005	ND	3000	--
	4006	50 J	330	1
Calcium, Total (mg/kg)	4004	2320	440	1.0
	4005	1360	444	1.0
	4006	1300	455	1.0
Carbonate (mg/kg)	4004	40.2	10.0	--
	4005	20.1	10.0	--
	4006	20.1	10.0	--
Chemical Oxygen Demand (mg/kg)	4004	296	25.1	1.0
	4005	271	25.1	1.0
	4006	291	25.1	1.0
Chromium, Total (mg/kg)	4004	3.8	0.88	1.0
	4005	4.0	0.89	1.0
	4006	5.7	0.91	1.0
Di-N-butyl phthalate (ug/kg)	4004	130 JB	340	1
	4005	35 JB	340	1
	4006	76 JB	330	1
Lead, Total (mg/kg)	4004	4.2	0.29	1.0
	4005	3.0	0.27	1.0
	4006	3.2	0.27	1.0
Magnesium, Total (mg/kg)	4004	537	440	1.0
	4005	510	444	1.0
	4006	811	455	1.0
Potassium, Total (mg/kg)	4004	655	440	1.0
	4005	744	444	1.0
	4006	1030	455	1.0
Silicon, Total (mg/kg)	4004	560	8.8	1.0
	4005	474	8.9	1.0
	4006	536	9.1	1.0
Total Organic Carbon (mg/kg)	4004	2370	177	1.0
	4005	2080	127	1.0
	4006	2370	118	1.0
Zinc, Total (mg/kg)	4004	11.1	1.8	1.0
	4005	18.8	1.8	1.0
	4006	15.0	1.8	1.0

B = Compound was found in the blank and sample.
J = Result is an estimated value below the reporting limit.
ND = Below quantitation limit.
Sampling Depth Range: 0.5-1.0 ft.

Table 3-5: Focused Site Investigation Soil Sampling Analytical Results

Parameter	Sample ID	Sampling Depth Range (Ft.)	Sample Result	Detection Limit	Dilution Factor
Solids (%)					
	Location 2001				
	0004	3.0-4.0	83.9	0.10	1.0
	0009	8.0-9.0	88.8	0.10	1.0
	0016	15.0-16.0	97.4	0.10	1.0
	Location 2002				
	0004	3.0-4.0	84.9	0.10	1.0
	0009	8.0-9.0	87.6	0.10	1.0
	0016	15.0-16.0	96.7	0.10	1.0
	Location 2003				
	0004	3.0-4.0	92.4	0.10	1.0
	0009	8.0-9.0	96.7	0.10	1.0
	0016	15.0-16.0	95.4	0.10	1.0
	Location 2004				
	0004	3.0-4.0	93.3	0.10	1.0
	0009	8.0-9.0	91.5	0.10	1.0
	0016	15.0-16.0	90.4	0.10	1.0
1,1,2-Trichloroethane (ug/kg)					
	Location 2001				
	0009	8.0-9.0	3 J	6	1
	Location 2004				
	0009	8.0-9.0	3 J	5	1
Acetone (ug/kg)					
	Location 2001				
	0004	3.0-4.0	15 B	12	1
	0009	8.0-9.0	18 B	11	1
	0016	15.0-16.0	10 B	10	1
	Location 2002				
	0004	3.0-4.0	16 B	12	1
	0009	8.0-9.0	13 B	11	1
	0016	15.0-16.0	15 B	10	1
	Location 2003				
	0004	3.0-4.0	36 B	11	1
	0009	8.0-9.0	12 B	10	1
	0016	15.0-16.0	11 B	11	1
	Location 2004				
	0004	3.0-4.0	19 B	11	1
	0009	8.0-9.0	20 B	11	1
	0016	15.0-16.0	22 B	11	1
Aroclor-1254 (ug/kg)					
	Location 2004				
	0004	3.0-4.0	34 JB	86	1.00
	0016	15.0-16.0	38 JB	84	1.00
Arsenic, Total (mg/kg)					
	Location 2001				
	0004	3.0-4.0	1.9	1.2	1.0
	0009	8.0-9.0	1.1	1.1	1.0
	Location 2002				
	0004	3.0-4.0	1.2	1.1	1.0
	0009	8.0-9.0	1.4	1.1	1.0

Table 3-5: Focused Site Investigation Soil Sampling Analytical Results

Parameter	Sample ID	Sampling Depth Range (Ft.)	Sample Result	Detection Limit	Dilution Factor
Arsenic, Total (mg/kg)					
	Location 2003				
	0004	3.0-4.0	1.3	1.1	1.0
	0009	8.0-9.0	1.5	1.0	1.0
	0016	15.0-16.0	1.0	1.0	1.0
	Location 2004				
	0004	3.0-4.0	1.6	1.1	1.0
	0009	8.0-9.0	4.8	1.1	1.0
	0016	15.0-16.0	2.4	1.1	1.0
Bicarbonate (mg/kg)					
	Location 2001				
	0004	3.0-4.0	167	10.0	1.0
	0009	8.0-9.0	135	10.0	1.0
	0016	15.0-16.0	41.1	10.0	1.0
	Location 2002				
	0004	3.0-4.0	94.2	10.0	1.0
	0009	8.0-9.0	91.4	10.0	1.0
	0016	15.0-16.0	62.0	10.0	1.0
	Location 2003				
	0004	3.0-4.0	119	10.0	1.0
	0009	8.0-9.0	114	10.0	1.0
	0016	15.0-16.0	157	10.0	1.0
	Location 2004				
	0004	3.0-4.0	139	10.0	1.0
	0009	8.0-9.0	120	10.0	1.0
	0016	15.0-16.0	133	10.0	1.0
Bis(2-ethylhexyl)phthalate (ug/kg)					
	Location 2001				
	0004	3.0-4.0	89 J	380	1
Calcium, Total (mg/kg)					
	Location 2001				
	0004	3.0-4.0	161000	59600	100
	0009	8.0-9.0	45900	548	1.0
	0016	15.0-16.0	18700	508	1.0
	Location 2002				
	0004	3.0-4.0	2060	576	1.0
	0009	8.0-9.0	1510	568	1.0
	0016	15.0-16.0	42800	504	1.0
	Location 2003				
	0004	3.0-4.0	2430	534	1.0
	0009	8.0-9.0	1440	508	1.0
	0016	15.0-16.0	2010	518	1.0
	Location 2004				
	0004	3.0-4.0	1030	492	1.0
	0009	8.0-9.0	3890	541	1.0
	0016	15.0-16.0	35200	534	1.0

Table 3-5: Focused Site Investigation Soil Sampling Analytical Results

Parameter	Sample ID	Sampling Depth Range (Ft.)	Sample Result	Detection Limit	Dilution Factor
Carbonate (mg/kg)					
	Location 2001				
	0004	3.0-4.0	47.7	10.0	1.0
	0009	8.0-9.0	90.1	10.0	1.0
	0016	15.0-16.0	82.2	10.0	1.0
	Location 2002				
	0004	3.0-4.0	23.6	10.0	1.0
	0009	8.0-9.0	22.8	10.0	1.0
	0016	15.0-16.0	41.4	10.0	1.0
	Location 2003				
	0004	3.0-4.0	64.9	10.0	1.0
	0009	8.0-9.0	82.7	10.0	1.0
	0016	15.0-16.0	83.9	10.0	1.0
	Location 2004				
	0004	3.0-4.0	10.7	10.0	1.0
Chemical Oxygen Demand (mg/kg)					
	Location 2001				
	0004	3.0-4.0	122	29.8	1.0
	0009	8.0-9.0	32.5	28.2	1.0
	0016	15.0-16.0	95.3	25.7	1.0
	Location 2002				
	0004	3.0-4.0	34.0	29.5	1.0
	0016	15.0-16.0	29.8	25.8	1.0
	Location 2003				
	0004	3.0-4.0	31.2	27.0	1.0
	0009	8.0-9.0	55.2	25.8	1.0
	0016	15.0-16.0	102	26.2	1.0
	Location 2004				
	0004	3.0-4.0	110	26.8	1.0
	0009	8.0-9.0	85.3	27.3	1.0
	0016	15.0-16.0	31.9	27.7	1.0
Chromium, Total (mg/kg)					
	Location 2001				
	0004	3.0-4.0	2.4	1.2	1.0
	0009	8.0-9.0	4.1	1.1	1.0
	0016	15.0-16.0	1.5	1.0	1.0
	Location 2002				
	0004	3.0-4.0	2.6	1.2	1.0
	0009	8.0-9.0	4.4	1.1	1.0
	0016	15.0-16.0	1.6	1.0	1.0
	Location 2003				
	0009	8.0-9.0	2.0	1.0	1.0
	0016	15.0-16.0	4.2	1.0	1.0
	Location 2004				
	0004	3.0-4.0	4.8	0.98	1.0
	0009	8.0-9.0	7.4	1.1	1.0
	0016	15.0-16.0	6.3	1.1	1.0

Table 3-5: Focused Site Investigation Soil Sampling Analytical Results

Parameter	Sample ID	Sampling Depth Range (Ft.)	Sample Result	Detection Limit	Dilution Factor
Copper, Total (mg/kg)					
	Location 2001				
	0009	8.0-9.0	3.2	2.7	1.0
	Location 2002				
	0009	8.0-9.0	4.3	2.8	1.0
	0016	15.0-16.0	2.6	2.5	1.0
	Location 2003				
	0016	15.0-16.0	2.9	2.6	1.0
	Location 2004				
	0009	8.0-9.0	3.3	2.7	1.0
	0016	15.0-16.0	7.3	2.7	1.0
Delta-BHC (ug/kg)					
	Location 2001				
	0009	8.0-9.0	0.75 J	4.5	1.00
Di-N-butyl phthalate (ug/kg)					
	Location 2001				
	0004	3.0-4.0	120 JB	380	1
	0009	8.0-9.0	92 JB	360	1
	0016	15.0-16.0	87 JB	340	1
	Location 2002				
	0004	3.0-4.0	150 JB	390	1
	0009	8.0-9.0	100 JB	370	1
	0009	8.0-9.0	110 JB	370	1
	0016	15.0-16.0	92 JB	340	1
	0016	15.0-16.0	120 JB		
	Location 2003				
	0004	3.0-4.0	96 JB	350	1
	0009	8.0-9.0	110 JB	350	1
	0009	8.0-9.0	110 JB	350	1
	0016	15.0-16.0	86 JB	350	1
	Location 2004				
	0004	3.0-4.0	70 JB	350	1
	0009	8.0-9.0	120 JB	350	1
	0016	15.0-16.0	100 JB	350	1
Dichloromethane-methylene chloride (ug/kg)					
	Location 2001				
	0004	3.0-4.0	11 B	6	1
	Location 2002				
	0016	15.0-16.0	4 JB	5	1
	Location 2003				
	0004	3.0-4.0	11 B	5	1
	0009	8.0-9.0	9 B	5	1
	0016	15.0-16.0	9 B	5	1
	Location 2004				
	0009	8.0-9.0	12 B	5	1
	0016	15.0-16.0	17 B	5	1

Table 3-5: Focused Site Investigation Soil Sampling Analytical Results

Parameter	Sample ID	Sampling Depth Range (Ft.)	Sample Result	Detection Limit	Dilution Factor
Lead, Total (mg/kg)					
	Location 2001				
	0004	3.0-4.0	4.4	0.36	1.0
	0009	8.0-9.0	3.8	0.34	1.0
	0016	15.0-16.0	1.5	0.30	1.0
	Location 2002				
	0004	3.0-4.0	2.5	0.33	1.0
	0009	8.0-9.0	3.6	0.33	1.0
	0016	15.0-16.0	2.1	0.30	1.0
	Location 2003				
	0004	3.0-4.0	2.5	0.32	1.0
	0009	8.0-9.0	1.9	0.31	1.0
	0016	15.0-16.0	4.0	0.30	1.0
	Location 2004				
	0004	3.0-4.0	3.8	0.32	1.0
	0009	8.0-9.0	6.7	0.32	1.0
	0016	15.0-16.0	4.7	0.33	1.0
Magnesium, Total (mg/kg)					
	Location 2001				
	0004	3.0-4.0	2680	596	1.0
	0009	8.0-9.0	2810	548	1.0
	0016	15.0-16.0	520	508	1.0
	Location 2002				
	0004	3.0-4.0	3640	576	1.0
	0009	8.0-9.0	3500	568	1.0
	0016	15.0-16.0	871	504	1.0
	Location 2003				
	0004	3.0-4.0	3080	534	1.0
	0009	8.0-9.0	2320	508	1.0
	0016	15.0-16.0	1540	518	1.0
	Location 2004				
	0004	3.0-4.0	608	492	1.0
	0009	8.0-9.0	1390	541	1.0
	0016	15.0-16.0	1800	534	1.0
Potassium, Total (mg/kg)					
	Location 2001				
	0009	8.0-9.0	578	548	1.0
	Location 2002				
	0009	8.0-9.0	732	568	1.0
	Location 2003				
	0016	15.0-16.0	838	518	1.0
	Location 2004				
	0004	3.0-4.0	672	492	1.0
	0009	8.0-9.0	1040	541	1.0
	0016	15.0-16.0	1220	534	1.0

Table 3-5: Focused Site Investigation Soil Sampling Analytical Results

Parameter	Sample ID	Sampling Depth Range (Ft.)	Sample Result	Detection Limit	Dilution Factor
Silicon, Total (mg/kg)					
	Location 2001				
	0004	3.0-4.0	289	11.9	1.0
	0009	8.0-9.0	274	10.9	1.0
	0016	15.0-16.0	149	10.1	1.0
	Location 2002				
	0004	3.0-4.0	401	11.5	1.0
	0009	8.0-9.0	407	11.4	1.0
	0016	15.0-16.0	196	10.1	1.0
	Location 2003				
	0004	3.0-4.0	335	10.7	1.0
	0009	8.0-9.0	306	10.2	1.0
	0016	15.0-16.0	292	10.4	1.0
	Location 2004				
	0004	3.0-4.0	290	9.8	1.0
	0009	8.0-9.0	331	10.8	1.0
	0016	15.0-16.0	390	10.7	1.0
Sodium, Total (mg/kg)					
	Location 2001				
	0004	3.0-4.0	637	596	1.0
	0009	8.0-9.0	597	548	1.0
	Location 2004				
	0004	3.0-4.0	887	492	1.0
Total Organic Carbon (mg/kg)					
	Location 2001				
	0004	3.0-4.0	10400	571	1.0
	0009	8.0-9.0	2170	328	1.0
	0016	15.0-16.0	3160	270	1.0
	Location 2002				
	0004	3.0-4.0	28700	909	1.0
	0009	8.0-9.0	10800	645	1.0
	0016	15.0-16.0	5820	400	1.0
	Location 2003				
	0004	3.0-4.0	22000	909	1.0
	0009	8.0-9.0	7910	455	1.0
	0016	15.0-16.0	98.3	75.2	1.0
	Location 2004				
	0004	3.0-4.0	812	60.4	1.0
	0009	8.0-9.0	311	66.4	1.0
	0016	15.0-16.0	928	70.9	1.0

Table 3-5: Focused Site Investigation Soil Sampling Analytical Results

Parameter	Sample ID	Sampling Depth Range (Ft.)	Sample Result	Detection Limit	Dilution Factor
Zinc, Total (mg/kg)					
	Location 2001				
	0004	3.0-4.0	8.1	2.4	1.0
	0009	8.0-9.0	12.4	2.2	1.0
	0016	15.0-16.0	5.0	2.0	1.0
	Location 2002				
	0004	3.0-4.0	7.6	2.3	1.0
	0009	8.0-9.0	12.3	2.3	1.0
	0016	15.0-16.0	5.4	2.0	1.0
	Location 2003				
	0004	3.0-4.0	4.7	2.1	1.0
	0009	8.0-9.0	6.2	2.0	1.0
	0016	15.0-16.0	16.8	2.1	1.0
	Location 2004				
	0004	3.0-4.0	10.4	2.0	1.0
	0009	8.0-9.0	11.7	2.2	1.0
	0016	15.0-16.0	12.8	2.1	1.0

B = Compund was found in the blank and sample.
J = Result is an estimated value below the reporting limit.

Table 3-6: EE/CA Soil and Waste Source Sampling Analytical Results (Inorganics)

Compound	BLM HRMC	NMED SSL	IW-WS-1	IW-WS-2	IW-WS-3	IW2-WS-1	IW2-WS-2
Arsenic	20	17	**35.6**	5.0	4.9	7.3	**275**
Barium	NE	15000	421	111	116	41.6	30.3
Cadmium	70	190	<0.65	<0.50	<0.50	<0.50	<0.73
Chromium	NE	100000 (a)	34	8.6	9.1	5.9	48.5
Lead	1000	1000	146	13.6	16.3	5.5	124
Mercury	40	69	0.72	<0.065	<0.066	<0.063	<0.097
Selenium	700	1200	0.99	<0.50	<0.50	<0.50	1.6
Silver	700	1200	<1.3	<1.0	<1.0	<0.99	<1.5

HRMC = Human Risk Management Criteria (Camper).
NMED SSL = New Mexico Environment Department Soil Screening Levels (Industrial/Occupational Worker).
NE = Not Established.
(a) Value reported is for Chromium III.
All values in mg/kg (ppm).
Bold indicates value in excess of risk based or regulatory criteria.

Table 3-7: EE/CA Soil and Waste Source Sampling Analytical Results (Purgeable Organics and TPH)

Compound	NMOCD RAL	NMED SSL	IW-WS-1	IW-WS-2	IW-WS-3	IW2-WS-1	IW2-WS-2
Benzene	10	5.6	**8.16**	<0.66	<0.66	NT	**70.6**
Toluene	NNS	180	<0.66	<0.66	<0.66	NT	190
Ethylbenzene	NNS	68	13.7	<0.66	<0.66	NT	**107**
Xylenes (total)	NNS	63	9.16	<0.66	<0.66	NT	**248**
BTEX (total)	50	NNS	31.68	<2.64	<2.64	NT	**615.6**
TPH (C10-C40)	5000	NNS	**104000**	**15500**	**15200**	2300	**458000**

NMOCD RAL = New Mexico Oil Conservation Division Remediation Action Level.
NMED SSL = New Mexico Environment Department Soil Screening Levels (Industrial/Occupational Worker).
NNS = No numeric standard.
NT = Not tested.
All values in mg/kg (ppm).
Bold indicates value in excess of regulatory threshold.

Table 3-8: EE/CA Soil and Waste Source Sampling Analytical Results (Polynuclear Aromatic Hydrocarbons)

Compound	NMED SSL	IW-WS-1	IW-WS-2	IW-WS-3	IW2-WS-1	IW2-WS-2
Acenaphthene	4900	<86	NT	NT	NT	<190
Acenaphthylene	NNS	<86	NT	NT	NT	<190
Anthracene	34000	<43	NT	NT	NT	<96
Benzo(a)anthracene	26	≤43	NT	NT	NT	≤96
Benzo(a)pyrene	2.6	≤8.6	NT	NT	NT	≤19
Benzo(b)fluoranthene	26	<8.6	NT	NT	NT	<19
Benzo(g,h,i)perylene	NNS	<8.6	NT	NT	NT	<19
Benzo(k)fluoranthene	260	<8.6	NT	NT	NT	<19
Chrysene	2500	<43	NT	NT	NT	<96
Dibenzo(a,h)anthracene	2.6	≤8.6	NT	NT	NT	≤19
Fluoranthene	5300	<43	NT	NT	NT	<96
Fluorene	4000	<43	NT	NT	NT	<96
Indeno(1,2,3-c,d)pyrene	26	<8.6	NT	NT	NT	<19
Naphthalene	43	<43	NT	NT	NT	**118**
1-Methylnaphthalene	NNS	225	NT	NT	NT	368
2-Methylnaphthalene	NNS	<43	NT	NT	NT	303
Phenanthrene	4400	<43	NT	NT	NT	<96
Pyrene	4300	<43	NT	NT	NT	<96

NMED SSL = New Mexico Environment Department Soil Screening Levels (Industrial/Occupational Worker).
NNS = No Numeric Standard.
NT = Not tested.
All values in mg/kg (ppm).
Bold indicates value in excess of regulatory criteria.

Table 3-9: EE/CA Soil and Waste Source Sampling Analytical Results (TCLP)

Compound	EPA TC	IW-WS-1	IW-WS-2	IW-WS-3	IW2-WS-1	IW2-WS-2
Benzene	0.5	0.194	NT	NT	NT	**3.59**
Chlorobenzene	100	<0.10	NT	NT	NT	<0.10
Chloroform	6.0	<0.10	NT	NT	NT	<0.10
Carbon Tetrachloride	0.5	<0.10	NT	NT	NT	<0.10
1,1-Dichloroethylene	0.7	<0.10	NT	NT	NT	<0.10
1,2-Dichloroethane	0.5	<0.10	NT	NT	NT	<0.10
Methyl Ethyl Ketone	200	<0.20	NT	NT	NT	<0.20
Tetrachloroethylene	0.7	<0.10	NT	NT	NT	<0.10
Trichloroethylene	0.5	<0.10	NT	NT	NT	<0.10
Vinyl Chloride	0.2	<0.10	NT	NT	NT	<0.10
2-Methylphenol	200	<0.05	NT	NT	NT	<0.05
3&4-Methylphenol	200	<0.05	NT	NT	NT	<0.05
Pentachlorophenol	100	<0.25	NT	NT	NT	<0.25
2,4,5-Trichlorophenol	400	<0.05	NT	NT	NT	<0.05
2,4,6-Trichlorophenol	2.0	<0.05	NT	NT	NT	<0.05
1,4-Dichlorobenzene	7.5	<0.05	NT	NT	NT	<0.05
2,4-Dinitrotoluene	0.13	<0.05	NT	NT	NT	<0.05
Hexachlorobenzene	0.13	<0.05	NT	NT	NT	<0.05
Hexachlorobutadiene	0.5	<0.05	NT	NT	NT	<0.05
Hexachloroethane	3.0	<0.05	NT	NT	NT	<0.05
Nitrobenzene	2.0	<0.05	NT	NT	NT	<0.05
Pyridine	5.0	<0.05	NT	NT	NT	<0.05
Arsenic	5.0	<0.10	NT	NT	NT	0.3
Barium	100	0.73	NT	NT	NT	0.36
Cadmium	1.0	<0.04	NT	NT	NT	<0.04
Chromium	5.0	<0.10	NT	NT	NT	<0.10
Lead	5.0	<0.10	NT	NT	NT	<0.10
Mercury	0.2	<0.0020	NT	NT	NT	<0.0020
Selenium	1.0	<0.10	NT	NT	NT	<0.10
Silver	5	<0.050	NT	NT	NT	<0.050

EPA TC = EPA Toxicity Characteristic Regulatory Level (40 CFR 261.24) for hazardous waste determination.
NT = Not tested.
All values in mg/l (ppm).
Bold indicates value in excess of regulatory threshold.

Table 3-10: EE/CA Soil and Waste Source Geotechnical Sampling Results

Parameter	IW-GT-3	IW-GT-4	IW2-GT-1	IW2-GT-2
Moisture Content	0.9%	1.4%	1.5%	1.6%
Liquid Limit	N/A	N/A	N/A	N/A
Plastic Limit	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic
Plasticity Index	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic
% Passing #200 Sieve	12.9%	17.7%	19%	19.3%
Soil Classification	SM	SM	SM	SM

N/A = Not applicable.
SM = Silty sand (>12% passes #200 sieve).

Table 3-11: EE/CA Soil and Waste Source Agronomic Sampling Results

Parameter	IW-AG-3	IW-AG-4	IW2-AG-1	IW2-AG-2
pH	8.0	8.0	7.9	7.6
Electrical Conductance (mmhos/cm)	0.3	0.3	0.4	1.1
Calcium (meq/l)	2.9	3.1	3.1	10.8
Magnesium (meq/l)	0.2	0.3	0.4	1.3
Sodium (meq/l)	0.4	0.5	0.5	2.1
Potassium (meq/l)	0.2	0.2	0.2	0.3
Sodium Adsorption Ratio	0.3	0.4	0.4	0.8
Alkalinity (mg/l)	121	130	98	152
% Organic Matter	0.5%	0.5%	0.4%	2.0%
% Total Nitrogen	0.004	0.009	0.002	0.022

mmhos/cm = Millimhos per centimeter.
meq/l = Milliequivalents per liter.

Table 3-12: Estimated Waste Unit Volumes

Waste Unit	**Surface Area (YD^2)**	**Average Depth (YD)**	**Volume (YD^3)**
Waste Pile (I&W South Site)	201	1.33	268.6
Trench Area (I&W South Site)	150	1.00	150.0
Liquid Waste Pit (I&W South Site)	37	0.97	35.6
		I&W South Site Total	**454.3**
Area of Visible Contamination (I&W South Site #2)	1867	0.10	186.7
Area of High Visible Contamination (I&W South Site #2)	40	1.25	50.0
		I&W South Site #2 Total	**236.7**
		Total Volume	**691.0**

YD = Yards.

YD^2 = Square yards.

YD^3 = Cubic yards.

Table 4-1: Human Health Risk Screening For Soil, I&W South Site

Constituent	Constituent Frequency and Range of Detects		EPA Screening Levels[1] (mg/kg) (Industrial Outdoor Worker with Dermal Exposure)	BLM Risk Criteria[2] (mg/kg) (Camper)	NMED[3] (mg/kg) (Industrial / Occupational Worker)	Exceed Screening Criteria?
	Number of Detects/Number of Samples	Range of Positive Detects (mg/kg)				
Metals Analysis						
Arsenic	2/2	4.9 - 5.0	2.0×10^2 (a)	20	17	No
Barium	22	111 - 116	8.3×10^4	NNS	15000	No
Cadmium	2/2	<0.50	6.3×10^2	70	190	No
Chromium	2/2	8.6 - 9.1	NNS	NNS	100000 (b)	No
Lead	22	13.6 - 16.3	1.4×10^3	NNS	1000	No
Mercury	2/2	<0.065 - <0.066	3.8×10^2	40	69	No
Selenium	2/2	<0.50	6.4×10^3	700	1200	No
Silver	2/2	<1.0	6.4×10^3	700	1200	No
Purgeable Aromatics						
Benzene	0/2	ND	1.8	NNS	5.6	No
Toluene	0/2	ND	5.2×10^2	NNS	180	No
Ethylbenzene	0/2	ND	2.3×10^2	NNS	68	Yes
Xylenes (Total)	0/2	ND	2.1×10^2	NNS	63	Yes
Other Organic Constituents						
TPH (C10 - C40)	2/2	15,200 - 15,500	NNS	NNS	NNS	NA

[1] Values from *EPA Region 6 - Human Health medium-Specific Screening Levels*, February 5, 2002.
[2] Values from *Risk Management Criteria for Metals at BLM Mining Sites*, U.S. Department of the Interior, Bureau of Land Management, December 1996.
[3] Values are soil screening levels from *New Mexico Environment Department, Hazardous Waste Bureau and Ground Water Quality Bureau, Voluntary Remediation Program, Technical Background Document for Development of Soil Screening Levels*, December 18, 2000.
(a) Cancer endpoint.
(b) Value reported is for Chromium III.
ND = Not detected.
NA = Not applicable.
NNS = No numeric standard.

Table 4-2: Human Health Risk Screening For Sludge, I&W South Site

Constituent	Constituent Frequency and Range of Detects		EPA Screening Levels[1] (mg/kg) (Industrial Outdoor Worker with Dermal Exposure)	BLM Risk Criteria [2] (mg/kg) (Camper)	NMED[3] (mg/kg) (Industrial / Occupational Worker)	Other Risk Criteria	Exceed Screening Criteria?
	Number of Detects/Number of Samples	Range of Positive Detects					
Metals Analysis							
Arsenic	1/1	35.6 mg/kg	2.0 (a)	20	17	NNS	Yes
Barium	1/1	421 mg/kg	8.3×10^4	NNS	15000	NNS	No
Cadmium	1/1	<0.65 mg/kg	6.3×10^2	70	190	NNS	No
Chromium	1/1	34.0 mg/kg	NNS	NNS	100000(b)	NNS	No
Lead	1/1	146 mg/kg	1.4×10^3	1,000	1000	NNS	No
Mercury	1/1	0.72 mg/kg	3.8×10^2	40	69	NNS	No
Selenium	1/1	0.99 mg/kg	6.4×10^3	700	1200	NNS	No
Silver	1/1	<1.3 mg/kg	6.4×10^3	700	1200	NNS	No
Purgeable Aromatics							
Benzene	1/1	8,160 µg/kg	1.8	NNS	5.6	NNS	No
Toluene	1/1	ND	5.2×10^2	NNS	180	NNS	No
Ethylbenzene	1/1	13,700 µg/kg	2.3×10^2	NNS	68	NNS	No
Xylenes (Total)	1/1	9,160 µg/kg	2.1×10^2	NNS	63	NNS	No
TPH (C10 - C40)	1/1	104,000 mg/kg	NNS	NNS	NNS	NNS	NA

Table 4-2: Human Health Risk Screening For Sludge, I&W South Site (Continued)

Constituent	Constituent Frequency and Range of Detects		EPA Screening Levels[1] (mg/kg) (Industrial Outdoor Worker with Dermal Exposure)	BLM Risk Criteria[2] (mg/kg) (Camper)	NMED[3] (mg/kg) (Industrial / Occupational Worker)	Other Risk Criteria	Exceed Screening Criteria?
	Number of Detects/Number of Samples	Range of Positive Detects					
Polynuclear Aromatic Hydrocarbons							
Acenaphthene	1/1	ND	NNS	NNS	4900	NNS	NA
Acenaphthylene	1/1	ND	NNS	NNS	NNS	NNS	NA
Anthracene	1/1	ND	NNS	NNS	34000	NNS	NA
Benzo(a)anthracene	1/1	ND	NNS	NNS	26	NNS	NA
Benzo(a)pyrene	1/1	ND	NNS	NNS	2.6	0.1 mg/kg (c)	NA
Benzo(b)fluoranthene	1/1	ND	NNS	NNS	260	NNS	NA
Benzo(g,h,i)perylene	1/1	ND	NNS	NNS	NNS	NNS	NA
Benzo(k)fluoranthene	1/1	ND	NNS	NNS	260	NNS	NA
Chrysene	1/1	ND	NNS	NNS	2500	NNS	NA
Dibenzo(a,h)anthracene	1/1	ND	NNS	NNS	2.6	NNS	NA
Fluoranthene	1/1	ND	NNS	NNS	5300	0.1 mg/kg (c)	NA
Fluorene	1/1	ND	NNS	NNS	4000	NNS	NA
Indeno(1,2,3-c,d)pyrene	1/1	ND	NNS	NNS	26	NNS	NA
Naphthalene	1/1	ND	NNS	NNS	43	0.1 mg/kg (c)	NA
1-Methylnaphthalene	1/1	22,500 μg/kg	NNS	NNS	NNS	NNS	NA

Table 4-2: Human Health Risk Screening For Sludge, I&W South Site (Continued)

Constituent	Constituent Frequency and Range of Detects		EPA Screening Levels[1] (mg/kg) (Industrial Outdoor Worker with Dermal Exposure)	BLM Risk Criteria [2] (mg/kg) (Camper)	NMED[3] (mg/kg) (Industrial / Occupational Worker)	Other Risk Criteria	Exceed Screening Criteria?
	Number of Detects/Number of Samples	Range of Positive Detects					
2-Methylnaphthalene	1/1	ND	NNS	NNS	NNS	NNS	NA
Phenanthrene	1/1	ND	NNS	NNS	4400	0.1 mg/kg (c)	NA
Pyrene	1/1	ND	NNS	NNS	4300	0.1 mg/kg (c)	NA

[1] *EPA Region 6 - Human Health medium-Specific Screening Levels*, February 5, 2002.
[2] *Risk Management Criteria for Metals at BLM Mining Sites*, U.S. Department of the Interior, Bureau of Land Management, December 1996.
[3] Values are soil screening levels from *New Mexico Environment Department, Hazardous Waste Bureau and Ground Water Quality Bureau, Voluntary Remediation Program, Technical Background Document for Development of Soil Screening Levels*, December 18, 2000.
(a) = Cancer endpoint.
(b) = Value reported is for Chromium III.
(c) = Background concentrations in soil or detection limit (Beyer, 1990).
ND = Not detected.
NA = Not applicable.
NNS = No numeric standard.

Table 4-3: Ecological Risk Screening For Soil, I&W South Site

Constituent	Constituent Frequency and Range of Detects		BLM Risk Criteria, Soils[1] (mg/kg)				Other Risk Criteria (mg/kg)	Exceed Screening Criteria?
	Number of Detects/Number of Samples	Range of Positive Detects (mg/kg)	Deer Mouse	Cottontail	Mule Deer	Cattle		
Metals Analysis								
Arsenic	2/2	4.9 - 5.0	52.0	122.0	82.0	193.0	10 (a)	No
Barium	22	111 - 116	NNS	NNS	NNS	NNS	165 (b)	No
Cadmium	2/2	<0.50	1.0	0.3	0.2	1.0	1.6 (b)	BLM Risk Criteria Only (Cottontail & Mule Deer).
Chromium	2/2	8.6 - 9.1	NNS	NNS	NNS	NNS	32 (c)	No
Lead	22	13.6 - 16.3	132.0	97.0	44.0	138.0	50 (c)	No
Mercury	2/2	<0.065 - <0.066	0.4	1.1	0.6	3.5	0.3 (d)	No
Selenium	2/2	<0.50	NNS	NNS	NNS	NNS	0.81 (b)	No
Silver	2/2	<1.0	NNS	NNS	NNS	NNS	2 (a)	No
Purgeable Aromatics								
Benzene	0/2	ND	NNS	NNS	NNS	NNS	0.05 (d)	No
Toluene	0/2	ND	NNS	NNS	NNS	NNS	0.05 (d)	No
Ethylbenzene	0/2	ND	NNS	NNS	NNS	NNS	0.7 (e)	No
Xylenes (Total)	0/2	ND	NNS	NNS	NNS	NNS	0.05 (f)	No
TPH (C10 - C40)	2/2	15,200 - 15,500	NNS	NNS	NNS	NNS	NNS	NA

Table 4-3: Ecological Risk Screening For Soil, I&W South Site (Continued)

[1] *Risk Management Criteria for Metals at BLM Mining Sites,* U.S. Department of the Interior, Bureau of Land Management, December 1996.
(a) Efroymson et al, 1997a.
(b) Crommentuijn et al, 1997.
(c) Efroymson et al, 1997b.
(d) MHSPE, 1994.
(e) CCME, 1998.
(f) Background concentrations in soil or detection limits, U.S. Fish and Wildlife Service.
ND = Not detected.
NA = Not applicable.
NNS = No Numeric Standard.

Table 4-4: Ecological Risk Screening For Sludge, I&W South Site

Constituent	Constituent Frequency and Range of Detects		BLM Risk Criteria[1] (mg/kg)				Other Risk Criteria (mg/kg)	Exceed Screening Criteria?
	Number of Detects/Number of Samples	Range of Positive Detects	Deer Mouse	Cottontail	Mule Deer	Cattle		
Metals Analysis								
Arsenic	1/1	35.6 mg/kg	52.0	122 0	82.0	193.0	10 (a)	Yes, Other Risk Criteria.
Barium	1/1	421 mg/kg	NNS	NNS	NNS	NNS	165 (b)	Yes, Other Risk Criteria.
Cadmium	1/1	<0.65 mg/kg	1.0	0.3	0.2	1.0	1.6 (b)	BLM Risk Criteria Only (Cottontail & Mule Deer).
Chromium	1/1	34.0 mg/kg	NNS	NNS	NNS	NNS	32 (c)	Yes, Other Risk Criteria.
Lead	1/1	146 mg/kg	132.0	97.0	44.0	138.0	50 (c)	Yes, BLM Risk Criteria and Other Risk Criteria.
Mercury	1/1	0.72 mg/kg	0.4	1.1	0.6	3.5	0.3 (d)	Yes, BLM Risk Criteria (Deer Mouse, Mule Deer) and Other Risk Criteria.
Selenium	1/1	0.99 mg/kg	NNS	NNS	NNS	NNS	0.81 (b)	No
Silver	1/1	<1.3 mg/kg	NNS	NNS	NNS	NNS	2 (a)	No

Table 4-4: Ecological Risk Screening For Sludge, I&W South Site (Continued)

Constituent	Constituent Frequency and Range of Detects		BLM Risk Criteria[1] (mg/kg)				Other Risk Criteria (mg/kg)	Exceed Screening Criteria?
	Number of Detects/Number of Samples	Range of Positive Detects	Deer Mouse	Cottontail	Mule Deer	Cattle		
Purgeable Aromatics								
Benzene	1/1	8,160 μg/kg	NNS	NNS	NNS	NNS	0.05 (d)	No
Toluene	1/1	ND	NNS	NNS	NNS	NNS	0.05 (d)	No
Ethylbenzene	1/1	13,700 μg/kg	NNS	NNS	NNS	NNS	0.7 (e)	No
Xylenes (Total)	1/1	9,160 μg/kg	NNS	NNS	NNS	NNS	0.05 (f)	No
TPH (C10 - C40)	1/1	104,000	NNS	NNS	NNS	NNS		NA
Polynuclear Aromatic Hydrocarbons								
Acenaphthene	1/1	ND	NNS	NNS	NNS	NNS	20 (a)	No
Acenaphthylene	1/1	ND	NNS	NNS	NNS	NNS	NNS	NA
Anthracene	1/1	ND	NNS	NNS	NNS	NNS	0.1 (f)	No
Benzo(a)anthracene	1/1	ND	NNS	NNS	NNS	NNS	NNS	NA
Benzo(a)pyrene	1/1	ND	NNS	NNS	NNS	NNS	0.1 (f)	No
Benzo(b)fluoranthene	1/1	ND	NNS	NNS	NNS	NNS	NNS	NA
Benzo(g,h,i)perylene	1/1	ND	NNS	NNS	NNS	NNS	NNS	NA
Benzo(k)fluoranthene	1/1	ND	NNS	NNS	NNS	NNS	NNS	NA
Chrysene	1/1	ND	NNS	NNS	NNS	NNS	NNS	NA

Table 4-4: Ecological Risk Screening For Sludge, I&W South Site (Continued)

Constituent	Constituent Frequency and Range of Detects		BLM Risk Criteria[1] (mg/kg)				Other Risk Criteria (mg/kg)	Exceed Screening Criteria?
	Number of Detects/Number of Samples	Range of Positive Detects	Deer Mouse	Cottontail	Mule Deer	Cattle		
Dibenzo(a,h)anthracene	1/1	ND	NNS	NNS	NNS	NNS	NNS	NA
Fluoranthene	1/1	ND	NNS	NNS	NNS	NNS	0.1 (f)	No
Fluorene	1/1	ND	NNS	NNS	NNS	NNS	NNS	NA
Indeno(1,2,3-cd)pyrene	1/1	ND	NNS	NNS	NNS	NNS	NNS	NA
Naphthalene	1/1	ND	NNS	NNS	NNS	NNS	0.1 (f)	No
1-Methylnaphthalene	1/1	22,500 µg/kg	NNS	NNS	NNS	NNS	NNS	NA
2-Methylnaphthalene	1/1	ND	NNS	NNS	NNS	NNS	NNS	NA
Phenanthrene	1/1	ND	NNS	NNS	NNS	NNS	0.1 (f)	No
Pyrene	1/1	ND	NNS	NNS	NNS	NNS	0.1 (f)	No

[1] *Risk Management Criteria for Metals at BLM Mining Sites*, U.S. Department of the Interior, Bureau of Land Management, December 1996.
(a) Efroymson et al, 1997a.
(b) Crommentuijn et al, 1997.
(c) Efroymson et al, 1997b.
(d) MHSPE, 1994.
(e) CCME, 1998.
(f) Background concentrations in soil or detection limits, U.S. Fish and Wildlife Service.
ND = Not detected.
NA = Not applicable.
NNS = No numeric standard.

Table 4-5: Human Health Risk Screening For Soil, I&W South Site #2

Constituent	Constituent Frequency and Range of Detects		EPA Screening Levels[1] (mg/kg) (Industrial Outdoor Worker with Dermal Exposure)	BLM Risk Criteria [2] (mg/kg) (Camper)	NMED[3] (mg/kg) (Industrial / Occupational Worker)	Exceed Screening Criteria?
	Number of Detects/Number of Samples	Range of Positive Detects (mg/kg)				
Metals Analysis						
Arsenic	1/1	7.3	2.0 (a)	20	17	Yes, EPA criteria.
Barium	1/1	41.6	8.3×10^4	NNS	15000	No
Cadmium	1/1	<0.50	6.3×10^2	70	190	No
Chromium	1/1	5.9	NNS	NNS	100000 (b)	No
Lead	1/1	5.5	1.4×10^3	1,000	1000	No
Mercury	1/1	<0.063	3.8×10^2	40	69	No
Selenium	1/1	<0.50	6.4×10^3	700	1200	No
Silver	1/1	<0.99	6.4×10^3	700	1200	No
TPH (C10 - C40)	1/1	2,300	NNS	NNS	NNS	NA

[1] *EPA Region 6 - Human Health medium-Specific Screening Levels*, February 5, 2002.
[2] *Risk Management Criteria for Metals at BLM Mining Sites*, U.S. Department of the Interior, Bureau of Land Management, December 1996.
[3] Values are soil screening levels from *New Mexico Environment Department, Hazardous Waste Bureau and Ground Water Quality Bureau, Voluntary Remediation Program, Technical Background Document for Development of Soil Screening Levels*, December 18, 2000.
(a) = Cancer endpoint.
(b) = Value reported is for Chromium III.
ND = Not detected.
NA = Not applicable.
NNS = No numeric standard.

Table 4-6: Human Health Risk Screening For Sludge, I&W South Site #2

Constituent	Constituent Frequency and Range of Detects		EPA Screening Levels[1] (mg/kg) (Industrial Outdoor Worker with Dermal Exposure)	BLM Risk Criteria [2] (mg/kg) (Camper)	NMED[3] (mg/kg) (Industrial / Occupational Worker)	Other Risk Criteria	Exceed Screening Criteria?
	Number of Detects/Number of Samples	Range of Positive Detects					
Metals Analysis							
Arsenic	1/1	275 mg/kg	2.0 (a)	20	17	NNS	Yes, EPA, BLM, and NMED criteria.
Barium	1/1	30.3 mg/kg	8.3×10^4	NNS	15000	NNS	No
Cadmium	1/1	<0.73 mg/kg	6.3×10^2	70	190	NNS	No
Chromium	1/1	48.5 mg/kg	NNS	NNS	100000 (b)	NNS	No
Lead	1/1	124 mg/kg	1.4×10^3	1,000	1000	NNS	No
Mercury	1/1	<0.097 mg/kg	3.8×10^2	40	69	NNS	No
Selenium	1/1	1.6 mg/kg	6.4×10^3	700	1200	NNS	No
Silver	1/1	1.5 mg/kg	6.4×10^3	700	1200	NNS	No
Purgeable Aromatics							
Benzene	1/1	70,600 µg/kg	1.8	NNS	5.6	NNS	NA
Toluene	1/1	190,000 µg/kg	5.2×10^2	NNS	180	NNS	NA
Ethylbenzene	1/1	107,000 µg/kg	2.3×10^2	NNS	68	NNS	NA
Xylenes (Total)	1/1	248,000 µg/kg	2.1×10^2	NNS	63	NNS	NA
TPH (C10 - C40)	1/1	458,000 mg/kg	NNS	NNS	NNS	NNS	NA

Table 4-6: Human Health Risk Screening For Sludge, I&W South Site #2 (Continued)

Constituent	Constituent Frequency and Range of Detects		EPA Screening Levels[1] (mg/kg) (Industrial Outdoor Worker with Dermal Exposure)	BLM Risk Criteria [2] (mg/kg) (Camper)	NMED[3] (mg/kg) (Industrial / Occupational Worker)	Other Risk Criteria	Exceed Screening Criteria?
	Number of Detects/Number of Samples	Range of Positive Detects					
Polynuclear Aromatic Hydrocarbons							
Acenaphthene	1/1	ND	NNS	NNS	4900	NNS	NA
Acenaphthylene	1/1	ND	NNS	NNS	NNS	NNS	NA
Anthracene	1/1	ND	NNS	NNS	34000	NNS	NA
Benzo(a)anthracene	1/1	ND	NNS	NNS	26	NNS	NA
Benzo(a)pyrene	1/1	ND	NNS	NNS	NNS	0.1 mg/kg (c)	NA
Benzo(b)fluoranthene	1/1	ND	NNS	NNS	26	NNS	NA
Benzo(g,h,i)perylene	1/1	ND	NNS	NNS	NNS	NNS	NA
Benzo(k)fluoranthene	1/1	ND	NNS	NNS	260	NNS	NA
Chrysene	1/1	ND	NNS	NNS	2500	NNS	NA
Dibenzo(a,h)anthracene	1/1	ND	NNS	NNS	2.6	NNS	NA
Fluoranthene	1/1	ND	NNS	NNS	5300	0.1 mg/kg (c)	NA
Fluorene	1/1	ND	NNS	NNS	4000	NNS	NA
Indeno(1,2,3-c,d)pyrene	1/1	ND	NNS	NNS	26	NNS	NA
Naphthalene	1/1	118,000 µg/kg	NNS	NNS	43	0.1 mg/kg (c)	No
1-Methylnaphthalene	1/1	368,000 µg/kg	NNS	NNS	NNS	NNS	NA

Table 4-6: Human Health Risk Screening For Sludge, I&W South Site #2 (Continued)

Constituent	Constituent Frequency and Range of Detects		EPA Screening Levels[1] (mg/kg) (Industrial Outdoor Worker with Dermal Exposure)	BLM Risk Criteria [2] (mg/kg) (Camper)	NMED[3] (mg/kg) (Industrial / Occupational Worker)	Other Risk Criteria	Exceed Screening Criteria?
	Number of Detects/Number of Samples	Range of Positive Detects					
2-Methylnaphthalene	1/1	303,000 µg/kg	NNS	NNS	NNS	NNS	NA
Phenanthrene	1/1	ND	NNS	NNS	4400	0.1 mg/kg (c)	NA
Pyrene	1/1	ND	NNS	NNS	4300	0.1 mg/kg (c)	NA

[1] *EPA Region 6 - Human Health medium-Specific Screening Levels*, February 5, 2002.
[2] *Risk Management Criteria for Metals at BLM Mining Sites,* U.S. Department of the Interior, Bureau of Land Management, December 1996.
(a) = Cancer endpoint.
(b) = Values reported are for Chromium III.
(c) = Background concentrations in soil or detection limit (Beyer, 1990).
ND = Not detected.
NNA = Not applicable
NNS = No numeric standard.

Table 4-7: Ecological Risk Screening For Soil, I&W South Site #2

Constituent	Constituent Frequency and Range of Detects		BLM Risk Criteria[1] (mg/kg)				Other Risk Criteria (mg/kg)	Exceed Screening Criteria?
	Number of Detects/Number of Samples	Range of Positive Detects (mg/kg)	Deer Mouse	Cottontail	Mule Deer	Cattle		
Metals Analysis								
Arsenic	1/1	7.3	52.0	122.0	82.0	193.0	10 (a)	No
Barium	1/1	41.6	NNS	NNS	NNS	NNS	165 (b)	No
Cadmium	1/1	<0.50	1.0	0.3	0.2	1.0	1.6 (b)	BLM Risk Criteria Only (Cottontail & Mule Deer).
Chromium	1/1	5.9	NNS	NNS	NNS	NNS	32 (c)	No
Lead	1/1	5.5	132.0	97.0	44.0	138.0	50 (c)	No
Mercury	1/1	<0.063	0.4	1.1	0.6	3.5	0.3 (d)	No
Selenium	1/1	<0.50	NNS	NNS	NNS	NNS	0.81 (b)	No
Silver	1/1	<0.99	NNS	NNS	NNS	NNS	2 (a)	No
TPH (C10 - C40)	1/1	2,300	NNS	NNS	NNS	NNS	NNS	NA

[1] *Risk Management Criteria for Metals at BLM Mining Sites*, U.S. Department of the Interior, Bureau of Land Management, December 1996.
(a) Efroymson et al, 1997a.
(b) Crommentuijn et al, 1997.
(c) Efroymson et al, 1997b.
(d) MHSPE, 1994.
ND = Not detected.
NA = Not applicable.
NNS = No numeric standard.

Table 4-8: Ecological Risk Screening For Sludge, I&W South Site #2

Constituent	Constituent Frequency and Range of Detects		BLM Risk Criteria[1] (mg/kg)				Other Risk Criteria	Exceed Screening Criteria?
	Number of Detects/Number of Samples	Range of Positive Detects	Deer Mouse	Cottontail	Mule Deer	Cattle		
Metals Analysis								
Arsenic	1/1	275 mg/kg	52.0	122.0	82.0	193.0	10 (a)	Yes, BLM Risk Criteria and Other Risk Criteria.
Barium	1/1	30.3 mg/kg	NNS	NNS	NNS	NNS	165 (b)	No
Cadmium	1/1	<0.73 mg/kg	1.0	0.3	0.2	1.0	1.6 (b)	BLM Risk Criteria Only (Cottontail & Mule Deer).
Chromium	1/1	48.5 mg/kg	NNS	NNS	NNS	NNS	32 (c)	Yes, Other Risk Criteria.
Lead	1/1	124 mg/kg	132.0	97.0	44.0	138.0	50 (c)	Yes, BLM Risk Criteria (Cottontail & Mule Deer) and Other Risk Criteria.
Mercury	1/1	<0.097 mg/kg	0.4	1.1	0.6	3.5	0.3 (d)	No
Selenium	1/1	1.6 mg/kg	NNS	NNS	NNS	NNS	0.81 (b)	Yes, Other Risk Criteria.
Silver	1/1	1.5 mg/kg	NNS	NNS	NNS	NNS	2 (a)	No

Table 4-8: Ecological Risk Screening For Sludge, I&W South Site #2 (Continued)

Constituent	Constituent Frequency and Range of Detects		BLM Risk Criteria[1] (mg/kg)				Other Risk Criteria	Exceed Screening Criteria?
	Number of Detects/Number of Samples	Range of Positive Detects	Deer Mouse	Cottontail	Mule Deer	Cattle		
Purgeable Aromatics								
Benzene	1/1	70,600 μg/kg	NNS	NNS	NNS	NNS	0.05 (d)	No
Toluene	1/1	190,000 μg/kg	NNS	NNS	NNS	NNS	0.05 (d)	No
Ethylbenzene	1/1	107,000 μg/kg	NNS	NNS	NNS	NNS	0.7 (e)	No
Xylenes (Total)	1/1	248,000 μg/kg	NNS	NNS	NNS	NNS	0.05 (f)	No
TPH (C10 - C40)	1/1	458,000 mg/kg	NNS	NNS	NNS	NNS	NNS	No
Polynuclear Aromatic Hydrocarbons								
Acenaphthene	1/1	ND	NNS	NNS	NNS	NNS	20 (a)	No
Acenaphthylene	1/1	ND	NNS	NNS	NNS	NNS	NNS	NA
Anthracene	1/1	ND	NNS	NNS	NNS	NNS	0.1 (f)	No
Benzo(a)anthracene	1/1	ND	NNS	NNS	NNS	NNS	NNS	NA
Benzo(a)pyrene	1/1	ND	NNS	NNS	NNS	NNS	0.1 (f)	No
Benzo(b)fluoranthene	1/1	ND	NNS	NNS	NNS	NNS	NNS	NA
Benzo(g,h,i)perylene	1/1	ND	NNS	NNS	NNS	NNS	NNS	NA
Benzo(k)fluoranthene	1/1	ND	NNS	NNS	NNS	NNS	NNS	NA
Chrysene	1/1	ND	NNS	NNS	NNS	NNS	NNS	NA

Table 4-8: Ecological Risk Screening For Sludge, I&W South Site #2 (Continued)

Constituent	Constituent Frequency and Range of Detects		BLM Risk Criteria[1] (mg/kg)				Other Risk Criteria	Exceed Screening Criteria?
	Number of Detects/Number of Samples	Range of Positive Detects	Deer Mouse	Cottontail	Mule Deer	Cattle		
Dibenzo(a,h)anthracene	1/1	ND	NNS	NNS	NNS	NNS	NNS	NA
Fluoranthene	1/1	ND	NNS	NNS	NNS	NNS	0.1 (f)	No
Fluorene	1/1	ND	NNS	NNS	NNS	NNS	NNS	NA
Indeno(1,2,3-cd)pyrene	1/1	ND	NNS	NNS	NNS	NNS	NNS	NA
Naphthalene	1/1	118,000 μg/kg	NNS	NNS	NNS	NNS	0.1 (f)	No
1-Methylnaphthalene	1/1	368,000 μg/kg	NNS	NNS	NNS	NNS	NNS	NA
2-Methylnaphthalene	1/1	303,000 μg/kg	NNS	NNS	NNS	NNS	NNS	NA
Phenanthrene	1/1	ND	NNS	NNS	NNS	NNS	0.1 (f)	No
Pyrene	1/1	ND	NNS	NNS	NNS	NNS	0.1 (f)	No

[1] *Risk Management Criteria for Metals at BLM Mining Sites*, U.S. Department of the Interior, Bureau of Land Management, December 1996.
(a) Efroymson et al, 1997a.
(b) Crommentuijn et al, 1997.
(c) Efroymson et al, 1997b.
(d) MHSPE, 1994.
(d) MHSPE, 1994.
(e) CCME, 1998.
(f) Background concentrations in soil or detection limits, U.S. Fish and Wildlife Service.
ND = Not detected.
NA = Not applicable.
NNS = No numeric standard.

Table 5-1: Summary of Potential Chemical-Specific ARARs

Standard, Requirement, Criteria, or Limitation	Citation	Potentially Applicable	Potentially Relevant and Appropriate	To Be Considered	Description/Comments
National Primary and Secondary Drinking Water Standards	40 CFR Part 141 and 143	No			Health-based standards (MCLs) for public drinking water systems. Groundwater is not part of any proposed removal alternatives. Drinking water is not expected to be impacted by the proposed alternatives.
RCRA Groundwater Protection Standards	40 CFR 264.92-264.101		Yes		Sets standards for groundwater at RCRA facilities. Groundwater is not part of any proposed removal alternatives unless waste is disposed of in a RCRA facility.
Federal Water Quality Criteria	40 CFR Part 131 Quality Criteria for Water, 1986	No			Sets standards for surface water to protect aquatic organisms and human health.
State of New Mexico Standards for Ground and Surface Water Protection	20.6.2 NMAC		Yes		Specifies standards and requirements for protection of surface and groundwater. There is currently no evidence that groundwater is potentially impacted at the site. Surface water in the area drains to a nearby catch basin and infiltrates.
State of New Mexico Standards for Interstate and Intrastate Surface Waters	NMSA 1978 §§ 74-6-1 to 74-6-17 20.6.4 NMAC		Yes		Provides for the protection of surface water through narrative and numerical surface water quality standards. Specifies water quality criteria necessary for water flowing into or discharged to the Pecos River Basin. Surface water in the area drains to a nearby catch basin and infiltrates.
Clean Air Act, National Primary and Secondary Ambient Air Quality Standards	40 CFR Part 50	Yes			Sets standards for air emissions. Defines levels of air quality for the protection of public health. Specifies standards for particulate matter emissions and lead.
National Emission Standards for Hazardous Air Pollutants	40 CFR Part 61, Subparts N, O, P	Yes			Regulates emission of hazardous chemicals to the atmosphere.
New Mexico Ambient Air Quality Standards	20.2.3 NMAC	Yes			Establishes ambient air quality standards for the areas of New Mexico under jurisdiction of the Environmental Improvement Board. Specifies standards for particulate matter emissions.

Table 5-1: Summary of Potential Chemical-Specific ARARs

Standard, Requirement, Criteria, or Limitation	Citation	Potentially Applicable	Potentially Relevant and Appropriate	To Be Considered	Description/Comments
Toxic Substances Control Act	40 CFR Part 700	Yes			Regulates hazardous materials from manufacture to disposal. Applies to manufacturers and processors.
BLM Risk Management Criteria	Technical Note 390 rev.			Yes	Suggests acceptable multimedia criteria for heavy metals as they relate to recreational use and wildlife habitat on BLM lands. Often utilized as removal action goals on BLM lands.
Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites	EPA Directive #9355.4-02, September, 1989			Yes	Suggests levels for lead in soil. This factor would be considered if lead is found in elevated levels in soils remaining after contaminant removal.
Technical Background Document for Development of Soil Screening Levels	NMED Soil Screening Levels, December 18, 2000, Revision 1.0			Yes	Discusses the methodology used to derive chemical-specific soil screening levels. Provides guidance in identifying and evaluating exposure pathways and receptors.

Table 5-2: Summary of Potential Action-Specific ARARs

Standard, Requirement, Criteria, or Limitation	Citation	Potentially Applicable	Potentially Relevant and Appropriate	To Be Considered	Description/Comments
Applicable to Surface Waste Management Facilities Only	19.15.9.711 NMAC		Yes		Describes administrative and operational requirements for surface waste management facilities which accept oilfield related waste.
Disposal of Certain Non-Domestic Waste at Solid Waste Facilities	19.15.9.712 NMAC		Yes		Describes provisions for disposal of non-domestic waste arising from the oil industry.
Solid Waste Management	NMSA 1978, §§ 74-1-8(A)(14) and the Solid Waste Act, NMSA 1978, §§ 74-9-1 to 9-42 20.9.1.NMAC Subpart VII	Yes			Describes restrictions and requirements for disposal of special waste. Describes requirements for transportation and disposal of Petroleum Contaminated Soil.
RCRA Subtitle C	40 CFR Part 261.4(b)(5), (b)(10), and RCRA Section 3001(b) (Beville Amendment)	Yes			Regulates disposal of hazardous materials. Applicable for disposal of listed wastes and sludges.
Solid Waste Disposal Act as amended by the Resource Conservation and Recovery Act of 1976 (RCRA)	40 CFR Part 257	No			Regulates the storage and handling of solid waste.
Hazardous Materials Transportation Act	49 USC § 1801-1813 40 CFR 107, 171-177	Yes			Regulates the transportation of hazardous waste. Will apply only if hazardous materials are transported offsite.
Guidelines for the Land Disposal of Solid Wastes	40 CFR Part 240	No			Regulates the land disposal of solid waste.

Table 5-2: Summary of Potential Action-Specific ARARs

Standard, Requirement, Criteria, or Limitation	Citation	Potentially Applicable	Potentially Relevant and Appropriate	To Be Considered	Description/Comments
Guidelines for the Storage and Collection of Residential, Commercial, and Institutional Solid Waste	40 CFR Part 243, pursuant to 42 USC § 6901, et.seq.	No			Establishes guidelines for the collection of residential, commercial, and institutional solid waste.
Source Separation for Materials Recovery Guidelines	40 CFR Part 246, pursuant to 42 USC § 6901, et.seq.	No			Outlines requirements and recommended procedures for source separation of solid waste.
Guidelines for Development and Implementation of State Solid Waste Management Plans	40 CFR Part 256	No			Establishes guidelines for Federal approval of State solid waste management programs.
Criteria for Classification of Solid Waste Disposal Facilities and Practices	40 CFR Part 257		Yes		Establishes criteria for solid waste disposal facilities and solid waste management.
Identification and Listing of Hazardous Waste	40 CFR Part 261	Yes			Establishes the procedures and process for listing and determining hazardous waste.
Standards Applicable to Generation of Hazardous Waste	40 CFR Part 262	Yes			Establishes standards for the generation of hazardous waste.
Standards Applicable to Transporters of Hazardous Waste	40 CFR Part 263	Yes			Regulates the transportation of hazardous waste. Will apply only if hazardous materials are transported offsite.
Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	40 CFR Part 264, pursuant to 42 USC § 6924, 6925		Yes		General regulations for the design, operation, and maintenance of hazardous waste treatment, storage, and disposal (TSD) facilities.

Table 5-2: Summary of Potential Action-Specific ARARs

Standard, Requirement, Criteria, or Limitation	Citation	Potentially Applicable	Potentially Relevant and Appropriate	To Be Considered	Description/Comments
Interim Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	40 CFR Part 265 State: 6 CCR 1007-3 Part 265		Yes		Establishes standard for TSD facilities during interim status.
Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities	40 CFR Part 266	No			Establishes requirements for the recovery of precious metals from a waste stream.
Interim Standards for Owners and Operators of New Hazardous Waste Land Disposal Facilities	40 CFR Part 267		Yes		Establishes requirements for new hazardous waste land disposal facilities.
Resource Conservation and Recovery Act (RCRA)	40 CFR 268	Yes			Restricts land disposal of certain hazardous wastes and specifies treatment standards prior to land disposal. If soils are determined to contain hazardous waste, provides treatment standard.
Hazardous Waste Permit Program	40 CFR Part 270	No			Establishes procedures for obtaining U.S. EPA permit for hazardous waste management program. Permits are not required for onsite disposal under CERCLA.
New Mexico Hazardous Waste Act	NMSA 1978 §§ 74-4-1 to 74-4-14 20.4.1 NMAC	Yes			Establishes regulations for the management of hazardous waste. If soils are determined to contain hazardous waste, standards for identification, generation and transportation of waste are provided.
National Pollutant Discharge Elimination System	40 CFR Parts 122, 125,	No			Regulates the discharge of treated effluent and storm water runoff to waters of the U.S.

Table 5-2: Summary of Potential Action-Specific ARARs

Standard, Requirement, Criteria, or Limitation	Citation	Potentially Applicable	Potentially Relevant and Appropriate	To Be Considered	Description/Comments
Effluent Limitations	40 CFR Part 440, pursuant to 33 USC § 1311 State: 5 CCR 1002-3, §§ 10.1 to 10.1.7, pursuant to CRS § 25-8-503	No			Sets standards for discharge of treated effluent to waters of the U.S.
Toxic Pollutant Effluent Standards	40 CFR Part 129, pursuant to 33 USC § 1317	No			Establishes standards or sets prohibitions for certain hazardous constituents.
Occupational Safety and Health Act	29 USC §§ 651-678	No			Regulates worker health and safety.
Occupational Safety and Health Act	29 CFR 1910.120	Yes			Describes training required for activities involving hazardous waste. Site workers must have HazWOper certification.
Federal Mine Safety and Health Act	30 USC §§ 801-962	No			Regulates worker safety at active mine sites.
NMOCD Guidelines for Remediation of Leaks, Spills, and Releases				Yes	Regulates cleanup of oil and other hazardous material spills and releases associated with the oil and gas industry.
Sediment Oil, Tank Cleaning and Transportation of Miscellaneous Hydrocarbons	19.15.5.311 NMAC			Yes	Describes requirements for companies engaged in cleaning of tanks.
Emulsion, Basic Sediment and Tank Bottom	19.15.5.313 NMAC			Yes	Describes requirements for surface pits used for placement of tank bottoms.
Guidance for Conducting Non-Time-Critical Removal Actions Under CERCLA	EPA/540-R-93-057	No			Describes process for screening and analysis of alternatives for removal actions. Used for the development of the EE/CA.

Table 5-2: Summary of Potential Action-Specific ARARs

Table 5-3: Summary of Potential Location-Specific ARARs

Standard, Requirement, Criteria, or Limitation	Citation	Potentially Applicable	Potentially Relevant and Appropriate	To Be Considered	Description/Comments
New Mexico Office of Cultural Affairs, Historic Preservation Division		No			Regulates impacts to historic places and structures; follows guidelines set forth by the National Historic Preservation Act and the New Mexico Cultural Properties Act.
National Historic Preservation Act (NHPA)	16 USC § 470 et seq. A portion of 40 CFR § 6.301 (b), 30 CFR Part 63, Part 65, Part 800	No			Regulates impacts to historic places and structures.
The Historic and Archaeological Data Preservation Act of 1974	40 CFR § 6.301(c)	No			Protects sites with historic, prehistoric and archeological significance.
Historic Sites Act of 1935, Executive Order 11593	40 CFR § 6.301(a)	No			Regulates designation and protection of historic places.
The Archaeological Resources Protection Act of 1979		No			Regulates removal of archeological resources from public or tribal lands.
Executive Order No. 11990 Protection of Wetlands	40 CFR § 6.302(a) and Appendix A	No			Minimizes impacts to wetlands.
Executive Order No. 11988 Floodplain Management	40 CFR § 6.302 and Appendix A	No			Regulates construction in floodplains.
Section 404, Clean Water Act (CWA)	33 CFR Part 330	No			Regulates discharge of dredge or fill materials into water of the U.S.
New Mexico Wildlife Conservation Act	NMSA 1978, 19.21.2 NMAC		Yes		Requires that an assessment be conducted within a project area to determine whether endangered animal species will be impacted . Based on the lack of suitable habitat within the area, it is not likely that T&E species are present at the site.
Fish and Wildlife Coordination Act	40 CFR § 6.302(g)	No			Requires coordination with Federal and State agencies to provide protection of fish and wildlife.

Table 5-3: Summary of Potential Location-Specific ARARs

Standard, Requirement, Criteria, or Limitation	Citation	Potentially Applicable	Potentially Relevant and Appropriate	To Be Considered	Description/Comments
Endangered Species Act	50 CFR Parts 17, 402 40 CFR § 6.302(b)		Yes		Regulates the protection of threatened or endangered species.
Wilderness Act	50 CFR 53, 50 CFR 27	No			Limits activities within areas designated as wilderness or National wildlife refuge. The Site is not in a designated wilderness or National wildlife refuge.
Wild and Scenic Rivers Act	40 CFR § 6.302(e) 36 CFR Part 297	No			Establishes requirements to protect wild, scenic, or recreational rivers.

Table 6-1: Summary of Screening of Management and Treatment Technologies

Category	Management/Treatment Technology	Results of Screening Process
No Action	None	Retained
Institutional Controls	Barriers, fences, gates, warning signs	Retained for further analysis as part of other alternatives
Management and/or Treatment of Waste Material	Containment	Eliminated
	Onsite Thermal Treatment	Eliminated
	Landfarming	Retained
	Soil Vapor Extraction (Vapor Venting)	Eliminated
	Bioventing (Active Soil Aeration)	Eliminated
	Composting (Biopiles)	Eliminated
	Solidification	Eliminated
	Offsite Disposal	Retained

Table 7-1: Comparative Analysis of Removal Action Alternatives

Criteria	Alternative 1: No Action	Alternative 2: Offsite Disposal of Sludge and Onsite Consolidation of Contaminated Soil	Alternative 3: Offsite Disposal of Sludge and Onsite Landfarming of Contaminated Soil	Alternative 4: Offsite Disposal of Sludge and Offsite Landfarming of Contaminated Soil
Effectiveness				
Overall Effectiveness	4	3	2	1
Protection of Human Health	○	◗	●	●
Protection of Environment	○	◗	●	●
Compliance with ARARs	○	◗	●	●
Long-Term Effectiveness	○	○	●	●
Short-Term Effectiveness	○	●	◗	●
Toxicity, Mobility, Volume Reduction	○	◗	●	●
Implementability				
Overall Implementability	1	2	4	3
Technical Feasibility	●	●	●	●
Administrative Feasibility	○	◗	●	●
Availability of Services & Materials	●	●	●	●
Community Acceptability	✶	✶	✶	✶
Cost				
Capital Cost	$0	$131,758	$261,225	$181,018
Operations and Maintenance Cost (Per Year)	$0	$3,300 (Year 1) $2,400 (Years 2-10)	$26,900	$1,000 (Year One Only)

● Completely Meets Criteria ◗ Partially Meets Criteria ○ Does Not Meet Criteria ✶ Community Acceptability to be Determined Through Public Comment

Numeric ranking: "1" indicates greatest conformance with the stated criteria; "4" indicates that the alternative is least effective/implementable of the four stated alternatives.

ATTACHMENTS

ATTACHMENT A

Photo Journal

Photo 1: I&W South Site, Trench, facing northwest.

Photo 2: I&W South Site, Waste Pile, facing southwest.

Photo 3: I&W South Site, Overburden Pile, facing northwest.

Photo 4: I&W South Site, Overburden Pile, facing northeast.

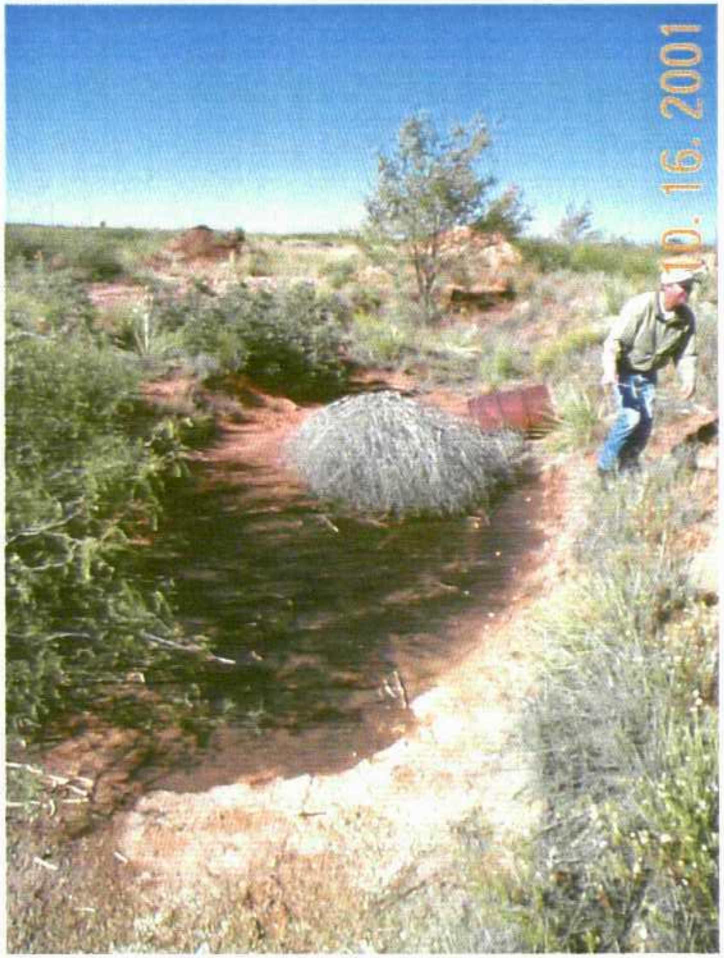

Photo 5: I&W South Site, Liquid Waste Pit, facing

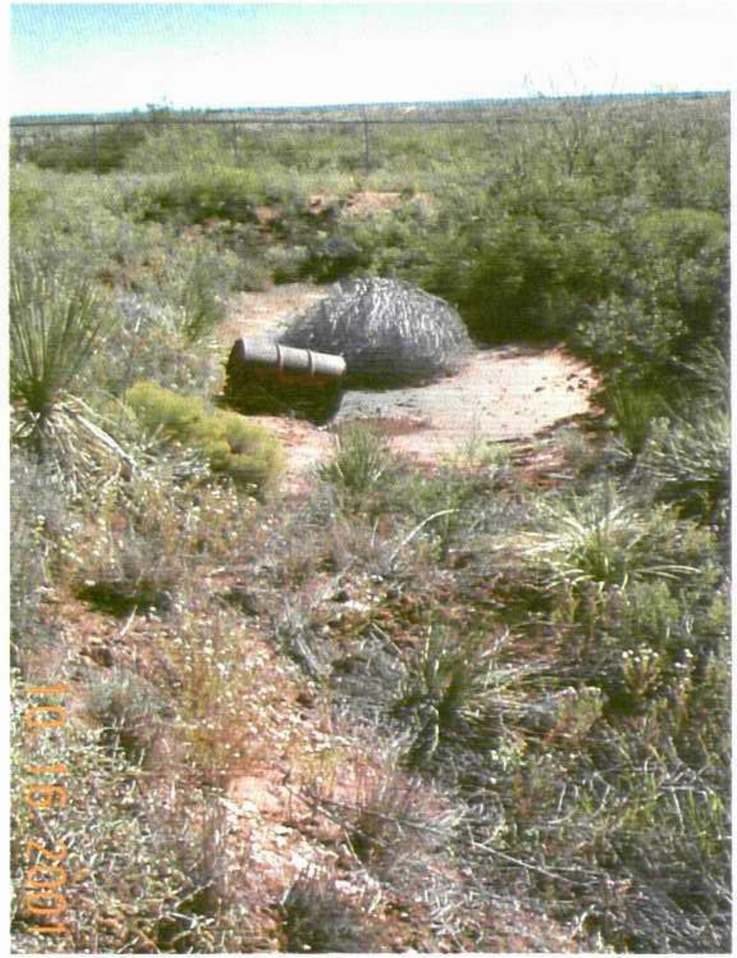

Photo 6: I&W South Site, Liquid Waste Pit, facing east.

Photo 7: I&W South Site, Debris Area in northeast corner of fenced enclosure, facing northwest.

Photo 8: I&W South Site #2, Area of High Visible Contamination (Foreground)
and waste pile (top left), facing northwest.

Photo 9: I&W South Site #2, Area of High Visible Contamination, facing west.

ATTACHMENT B

Data Validation Report and Raw Analytical Results

Date: August 14, 2002

Subject: I&W Hot Oil, Data Validation

From: Craig Markowitz - Data Validator
Dynamac Corporation

Kelly Luck - Senior Data Validator
Dynamac Corporation

To: Bryan Frey
Dynamac Corporation

Overview

Analytical data generated by Accutest Laboratories Gulf Coast, Inc. for 3 soil samples, 2 sludge samples, and 2 aqueous samples collected for the I&W Hot Oil sampling project were evaluated. The sample set contained one field blank, one trip blank, and one field duplicate pair. Samples were analyzed for total petroleum hydrocarbons (TPH; SW-846 Method 8015 modified), metals (Method 6010), mercury (Method 7471), purgeable aromatics (Method 8021), polynuclear aromatic hydrocarbons (PAHs; Method 8310), TCLP volatiles (Method 1311 and 8260), TCLP semivolatiles (Methods 1311 and 8270), TCLP metals (Methods 1311 and 6010), and TCLP mercury (Methods 1311 and 7470).

The data were reviewed according to the National Functional Guidelines for Inorganic Data Review (2/94) and National Functional Guidelines for Organic Data Review (2/94) in conjunction with the QA/QC requirements specified in SW-846 Methods 1311, 6010, 7470, 7471, 8015, 8021, 8260, 8270, and 8310. The text of this report addresses only those problems affecting usability.

Discussion

Holding Times: All analyses were completed within required holding times (14 days for TPH, purgeable aromatics, and TCLP volatiles; 14 days to extraction and 40 days to analysis for PAHs and TCLP semivolatiles; 28 days for mercury; and 180 days for metals).

Blank Analysis Results: No target analytes were detected in the method blanks reported by the laboratory or in the field and trip blanks.

Surrogate Spike Recovery Results: Surrogate spike recoveries were within QC limits in all samples, with some exceptions which are detailed in the table below.

Sample	Fraction	Surrogate	Surrogate Recovery, %	QC Limits, %	Action
IW2-WS-1	TPH	o-terphenyl	0	60-124	None; surrogate recovery was low because the sample required dilution.
IW2-WS-2	PAHs	o-terphenyl	0	37-158	None; surrogate recoveries were low because the sample required dilution.
		p-terphenyl	0	59-149	
	TPH	o-terphenyl	0	60-124	
IW-WS-1	PAHs	o-terphenyl	0	37-158	None; surrogate recoveries were low because the sample required dilution.
		p-terphenyl	0	59-149	
	TPH	o-terphenyl	0	60-124	
IW-WS-2	TPH	o-terphenyl	0	60-124	None; surrogate recovery was low because the sample required dilution.
IW-WS-3	TPH	o-terphenyl	0	60-124	None; surrogate recovery was low because the sample required dilution.

Matrix Spike/Matrix Spike Duplicate Results: The matrix spike and matrix spike duplicate (MS/MSD) recovery results for all analytes were within QC limits (laboratory-specified limits for each analyte) for all organic analytes, and were within QC limits (75-125%) for all inorganic analytes, with the exception of TCLP barium (recoveries of 65.0% and 67.5%). The results for TCLP barium in samples IW2-WS-2 and IW-WS-1 were qualified as estimated with a low bias (L).

Samples outside the sample set were used for MS/MSD for purgeable aromatics (soil samples), PAHs, metals (soil samples), and mercury (soil samples); all results were within QC limits.

Relative percent difference (RPD) between the analysis of matrix spike and matrix spike duplicate samples was within the QC limits (0-20% RPD for metals and mercury; laboratory-specified limits for organic analytes).

Laboratory Duplicate Samples: The RPD between the analysis of samples and their laboratory duplicates was within QC limits (0-20% RPD for metals and mercury; laboratory-specified limits for organic analytes) for all analytes. Laboratory duplicate analyses were not conducted for TPH (MS/MSD analyses were conducted instead).

Samples outside the sample set were used for duplicate analyses for percent solids, purgeable aromatics (soil samples), PAHs (soil samples), metals (soil samples), and mercury (soil samples); all results were within QC limits, with the exception of high RPD observed for total selenium. Because the actual matrix of the samples used for these duplicate analyses is not known, the results of these analyses cannot be applied to samples in this sample set.

Laboratory Control Sample Results: Recovery of target analytes in the laboratory control samples was within QC limits (laboratory-specified limits for each analyte) for all target analytes, with the exception of TCLP vinyl chloride. High recovery was observed for TCLP vinyl chloride in the laboratory control sample (166%); however, no qualification of data was required as TCLP vinyl chloride was not detected in any sample.

ICP Serial Dilution Results: The percent difference between initial sample results and the results of a 5x dilution of the same sample were within QC limits (0-10% difference for analytes present at greater than 50x the instrument detection limit) for all analytes except TCLP barium (79.5% RPD). No qualification of data was required as TCLP barium results were previously qualified due to poor matrix spike recovery. We note that a sample outside the sample set was used for serial dilution analyses for total metals.

Field Duplicate Results: One field duplicate pair was collected, samples IW-WS-2 and IW-WS-3. The RPD between the results for target analytes in these samples are presented in the table below. All RPDs were within QC limits (0-50%).

Analyte	Units	IW-WS-2	IW-WS-3	Reporting Limit	RPD
Percent Solids	%	99.3	99.5	NA	0.2%
Arsenic	mg/kg	5.0	4.9	1.0	2.0%
Barium	mg/kg	111	116	0.50	4.4%
Cadmium	mg/kg	<0.50	<0.50	0.50	Not calculated
Chromium	mg/kg	8.6	9.1	1.5	5.7%
Lead	mg/kg	13.6	16.3	0.50	18.1%
Mercury	mg/kg	<0.065	<0.066	0.065	Not calculated
Selenium	mg/kg	<0.50	<0.50	0.50	Not calculated
Silver	mg/kg	<1.0	<1.0	1.0	Not calculated
TPH (C10-C40)	mg/kg	15500	15200	3300	2.0%
Benzene	ug/kg	ND	ND	50	Not calculated
Toluene	ug/kg	ND	ND	50	Not calculated
Ethylbenzene	ug/kg	ND	ND	50	Not calculated
Xylenes (total)	ug/kg	ND	ND	150	Not calculated

Attachments:

1. Glossary of Data Qualifier Codes
2. Data Summary Forms. These are spreadsheets of all results with applied qualifier codes.

Attachment 1
Glossary of Data Qualifier Codes

GLOSSARY OF DATA QUALIFIERS CODES - INORGANIC

Code	Definition
Codes Relating to Identification	
(NO CODE)	Confirmed identification.
U	Not detected. The associated number indicates approximate sample concentration necessary to be detected.
B	Detected at greater than the reporting limit but not substantially above the level reported in laboratory or field blanks.
R	Results are rejected. Analyte may or may not be present in the sample. Supporting data necessary to confirm result.
Codes Relating to Quantitation	
J	Analyte present. Reported value may not be accurate or precise. This qualifier is applied in cases where the relative percent difference between duplicate analyses (matrix spike/matrix spike duplicate, laboratory duplicate, and/or field duplicate) is outside the QC limits.
K	Analyte present. Reported value may be biased high. Actual value is expected to be lower. This qualifier is applied in cases where the matrix spike, post-digestion spike, or laboratory control sample recovery is higher than the QC limits.
L	Analyte present. Reported value may be biased low. Actual value is expected to be higher. This qualifier is applied in cases where samples were analyzed outside holding times, or where the matrix spike, post-digestion spike, or laboratory control sample recovery is lower than the QC limits.
UJ	Not detected; reporting limit may be inaccurate or imprecise. This qualifier is applied in cases where the relative percent difference between duplicate analyses (matrix spike/matrix spike duplicate, laboratory duplicate, and/or field duplicate) is outside the QC limits.
UL	Not detected; reporting limit is probably higher. This qualifier is applied in cases where samples were analyzed outside holding times, or where the matrix spike, post-digestion spike, or laboratory control sample recovery is lower than the QC limits.

Attachment 2
Data Summary Forms

I and W Hot Oil
Sample Results
Page 3 of 4
Lab Job Number T2695

	Laboratory ID	T2695-4					T2695-5					T2695-6					T2695-7				
	Dynamac Sample ID	IW-WS-2					IW-WS-3					FB-1					TB-1				
	Date Sampled	14-May-02					14-May-02					14-May-02					14-May-02				
	Matrix	Soil					Soil					Field blank					Trip blank				
	Percent Solids	99.3					99.5					NA					NA				
		Total					Total					Total					Total				
METHOD	ANALYTE	Result	DQF	UNITS	DF	RL	Result	DQF	UNITS	DF	RL	Result	DQF	UNITS	DF	RL	Result	DQF	UNITS	DF	RL
6010B	Arsenic	5.0		mg/kg	1	1.0	4.9		mg/kg	1	1.0	NA					NA				
6010B	Barium	111		mg/kg	1	0.50	116		mg/kg	1	0.50	NA					NA				
6010B	Cadmium	<0.50		mg/kg	1	0.50	<0.50		mg/kg	1	0.50	NA					NA				
6010B	Chromium	8.6		mg/kg	1	1.5	9.1		mg/kg	1	1.5	NA					NA				
6010B	Lead	13.6		mg/kg	1	0.50	16.3		mg/kg	1	0.50	NA					NA				
7470/7471	Mercury	<0.065		mg/kg	1	0.065	<0.066		mg/kg	1	0.066	NA					NA				
6010B	Selenium	<0.50		mg/kg	1	0.50	<0.50		mg/kg	1	0.50	NA					NA				
6010B	Silver	<1.0		mg/kg	1	1.0	<1.0		mg/kg	1	1.0	NA					NA				
8015 M	TPH (C10-C40)	15500		mg/kg	20	3300	15200		mg/kg	20	3300	NA					NA				
8310	Acenaphthene	NA					NA					NA					NA				
8310	Acenaphthylene	NA					NA					NA					NA				
8310	Anthracene	NA					NA					NA					NA				
8310	Benzo(a)anthracene	NA					NA					NA					NA				
8310	Benzo(a)pyrene	NA					NA					NA					NA				
8310	Benzo(b)fluoranthene	NA					NA					NA					NA				
8310	Benzo(g,h,i)perylene	NA					NA					NA					NA				
8310	Benzo(k)fluoranthene	NA					NA					NA					NA				
8310	Chrysene	NA					NA					NA					NA				
8310	Dibenzo(a,h)anthracene	NA					NA					NA					NA				
8310	Fluoranthene	NA					NA					NA					NA				
8310	Fluorene	NA					NA					NA					NA				
8310	Indeno(1,2,3-cd)pyrene	NA					NA					NA					NA				
8310	Naphthalene	NA					NA					NA					NA				
8310	1-Methylnaphthalene	NA					NA					NA					NA				
8310	2-Methylnaphthalene	NA					NA					NA					NA				
8310	Phenanthrene	NA					NA					NA					NA				
8310	Pyrene	NA					NA					NA					NA				

I and W Hot Oil
Sample Results
Page 4 of 4
Lab Job Number T2695

	Laboratory ID	T2695-4					T2695-5					T2695-6					T2695-7				
	Dynamac Sample ID	IW-WS-2					IW-WS-3					FB-1					TB-1				
	Date Sampled	14-May-02					14-May-02					14-May-02					14-May-02				
	Matrix	Soil					Soil					Field blank					Trip blank				
	Percent Solids	99 3					99 5					NA					NA				
		Total					Total					Total					Total				
METHOD	ANALYTE	Result	DQF	UNITS	DF	RL	Result	DQF	UNITS	DF	RL	Result	DQF	UNITS	DF	RL	Result	DQF	UNITS	DF	RL
8021B	Benzene	ND		ug/kg	50	50	ND		ug/kg	50	50	ND		ug/l	1	1.0	ND		ug/l	1	1.0
8021B	Toluene	ND		ug/kg	50	50	ND		ug/kg	50	50	ND		ug/l	1	1 0	ND		ug/l	1	1.0
8021B	Ethylbenzene	ND		ug/kg	50	50	ND		ug/kg	50	50	ND		ug/l	1	1.0	ND		ug/l	1	1.0
8021B	Xylenes (total)	ND		ug/kg	50	150	ND		ug/kg	50	150	ND		ug/l	1	3 0	ND		ug/l	1	3 0
8260B	Benzene	NA					NA					NA					NA				
8260B	Chlorobenzene	NA					NA					NA					NA				
8260B	Chloroform	NA					NA					NA					NA				
8260B	Carbon tetrachloride	NA					NA					NA					NA				
8260B	1,1-Dichloroethylene	NA					NA					NA					NA				
8260B	1,2-Dichloroethane	NA					NA					NA					NA				
8260B	Methyl ethyl ketone	NA					NA					NA					NA				
8260B	Tetrachloroethylene	NA					NA					NA					NA				
8260B	Trichloroethylene	NA					NA					NA					NA				
8260B	Vinyl chloride	NA					NA					NA					NA				
8270C	2-Methylphenol	NA					NA					NA					NA				
8270C	3&4-Methylphenol	NA					NA					NA					NA				
8270C	Pentachlorophenol	NA					NA					NA					NA				
8270C	2,4,5-Trichlorophenol	NA					NA					NA					NA				
8270C	2,4,6-Trichlorophenol	NA					NA					NA					NA				
8270C	1,4-Dichlorobenzene	NA					NA					NA					NA				
8270C	2,4-Dinitrotoluene	NA					NA					NA					NA				
8270C	Hexachlorobenzene	NA					NA					NA					NA				
8270C	Hexachlorobutadiene	NA					NA					NA					NA				
8270C	Hexachloroethane	NA					NA					NA					NA				
8270C	Nitrobenzene	NA					NA					NA					NA				
8270C	Pyridine	NA					NA					NA					NA				

I and W Hot Oil
Sample Results
Page 1 of 4
Lab Job Number T2695

	Laboratory ID	T2695-1					T2695-2					T2695-2A					T2695-3					T2695-3A				
	Dynamac Sample ID	IW2-WS-1					IW2-WS-2										IW-WS-1									
	Date Sampled	14-May-02					14-May-02										14-May-02									
	Matrix	Soil					Sludge										Sludge									
	Percent Solids	99.6					67.6										76.8									
		Total					Total					TCLP Leachate					Total					TCLP Leachate				
METHOD	ANALYTE	Result	DQF	UNITS	DF	RL	Result	DQF	UNITS	DF	RL	Result	DQF	UNITS	DF	RL	Result	DQF	UNITS	DF	RL	Result	DQF	UNITS	DF	RL
6010B	Arsenic	7.3		mg/kg	1	0.99	275		mg/kg	1	1.5	0.3		mg/l	10	0.10	35.6		mg/kg	1	1.3	<0.10		mg/l	10	0.10
6010B	Barium	41.6		mg/kg	1	0.50	30.3		mg/kg	1	0.73	0.36	L	mg/l	10	0.10	421		mg/kg	1	0.65	0.73	L	mg/l	10	0.10
6010B	Cadmium	<0.50		mg/kg	1	0.50	<0.73		mg/kg	1	0.73	<0.040		mg/l	10	0.040	<0.65		mg/kg	1	0.65	<0.040		mg/l	10	0.040
6010B	Chromium	5.9		mg/kg	1	1.5	48.5		mg/kg	1	2.2	<0.10		mg/l	10	0.10	34		mg/kg	1	2.0	<0.10		mg/l	10	0.10
6010B	Lead	5.5		mg/kg	1	0.50	124		mg/kg	1	0.73	<0.10		mg/l	10	0.10	146		mg/kg	1	0.65	<0.10		mg/l	10	0.10
7470/7471	Mercury	<0.063		mg/kg	1	0.063	<0.097		mg/kg	1	0.097	<0.0020		mg/l	1	0.0020	0.72		mg/kg	1	0.087	<0.0020		mg/l	1	0.0020
6010B	Selenium	<0.50		mg/kg	1	0.50	1.6		mg/kg	1	0.73	<0.10		mg/l	10	0.10	0.99		mg/kg	1	0.65	<0.10		mg/l	10	0.10
6010B	Silver	<0.99		mg/kg	1	0.99	<1.5		mg/kg	1	1.5	<0.050		mg/l	10	0.050	<1.3		mg/kg	1	1.3	<0.050		mg/l	10	0.050
8015 M	TPH (C10-C40)	2300		mg/kg	10	1700	458000		mg/kg	100	240000	NA					104000		mg/kg	100	22000	NA				
8310	Acenaphthene	NA					ND		ug/kg	10	190000	NA					ND		ug/kg	10	86000	NA				
8310	Acenaphthylene	NA					ND		ug/kg	10	190000	NA					ND		ug/kg	10	86000	NA				
8310	Anthracene	NA					ND		ug/kg	10	96000	NA					ND		ug/kg	10	43000	NA				
8310	Benzo(a)anthracene	NA					ND		ug/kg	10	96000	NA					ND		ug/kg	10	43000	NA				
8310	Benzo(a)pyrene	NA					ND		ug/kg	10	19000	NA					ND		ug/kg	10	8600	NA				
8310	Benzo(b)fluoranthene	NA					ND		ug/kg	10	19000	NA					ND		ug/kg	10	8600	NA				
8310	Benzo(g,h,i)perylene	NA					ND		ug/kg	10	19000	NA					ND		ug/kg	10	8600	NA				
8310	Benzo(k)fluoranthene	NA					ND		ug/kg	10	19000	NA					ND		ug/kg	10	8600	NA				
8310	Chrysene	NA					ND		ug/kg	10	96000	NA					ND		ug/kg	10	43000	NA				
8310	Dibenzo(a,h)anthracene	NA					ND		ug/kg	10	19000	NA					ND		ug/kg	10	8600	NA				
8310	Fluoranthene	NA					ND		ug/kg	10	96000	NA					ND		ug/kg	10	43000	NA				
8310	Fluorene	NA					ND		ug/kg	10	96000	NA					ND		ug/kg	10	43000	NA				
8310	Indeno(1,2,3-cd)pyrene	NA					ND		ug/kg	10	19000	NA					ND		ug/kg	10	8600	NA				
8310	Naphthalene	NA					118000		ug/kg	10	96000	NA					ND		ug/kg	10	43000	NA				
8310	1-Methylnaphthalene	NA					368000		ug/kg	10	96000	NA					22500	J	ug/kg	10	43000	NA				
8310	2-Methylnaphthalene	NA					303000		ug/kg	10	96000	NA					ND		ug/kg	10	43000	NA				
8310	Phenanthrene	NA					ND		ug/kg	10	96000	NA					ND		ug/kg	10	43000	NA				
8310	Pyrene	NA					ND		ug/kg	10	96000	NA					ND		ug/kg	10	43000	NA				

	Laboratory ID	T2695-1					T2695-2					T2695-2A					T2695-3					T2695-3A				
	Dynamac Sample ID	IW2-WS-1					IW2-WS-2										IW-WS-1									
	Date Sampled	14-May-02					14-May-02										14-May-02									
	Matrix	Soil					Sludge										Sludge									
	Percent Solids	99 6					67 6										76.8									
		Total					Total					TCLP Leachate					Total					TCLP Leachate				
METHOD	ANALYTE	Result	DQF	UNITS	DF	RL	Result	DQF	UNITS	DF	RL	Result	DQF	UNITS	DF	RL	Result	DQF	UNITS	DF	RL	Result	DQF	UNITS	DF	RL
8021B	Benzene	NA					70600		ug/kg	5000	8000	NA					8160		ug/kg	500	660	NA				
8021B	Toluene	NA					190000		ug/kg	5000	8000	NA					ND		ug/kg	500	660	NA				
8021B	Ethylbenzene	NA					107000		ug/kg	5000	8000	NA					13700		ug/kg	500	660	NA				
8021B	Xylenes (total)	NA					248000		ug/kg	5000	24000	NA					9160		ug/kg	500	2000	NA				
8260B	Benzene	NA					NA					3.59		mg/l	40	0 20	NA					0.194		mg/l	20	0 20
8260B	Chlorobenzene	NA					NA					ND		mg/l	20	0.10	NA					ND		mg/l	20	0.10
8260B	Chloroform	NA					NA					ND		mg/l	20	0.10	NA					ND		mg/l	20	0.10
8260B	Carbon tetrachloride	NA					NA					ND		mg/l	20	0.10	NA					ND		mg/l	20	0.10
8260B	1,1-Dichloroethylene	NA					NA					ND		mg/l	20	0 10	NA					ND		mg/l	20	0 10
8260B	1,2-Dichloroethane	NA					NA					ND		mg/l	20	0.10	NA					ND		mg/l	20	0 10
8260B	Methyl ethyl ketone	NA					NA					ND		mg/l	20	0 20	NA					ND		mg/l	20	0.20
8260B	Tetrachloroethylene	NA					NA					ND		mg/l	20	0.10	NA					ND		mg/l	20	0.10
8260B	Trichloroethylene	NA					NA					ND		mg/l	20	0.10	NA					ND		mg/l	20	0 10
8260B	Vinyl chloride	NA					NA					ND		mg/l	20	0.10	NA					ND		mg/l	20	0 10
8270C	2-Methylphenol	NA					NA					ND		mg/l	1	0.050	NA					ND		mg/l	1	0.050
8270C	3&4-Methylphenol	NA					NA					ND		mg/l	1	0.050	NA					ND		mg/l	1	0 050
8270C	Pentachlorophenol	NA					NA					ND		mg/l	1	0.25	NA					ND		mg/l	1	0 25
8270C	2,4,5-Trichlorophenol	NA					NA					ND		mg/l	1	0 050	NA					ND		mg/l	1	0.050
8270C	2,4,6-Trichlorophenol	NA					NA					ND		mg/l	1	0.050	NA					ND		mg/l	1	0.050
8270C	1,4-Dichlorobenzene	NA					NA					ND		mg/l	1	0.050	NA					ND		mg/l	1	0.050
8270C	2,4-Dinitrotoluene	NA					NA					ND		mg/l	1	0.050	NA					ND		mg/l	1	0 050
8270C	Hexachlorobenzene	NA					NA					ND		mg/l	1	0.050	NA					ND		mg/l	1	0.050
8270C	Hexachlorobutadiene	NA					NA					ND		mg/l	1	0 050	NA					ND		mg/l	1	0 050
8270C	Hexachloroethane	NA					NA					ND		mg/l	1	0 050	NA					ND		mg/l	1	0.050
8270C	Nitrobenzene	NA					NA					ND		mg/l	1	0 050	NA					ND		mg/l	1	0.050
8270C	Pyridine	NA					NA					ND		mg/l	1	0.050	NA					ND		mg/l	1	0.050

06/04/02

Technical Report for

Dynamac Corporation Environmental Serv.

I&W Hot Oil

DYNAMAC/ BLM / I&W HOT OIL

Accutest Job Number: T2695

Report to:

Dynamac Corporation Environmental Serv.
20440 Century Boulevard Suite 100
Germantown, MD 20874
BFrey@Dynamac.com

ATTN: Bryan Frey

Total number of pages in report:

ACCREDITED IN ACCORDANCE WITH nelac

Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Conference and/or state specific certification programs as applicable.

Ron Martino
Laboratory Manager

Accutest Laboratories

Sample Summary

Dynamac Corporation Environmental Serv.

Job No: T2695

I&W Hot Oil
Project No: DYNAMAC/ BLM / I&W HOT OIL

Sample Number	Collected Date	Time By	Received	Matrix Code	Type	Client Sample ID
T2695-1	05/14/02	08:35 BF	05/15/02	SO	Soil	IW2-WS-1
T2695-2	05/14/02	09:00 BF	05/15/02	SO	Sludge	IW2-WS-2
T2695-3	05/14/02	10:55 BF	05/15/02	SO	Sludge	IW-WS-1
T2695-4	05/14/02	11:30 BF	05/15/02	SO	Soil	IW-WS-2
T2695-5	05/14/02	11:30 BF	05/15/02	SO	Soil	IW-WS-3
T2695-6	05/14/02	11:50 BF	05/15/02	AQ	Water	FB-1
T2695-7	05/14/02	00:00 BF	05/15/02	AQ	Trip Blank Water	TB-1
T2695-2A	05/14/02	09:00 BF	05/15/02	SO	Sludge	IW2-WS-2
T2695-3A	05/14/02	10:55 BF	05/15/02	SO	Sludge	IW-WS-1

Soil samples reported on a dry weight basis unless otherwise indicated on result page.

Report of Analysis

Client Sample ID:	IW2-WS-1			
Lab Sample ID:	T2695-1		Date Sampled:	05/14/02
Matrix:	SO - Soil		Date Received:	05/15/02
Method:	SW846 8015 M	SW846 3550B	Percent Solids:	99.6
Project:	I&W Hot Oil			

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	ZF05174.D	10	05/23/02	AFL	05/20/02	F:OP5172	F:GZF240
Run #2							

CAS No.	Compound	Result	RL	Units	Q
	TPH (C10-C40)	2300	1700	mg/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	0% [a]		60-124%

(a) Outside control limits due to dilution.

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	IW2-WS-1		
Lab Sample ID:	T2695-1	Date Sampled:	05/14/02
Matrix:	SO - Soil	Date Received:	05/15/02
		Percent Solids:	99.6
Project:	I&W Hot Oil		

Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Arsenic	7.3	0.99	mg/kg	1	05/17/02	05/20/02	JA	SW846 6010B	SW846 3050B
Barium	41.6	0.50	mg/kg	1	05/17/02	05/20/02	JA	SW846 6010B	SW846 3050B
Cadmium	<0.50	0.50	mg/kg	1	05/17/02	05/20/02	JA	SW846 6010B	SW846 3050B
Chromium	5.9	1.5	mg/kg	1	05/17/02	05/20/02	JA	SW846 6010B	SW846 3050B
Lead	5.5	0.50	mg/kg	1	05/17/02	05/20/02	JA	SW846 6010B	SW846 3050B
Mercury	<0.063	0.063	mg/kg	1	05/29/02	05/29/02	JC	SW846 7471A	SW846 7471A
Selenium	<0.50	0.50	mg/kg	1	05/17/02	05/21/02	JA	SW846 6010B	SW846 3050B
Silver	<0.99	0.99	mg/kg	1	05/17/02	05/20/02	JA	SW846 6010B	SW846 3050B

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	IW2-WS-2		
Lab Sample ID:	T2695-2	Date Sampled:	05/14/02
Matrix:	SO - Sludge	Date Received:	05/15/02
Method:	SW846 8021B	Percent Solids:	67.6
Project:	I&W Hot Oil		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	KK002462.D	5000	05/23/02	RM	n/a	n/a	GKK125
Run #2							

Purgeable Aromatics

CAS No.	Compound	Result	RL	Units	Q
71-43-2	Benzene	70600	8000	ug/kg	
108-88-3	Toluene	190000	8000	ug/kg	
100-41-4	Ethylbenzene	107000	8000	ug/kg	
1330-20-7	Xylenes (total)	248000	24000	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
460-00-4	4-Bromofluorobenzene	98%		66-141%
98-08-8	aaa-Trifluorotoluene	99%		70-130%

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	IW2-WS-2		
Lab Sample ID:	T2695-2	Date Sampled:	05/14/02
Matrix:	SO - Sludge	Date Received:	05/15/02
Method:	EPA 8310 SW846 3550B	Percent Solids:	67.6
Project:	I&W Hot Oil		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	AA010812.D	10	05/23/02	AFL	05/22/02	F:OP5194	F:GAA499
Run #2							

Polynuclear Aromatic Hydrocarbons

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	190000	ug/kg	
208-96-8	Acenaphthylene	ND	190000	ug/kg	
120-12-7	Anthracene	ND	96000	ug/kg	
56-55-3	Benzo(a)anthracene	ND	96000	ug/kg	
50-32-8	Benzo(a)pyrene	ND	19000	ug/kg	
205-99-2	Benzo(b)fluoranthene	ND	19000	ug/kg	
191-24-2	Benzo(g,h,i)perylene	ND	19000	ug/kg	
207-08-9	Benzo(k)fluoranthene	ND	19000	ug/kg	
218-01-9	Chrysene	ND	96000	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	19000	ug/kg	
206-44-0	Fluoranthene	ND	96000	ug/kg	
86-73-7	Fluorene	ND	96000	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	19000	ug/kg	
91-20-3	Naphthalene [b]	118000	96000	ug/kg	
90-12-0	1-Methylnaphthalene [b]	368000	96000	ug/kg	
91-57-6	2-Methylnaphthalene [b]	303000	96000	ug/kg	
85-01-8	Phenanthrene	ND	96000	ug/kg	
129-00-0	Pyrene	ND	96000	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	0% [c]		37-158%
92-94-4	p-Terphenyl	0% [c]		59-149%

(a) Dilution required due to matrix interference; extract was viscous.
(b) All hits confirmed by spectral match using a diode array detector.
(c) Outside control limits due to dilution.

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	IW2-WS-2		
Lab Sample ID:	T2695-2	Date Sampled:	05/14/02
Matrix:	SO - Sludge	Date Received:	05/15/02
Method:	SW846 8015 M SW846 3550B	Percent Solids:	67.6
Project:	I&W Hot Oil		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	ZF05175.D	100	05/23/02	AFL	05/20/02	F:OP5172	F:GZF240
Run #2							

CAS No.	Compound	Result	RL	Units	Q
	TPH (C10-C40)	458000	240000	mg/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	0% [a]		60-124%

(a) Outside control limits due to dilution.

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	IW2-WS-2		
Lab Sample ID:	T2695-2	Date Sampled:	05/14/02
Matrix:	SO - Sludge	Date Received:	05/15/02
		Percent Solids:	67.6
Project:	I&W Hot Oil		

Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Arsenic	275	1.5	mg/kg	1	05/17/02	05/21/02	JA	SW846 6010B	SW846 3050B
Barium	30.3	0.73	mg/kg	1	05/17/02	05/21/02	JA	SW846 6010B	SW846 3050B
Cadmium	< 0.73	0.73	mg/kg	1	05/17/02	05/21/02	JA	SW846 6010B	SW846 3050B
Chromium	48.5	2.2	mg/kg	1	05/17/02	05/21/02	JA	SW846 6010B	SW846 3050B
Lead	124	0.73	mg/kg	1	05/17/02	05/21/02	JA	SW846 6010B	SW846 3050B
Mercury	< 0.097	0.097	mg/kg	1	05/29/02	05/29/02	JC	SW846 7471A	SW846 7471A
Selenium	1.6	0.73	mg/kg	1	05/17/02	05/21/02	JA	SW846 6010B	SW846 3050B
Silver	< 1.5	1.5	mg/kg	1	05/17/02	05/21/02	JA	SW846 6010B	SW846 3050B

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	IW-WS-1		
Lab Sample ID:	T2695-3	Date Sampled:	05/14/02
Matrix:	SO - Sludge	Date Received:	05/15/02
Method:	SW846 8021B	Percent Solids:	76.8
Project:	I&W Hot Oil		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	KK002452.D	500	05/23/02	RM	n/a	n/a	GKK125
Run #2							

Purgeable Aromatics

CAS No.	Compound	Result	RL	Units	Q
71-43-2	Benzene	8160	660	ug/kg	
108-88-3	Toluene	ND	660	ug/kg	
100-41-4	Ethylbenzene	13700	660	ug/kg	
1330-20-7	Xylenes (total)	9160	2000	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
460-00-4	4-Bromofluorobenzene	100%		66-141%
98-08-8	aaa-Trifluorotoluene	108%		70-130%

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	IW-WS-1		
Lab Sample ID:	T2695-3	Date Sampled:	05/14/02
Matrix:	SO - Sludge	Date Received:	05/15/02
Method:	EPA 8310 SW846 3550B	Percent Solids:	76.8
Project:	I&W Hot Oil		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	AA010813.D	10	05/23/02	AFL	05/22/02	F:OP5194	F:GAA499
Run #2							

Polynuclear Aromatic Hydrocarbons

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	86000	ug/kg	
208-96-8	Acenaphthylene	ND	86000	ug/kg	
120-12-7	Anthracene	ND	43000	ug/kg	
56-55-3	Benzo(a)anthracene	ND	43000	ug/kg	
50-32-8	Benzo(a)pyrene	ND	8600	ug/kg	
205-99-2	Benzo(b)fluoranthene	ND	8600	ug/kg	
191-24-2	Benzo(g,h,i)perylene	ND	8600	ug/kg	
207-08-9	Benzo(k)fluoranthene	ND	8600	ug/kg	
218-01-9	Chrysene	ND	43000	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	8600	ug/kg	
206-44-0	Fluoranthene	ND	43000	ug/kg	
86-73-7	Fluorene	ND	43000	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	8600	ug/kg	
91-20-3	Naphthalene	ND	43000	ug/kg	
90-12-0	1-Methylnaphthalene [b]	22500	43000	ug/kg	J
91-57-6	2-Methylnaphthalene	ND	43000	ug/kg	
85-01-8	Phenanthrene	ND	43000	ug/kg	
129-00-0	Pyrene	ND	43000	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	0% [c]		37-158%
92-94-4	p-Terphenyl	0% [c]		59-149%

(a) Dilution required due to matrix interference; extract was viscous.
(b) All hits confirmed by spectral match using a diode array detector.
(c) Outside control limits due to dilution.

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	IW-WS-1		
Lab Sample ID:	T2695-3	Date Sampled:	05/14/02
Matrix:	SO - Sludge	Date Received:	05/15/02
Method:	SW846 8015 M SW846 3550B	Percent Solids:	76.8
Project:	I&W Hot Oil		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	ZF05176.D	100	05/23/02	AFL	05/20/02	F:OP5172	F:GZF240
Run #2							

CAS No.	Compound	Result	RL	Units	Q
	TPH (C10-C40)	104000	22000	mg/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	0% [a]		60-124%

(a) Outside control limits due to dilution.

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	IW-WS-1			
Lab Sample ID:	T2695-3		Date Sampled:	05/14/02
Matrix:	SO - Sludge		Date Received:	05/15/02
			Percent Solids:	76.8
Project:	I&W Hot Oil			

Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Arsenic	35.6	1.3	mg/kg	1	05/17/02	05/21/02	JA	SW846 6010B	SW846 3050B
Barium	421	0.65	mg/kg	1	05/17/02	05/21/02	JA	SW846 6010B	SW846 3050B
Cadmium	< 0.65	0.65	mg/kg	1	05/17/02	05/21/02	JA	SW846 6010B	SW846 3050B
Chromium	34.0	2.0	mg/kg	1	05/17/02	05/21/02	JA	SW846 6010B	SW846 3050B
Lead	146	0.65	mg/kg	1	05/17/02	05/21/02	JA	SW846 6010B	SW846 3050B
Mercury	0.72	0.087	mg/kg	1	05/29/02	05/29/02	JC	SW846 7471A	SW846 7471A
Selenium	0.99	0.65	mg/kg	1	05/17/02	05/21/02	JA	SW846 6010B	SW846 3050B
Silver	< 1.3	1.3	mg/kg	1	05/17/02	05/21/02	JA	SW846 6010B	SW846 3050B

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	IW-WS-2		
Lab Sample ID:	T2695-4	Date Sampled:	05/14/02
Matrix:	SO - Soil	Date Received:	05/15/02
Method:	SW846 8021B	Percent Solids:	99.3
Project:	I&W Hot Oil		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	KK002463.D	50	05/23/02	RM	n/a	n/a	GKK125
Run #2							

Purgeable Aromatics

CAS No.	Compound	Result	RL	Units	Q
71-43-2	Benzene	ND	50	ug/kg	
108-88-3	Toluene	ND	50	ug/kg	
100-41-4	Ethylbenzene	ND	50	ug/kg	
1330-20-7	Xylenes (total)	ND	150	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
460-00-4	4-Bromofluorobenzene	84%		66-141%
98-08-8	aaa-Trifluorotoluene	91%		70-130%

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	IW-WS-2		
Lab Sample ID:	T2695-4	Date Sampled:	05/14/02
Matrix:	SO - Soil	Date Received:	05/15/02
Method:	SW846 8015 M SW846 3550B	Percent Solids:	99.3
Project:	I&W Hot Oil		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	ZF05177.D	20	05/23/02	AFL	05/20/02	F:OP5172	F:GZF240
Run #2							

CAS No.	Compound	Result	RL	Units	Q
	TPH (C10-C40)	15500	3300	mg/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	0% [a]		60-124%

(a) Outside control limits due to dilution.

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	IW-WS-2		
Lab Sample ID:	T2695-4	Date Sampled:	05/14/02
Matrix:	SO - Soil	Date Received:	05/15/02
		Percent Solids:	99.3
Project:	I&W Hot Oil		

Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Arsenic	5.0	1.0	mg/kg	1	05/17/02	05/21/02	JA	SW846 6010B	SW846 3050B
Barium	111	0.50	mg/kg	1	05/17/02	05/21/02	JA	SW846 6010B	SW846 3050B
Cadmium	<0.50	0.50	mg/kg	1	05/17/02	05/21/02	JA	SW846 6010B	SW846 3050B
Chromium	8.6	1.5	mg/kg	1	05/17/02	05/21/02	JA	SW846 6010B	SW846 3050B
Lead	13.6	0.50	mg/kg	1	05/17/02	05/21/02	JA	SW846 6010B	SW846 3050B
Mercury	<0.065	0.065	mg/kg	1	05/29/02	05/29/02	JC	SW846 7471A	SW846 7471A
Selenium	<0.50	0.50	mg/kg	1	05/17/02	05/21/02	JA	SW846 6010B	SW846 3050B
Silver	<1.0	1.0	mg/kg	1	05/17/02	05/21/02	JA	SW846 6010B	SW846 3050B

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	IW-WS-3		
Lab Sample ID:	T2695-5	Date Sampled:	05/14/02
Matrix:	SO - Soil	Date Received:	05/15/02
Method:	SW846 8021B	Percent Solids:	99.5
Project:	I&W Hot Oil		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	KK002464.D	50	05/23/02	RM	n/a	n/a	GKK125
Run #2							

Purgeable Aromatics

CAS No.	Compound	Result	RL	Units	Q
71-43-2	Benzene	ND	50	ug/kg	
108-88-3	Toluene	ND	50	ug/kg	
100-41-4	Ethylbenzene	ND	50	ug/kg	
1330-20-7	Xylenes (total)	ND	150	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
460-00-4	4-Bromofluorobenzene	81%		66-141%
98-08-8	aaa-Trifluorotoluene	91%		70-130%

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	IW-WS-3		
Lab Sample ID:	T2695-5	Date Sampled:	05/14/02
Matrix:	SO - Soil	Date Received:	05/15/02
Method:	SW846 8015 M SW846 3550B	Percent Solids:	99.5
Project:	I&W Hot Oil		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	ZF05188.D	20	05/24/02	AFL	05/20/02	F:OP5172	F:GZF241
Run #2							

CAS No.	Compound	Result	RL	Units	Q
	TPH (C10-C40)	15200	3300	mg/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	0% [a]		60-124%

(a) Outside control limits due to dilution.

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	IW-WS-3			
Lab Sample ID:	T2695-5		Date Sampled:	05/14/02
Matrix:	SO - Soil		Date Received:	05/15/02
			Percent Solids:	99.5
Project:	I&W Hot Oil			

Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Arsenic	4.9	1.0	mg/kg	1	05/17/02	05/21/02	JA	SW846 6010B	SW846 3050B
Barium	116	0.50	mg/kg	1	05/17/02	05/21/02	JA	SW846 6010B	SW846 3050B
Cadmium	< 0.50	0.50	mg/kg	1	05/17/02	05/21/02	JA	SW846 6010B	SW846 3050B
Chromium	9.1	1.5	mg/kg	1	05/17/02	05/21/02	JA	SW846 6010B	SW846 3050B
Lead	16.3	0.50	mg/kg	1	05/17/02	05/21/02	JA	SW846 6010B	SW846 3050B
Mercury	< 0.066	0.066	mg/kg	1	05/29/02	05/29/02	JC	SW846 7471A	SW846 7471A
Selenium	< 0.50	0.50	mg/kg	1	05/17/02	05/21/02	JA	SW846 6010B	SW846 3050B
Silver	< 1.0	1.0	mg/kg	1	05/17/02	05/21/02	JA	SW846 6010B	SW846 3050B

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	FB-1		
Lab Sample ID:	T2695-6	Date Sampled:	05/14/02
Matrix:	AQ - Water	Date Received:	05/15/02
Method:	SW846 8021B	Percent Solids:	n/a
Project:	I&W Hot Oil		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	KK002390.D	1	05/20/02	RM	n/a	n/a	GKK122
Run #2							

Purgeable Aromatics

CAS No.	Compound	Result	RL	Units	Q
71-43-2	Benzene	ND	1.0	ug/l	
108-88-3	Toluene	ND	1.0	ug/l	
100-41-4	Ethylbenzene	ND	1.0	ug/l	
1330-20-7	Xylenes (total)	ND	3.0	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
460-00-4	4-Bromofluorobenzene	85%		63-123%
98-08-8	aaa-Trifluorotoluene	97%		70-130%

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	TB-1		
Lab Sample ID:	T2695-7	Date Sampled:	05/14/02
Matrix:	AQ - Trip Blank Water	Date Received:	05/15/02
Method:	SW846 8021B	Percent Solids:	n/a
Project:	I&W Hot Oil		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	KK002394.D	200	05/20/02	RM	n/a	n/a	GKK122
Run #2							

Purgeable Aromatics

CAS No.	Compound	Result	RL	Units	Q
71-43-2	Benzene	ND	1.0	ug/l	
108-88-3	Toluene	ND	1.0	ug/l	
100-41-4	Ethylbenzene	ND	1.0	ug/l	
1330-20-7	Xylenes (total)	ND	3.0	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
460-00-4	4-Bromofluorobenzene	86%		63-123%
98-08-8	**aaa-Trifluorotoluene**	**98%**		**70-130%**

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	IW2-WS-2		
Lab Sample ID:	T2695-2A	Date Sampled:	05/14/02
Matrix:	SO - Sludge	Date Received:	05/15/02
Method:	SW846 8260B	Percent Solids:	67.6
Project:	I&W Hot Oil		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	F0049268.D	20	05/29/02	BC	05/28/02	OP1028	VF451
Run #2	F0049272.D	40	05/29/02	BC	05/28/02	OP1028	VF451

VOA TCLP Leachate

CAS No.	Compound	Result	HW#	MCL	RL	Units	Q
71-43-2	Benzene	3.59 [a]	D018	0.50	0.20	mg/l	
108-90-7	Chlorobenzene	ND	D021	100	0.10	mg/l	
67-66-3	Chloroform	ND	D022	6.0	0.10	mg/l	
56-23-5	Carbon tetrachloride	ND	D019	0.50	0.10	mg/l	
75-35-4	1,1-Dichloroethylene	ND	D029	0.70	0.10	mg/l	
107-06-2	1,2-Dichloroethane	ND	D028	0.50	0.10	mg/l	
78-93-3	Methyl ethyl ketone	ND	D035	200	0.20	mg/l	
127-18-4	Tetrachloroethylene	ND	D039	0.70	0.10	mg/l	
79-01-6	Trichloroethylene	ND	D040	0.50	0.10	mg/l	
75-01-4	Vinyl chloride	ND	D043	0.20	0.10	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	102%	102%	86-118%
2037-26-5	Toluene-D8	98%	98%	88-110%
460-00-4	4-Bromofluorobenzene	105%	104%	86-115%
17060-07-0	1,2-Dichloroethane-D4	101%	102%	80-120%

(a) Result is from Run# 2

ND = Not detected
MCL = Maximum Contamination Level (40 CFR 261 6/96)
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	IW2-WS-2		
Lab Sample ID:	T2695-2A	Date Sampled:	05/14/02
Matrix:	SO - Sludge	Date Received:	05/15/02
Method:	SW846 8270C SW846 3510C	Percent Solids:	67.6
Project:	I&W Hot Oil		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	A01782.D	1	05/28/02	SC	05/28/02	OP1027	EA327
Run #2							

ABN TCLP Leachate

CAS No.	Compound	Result	HW#	MCL	RL	Units	Q
95-48-7	2-Methylphenol	ND	D023	200	0.050	mg/l	
	3&4-Methylphenol	ND	D024	200	0.050	mg/l	
87-86-5	Pentachlorophenol	ND	D037	100	0.25	mg/l	
95-95-4	2,4,5-Trichlorophenol	ND	D041	400	0.050	mg/l	
88-06-2	2,4,6-Trichlorophenol	ND	D042	2.0	0.050	mg/l	
106-46-7	1,4-Dichlorobenzene	ND	D027	7.5	0.050	mg/l	
121-14-2	2,4-Dinitrotoluene	ND	D030	0.13	0.050	mg/l	
118-74-1	Hexachlorobenzene	ND	D032	0.13	0.050	mg/l	
87-68-3	Hexachlorobutadiene	ND	D033	0.50	0.050	mg/l	
67-72-1	Hexachloroethane	ND	D034	3.0	0.050	mg/l	
98-95-3	Nitrobenzene	ND	D036	2.0	0.050	mg/l	
110-86-1	Pyridine	ND	D038	5.0	0.050	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
367-12-4	2-Fluorophenol	51%		21-100%
4165-62-2	Phenol-d5	31%		10-94%
118-79-6	2,4,6-Tribromophenol	94%		10-123%
4165-60-0	Nitrobenzene-d5	91%		35-114%
321-60-8	2-Fluorobiphenyl	92%		43-116%
1718-51-0	Terphenyl-d14	93%		33-141%

ND = Not detected
MCL = Maximum Contamination Level (40 CFR 261 6/96)
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	IW2-WS-2		
Lab Sample ID:	T2695-2A	Date Sampled:	05/14/02
Matrix:	SO - Sludge	Date Received:	05/15/02
		Percent Solids:	67.6
Project:	I&W Hot Oil		

Metals Analysis, TCLP Leachate SW846 1311

Analyte	Result	HW#	MCL	RL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Arsenic	0.30	D004	5.0	0.10	mg/l	10	05/23/02	05/24/02	JA	SW846 6010B	SW846 3010A
Barium	0.36	D005	100	0.10	mg/l	10	05/23/02	05/24/02	JA	SW846 6010B	SW846 3010A
Cadmium	< 0.040	D006	1.0	0.040	mg/l	10	05/23/02	05/24/02	JA	SW846 6010B	SW846 3010A
Chromium	< 0.10	D007	5.0	0.10	mg/l	10	05/23/02	05/24/02	JA	SW846 6010B	SW846 3010A
Lead	< 0.10	D008	5.0	0.10	mg/l	10	05/23/02	05/24/02	JA	SW846 6010B	SW846 3010A
Mercury	< 0.0020	D009	0.20	0.0020	mg/l	1	05/29/02	06/01/02	JA	SW846 7470A	SW846 7470A
Selenium	< 0.10	D010	1.0	0.10	mg/l	10	05/23/02	05/24/02	JA	SW846 6010B	SW846 3010A
Silver	< 0.050	D011	5.0	0.050	mg/l	10	05/23/02	05/24/02	JA	SW846 6010B	SW846 3010A

RL = Reporting Limit
MCL = Maximum Contamination Level (40 CFR 261 6/96)

Accutest Laboratories

Report of Analysis

Client Sample ID:	IW-WS-1		
Lab Sample ID:	T2695-3A	Date Sampled:	05/14/02
Matrix:	SO - Sludge	Date Received:	05/15/02
Method:	SW846 8260B	Percent Solids:	76.8
Project:	I&W Hot Oil		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	F0049311.D	20	05/30/02	BC	05/28/02	OP1028	VF451
Run #2							

VOA TCLP Leachate

CAS No.	Compound	Result	HW#	MCL	RL	Units	Q
71-43-2	Benzene	0.194	D018	0.50	0.10	mg/l	
108-90-7	Chlorobenzene	ND	D021	100	0.10	mg/l	
67-66-3	Chloroform	ND	D022	6.0	0.10	mg/l	
56-23-5	Carbon tetrachloride	ND	D019	0.50	0.10	mg/l	
75-35-4	1,1-Dichloroethylene	ND	D029	0.70	0.10	mg/l	
107-06-2	1,2-Dichloroethane	ND	D028	0.50	0.10	mg/l	
78-93-3	Methyl ethyl ketone	ND	D035	200	0.20	mg/l	
127-18-4	Tetrachloroethylene	ND	D039	0.70	0.10	mg/l	
79-01-6	Trichloroethylene	ND	D040	0.50	0.10	mg/l	
75-01-4	Vinyl chloride	ND	D043	0.20	0.10	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	102%		86-118%
2037-26-5	Toluene-D8	98%		88-110%
460-00-4	4-Bromofluorobenzene	100%		86-115%
17060-07-0	1,2-Dichloroethane-D4	103%		80-120%

ND = Not detected
MCL = Maximum Contamination Level (40 CFR 261 6/96)
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	IW-WS-1		
Lab Sample ID:	T2695-3A	Date Sampled:	05/14/02
Matrix:	SO - Sludge	Date Received:	05/15/02
Method:	SW846 8270C SW846 3510C	Percent Solids:	76.8
Project:	I&W Hot Oil		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	A01783.D	1	05/28/02	SC	05/28/02	OP1027	EA327
Run #2							

ABN TCLP Leachate

CAS No.	Compound	Result	HW#	MCL	RL	Units	Q
95-48-7	2-Methylphenol	ND	D023	200	0.050	mg/l	
	3&4-Methylphenol	ND	D024	200	0.050	mg/l	
87-86-5	Pentachlorophenol	ND	D037	100	0.25	mg/l	
95-95-4	2,4,5-Trichlorophenol	ND	D041	400	0.050	mg/l	
88-06-2	2,4,6-Trichlorophenol	ND	D042	2.0	0.050	mg/l	
106-46-7	1,4-Dichlorobenzene	ND	D027	7.5	0.050	mg/l	
121-14-2	2,4-Dinitrotoluene	ND	D030	0.13	0.050	mg/l	
118-74-1	Hexachlorobenzene	ND	D032	0.13	0.050	mg/l	
87-68-3	Hexachlorobutadiene	ND	D033	0.50	0.050	mg/l	
67-72-1	Hexachloroethane	ND	D034	3.0	0.050	mg/l	
98-95-3	Nitrobenzene	ND	D036	2.0	0.050	mg/l	
110-86-1	Pyridine	ND	D038	5.0	0.050	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
367-12-4	2-Fluorophenol	42%		21-100%
4165-62-2	Phenol-d5	28%		10-94%
118-79-6	2,4,6-Tribromophenol	87%		10-123%
4165-60-0	Nitrobenzene-d5	82%		35-114%
321-60-8	2-Fluorobiphenyl	84%		43-116%
1718-51-0	Terphenyl-d14	81%		33-141%

ND = Not detected
MCL = Maximum Contamination Level (40 CFR 261 6/96)
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	IW-WS-1			
Lab Sample ID:	T2695-3A		Date Sampled:	05/14/02
Matrix:	SO - Sludge		Date Received:	05/15/02
			Percent Solids:	76.8
Project:	I&W Hot Oil			

Metals Analysis, TCLP Leachate SW846 1311

Analyte	Result	HW#	MCL	RL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Arsenic	<0.10	D004	5.0	0.10	mg/l	10	05/23/02	05/24/02	JA	SW846 6010B	SW846 3010A
Barium	0.73	D005	100	0.10	mg/l	10	05/23/02	05/24/02	JA	SW846 6010B	SW846 3010A
Cadmium	<0.040	D006	1.0	0.040	mg/l	10	05/23/02	05/24/02	JA	SW846 6010B	SW846 3010A
Chromium	<0.10	D007	5.0	0.10	mg/l	10	05/23/02	05/24/02	JA	SW846 6010B	SW846 3010A
Lead	<0.10	D008	5.0	0.10	mg/l	10	05/23/02	05/24/02	JA	SW846 6010B	SW846 3010A
Mercury	<0.0020	D009	0.20	0.0020	mg/l	1	05/29/02	06/01/02	JA	SW846 7470A	SW846 7470A
Selenium	<0.10	D010	1.0	0.10	mg/l	10	05/23/02	05/24/02	JA	SW846 6010B	SW846 3010A
Silver	<0.050	D011	5.0	0.050	mg/l	10	05/23/02	05/24/02	JA	SW846 6010B	SW846 3010A

RL = Reporting Limit
MCL = Maximum Contamination Level (40 CFR 261 6/96)

Analysis Request and Chain of Custody Record

Page 1 of 1

ACCUTEST. ACCUTEST LABORATORIES GULF COAST, INC.

10165 HARWIN DRIVE, SUITE 150 • HOUSTON, TEXAS 77036 • (713) 271-4700 • FAX (713) 271-4770

Project no.

Client/Project: DYNAMAC / BLM / 1&W HOT OIL

P.O.#

Lab ID No.	Field Sample No./ Identification	Date and Time	Grab	Comp	Sample Container (Size/Mat'l)	Sample Type (Liquid Sludge, Etc.)	Preservative	ANALYSIS REQUESTED	LABORATORY REMARKS
1	1W2-WS-1	5/14/02 0835	✓		4oz glass x2	SOIL	4°C	RCRA METALS (6010), TPH (8015).	Only one 4oz recvd
2	1W2-WS-2	5/14/02 0900	✓		4oz glass x5; 1x 8oz gl	SLUDGE	↓	BTEX (8021), TPH (8015), PAH (8310), METALS (6010), TCLP (1311) EXTRACT, THEN METALS, VOA, SVOA	JT/HUSE VDH
3	1W-WS-1	5/14/02 1055	✓		↓	SLUDGE	↓	BTEX (8021), PAH (8310), RCRA METALS (6010), TPH (8015) TCLP (1311) EXTRACT, THEN METALS, VOA, SVOA	
4	1W-WS-2	5/14/02 1130	✓		4oz glass x3	SOIL	↓	BTEX (8021), RCRA METALS (6010), TPH (8015)	
5	1W-WS-3	5/14/02 1130	✓		↓	SOIL	↓	BTEX (8021), RCRA METALS (6010), TPH (8015)	
6	FB-1	5/14/02 1150	✓		GLASS VOA vial	LIQUID ~~SOLIDS~~	HCl	BTEX (8021), TPH (8015)	4 x 40ml recvd.
7	TB-1				↓	LIQUID	HCl	BTEX (8021), TPH (8015)	2 x 40ml recvd.

BF

Samplers: (Print) BRYAN FREY, BROOKE LEVY	Relinquished by: (Signature) [signature]	Date: 5/14/02 Time: 1500	Received by: (Signature) FED EX	Date: Time:	COC Seal No.
Affiliation: DYNAMAC	Relinquished by: (Signature)	Date: Time:	Received by: (Signature)	Date: Time:	REC'D. ON ICE Yes LLC No
	Relinquished by: (Signature)	Date: Time:	Received by Laboratory: (Signature) [signature]	Date: 5-15-02 Time: 0900	Intact:

Results by 30 MAY 2002

Rush Charges Authorized Yes ___ No ✓

REMARKS: ANY QUESTIONS, PLEASE CALL BRYAN FREY - 240.778.1012

Data Results to: 1. BRYAN FREY 2.

Laboratory No. T2645

QC DATA SUMMARY

Blank Spike Summary

Job Number: T2695
Account: ALGC Accutest Laboratories Gulf Coast, Inc.
Project: DYNAMDGE: I&W Hot Oil

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP5172-BS	ZF05173.D	1	05/23/02	NJ	05/20/02	OP5172	GZF240

The QC reported here applies to the following samples:

Method: SW846 8015 M

T2695-1, T2695-2, T2695-3, T2695-4, T2695-5

CAS No.	Compound	Spike mg/kg	BSP mg/kg	BSP %	Limits
	TPH (C10-C40)	66.6	63.1	95	40-140

CAS No.	Surrogate Recoveries	BSP	Limits
84-15-1	o-Terphenyl	85%	60-124%

Blank Spike Summary

Job Number: T2695
Account: ALGC Accutest Laboratories Gulf Coast, Inc.
Project: DYNAMDGE: I&W Hot Oil

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP5194-BS	AA010801.D1		05/23/02	MRE	05/22/02	OP5194	GAA499

The QC reported here applies to the following samples: Method: EPA 8310

T2695-2, T2695-3

CAS No.	Compound	Spike ug/kg	BSP ug/kg	BSP %	Limits
83-32-9	Acenaphthene	3330	2710	81	56-124
208-96-8	Acenaphthylene	3330	2780	83	55-125
120-12-7	Anthracene	3330	3310	99	57-124
56-55-3	Benzo(a)anthracene	1670	1560	94	68-124
50-32-8	Benzo(a)pyrene	1670	1460	88	56-123
205-99-2	Benzo(b)fluoranthene	1670	1570	94	69-127
191-24-2	Benzo(g,h,i)perylene	1670	1510	91	67-129
207-08-9	Benzo(k)fluoranthene	1670	1580	95	68-129
218-01-9	Chrysene	1670	1680	101	70-126
53-70-3	Dibenzo(a,h)anthracene	1670	1550	93	68-127
206-44-0	Fluoranthene	3330	3030	91	67-129
86-73-7	Fluorene	3330	2940	88	62-124
193-39-5	Indeno(1,2,3-cd)pyrene	1670	1470	88	67-129
91-20-3	Naphthalene	3330	2520	76	54-125
90-12-0	1-Methylnaphthalene	3330	2590	78	54-123
91-57-6	2-Methylnaphthalene	3330	2600	78	55-123
85-01-8	Phenanthrene	3330	2990	90	66-125
129-00-0	Pyrene	3330	3090	93	[illegible]

CAS No.	Surrogate Recoveries	BSP	Limits
84-15-1	o-Terphenyl	93%	37-158%
92-94-4	p-Terphenyl	96%	59-149%

Method Blank Summary

Job Number: T2695
Account: ALGC Accutest Laboratories Gulf Coast, Inc.
Project: DYNAMDGE: I&W Hot Oil

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP5172-MB	ZF05172.D	1	05/23/02	NJ	05/20/02	OP5172	GZF240

The QC reported here applies to the following samples: Method: SW846 8015 M

T2695-1, T2695-2, T2695-3, T2695-4, T2695-5

CAS No.	Compound	Result	RL	Units	Q
	TPH (C10-C40)	ND		mg/kg	

CAS No.	Surrogate Recoveries		Limits
84-15-:	o-Terphenyl	76%	60-124%

Matrix Spike/Matrix Spike Duplicate Summary

Job Number: T2695
Account: ALGC Accutest Laboratories Gulf Coast, Inc.
Project: DYNAMDGE: I&W Hot Oil

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP5172-MS	ZF05186.D	20	05/24/02	NJ	05/20/02	OP5172	GZF241
OP5172-MSD	ZF05187.D	20	05/24/02	NJ	05/20/02	OP5172	GZF241
T2695-4	ZF05177.D	20	05/23/02	NJ	05/20/02	OP5172	GZF240

The QC reported here applies to the following samples: Method: SW846 8015 M

T2695-1, T2695-2, T2695-3, T2695-4, T2695-5

CAS No.	Compound	T2695-4 mg/kg	Q	Spike mg/kg	MS mg/kg	MS %	MSD mg/kg	MSD %	RPD	Limits Rec/RPD
	TPH (C10-C40)	15500		66	7600	3180* [a]	14400	-1671* [a]	20	40-140/25

CAS No.	Surrogate Recoveries	MS	MSD	T2695-4	Limits
84-15-1	o-Terphenyl	0%* [b]	0%* [b]	0%* [b]	60-124%

(a) Outside control limits due to high level in sample relative to spike amount.
(b) Outside control limits due to dilution.

Matrix Spike/Matrix Spike Duplicate Summary

Job Number: T2695
Account: ALGC Accutest Laboratories Gulf Coast, Inc.
Project: DYNAMDGE: I&W Hot Oil

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP5194-MS	AA010804.D	1	05/23/02	MRE	05/22/02	OP5194	GAA499
OP5194-MSD	AA010805.D	1	05/23/02	MRE	05/22/02	OP5194	GAA499
F13224-1	AA010803.D	1	05/23/02	MRE	05/22/02	OP5194	GAA499

The QC reported here applies to the following samples: Method: EPA 8310

T2695-2, T2695-3

CAS No.	Compound	F13224-1 ug/kg	Q	Spike ug/kg	MS ug/kg	MS %	MSD ug/kg	MSD %	RPD	Limits Rec/RPD
83-32-9	Acenaphthene	ND		3880	3240	83	2900	77	11	49-132/32
208-96-8	Acenaphthylene	ND		3880	3330	86	2990	80	11	49-132/28
120-12-7	Anthracene	ND		3880	3980	103	3510	94	13	27-157/25
56-55-3	Benzo(a)anthracene	ND		1940	1810	93	1590	85	13	45-150/21
50-32-8	Benzo(a)pyrene	ND		1940	1730	89	1520	81	13	54-134/23
205-99-2	Benzo(b)fluoranthene	ND		1940	1810	93	1590	85	13	55-131/21
191-24-2	Benzo(g,h,i)perylene	ND		1940	1770	91	1550	83	13	55-133/24
207-08-9	Benzo(k)fluoranthene	ND		1940	1850	95	1620	87	13	60-133/24
218-01-9	Chrysene	ND		1940	1950	100	1710	91	13	60-139/20
53-70-3	Dibenzo(a,h)anthracene	ND		1940	1820	94	1590	85	13	57-129/20
206-44-0	Fluoranthene	ND		3880	3630	94	3190	85	13	55-139/20
86-73-7	Fluorene	ND		3880	3500	90	3130	84	11	58-126/25
193-39-5	Indeno(1,2,3-cd)pyrene	ND		1940	1730	89	1510	81	14	54-133/25
91-20-3	Naphthalene	ND		3880	2970	77	2620	70	13	35-139/31
90-12-0	1-Methylnaphthalene	ND		3880	3070	79	2740	73	11	37-135/27
91-57-6	2-Methylnaphthalene	ND		3880	3080	79	2750	73	11	41-129/36
85-01-8	Phenanthrene	ND		3880	3560	92	3180	85	11	42-150/30
129-00-0	Pyrene	ND		3880	3690	95	3260	87	12	54-140/20

CAS No.	Surrogate Recoveries	MS	MSD	F13224-1	Limits
84-15-1	o-Terphenyl	92%	86%	77%	37-158%
92-94-4	p-Terphenyl	93%	86%	82%	59-149%

Method Blank Summary

Job Number: T2695
Account: ALGC Accutest Laboratories Gulf Coast, Inc.
Project: DYNAMDGE: I&W Hot Oil

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP5172-MB	ZF05185.D	1	05/24/02	NJ	05/20/02	OP5172	GZF241

The QC reported here applies to the following samples: Method: SW846 8015 M

T2695-1, T2695-2, T2695-3, T2695-4, T2695-5

CAS No.	Compound	Result	RL	Units	Q
	TPH (C10-C40)	ND		mg/kg	

CAS No.	Surrogate Recoveries		Limits
84-15-1	o-Terphenyl	81%	60-124%

Method Blank Summary

Job Number: T2695
Account: ALGC Accutest Laboratories Gulf Coast, Inc.
Project: DYNAMDGE: I&W Hot Oil

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP5194-MB	AA010802.D	1	05/23/02	MRE	05/22/02	OP5194	GAA499

The QC reported here applies to the following samples: Method: EPA 8310

T2695-2, T2695-3

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	670	ug/kg	
208-96-8	Acenaphthylene	ND	670	ug/kg	
120-12-7	Anthracene	ND	330	ug/kg	
56-55-3	Benzo(a)anthracene	ND	330	ug/kg	
50-32-8	Benzo(a)pyrene	ND	67	ug/kg	
205-99-2	Benzo(b)fluoranthene	ND	67	ug/kg	
191-24-2	Benzo(g,h,i)perylene	ND	67	ug/kg	
207-08-9	Benzo(k)fluoranthene	ND	67	ug/kg	
218-01-9	Chrysene	ND	330	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	67	ug/kg	
206-44-0	Fluoranthene	ND	330	ug/kg	
86-73-7	Fluorene	ND	330	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	67	ug/kg	
91-20-3	Naphthalene	ND	330	ug/kg	
90-12-0	1-Methylnaphthalene	ND	330	ug/kg	
91-57-6	2-Methylnaphthalene	ND	330	ug/kg	
85-01-8	Phenanthrene	ND	330	ug/kg	
129-00-0	Pyrene	ND	330	ug/kg	

CAS No.	Surrogate Recoveries		Limits
84-15-1	o-Terphenyl	86%	37-158%
92-94-4	p-Terphenyl	93%	59-149%

DUPLICATE RESULTS SUMMARY
GENERAL CHEMISTRY

Login Number: T2695
DYNAMDGE - Dynamac Corporation Environmental Serv
Project: DYNAMDGE535 - I&W Hot Oil

Analyte	Batch ID	QC Sample	Units	Original Result	DUP Result	RPD	QC Limits
Solids, Percent	GN2799	[illegible]	%	75.7	[illegible]	[illegible]	[illegible]
Solids, Percent	GN2799	[illegible]	%	[illegible]	[illegible]	[illegible]	[illegible]
Solids, Percent	GN2799	[illegible]	%	[illegible]	[illegible]	[illegible]	[illegible]

Associated Samples:
Batch GN2799: T2695-1, T2695-2, T2695-3 '2695-4

Blank Spike Summary

Job Number: T2695
Account: DYNAMDGE Dynamac Corporation Environmental Serv
Project: I&W Hot Oil

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
GKK122-BS	KK002378.D	1	05/20/02	RM	n/a	n/a	GKK122

The QC reported here applies to the following samples: Method: SW846 8021B

T2695-6, T2695-7

CAS No.	Compound	Spike ug/l	BSP ug/l	BSP %	Limits
71-43-2	Benzene	20	18.7	94	50-124
100-41-4	Ethylbenzene	20	18.7	94	52-131
108-88-3	Toluene	20	18.2	91	56-123
1330-20-7	Xylenes (total)	60	54.6	91	54-129

CAS No.	Surrogate Recoveries	BSP	Limits
460-00-4	4-Bromofluorobenzene	94%	63-123%
98-08-8	aaa-Trifluorotoluene	101%	70-130%

Blank Spike Summary

Job Number: T2695
Account: DYNAMDGE Dynamac Corporation Environmental Serv.
Project: I&W Hot Oil

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
GKK125-BS	KK002445.D	50	05/23/02	RM	n/a	n/a	GKK125

The QC reported here applies to the following samples: Method: SW846 8021B

T2695-2, T2695-3, T2695-4, T2695-5

CAS No.	Compound	Spike ug/kg	BSP ug/kg	BSP %	Limits
71-43-2	Benzene	1000	937	94	59-137
100-41-4	Ethylbenzene	1000	961	96	62-136
108-88-3	Toluene	1000	926	93	64-131
1330-20-7	Xylenes (total)	3000	2810	94	66-140

CAS No.	Surrogate Recoveries	BSP	Limits
460-00-4	4-Bromofluorobenzene	95%	66-141%
98-08-8	aaa-Trifluorotoluene	99%	70-130%

Method Blank Summary

Job Number: T2695
Account: DYNAMDGE Dynamac Corporation Environmental Serv.
Project: I&W Hot Oil

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
GKK122-MB	KK002379.D	1	05/20/02	RM	n/a	n/a	GKK122

The QC reported here applies to the following samples:

Method: SW846 8021B

T2695-6, T2695-7

CAS No.	Compound	Result	RL	Units	Q
71-43-2	Benzene	ND	1.0	ug/l	
100-41-4	Ethylbenzene	ND	1.0	ug/l	
108-88-3	Toluene	ND	1.0	ug/l	
1330-20-7	Xylenes (total)	ND	3.0	ug/l	

CAS No.	Surrogate Recoveries		Limits
460-00-4	4-Bromofluorobenzene	86%	63-123%
98-08-8	aaa-Trifluorotoluene	97%	70-130%

Method Blank Summary

Job Number: T2695
Account: DYNAMDGE Dynamac Corporation Environmental Serv
Project: I&W Hot Oil

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
GKK125-MB	KK002446.D	50	05/23/02	RM	n/a	n/a	GKK125

The QC reported here applies to the following samples:

Method: SW846 8021B

T2695-2, T2695-3, T2695-4, T2695-5

CAS No.	Compound	Result	RL	Units	Q
71-43-2	Benzene	ND	50	ug/kg	
100-41-4	Ethylbenzene	ND	50	ug/kg	
108-88-3	Toluene	ND	50	ug/kg	
1330-20-7	Xylenes (total)	ND	150	ug/kg	

CAS No.	Surrogate Recoveries		Limits
460-00-4	4-Bromofluorobenzene	88%	66-141%
98-08-8	aaa-Trifluorotoluene	99%	70-130%

Matrix Spike/Matrix Spike Duplicate Summary

Job Number: T2695
Account: DYNAMDGE Dynamac Corporation Environmental Serv.
Project: I&W Hot Oil

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
T2695-6MS	KK002391.D	1	05/20/02	RM	n/a	n/a	GKK122
T2695-6MSD	KK002392.D	1	05/20/02	RM	n/a	n/a	GKK122
T2695-6	KK002390.D	1	05/20/02	RM	n/a	n/a	GKK122

The QC reported here applies to the following samples: Method: SW846 8021B

T2695-6, T2695-7

CAS No.	Compound	T2695-6 ug/l	Q	Spike ug/l	MS ug/l	MS %	MSD ug/l	MSD %	RPD	Limits Rec/RPD
71-43-2	Benzene	ND		20	18.0	90	17.7	89	[illegible]	32-128/33
100-41-4	Ethylbenzene	ND		20	18.5	93	18.2	91	[illegible]	41-133/37
108-88-3	Toluene	ND		20	17.8	89	17.5	88	[illegible]	37-129/36
1330-20-7	Xylenes (total)	ND		60	53.8	90	52.5	88	[illegible]	46-128/25

CAS No.	Surrogate Recoveries	MS	MSD	T2695-6	Limits
460-00-4	4-Bromofluorobenzene	94%	93%	85%	63-123%
98-08-8	aaa-Trifluorotoluene	97%	98%	97%	70-130%

Matrix Spike/Matrix Spike Duplicate Summary

Job Number: T2695
Account: DYNAMDGE Dynamac Corporation Environmental Serv.
Project: I&W Hot Oil

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
T2698-18MS	KK002448.D	50	05/23/02	RM	n/a	n/a	GKK125
T2698-18MSD	KK002449.D	50	05/23/02	RM	n/a	n/a	GKK125
T2698-18	KK002447.D	50	05/23/02	RM	n/a	n/a	GKK125

The QC reported here applies to the following samples: Method: SW846 8021B

T2695-2, T2695-3, T2695-4, T2695-5

CAS No.	Compound	T2698-18 ug/kg	Q	Spike ug/kg	MS ug/kg	MS %	MSD ug/kg	MSD %	RPD	Limits Rec/RPD
71-43-2	Benzene	ND		1270	1150	91	1110	87	4	42-146/30
100-41-4	Ethylbenzene	ND		1270	1190	94	1140	90	4	40-140/34
108-88-3	Toluene	ND		1270	1130	89	1090	86	4	55-125/25
1330-20-7	Xylenes (total)	ND		3810	3470	91	3330	87	4	46-137/35

CAS No.	Surrogate Recoveries	MS	MSD	T2698-18	Limits
460-00-4	4-Bromofluorobenzene	99%	93%	77%	66-141%
98-08-8	aaa-Trifluorotoluene	101%	94%	88%	70-130%

Blank Spike Summary

Job Number: T2695
Account: DYNAMDGE Dynamac Corporation Environmental Serv.
Project: I&W Hot Oil

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP1027-BS	A01780.D	1	05/28/02	SC	05/28/02	OP1027	EA327

The QC reported here applies to the following samples:

Method: SW846 8270C

T2695-2A, T2695-3A

CAS No.	Compound	Spike ug/l	BSP ug/l	BSP %	Limits
95-48-7	2-Methylphenol	500	377	75	26-125
	3&4-Methylphenol	1000	759	76	20-151
87-86-5	Pentachlorophenol	500	429	86	10-144
95-95-4	2,4,5-Trichlorophenol	500	454	91	39-125
88-06-2	2,4,6-Trichlorophenol	500	436	87	43-125
106-46-7	1,4-Dichlorobenzene	500	330	66	10-125
121-14-2	2,4-Dinitrotoluene	500	461	92	21-140
118-74-1	Hexachlorobenzene	500	533	107	43-125
87-68-3	Hexachlorobutadiene	500	268	54	10-125
67-72-1	Hexachloroethane	500	308	62	10-125
98-95-3	Nitrobenzene	500	466	93	26-125
110-86-1	Pyridine	500	240	48	10-125

CAS No.	Surrogate Recoveries	BSP	Limits
367-12-4	2-Fluorophenol	61%	21-100%
4165-62-2	Phenol-d5	45%	10-94%
118-79-6	2,4,6-Tribromophenol	98%	10-123%
4165-60-0	Nitrobenzene-d5	97%	35-114%
321-60-8	2-Fluorobiphenyl	100%	43-116%
1718-51-0	Terphenyl-d14	88%	33-141%

Duplicate Summary

Job Number: T2695
Account: DYNAMDGE Dynamac Corporation Environmental Serv
Project: I&W Hot Oil

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP1027-DUP	A01786.D	1	05/28/02	SC	05/28/02	OP1027	EA327
T2695-2A	A01782.D	1	05/28/02	SC	05/28/02	OP1027	EA327

The QC reported here applies to the following samples: Method: SW846 8270C

T2695-2A, T2695-3A

CAS No.	Compound	T2695-2A ug/l	Q	DUP ug/l	Q	RPD	Limits
95-48-7	2-Methylphenol	ND		ND		nc	30
	3&4-Methylphenol	ND		ND		nc	44
87-86-5	Pentachlorophenol	ND		ND		nc	44
95-95-4	2,4,5-Trichlorophenol	ND		ND		nc	40
88-06-2	2,4,6-Trichlorophenol	ND		ND		nc	43
106-46-7	1,4-Dichlorobenzene	ND		ND		nc	58
121-14-2	2,4-Dinitrotoluene	ND		ND		nc	39
118-74-1	Hexachlorobenzene	ND		ND		nc	33
87-68-3	Hexachlorobutadiene	ND		ND		nc	57
67-72-1	Hexachloroethane	ND		ND		nc	56
98-95-3	Nitrobenzene	ND		ND		nc	42
110-86-1	Pyridine	ND		ND		nc	67

CAS No.	Surrogate Recoveries	DUP	T2695-2A	Limits
367-12-4	2-Fluorophenol	37%	51%	21-100%
4165-62-2	Phenol-d5	25%	31%	10-94%
118-79-6	2,4,6-Tribromophenol	71%	94%	10-123%
4165-60-0	Nitrobenzene-d5	67%	91%	35-114%
321-60-8	2-Fluorobiphenyl	72%	92%	43-116%
1718-51-0	Terphenyl-d14	68%	93%	33-141%

Leachate Blank Summary

Job Number: T2695
Account: DYNAMDGE Dynamac Corporation Environmental Serv
Project: I&W Hot Oil

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP1027-LB	A01781.D	1	05/28/02	SC	05/28/02	OP1027	EA327

The QC reported here applies to the following samples: Method: SW846 8270C

T2695-2A, T2695-3A

CAS No.	Compound	Result	RL	Units	Q
95-48-7	2-Methylphenol	ND	50	ug/l	
	3&4-Methylphenol	ND	50	ug/l	
87-86-5	Pentachlorophenol	ND	250	ug/l	
95-95-4	2,4,5-Trichlorophenol	ND	50	ug/l	
88-06-2	2,4,6-Trichlorophenol	ND	50	ug/l	
106-46-7	1,4-Dichlorobenzene	ND	50	ug/l	
121-14-2	2,4-Dinitrotoluene	ND	50	ug/l	
118-74-1	Hexachlorobenzene	ND	50	ug/l	
87-68-3	Hexachlorobutadiene	ND	50	ug/l	
67-72-1	Hexachloroethane	ND	50	ug/l	
98-95-3	Nitrobenzene	ND	50	ug/l	
110-86-1	Pyridine	ND	50	ug/l	

CAS No.	Surrogate Recoveries		Limits
367-12-4	2-Fluorophenol	49%	21-100%
4165-62-2	Phenol-d5	32%	10-94%
118-79-6	2,4,6-Tribromophenol	81%	10-123%
4165-60-0	Nitrobenzene-d5	86%	35-114%
321-60-8	2-Fluorobiphenyl	91%	43-116%
1718-51-0	Terphenyl-d14	83%	33-141%

Matrix Spike/Matrix Spike Duplicate Summary

Job Number: T2695
Account: DYNAMDGE Dynamac Corporation Environmental Serv
Project: I&W Hot Oil

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP1027-MS	A01784.D	1	05/28/02	SC	05/28/02	OP1027	EA327
OP1027-MSD	A01785.D	1	05/28/02	SC	05/28/02	OP1027	EA327
T2695-2A	A01782.D	1	05/28/02	SC	05/28/02	OP1027	EA327

The QC reported here applies to the following samples:

Method: SW846 8270C

T2695-2A, T2695-3A

CAS No.	Compound	T2695-2A ug/l	Q	Spike ug/l	MS ug/l	MS %	MSD ug/l	MSD %	RPD	Limits Rec/RPD
95-48-7	2-Methylphenol	ND		500	353	71	336	67	5	10-126/30
	3&4-Methylphenol	ND		1000	655	66	656	66	0	10-149/44
87-86-5	Pentachlorophenol	ND		500	488	98	516	103	6	10-181/44
95-95-4	2,4,5-Trichlorophenol	ND		500	433	87	439	88	1	12-140/40
88-06-2	2,4,6-Trichlorophenol	ND		500	392	78	410	82	4	11-139/38
106-46-7	1,4-Dichlorobenzene	ND		500	278	56	272	54	2	10-125/58
121-14-2	2,4-Dinitrotoluene	ND		500	433	87	459	92	6	11-125/39
118-74-1	Hexachlorobenzene	ND		500	465	93	468	94	1	42-125/33
87-68-3	Hexachlorobutadiene	ND		500	207	41	196	39	5	16-125/57
67-72-1	Hexachloroethane	ND		500	267	53	259	52	3	10-125/56
98-95-3	Nitrobenzene	ND		500	413	83	428	86	4	12-125/42
110-86-1	Pyridine	ND		500	234	47	217	43	8	10-125/67

CAS No.	Surrogate Recoveries	MS	MSD	T2695-2A	Limits
367-12-4	2-Fluorophenol	45%	46%	51%	21-100%
4165-62-2	Phenol-d5	32%	31%	31%	10-94%
118-79-6	2,4,6-Tribromophenol	91%	95%	94%	10-123%
4165-60-0	Nitrobenzene-d5	86%	89%	91%	35-114%
321-60-8	2-Fluorobiphenyl	90%	92%	92%	43-116%
1718-51-0	Terphenyl-d14	73%	70%	93%	33-141%

Blank Spike Summary

Job Number: T2695
Account: DYNAMDGE Dynamac Corporation Environmental Serv
Project: I&W Hot Oil

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP1028-BS	F0049264.D	20	05/29/02	BC	05/28/02	OP1028	VF451

The QC reported here applies to the following samples: Method: SW846 8260B

T2695-2A, T2695-3A

CAS No.	Compound	Spike ug/l	BSP ug/l	BSP %	Limits
71-43-2	Benzene	500	504	101	74-138
108-90-7	Chlorobenzene	500	463	93	72-131
67-66-3	Chloroform	500	481	96	66-133
56-23-5	Carbon tetrachloride	500	496	99	58-141
75-35-4	1,1-Dichloroethylene	500	526	105	60-143
107-06-2	1,2-Dichloroethane	500	446	89	64-129
78-93-3	Methyl ethyl ketone	2500	2040	82	50-151
127-18-4	Tetrachloroethylene	500	497	99	75-126
79-01-6	Trichloroethylene	500	487	97	72-128
75-01-4	Vinyl chloride	500	828	166* a	61-125

CAS No.	Surrogate Recoveries	BSP	Limits
1868-53-7	Dibromofluoromethane	102%	86-118%
17060-07-0	1,2-Dichloroethane-D4	99%	80-120%
2037-26-5	Toluene-D8	100%	88-110%
460-00-4	4-Bromofluorobenzene	101%	86-115%

(a) Outside control limits but not detected in the samples.

Leachate Blank Summary

Job Number: T2695
Account: DYNAMDGE Dynamac Corporation Environmental Serv.
Project: I&W Hot Oil

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP1028-MB	F0049265.D	20	05/29/02	BC	05/28/02	OP1028	VF451

The QC reported here applies to the following samples: Method: SW846 8260B

T2695-2A, T2695-3A

CAS No.	Compound	Result	RL	Units	Q
71-43-2	Benzene	ND	100	ug/l	
108-90-7	Chlorobenzene	ND	100	ug/l	
67-66-3	Chloroform	ND	100	ug/l	
56-23-5	Carbon tetrachloride	ND	100	ug/l	
75-35-4	1,1-Dichloroethylene	ND	100	ug/l	
107-06-2	1,2-Dichloroethane	ND	100	ug/l	
78-93-3	Methyl ethyl ketone	ND	200	ug/l	
127-18-4	Tetrachloroethylene	ND	100	ug/l	
79-01-6	Trichloroethylene	ND	100	ug/l	
75-01-4	Vinyl chloride	ND	100	ug/l	

CAS No.	Surrogate Recoveries		Limits
1868-53-7	Dibromofluoromethane	102%	86-1 8%
17060-07-0	1,2-Dichloroethane-D4	101%	80-1 :0%
2037-26-5	Toluene-D8	98%	88-1 0%
460-00-4	4-Bromofluorobenzene	107%	86-1 5%

Matrix Spike/Matrix Spike Duplicate Summary

Job Number: T2695
Account: DYNAMDGE Dynamac Corporation Environmental Serv
Project: I&W Hot Oil

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
T2695-3AMS	F0049312.D	20	05/30/02	BC	n/a	n/a	VF451
T2695-3AMSD	F0049313.D	20	05/30/02	BC	n/a	n/a	VF451
T2695-3A	F0049311.D	20	05/30/02	BC	05/28/02	OP1028	VF451

The QC reported here applies to the following samples:

Method: SW846 8260B

T2695-2A, T2695-3A

CAS No.	Compound	T2695-3A ug/l	Q	Spike ug/l	MS ug/l	MS %	MSD ug/l	MSD %	RPD	Limits Rec/RPD
71-43-2	Benzene	194		500	729	107	713	104	2	47-141/16
108-90-7	Chlorobenzene	ND		500	504	101	487	97	3	66-131/15
67-66-3	Chloroform	ND		500	517	103	503	101	3	38-148/18
56-23-5	Carbon tetrachloride	ND		500	561	112	543	109	3	26-145/25
75-35-4	1,1-Dichloroethylene	ND		500	545	109	549	110		20-161/21
107-06-2	1,2-Dichloroethane	ND		500	494	99	488	98	1	37-158/15
78-93-3	Methyl ethyl ketone	ND		2500	2470	99	2540	102	3	12-178/18
127-18-4	Tetrachloroethylene	ND		500	559	112	526	105	6	20-133/15
79-01-6	Trichloroethylene	ND		500	540	108	531	106	2	40-152/18
75-01-4	Vinyl chloride	ND		500	508	102	539	108	6	16-148/51

CAS No.	Surrogate Recoveries	MS	MSD	T2695-3A	Limits
1868-53-7	Dibromofluoromethane	103%	101%	102%	86-118%
17060-07-0	1,2-Dichloroethane-D4	101%	99%	103%	80-120%
2037-26-5	Toluene-D8	99%	99%	98%	88-110%
460-00-4	4-Bromofluorobenzene	96%	101%	100%	86-115%

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: T2695
Account: DYNAMDGE - Dynamac Corporation Environmental Serv.
Project: DYNAMDGE535 - I&W Hot Oil

QC Batch ID: MP948
Matrix Type: SOLID

Methods: SW846 6010B
Units: mg/kg

Prep Date: 05/17/02

Metal	RL	IDL	MB raw	final
Aluminum	10	.4		
Antimony	0.50	.07		
Arsenic	1.0	.06	0.085	<1.0
Barium	0.50	.01	0.029	<0.50
Beryllium	0.50	.02		
Boron	25	.2		
Cadmium	0.50	.02	0.023	<0.50
Calcium	50	.45		
Chromium	1.5	.05	0.047	<1.5
Cobalt	0.50	.025		
Copper	1.0	.05		
Iron	15	.7		
Lead	0.50	.07	0.049	<0.50
Lithium	0.50	.02		
Magnesium	50	.2		
Manganese	1.5	.015		
Molybdenum	1.0	.05		
Nickel	2.0	.065		
Potassium	50	.45		
Selenium	0.50	.085	-0.050	<0.50
Silicon	60	.35		
Silver	1.0	.03	-0.0090	<1.0
Sodium	50	.4		
Strontium	0.50	.005		
Thallium	0.50	.1		
Titanium	0.50	.02		
Uranium	5.3	.22		
Vanadium	0.50	.025		
Zinc	1.0	.025		

Associated samples MP948: T2695-1, T2695-2, T2695-3, T2695-4, T2695-5

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(anr) Analyte not requested

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: T2695
Account: DYNAMDGE - Dynamac Corporation Environmental Serv.
Project: DYNAMDGE535 - I&W Hot Oil

QC Batch ID: MP948
Matrix Type: SOLID

Methods: SW846 6010B
Units: mg/kg

Prep Date:	05/17/02				05/17/02				
Metal	T2652-1 Original	DUP	RPD	QC Limits	T2652-1 Original	MS	Spikelot MPTS1	% Rec	QC Limits
Aluminum									
Antimony									
Arsenic	6.4	6.4	0.0	0-20	6.4	57.2	51.2	99.1	75-125
Barium	269	285	5.8	0-20	269	318	51.2	95.6	75-125
Beryllium									
Boron									
Cadmium	0.57	0.55	3.6	0-20	0.57	47.0	51.2	90.6	75-125
Calcium									
Chromium	11.0	12.8	15.1	0-20	11.0	57.8	51.2	91.3	75-125
Cobalt									
Copper									
Iron									
Lead	78.2	65.9	17.1	0-20	78.2	114	51.2	69.9N(b)	75-125
Lithium									
Magnesium									
Manganese									
Molybdenum									
Nickel									
Potassium									
Selenium	0.51	0.75	38.1 (a)	0-20	0.51	44.8	51.2	86.4	75-125
Silicon									
Silver	0.0	0.0	NC	0-20	0.0	18.8	20.5	91.7	75-125
Sodium									
Strontium									
Thallium									
Titanium									
Uranium									
Vanadium									
Zinc									

Associated samples MP948: T2695-1, T2695-2, T2695-3, T2695-4, T2695-5

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(N) Matrix Spike Rec. outside of QC limits
(anr) Analyte not requested
(a) RPD acceptable due to low duplicate and sample concentrations.
(b) Post-spike recovery for Pb(T2652-1):90.8%

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: T2695
Account: DYNAMDGE - Dynamac Corporation Environmental Serv.
Project: DYNAMDGE535 - I&W Hot Oil

QC Batch ID: MP948
Matrix Type: SOLID

Methods: SW846 6010B
Units: mg/kg

Prep Date:				05/17/02				05/17/02	
Metal	T2652-1 Original	MSD	Spikelot MPTS1	% Rec	QC Limits	T2658-1 Original	DUP	RPD	QC Limits
Aluminum									
Antimony									
Arsenic	6.4	54.5	51.2	93.9	75-125	2.0	5.2	88.9*(a)	0-20
Barium	269	330	51.2	119.1	75-125	62.4	44.8	32.8*(a)	0-20
Beryllium									
Boron									
Cadmium	0.57	47.3	51.2	91.2	75-125	0.047	0.0	200.0(b)	0-20
Calcium									
Chromium	11.0	59.2	51.2	94.1	75-125	6.4	8.4	27.0*(a)	0-20
Cobalt									
Copper									
Iron									
Lead	78.2	123	51.2	87.4	75-125	7.7	9.7	23.0*(a)	0-20
Lithium									
Magnesium									
Manganese									
Molybdenum									
Nickel									
Potassium									
Selenium	0.51	44.2	51.2	85.3	75-125	0.50	1.2	82.4*(a)	0-20
Silicon									
Silver	0.0	18.7	20.5	91.2	75-125	0.0	0.0	NC	0-20
Sodium									
Strontium									
Thallium									
Titanium									
Uranium									
Vanadium									
Zinc									

Associated samples MP948: T2695-1, T2695-2, T2695-3, T2695-4, T2695-5

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(N) Matrix Spike Rec. outside of QC limits
(anr) Analyte not requested
(a) High RPD due to possible sample nonhomogeneity.
(b) RPD acceptable due to low duplicate and sample concentrations.

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: T2695
Account: DYNAMDGE - Dynamac Corporation Environmental Serv.
Project: DYNAMDGE535 - I&W Hot Oil

QC Batch ID: MP948
Matrix Type: SOLID

Methods: SW846 6010B
Units: mg/kg

Prep Date: 05/17/02 05/17/02

Metal	T2658-1 Original	MS	Spikelot MPTS1	% Rec	QC Limits	T2658-1 Original	MSD	Spikelot MPTS1	% Rec	QC Limits
Aluminum										
Antimony										
Arsenic	2.0	54.0	56.2	92.6	75-125	2.0	55.4	55.6	96.0	75-125
Barium	62.4	79.6	56.2	30.6N(a)	75-125	62.4	75.5	55.6	23.6N(a)	75-125
Beryllium										
Boron										
Cadmium	0.047	56.1	56.2	99.8	75-125	0.047	56.6	55.6	101.7	75-125
Calcium										
Chromium	6.4	61.2	56.2	97.6	75-125	6.4	62.2	55.6	100.4	75-125
Cobalt										
Copper										
Iron										
Lead	7.7	66.9	56.2	105.4	75-125	7.7	59.5	55.6	93.2	75-125
Lithium										
Magnesium										
Manganese										
Molybdenum										
Nickel										
Potassium										
Selenium	0.50	48.2	56.2	84.9	75-125	0.50	49.3	55.6	87.8	75-125
Silicon										
Silver	0.0	20.8	22.5	92.6	75-125	0.0	21.0	22.2	94.4	75-125
Sodium										
Strontium										
Thallium										
Titanium										
Uranium										
Vanadium										
Zinc										

Associated samples MP948: T2695-1, T2695-2, T2695-3, T2695-4, T2695-5

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(N) Matrix Spike Rec. outside of QC limits
(anr) Analyte not requested
(a) Post-spike recovery for Ba(T2658-1):99.8%

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: T2695
Account: DYNAMDGE - Dynamac Corporation Environmental Serv.
Project: DYNAMDGE535 - I&W Hot Oil

QC Batch ID: MP948
Matrix Type: SOLID

Methods: SW846 6010B
Units: mg/kg

Prep Date: 05/17/02

Metal	BSP Result	Spikelot MPTS1	% Rec	QC Limits
Aluminum				
Antimony				
Arsenic	53.2	50	106.4	80-120
Barium	52.8	50	105.6	80-120
Beryllium				
Boron				
Cadmium	53.2	50	106.4	80-120
Calcium				
Chromium	52.2	50	104.4	80-120
Cobalt				
Copper				
Iron				
Lead	50.3	50	100.6	80-120
Lithium				
Magnesium				
Manganese				
Molybdenum				
Nickel				
Potassium				
Selenium	46.6	50	93.2	80-120
Silicon				
Silver	19.9	20	99.5	80-120
Sodium				
Strontium				
Thallium				
Titanium				
Uranium				
Vanadium				
Zinc				

Associated samples MP948: T2695-1, T2695-2, T2695-3, T2695-4, T2695-5

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(anr) Analyte not requested

SERIAL DILUTION RESULTS SUMMARY

Login Number: T2695
Account: DYNAMDGE - Dynamac Corporation Environmental Serv.
Project: DYNAMDGE535 - I&W Hot Oil

QC Batch ID: MP948 Methods: SW846 6010B
Matrix Type: SOLID Units: ug/l

Prep Date: 05/17/02 05/17/02

Metal	T2652-1 Original	SDL 1:5	RPD	QC Limits	T2658-1 Original	SDL 1:5	RPD	QC Limits
Aluminum								
Antimony								
Arsenic	125	135	8.0	0-10	35.5	40.6	14.4 (b)	0-10
Barium	5280	6010	13.8*(a)	0-10	1110	1250	12.5*(a)	0-10
Beryllium								
Boron								
Cadmium	11.2	14.2	26.6 (b)	0-10	0.840	0.00	100.0(b)	0-10
Calcium								
Chromium	215	243	12.6*(a)	0-10	114	122	6.4	0-10
Cobalt								
Copper								
Iron								
Lead	1530	1770	15.6*(a)	0-10	137	152	10.6*(a)	0-10
Lithium								
Magnesium								
Manganese								
Molybdenum								
Nickel								
Potassium								
Selenium	10.0	13.1	30.8 (b)	0-10	8.93	0.00	100.0(b)	0-10
Silicon								
Silver	0.00	0.00	NC	0-10	0.00	0.00	NC	0-10
Sodium								
Strontium								
Thallium								
Titanium								
Uranium								
Vanadium								
Zinc								

Associated samples MP948: T2695-1, T2695-2, T2695-3, T2695-4, T2695-5

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(anr) Analyte not requested
(a) Serial dilution indicates possible matrix interference.
(b) Percent difference acceptable due to low initial sample concentration (< 50 times IDL).

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: T2695
Account: DYNAMDGE - Dynamac Corporation Environmental Serv.
Project: DYNAMDGE535 - I&W Hot Oil

QC Batch ID: MP967
Matrix Type: SOLID

Methods: SW846 7471A
Units: mg/kg

Prep Date: 05/29/02

Metal	RL	IDL	MB raw	final
Mercury	0.067	.01	0.028	<0.067

Associated samples MP967: T2695-1, T2695-2, T2695-3, T2695-4

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(anr) Analyte not requested

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: T2695
Account: DYNAMDGE - Dynamac Corporation Environmental Serv.
Project: DYNAMDGE535 - I&W Hot Oil

QC Batch ID: MP967
Matrix Type: SOLID

Methods: SW846 7471A
Units: mg/kg

Prep Date: 05/29/02 05/29/02

Metal	T2670-4 Original	DUP	RPD	QC Limits	T2670-4 Original	MS	Spikelot HGTXWS1	% Rec	QC Limits
Mercury	0.039	0.040	2.5	0-20	0.039	2.1	2	105.3	75-125

Associated samples MP967: T2695-1, T2695-2, T2695-3, T2695-4

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(N) Matrix Spike Rec. outside of QC limits
(anr) Analyte not requested

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: T2695
Account: DYNAMDGE - Dynamac Corporation Environmental Serv.
Project: DYNAMDGE535 - I&W Hot Oil

QC Batch ID: MP967
Matrix Type: SOLID

Methods: SW846 7471A
Units: mg/kg

Prep Date: 05/29/02

Metal	T2670-4 Original	MSD	Spikelot HGTXWS1	% Rec	QC Limits
Mercury	0.039	2.1	2	105.3	75-125

Associated samples MP967: T2695-1, T2695-2, T2695-3, T2695-4

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(N) Matrix Spike Rec. outside of QC limits
(anr) Analyte not requested

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: T2695
Account: DYNAMDGE - Dynamac Corporation Environmental Serv.
Project: DYNAMDGE535 - I&W Hot Oil

QC Batch ID: MP967
Matrix Type: SOLID

Methods: SW846 7471A
Units: mg/kg

Prep Date: 05/29/02

Metal	BSP Result	Spikelot HGTXWS1	% Rec	QC Limits
Mercury	1.7	1.7	102.0	80-120

Associated samples MP967: T2695-1, T2695-2, T2695-3, T2695-4

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(anr) Analyte not requested

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: T2695
Account: DYNAMDGE - Dynamac Corporation Environmental Serv.
Project: DYNAMDGE535 - I&W Hot Oil

QC Batch ID: MP968
Matrix Type: SOLID

Methods: SW846 7471A
Units: mg/kg

Prep Date: 05/29/02

Metal	RL	IDL	MB raw	final
Mercury	0.067	.01	0.025	<0.067

Associated samples MP968: T2695-5

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(anr) Analyte not requested

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: T2695
Account: DYNAMDGE - Dynamac Corporation Environmental Serv.
Project: DYNAMDGE535 - I&W Hot Oil

QC Batch ID: MP968
Matrix Type: SOLID

Methods: SW846 7471A
Units: mg/kg

Prep Date: 05/29/02 05/29/02

Metal	T2677-20 Original	DUP	RPD	QC Limits	T2677-20 Original	MS	Spikelot HGTXWS1	% Rec	QC Limits
Mercury	0.0	0.0	NC	0-20	0.0	2.2	2.1	103.1	75-125

Associated samples MP968: T2695-5

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(N) Matrix Spike Rec. outside of QC limits
(anr) Analyte not requested

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: T2695
Account: DYNAMDGE - Dynamac Corporation Environmental Serv.
Project: DYNAMDGE535 - I&W Hot Oil

QC Batch ID: MP968
Matrix Type: SOLID

Methods: SW846 7471A
Units: mg/kg

Prep Date: 05/29/02

Metal	T2677-20 Original	MSD	Spikelot HGTXWS1	% Rec	QC Limits
Mercury	0.0	2.2	2.1	104.8	75-125

Associated samples MP968: T2695-5

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(N) Matrix Spike Rec. outside of QC limits
(anr) Analyte not requested

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: T2695
Account: DYNAMDGE - Dynamac Corporation Environmental Serv.
Project: DYNAMDGE535 - I&W Hot Oil

QC Batch ID: MP968
Matrix Type: SOLID

Methods: SW846 7471A
Units: mg/kg

Prep Date: 05/29/02

Metal	BSP Result	Spikelot HGTXWS1	% Rec	QC Limits
Mercury	1.8	1.7	108.0	80-120

Associated samples MP968: T2695-5

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(anr) Analyte not requested

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: T2695
Account: DYNAMDGE - Dynamac Corporation Environmental Serv.
Project: DYNAMDGE535 - I&W Hot Oil

QC Batch ID: MP972
Matrix Type: LEACHATE

Methods: SW846 6010B
Units: mg/l

Prep Date: 05/23/02

Metal	RL	IDL	MB raw	final
Aluminum	2.0	.08		
Antimony	0.10	.014		
Arsenic	0.10	.012	0.0036	<0.10
Barium	0.10	.002	0.015	<0.10
Beryllium	0.10	.004		
Boron	5.0	.04		
Cadmium	0.040	.004	0.000060	<0.040
Calcium	10	.09		
Chromium	0.10	.01	-0.0051	<0.10
Cobalt	0.10	.005		
Copper	0.20	.01		
Iron	3.0	.14		
Lead	0.10	.014	0.012	<0.10
Lithium	0.10	.004		
Magnesium	10	.04		
Manganese	0.30	.003		
Molybdenum	0.20	.01		
Nickel	0.40	.013		
Potassium	10	.09		
Selenium	0.10	.017	-0.000050	<0.10
Silicon	12	.07		
Silver	0.050	.006	-0.0088	<0.050
Sodium	10	.08		
Strontium	0.10	.001		
Thallium	0.10	.02		
Titanium	0.10	.004		
Vanadium	0.10	.005		
Zinc	0.20	.005		

Associated samples MP972: T2695-2A, T2695-3A

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(anr) Analyte not requested

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: T2695
Account: DYNAMDGE - Dynamac Corporation Environmental Serv.
Project: DYNAMDGE535 - I&W Hot Oil

QC Batch ID: MP972
Matrix Type: LEACHATE

Methods: SW846 6010B
Units: mg/l

Prep Date:			05/23/02					05/23/02	
Metal	T2695-2A Original	DUP	RPD	QC Limits	T2695-2A Original	MS	Spikelot MPTTC1	% Rec	QC Limits
Aluminum									
Antimony									
Arsenic	0.30	0.46	42.1*(a)	0-20	0.30	4.5	5.0	84.0	75-125
Barium	0.36	0.25	36.1*	0-20	0.36	0.63	0.40	67.5N(c)	75-125
Beryllium									
Boron									
Cadmium	0.0	0.0	NC	0-20	0.0	0.33	0.40	82.5	75-125
Calcium									
Chromium	0.0	0.0	NC	0-20	0.0	0.32	0.40	80.0	75-125
Cobalt									
Copper									
Iron									
Lead	0.0	0.029	200.0(b)	0-20	0.0	4.1	5.0	82.0	75-125
Lithium									
Magnesium									
Manganese									
Molybdenum									
Nickel									
Potassium									
Selenium	0.0	0.0	NC	0-20	0.0	0.83	1.0	83.0	75-125
Silicon									
Silver	0.0	0.0	NC	0-20	0.0	0.32	0.40	80.0	75-125
Sodium									
Strontium									
Thallium									
Titanium									
Vanadium									
Zinc									

Associated samples MP972: T2695-2A, T2695-3A

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(N) Matrix Spike Rec. outside of QC limits
(anr) Analyte not requested
(a) High RPD due to possible sample nonhomogeneity. Actual extraction duplicate.
(b) RPD acceptable due to low duplicate and sample concentrations.
(c) Spike recovery indicates possible matrix interference. Post-spike recovery for Ba(T2695-2A):98.3%

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: T2695
Account: DYNAMDGE - Dynamac Corporation Environmental Serv.
Project: DYNAMDGE535 - I&W Hot Oil

QC Batch ID: MP972
Matrix Type: LEACHATE

Methods: SW846 6010B
Units: mg/l

Prep Date: 05/23/02

Metal	T2695-2A Original	MSD	Spikelot MPTTC1	% Rec	QC Limits
Aluminum					
Antimony					
Arsenic	0.30	4.4	5.0	82.0	75-125
Barium	0.36	0.62	0.40	65.0N(a)	75-125
Beryllium					
Boron					
Cadmium	0.0	0.33	0.40	82.5	75-125
Calcium					
Chromium	0.0	0.32	0.40	80.0	75-125
Cobalt					
Copper					
Iron					
Lead	0.0	4.1	5.0	82.0	75-125
Lithium					
Magnesium					
Manganese					
Molybdenum					
Nickel					
Potassium					
Selenium	0.0	0.80	1.0	80.0	75-125
Silicon					
Silver	0.0	0.31	0.40	77.5	75-125
Sodium					
Strontium					
Thallium					
Titanium					
Vanadium					
Zinc					

Associated samples MP972: T2695-2A, T2695-3A

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(N) Matrix Spike Rec. outside of QC limits
(anr) Analyte not requested
(a) Spike recovery indicates possible matrix interference. Post-spike recovery for Ba(T2695-2A):98.3%

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: T2695
Account: DYNAMDGE - Dynamac Corporation Environmental Serv.
Project: DYNAMDGE535 - I&W Hot Oil

QC Batch ID: MP972
Matrix Type: LEACHATE

Methods: SW846 6010B
Units: mg/l

Prep Date: 05/23/02

Metal	BSP Result	Spikelot MPTTC1	% Rec	QC Limits
Aluminum				
Antimony				
Arsenic	5.1	5.0	102.0	80-120
Barium	0.41	0.40	102.5	80-120
Beryllium				
Boron				
Cadmium	0.41	0.40	102.5	80-120
Calcium				
Chromium	0.39	0.40	97.5	80-120
Cobalt				
Copper				
Iron				
Lead	5.1	5.0	102.0	80-120
Lithium				
Magnesium				
Manganese				
Molybdenum				
Nickel				
Potassium				
Selenium	0.99	1.0	99.0	80-120
Silicon				
Silver	0.39	0.40	97.5	80-120
Sodium				
Strontium				
Thallium				
Titanium				
Vanadium				
Zinc				

Associated samples MP972: T2695-2A, T2695-3A

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(anr) Analyte not requested

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: T2695
Account: DYNAMDGE - Dynamac Corporation Environmental Serv.
Project: DYNAMDGE535 - I&W Hot Oil

QC Batch ID: MP980
Matrix Type: LEACHATE

Methods: SW846 7470A
Units: mg/l

Prep Date:	05/29/02					05/29/02			
Metal	T2695-2A Original	DUP	RPD	QC Limits	T2695-2A Original	MS	Spikelot HGTXWS1	% Rec	QC Limits
Mercury	0.0011	0.0023	70.6 (a)	0-20	0.0011	0.095	0.10	93.9	75-125

Associated samples MP980: T2695-2A, T2695-3A

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(N) Matrix Spike Rec. outside of QC limits
(anr) Analyte not requested
(a) RPD acceptable due to low duplicate and sample concentrations.

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: T2695
Account: DYNAMDGE - Dynamac Corporation Environmental Serv.
Project: DYNAMDGE535 - I&W Hot Oil

QC Batch ID: MP980
Matrix Type: LEACHATE

Methods: SW846 7470A
Units: mg/l

Prep Date: 05/29/02

Metal	T2695-2A Original	MSD	Spikelot HGTXWS1	% Rec	QC Limits
Mercury	0.0011	0.094	0.10	92.9	75-125

Associated samples MP980: T2695-2A, T2695-3A

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(N) Matrix Spike Rec. outside of QC limits
(anr) Analyte not requested

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: T2695
Account: DYNAMDGE - Dynamac Corporation Environmental Serv.
Project: DYNAMDGE535 - I&W Hot Oil

QC Batch ID: MP980
Matrix Type: LEACHATE

Methods: SW846 7470A
Units: mg/l

Prep Date: 05/29/02

Metal	BSP Result	Spikelot HGTXWS1	% Rec	QC Limits
Mercury	0.095	0.10	95.0	80-120

Associated samples MP980: T2695-2A, T2695-3A

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(anr) Analyte not requested

Analysis Request and Chain of Custody Record

Page 1 of 1

ACCUTEST.
ACCUTEST LABORATORIES GULF COAST, INC.

10165 HARWIN DRIVE, SUITE 150 • HOUSTON, TEXAS 77036 • (713) 271-4700 • FAX (713) 271-4770

Project no.:

Client/Project: DYNAMAC / BLM / 19W HOT OIL

P.O.#:

Lab ID No.	Field Sample No./ Identification	Date and Time	Grab	Comp	Sample Container (Size/Mat'l)	Sample Type (Liquid Sludge, Etc.)	Preservative	ANALYSIS REQUESTED	LABORATORY REMARKS
1	1W2-WS-1	5/14/02 0835	✓		4oz glass x2	SOIL	4°C	RCRA METALS (6010), TPH (8015).	Only One 4oz rcvd
2	1W2-WS-2	5/14/02 0900	✓		4oz glass x5 ; 1x 8oz gl	SLUDGE	↓	BTEX (8021), TPH (8015), PAH (8310), METALS (6010), TCLP (1311) EXTRACT, THEN METALS VOA, SVOA	2 JT HSE VOA
3	1W-WS-1	5/14/02 1055	✓		↓	SLUDGE		BTEX (8021), PAH (8310), RCRA METALS (6010), TPH (8015) TCLP (1311) EXTRACT, THEN METALS, VOA, SVOA	2.2
4	1W-WS-2	5/14/02 1130	✓		4oz glass x3	SOIL		BTEX (8021), RCRA METALS (6010), TPH (8015)	
5	1W-WS-3	5/14/02 1130	✓		↓	SOIL		BTEX (8021), RCRA METALS (6010), TPH (8015)	
6	FB-1	5/14/02 1150	✓		GLASS VOA vial	LIQUID ~~SOLIDF~~	HCl	BTEX (8021), TPH (8015)	4 x 40ml rcvd.
7	TB-1				↓	LIQUID	HCl ↓	BTEX (8021), TPH (8015)	2 x 40ml rcvd.

BF

Samplers: *(Print)* BRYAN FREY, BROOKE LEVY

Affiliation: DYNAMAC

Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Date / Time
[signature]	Date: 5/14/02 Time: 1500	FED EX	Date: Time:
	Date: Time:	[signature]	Date: Time:
	Date: Time:	Received by Laboratory: [signature]	Date: 5-15-02 Time: 0900

COC Seal No.:

REC'D. ON ICE Yes 2.2C No ____

Intact:

Results by 30 MAY 2002

Rush Charges Authorized Yes ____ No ✓

REMARKS: ANY QUESTIONS, PLEASE CALL BRYAN FREY - 240.778.1012

Data Results To: 1. BRYAN FREY 2.

Laboratory No. T2645

Bryan Frey/Dynamic/BLM
20440 Century Blvd # 100
Germantown MD 20874

Colorado State University
Soil, Water and Plant Testing Laboratory
Natural & Environmental Sciences Bldg - A319
Fort Collins, CO 80523

(970) 491-5061 FAX: 491-2930

BILLING:

DATE RECEIVED: 05-16-2002
DATE REPORTED: 07-25-2002

RESEARCH SOIL ANALYSIS

Sampler Frey/Lacewell Proj Name 1 & W Hot Oil Proj # BLM4-82R

Lab	Sample	paste		meq/L					mg/L	%	Total
#	ID #	pH	EC mmhos/cm	Ca	Mg	Na	K	SAR	Alkalinity	OM	N
R5953	1W2-AG-1	7.9	0.4	3.1	0.4	0.5	0.2	0.4	98	0.4	0.002
R5954	1W2-AG-2	7.6	1.1	10.8	1.3	2.1	0.3	0.8	152	2.0	0.022
R5955	1W2-AG-3	8.0	0.3	2.9	0.2	0.4	0.2	0.3	121	0.5	0.004
R5956	1W2-AG-4	8.0	0.3	3.1	0.3	0.5	0.2	0.4	130	0.5	0.009

SPEEDIE AND ASSOCIATES

GEOTECHNICAL / ENVIRONMENTAL / MATERIALS ENGINEERS
3331 E. WOOD STREET • PHOENIX, ARIZONA 85040

LABORATORY REPORT

Physical Properties of Soils and Aggregates

Client:	Dynamac Corporation	Project No.	020542LA
ATTN:	Bryan Frey	Lab No.	121645
	20440 Century Blvd., # 100	Field No.	N/A
	Germantown, Maryland 20874	Report Date:	05-21-02

Project:	I&W Hot Oil Service South				
Location:	Southeastern New Mexico				
Material:	Reddish Silty Sand	Sampled By:	Client	Date	05-14-02
Source:	Native	Submitted By:	Fed Ex	Date	05-16-02
Supplier:	N/A	Authorized By:	Client	Date	05-16-02
Sample Location:	IW2-GT-1				

SIEVE ANALYSIS - ASTM C136

Sieve Size	Cumulative % Passing	Specification Limits
6"	100	
3"	100	
21/2"	100	
2"	100	
11/2"	100	
1"	100	
3/4"	100	
1/2"	99	
3/8"	98	
1/4"	96	
#4	96	
#8	94	
#10	94	
#16	93	
#30	93	
#40	92	
#50	89	
#100	43	
#200	19.0	

ADDITIONAL TESTING

PHYSICAL PROPERTIES	TEST RESULTS	SPECIFICATION LIMITS
LIQUID & PLASTIC PROPERTIES; ASTM D4318		
Liquid Limit	N/A	
Plastic Limit	Non-Plastic	
Plasticity Index	Non-Plastic	
MOISTURE CONTENT; ASTM D2216	1.5%	
SOIL CLASSIFICATION; ASTM D2487	SM	

Comments:

Copies to: *Addressee (1)*

Reviewed by

Laboratory Manager

SPEEDIE AND ASSOCIATES
GEOTECHNICAL / ENVIRONMENTAL / MATERIALS ENGINEERS
3331 E. WOOD STREET • PHOENIX, ARIZONA 85040

LABORATORY REPORT

Physical Properties of Soils and Aggregates

Client:	Dynamac Corporation	Project No.	020542LA
ATTN:	Bryan Frey	Lab No.	121646
	20440 Century Blvd., # 100	Field No.	N/A
	Germantown, Maryland 20874	Report Date:	05-22-02

Project: I&W Hot Oil Service South

Location: Southeastern New Mexico

Material:	Light Brown Silty Sand	Sampled By:	Client	Date	05-14-02
Source:	Native	Submitted By:	Fed Ex	Date	05-16-02
Supplier:	N/A	Authorized By:	Client	Date	05-16-02

Sample Location: IW2-GT-2

SIEVE ANALYSIS - ASTM C136

Sieve Size	Cumulative % Passing	Specification Limits
6"	100	
3"	100	
21/2"	100	
2"	100	
11/2"	100	
1"	100	
3/4"	100	
1/2"	100	
3/8"	98	
1/4"	95	
#4	93	
#8	91	
#10	90	
#16	89	
#30	88	
#40	87	
#50	82	
#100	41	
#200	19.3	

ADDITIONAL TESTING

PHYSICAL PROPERTIES	TEST RESULTS	SPECIFICATION LIMITS
LIQUID & PLASTIC PROPERTIES; ASTM D4318		
Liquid Limit	N/A	
Plastic Limit	Non-Plastic	
Plasticity Index	Non-Plastic	
MOISTURE CONTENT; ASTM D2216	1.6%	
SOIL CLASSIFICATION; ASTM D2487	SM	

Comments:

Copies to: Addressee (1)

Reviewed by
Laboratory Manager

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3331 E. WOOD STREET • PHOENIX, ARIZONA 85040

LABORATORY REPORT

Physical Properties of Soils and Aggregates

Client: Dynamac Corporation
ATTN: Bryan Frey
20440 Century Blvd., # 100
Germantown, Maryland 20874

Project No. 020542LA
Lab No. 121647
Field No. N/A
Report Date: 05-22-02

Project: I&W Hot Oil Service South
Location: Southeastern New Mexico
Material: Light Reddish Silty Sand | Sampled By: Client | Date 05-14-02
Source: Native | Submitted By: Fed Ex | Date 05-16-02
Supplier: N/A | Authorized By: Client | Date 05-16-02
Sample Location: IW-GT-3

SIEVE ANALYSIS - ASTM C136

Sieve Size	Cumulative % Passing	Specification Limits
6"	100	
3"	100	
21/2"	100	
2"	100	
11/2"	100	
1"	100	
3/4"	100	
1/2"	100	
3/8"	100	
1/4"	100	
#4	99	
#8	99	
#10	99	
#16	99	
#30	98	
#40	98	
#50	93	
#100	41	
#200	12.9	

ADDITIONAL TESTING

PHYSICAL PROPERTIES	TEST RESULTS	SPECIFICATION LIMITS
LIQUID & PLASTIC PROPERTIES; ASTM D4318		
Liquid Limit	N/A	
Plastic Limit	Non-Plastic	
Plasticity Index	Non-Plastic	
MOISTURE CONTENT; ASTM D2216	0.9%	
SOIL CLASSIFICATION; ASTM D2487	SM	

Comments:

Copies to: Addressee (1)

Laboratory test results reported herein apply only to the specific sample on which the test was run. The above services and report were performed pursuant to the terms and conditions of the agreement or proposal, if any, between SA and client. SA warrants that this work was performed under the appropriate standard of care, including the skill and judgement that is reasonably expected from similarly situated professionals. No other warranty, guaranty, or representation, either express or implied is included or intended.

Reviewed by
Laboratory Manager

SPEEDIE
AND ASSOCIATES
GEOTECHNICAL / ENVIRONMENTAL / MATERIALS ENGINEERS
3331 E. WOOD STREET • PHOENIX, ARIZONA 85040

LABORATORY REPORT

Physical Properties of Soils and Aggregates

Client:	Dynamac Corporation	Project No.	020542LA
ATTN:	Bryan Frey	Lab No.	121648
	20440 Century Blvd., # 100	Field No.	N/A
	Germantown, Maryland 20874	Report Date:	05-22-02

Project: I&W Hot Oil Service South
Location: Southeastern New Mexico

Material:	Light Reddish Silty Sand	Sampled By:	Client	Date	05-14-02
Source:	Native	Submitted By:	Fed Ex	Date	05-16-02
Supplier:	N/A	Authorized By:	Client	Date	05-16-02

Sample Location: IW-GT-4

SIEVE ANALYSIS - ASTM C136

Sieve Size	Cumulative % Passing	Specification Limits
6"	100	
3"	100	
21/2"	100	
2"	100	
11/2"	100	
1"	100	
3/4"	100	
1/2"	100	
3/8"	100	
1/4"	100	
#4	100	
#8	100	
#10	100	
#16	99	
#30	99	
#40	99	
#50	93	
#100	44	
#200	17.7	

ADDITIONAL TESTING

PHYSICAL PROPERTIES	TEST RESULTS	SPECIFICATION LIMITS
LIQUID & PLASTIC PROPERTIES; ASTM D4318		
Liquid Limit	N/A	
Plastic Limit	Non-Plastic	
Plasticity Index	Non-Plastic	
MOISTURE CONTENT; ASTM D2216	1.4%	
SOIL CLASSIFICATION; ASTM D2487	SM	

Comments:

Copies to: Addressee (1)

Laboratory test results reported herein apply only to the specific sample on which the test was run. The above services and report were performed pursuant to the terms and conditions of the agreement or proposal, if any, between SA and client. SA warrants that this work was performed under the appropriate standard of care, including the skill and judgement that is reasonably expected from similarly situated professionals. No other warranty, guaranty, or representation, either express or implied is included or intended.

Reviewed by ______________
Laboratory Manager

SERIAL DILUTION RESULTS SUMMARY

Login Number: T2695
Account: DYNAMDGE - Dynamac Corporation Environmental Serv.
Project: DYNAMDGE535 - I&W Hot Oil

QC Batch ID: MP972
Matrix Type: LEACHATE

Methods: SW846 6010B
Units: ug/l

Prep Date: 05/23/02

Metal	T2695-2A Original	SDL 10:10	RPD	QC Limits
Aluminum				
Antimony				
Arsenic	304	83.4	72.5 (a)	0-10
Barium	365	74.9	79.5* (b)	0-10
Beryllium				
Boron				
Cadmium	0.00	0.00	NC	0-10
Calcium				
Chromium	0.00	0.00	NC	0-10
Cobalt				
Copper				
Iron				
Lead	0.00	0.00	NC	0-10
Lithium				
Magnesium				
Manganese				
Molybdenum				
Nickel				
Potassium				
Selenium	0.00	0.00	NC	0-10
Silicon				
Silver	0.00	0.00	NC	0-10
Sodium				
Strontium				
Thallium				
Titanium				
Vanadium				
Zinc				

Associated samples MP972: T2695-2A, T2695-3A

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(anr) Analyte not requested
(a) Percent difference acceptable due to low initial sample concentration (< 50 times IDL).
(b) Serial dilution indicates possible matrix interference.

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: T2695
Account: DYNAMDGE - Dynamac Corporation Environmental Serv.
Project: DYNAMDGE535 - I&W Hot Oil

QC Batch ID: MP980
Matrix Type: LEACHATE

Methods: SW846 7470A
Units: mg/l

Prep Date: 05/29/02

Metal	RL	IDL	MB raw	final
Mercury	0.0020	.0006	0.0010	<0.0020

Associated samples MP980: T2695-2A, T2695-3A

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(anr) Analyte not requested

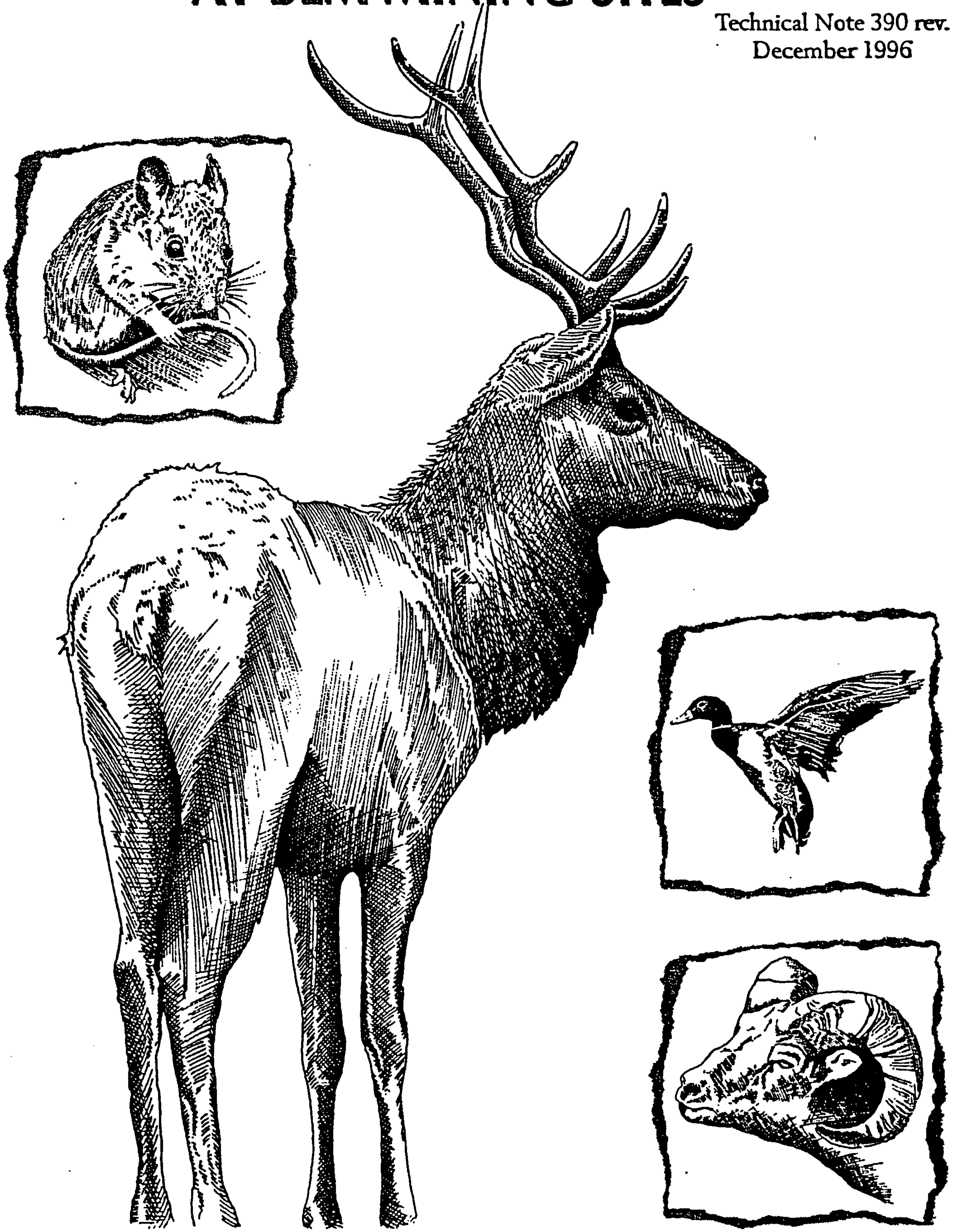
ATTACHMENT C

Bureau of Land Management Technical Note: ***Risk Management Criteria For Metals at BLM Mining Sites***

RISK MANAGEMENT CRITERIA FOR METALS AT BLM MINING SITES

Technical Note 390 rev.
December 1996

U.S. DEPARTMENT OF THE INTERIOR • BUREAU OF LAND MANAGEMENT



United States Department of the Interior
Bureau of Land Management

RISK MANAGEMENT CRITERIA FOR METALS AT BLM MINING SITES

Karl L. Ford, Ph.D.
Bureau of Land Management
National Applied Resource Sciences Center
Denver, CO

Technical Note 390 (revised)
December 1996

BLM/RS/ST-97/001+1703

HUMAN HEALTH RISK MANAGEMENT CRITERIA

RISK MANAGEMENT CRITERIA FOR METALS AT BLM MINING SITES

Karl L. Ford, Ph.D.
National Applied Resource Sciences Center, Denver, CO

INTRODUCTION

Mining activities have influenced the environment of Public Lands throughout the West. Tailings from ore mills have contributed large amounts of heavy metals into air, water, stream sediments, and soils. Uncontrolled migration of metal-laden mine tailings via dust entrainment and erosion continues to present potentially adverse risks to human health and wildlife. Recreational demands are increasing on areas where acute and prolonged exposure to relatively high metal concentrations in soils, sediments, and surface waters is occurring. In some locations, avian and aquatic kills have been reported.

To address these issues, BLM has developed acceptable multimedia criteria for the chemicals of concern (heavy metals) as they relate to recreational use and wildlife habitat on BLM lands. The primary objective of this report is to establish risk management criteria (RMC) for human health and wildlife. Risk management criteria provide numerical action levels for metals in environmental media. RMC are designed (1) to assist land managers in making natural resource decisions and (2) to support ecosystem management. Ecosystem management is defined as the skillful use of ecological, economic, social, and managerial principles in managing ecosystems to produce, restore, or sustain ecosystem integrity and desired conditions, uses, products, or values and services over the long term.

RMC designed to protect human receptors for the metals of concern were developed using available toxicity data and standard U.S. Environmental Protection Agency (EPA) exposure assumptions. RMC designed to protect wildlife receptors for the metals of concern were developed using toxicity values and wildlife intake assumptions reported in the current ecotoxicology literature. Ingestion of soil, sediment, and plants is assumed to be the predominant source of metal exposure for wildlife receptors.

The contaminants of concern and metal contamination migration pathways were identified from historical information and site visits. Potential receptors, receptor exposure routes, and exposure scenarios were identified from on-site visits and discussions with BLM personnel. Representative wildlife receptors at risk were chosen using a number of criteria, including likelihood of inhabitation and availability of data.

Risk management criteria should be used by the land manager as a cautionary signal that potential health hazards are present and that natural resource management or remedial actions are indicated. Furthermore, these criteria may be used as target cleanup levels if remedial action is undertaken.

HUMAN HEALTH RISK MANAGEMENT CRITERIA

A wide range of possible exposure scenarios was examined to represent potential human exposures that might occur on BLM lands. Table 1 provides an overview of the potential human receptors considered and the media to which they are assumed to be exposed. All exposure factors are presented in Appendix A. For the most part, the exposure assumptions used in the calculation of human health RMC are those provided in EPA guidance documents.

The equations for the calculations of the human RMC in soil, sediment, groundwater, surface water, and fish are presented in Appendix A. The RMC correspond to a generally recognized acceptable level of health risk, specifically an excess cancer risk of 1.0E-05 or a noncancer hazard index of 1.0. An excess cancer risk of 1.0E-05 means that for an individual exposed at these RMC under the described exposure conditions, there is only a 1 in 100,000 chance that they would develop any type of cancer in a lifetime as a result of contact with the metals of concern on BLM lands. A hazard index of 1.0 means that the dose of noncancer metals assumed to be received on BLM lands by any of the receptors in a medium is lower than, or the same as, a dose that would not result in any adverse noncancer health effects.

The risk and hazard levels are consistent with EPA guidance. The concept behind the RMC is that people will not experience adverse health effects from metal contamination on BLM lands during their lifetimes if exposure is limited to soil, sediments, and waters with concentrations at or less than the RMC. To calculate this chance, EPA's conservative interpretations of cancer data have been used; therefore, the likelihood that this risk has been underestimated is very low.

TABLE 1. Human Health Receptors, Media and Exposure Routes

RECEPTOR	Medium/Exposure Routes					
	Groundwater	Surface Water	Sediments	Surface Soils		Fish
	ingestion	ingestion	ingestion	ingestion	inhalation	ingestion
Resident	■			■	■	■
Camper	■	■	■	■	■	■
Boater		■	■			
Swimmer		■	■			
ATV Driver				■	■	
Worker	■			■	■	
Surveyor	■			■	■	

Contaminant of Concern Selection

The contaminant of concern (COC) selection processes utilized previous work at mining sites. The selection processes in these investigations were scientifically rigorous and in accordance with EPA risk assessment guidance. Therefore, the COCs for these investigations were combined to form the COC list for this effort. The COCs for the human health RMC are antimony, arsenic, cadmium, copper, lead, manganese, mercury, nickel, selenium, silver, and zinc.

Lead RMC for the resident were determined from EPA's Integrated Exposure Uptake Biokinetic Model. This model calculates acceptable lead exposure via ingestion of soil, drinking water, and food, and via inhalation of air, using 10 ug Pb/dl as an acceptable blood lead concentration for 95% of the exposed child population. Lead criteria for other human receptors were based on available EPA regulation and guidance.

Exposure Scenarios

The human exposure scenarios were developed to provide realistic estimates of the types and extent of exposure which individuals might experience to the COCs in the water, soils, and sediments on BLM property. Such exposures might occur to individuals living on properties adjacent to BLM lands; to individuals who use BLM lands for camping, boating, or all-terrain-vehicle (ATV) driving; or to individuals who work on BLM lands. EPA has published a number of standard exposure assumptions that are consistently used to estimate those factors which have been empirically determined, such as the number of liters of water an adult drinks in a day, the average rate of inhalation of dust, or the average number of years spent in one residence. However, several site-specific exposure assumptions have been developed in this report, in addition to the standard EPA assumptions, to provide estimates as closely resembling probable exposures on BLM property as possible.

The residential scenario was developed because there are residential properties adjacent to BLM land. Contamination may migrate from the BLM tracts to adjoining residential property. All residential scenario exposure assumptions were obtained directly from EPA guidance. A variety of recreational exposure scenarios on BLM lands were also considered, including camping, swimming, boating, and ATV driving. The BLM-specific assumptions were made for the recreational exposure scenarios in consultation with BLM field offices. Table 2 presents the human health RMC. In the case of metals posing both cancer and noncancer threats to health, the lower (more protective) concentration was selected as the risk management criterion.

The RMC have been divided by 11 metals and by "n" media that receptors are exposed to (Table 1) to account for multiple chemical and media exposures. This ensures that the cumulative effects of all the metals and all of the media are considered. Therefore, as long as people are not exposed to metals concentrations exceeding the RMC, they are not expected to experience adverse effects.

TABLE 2. Human Risk Management Criteria

Medium	Resident	Camper	ATV Driver	Worker	Surveyor	Boater	Swimmer
SOILS (mg/kg)							
Antimony	3	50	750	100	600	NA	NA
Arsenic	1	20	300	12	100	NA	NA
Cadmium	3	70	950	100	800	NA	NA
Copper	250	5000	70000	7400	59000	NA	NA
Lead	400	1000	1000	2000	2000	NA	NA
Manganese	960	19000	250000	28000	220000	NA	NA
Mercury	2	40	550	60	480	NA	NA
Nickel	135	2700	38000	4000	32000	NA	NA
Selenium	35	700	9600	1000	8000	NA	NA
Silver	35	700	9600	1000	8000	NA	NA
Zinc	2000	40000	550000	60000	480000	NA	NA
SEDIMENTS (mg/kg)							
Antimony	NA	62	NA	NA	NA	221	96
Arsenic	NA	46	NA	NA	NA	166	72
Cadmium	NA	155	NA	NA	NA	553	239
Copper	NA	5745	NA	NA	NA	20517	8884
Lead	NA	1000	NA	NA	NA	1000	1000
Manganese	NA	21679	NA	NA	NA	77424	33525
Mercury	NA	46	NA	NA	NA	166	72
Nickel	NA	3094	NA	NA	NA	11061	4789
Selenium	NA	774	NA	NA	NA	2765	1197
Silver	NA	774	NA	NA	NA	2765	1197
Zinc	NA	46455	NA	NA	NA	165909	71839
SURFACE WATER (ug/l)							
Antimony	NA	124	NA	NA	NA	442	192
Arsenic	NA	93	NA	NA	NA	81	144
Cadmium	NA	155	NA	NA	NA	553	239
Copper	NA	11490	NA	NA	NA	41035	17768
Lead	NA	50	NA	NA	NA	50	50
Manganese	NA	1548	NA	NA	NA	5530	2395
Mercury	NA	93	NA	NA	NA	332	144
Nickel	NA	6194	NA	NA	NA	22121	9578
Selenium	NA	1548	NA	NA	NA	5530	2395
Silver	NA	1548	NA	NA	NA	5530	2395
Zinc	NA	92909	NA	NA	NA	331818	143677

TABLE 2. Human Risk Management Criteria (continued)

Medium	Resident	Camper	ATV Driver	Worker	Surveyor	Boater	Swimmer
GROUND WATER (ug/l)							
Antimony	0.2	1	NA	3	31	NA	NA
Arsenic	0.1	1	NA	0.7	7	NA	NA
Cadmium	0.2	2	NA	4	39	NA	NA
Copper	18	137	NA	287	2872	NA	NA
Lead	15	15	NA	15	15	NA	NA
Manganese	2	18	NA	39	387	NA	NA
Mercury	0.1	1	NA	2	23	NA	NA
Nickel	9	74	NA	155	1548	NA	NA
Selenium	2	18	NA	39	387	NA	NA
Silver	2	18	NA	39	387	NA	NA
Zinc	142	1106	NA	2323	23227	NA	NA
FISH (ug/kg)							
Antimony	31	65	NA	NA	NA	NA	NA
Arsenic	24	48	NA	NA	NA	NA	NA
Cadmium	78	161	NA	NA	NA	NA	NA
Copper	2907	5984	NA	NA	NA	NA	NA
Lead	200	200	NA	NA	NA	NA	NA
Manganese	10969	22582	NA	NA	NA	NA	NA
Mercury	24	48	NA	NA	NA	NA	NA
Nickel	1567	3226	NA	NA	NA	NA	NA
Selenium	392	807	NA	NA	NA	NA	NA
Silver	392	807	NA	NA	NA	NA	NA
Zinc	23505	48390	NA	NA	NA	NA	NA

(1) Alternatives include defaulting to local background or evaluating bioavailable fraction
NA -Indicates not applicable

ECOLOGICAL RISK MANAGEMENT CRITERIA

Wildlife on the BLM lands may be exposed to metal contamination via several environmental pathways. The potential exposure pathways include soil and sediment ingestion, vegetation ingestion, surface water ingestion, and airborne dust inhalation. This report establishes ecological RMC for metals in soil and sediments. This has been accomplished using the best data available for the calculations, including ecotoxicological effects data for the metals of concern, soil-plant uptake factors, representative wildlife receptors, body weights, and soil and plant ingestion rates for each receptor.

After careful consideration of regional scientific literature, and on the basis of field observations, several wildlife receptors have been selected to represent a range of the types, sizes, and habitats of birds and mammals representative of temperate BLM lands. The selected wildlife receptors are the deer mouse, mountain cottontail, bighorn sheep, white-tailed deer, mule deer, cattle, elk, mallard, Canada goose, and trumpeter swan.

The literature was surveyed for toxicity data relevant either to wildlife receptors at the site or to closely related species. In the absence of available toxicity data for any receptor, data were selected on the basis of phylogenetic similarity between ecological receptors and the test species for which toxicity data were reported. For example, while no data on metal toxicity were found in the literature for trumpeter swans, there were data available on metal toxicity to Canada geese and mallard ducks. Accordingly, the goose and duck data were used, and the toxicity values were adjusted to account for the differences in body weight and food ingestion rate between the species. Uncertainty factors were applied to protect against underestimation of risks to trumpeter swans that might result from metabolic differences between ducks, geese, and swans. The COCs for the ecological assessment included arsenic, cadmium, copper, lead, mercury, and zinc.

Soil ingestion rates and exposure factors for each receptor were obtained from the U.S. Fish and Wildlife Service (Beyer, 1994) and unpublished data. Soil-plant uptake factors were obtained from Baes (1984). Where no dietary soil intake data were available for a particular receptor, the soil intake was assumed to be equal to that of an animal with similar diets and habits.

RMC were calculated for each chemical of concern in soil based upon assumed exposure factors for the selected receptors, along with species- and chemical-specific toxicity reference values (TRVs). TRVs were computed by chemical of concern for each wildlife receptor/metal combination, using the method of Ford, et al. (1992), shown in Appendix A. Table 3 displays the TRVs.

TRVs represent daily doses of the metals for each wildlife receptor that will not result in adverse chronic toxic effects. Wildlife RMC have been calculated from the TRVs and the assumed intake of soil/sediment and plants that each receptor will receive. Therefore, as long as wildlife are not exposed to soils/sediments with concentrations of metals exceeding the RMC, they are not expected to experience adverse toxic effects. Table 4 shows the RMC.

T. 3. Toxicity Reference Values (mg/kg/d)

SPECIES	As TRV	Source	UF	Cu TRV	Source	UF	Cd TRV	Source	UF	Pb TRV	Source	UF
Deer Mouse	0.360	crc p.209	400	0.080	crc p.331	40	0.030	Eisler p.85	8	1.500	Schroeder	3
Cottontail	0.300	crc p.228	40	1.720	nrc-rabbt	8	0.004	nrc-rabbt	8	0.258	nrc-rabbt	8
Bighorn Sheep	0.350	nrc-sheep	4	0.180	nrc-sheep	4	0.003	nrc-sheep	4	0.210	nrc-sheep	4
White-Tailed Deer	0.090	nrc-cow	16	0.177	nrc-cow	16	0.001	nrc-cow	16	0.053	nrc-cow	16
Mule Deer	0.090	nrc-cow	16	0.177	nrc-cow	16	0.001	nrc-cow	16	0.053	nrc-cow	16
Rocky Mtn. Elk	0.090	nrc-cow	16	0.177	nrc-cow	16	0.001	nrc-cow	16	0.053	nrc-cow	16
Mallard	0.310	nrc-poultry	16	1.880	nrc-poultry	16	0.003	nrc-poultry	16	0.500	Eisler p.77	20
Canada Goose	0.310	nrc-poultry	16	1.880	nrc-poultry	16	0.003	nrc-poultry	16	0.125	Eisler p.77	80
Trumpeter Swan	0.310	nrc-poultry	16	1.880	nrc-poultry	16	0.003	nrc-poultry	16	0.125	Eisler p.77	80
Cattle	0.700	nrc	2	1.410	nrc	2	0.700	nrc	2	0.425		2

SPECIES	Hg TRV	Source	UF	Zn TRV	Source	UF
Deer Mouse	0.015	crc p.200	400	1.750	crc p.208	200
Cottontail	0.017	nrc-rabbt	8	4.300	nrc-rabbt	8
Bighorn Sheep	0.003	nrc-sheep	4	2.100	nrc-sheep	4
White-Tailed Deer	0.004	nrc.cow	16	0.880	nrc-cow	16
Mule Deer	0.004	nrc.cow	16	0.880	nrc-cow	16
Rocky Mtn. Elk	0.004	nrc-cow	16	0.880	nrc-cow	16
Mallard	0.013	nrc-poultry	16	6.250	nrc-poultry	16
Canada Goose	0.013	nrc-poultry	16	6.250	nrc-poultry	16
Trumpeter Swan	0.013	nrc-poultry	16	6.250	nrc-poultry	16
Cattle	0.028	nrc	2	7.000	nrc	2

Abbreviations:

crc p._: Handbook of Chemical Toxicity Profiles of Biological Species. Ramamoorthy, et al., 1995. Lewis Publishers.
nrc: National Research Council, 1980. Mineral Tolerance of Domestic Animals.
Eisler p._: Eisler, Fish and Wildlife Service Synoptic Reviews, various dates.
UF: Total uncertainty factor.

Note: nrc TRVs were calculated as the product of the dietary concentration times the kg plant ingestion divided by the body weight. Uncertainty factors were applied according to the extrapolation approach above.

TABLE 4. Wildlife and Cattle Risk Management Criteria, Soils (mg/kg)

	Arsenic	Cadmium	Copper	Lead	Mercury	Zinc
Deer Mouse	52.0	1.0	4.2	132.0	0.4	40.0
Cottontail	122.0	0.3	232.0	97.0	1.1	266.0
Bighorn Sheep	72.0	0.5	40.0	74.0	0.4	288.0
White-Tailed Deer	95.0	0.2	62.0	52.0	0.7	142.0
Mule Deer	82.0	0.2	53.0	44.0	0.6	122.0
Rocky Mtn. Elk	98.0	0.2	64.0	53.0	0.7	146.0
Cattle	193.0	1.0	265.0	138.0	3.5	846.0
Mallard	95.0	0.3	250.0	147.0	0.9	418.0
Canada Goose	67.0	0.3	258.0	26.0	1.1	527.0
Trumpeter Swan	84.0	0.4	326.0	33.0	1.4	664.0
Mean	96.0	0.4	155.4	79.6	1.1	345.9
Standard Error	19.3	0.1	40.3	15.3	0.3	88.3
Lower 95th CL	58	0.4	76	49	0.5	172
Western U.S. Mean Soil Concentrations[1]	7	0.3[2]	27	20	0.6	65

[1] Schacklette and Boernegen, 1984.
[2] Kabata-Pendias, 1992.

Aquatic Plant Ingestion

Aquatic plants such as Arrowhead (*Sagitarria sp.*) appear to accumulate metals and store them in their tubers. Arrowhead tubers are eaten by swan and other waterfowl. Of these consumers, swans reportedly eat the most; the plant constitutes 5-10% of the diet of trumpeter swans and muskrats.

Elevated lead levels in *Sagitarria* have been reported (Krieger, 1990). The mean value detected in tubers was 159 ppm. The trumpeter swan body weight is approximately 8.17 kg, and the daily ingestion rate is 386 grams/day. Assuming the *Sagitarria* is 10% of the swan's diet, a swan's lead intake might be 0.75 mg/kg/day. As shown in Table 3, the swan TRV is 0.125 mg/kg/day. Thus, it can be seen that the lead intake by waterfowl from *Sagitarria* alone may represent a chronic (or possibly acute) lead poisoning hazard for waterfowl.

Aquatic Life Protection

Surface waters are often contaminated by mining sites. Table 5 presents EPA ambient water criteria for metals and cyanide for the protection of aquatic life and humans ingesting water and fish (EPA, 1986). States may have other criteria.

TABLE 5. Selected EPA Ambient Water Quality Criteria (micrograms/liter). Note: States may have other criteria.

Metal	Freshwater Aquatic Life Acute Exposure	Freshwater Aquatic Life Chronic Exposure	Human Water+Fish Ingestion
Antimony	9000	1600	146
Arsenic (V)	850	48	0.002
Barium	NA	NA	1000
Cadmium	3.9*	1.1*	10
Chromium (III)	1700*	210*	170000
Copper	18*	12*	NA
Cyanide	22	5.2	200
Iron	NA	1000	300
Lead	82*	3.2*	50
Manganese	NA	NA	50
Mercury	2.4	0.012	0.144
Nickel	1400*	160*	13.4
Selenium	260	35	10
Silver	4.1*	0.12	50
Thallium	1400	40	13
Zinc	120*	110*	NA

* Computed from hardness; (100 mg/1 used. See reference equation for other hardnesses).
Source: EPA, 1986.

DISCUSSION

It is anticipated that the RMC will be used as a benchmark concentration to which environmental concentrations may be compared, assisting land managers in protecting humans and wildlife on BLM lands. These criteria should be used by the land manager as a cautionary signal that potential health hazards are present and that natural resource management or remedial actions are indicated. It is suggested that exceedances of the criteria be interpreted as follows:

- less than criteria: low risk
- 1-10 times the criteria: moderate risk
- 10-100 times the criteria: high risk
- >100 times the criteria: extremely high risk

Given the uncertainties associated with the ecological RMC and the values inherent in ecosystem management, moderate risk may be addressed by management and or institutional controls, whereas high risk may require remediation. Additionally, the criteria may be used as target cleanup levels if remedial action is undertaken. The human RMC may be modified to be less stringent if the number of metals present are fewer or if background concentrations are locally elevated.

Data from this study indicate the importance of plant accumulation of metals. Some authors believe that copper and zinc are self-regulated; however, there is evidence that copper and zinc can be accumulated in target organs such as the kidneys and liver and can cause toxicity. Cadmium and mercury can be bioaccumulated in tissue from one trophic level to the next, resulting in the so-called "secondary poisoning" of top consumers in a food web. The wildlife criteria also protect soil macrofauna such as earthworms and insects that are important parts of terrestrial food chains and detritivores important to nutrient cycling in ecosystems.

Wildlife RMC are consistent with no-effect metal concentrations found for plants (Kabata-Pendias, 1992), for aquatic life associated with stream sediment (EPA, 1977), and for soil organisms responsible for fertility and nutrient cycling (Will and Suter, 1994). For wildlife, this model indicates that the majority of the intake for copper, cadmium, mercury, and zinc derives from ingestion of plants; the majority of intake of arsenic and lead derives from soil ingestion.

Various approaches have been suggested for selecting a criterion suitable for protecting groups of species, communities, or ecosystems; however, none have been widely accepted. For the purposes of this Technical Note, the lower 95% confidence limit of the mean (Table 4) is recommended at the present time.

In summary, there are numerous applications of the RMC, depending on the medium and the type of exposure considered. Based on comparisons to available sampling data from mining sites, it is likely that humans are occasionally and wildlife receptors are frequently at risk from adverse toxic effects associated with metal contamination in soils and sediments. In order to ensure proper interpretation of the significance of these results, all of the RMC in this paper must be considered in light of the assumptions used in their development. The contributions of the assumptions used in this report to the degree of uncertainty are described below.

Numerous toxicological interactions are known among the metals of concern. Some are protective (e.g., zinc, copper, and calcium protect against cadmium and lead), while others are synergistic (i.e., toxic effects are cumulative). These effects can be concentration dependent and species dependent. The COCs on BLM lands may have synergistic effects on human or wildlife receptors. Cumulative effects were quantitatively dealt with for the human assessment, but not for the ecological assessment. Because species-specific toxicity data were not available for each wildlife receptor and each metal, the ecological RMC for each metal were calculated as though each was the only metal present. As a result, the current ecological RMC for each receptor/metal combination may be numerically larger than if the synergistic effect of simultaneous exposure to all the metals could be estimated.

After careful research into the current wildlife management literature, toxicity data were selected from test species that were phylogenetically similar as possible to likely receptors. The highest potential for uncertainty in the wildlife calculations is associated with the protection against a greater toxic response to any metal by wildlife, as compared to the toxic response to the same metal by laboratory animals. The amount of uncertainty in such cases would be directly proportional to the extent of phylogenetic difference between test and receptor organisms. To minimize this uncertainty, test species data were selected from animals as closely related to the ecological receptors for the region as possible. Most values selected for use in the wildlife risk management calculations are for test species from the same biological order as the ecological receptor, except for the use of poultry (*Galliformes*) test species to estimate effects of cadmium, manganese, and zinc on waterfowl (*Anseriformes*). To account for phylogenetic differences, uncertainty factors were used (Ford, et al., 1992).

Phylogenetic and intraspecies differences between test species and ecological receptors have been taken into account by the application of uncertainty factors in derivation of critical toxicity values. These uncertainty factors were applied to protect wildlife receptors which might be more sensitive to the toxic effects of a metal than the test species. The uncertainty factors were applied to the test species toxicity data in accordance with a method developed by BLM. In accordance with this system, a divisor of two (2) was applied to the toxicity reference dose for each level of phylogenetic difference between the test and wildlife species, (e.g., individual, species, genus, and family). Reasonable uncertainty factors have also been applied to account for the differences between test administration conditions (length of exposure) and conditions in the wild.

Toxic doses for each metal were selected from the literature without regard to the specific metal compound administered in the toxicity test. Metal toxicity varies greatly with the solubility of the metallic compound, which determines the ease of passage through biological membranes. This bioavailability factor results in a tendency to overestimate actual human and wildlife RMC because the geochemical species present in soils, sediments, or waters of mining sites are expected to be of lower solubility. Collection of mineralogical data on a site may permit an upward adjustment of the RMC.

The process of calculating human health RMC using a target hazard index and target excess lifetime cancer risk has a number of inherent sources of uncertainty. There is statistical quantitative uncertainty associated with the estimates of exposure used in the calculation of the human health RMC. Furthermore, EPA applies uncertainty factors when establishing reference doses and cancer potency slope factors by using animal data to develop human toxicity criteria. The degree of uncertainty in the human health RMC cannot be completely quantified; however, due to the conservative assumptions incorporated in the standard EPA default exposure factors and EPA toxicity criteria used, and due to the conservative nature of the exposure assumptions used for this report, the human health RMC are unlikely to underestimate the true criteria.

For some metal-wildlife combinations, there was a dearth of chronic toxicity data available. Uncertainty exists with the extrapolation process used for wildlife; however, it is conservative and consistent with other work performed with plants and domestic animals (Kabata-Pendias, 1992; National Academy of Sciences, 1980) and soil organisms (Will and Suter, 1994).

SUMMARY

Interpretation of the significance of the human health RMC depends on the current and future land uses envisioned and the potential exposures that could occur. An in-depth comparison between the human health RMC and the actual concentrations of metals on BLM lands is beyond the scope of this paper. A high degree of confidence can be placed in the RMC, because they have been calculated using verifiable scientific data and valid exposure assumptions. Furthermore, a comparison between the risk management calculations and background concentrations shows that, for the most part, all of the calculated wildlife and human RMC are higher than reported background concentrations.

The wildlife RMC are also protective of plants. As would be expected, the wildlife risk management criteria are generally numerically larger than the published soil and sediment background concentrations in the western U.S. (Table 4). However, the increment is often only a few ppm to 50 ppm, suggesting that only slightly elevated concentrations may indicate risk. Based on the size of the exceedances of the risk management criteria routinely found at mining sites, it appears that soil/sediment and plant ingestion may currently be causing metal toxicity in wildlife receptors on Public Lands. Furthermore, there are additional sources of metals for regional wildlife, including contaminated surface water and contaminated airborne dust. Consideration of wildlife exposure to metals in plants indicates that plant ingestion may be a significant exposure route that should be considered when making risk management decisions.

The RMC developed in this paper are conservative and are designed specifically to protect against underestimation of risks to wildlife or human receptors. Therefore, it may be concluded that for any area where environmental metal concentrations are lower than the RMC, such media are not likely to pose a risk of adverse effects to wildlife or humans. Given the uncertainties associated with the ecological RMC and the values inherent in ecosystem management, moderate risk may be addressed by management and or institutional controls, whereas high risk may require remediation.

REFERENCES

Baes, C.F., et al. 1984. A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture. Oak Ridge National Laboratory.

Beyer, W.N., E. Connor, and S. Gerould. 1994. Survey of Soil Ingestion By Wildlife. Journal of Wildlife Management, Vol. 58.

Burt, W.H. 1976. A Field Guide to the Mammals, North America, North of Mexico, third edition. Houghton Mifflin Company, Boston.

Eisler, R. 1988. Arsenic Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review. Biological Report 12, U.S. Fish and Wildlife Service. January, 1988.

Eisler, R. 1985. Cadmium Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review. Biological Report 2, U.S. Fish and Wildlife Service. July, 1985.

Eisler, R. 1987. Mercury Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review. Biological Report 85(1.10), U.S. Fish and Wildlife Service. April, 1987.

Eisler, R. 1993. Zinc Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review. Biological Report 26, U.S. Fish and Wildlife Service. April, 1993.

Elinder, C.G., and L. Friberg. 1986. Antimony.*in* Handbook on the Toxicology of Metals, 2nd edition. New York: Elsevier Science Publishers.

Federal Register (FR). 1991. 56 FR 26460.

Ford, K.L., F.M. Applehans, and R. Ober. 1992. Development of Toxicity reference Values for Terrestrial Wildlife. Proceedings of the HMC/Superfund 1992 Conference. 803-812.

Friberg, L., T. Kjellstrom, and G. F. Nordberg. 1986. Cadmium.*in* Handbook on the Toxicology of Metals, 2nd edition. New York: Elsevier Science Publishers.

Hart, D.R., J. Fitchko, and P. McKee. September 1988. Development of Sediment Quality Guidelines. Phase II - Guidelines Development. Beak Consultants, Ltd., Brampton, Ontario, Canada.

Ishinishi, N., K. Tsuchiya, M. Vahter, and B. A. Fowler. 1986. Arsenic.*in* Handbook on the Toxicology of Metals, 2nd edition. New York: Elsevier Science Publishers.

Kabata-Pendias, A, H. Pendias. 1992. Trace Metals in Soil and Plants. CRC Press, Ann Arbor. 385 pp.

Krieger, R.I. 1990. Toxicity and Bioavailablity Studies of Lead and Other Elements in the Lower Coeur d'Alene River. Prepared for Coeur d'Alene District, Bureau of Land Management. Technical Bulletin 90-3.

Martin, A.C., H.S. Zim, and A.L. Nelson. 1961. American Wildlife and Plants: A Guide to Wildlife Food Habits. New York: Dover Publications, Inc. 500 pp.

Nagy, K. 1987. Field Metabolic Rate and Food Requirement Scaling. *Ecological Monographs*. 57:111-128.

National Academy of Sciences. 1980. Mineral Tolerance of Domestic Animals. Washington D.C.

OME. 1988. Ontario Ministry of the Environment. Guidelines for the Management of Dredged Material. Ontario Ministry of the Environment. Toronto, Ontario, Canada.

Persaud, D., R. Jaagumagi, and A. Hayton. May 1991. The Provincial Sediment Quality Guidelines, Water Resources Branch, Ontario Ministry of the Environment (Draft).

Puls, R. 1989. Mineral Levels in Animal Health: Diagnostic Data. Clearbrook, British Columbia, Canada: Sherpa International. 240 pp.

Shacklette, H.T. and J.G. Boerngen. 1984. Element Concentration in Soils and Other Surficial Materials of the Conterminous United States. USGS Professional Paper 1270.

Taylor, M.C., A. Demayo and S. Reeder, 1980. Inorganic Chemical Substances-Silver, Guidelines for Surface Water Quality. *in* Remedial Investigation Report, Buckingham County Landfill Site, Buckingham County, Virginia. Engineering Science, Inc., October, 1992.

Terres, J.K. 1991. The Audubon Society Encyclopedia of North American Birds. Wings Books, New York.

U.S. Environmental Protection Agency (USEPA). 1986. Quality Criteria for Water. Criteria and Standards Division, Washington, D.C.

U.S. Environmental Protection Agency (USEPA). 1991. Risk Assessment Guidance for Superfund, Part B. Publication 9285.7-01B

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U.S. Environmental Protection Agency (USEPA). 1993a. Integrated Risk Information System (IRIS), On-line database, accessed September, 1993.

U.S. Environmental Protection Agency (USEPA). 1993b. Risk-Based Concentration Table, Third Quarter 1993. Roy L. Smith, Senior Toxicologist. Technical Support Section, USEPA Region III.

U.S. Environmental Protection Agency (USEPA). 1993c. Health Effects Assessment Summary Tables, Annual Update. Office of Solid Waste and Emergency Response. EPA 540-R-93-058.

U.S. Environmental Protection Agency (USEPA). 1993d. Integrated Exposure #2 Uptake Biokinetic Model (IEUBK), Version 6.

U.S. Environmental Protection Agency (USEPA). 1993e. Standards for the Use or Disposal of Sewage Sludge. FR 9248-9392.

U.S. Environmental Protection Agency (USEPA). 1993f. Wildlife Exposure Factors Handbook. EPA/600/R-93/187a.

Will, M.E. and G.W. Suter. 1994. Toxicological Benchmarts for Screening Potential Contaminants of Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Processes. Oak Ridge National Laboratory, Oak Ridge, TN.

APPENDIX A

EQUATION 1: Risk management criteria calculation based upon the noncarcinogenic hazards from exposure to groundwater: residential, campground host, camper, recreation maintenance worker, and surveyor receptors

$$C_W(mg/L) = \frac{THI * RfD_o * BW * NCAT}{IR * EF * ED * N_{NCO}}$$

Where:

- C_W = Chemical Risk Management Criteria in Water (mg/L)
- THI = Target Hazard Index (unitless)
- RfD_O = Oral Chronic Reference Dose (mg/kg-day)
- BW = Body Weight (kg)
- NCAT = Noncarcinogenic Averaging Time (period over which exposure resulting in noncarcinogenic effects is averaged - days)
- IR = Ingestion Rate (L/day)
- EF = Exposure Frequency (days/year)
- ED = Exposure Duration (years)
- N_{NCO} = Number of COCs with an Oral Chronic Reference Dose (unitless)

EQUATION 2: Risk management criteria calculation based upon the carcinogenic risks from the exposure to groundwater: residential, campground host, camper, recreation maintenance worker, and surveyor receptors

$$C_W(mg/L) = \frac{TR * CAT}{CPS_o * EF * N_{CO}} * \left(\frac{BW_A}{IR_A * ED_A} + \frac{BW_C}{IR_C * ED_C}\right)$$

Where:

- C_W = Chemical Risk Management Criteria in Water (mg/L)
- TR = Target Excess Individual Lifetime Cancer Risk (unitless)
- CAT = Carcinogenic Averaging Time (period over which exposure resulting in carcinogenic effects is averaged - days)
- CPS_O = Oral Carcinogenic Potency Slope $(mg/kg\text{-}day)^{-1}$
- EF = Exposure Frequency (days/year)
- N_{CO} = Number of COCs with an Oral Carcinogenic Potency Slope (unitless)
- BW_A = Body Weight, Adult (kg)
- IR_A = Ingestion Rate, Adult (L/day)
- ED_A = Exposure Duration, Adult (years)
- BW_C = Body Weight, Child (kg)
- IR_C = Ingestion Rate, Child (L/day)
- ED_C = Exposure Duration, Child (years)

EQUATION 3: Risk management criteria calculation based upon the noncarcinogenic hazards from exposure to surface water: campground host, camper, boater, and swimmer receptors

$$C_W(mg/L) = \frac{THI * RfD_o * BW * NCAT}{CR * ET * EF * ED * N_{NCO}}$$

Where:

C_W = Chemical Risk Management Criteria in Surface Water (mg/L)
THI = Target Hazard Index (unitless)
RfD_O = Oral Chronic Reference Dose (mg/kg-day)
BW = Body Weight (kg)
NCAT = Noncarcinogenic Averaging Time (period over which exposure resulting in noncarcinogenic effects is averaged - days)
CR = Contact Rate (L/hour)
ET = Exposure Time (hours/event)
EF = Exposure Frequency (events/year)
ED = Exposure Duration (years)
N_{NCO} = Number of COCs with an Oral Chronic Reference Dose

EQUATION 4: Risk management criteria calculation based upon the carcinogenic risks from exposure to chemicals in surface water: campground host, camper, boater, and swimmer receptors

$$C_W(mg/L) = \frac{TR * CAT}{CPS_o * CR * ET * EF * N_{CO}} * \left(\frac{BW_A}{ED_A} + \frac{BW_C}{ED_C}\right)$$

Where:

C_W = Chemical Risk Management Criteria in Surface Water (mg/L)
TR = Target Excess Individual Lifetime Cancer Risk (unitless)
CAT = Carcinogenic Averaging Time (period over which exposure resulting in carcinogenic effects is averaged - days)
CPS_O = Oral Carcinogenic Potency Slope $(mg/kg\text{-}day)^{-1}$
CR = Contact Rate (L/hour)
ET = Exposure Time (hours/event)
EF = Exposure Frequency (events/year)
N_{CO} = Number of COCs with an Oral Carcinogenic Potency Slope (unitless)
BW_A = Body Weight, Adult (kg) BW_C = Body Weight, Child (kg)
ED_A = Exposure Duration, Adult (years) ED_C = Exposure Duration, Child

EQUATION 5: Risk management criteria calculation based upon the noncarcinogenic hazards from exposure to sediments: campground host, camper, boater, and swimmer receptors

$$C_S\,(mg/kg) = \frac{THI * RfD_o * BW * NCAT}{IR * CF * EF * ED * N_{NCO}}$$

Where:

C_S = Chemical Risk Management Criteria in Sediments (mg/kg)
THI = Target Hazard Index (unitless)
RfD_O = Oral Chronic Reference Dose (mg/kg-day)
BW = Body Weight (kg)
NCAT = Noncarcinogenic Averaging Time (period over which exposure resulting in noncarcinogenic effects is averaged - days)
IR = Ingestion Rate (mg/day)
CF = Conversion Factor (kg/mg)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
N_{NCO} = Number of COCs with an Oral Chronic Reference Dose (unitless)

EQUATION 6: Risk management criteria calculation based upon the carcinogenic risks from exposure to sediments: campground host, camper, boater, and swimmer receptors

$$C_S\,(mg/kg) = \frac{TR * CAT}{CPS_o * CF * EF * N_{CO}} * \left[\frac{BW_A}{IR_A * ED_A} + \frac{BW_C}{IR_C * ED_C}\right]$$

Where:

C_S = Chemical Risk Management Criteria in Sediments (mg/kg)
TR = Target Excess Individual Lifetime Cancer Risk (unitless)
CAT = Carcinogenic Averaging Time (period over which exposure resulting in carcinogenic effects is averaged - days)
CPS_O = Oral Carcinogenic Potency Slope (mg/kg-day)- 1
CF = Conversion Factor (kg/mg)
EF = Exposure Frequency (days/year)
N_{CO} = Number of COCs with an Oral Carcinogenic Potency Slope (unitless)
BW_A = Body Weight, Adult (kg)
IR_A = Ingestion Rate, Adult (mg/day)
ED_A = Exposure Duration, Adult (years)
BW_C = Body Weight, Child (kg)
IR_C = Ingestion Rate, Child (mg/day)
ED_C = Exposure Duration, Child (years)

EQUATION 7: **Risk management criteria calculation based upon the noncarcinogenic hazards from exposure to soil: residential, campground host, camper, ATV driver, recreation maintenance worker, and surveyor receptors**

$$C_S\ (mg/kg) = \frac{THI * 365 * NCAT}{EF * M_N} * \left[\left[\frac{RfD_o}{IR_S * CF * N_{NCO}}\right] + \left[\frac{RfD_i}{IHR * 1/PEF * N_{NCI}}\right]\right]$$

Where:

C_S = Chemical Risk Management Criteria in Soil (mg/kg)
THI = Target Hazard Index (unitless)
NCAT = Noncarcinogenic Averaging Time (period over which exposure resulting in noncarcinogenic effects is averaged - years)
EF = Exposure Frequency (days/year)
RfDo = Oral Chronic Reference Dose (mg/kg-day)
IR_S = Age Ajusted Soil Ingestion Rate (mg-yr/kg-day)
CF = Conversion Factor (kg/mg)
N_{NCO} = Number of COCs with an Oral Chronic Reference Dose (unitless)
RfDi = Inhalation Chronic Reference Dose (mg/kg-day)
IHR = Inhalation Rate (m^3/hr)
PEF = Particulate Emission Factor (m^3/kg)
N_{NCI} = Number of COCs with an Inhalation Chronic Reference Dose (unitless)
M_N = Number of Media

EQUATION 8: **Risk management criteria calculation based upon the carcinogenic risks from exposure to soil: residential, campground host, camper, ATV driver, recreation maintenance worker, and surveyor receptors**

$$C_S\ (mg/kg) = TR * AT * 365 / \left[EF * M_N * \left[\left[SF_o * CF * IR_S\right] + \left[SF_i/N \quad * IR * \left[1/PEF\right]\right]\right]\right]$$

Where:

C_S = Chemical Risk Management Criteria in Soil (mg/kg)
TR = Target Excess Individual Lifetime Cancer Risk (unitless)
AT = Carcinogenic Averaging Time (period over which exposure resulting in carcinogenic effects is averaged - years)
EF = Exposure Frequency (days/year)
SFo = Oral Carcinogenic Potency Slope $(mg/kg\text{-}day)^{-1}$
CF = Conversion Factor (kg/mg)
N_{CO} = Number of COCs with an Oral Carcinogenic Potency Slope (unitless)
M_N = Number of Media
IR_S = Age Ajusted Soil Ingestion Rate (mg-yr/kg-day)
SFi = Inhalation Carcinogenic Potency Slope $(mg/kg\text{-}day)^{-1}$
N_{CI} = Number of COCs with an Inhalation Carcinogenic Potency Slope (unitless)
IR = Inhalation Rate (m^3/hr)

EQUATION 9: **Risk management criteria calculation based upon the noncarcinogenic hazards from the ingestion of chemicals in fish tissue: residential, campground host, and camper receptors**

$$C_F\ (mg/kg) = \frac{THI * RfD_o * BW * NCAT}{IR * EF * ED * N_{NCO}}$$

Where:

C_F = Chemical Criteria in Fish (mg/kg)
THI = Target Hazard Index (unitless)
RfD_O = Oral Chronic Reference Dose (mg/kg-day)
BW = Body Weight (kg)
NCAT = Noncarcinogenic Averaging Time (period over which exposure resulting in noncarcinogenic effects is averaged - days)
IR = Ingestion Rate (kg/day)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
N_{NCO} = Number of COCs with an Oral Chronic Reference Dose (unitless)

EQUATION 10: **Risk management criteria calculation based upon the carcinogenic risks from the ingestion of chemicals in fish tissue: residential, campground host, and camper receptors**

$$C_F\ (mg/kg) = \frac{TR * CAT}{CPS_o * EF * N_{CO}} * \left[\frac{BW_A}{IR_A * ED_A} + \frac{BW_C}{IR_C * ED_C}\right]$$

Where:

C_F = Chemical Criteria in Fish (mg/kg)
TR = Target Excess Individual Lifetime Cancer Risk (unitless)
CAT = Carcinogenic Averaging Time (period over which exposure resulting in carcinogenic effects is averaged - days)
CPS_O = Oral Carcinogenic Potency Slope $(mg/kg\text{-}day)^{-1}$
EF = Exposure Frequency (days/year)
N_{CO} = Number of COCs with an Oral Carcinogenic Potency Slope (unitless)
BW_A = Body Weight, Adult (kg) BW_C = Body Weight, Child (kg)
IR_A = Ingestion Rate, Adult (kg/day)
IR_C = Ingestion Rate, Child (kg/day)
ED_A = Exposure Duration, Adult (years) ED_C = Exposure Duration, Child (years)

EQUATION 11: Risk management criteria calculation based upon ecological receptor exposure to soil and plants

$$C_S\,(mg/kg) = \frac{TRV * BW}{(IR_S * CF) + (B_r * IR_p * CF * PDW)}$$

Where:

C_S = Dry Weight Soil Concentration
TRV = Toxicity Reference Value (mg/kg-day)
BW = Body Weight (kg)
IRS = Soil Ingestion Rate (g/day)
B_r = Soil-Plant Uptake Factor (unitless)
IR_p = Plant Ingestion Rate (g/day)
CF = Conversion Factor (kg/g)
PDW = Plant Fraction Dry:Fresh Weight (unitless: 0.65)

Variable Values:

TRV: chemical- and species-specific (See Table 3)
BW: species-specific
IRS: species-specific (Beyer, 1992)
B_r: chemical-specific: arsenic .006; cadmium 0.14; copper 0.08; lead .009; manganese .05; mercury 0.2; zinc 0.21
CF: 1E-03 kg/g

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13. ABSTRACT *(Maximum 200 words)*

This report sets forth acceptable soil and sediment criteria for heavy metals released from abandoned hard rock mining sites as they relate to ecosystem management and protection of human health and wildlife. The USDI Bureau of Land Management (BLM) manages approximately 270 million acres of public lands, primarily in the Western U.S. These lands include several hundred thousand abandoned mining sites, some of which may be releasing heavy metals into the environment at levels toxic to wildlife.

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ATTACHMENT D

Detailed Analysis and Cost Estimate Calculations of Removal Action Alternatives

ATTACHMENT D - DETAILED ANALYSIS AND COST ESTIMATE CALCULATIONS OF REMOVAL ACTION ALTERNATIVES

Note regarding cost estimate calculations: The costs presented in this document are conceptual in nature and are *not intended to be used for budgeting purposes*. The purpose of presenting cost data within an EE/CA is to provide *relative* costs solely for comparing the alternatives to one another. The cost estimates provided here often omit line items common to some or all of the alternatives because such level of detail is not required by EPA guidance and cannot be realistically expected at this stage in the development of the alternatives. The line items that are occasionally omitted from this cost analysis at this stage in the alternative development are sometimes substantial. The cost data presented here is in no way expected to be substituted for a full engineering cost estimate which is typically generated during the removal design once an alternative has been selected for implementation.

D.1 Removal Action Alternative 1: No Action

The No Action Alternative leaves all of the contaminated material at the Site in its current condition.

Analysis:

Removal Action Alternative 1: No Action	
Evaluation Criteria	**Alternative Analysis**
EFFECTIVENESS	Overall - Not effective.
Protective of public health and community	No.
Protective of workers during implementation	No workers required for implementation
Protective of the environment	No.
Complies with ARARs	No.
Ability to achieve removal action objectives	No.
Level of treatment/containment expected	None.
No residual effect concerns	Significant residual effect concerns remain.
Will maintain control until long-term solution is implemented	Will not implement any controls.
IMPLEMENTABILITY	Overall - Technically implementable, but probably not administratively implementable.
Technical feasibility	No technology required.
Construction and operational considerations	No construction or operations required.
Demonstrated performance/useful life	Performance and useful life of technology is inapplicable.

Removal Action Alternative 1: No Action	
Evaluation Criteria	**Alternative Analysis**
Adaptable to environmental conditions	Environmental conditions will not make site more or less of a threat.
Can be implemented in one year	Yes.
Availability	Yes.
Equipment	Requires no equipment.
Personnel and services	Requires no personnel or services.
Outside laboratory testing capacity	Requires no laboratory testing.
Offsite treatment and disposal capacity	Requires no offsite treatment or disposal
Post removal action site control	Requires no post removal action site control.
Permits required	Permits not required for CERCLA actions.
Easements or rights-of-way required	No.
Impact on adjoining property	Site will continue to impact adjoining property because it will not reduce the mobility of contaminants.
Ability to impose institutional controls	No institutional controls will be imposed.
Community acceptance	Unknown, but could be determined through public comment.
COST	Overall - No immediate cost. May present a future liability cost to the BLM which cannot be estimated.
Capital cost	$0
Post removal action site control, maintenance, and monitoring cost	$0

D.2 Removal Action Alternative 2: Offsite Disposal of Sludge and Onsite Consolidation of Contaminated Soil

This alternative involves the removal and offsite disposal of the sludge at I&W South and I&W South Site #2 and the subsequent consolidation of the remaining contaminated soil in the fenced enclosure at I&W South. No treatment of the contaminated soil will occur under this alternative. Periodic maintenance of the fences, gates, and warning signs (if posted) will be performed.

Analysis:

Removal Action Alternative 2: Offsite Disposal of Sludge and Onsite Consolidation of Contaminated Soil	
Evaluation Criteria	**Alternative Analysis**
EFFECTIVENESS	Overall - Moderately effective by removing the most contaminated material and by attempting to deter trespasser access. Does not reduce the potential for offsite transport of waste materials via the air and surface water pathways, or the potential for ecological exposure.
Protective of public health and community	Consolidation of waste remaining onsite in a fenced area may reduce risk of direct exposure to humans in the short-term; however, this alternative leaves the contaminated soil in place without containment and may continue to present a threat, particularly via the air and surface water pathways.
Protective of workers during . implementation	With proper protective equipment, training, and supervision, threats to workers would be minimal. During implementation of this alternative, workers need to be protected by a site health and safety plan which complies with the requirements of 29 CFR 1910.120. This includes a requirement for OSHA hazardous site worker training and medical monitoring.
Protective of the environment	Environmental impacts will be reduced by the removal of the sludge, but the presence of contaminated soil onsite presents continued opportunities for exposure to contaminants, particularly by ecological targets or to humans via wind blown contaminant transport.
Complies with ARARs	Meets ARARs for metals, but does not meet NMOCD requirements for TPH.
Ability to achieve removal action objectives	Will partially meet the RAOs but will not meet stated objectives associated with ecological exposure or offsite transport of contaminants..
Level of treatment/containment expected	Removal of sludge results in a high level of treatment at a TSD facility. Minimal containment anticipated as a result of consolidation of contaminated soil.
No residual effect concerns	Moderate residual effect concerns exist associated with the contaminated soil.
Will maintain control until long-term solution is implemented	May be used in the short-term to reduce the potential for human exposure until a long-term solution can be implemented.

Removal Action Alternative 2: Offsite Disposal of Sludge and Onsite Consolidation of Contaminated Soil	
Evaluation Criteria	**Alternative Analysis**
IMPLEMENTABILITY	Overall - Easily technically implementable, but may not be administratively feasible.
Technical feasibility	Excavation of sludge and contaminated soil and offsite disposal of sludge are technically feasible, although sludge excavation may present minor operational difficulties due to its physical properties.
Construction and operational considerations	A moderate level of earthwork is needed. Excavation of sludge and contaminated soil and offsite disposal of sludge are technically feasible, although sludge excavation may present minor operational difficulties due to its physical properties. Would require a minimal level of future maintenance to ensure continued operation of fencing and other institutional controls.
Demonstrated performance/useful life	Offsite disposal has been demonstrated at many other locations. The efficiency of natural attenuation of soils contaminated with petroleum hydrocarbons is not a proven technology.
Adaptable to environmental conditions	The methods proposed in this alternative are highly compatible with the environmental conditions at the Site, but the revegetated areas should be protected from uncontrolled livestock grazing and unwanted anthropogenic impacts.
Can be implemented in one year	Yes.
Availability	Yes.
Equipment	Equipment and materials expected to be readily available.
Personnel and services	Expected to be readily available.
Outside laboratory testing capacity	Outside laboratory services needed for waste profiling of sludge are readily available.
Offsite treatment and disposal capacity	Readily available.
Post removal action site control	Would require an incidental level of post removal site control to remain effective.
Permits required	Permits not required for CERCLA actions.
Easements or rights-of-way required	None anticipated.
Impact on adjoining property	May have short-term impacts due to dust generation during waste material relocation activities. In addition, these activities may impact wildlife and result in increased offsite sediment transport in the short term until new vegetation can be established in these areas.
Ability to impose institutional controls	Existing institutional controls expected to be easily modified or enhanced to fit the needs of this alternative.
Community acceptance	Unknown, but could be determined through public comment.

Removal Action Alternative 2: Offsite Disposal of Sludge and Onsite Consolidation of Contaminated Soil	
Evaluation Criteria	**Alternative Analysis**
COST	Overall - Capital costs relatively small compared to the other alternatives (except No Action). Because contaminated material remains onsite, the Site may continue to present a future liability cost to the BLM which cannot be estimated.
Capital cost	$131,758
Post removal action site control, maintenance, and monitoring cost	Year 1 = $3,300 Year 2 = $2,400 (Annually in 2002 dollars)

Cost Analysis

All costs were obtained from the *2002 Environmental Remediation Cost Data - Unit Price 8th Annual Edition, RS Means* or the *Building Construction Cost Data 60th Annual Edition, RS Means* and are in 2002 dollars. Costs from the *2002 Environmental Remediation Cost Data - Unit Price 8th Annual Edition* are not adjusted for overhead and profit on labor or for conducting the work in Level C or D protective clothing as may be necessary during some phases of the work. As a result, the individual cost items predicted here may be biased low.

Capital Costs

The volume of sludge to be removed and disposed offsite from I&W South and I&W South Site #2 totals approximately 85 cubic yards. The nearest facility that is suitable to receive the sludge is the Laidlaw incinerator in Deer Park, Texas. The remaining contaminated material at I&W South Site #2 (approximately 186 cubic yards) will be excavated and hauled to I&W South, and it will then be consolidated with the remaining contaminated soil at I&W South (approximately 418 cubic yards). The contaminated soil from the two locations will be regraded and blended into the surface soils within the existing fenced enclosure at I&W South. Disturbed areas at both sites will be regraded to match surrounding terrain and revegetated as necessary after the contaminated material has been relocated. In revegetation areas, broadcast seeding will be implemented, and it is assumed that no additional topsoil will be required and that no organic soil amendments or fertilization will be used.

Post Removal Action Site Control, Maintenance, and Monitoring Costs

For the operational life of this alternative, the fence line and gates will be inspected on a monthly basis. This inspection will also include the revegetated areas which were disturbed during the excavation of the waste materials for the first year. For the first year, it is assumed that each inspection will take an average of three hours at a labor rate of $225. Thereafter, the inspections are assumed to be two hours in duration (including travel time) at a labor rate of $150 per inspection. It is assumed that patching and repairing of the fence and gates will be conducted once per year for a total of one day at a daily labor rate of $600.

Alternative 2: Offsite Disposal of Sludge and Onsite Consolidation of Contaminated Soil

Capital Costs

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL COST
CONTRACTOR SUBMITTALS				
Site Safety and Health Plan	1	EA	2500	$2,500
Site Specific Work Plan	1	EA	4000	$4,000
CONSTRUCTION MANAGEMENT				
Removal Contractor Field Team				
Labor				
Site Manager ($65/hr)	7	DAY	520	$3,640
Heath and Safety Officer ($65/hr)	7	DAY	520	$3,640
Per Diem ($85/day per person)	7	DAY	340	$2,380
Pickup Truck Rental	1	WK	240	$240
MOBILIZATION/DEMOBILIZATION	1	EA	6000	$6,000
CONSTRUCT DECONTAMINATION PAD				
2"x4" Framed HDPE Liner	1	EA	2200	$2,200
EXCAVATE SLUDGE, DIRECT LOAD INTO TRUCKS				
Excavator, Crawler Mounted, 1 CY Bucket	1	DAY	1900	$1,900
Front End Loader, Wheel Mounted, 1-1/2 CY Bucket	1	DAY	1150	$1,150
DECONTAMINATE EQUIPMENT	6	EA	225	$1,350
WASTE PROFILING	3	EA	165	$495
HAULING OF SLUDGE TO TSD FACILITY				
20 CY Dump Trailer or Intermodal Container (4 Loads; total round trip distance 1420 miles)	5680	MI	3.25	$18,460
INCINERATION OF SLUDGE (RCRA HAZARDOUS)	85	CY	500	$42,500
Disposal Tax (5.5%)	1	LS	2337.50	$2,338
INSTALL SEDIMENT AND EROSION CONTROL DEVICES				
Silt Fences and/or Hay Bales, As Needed	100	LF	2.60	$260
EXCAVATE CONTAMINATED SOIL & LOAD INTO TRUCKS				
Front End Loader, Wheel Mounted, 1-1/2 CY Bucket	2	DAY	800	$1,600
HAUL CONTAMINATED SOIL TO I&W SOUTH				
6 CY Dump Truck, 1/4 Mile Round Trip	2	DAY	700	$1,400
REMOVAL CONFIRMATION SAMPLING (AT SITE #2)				
TPH Analysis by Fixed Laboratory (Quick Turn-Around)	5	EA	80	$400
REGRADING AND "BLENDING" OF CONTAMINATED SOIL				
Dozer, 200 HP, 50' Maximum Haul	3	DAY	1400	$4,200
REVEGETATION OF DISTURBED AREAS	0.4	ACRE	1750	$700
SUBTOTAL				$101,353
TOTAL INCLUDING OVERHEAD, PROFIT, AND CONTINGENCY				$131,758

Post Removal Action Site Control, Maintenance, and Monitoring Costs

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL COST
MONTHLY INSPECTIONS (YEAR 1)				
Inspect Fence, Gates, and Revegetated Areas	12	EA	225	$2.700
Repair Fence, Gates, and Revegetated Areas as Needed	1	EA	600	$600
MONTHLY INSPECTIONS (YEARS 2-10)				
Inspect Fence and Gates	12	EA	150	$1.800
Repair Fence and Gates as Needed	1	EA	600	$600
TOTAL ANNUAL MAINTENANCE COSTS				
Year 1				$3.300
Years 2-10				$2,400

D.3 Removal Action Alternative 3: Offsite Disposal of Sludge and Onsite Landfarming of Contaminated Soil

This alternative involves the removal and offsite disposal of the sludge at I&W South and I&W South Site #2 and the design and construction of an onsite landfarm to be located in the fenced enclosure at I&W South. Prior to construction, the proposed location will be regraded, cleared, and grubbed as needed. Once the construction is complete, the contaminated soil from I&W South and I&W South Site #2 will be relocated and placed into the landfarm and treated for a period not expected to exceed two years based on anticipated treatment efficiency. To protect the landfarm from runon associated with precipitation events, simple earthen berms or ditches will be constructed around the perimeter. Finally, to allow the heavy equipment which will perform aeration of the contaminated soils, an access ramp will be installed.

The calculated footprint of the landfarm will be approximately 35 yards by 35 yards or approximately 1,210 square yards (10,890 square feet). For cost estimating purposes, it is assumed that no liner, leachate collection, or vapor collection systems will be required.

After treatment has been determined sufficient to meet the removal goals via soil sampling and laboratory analysis of the treated soil, the landfarm will be decommissioned. This will be accomplished by removing the fencing around I&W South, flattening the berms or channels, regrading the Site, and revegetating the landfarm area. Maintenance of the revegetated areas is assumed for an additional twelve months following closure of the landfarm.

Analysis:

Removal Action Alternative 3: Offsite Disposal of Sludge and Onsite Landfarming of Contaminated Soil	
Evaluation Criteria	Alternative Analysis
EFFECTIVENESS	Overall – At the conclusion of treatment, this alternative will be highly effective in protecting human health and the environment when compared to Alternatives 1 and 2. Based on expected efficiency, the level of treatment provided by the landfarm will attain ARARs and will meet RAOs if it is adequately designed and maintained.
Protective of public health and community	By removing the sludge and consolidating the remaining contaminated soil for treatment in an onsite landfarm, this alternative is highly protective of public health.
Protective of workers during implementation	With proper protective equipment, training, and supervision, threats to workers would be minimal. During implementation of this alternative, workers need to be protected by a site health and safety plan which complies with the requirements of 29 CFR 1910.120. This includes a requirement for OSHA hazardous site worker training and medical monitoring.
Protective of the environment	The removal and treatment of contaminated material proposed under this alternative will eliminate the currently identified threats to human and ecological receptors. The potential for offsite transport of contaminants via all identified environmental pathways will be eliminated..

Removal Action Alternative 3: Offsite Disposal of Sludge and Onsite Landfarming of Contaminated Soil	
Evaluation Criteria	**Alternative Analysis**
Complies with ARARs	ARARs will be met at the conclusion of the treatment phase.
Ability to achieve removal action objectives	Will achieve RAOs at the conclusion of the treatment phase.
Level of treatment/containment expected	Provides an acceptable level of treatment for activities involving onsite closure.
No residual effect concerns	Residual effect concerns continue to exist until treatment is completed.
Will maintain control until long-term solution is implemented	This is the most effective of the onsite management alternatives considered. With a properly engineered, constructed, and maintained landfarm, this will be an effective long-term solution.
IMPLEMENTABILITY	Overall - Technically feasible to implement, since it requires established earth moving, *in-situ* treatment, and seeding technologies.
Technical feasibility	Required technologies have been demonstrated to be effective at similar sites.
Construction and operational considerations	Will require construction activities onsite which are greater in magnitude than those associated with the other alternatives. Excavation of sludge and contaminated soil and offsite disposal of sludge are technically feasible, although sludge excavation may present minor operational difficulties due to its physical properties. Will require moderate post-construction maintenance to maintain desired landfarm performance.
Demonstrated performance/useful life	Landfarming techniques have been demonstrated on similar sites.
Adaptable to environmental conditions	The methods proposed in this alternative are highly compatible with the environmental conditions at the Site, but the landfarm and any revegetated areas should be protected from uncontrolled livestock grazing and unwanted anthropogenic impacts.
Can be implemented in one year	Yes, although the contaminated soil treatment is expected to take longer to meet cleanup goals.
Availability	Yes.
Equipment	Earth moving support equipment will be required, and is expected to be readily available.
Personnel and services	Expected to be readily available.
Outside laboratory testing capacity	Outside laboratory services needed for waste profiling of sludge and landfarm treatment monitoring are readily available.
Offsite treatment and disposal capacity	Readily available.
Post removal site control	Post removal institutional controls, including land use restrictions, will be required to mitigate continuing threats to authorized site visitors and trespassers until site closure after completion of treatment.
Permits required	Permits not required for CERCLA actions.

Removal Action Alternative 3: Offsite Disposal of Sludge and Onsite Landfarming of Contaminated Soil	
Evaluation Criteria	**Alternative Analysis**
Easements or rights-of-way required	None required.
Impact on adjoining property	May have short-term impacts due to dust generation during waste material relocation and landfarm construction activities. In addition, these activities may impact wildlife and result in increased offsite sediment transport in the short term until new vegetation can be established in these areas.
Ability to impose institutional controls	Existing institutional controls expected to be easily modified or enhanced to fit the needs of this alternative.
Community acceptance	Unknown, but may be determined through public comment.
COST	Overall - Capital costs and ongoing maintenance costs are higher than the other alternatives, due to construction and maintenance of the onsite landfarm.
Capital cost	$261,225
Post removal site control, maintenance, and monitoring cost	$26,900 (annually for 2 years in 2002 dollars)

Cost Analysis

All costs were obtained from the *2002 Environmental Remediation Cost Data - Unit Price 8th Annual Edition, RS Means* or the *Building Construction Cost Data 60th Annual Edition, RS Means* and are in 2002 dollars. Costs from the *2002 Environmental Remediation Cost Data - Unit Price 8th Annual Edition* are not adjusted for overhead and profit on labor or for conducting the work in Level C or D protective clothing as may be necessary during some phases of the work. As a result, the individual cost items predicted here may be biased low.

Capital Costs

The volume of sludge to be removed and disposed offsite from I&W South and I&W South Site #2 totals approximately 85 cubic yards. The nearest facility that is suitable to receive the sludge is the Laidlaw incinerator in Deer Park, Texas.

After the sludge is removed and after the design of the landfarm is complete, a site for the landfarm will be selected, cleared, and graded in preparation for placement of the contaminated material. The contaminated material at I&W South Site #2 (approximately 186 cubic yards) will be excavated and hauled to I&W South. This material will then be consolidated with the remaining contaminated soil at I&W South (approximately 418 cubic yards) in the landfarm footprint. Based on these volume estimates, the landfarm will need to be sized to accommodate approximately 605 cubic yards of contaminated soil. The contaminated soil will be placed at a maximum thickness of 18 inches to ensure that commonly available tilling equipment will be able to provide adequate aeration. To accommodate the known volume of soil at this thickness, a landfarm surface area of approximately 1,210 square yards is required. To conservatively achieve this surface area, the landfarm will be a 35 yard by 35 yard square.

After placement in the landfarm, the contaminated material will be terraced into windrows by construction equipment to minimize air erosion, and earthen berms or drainage channels will be installed around the perimeter to minimize erosion via surface water runon and runoff. At this time, it is believed that simple earthen berms or ditches will be sufficient to manage the surface water that is expected at the Site. To provide continue access to the treated soils, an access ramp will be installed over the berms or channels.

Disturbed areas at both sites will be regraded to match surrounding terrain and revegetated as necessary after the contaminated material has been relocated. In revegetation areas, broadcast seeding will be implemented, and it is assumed that no additional topsoil will be required and that no organic soil amendments or fertilization will be used.

Post Removal Action Site Control, Maintenance, and Monitoring Costs

Operation and maintenance of the landfarm will include monthly aeration of the contaminated soil and bimonthly sampling of treated soil to determine treatment efficiency. The most common method for aeration of landfarms is the use of farm equipment towing a discing device, and this type of equipment is assumed here for cost estimating purposes.

Aside from the regular aeration, operations and maintenance activities are expected include the application of nutrients and water, and for cost estimating purposes, it is assumed that this will take place eight times per year (no watering will occur during the winter months).

In addition, general maintenance of the fences, berms/channels, and revegetated areas will occur during the two year operational life of the landfarm until it is decommissioned. During this two year period, these features will be inspected on a monthly basis. It is assumed that each inspection will take an average of three hours (including travel time) at a labor rate of $225 per inspection. It is assumed that patching and repairing of the fence and minor repair to the berms will be conducted once per year for a total of one day at a daily labor rate of $800. This cost also includes inspection and repair, as needed, of the revegetated areas.

Alternative 3: Offsite Disposal of Sludge and Onsite Landfarming of Contaminated Soil

Capital Costs

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL COST
CONTRACTOR SUBMITTALS				
Site Safety and Health Plan	1	EA	3500	$3,500
Site Specific Work Plan	1	EA	6500	$6,500
CONSTRUCTION MANAGEMENT				
Removal Contractor Field Team				
Labor				
Site Manager ($65/hr)	14	DAY	520	$7,280
Heath and Safety Officer ($65/hr)	14	DAY	520	$7,280
Per Diem ($85/day per person)	14	DAY	340	$4,760
Pickup Truck Rental	2	WK	240	$480
MOBILIZATION/DEMOBILIZATION	1	EA	8000	$8,000
CONSTRUCT DECONTAMINATION PAD				
2"x4" Framed HDPE Liner	1	EA	2200	$2,200
EXCAVATE SLUDGE, DIRECT LOAD INTO TRUCKS				
Excavator, Crawler Mounted, 1 CY Bucket	1	DAY	1900	$1,900
Front End Loader, Wheel Mounted, 1-1/2 CY Bucket	1	DAY	1150	$1,150
DECONTAMINATE EQUIPMENT	6	EA	225	$1,350
WASTE PROFILING	3	EA	165	$495
HAULING OF SLUDGE TO TSD FACILITY				
20 CY Dump Trailer or Intermodal Container (4 Loads; total round trip distance 1420 miles)	5680	MI	3.25	$18,460
INCINERATION OF SLUDGE (RCRA HAZARDOUS)	85	CY	500	$42,500
Disposal Tax (5.5%)	1	LS	2337.50	$2,338
LANDFARM REMEDIAL DESIGN (SERVICE CONTRACT)	1	LS	45000	$45,000
CONSTRUCTION OF SOIL STAGING AREAS				
Staging Areas With Hay Bales & HDPE Liner (50'x30')	4	EA	1250	$5,000
INSTALL SEDIMENT AND EROSION CONTROL DEVICES				
Silt Fences and/or Hay Bales, As Needed	200	LF	2.60	$520
SITE CLEARING AND GRUBBING				
With Dozer and Brush Rake	0.5	ACRE	1650	$825
EXCAVATE CONTAMINATED SOIL & LOAD INTO TRUCKS				
Front End Loader, Wheel Mounted, 1-1/2 CY Bucket	2	DAY	800	$1,600
Excavator, Crawler Mounted, 1 CY Bucket	2	DAY	1900	$3,800
COMPACTION OF LANDFARM AREA				
Sheepsfoot or Roller, 8" Lifts, Three Passes	3675	CY	1.60	$5,880
HAUL CONTAMINATED SOIL TO I&W SOUTH				
6 CY Dump Truck, 1/4 Mile Round Trip	2	DAY	700	$1,400
REMOVAL CONFIRMATION SAMPLING				
TPH Analysis by Fixed Laboratory (Quick Turn-Around)	10	EA	80	$800

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL COST
PLACEMENT OF CONTAMINATED SOIL IN LANDFARM				
2 @ Front End Loaders, Wheel Mounted, 1-1/2 CY Bucket	4	DAY	2300	$9,200
Dozer, 200 HP, 50' Maximum Haul	3	DAY	1400	$4,200
SOIL TILLING FOR WINDROW INSTALLATION				
Dozer, 200 HP, With Disc Attachment	0.5	DAY	1400	$700
BERM INSTALLATION AND OTHER REGRADING				
Dozer, 200 HP, 50' Maximum Haul	2	DAY	1400	$2,800
ACCESS RAMP INSTALLATION	1	LS	1750	$3,000
REVEGETATION OF DISTURBED AREAS	0.5	ACRE	1750	$875
LANDFARM POST CLOSURE ACTIVITIES				
Fence Removal and Disposal	1600	LF	4.25	$6,800
Revegetation of Landfarm Area	0.2	ACRE	1750	$350
SUBTOTAL				$200,943
TOTAL INCLUDING OVERHEAD, PROFIT, AND CONTINGENCY				$261,225

Post Removal Action Site Control, Maintenance, and Monitoring Costs

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL COST
MONTHLY AERATION OF LANDFARM				
Mobilization/Demobilization of Dozer	12	EA	190	$2,280
Dozer, 200 HP, With Disc Attachment	6	DAY	1400	$8,400
TREATMENT EFFICIENCY CONFIRMATION SAMPLING				
TPH	12	EA	80	$960
NUTRIENT AND/OR WATER APPLICATION				
Mobilization/Demobilization of Water Truck	8	EA	120	$960
Mobilization/Demobilization of Dump Truck	8	EA	150	$1,200
Apply Water and Nutrients, Including Labor and Materials	8	EA	1,200	$9,600
MONTHLY INSPECTIONS				
Inspect Fence, Gates, and Revegetated Areas	12	EA	225	$2,700
Repair Fence, Gates, and Revegetated Areas as Needed	1	EA	800	$800
TOTAL ANNUAL MAINTENANCE COSTS				$26,900

D.4 Removal Action Alternative 4: Offsite Disposal of Sludge and Offsite Landfarming of Contaminated Soil

This alternative involves the complete removal of all material identified onsite in excess of the removal goals. This includes the sludge at I&W South and I&W South Site #2 and all contaminated soil in excess of the NMOCD remediation action levels for TPH and BTEX compounds. As with Alternatives 3 and 4, the sludge will be disposed offsite at a permitted TSD facility in Deer Park, Texas. The remaining material will be hauled to the Lea Land, Inc. landfarm for treatment. After this material is removed, the existing fence will be removed and all disturbed areas will be regraded and revegetated.

Analysis:

Removal Action Alternative 4: Offsite Disposal of Sludge and Offsite Landfarming of Contaminated Soil	
Evaluation Criteria	**Alternative Analysis**
EFFECTIVENESS	Overall – Provides the maximum level of protectiveness for human health and the environment when compared to other alternatives being considered. Will attain ARARs and will meet RAOs.
Protective of public health and community	Will substantially reduce the currently identified threats to authorized site visitors and trespassers by complete removal of waste materials.
Protective of workers during implementation	With proper protective equipment, training, and supervision, threats to workers would be minimal. During implementation of this alternative, workers need to be protected by a site health and safety plan which complies with the requirements of 29 CFR 1910.120. This includes a requirement for OSHA hazardous site worker training and medical monitoring.
Protective of the environment	Will eliminate the currently identified threats to ecological receptors by removing the onsite source of contamination.
Complies with ARARs	ARARs will be met.
Ability to achieve removal action objectives	Will achieve RAOs.
Level of treatment/containment expected	Provides the maximum level of treatment.
No residual effect concerns	No residual effect concerns.
Will maintain control until long-term solution is implemented	This is the most immediately effective of the alternatives considered. Removing waste to the offsite facility is an effective long-term solution.
IMPLEMENTABILITY	Overall - Technically easy to implement, since it requires only earth moving and seeding technologies.
Technical feasibility	Required technologies have been demonstrated to be effective at similar sites.
Construction and operational considerations	Excavation of sludge and contaminated soil and offsite disposal of sludge are technically feasible, although sludge excavation may present minor operational difficulties due to its physical properties.

Removal Action Alternative 4: Offsite Disposal of Sludge and Offsite Landfarming of Contaminated Soil	
Evaluation Criteria	**Alternative Analysis**
Demonstrated performance/useful life	Removal and disposal techniques have been demonstrated on similar sites.
Adaptable to environmental conditions	Because waste materials are removed and disposed offsite, environmental conditions will not have an impact on the alternative.
Can be implemented in one year	Yes.
Availability	It is anticipated that equipment and staffing would be readily available within close proximity of the site.
Equipment	Earth moving support and hauling equipment will be required and are expected to be readily available.
Personnel and services	Expected to be readily available.
Outside laboratory testing capacity	Outside laboratory services will be required for waste profiling; these services are expected to be readily available.
Offsite treatment and disposal capacity	Offsite stabilization and disposal to the permitted landfill are required.
Post removal site control	Post removal site control is not required.
Permits required	Permits not required for CERCLA actions.
Easements or rights-of-way required	Not expected to require any offsite easements or rights-of-way.
Impact on adjoining property	May have short-term impacts due to dust generation during waste material excavation activities. In addition, these activities may impact wildlife and result in increased offsite sediment transport in the short term until new vegetation can be established in these areas.
Ability to impose institutional controls	Implementation of institutional controls is not required after removal.
Community acceptance	Unknown, but may be determined through public comment.
COST	Overall - Capital costs and ongoing maintenance costs are higher than Alternatives 1 and 2, due to the costs transport and disposal of the waste material. But both capital costs and maintenance costs are expected to be lower than Alternative 3.
Capital cost	$181,018
Post removal site control, maintenance, and monitoring cost	$1,000 (for the first year only in 2002 dollars)

Cost Analysis

All costs were obtained from the *2002 Environmental Remediation Cost Data - Unit Price 8th Annual Edition, RS Means* or the *Building Construction Cost Data 60th Annual Edition, RS Means* and are in 2002 dollars. Costs from the *2002 Environmental Remediation Cost Data - Unit Price 8th Annual Edition* are not adjusted for overhead and profit on labor or for conducting the work in Level C or D protective clothing as may be necessary during some phases of the work. As a result, the individual cost items predicted here may be biased low.

Capital Costs

The volume of sludge to be removed and disposed offsite from I&W South and I&W South Site #2 totals approximately 85 cubic yards. The nearest facility that is suitable to receive the sludge is the Laidlaw incinerator in Deer Park, Texas. Excavation, hauling, and disposal of contaminated soil which exceeds the removal goals from I&W South (approximately 418 cubic yards) and I&W South Site #2 (approximately 186 cubic yards) will follow. Disposal of this material will occur at the Lea Land, Inc. NMOCD permitted commercial landfarm.

Following removal of the sludge and contaminated soil, the excavated areas will be recontoured and revegetated. In revegetation areas, broadcast seeding will be implemented, and it is assumed that no additional topsoil will be required and that no organic soil amendments or fertilization will be used.

Post Removal Action Site Control, Maintenance, and Monitoring Costs

It is assumed that a two man crew will be required to visit the Site twice during the first year to provide routine maintenance on the revegetated areas at a daily labor rate of $500 per day.

Alternative 4: Offsite Disposal of Sludge and Offsite Landfarming of Contaminated Soil

Capital Costs

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL COST
CONTRACTOR SUBMITTALS				
Site Safety and Health Plan	1	EA	2500	$2,500
Site Specific Work Plan	1	EA	4000	$4,000
CONSTRUCTION MANAGEMENT				
Removal Contractor Field Team				
Labor				
Site Manager ($65/hr)	7	DAY	520	$3,640
Heath and Safety Officer ($65/hr)	7	DAY	520	$3,640
Per Diem ($55/day per person)	7	DAY	340	$2,380
Pickup Truck Rental	1	WK	240	$240
MOBILIZATION DEMOBILIZATION	1	EA	3000	$3,000
CONSTRUCT DECONTAMINATION PAD				
2"x4" Framed HDPE Liner	1	EA	2200	$2,200
EXCAVATE SLUDGE, DIRECT LOAD INTO TRUCKS				
Excavator, Crawler Mounted, 1 CY Bucket	1	DAY	1900	$1,900
Front End Loader, Wheel Mounted, 1-1/2 CY Bucket	1	DAY	1150	$1,150
DECONTAMINATE EQUIPMENT	6	EA	225	$1,350
WASTE PROFILING	3	EA	165	$495
HAULING OF SLUDGE TO TSD FACILITY				
20 CY Dump Trailer or Intermodal Container (4 Loads; total round trip distance 1420 miles)	5680	MI	3.25	$18,460
INCINERATION OF SLUDGE (RCRA HAZARDOUS)	85	CY	500	$42,500
Disposal Tax (5.5%)	1	LS	2337.50	$2,338
INSTALL SEDIMENT AND EROSION CONTROL DEVICES				
Silt Fences and/or Hay Bales, As Needed	100	LF	2.60	$260
EXCAVATE CONTAMINATED SOIL & LOAD INTO TRUCKS				
Front End Loader, Wheel Mounted, 1-1/2 CY Bucket	7	DAY	800	$5,600
Excavator, Crawler Mounted, 1 CY Bucket	7	DAY	1900	$13,300
HAULING OF CONTAMINATED SOIL TO LANDFARM				
20 CY Dump Trailer (20 Loads; total round-trip distance 60 miles)	2400	MI	2.15	$5,160
OFFSITE LANDFARMING DISPOSAL	605	CY	25	$15,125
Disposal Tax (5.5%)	1	LS	832	$832
REMOVAL CONFIRMATION SAMPLING				
TPH Analysis by Fixed Laboratory (Quick Turn-Around)	10	EA	80	$800
SITE REGRADING				
Dozer, 200 HP, 50' Maximum Haul	0.5	DAY	1400	$700
REVEGETATION OF DISTURBED AREAS	0.5	ACRE	1750	$875
FENCE REMOVAL AND DISPOSAL	1600	LF	4.25	$6,800
SUBTOTAL				$139,244
TOTAL INCLUDING OVERHEAD, PROFIT, AND CONTINGENCY				$181,018

Post Removal Action Site Control, Maintenance, and Monitoring Costs

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL COST
INSPECTION AND REPAIR OF REVEGETATED AREAS	2	EA	500	$1,000
TOTAL ANNUAL MAINTENANCE COSTS (YEAR 1 ONLY)				$1,000

NEW MEXICO ENERGY, MINERALS and NATURAL RESOURCES DEPARTMENT

BILL RICHARDSON
Governor
Joanna Prukop
Cabinet Secretary

Lori Wrotenbery
Director
Oil Conservation Division

January 6, 2002

Link Lacewell
Bureau of Land Management
Carlsbad Field Office
620 E. Green St.
Carlsbad, NM 88221-1778

RE: Treating Plant History for Tank Services Company – Double I, Inc. – Lowell Irby SE/4 SW/4 NW/4 SE/4 Section 21, T 17 S, R 30 E, NMPM, Eddy County, NM

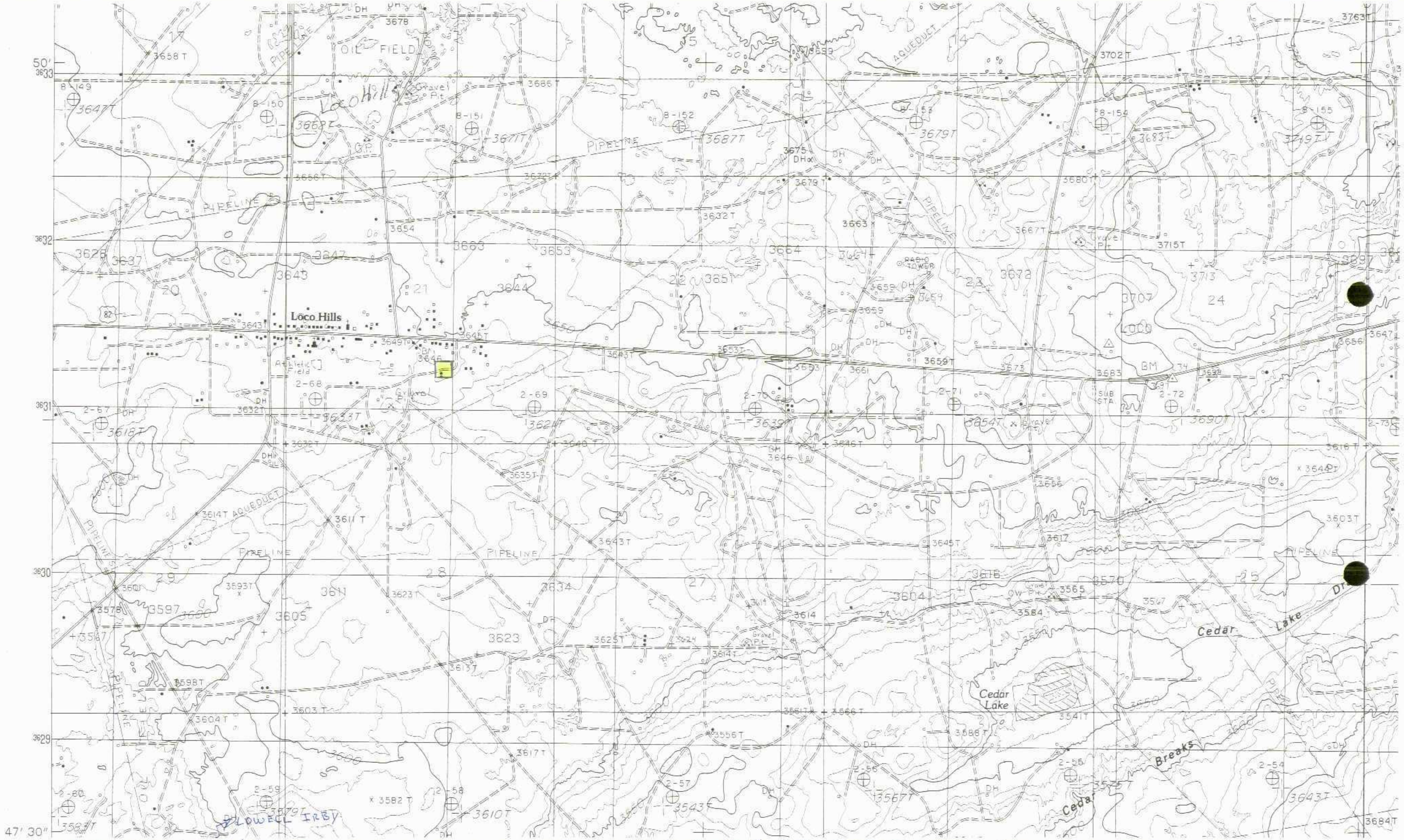
Dear Mr. Lacewell;

Here are copies of the material that I was able to uncover through my research. I hope this helps. Thank you for the color copies of your maps.

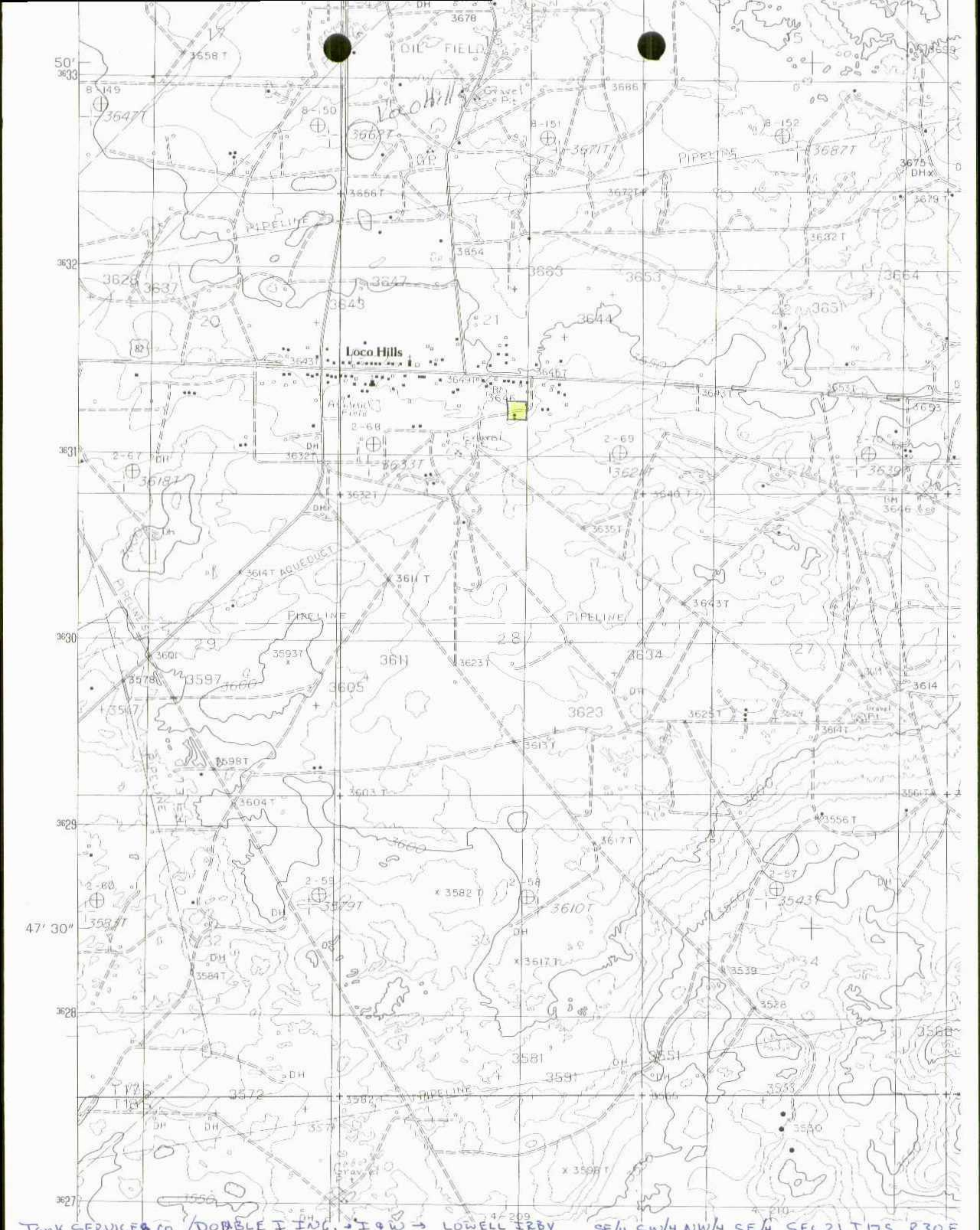
Sincerely,

Martyne Kieling
Environmental Geologist

Oil Conservation Division * 1220 South St. Francis Drive * Santa Fe, New Mexico 87505
Phone: (505) 476-3440 * Fax (505) 476-3462 * http://www.emnrd.state.nm.us

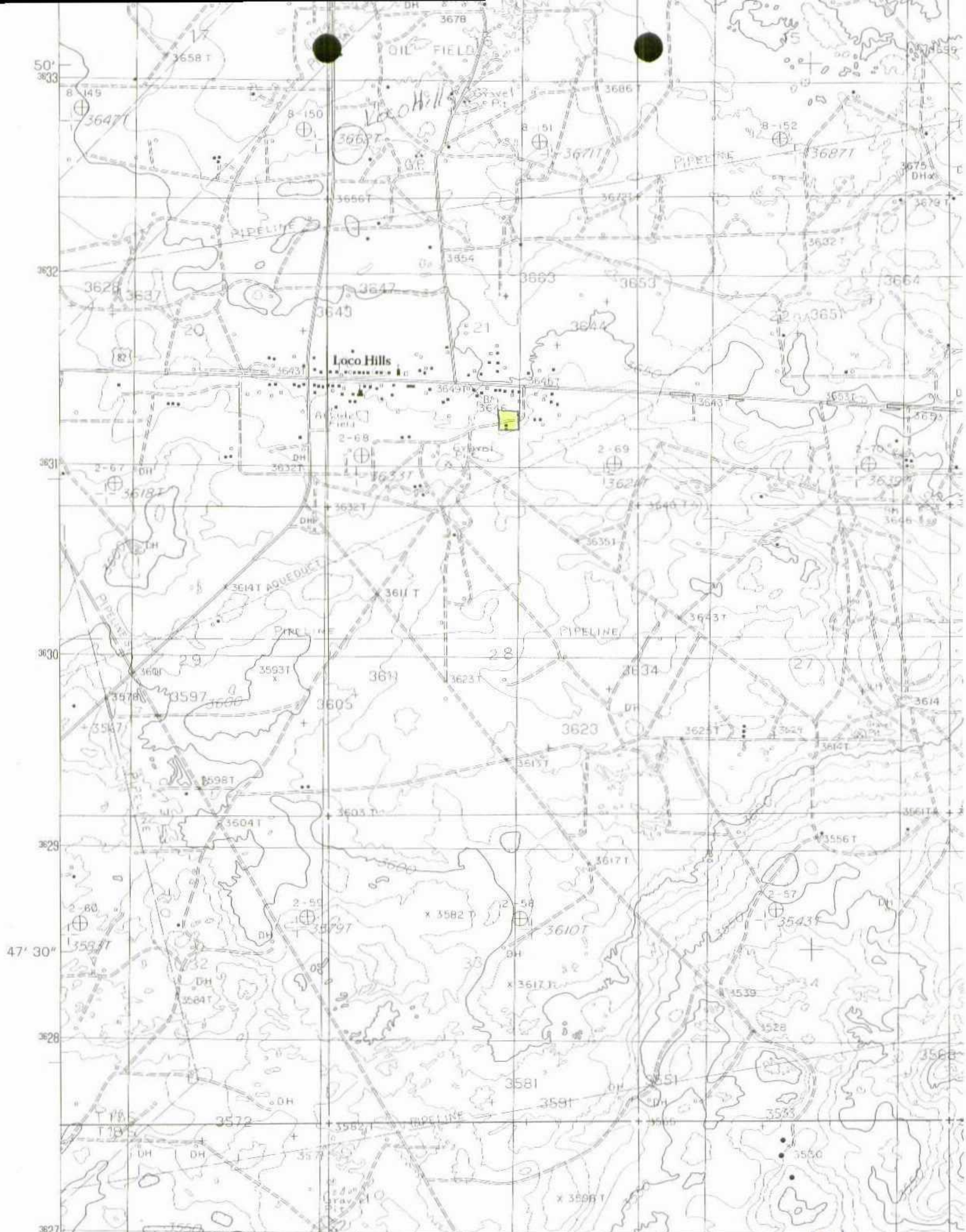


TANK SERVICE & CO. / DOUBLE I. Inc. → I & W, INC. → LOWELL IRBY SE¼, SW¼, NW¼, SE¼ SECTION 21, T17S, R30E, NMPM, EDDY COUNTY, NM

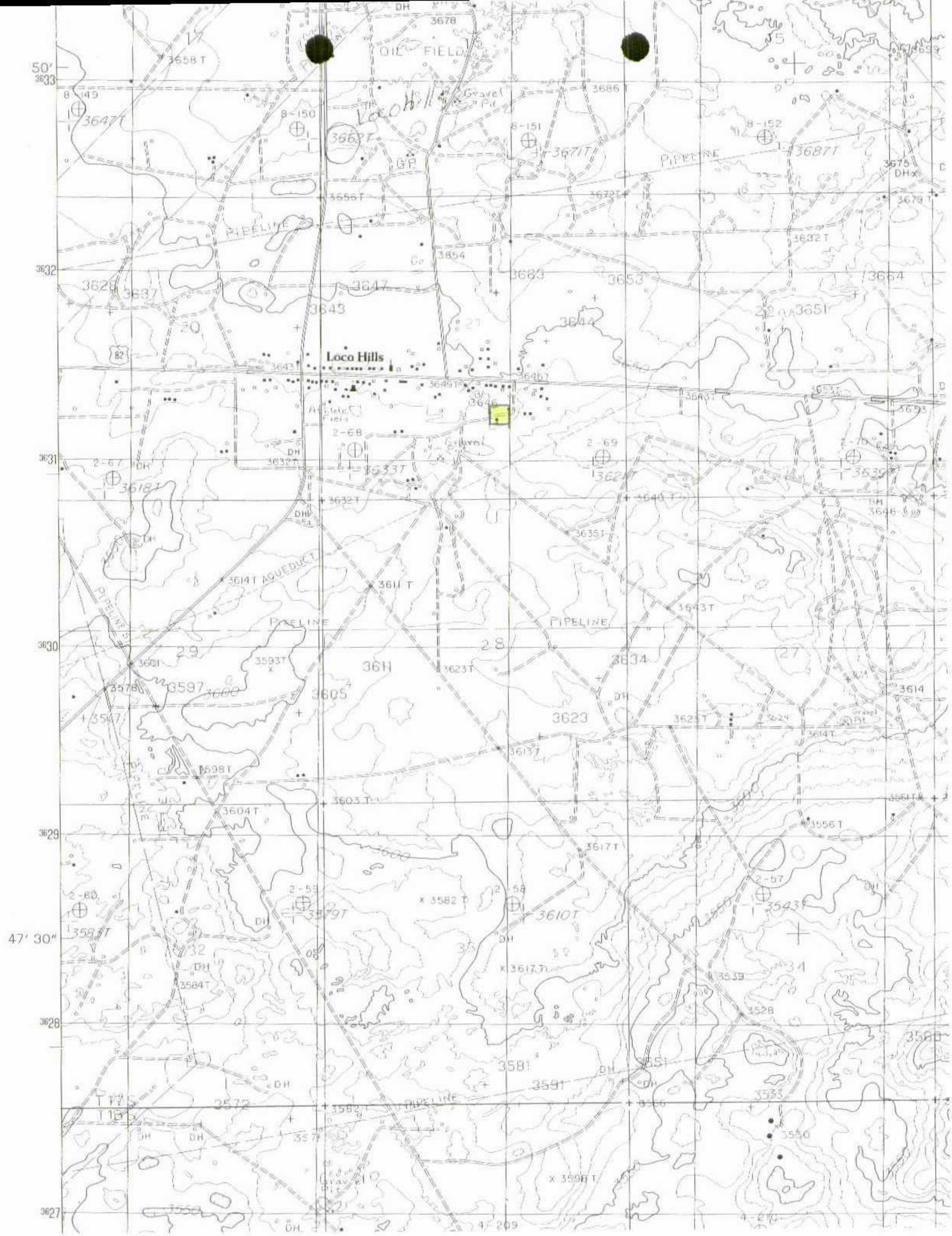


Tank SERVICES CO. /DOUBLE I, INC. → I & W → LOWELL IRBY
→ LOWELL IRBY

SE/4 SW/4 NW/4 SE/4 SEC 21, T17S, R30E
NMPM, EDDY COUNTY, NM



TANK SERVICE CO. / DOUBLE I, INC. → I & W, INC → LOWELL IRBY SE/4 SW/4 NW/4 SE/4 Sec 21
↳ LOWELL IRBY T17S, R30E, NMPM, EDDY CO



50'
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OIL FIELD
Loco Hills
PIPELINE
AQUEDUCT
Gravel Pit
Athletic Field
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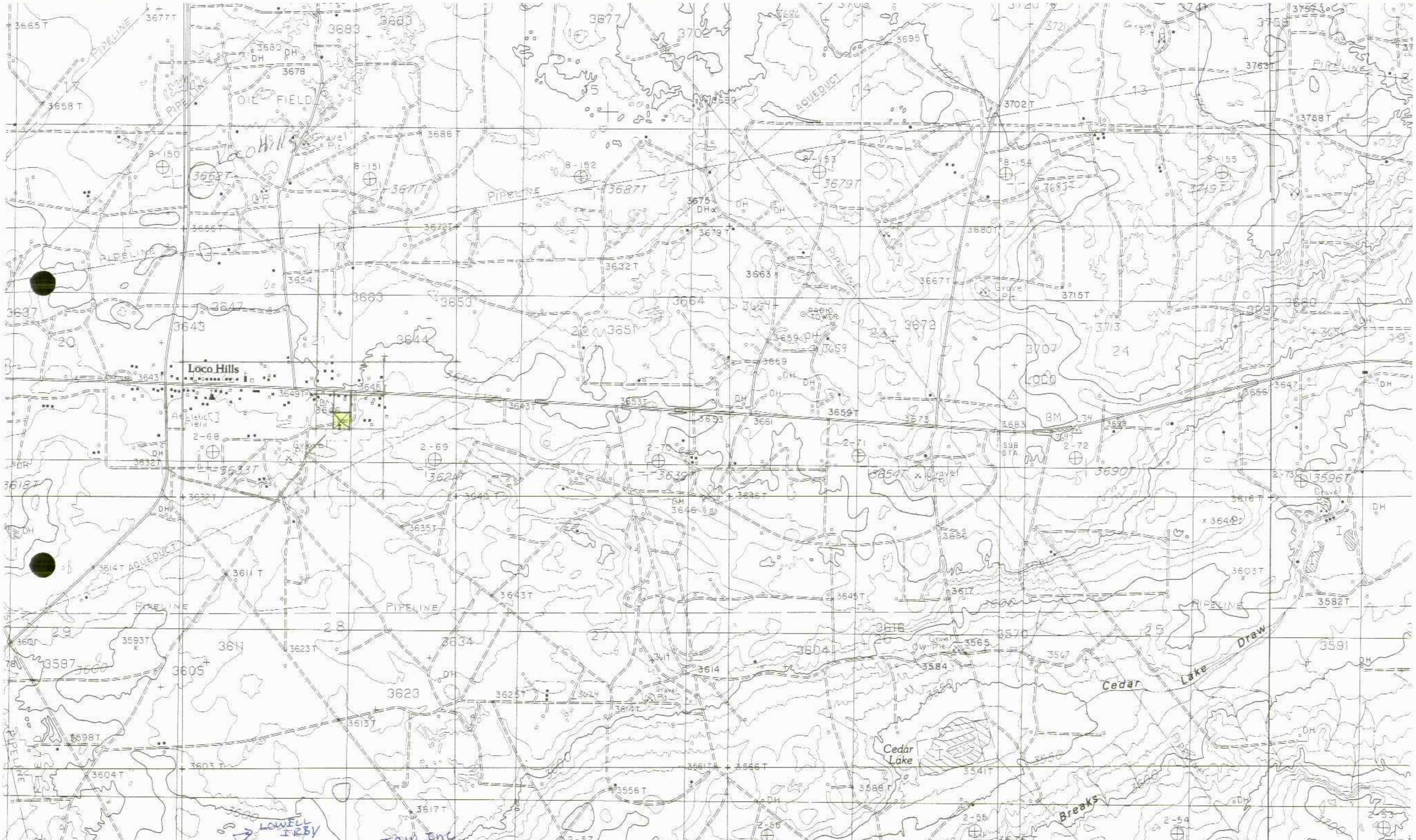
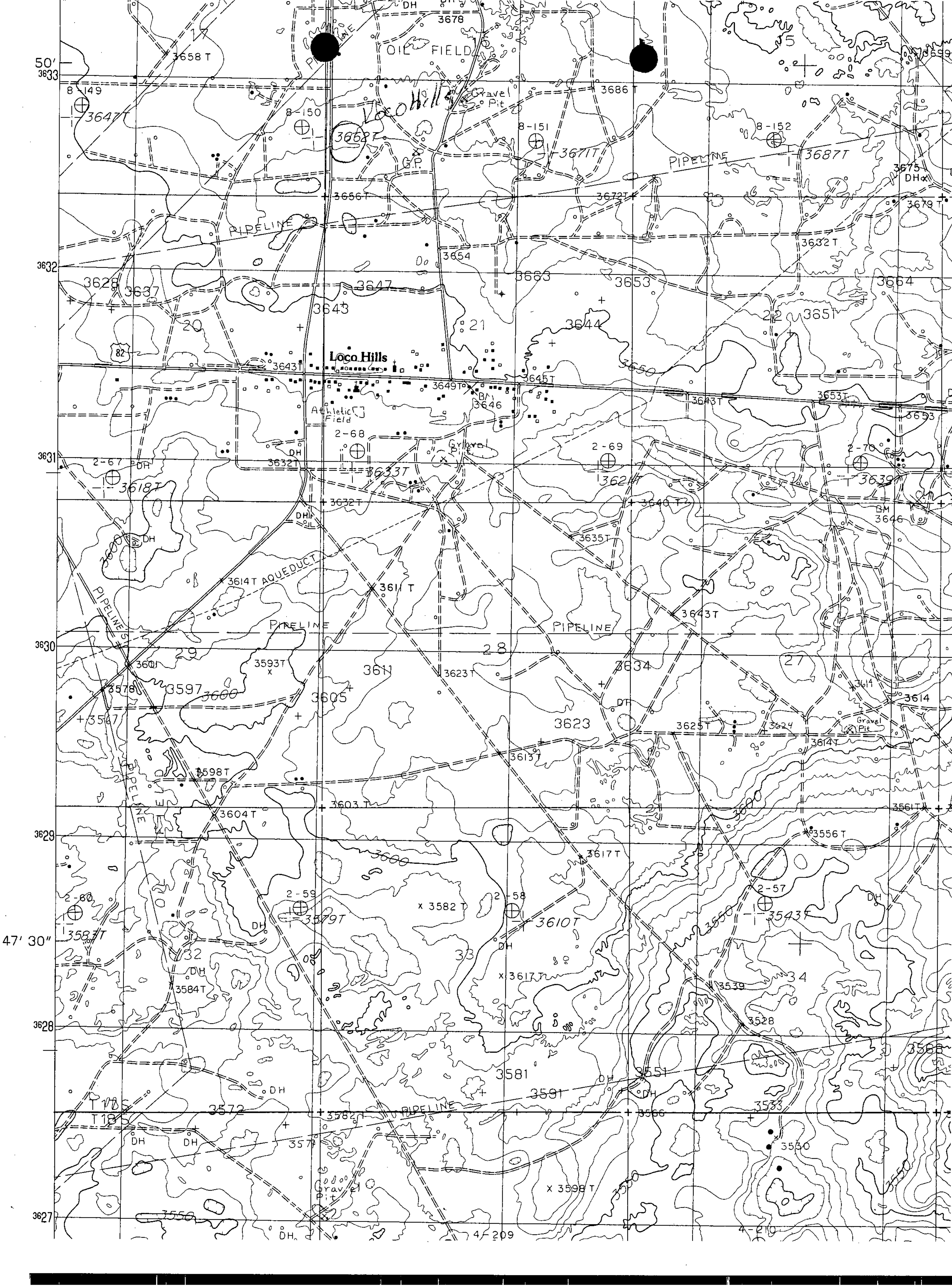
8-152
4-209



TANK SERVICE Co. = Double I = LOWELL IRBY   SE 1/4, SW 1/4, NW 1/4, SE 1/4 SECTION 21, T17S, R30E, NMPM, EDDY COUNTY, NM



OIL FIELD
Loco Hills
Gravel Pit
G.P.
PIPELINE
AQUEDUCT
Athletic Field
Loco Hills
50'
47' 30"
3633
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8-152
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4-209
4-210
T17S
T18S
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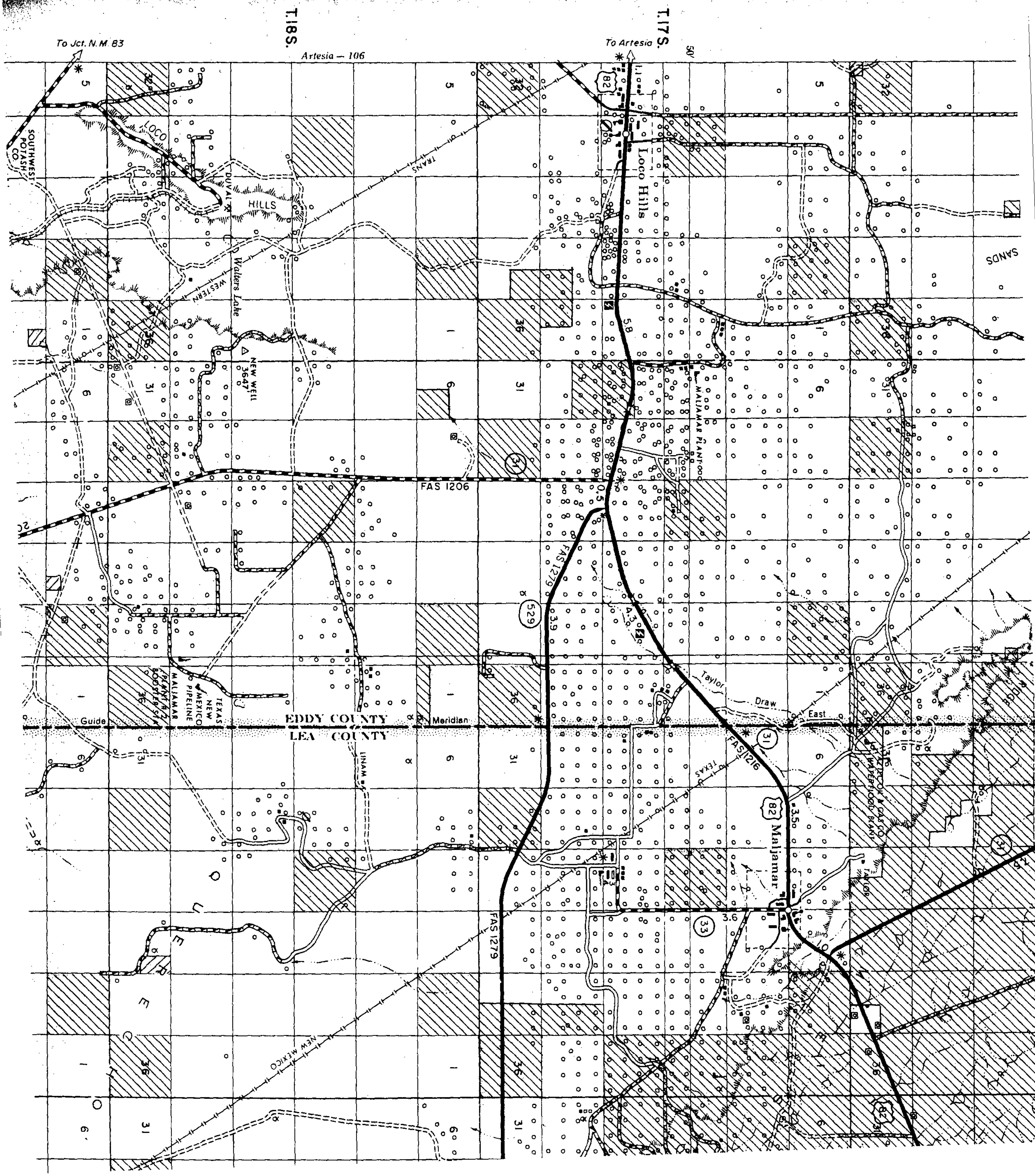


T.18S.
T.17S.
To Jct. N.M. 83
Artesia — 106
To Artesia
SOUTHWEST POTASH CO.
LOCO
HILLS
DUVAL
Walters Lake
TRANS WESTERN
NEW WELL 3647
Loco Hills
MALJAMAR PLANT
SANDS
FAS 1206
FAS 1279
529
Taylor
Draw
East
Guide
Meridian
EDDY COUNTY
LEA COUNTY
TEXAS NEW MEXICO PIPELINE
MALJAMAR
LINAM
FAS 1216
TEXAS
82
Maljamar
33
NEW MEXICO


11-15-92
LOCO
1:4000


7-62-10
BLM-ARS
10-01-73

T17S, R30E

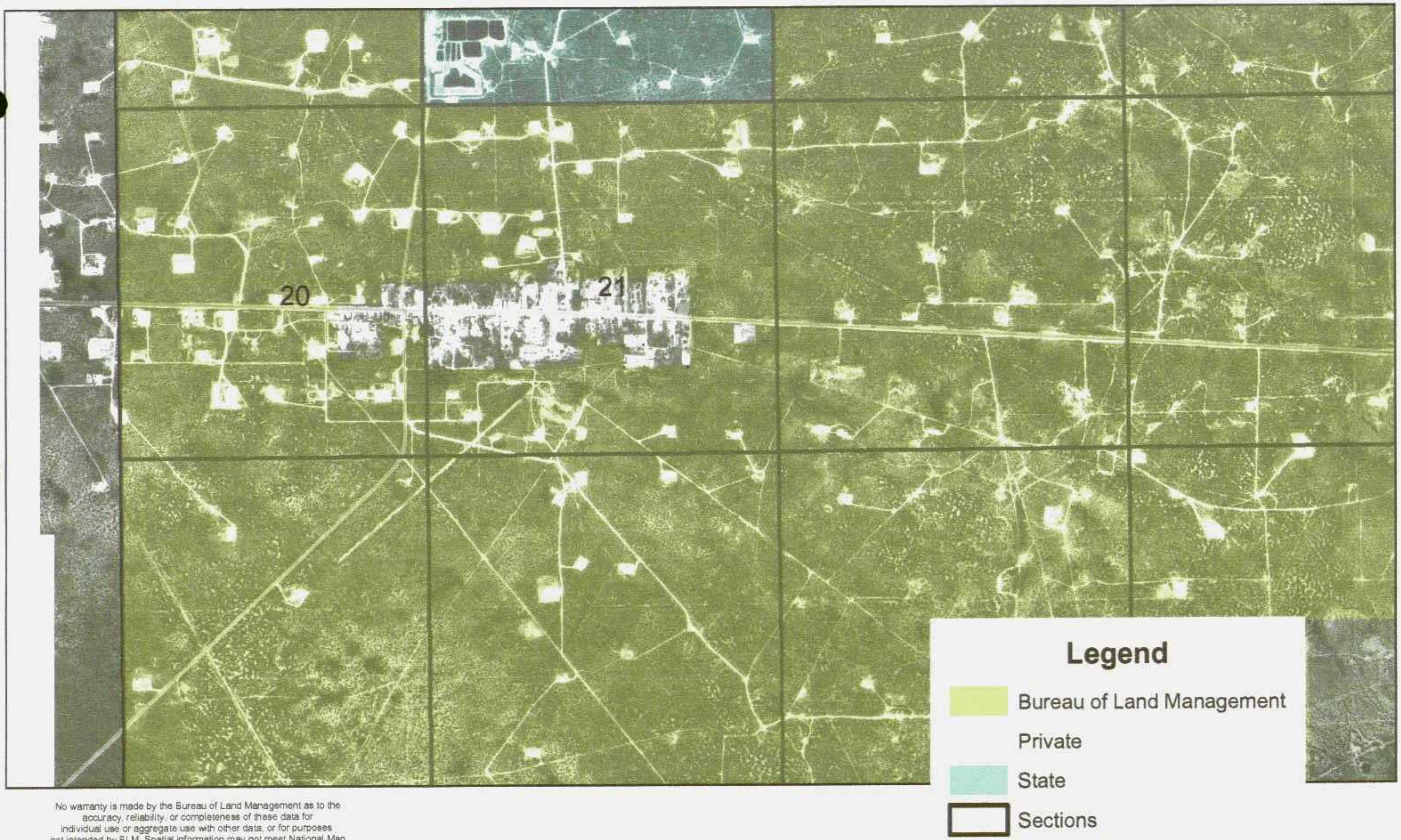
N

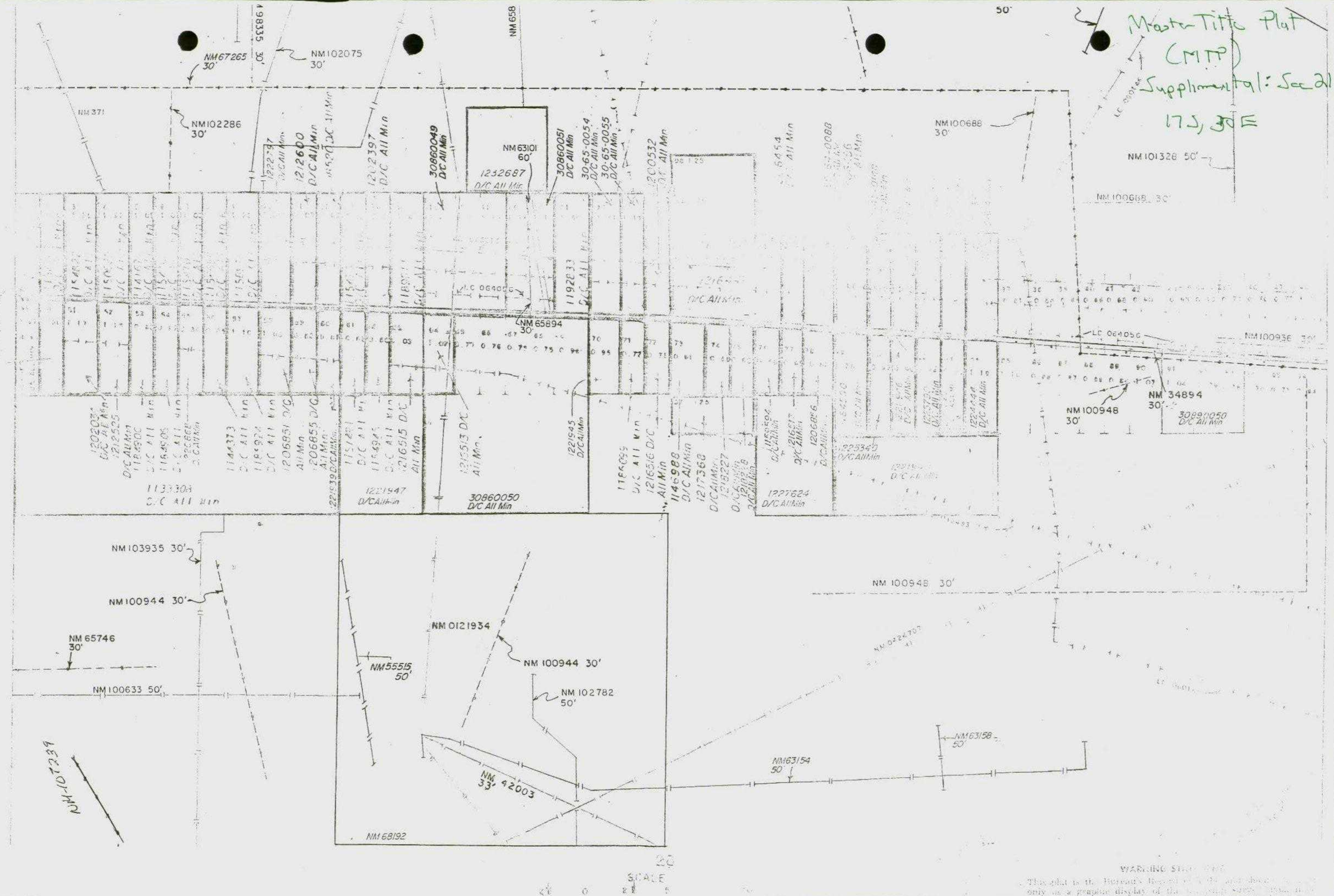
0 0.3 0.6 1.2 Miles

1:24,000

640 Acres Section
160 1/4
40 1/4 1/4
10 1/4 1/4 1/4
2.5 1/4 1/4 1/4 1/4

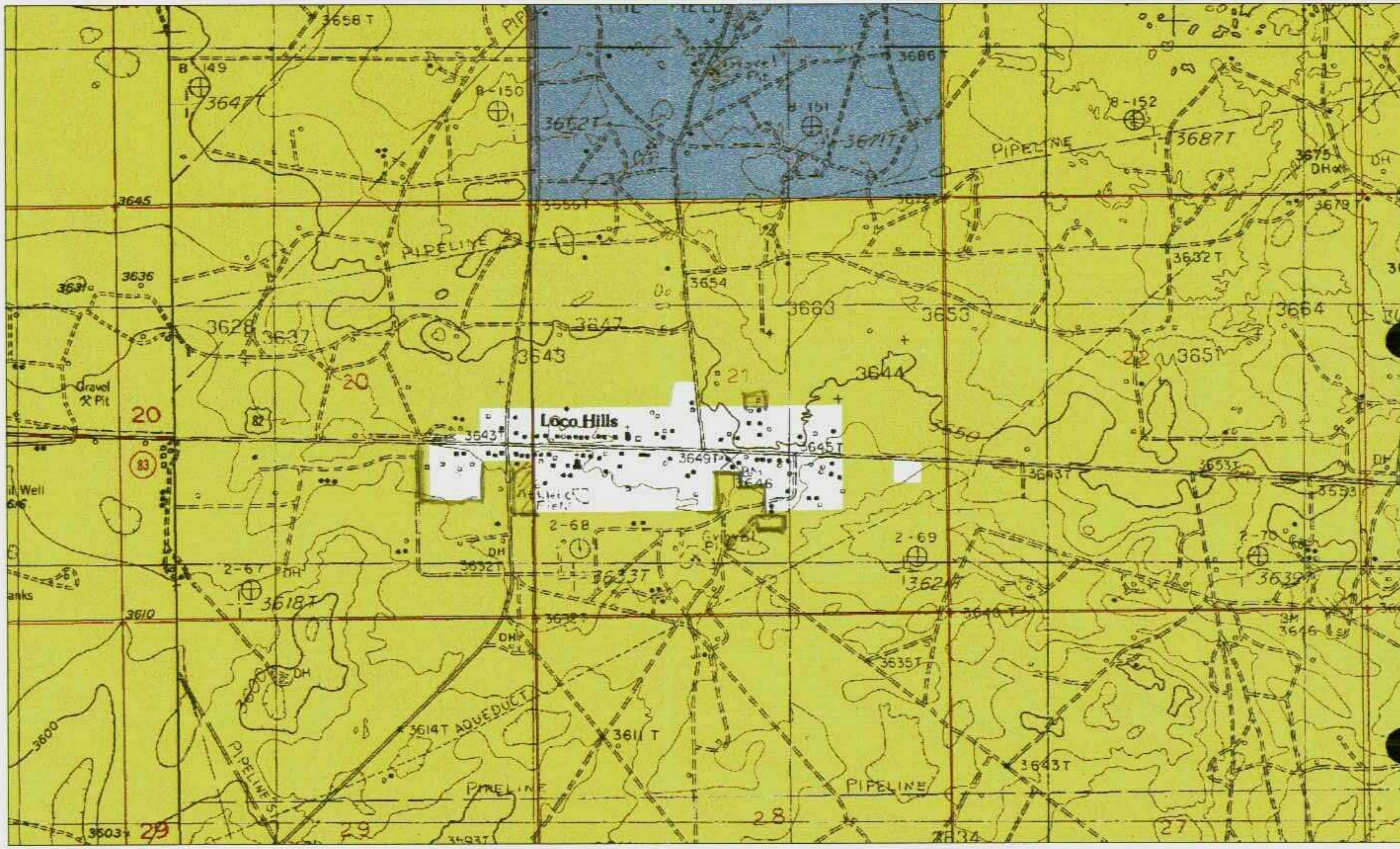
6.7
3.35
1.675
.8375
.418




Master Title Plat
(MTP)
Supplemental: Sec 21
17S, 30E
NM67265 30'
NM102075 30'
NM658
50'
NM102286 30'
NM63101 60'
1232687 D/C All Min
30860049 D/C All Min
30860051 D/C All Min
30-65-0054 D/C All Min
30-65-0055 D/C All Min
1212600 D/C All Min
1202397 D/C All Min
NM100688 30'
NM101328 50'
NM100688 30'
LC 064006
NM 65894 30'
1216860 D/C All Min
LC 064056
NM100936 30'
NM100948 30'
NM 34894 30'
30890050 D/C All Min
1113308 D/C All Min
1221947 D/C All Min
30860050 D/C All Min
1221945 D/C All Min
1216513 D/C All Min
1227624 D/C All Min
1225340 D/C All Min
1146988 D/C All Min
1217368
NM103935 30'
NM100944 30'
NM 65746 30'
NM100633 50'
NM55515 50'
NM 0121934
NM 100944 30'
NM 102782 50'
NM 100948 30'
NM63158 50'
NM63154 50'
NM 42003 33'
NM68192
NM-107239
SCALE
WARNING STATEMENT
This plat is the Bureau's Record of Title and should be used only as a graphic display of the township survey.

Loco Hills Area

New Mexico



1:22628

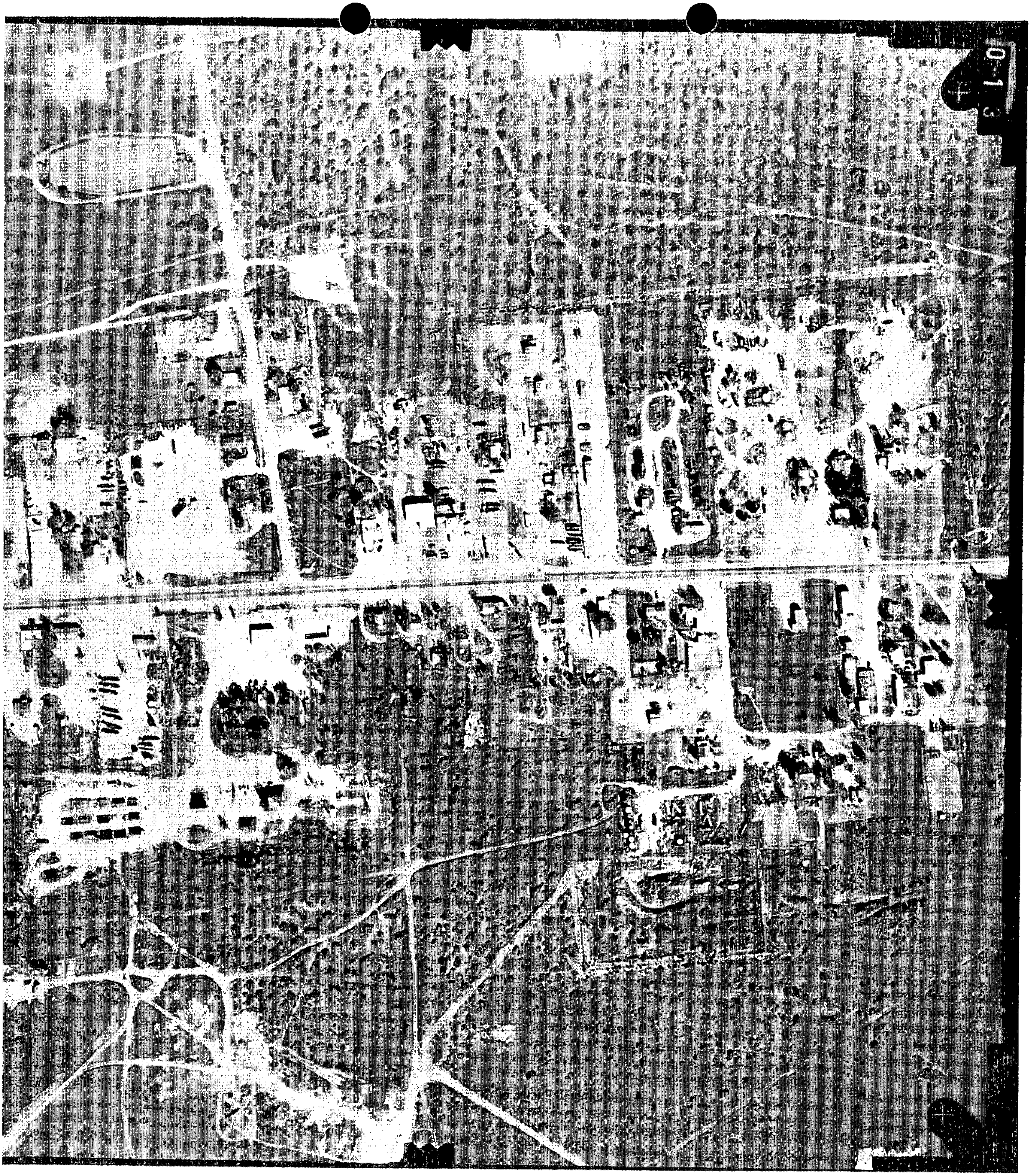
Produced by the Bureau of Land Management.

Map printed on December 19, 2002

LOCATION MAP

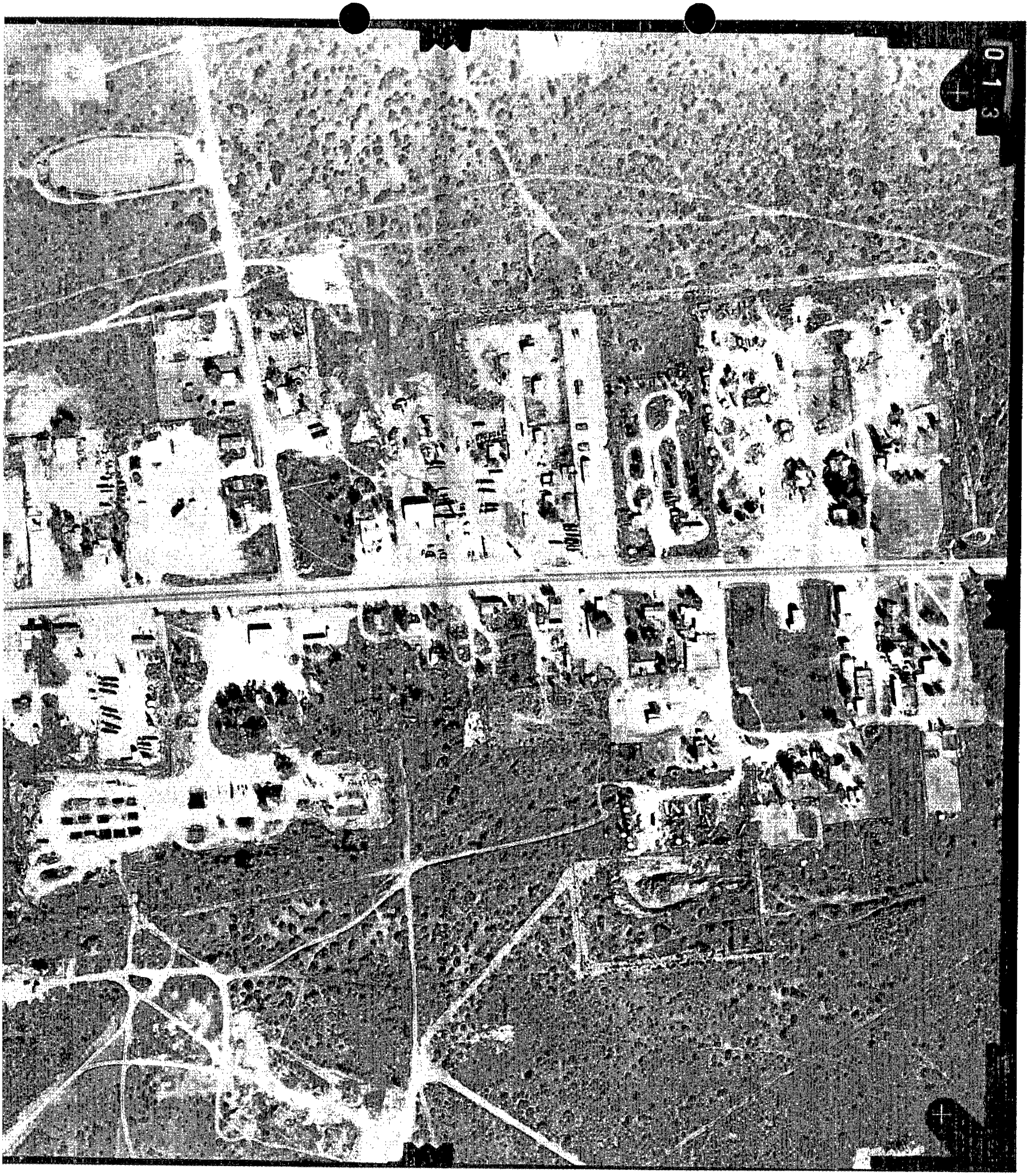
Statewide Land Status Legend

- Bureau of Land Management
- Bureau of Reclamation
- Dept. of Agriculture
- Dept. of Defense
- Dept. of Energy
- Forest Service
- Fish & Wildlife Service
- Tribal Lands
- National Park Service
- Private
- State
- State Game & Fish
- State Park
- Valles Caldera National Preserve

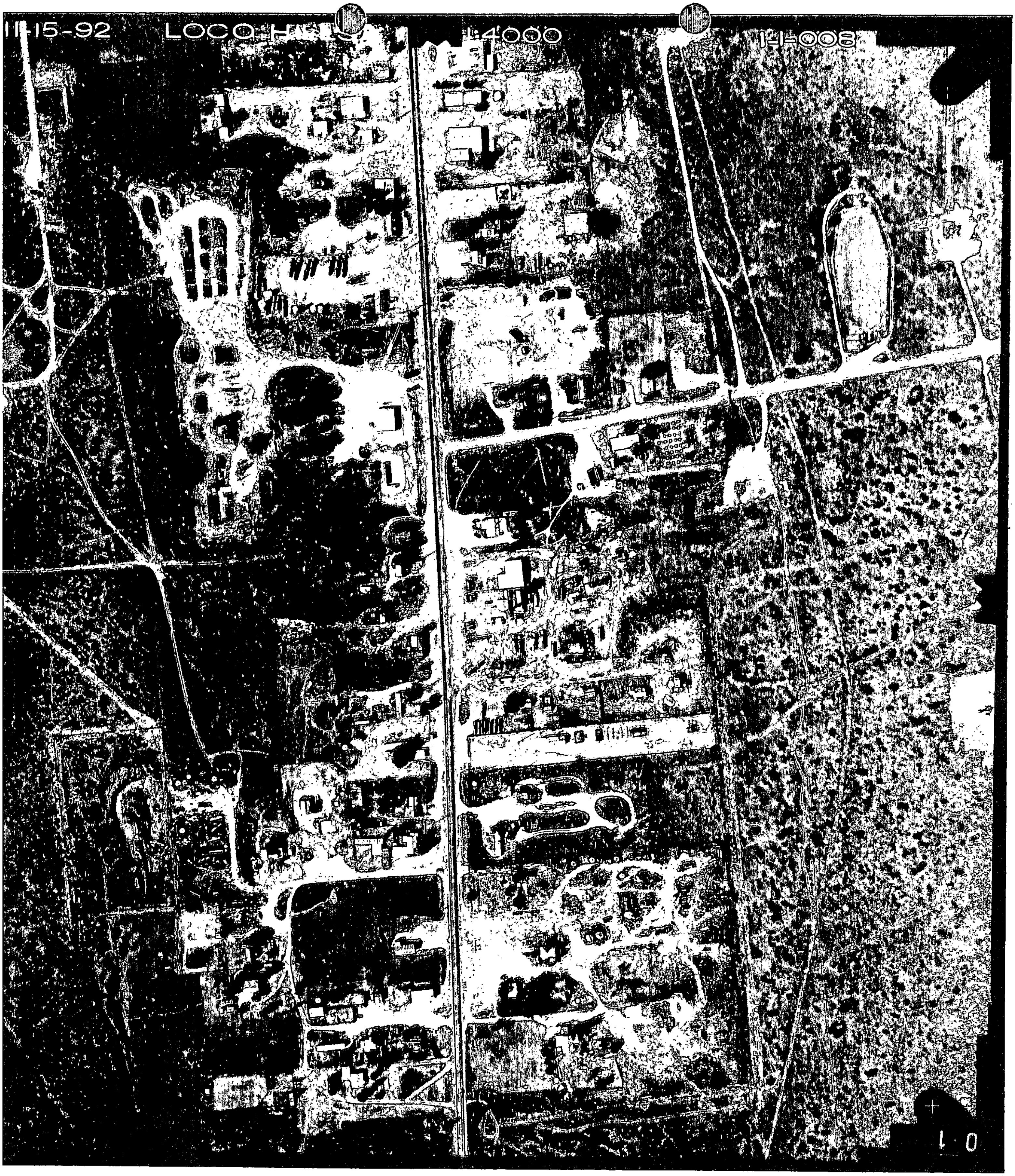


11-15-92 Loco Hills 1:4000

1-1-008



11-15-92 Loco Hills 1:4000 1-1-008



11-15-92 Loco Hills 1:4000 1-1-008

Kieling, Martyne

From: Kieling, Martyne
Sent: Monday, December 09, 2002 4:41 PM
To: Stubblefield, Mike
Subject: question for you!

Mike,

I have a question for you. I got a copy of the BLM project that is going on in Loco Hills. They are calling it the I & W Hot Oil Service South. I need to know where the BLM property starts and stops and where exactly the old treating plant was located. Here is a brief history as I have on file. Names change and I don't have legals on everything but I believe they are all tied together. I also have, I believe a good $25,000 Bond for this site (wherever it is).

June 1971 Case R-4151 Treating Plant approved for **Tank Services, Co**
SE/4 SW/4 NW/4 SE/4 of Section 21, Township 17 South, Range 30 East, NMPM, Eddy County, NM

January 1988 Letter from OCD to **Double I,** address Box 7 Loco Hills, NM 88255, requesting an increase from the current $10,000 bond to $25,000.

February 1991 New Bond for $25,000 sent From **Double I, Inc**. bond signed by Lowel Irby (no legal location mentioned on the bond)

March 1991 $25,000 Bond approved by the OCD for **Double I, Inc** address P.O. Box 1013 Artesia, NM 88210 (no legal location mentioned in letter)

May 1994 BLM Investigation on Trespass naming the location I&W Hot Oil Service South
Section 21, T 17 S, R 30 E

September 1998 Witness sampling by Wayne Price and Bryan Arrant on BLM project. Waste hauled to Gandy Marley Landfarm, 2500 cy of contaminated soil.

September 2002 OCD received on December 9, 2002 Final Engineering Evaluation/Cost Analysis I&W Hot Oil Service South Eddy County, NM.
Letter requesting comments and questions attached.

My next step will probably be to call Link Lacewell and try and meet out at the site with him you and someone from I&W who knows the history...

I will call you tomorrow so we can chat. Ed and I will be passing through and stopping to see you on December 19, 2002. That maybe a good time to check this all out.
Later,

Martyne J. Kieling

Martyne J. Kieling
Environmental Geologist

FAX COVER SHEET

OIL CONSERVATION DIVISON
1301 W. GRAND AVE
ARTESIA, NM 88210

PHONE (505-748-1283
FAX (505-748-9720

Date 12/11/2002.

TO: Martyne Kieling 700·476·3462

FROM: mike Stubblefield

NUMBER OF PAGES 9. (INCLUDING COVER SHEET)

MESSAGE Sec. 21 · 17s · 30e Property Ownership from Tax Roles.

Legal matches TANK SERVICES ORDER

OWNER # DIST	OWNER NAME AND ADDRESS			SEC/TWN/RG	PROPERTY DESCRIPTION
251349 160 4-000-006 -983-002	ROWLAND, JAMES L PO BOX 218 LOCO HILLS	NM	88255-0218	21 17 30	LOT 34 IN SE/4 COMMERCIAL IMPROVEMENTS ONLY MAP#100-12 LOC 13328 LOVINGTON HWY
251823 160 4-000-007 -090-001	I & W INC PO BOX 98 LOCO HILLS	NM	88255-0098	21 17 30	S 211' OF SESWNWSE MAP#100-1.9B
99764 160 4-000-099 -764-001	PAUL, BLAINE & VIRGINIA XTIPTON, MARY PO BOX 51 LOCO HILLS	NM	88255-0051	21 17 30	LOT 74 MAP#100-27 LOC-132997 LOVINGTON HWY
252785 160 4-000-006 -540-001	DELONG, HORACE E & DONNA M PO DRAWER 8A LOCO HILLS	NM	88255-0000	21 17 30	N 100' OF S 200' LOT 83 MAP#100-36.1 LOC 13333-2 LOVINGTON HWY
6363 160 4-000-006 -363-001	SANCHEZ, FRANK P & ANGI LYNN PO BOX 103 LOCO HILLS	NM	88255-0103	21 17 30	LOTS 35 & 36 IN SE MAP#100-13,14 LOC 13334 LOVINGTON HWY
256657 160 4-000-099 -713-001	ROWLAND, ROBY J & JESSICA TROYLENE PO BOX 218 LOCO HILLS	NM	88255-0218	21 17 30	LOT 31 IN SE/4 MAP#100-9 LOC-13328 LOVINGTON HWY MH #114109
6474 160 4-000-006 -474-001	CARTWRIGHT, THOMAS EDWARD PO BOX 143 LOCO HILLS	NM	88255-0143	21 17 30	THE EAST 100' OF THE WEST 230' OF S/2SENWSE, MAP#100-1.8 LOC 13313 LOVINGTON HWY
6539 160 4-000-006 -539-001	STANDARD OIL FIELD SUPPLY, INC PO BOX 6 LOCO HILLS	NM	88225-0006	21 17 30	LOT 82 IN SE/4 (LESS S 225') MAP#100-35 LOC-13327 LOVINGTON HWY
251279 160 4-000-006 -646-001	KAISER, DONNA PO BOX 1002 ARTESIA	NM	88211-1002	21 17 30	LOTS 79, 80, 81 IN SE IMPS ON LOT 80 MAP#100-32,33,34 LOC 13323 LOVINGTON HWY
6661 160 4-000-006 -661-001	KERBEY & COMPANY PO BOX 316 ARTESIA	NM	88211-0316	21 17 30	LOT 97 IN SE MAP#100-50 LOC 133000 LOVINGTON HWY E OF LOCO HILLS
6667 160 4-000-006 -667-001	ROWLAND, JABO CONSTRUCTION PO BOX 218 LOCO HILLS	NM	88255-0218	21 17 30	LOT 32 IN SE PATENT 130/262 MAP#100-10 LOC 13328 LOVINGTON HWY
258174 160 4-000-007 -093-001	PACKRATS PURE TRUST C/O RATLIFF, DOUGLAS PO BOX 74 LOCO HILLS	NM	88255-0074	21 17 30	BEG 130' W & 33' N OF SE COR S/2SENWSE,N 267', W 100', S 267', E 100' TO POB MAP#100-1.6 LOC 13313-2 LOVINGTON HWY
99720 160 4-000-099 -720-001	THORNTON, ROGER P PO BOX 24 LOCO HILLS	NM	88255-0024	21 17 30	BEG 33' N & 20' E OF SW COR S/2SENWSE, N 267', E 100', S 267' W TO POB MAP#100-1.7 LOC SOUTH OF 13327 LOVINGTON HWY
99746 160 4-000-099	JACKSON, ED & DORIS 1801 S 15TH ST			21 17 30	S/2NESWNWSE, SESWNWSE (LESS S 100' OF N 284' & S 211' OF SESWNWSE)

OWNER # DIST	OWNER NAME AND ADDRESS	SEC/TWN/RG	PROPERTY DESCRIPTION	LAND	QUANTITY
-746-001	ARTESIA NM 88210-2603		MAP#100-1.9 LOC S OF 13311 LOVINGTON HWY		
252108 160 4-000-252 -108-001	HUGHES HOT OIL SERVICE, INC PO BOX 68 LOCO HILLS NM 88255-0068	21 17 30E	BEG S 0 DEG 02' E 29.4' FROM NW COR SE, S 0 DEG 02' E 105', S 89 DEG 57' E 180', N 0 DEG 02' W 105', N 89 DEG 57' W 180' TO POB MAP#100 LOC BEHIND 132990 LOVINGTON HWY		
258792 160 4-000-258 -792-002	R & S PARTNERS %CONCHO RESOURCES, INC 110 W LOUISIANA, SUITE 410 MIDLAND TX 79701-0000	21 17 30E	30' LOT 27 (30X 334), W 70' LT 28 (70X334), E 100' OF W 400' OF N165' N2NWNWSE (100X165) MAP#160-100-1.3, 5.1,6.1 LOC 13304 LOVINGTON HWY		
251349 160 4-000-005 -991-001	ROWLAND, JAMES L PO BOX 218 LOCO HILLS NM 88255-0218	21 17 30E	LOT 33 IN SESE MAP#100-11 LOC-13328-1 LOVINGTON HWY WAREHOUSE		
6431 160 4-000-004 -431-001	FRANKLIN, SAMMY K & JULIE H PO BOX 8 LOCO HILLS NM 88255-0008	21 17 30E	LOT 77 & E 30' LOT 76 IN SE MAP#100-30 LOC 13307 LOVINGTON HWY		
6473 160 4-000-006 -473-001	FRANKLIN, SAMUEL K & JULIA K PO BOX 8 LOCO HILLS NM 88255-0008	21 17 30E	LOTS 75, 76 IN SE/4 (LESS E 30' OF LOT 76) MAP#100-28,28.1,29 LOC 13303 LOVINGTON HWY MH #117345		
6483 160 4-000-006 -683-001	HEADEN, CHARLES F & JESSIE M PO BOX 858 SOCORRO NM 87801-0858	21 17 30E	LOT 29 IN SE MAP#100-7 LOC-13310 LOVINGTON HWY		
105674 160 4-000-006 -723-001	PARRISH, H DUANE, JR & RHONDA K 1306 S NINTH STREET ARTESIA NM 88210-0000	21 17 30E	LOT 73 IN SE/4 MAP#100-2 LOC 132971 LOVINGTON HWY		
130151 160 4-000-006 -915-001	CARRE, RONNIE & DEBRA PO BOX 3 LOCO HILLS NM 88255-0003	21 17 30E	100' OF N 284' OF S/2NESWNWSE & SESWNWSE MAP#100-1.9A LOC 13311 LOVINGTON HWY		
251349 160 4-000-006 -983-001	ROWLAND, JAMES L PO BOX 218 LOCO HILLS NM 88255-0218	21 17 30E	LOT 34 IN SESE MAP#100-12 LOC 13320-2 LOVINGTON HWY		
7090 160 4-000-007 -091-001	DELONG, HORACE E & DONNA MARIE PO DRAWER 8A LOCO HILLS NM 88255-0000	21 17 30E	LOT 83 LESS N 100' OF S 200' IN SE MAP#100-36 LOC 13333 LOVINGTON HWY		
99745 160 4-000-099 -745-001	DANIELS, DONALD J JR & BARBARA J PO BOX 82 LOCO HILL NM 88255-0082	21 17 30E	LOT 78 IN SE MAP#100-31 LOC 13309 LOVINGTON HWY MH #180230		
112556 160 4-000-112 -555-001	HUGHES HOT OIL SERVICE PO BOX 68 LOCO HILLS NM 88255-0068	21 17 30E	PART LOT 25, 26, 27 DESCRIBED BEG S 00 DEG 02' E 134.4' FROM NW COR SE, S 0 DEG 02' E 334', S 87 DEG 57' E 90', S 86 DEG 24' E 210.6', N 0 DEG 02' W 376', N 89 DEG 57' W 120', S 0 DEG 02' W 25', N 89 DEG 57' W 180' TO POB MAP#100-1.4A,3.1,4.1,5.2 LOC 132990 LOVINGTON HWY		

OWNER # DIST	OWNER NAME AND ADDRESS	SEC/TWN/RG	PROPERTY DESCRIPTION	LAND	QUANTITY
180017 160 4-000-180 -017-001	PACKRATS TRUST PO BOX 74 LOCO HILLS NM 88255-0074	21 17 30	S 225' LOT 82 IN SE MAP#100-35.1 LOC 13329 LOVINGTON HWY		
257475 160 4-000-257 -475-001	HEADEN, CHARLES F & JESSIE H PO BOX 858 SOCORRO NM 87801-0858	21 17 30	LOT 30 IN SE MAP# 100-8 LOC 13310 LOVINGTON HWY		
6273 160 4-000-006 -273-001	TRUJILLO, RUBEN & PITA PO BOX 133 LOCO HILLS NM 88255-0133	21 17 30	LOT 84 IN SE/4 MAP#100-37 LOC-13335 LOVINGTON HWY		
6273 160 4-000-006 -719-001	TRUJILLO, RUBEN & PITA PO BOX 133 LOCO HILLS NM 88255-0133	21 17 30	BEG 33' N & 33'W OF SE COR S/2SENWSE, N 267', W 97', S 267', E 97' TO POB MAP#100-1.1 LOC 13435 LOVINGTON HWY		
7093 160 4-000-006 -121-001	CHASE OIL CORPORATION PO BOX 1767 ARTESIA NM 88211-0000	21 17 30	BEG 330' W & 33' N OF SE COR S/2SENWSE, N 267', W 100', S 267', E 100' TO POB & BEG 230' W & 33' N OF SE COR S/2SENWSE, N 267', W 100' S 267', E 100' TO POB MAP# 100-1.2,1.5 LOC 13313-2 LOVINGTON HWY		
6748 160 4-000-130 -525-001	COUNTY OF EDDY	21 17 30	LOTS 91, 92, 93 IN SE MAP#100-44, 45, 46 LOC 13300 LOVINGTON HWY LOCO HILLS EXEMPT		
20717 160 4-000-020 -717-001	ARTESIA MUNICIPAL SCHOOLS	21 17 30	S 50' LOT 50 IN SW/4 MAP#99-30.1 LOC 133487 LOVINGTON HWY EXEMPT		
120967 160 4-000-120 -967-001	THOMPSON, CLEO J ET AL DELOITTE & TOUCHE XBRAD BAILEY 5550 LBJ FREEWAY SUITE 700 DALLAS TX 75240-0000	21 17 30	N 223.4' OF LOT 20 IN SW/4 MAP#99-24.2 LOC 11 GOAT ROPERS ROAD		
6316 160 4-000-006 -316-001	STEVE CARTER, INC PO BOX 26 LOCO HILLS NM 88255-0026	21 17 30	LOT 22 IN SW MAP#99-26 LOC 132910 LOVINGTON HWY		
99719 160 4-000-099 -719-001	HOGGETT, HELEN A STANDARD, LEE ROY PO BOX 151 LOCO HILLS NM 88255-0151	21 17 30	LOT 1 IN SW MAP#99-14 LOC 132460 LOVINGTON HWY		
257415 160 4-000-006 -068-003	I & W INC PO BOX 98 LOCO HILLS NM 88255-0098	21 17 30	PART OF SW LOTS 16 & 17 MAP#99-20.21 LOC 132794 LOVINGTON HWY		
257588 160 4-000-006 -139-001	CHASE OIL CORPORATION PO BOX 1767 ARTESIA NM 88211-1767	21 17 30	LOT 9 IN SW/4 MAP#99-4.1 LOC 132600 LOVINGTON HWY		
6587 160 4-000-006 -587-001	I & W HOT OIL SERVICE, INC PO BOX 217 LOCO HILLS NM 88255-0217	21 17 30	LOTS 14, 15 IN SW (LESS 230'X 80' SE COR) MAP#99-18,19 LOC 132750 LOVINGTON HWY		

OWNER # DIST	OWNER NAME AND ADDRESS	SEC/TWN/RG.	PROPERTY DESCRIPTION	LAND	QUANTITY
6910 160 4-000-006 -655-001	LANGLITZ, DENNIS & PAMELA J 1425 S COUNTRY CLUB CIRCLE CARLSBAD NM 88220-0000	21 17 30S 165'	LOT 60 IN SW LESS E 8' MAP#99-35 LOC 132651 LOVINGTON HWY LOCO HILLS ELECTRIC SHOP		
250708 160 4-000-006 -910-001	HERRING, ZELPHIA M & JOHN WILLIAM 300 E 17TH ST TRLR 11 BRADY TX 76825-6779	21 17 30LOT 60	IN SW/4 (LESS S 165') MAP#99-35.1 LOC 132701 LOVINGTON HWY LOCO HILLS CAFE		
7104 160 4-000-007 -104-001	THOMPSON, J CLEO SR ET AL XDELOITTE & TOUCHE, LLP 5550 LBJ FREEWAY SUITE 700 DALLAS TX 75240-0000	21 17 30LOT 21	IN SW MAP#99-25 LOC 132900 LOVINGTON HWY		
7194 160 4-000-007 -194-001	Y & W, INC PO BOX 98 LOCO HILLS NM 88255-0098	21 17 30PART	LOT 15 DESCRIBED BEG SE COR. N 230', W 80', S 230', E TO POB IN SW/4 MAP#99-19.1 LOC 132746 LOVINGTON HWY		
20742 160 4-000-020 -742-001	FIRST BAPTIST CHURCH OF LOCO HILLS PO BOX 177 LOCO HILLS NM 88255-0177	21 17 30LOT 53,	S 227.5' LOT 54 IN SW/4 PATENT 6/319,320 MAP#99-6 LOC 132531 LOVINGTON HWY CHURCH BUILDING EXEMPT		
20749 160 4-000-020 -747-001	COUNTY OF EDDY LOCO HILLS FIRE DEPARTMENT	21 17 30LOTS	12 & 13 IN SW/4 MAP#99-5.17 LOC 132706 LOVINGTON HWY EXEMPT		
20757 160 4-000-020 -757-001	WAGGONER, CARL XMATHEWS, DELTON & SHANNON PO BOX 145 LOCO HILLS NM 88255-0145	21 17 30LOT 11	IN SW/4 PATENT 6-397 MAP#99-16 LOC-132684-1 LOVINGTON HWY K OF S		
212646 160 4-000-020 -892-001	WESTALL, RAY 114 S CANYON ST CARLSBAD NM 88220-0000	21 17 30TR 49	IN NWSW MAP#99-29 LOC 132465 LOVINGTON HWY		
212646 160 4-000-020 -893-001	WESTALL, RAY 114 S CANYON ST CARLSBAD NM 88220-0000	21 17 30S/2S/2NWSW	(LESS NE 165' X 460'), S/2N/2S/2NWSW (LESS NE 82.5'X 460 IN SW/4) MAP#99-13 LOC 132480 LOVINGTON HWY		
99735 160 4-000-099 -735-001	HEALD, EVAN D JR & SHERRY 132660 LOVINGTON LOCO HILLS NM 88255-0000	21 17 30LOT 10	IN SW/4 MAP099-15 LOC 132660 LOVINGTON HWY		
104836 160 4-000-104 -836-001	CHASE OIL CORPORATION PO BOX 1767 ARTESIA NM 88211-1767	21 17 30S 82'	OF LOT 5 IN SW/4 MAP#99-4.1 LOC 132556 LOVINGTON HWY		
107439 160 4-000-107 -439-001	BLEVINS, STEVE L & KIM 208 W ROJO HOBBS NM 88240-0000	21 17 30TR 59	(LESS W 10'); E 200' OF S/2NESENWSW (LESS W 10'); E 200' OF N 82.5' OF SESENWSW (LESS W 10') MAP#99-34 & 13.1A LOC 132603 LOVINGTON HWY MH #120296		
120953 160 4-000-120 -953-001	WAGGONER, CARL H PO BOX 4-A LOCO HILLS NM 88255-0041	21 17 30PART	OF LOTS 19, 20 DESCRIBED BEG ON E LINE LOT 20 & N R/W HWY, N 87 DEG 57' W 200.13', N 00 DEG 02' W 219.9', N 89 DEG 58' E 200', S 00 DEG 02' E 226.9' TO POB MAP#99-23.1,24.1		

FROM SECTION-21 TOWNSHIP-17S RANGE-30E TO SECTION-21 TOWNSHIP-17S RANGE-30E

OWNER # DIST	OWNER NAME AND ADDRESS			SEC/TWN/RG	PROPERTY DESCRIPTION	LAND	QUANTITY
					LOC 3 GOAT ROPERS ROAD POST OFFICE PP BLDG EXEMPT		
212707 160 4-000-227 -041-001	J-&-W-HOT-OIL-SERVICE-INC KIRBY, LOWELL PO BOX 99 LOCO HILLS	NM	88255-0098	21 17 30E/2	LOT-63, ALL LOT-64 IN SW/4 MAP#99-34.21.37 LOC 132745 LOVINGTON HWY		
253248 160 4-000-006 -189-001	CHASE OIL CORPORATION PO BOX 1767 ARTESIA	NM	88211-1767	21 17 30	LOT 8 IN SW/4 MAP#99-4 LOC 132600 LOVINGTON HWY		
253755 160 4-000-006 -463-001	MATHEWS, JERRY PO BOX 54 LOCO HILLS	NM	88255-0054	21 17 30E	8.0' OF S 165.0' LOT 60 W 67' OF N2. & S 162.60' E2 LOT 61 MAP#99-5.2 LOC 132717 LOVINGTON HWY		
253755 160 4-000-006 -728-001	MATHEWS, JERRY PO BOX 54 LOCO HILLS	NM	88255-0054	21 17 30W/25/2	OF LOT 61 IN SW MAP#99-10 LOC 132717 LOVINGTON HWY		
251823 160 4-000-007 -090-002	J & W INC PO BOX 99 LOCO HILLS	NM	88255-0098	21 17 30N	153' OF S2NWSWNESW AND N 153' OF W 130' S2NESWNESW MAP#99-1.1A LOC SE OF 132829 LOVINGTON HWY		
22446 160 4-000-006 -000-001	CHASE OIL CORPORATION PO BOX 1767 ARTESIA	NM	88211-1767	21 17 30S	12' OF S/2NWSWNESW, & SWSWNESW MAP#99-1.1 LOC SE OF 132829 LOVINGTON HWY		
6046 160 4-000-006 -046-001	ROBERTS, GAYNEL C 10722 DOGWOOD CORPUS CHRISTI	TX	78410-1401	21 17 30	LOT 70 IN NESW MAP#99-43 LOC 132909 LOVINGTON HWY		
6102 160 4-000-006 -102-001	J & W, INC PO BOX 217 LOCO HILLS	NM	88255-0217	21 17 30E	9' OF N 100' LOT 61; ALL LOT 62; LOT 63 LESS E/2 MAP#99-34 & 11.1 LOC 132725-A LOVINGTON HWY		
112555 160 4-000-006 -578-001	HUGHES HOT OIL SERVICE PO BOX 68 LOCO HILLS	NM	88255-0068	21 17 30	LOT 24 IN NESW MAP#99-28 LOC 132952 LOVINGTON HWY		
112555 160 4-000-006 -579-001	HUGHES HOT OIL SERVICE PO BOX 68 LOCO HILLS	NM	88255-0068	21 17 30	LOT 23 IN SW MAP#99-27 LOC 132928 LOVINGTON HWY		
6617 160 4-000-006 -617-001	STANDARD OIL FIELD SUPPLY, INC %WEED, GARY PO BOX 67 LOCO HILLS	NM	88255-0067	21 17 30	LOT 51 IN NWSW MAP#99-31 LOC-132501 LOVINGTON HWY K OF S		
259529 160 4-000-007 -032-001	SKINNER, VERNIE W & GEORGIALENE PO BOX 176 LOCO HILLS	NM	88255-0000	21 17 30	LOT 72 IN SW/4 PATENT 6/405 MAP#99-44 CAB 1 38C-1 LOC 132951 LOVINGTON HWY		
7045 160 4-000-007 -045-001	SMITH, JOSEPH JACKSON MORROW, WILMA PO BOX 72 LOCO HILLS	NM	88255-0072	21 17 30E/2	TR 71 IN SW MAP#99-12.1 LOC 132939 LOVINGTON HWY		

OWNER # DIST	OWNER NAME AND ADDRESS			SEC/TWN/RG	PROPERTY DESCRIPTION	LAND	QUANTITY
7044 160 4-000-007 -064-001	STANDARD OIL FIELD SUPPLY, INC PO BOX 6 LOCO HILLS	NM	88255-0006	21 17 30	LOT 54 & 57 IN SW ALL OF 54 & W 5' OF 57 MAP#99-7 LOC 132597 LOVINGTON HWY		
7045 160 4-000-007 -065-001	STANDARD OIL FIELD SUPPLY, INC PO BOX 6 LOCO HILLS	NM	88255-0006	21 17 30	LOT 65 IN SW MAP#99-33 LOC 132591 LOVINGTON HWY		
7065 160 4-000-007 -065-002	STANDARD OIL FIELD SUPPLY, INC PO BOX 6 LOCO HILLS	NM	88255-0006	21 17 30	PART LOT 54 IN SW/4 DESCRIBED BEG NW COR, S 00 DEG 02' E 153.8', S 89 DEG 57' E 100' N 0 DEG 02' W 150.3' N 89 DEG 57' W 100.07' TO POB MAP#99-6.1 LOC 132573 LOVINGTON HWY		
7159 160 4-000-007 -159-001	WAGGONER, CARL H PO BOX 4-A LOCO HILLS	NM	88255-0000	21 17 30	LOT 50 IN SW/4 (LESS 100' X 50') MAP#99-30 LOC 132487 LOVINGTON HWY		
7183 160 4-000-007 -183-001	WESTALL, CAREL RAY, JR & WESTALL, GLEN RAY 1305 DOEPP CARLSBAD	NM	88220-0000	21 17 30	LOT 4, W 18' LOT 5 IN SW/4 MAP#99-3 LOC 132540 LOVINGTON HWY		
252301 160 4-000-007 -188-001	FROST, WALTER J & PATSY L HC 69 BOX 420 HUGO	OK	74743-0000	21 17 30	BEG 9' W OF NE COR LOT 61 IN SW/4, W 24', S 177', E 43', N 77', W 9', N 100' TO POB MAP#99-11.1A LOC 132725 LOVINGTON HWY STORAGE (OLD POST OFFICE)		
259925 160 4-000-116 -669-001	MANN, MARTHA JEAN PO BOX 471 DENVER CITY	TX	79323-0471	21 17 30	BEG NW COR LT 57; S87 DEG 57'E 270.11', S 00 DEG 03'40"W 361.35', N 89 DEG 59'13"W 100', N 00 DEG 03'40"E 264.91', N 87 DEG 57'W 170.01', N 00 DEG 07'08"E 100' TO POB AKA TR 1 MAP# 99-? CAB 2 166-3 LOC 132661 LOVINGTON HWY		
120940 160 4-000-120 -939-001	CHASE OIL CORPORATION PO BOX 1767 ARTESIA	NM	88211-1767	21 17 30	LOTS 65,66,67,68 & 69 IN SW/4 S/2NWSENESW, SESWNESW, SWSENESW,(LESS .373 AC D229/876) S2NESWNESW LESS N 103' OF W 130' MAP#99-38 THRU 42 & 99-1.2 LOC 132829-1-8 LOVINGTON HWY MH 0180122 LOCO HILLS		
120961 160 4-000-120 -961-001	WAGGONER, CARL PO BOX 4A LOCO HILLS	NM	88255-0000	21 17 30	LOTS 19, 20 (LESS D 267/6 & 929) IN SW/4 MAP#99-23,24 LOC 7 GOAT ROPERS ROAD		
255831 160 4-000-255 -831-001	WATERS, MILDRED PO BOX 42 LOCO HILLS	NM	88255-0042	21 17 30	PART S2NWSENESW AND LOTS 67, 68 BEG SE COR LOT 68, N 00 DEG 03'E 35.9', N 89 DEG 57'W 130', S 00 DEG 03'W 125', S 89 DEG 57'E 130', N 00 DEG 03'E 89.1' TO POB STC .373 AC MAP#99-41A LOC S OF 132829 LOVINGTON HWY LIFE ESTATE WITH CHASE OIL CORP AND OPTION (D373/96 4120940)		
6861 160 4-000-006 -861-001	SEWELL, TINA MARIE PO BOX 96 LOCO HILLS	NM	88255-0096	21 17 30	LOTS 2 & 3 IN SW MAP# 99-2 LOC 132478 LOVINGTON HWY		
7088 160	CHASE OIL CORPORATION			21 17 30	BEG NW COR LT 57, N 00 DEG 07'08"E		

Account	Owner Name / Address		Zip	SEC/TWN/RG	PROPERTY DESCRIPTION
	PO BOX 1767 ARTESIA	NM	88211-1767		100' TO POB, S 87 DEG 57'E 170.01', S 00 DEG 03'40"W 264.91', S 89 DEG 59'13"E 100', S 00 DEG 08'10"W 247.4', N 89 DEG 57'54"W 269.74', N 00 DEG 07'08"E 518.25' TO POB AKA TR 2 MAP# 99-8 CAB 2 166-3 LOC 132661 LOVINGTON HWY
104832 160 4-000-104 -832-001	CHASE OIL CORPORATION PO BOX 1767 ARTESIA	NM	88211-1767	21 17 30	LOT 6 IN SW/4 MAP# 99-4.1 LOC-132568 LOVINGTON HWY
104832 160 4-000-104 -833-001	CHASE OIL CORPORATION PO BOX 1767 ARTESIA	NM	88211-1767	21 17 30	LOT 7 IN SW/4 MAP# 99-4.2 LOC-132502 LOVINGTON HWY
121432 160 4-000-121 -432-001	HOPE ENTERPRISES, INC 1119 S ROSELAWN ARTESIA	NM	88210-0000	21 17 30	LOT 18 IN SW MAP# 99-22 LOC 132794 LOVINGTON HWY
6824 160 4-000-006 -824-001	DEES, DOYLE PO BOX 205 LOCO HILLS	NM	88255-0000	21 17 30	W/2 TR 71 IN E/2NESW MAP# 99-12 CAB 3 171-2 LOC 132927 LOVINGTON HWY
7050 160 4-000-007 -050-001	THOMPSON, JAMES CLEO JR XREAL ESTATE TAX SERVICES 5550 LYNDON B JOHNSON FWY STE 700 DALLAS	TX	75240-1414	21 17 30	E/2SESWSENW, W/2SWSESENW MAP#98-1.2 LOC 10 GOAT ROPERS ROAD MH 0114142
130508 160 4-000-130 -508-001	HUGHES SERVICES, INC PO BOX 68 LOCO HILLS	NM	88255-0068	21 17 30	BEG S 00 DEG 02' E 2538.3' OF NW COR NE/4; S 0 DEG 02' E ON W LINE 131', S 89 DEG 57' E 180' TO POB, S 00 DEG 02' E 80', S 89 DEG 57' E 120', N 00 DEG 02' W 80', N 89 DEG 57' W 120' TO POB MAP#100-1.4B LOC 132990-4 LOVINGTON HWY
238792 160 4-000-238 -792-001	R & B PARTNERS XCONCHO RESOURCES, INC 110 W LOUISIANA, SUITE 410 MIDLAND	TX	79701-0000	21 17 30	E 100' OF W 400' OF S 201.6' IN S2SWSWNE MAP#100-98A-2 LOC N OF 13304 LOVINGTON HWY
22751 160 4-000-006 -654-001	HUGHES SERVICES, INC PO BOX 68 LOCO HILLS	NM	88255-0068	21 17 30	E 30' OF LOT 28 IN SE/4, N 100' OF S 201.6' OF W 300' OF S/2SWSWNE MAP#100-6 & 98A-4 LOC 132990 LOVINGTON HWY
6656 160 4-000-006 -656-001	HUGHES SERVICES, INC PO BOX 68 LOCO HILLS	NM	88255-0068	21 17 30	N 29.4' OF W 300' OF N/2NWNWSE & S 101.6' OF W 300' OF S/2SWSWNE MAP#98A-3 LOC 132900 LOVINGTON HWY
250195 160 4-000-250 -195-063	BUREAU-OF-LAND MANAGEMENT PO BOX 1778 620 E GREENE ST CARLSBAD	NM	88220-6292	21 17 30	

[illegible] TOWNSHIP-17S RANGE-30E

SEC/TWN/RG PROPERTY DESCRIPTION		LAND	QUANTITY
	112	3,737	24.90
	101	24,608	26.83
	111	62,696	49.97
	104	4,890	4.89
	159	6,360	4.77
	182	147	.11
	103	74	.49

NMPRC Corporation Information Inquiry

Public Regulation Commission

12/23/2002

- Follow this link to start a new search.

I & W, INC.

SCC Number:	**0349209**
Tax & Revenue Number:	**01098097005**
Incorporation Date:	**DECEMBER 28, 1956, in NEW MEXICO**
Corporation Type:	**IS A DOMESTIC PROFIT**
Corporation Status:	**IS ACTIVE**
Good Standing:	**In GOOD STANDING through 3/15/2004**
Purpose:	**OILFIELD SERVICE**

CORPORATION DATES

Taxable Year End Date:	12/31/01
Filing Date:	01/29/02
Expiration Date:	12/28/2056

SUPPLEMENTAL POST MARK DATES

Supplemental:	09/02/96
Name Change:	
Purpose Change:	09/02/96

MAILING ADDRESS

P. O. BOX 98 LOCO HILLS , NEW MEXICO 88255

PRINCIPAL ADDRESS

132745 LOVINGTON HIGHWAY LOCO HILLS NEW MEXICO 88255

PRINCIPAL ADDRESS (Outside New Mexico)

REGISTERED AGENT

LOWELL M. IRBY

612 N. 13TH STE A ARTESIA NEW MEXICO 88210

COOP LICENSE INFORMATION

Number:
Type:
Expiration Year:

OFFICERS

President	***IRBY, LOWELL M.***
Vice President	
Secretary	***IRBY, BAYLESS E.***
Treasurer	

DIRECTORS

Date Election of Directors: 12/31/02

DEANS , A J ,

NMPRC Corporation Information Inquiry

Public Regulation Commission

12/13/2002

- Follow this link to start a new search.

DOUBLE I, INC.

SCC Number:	**0987826**
Tax & Revenue Number:	**01874494000**
Incorporation Date:	**NOVEMBER 13, 1978, in NEW MEXICO**
Corporation Type:	**IS A DOMESTIC PROFIT**
Corporation Status:	**MERGED OUT**
Good Standing:	
Purpose:	

CORPORATION DATES

Taxable Year End Date:	12/31/94
Filing Date:	//
Expiration Date:	

SUPPLEMENTAL POST MARK DATES

Supplemental:	09/07/88
Name Change:	
Purpose Change:	

MAILING ADDRESS

,

PRINCIPAL ADDRESS

PRINCIPAL ADDRESS (Outside New Mexico)

REGISTERED AGENT

MERGED OUT OF EXISTENCE

SEE FT11 FOR SERVICE OF PROCESS

COOP LICENSE INFORMATION

Number:
Type:
Expiration Year:

INCORPORATORS

DIRECTORS

Date Election of Directors:

NMPRC Corporation Information Inquiry

Public Regulation Commission

12/13/2002

- Follow this link to start a new search.

TANK SERVICE CO.

SCC Number:	**0690693**
Tax & Revenue Number:	
Incorporation Date:	**MARCH 11, 1971, in NEW MEXICO**
Corporation Type:	**IS A DOMESTIC PROFIT**
Corporation Status:	**IS INACTIVE DUE TO VOLUNTARY DISSOLUTION**
Good Standing:	
Purpose:	

CORPORATION DATES

Taxable Year End Date:	05/19/80
Filing Date:	08/18/80
Expiration Date:	

SUPPLEMENTAL POST MARK DATES

Supplemental:
Name Change:
Purpose Change:

MAILING ADDRESS

,

PRINCIPAL ADDRESS

PRINCIPAL ADDRESS (Outside New Mexico)

REGISTERED AGENT

COOP LICENSE INFORMATION

Number:
Type:
Expiration Year:

INCORPORATORS

DIRECTORS

Date Election of Directors: 06/19/81

HODGES , BOBBY J	110 LILAC MABANK , TX 75147
HODGES , JOE E	EAST HIGHWAY 82 LOCO HILLS , NM 88255
HODGES , MAXINE	110 LILAC MABANK , TX 75147

NMPRC Corporation Information Inquiry

Public Regulation Commission

12/13/2002

- Follow this link to start a new search.

I & W TRANSPORTATION, INC.

SCC Number:	**1105139**
Tax & Revenue Number:	**01153521000**
Incorporation Date:	**JULY 06, 1981, in NEW MEXICO**
Corporation Type:	**IS A DOMESTIC PROFIT**
Corporation Status:	**IS INACTIVE DUE TO VOLUNTARY DISSOLUTION**
Good Standing:	
Purpose:	

CORPORATION DATES

Taxable Year End Date:	12/31/95
Filing Date:	//
Expiration Date:	

SUPPLEMENTAL POST MARK DATES

Supplemental:	04/05/95
Name Change:	
Purpose Change:	

MAILING ADDRESS

,

PRINCIPAL ADDRESS

PRINCIPAL ADDRESS (Outside New Mexico)

REGISTERED AGENT

COOP LICENSE INFORMATION

Number:
Type:
Expiration Year:

INCORPORATORS

DIRECTORS

Date Election of Directors:

BUTTS , MICHAEL	1213 CALLE DEL SOL ARTESIA , NM 88210
IRBY , BAYLESS E	207 N. 5TH ARTESIA , NM 88210
IRBY , G. NORBERTA	1807 RAY ARTESIA , NM 88210
IRBY , LOWELL M	1807 RAY ARTESIA , NM 88210
PARCHMAN , GEORGE	PO BOX 939 LOVINGTON , NM 88260

APR 18 '91

BUR... ROSWELL

GEORGE A. GRAHAM, JR.
ATTORNEY & COUNSELOR AT LAW
212 SOUTH FOURTH STREET
POST OFFICE DRAWER Z
ARTESIA, NEW MEXICO 88211-0657
(505) 746-9881
FAX (505) 746-6455

April 17, 1991

United States Dept. of the Interior
Bureau of Land Management
P. O. Box 1397
Roswell, NM 88202-1397

ATTENTION: Mr. Al Collar

Re: 1703 (064)

Dear Mr. Collar:

Some time back in February, you and I did discuss the BLM fencing off that hazardous wastes site south of the highway. I think you will recall I told you that the property south of which the waste site is located does not belong to I & W, Inc. and, therefore, I & W cannot grant you the easement which you request. However, if you will make a request of Double I, Inc., a New Mexico corporation, and address your request to me, I feel that there should be no problem in obtaining a construction easement and the placement of a fence such as is described in the letter of April 11, 1991. However, I must first have a request to present to Double I.

Thank you very much. Best regards.

Sincerely,

George A. Graham

GEORGE A. GRAHAM, JR.

GAG:pao

cc: Double I, Inc.

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION

GARREY CARRUTHERS
GOVERNOR

POST OFFICE BOX 2088
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO 87504
(505) 827-5800

January 15, 1988

Double I
Box 7
Loco Hills, New Mexico 88255

Re: $10,000 Treating Plant Bond
Double I, Inc., Principal
The Travelers Indemnity, Surety
Bond No. 427F256-5

Gentlemen:

In checking our records, I note that you have a $10,000 Treating Plant Bond on file in this office. I am enclosing a copy of our Order No. R-8284 which states that all treating plant bonds must be replaced with $25,000 bonds by January 1, 1988. To date, we have not received your replacement bond.

Since this is a violation of the Oil Conservation Division Rules and Regulations, we would appreciate your taking care of this matter immediately. Please advise me no later than January 28th as to when I may expect to receive your replacement bond.

Thank you.

Sincerely,

DIANA RICHARDSON
Administrator
Bonding Department

enclosure

cc: OCD - Artesia

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT

OIL CONSERVATION DIVISION

P. O. BOX 2088
SANTA FE, NEW MEXICO 87501

Form C-104
Revised 10-1-78

RECEIVED
AUG 15 1980
O. C. D.
ARTESIA, OFFICE

NO. OF COPIES RECEIVED	4
DISTRIBUTION	
SANTA FE	1
FILE	1
U.S.G.S.	
LAND OFFICE	
TRANSPORTER OIL	1
TRANSPORTER GAS	
OPERATOR	1
PRORATION OFFICE	

REQUEST FOR ALLOWABLE AND AUTHORIZATION TO TRANSPORT OIL AND NATURAL GAS

I. Operator

Lowell M. Irby

Address

315 W. Washington Artesia, N. M. 88210

Reason(s) for filing (Check proper box)

New Well ☐
Recompletion ☐
Change in Ownership ☐

Change in Transporter of:
Oil ☐ Dry Gas ☐
Casinghead Gas ☐ Condensate ☐

Other (Please explain)

If change of ownership give name and address of previous owner Tank Service Co. Box 215 Loco Hills, N.M.

II. DESCRIPTION OF WELL AND LEASE

Lease Name	Well No.	Pool Name, Including Formation	Kind of Lease State, Federal or Fee	Lease

Location

Unit Letter ______ : ______ Feet From The ______ Line and ______ Feet From The ______

Line of Section ______ Township ______ Range ______ , NMPM, ______ Cou

III. DESIGNATION OF TRANSPORTER OF OIL AND NATURAL GAS

Name of Authorized Transporter of Oil ☒ or Condensate ☐	Address (Give address to which approved copy of this form is to be sent)
Navajo Refining Co., Pipeline Division	N. Freeman Artesia, N.M. 88210
Name of Authorized Transporter of Casinghead Gas ☐ or Dry Gas ☐	Address (Give address to which approved copy of this form is to be sent)

If well produces oil or liquids, give location of tanks.	Unit	Sec.	Twp.	Rge.	Is gas actually connected?	When
	J	21	17	30		

If this production is commingled with that from any other lease or pool, give commingling order number:

IV. COMPLETION DATA

Designate Type of Completion – (X)	Oil Well	Gas Well	New Well	Workover	Deepen	Plug Back	Same Res'v.	Diff. R

Date Spudded	Date Compl. Ready to Prod.	Total Depth	P.B.T.D.
Elevations (DF, RKB, RT, GR, etc.)	**Name of Producing Formation**	**Top Oil/Gas Pay**	**Tubing Depth**
Perforations			**Depth Casing Shoe**

TUBING, CASING, AND CEMENTING RECORD

HOLE SIZE	CASING & TUBING SIZE	DEPTH SET	SACKS CEMENT

V. TEST DATA AND REQUEST FOR ALLOWABLE

(Test must be after recovery of total volume of load oil and must be equal to or exceed top al... able for this depth or be for full 24 hours)

OIL WELL

Date First New Oil Run To Tanks	Date of Test	Producing Method (Flow, pump, gas lift, etc.)	
Length of Test	**Tubing Pressure**	**Casing Pressure**	**Choke Size**
Actual Prod. During Test	**Oil-Bbls.**	**Water-Bbls.**	**Gas-MCF**

GAS WELL

Actual Prod. Test-MCF/D	Length of Test	Bbls. Condensate/MMCF	Gravity of Condensate
Testing Method (pitot, back pr.)	**Tubing Pressure (shut-in)**	**Casing Pressure (shut-in)**	**Choke Size**

VI. CERTIFICATE OF COMPLIANCE

I hereby certify that the rules and regulations of the Oil Conservation Division have been complied with and that the information given above is true and complete to the best of my knowledge and belief.

Lowell M Irby
(Signature)

Owner
(Title)

8/15/80
(Date)

OIL CONSERVATION DIVISION

APPROVED SEP 25 1980, 19

BY Mike Williams

TITLE OIL AND GAS INSPECTOR

This form is to be filed in compliance with RULE 1104.

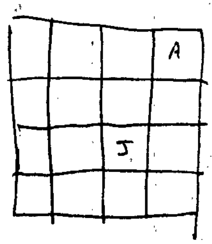
If this is a request for allowable for a newly drilled or deeper well, this form must be accompanied by a tabulation of the deviat tests taken on the well in accordance with RULE 111.

All sections of this form must be filled out completely for all able on new and recompleted wells.

Fill out only Sections I, II, III, and VI for changes of own well name or number, or transporter or other such change of conditi

Separate Forms C-104 must be filed for each pool in multi completed wells.

Unit J Sec 21 ; T21E, R30S



NEW MEXICO ENERGY, MINERALS
& NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION
DISTRICT I HOBBS
PO BOX 1980, Hobbs, NM 88241
(505) 393-6161
FAX (505) 393-0720

Jennifer A. Salisbury
CABINET SECRETARY

Att: MARTYNE HIGGINS (.

OLD I&W
Hot oil TREAT PLANT!

September 11, 1998

Mr. Larry Gandy
Gandy Marley Inc.
P.O. Box 1658
Roswell, NM 88202

Dear Mr. Gandy:

Re: C-138 BLM (Old I&W Hot Oil Service)

New Mexico Oil Conservation Division (NMOCD) is in receipt of the C-138 for the above referenced facility. NMOCD cannot approve the C-138 at this time for the following reason(s).

** The analyticals provided do not represent the above ground waste piles. The analyticals provided are for sub-surface soil samples.

** The most recent analytical does not contain the full TCLP criteria.

Please inform your client to make arrangements to sample the above ground waste. Please notify NMOCD 48 hours in advance so as we may witness this event.

If you require any further information or assistance please do not hesitate to call (505-393-6161) or write this office.

Sincerely Yours,

Wayne Price

Wayne Price-Environmental Engineer

cc: Chris Williams-NMOCD District I Supervisor
Roger Anderson-Environmental Bureau Chief, Santa Fe, NM
FAX 398-6857 GM

file: wp98/gmblm

. S. First
esia, NM 88210
strict III - (505) 334-6178
0 Rio Brazos Road
c, NM 87410
strict IV - (505) 827-7131

Oil Conservation Division
2040 South Pacheco Street
Santa Fe, New Mexico 87505
(505) 827-7131

Submit Origina
Plus 1 Cop
to appropriate
District Office

REQUEST FOR APPROVAL TO ACCEPT SOLID WASTE

1. RCRA Exempt: ☐ Non-Exempt: ☒ Verbal Approval Received: Yes ☐ No ☒	4. Generator Bureau of Land Man 5. Originating Site Loco Hills NM
2. Management Facility Destination Gandy Marley Inc.	6. Transporter Gandy Corp.
3. Address of Facility Operator Box 1658 Roswell	8. State NM
7. Location of Material (Street Address or ULSTR) Hiway 82 Loco Hills	

9. Circle One:

A. All requests for approval to accept oilfield exempt wastes will be accompanied by a certification of waste from the Generator; one certificate per job.

(B) All requests for approval to accept non-exempt wastes must be accompanied by necessary chemical analysis to PROVE the material is not-hazardous and the Generator's certification of origin. No waste classified hazardous by listing or testing will be approved.

All transporters must certify the wastes delivered are only those consigned for transport.

BRIEF DESCRIPTION OF MATERIAL:

Contaminated dirt from old oilfield operations dumping in old pit

DENIED AT THIS TIME! 9/11/98
LWJ

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
SEP 1998
RECEIVED
Hobbs
OCD

Estimated Volume 2500 cy Known Volume (to be entered by the operator at the end of the haul) ______ cy

SIGNATURE: ______________________ TITLE: V-P DATE: 9-2-98
Waste Management Facility Authorized Agent

TYPE OR PRINT NAME: Larry Gandy TELEPHONE NO. 398-4960

(This space for State Use)

APPROVED BY: ______________________ TITLE: ______________________ DATE: ______________

APPROVED BY: ______________________ TITLE: ______________________ DATE: ______________

O. Box 1980
obbs, NM 88241-1980
istrict II - (505) 748-1283
1 S. First
rtesia, NM 88210
istrict III - (505) 334-6178
00 Rio Brazos Road
ec, NM 87410
strict IV - (505) 827-7131

New Mexico
Energy Minerals and Natural Resources Department
Oil Conservation Division
2040 South Pacheco Street
Santa Fe, New Mexico 87505
(505) 827-7131

Form C-138
Originated 8/8/95

Submit Original
Plus 1 Copy
to appropriate
District Office

REQUEST FOR APPROVAL TO ACCEPT SOLID WASTE

1. RCRA Exempt: ☐ Non-Exempt: ☒ XX Verbal Approval Received: Yes ☐ No ☒ x	4. Generator Bureau of Land Man 5. Originating Site Loco Hills NM
2. Management Facility Destination Gandy Marley Inc.	6. Transporter Gandy Corp.
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Waste Management Facility Authorized Agent

TYPE OR PRINT NAME: Larry Gandy TELEPHONE NO. 398-4960

(This space for State Use)

APPROVED BY: ____________________ TITLE: ____________________ DATE: ____________

APPROVED BY: ____________________ TITLE: ____________________ DATE: ____________

GANDY MARLEY, INC.
P. O. BOX 827
TATUM, NEW MEXICO 88267

TATUM, NEW MEXICO ROSWELL, NEW MEXICO

CERTIFICATE OF WASTE STATUS

OILFIELD NON-EXEMPT WASTE MATERIAL

Originating Location: BUREAU OF LAND MANAGEMENT
LOCO HILLS NEW MEXICO

Source: OLD ABANDONED OIL PIT

Disposal Location: 34 MILES WEST OF TATUM ON HIGHWAY 380

"As a condition of acceptance for disposal, I hereby certify that this waste is a non-exempt waste as defined by the Environmental Protection Agency's (EPA) July 1988 Regulatory Determination. To my knowledge, this waste will be analyzed pursuant to the provisions of 40 CFR Part 261 to verify the nature as non-hazardous. I further certify that to my knowledge no "hazardous or listed waste" pursuant to the provisions of 40 CFR, Part 261, Subparts C and D, has been added or mixed with the waste so as to make the resultant mixture a "hazardous waste" pursuant to the provisions of 40 CFR, section 261.3 (b)."

I, the undersigned as the agent for BUREAU OF LAND MANAGEMENT concur with the status of the waste from the subject site.

Name Link Lacewell

Title/Agency
BUREAU OF LAND MANAGEMENT

Address ~~WEST SECOND~~ 620 E. Greene
Carlsbad ~~ROSWELL~~, NEW MEXICO 88220

Signature Link Lacewell

Date 8-31-98

Aspen Analytical
1110 Elkton Drive, Suite A • Colorado Springs, CO 80907
(719) 593-9595 • FAX (719) 593-9911

GES	Client Project ID: BLM-I & W Loco Hills	Sampled: Aug 18, 1998
1040-A Elkton Drive	Sample Descript: Soil, 980237-01	Received: Aug 20, 1998
Colorado Springs, CO 80907		Analyzed: Aug 27, 1998
Attention: Frank L. Foree	Lab Number: 808-0485	Reported: Aug 28, 1998

LABORATORY ANALYSIS

Analyte	Detection Limit	Sample Results
Corrosivity:		
pH	N.A.	7.5
Ignitability:		
Flashpoint (Pensky-Martens), °C	20 °C	> 94 °C
Reactivity:		
Sulfide, mg/kg	10	N.D.
Cyanide, mg/kg	0.75	N.D.
Reaction with water	N.A.	Negative

Analytes reported as N.D. were not present above the stated limit of detection.

ASPEN ANALYTICAL

Thomas R. Fowler
Laboratory Director

8080485.GES <2>

Aspen Analytical
1110 Elkton Drive, Suite A • Colorado Springs, CO 80907
(719) 593-9595 • FAX (719) 593-9911

GES	Client Project ID: BLM-I & W Loco Hills	Sampled: Aug 18, 1998
1040-A Elkton Drive	Sample Matrix: Solid	Received: Aug 20, 1998
Colorado Springs, CO 80907	Analysis Method: EPA 5030/8020	Reported: Aug 28, 1998
Attention: Frank LaForce	First Sample #: 808-0485	

BTEX DISTINCTION

Analyte	Reporting Limit mg/kg	Sample I.D. 808-0485 980237-01
Benzene	0.0050	N.D.
Toluene	0.0050	N.D.
Ethyl Benzene	0.0050	N.D.
Total Xylenes	0.0050	N.D.

Quality Control Data

Report Limit Multiplication Factor.	1.0
Date Analyzed:	8/27/98
Instrument Identification:	HP-1
Surrogate Recovery, %: (QC Limits = 61-108%)	89

Analytes reported as N.D. were not detected above the stated reporting limit.

ASPEN ANALYTICAL

Thomas R. Fowler
Laboratory Director

8080485.GES <1>

Aspen Analytical
1110 Elkton Drive, Suite A • Colorado Springs, CO 80907
(719) 593-9595 • FAX (719) 593-9911

GES	Client Project ID: BLM-I & W Loco Hills	Sampled:	Aug 18, 1998
1040-A Elkton Drive	Matrix Descript: Soil	Received:	Aug 20, 1998
Colorado Springs, CO 80907	Analysis Method: EPA 418.1	Extracted:	Aug 24, 1998
Attention: Frank L. Forse	First Sample #: 808-0485	Analyzed:	Aug 24, 1998
		Reported:	Aug 28, 1998

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS

Sample Number	Sample Description	Sample Results mg/kg
808-0485	980237-01	13,000

Detection Limits:	1000

Analytes reported as N.D. were not present above the stated limit of detection.

ASPEN ANALYTICAL

Thomas R. Fowler
Laboratory Director

8080485.GES <3>

[redacted]
8300 Westpark
Houston, TX 77063
[redacted]

☐ Buffalo
☐ Houston
☐ Pittsburgh

CHAIN-OF-CUSTODY RECORD

Page ____ of ____

Project Manager Frank LaForce
Project Name BLM-I-W Foothills
Purchase Order No.
Sampler(s)

Company GES Inc
Address 1040-A Elkton Dr.
Colorado Springs, CO 80907
Phone #800 535 8411 Fax
Mail Report to:

Requested Turn Around Time
Subcontractor

COMMENTS:
ZS 550 0064

Preservative: 1. HNO_3 2. H_2SO_4 3. H_3PO_4 4. HCl 5. NaOH 6. Na_2SO_4 7. None 8. Other(s)

SAMPLE IDENTITY	Date Sampled	Time Sampled	Media: Soil	Media: Water	Media: Air	Media: Other	Preservative	Volatile Organics	Semi-Volatile Organics	Pesticides	PCB's	Herbicides	Btex	Metals	Other Analyses: TX	Other Analyses: PH	Other Analyses: TPH	Other Analyses	Other Analyses	No. of Containers	REMARKS
													Ø	Ø	Ø	Ø	Ø				S080485
980237-01	8-18-98	11:54	X																		
																					2°C
GES																					

Relinquished By: (Signature)	Date	Time	Received By: (Signature)	Date	Time
Frank LaForce	8-19	16:00	FedX		
Relinquished By: (Signature)	Date	Time	Received By: (Signature)	8/20/98	11:00
Relinquished By: (Signature)	Date	Time	Received By: (Signature)	Date	Time

Delivery Method: ☐ In Person ☐ Common Carrier ____ (Specify) ☐ Lab Courier ☐ Other
Airbill

White - Lab Copy Canary - File Copy Pink - Client Copy

Attn: Larry

GES 980237

ATL JOB NO. 192063 *May 18, 1994*

NARRATIVE REPORT

FOCUSED SITE INVESTIGATION

FOR

BUREAU OF LAND MANAGEMENT

NARRATIVE REPORT
I & W HOT OIL SERVICE SOUTH
EDDY COUNTY, NEW MEXICO
ATL JOB NO. 192063

JAMES D. ROSE
NEW MEXICO
7381
REGISTERED PROFESSIONAL ENGINEER

Prepared by: ______________________
James D. Rose, P.E., Project Manager

Approved by: ______________________
Acting BLM State Director

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NARRATIVE REPORT

FOCUSED SITE INVESTIGATION

FOR

BUREAU OF LAND MANAGEMENT

PROJECT

I & W HOT OIL SERVICE SOUTH
EPA CERCLIS NO. NM8141199978

1.0 INTRODUCTION

1.1 Purpose

The purpose of this investigation is to evaluate the I & W Hot Oil Service South site, a potential hazardous waste site located on land under the jurisdiction of the U.S. Department of Interior, Bureau of Land Management (BLM). The scope of work involved is specifically identified in BLM's contract with ATL, Inc. (Contract No. 1422-N65-C2-3085, dated September 30, 1992), and ATL's technical proposal no. P92277, dated August 24, 1992 which is incorporated into BLM's contract.

This investigation encompasses what the U.S. Environmental Protection Agency (EPA) refers to as a Focused Site Investigation (FSI). The FSI is conducted in accordance with EPA Guidance for Performing Site Inspections Under CERCLA, Interim Final version, Publication 9345.1-01, September, 1992.

1.2 Objectives

The objectives of this FSI are to characterize hazardous substances released at the site, investigate pathways of concern, identify targets at the site, collect and document sufficient information to access any threat posed to human health and the environment, use the Hazard Ranking System (HRS II) scoring to rank the site, and determine if the site should be considered for inclusion on the National Priorities List (NPL).

1.3 Scope of Work

For this FSI, the scope of work included the following:

- Review of previous information.
- Collection of information relating to the amount, nature, and toxicity of the hazardous waste or hazardous substances at the site including the results of any systematic testing and analysis of the material.
- Collection of information on the nature and extent of contamination at the site.
- Collection of information on the general hydrogeology of the site and the location of withdrawal wells within 4 miles and surface water within 2 miles of the site.
- A description of actual or potential pathways by which the hazardous materials could leave the site, including an estimate of the probability that any particular pathway is actually being used.
- The extent and type of injury, destruction or loss of natural resources caused by the hazardous materials.
- A ranking of the site using EPA's Hazard Ranking System (HRS II) will be performed. The basis for the total score and the individual route scores will be discussed and justification included.

2.0 SITE INFORMATION

2.1 Location

The I & W Hot Oil Service, South site is located in Loco Hills, New Mexico. The site is in Section 21, Township 17 South, Range 30 East, New Mexico Principal Meridian (N.M.P.M.), Eddy County, New Mexico. The geographic coordinates are 32° 49′ 05" N latitude and 103° 58′ 45" W longitude. Access to the site is from an unimproved road east off Eddy County Road 217. Refer to Figure 1.

2.2 Site Description

The site is a trespass site on BLM managed land. The site is approximately 300 feet by 500 feet (3.4 acres) and contains no structures. The site is fenced with a chain link fence, barbed wire and a locked entrance gate. The site elevation is approximately 3635 feet (Mean Sea Level) with sand dune covered terrain sloping south and southeast toward a closed basin. Slopes range from 1.4 to 5 percent. Surface runoff is directed toward a closed basin southeast of the site (Putt, 1993).

The site is formed on silty sands, clayey sands and sandy clay. The site is underlain by Permo-Triassic Redbeds overlying the Permian Rustler Formation (Kelley, 1971; Dane and Bachman, 1965). The soils support only sparse stands of vegetation dominated by creosote bush, scrub oak, mesquite, and black grama.

2.3 Operational History and Waste Characteristics

The I & W Hot Oil Service South site is a trespass site on BLM managed land. The site had oil field waste deposited on it. The property is south of property owned by I & W Hot Oil Service, Inc. containing storage tanks for oil field waste.

The wastes present are oil sludge likely derived from hot oil treatment of wells and pipelines. The contamination is present as oil sludge filled pit, shallow puddles, and mixtures of oil sludge and sandy soil in the piles and within the large pit.

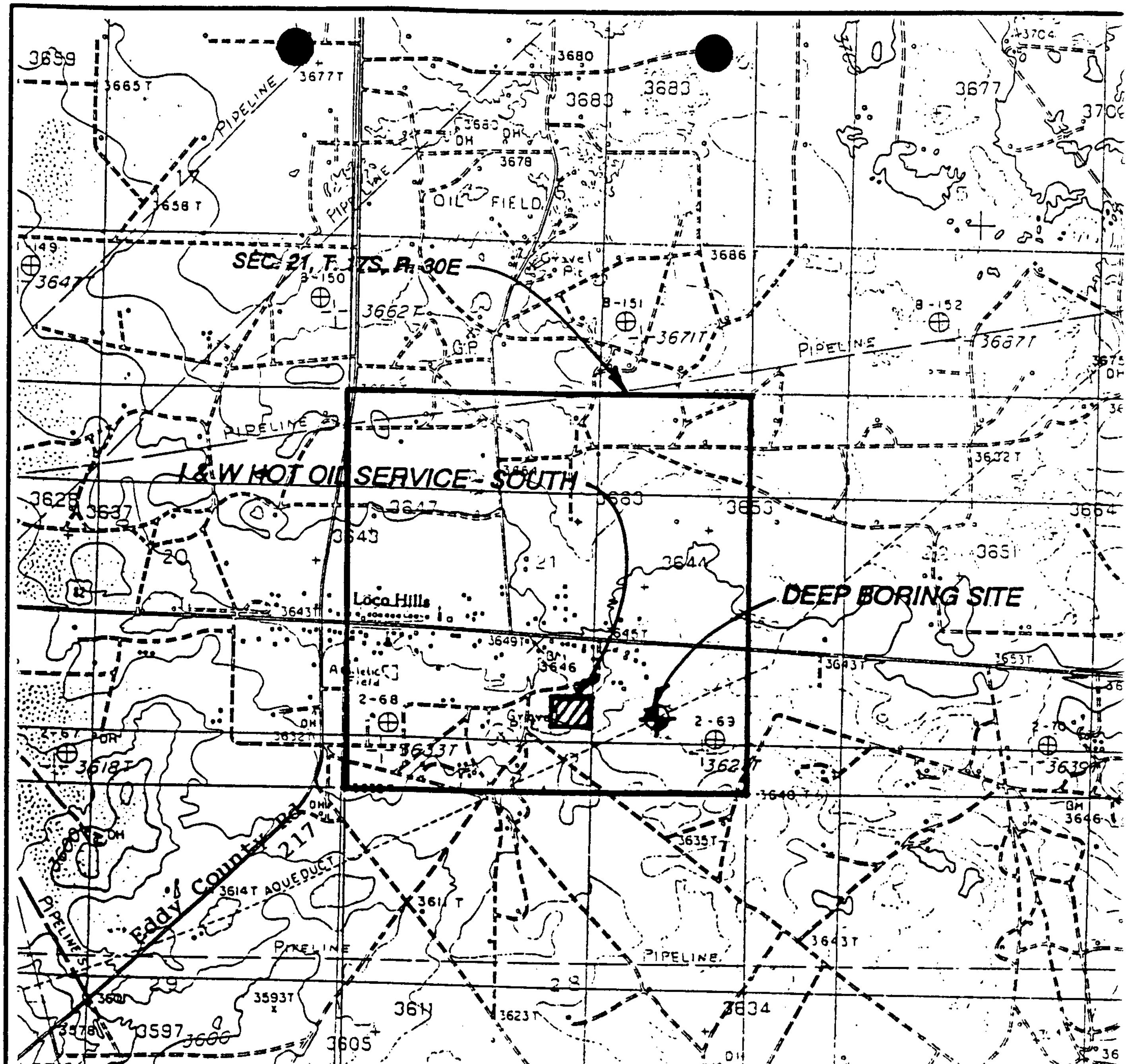
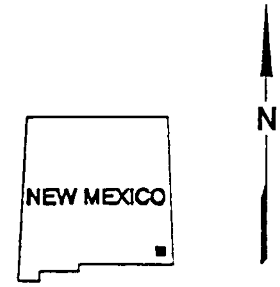


FIGURE 1

SITE LOCATION MAP
I & W HOT OIL SERVICE - SOUTH

LOCO HILLS QUADRANGLE
NEW MEXICO-EDDY CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
SCALE: 1" = 2000'



QUADRANGLE LOCATION

Site information reviewed include the BLM files and the ICF Technology Incorporated Preliminary Assessment (PA) report completed September, 1988. The following areas within the site have been considered as sources for contaminant releases based on analytical results of the PA and FSI pre-reconnaissance.

1. Sludge (soil and waste oil mixture) piles at BLM10-2001 with an estimated volume of 1185 cubic yards based on an estimated area of 10,090 square feet.

2. A sludge pile at BLM10-2002 with an estimated volume of 942 cubic yards based on an estimated area of 7860 square feet.

3. A sludge pit at BLM10-2003 with an estimated volume of 27 cubic yards based on an estimated area of 715 square feet.

4. A sludge pile at BLM10-2004 with an estimated volume of 10 cubic yards based on an estimated area of 540 square feet.

There was no indication from past records nor from the PA that other areas needed to be studied. The focus of the scope of work for this FSI was four (4) sources identified above.

A PA of the I&W Hot Oil Service South site was conducted by ICF Technology Incorporated in 1988 (BLM 1988). Soil samples from three (3) oil sludge piles or pits were taken. Compounds of concern identified in the 1988 PA are as follows:

Arsenic	Chromium
Lead	Zinc
Ethylbenzene	Phenanthrene

3.0 SITE INVESTIGATION SUMMARY

Field work at the I & W Hot Oil Service South was performed in accordance with the Project Work Plan for Loco Hills Landfill and I & W Hot Oil Service South, BLM Contract 1422-N651-C2-3085; May 5, 1993. This FSI attempted to determine if the contaminants from previously identified sources had migrated vertically and horizontally.

Decontamination Procedures

Augers, tools, and split spoon samplers were steam cleaned with detergent, tap water rinsed, alcohol rinsed, then rinsed with distilled water. All liquid and solid waste from the decontamination was collected on visqueen that formed the decontamination area. The water was allowed to evaporate. The sediments remaining from the decontamination and the visqueen were left on site for treatment during final remedial action.

Land Survey

A site land survey and mapping of the I & W Hot Oil Service South site was conducted to provide documentation of site conditions and locations of samples. The maps were produced under the direct supervision of a registered land surveyor.

The site survey map was developed on an Auto CADD system with a scale of 1" = 30 feet.

Sampling

The sampling activities included twelve (12) soil samples from four (4) shallow soil borings on the site; three (3) "background" surface soil samples from outside the site. One (1) deep boring (200 feet depth) was drilled during the Loco Hills Landfill FSI at the closed basin where surface runoff collects. The deep boring was drilled to investigate the possibility of shallow groundwater in the area. No water wells were sampled. The closest water well is over four miles away.

The shallow soil borings were drilled to approximately 17 feet depth, using a hollow stem auger. Driven soil samples were taken at 3-5 feet, 8-10 feet, and 15-17 feet depth for chemical analysis. The borings were drilled using a truck mounted CME55 drill. The drilling was supervised by ATL's Field Investigator who also kept boring logs. The three background surface soil samples were taken at field selected locations outside the influence of site activities.

The deep boring was drilled to a 200 foot depth without encountering groundwater. The deep boring was sampled at 10, 80, 130 and 170 feet below grade.

Samples are numbered using a three-letter, ten-digit identifier (BLMXX-YYYY-ZZZZ). BLMXX is the investigation identifier, which for the Loco Hills Landfill and I & W Hot Oil Service South is BLM 10. The next portion of the identifier, YYYY, designates the specific sample location. This is further divided into 1YYY for the Loco Hills Landfill location, 2YYY for the I & W Hot Oil Service South location, 3YYY for the deep soil boring location, and 4YYY for the background soil location.

The last four digits (ZZZZ) serve as the sample identifier, which documents the depth of sampling (for multiple depth sampling locations like the boreholes). For example, -0005 is the sample collected at an end depth of 5 feet (3 to 5 feet). This portion of the identifier also designates the field quality control samples. Equipment blanks will be designated -1ZZZ, and trip blanks will be designated -2ZZZ.

Soil samples were analyzed by a CLP laboratory in accordance with the third edition of EPA's "Tests for Evaluation of Solid Waste" (SW 846). Table 1 presents a summary of all the samples that were collected for this project. The full set of data for the project presented in Appendix B. The sampling locations are shown on Figure 2 and the Topographic Map in Appendix D.

TABLE 1

PARAMETER EPA METHOD	SAMPLE MATRIX	NUMBER OF SAMPLES	NUMBER OF EQUIPMENT BLANKS	TOTAL NUMBER OF SAMPLES
PURGEABLE ORGANICS 8240	SOIL	12	1	13
SEMI VOC 8270	SOIL	12	1	13
PESTICIDE/PCB 8080	SOIL	12	1	13
PESTICIDE 8140	SOIL	12	1	13
METALS-INORGANICS	SOIL	12	1	13
FULL TCLP	ED WASTE	4	0	4

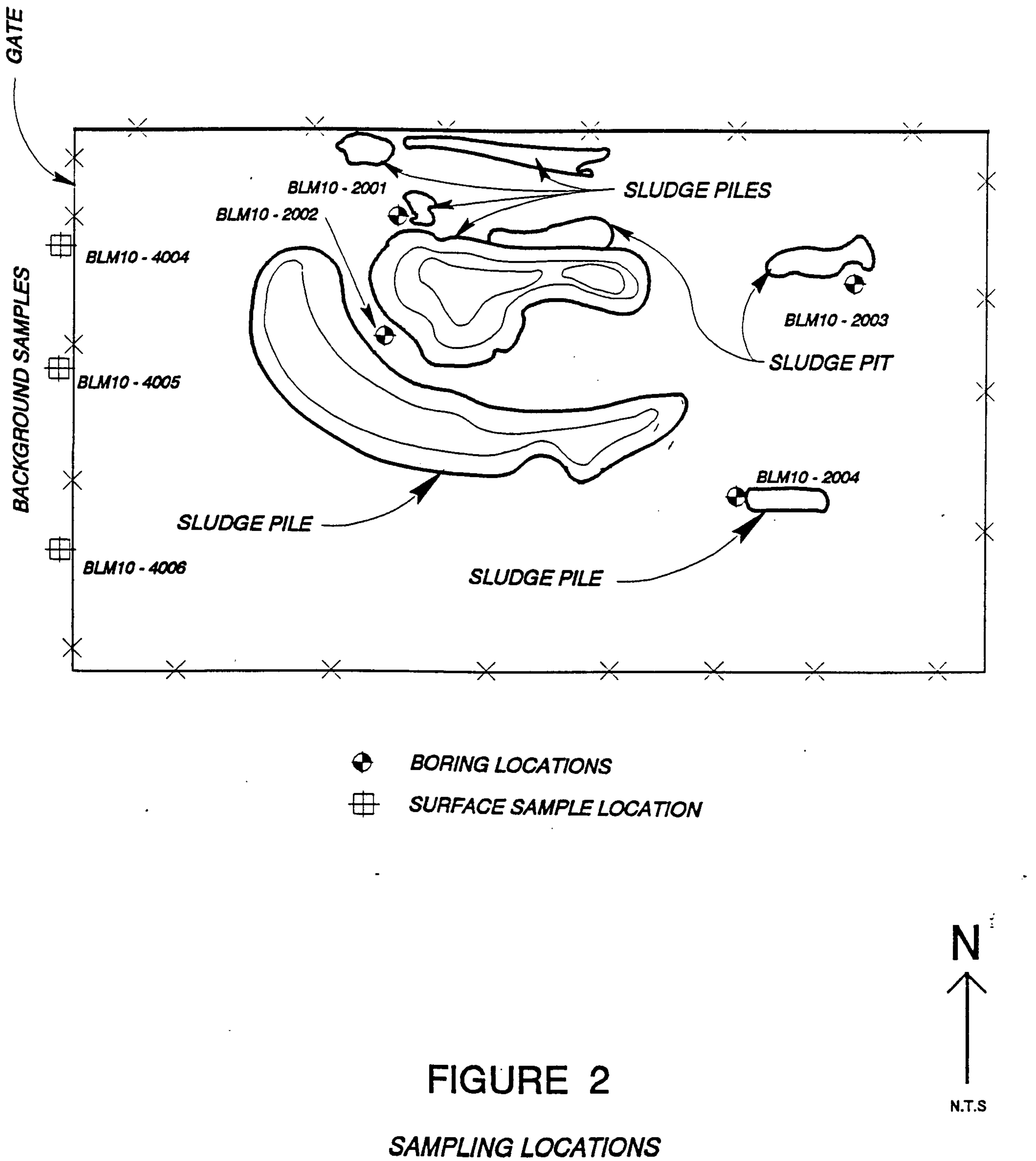


FIGURE 2

SAMPLING LOCATIONS

I & W HOT OIL SERVICE SOUTH

4.0 DATA ANALYSIS/TOXICOLOGY

4.1 PATHWAYS

4.1.1 Groundwater

The site is underlain by 10 to 15 ft of caliche and calichefied eolian deposits (described in Section 4.1.3). These deposits are underlain by Permo-Triassic Redbeds, which rest on Permian Rustler Formation. In the vicinity of the site, the name Triassic Santa Rosa Formation of the Dockum Group has been given to the Redbeds (Reed and Associates 1981). Reed et al. (1981) have described the Triassic Santa Rosa Formation as directly overlying the Permian Rustler Formation. However, other reports describe the Permian Dewey Lake Formation as being stratigraphically between the Santa Rosa and Rustler Formations (Kelley, 1971; Dane and Bachman 1965). Dane and Bachman's (1965) map show the Dewey Lake Redbeds (an alias for Dewey Lake Formation) and overlying Dockum Group contact outcropping approximately 7 miles south-southeast of the site. Kelley (1971) describes the Dewey Lake Formation as being 200 to 300 ft thick and overlying the Rustler. Deep drilling in the area has shown that the distinctive evaporite beds of the Rustler Formation are found at a depth of 228 ft (Reed and Associates, 1981). This suggests that part, if not most, of the Redbeds in the area belong to the Dewey Lake Formation. Regardless of stratigraphic uncertainties, the Redbeds in the area have been described as primarily fine-grained sand with interbedded siltstone, silty clay, and clay. The clay layers within the Redbeds are thought to be laterally discontinuous (Reed and Associates, 1981).

Below the Redbeds, the underlying Rustler Formation is 250 to 450 ft thick and consists of two members; the upper member is predominantly gypsum and anhydrite; the lower member is predominantly dolomite and anhydrite (Reed and Associates, 1981; Kelley, 1971). Reed and Associates (1981) describe the Rustler as having collapse features or erosional depressions, which suggests Karst development in the Rustler or underlying Permian Salado or Castile Formations. This is a likely scenario considering the extremely thick sequence of evaporite deposits in the Permian strata in the region.

Subsurface lithologic information from the Site Investigation is available from two sources: the deep soil boring, and shallow soil borings. The shallow soil borings are discussed below in Section 4.1.3, and the deep soil boring is described here. The deep soil boring (BLM10-3001) was drilled in between the Loco Hills Landfill and I&W Hot Oil Service South Sites (Figure 1), with intentions of locating water and describing the stratigraphy of the subsurface materials. This deep soil boring was advanced to 200 ft below ground surface without encountering ground water. Therefore, no groundwater samples were obtained. The lithologies encountered consisted predominantly of moderate reddish brown (10 R 4/6) to pale brown (5 YR 5/2) silty sand. The sand is mostly very fine to fine grained, with a trace of clay and gravel. Sands were non-cemented to highly indurated (highly compacted), and sometimes calichefied, especially at shallower depths. Other lithologies alternated with the silty sandstone throughout the 200 ft depth, including a fat (high plasticity), hard clay (possibly claystone) from 95 to 105 ft, a clayey silty sand from 105 to 115 ft, and a gravel zone from 190 to 200 ft. The subsurface materials were mostly dry, but were occasionally described as slightly moist.

The uppermost aquifer in the region within the lower member of the Permian Rustler Formation is at a depth of approximately 500 ft below ground surface (BLM 1990 - Report did not provide data source for the 500 feet). Due to poor water quality, people in the local community do not use water from the Rustler Aquifer. An abandoned water supply well that was drilled in the town of Loco Hills just west of the site was completed in the basal Rustler Formation and had extremely poor water quality, with chloride concentrations exceeding 10,000 mg/L (Reed and Associates, 1981).

There were no wells located for this study within a 4-mile radius of the site

(Collar, 1992). Therefore, there are no groundwater analytical results available. The nearest water well to the site is located at the Arrow Gas Corporation facility, five miles west of Loco Hills. The Loco Hills community currently receives their water from a pipeline that draws water from wells near Maljamar, 20 miles east of the site. The Maljamar wells are completed in the Tertiary Ogalala Formation (the High Plains Aquifer). Due to post-depositional erosion, this important aquifer is not found in the vicinity of the site. The Caprock geomorphic feature near Maljamar is the outcrop of the Ogalala Formation closest to the site (Dane and Bachman, 1965).

The site is located in an area where fresh ground water is non-existent. In fact, a salt water disposal facility has been permitted for a location just northwest of the site (Reed and Associates, 1981). The site is not within a declared ground water protection basin, but is approximately 9 miles southwest of the Lea County Underground Water Basin, and approximately 3 miles northeast of the Capitan Underground Water Basin (NMSEO, 1966). Water from the Lea County Underground Water Basin is derived from a stratigraphically higher aquifer than that at the site. It is not known which aquifer(s) supplies the water for the Capitan Underground Water Basin.

The local hydraulic gradient is to the southeast at about 25 to 30 ft per mile, with a regional gradient south and southwestward toward the Pecos River (Reed and Associates, 1981). Information regarding the hydraulic conductivity of ground water is not available. However, information regarding permeabilities of the Redbeds near the site showed that shallow claystones had permeabilities ranging from 4.9×10^{-6} to less than 1×10^{-9} cm/sec (Reed and Associates, 1982). Although these were laboratory Geotechnical test results, which are not always reflective of natural conditions, the results do indicate that vertical migration of water beneath the site would be slow (on the order of 9×10^{-3} ft per day; Reed and Associates, 1982).

4.1.2 Surface Water

The I & W Hot Oil Service South Site is located within the Lake McMillian - State Line segment of the Pecos River Basin. Mountain runoff, runoff from precipitation, and groundwater influx contribute to stream flow in the Pecos River. Eleven to twelve inches of annual average precipitation occur in the Loco Hills area. Intense localized thunderstorms of short duration are characteristic of rainfall during the summer months. Annual free water surface evaporation ranges from 55 to 85 inches.

Surface water flow in the Loco Hills area occurs only during intense rainfall events. Local arroyos flow from the site to the east and empty into a closed basin approximately 1485 feet east of the site. All surface water from the site ultimately infiltrates into the sandy soil or evaporates.

No surface water is present within the Loco Hills area. The drainage from the site flows east into a closed basin south of the waste transfer station and approximately 1485 feet east of the site boundary.

4.1.3 Soils

The soil profile at the I & W Hot Oil Service South site consists of 2 to 2½ feet of slightly moist reddish-brown silty sand at the surface. Beneath the surface soil is a moist tannish white sandy clay with moderate calcareous cementation. This tannish white layer is not present at BLM 10-2004.

At borings BLM 10-2001 and BLM 10-2002, a moist reddish-brown clayey sand to sandy clay with weak calcareous cementation is present beneath the tannish white sandy clay. The reddish-brown clayey sand extends to approximately 14 feet depth. At Boring BLM 10-2003, this soil layer was reported as silty sand. At Boring BLM 10-2004, this soil layer runs between 3 and 9 feet of depth.

Moist tan sand and gravel is present at 14 feet depth in boring BLM 10-2001. Moist reddish-brown clayey sand with gravel is present at 14 feet of depth.

At boring BLM 10-2003, moist brown sandy clay with weak calcareous cementation is found between 14 and 16 feet of depth. Moist reddish-brown silty sand is present below 16 feet of depth in Boring BLM 10-2003. Boring BLM 10-2004 has moist tannish-white sandy clay with moderate calcareous cementation at 15 feet of depth. All borings within the site were stopped at 17 feet below surface elevation. Reddish-brown silty sand was present at the three (3) background sample locations.

4.1.4 Air

The climate of the site is characteristic of the High Plains Desert with an average daily maximum temperature for the warmest month of approximately 95 degrees Fahrenheit and an average daily minimum temperature for the coldest month of approximately 25 degrees Fahrenheit (Williams, 1986). The site is near the warmest part of the state with almost 210 frost-free days per year. Average annual precipitation is 12 to 14 inches per year, with the majority of the precipitation falling during thunderstorms from May to September. Annual free water surface evaporation is over 80 inches per year, with a net precipitation of -66 inches per year (-5.5 inches per month). Average monthly wind speeds range from 10 to 16 miles per hour. March and April are the windiest months. Winds are predominantly from the south (Williams, 1986).

No air sampling was conducted for this study; therefore, no results are available from this study or from previous studies.

4.2 TARGETS

4.2.1 Soil Exposure

Targets: There are no workers at the I&W Hot Oil Service South Site, and access to the site is restricted by a fence. No residences, schools, or day care facilities are located within 200 ft of the site. The nearest individual is approximately

600 ft from the site boundary. Approximately 275 people live within a 1-mile radius of the site. No sensitive environments, including wetlands, are located within a 4-mile radius of the site.

Exposure scenario: Due to the limited site access and distance to the nearest individual, the most likely soil exposure scenario is ingestion of airborne soil. Sampling of airborne particles has not been conducted, therefore the potential for this exposure pathway has not been delineated. The soil exposure pathway would be greatly reduced by capping contaminated surface soils at the site, or instituting another mitigative procedure.

4.2.2 Surface Water Migration

Targets: There is no surface water on or within 15 miles of the I&W Hot Oil Service South site. No sensitive environments, including wetlands, are located within a 4-mile radius of the site.

Exposure scenario: The surface water pathway was not evaluated because no pathway distance limit targets were determined within the 15-mile target.

4.2.3 Groundwater Migration

Targets: The nearest well is approximately five miles from the site. This well is not a drinking water well. The closest public drinking water well is approximately 20 miles from the site. The shallowest aquifer is located 500 ft below the ground surface. This aquifer has a high chloride content, making it unsuitable for drinking water.

Exposure scenario: The groundwater pathway was not evaluated because no pathway targets were determined within the 4-mile target distance limit.

4.2.4 Air Exposure

Targets: The nearest individual is approximately 600 ft from the site boundary. Approximately 285 individuals live within a 4-mile radius of the site.

The number of people that reside within 4 miles of the site was calculated using 2.63 persons per household for Carlsbad. The average for Eddy County is not available.

On-site	---------------	0 people
0-0.25 mile	---------------	93 people
0.25 to 0.50 mile	---------------	81 people
0.50 to 1.0 mile	---------------	99 people
1.0 to 2.0 miles	---------------	12 people
2.0 to 3.0 miles	---------------	0 people
3.0 to 4.0 miles	---------------	0 people

Exposure scenario: The most likely air exposure scenario for individuals near the site is volatilization of contaminants in the soil. No air sampling has been conducted at the site, therefore the potential for this exposure pathway has not been delineated. The air exposure pathway would be greatly reduced by capping contaminated surface soils at the site, or instituting another mitigative procedure.

4.3 FOCUSED SITE INVESTIGATION ANALYTICAL RESULTS

This section provides a comparison of chemical concentrations found in soil samples collected from the four (4) boring locations at the site to levels reported for the three (3) surface background samples collected outside the fenced area of the site. The completed data set for the I & W Hot Oil Service South site presented in Appendix B. Note that the comparison of surface background samples with subsurface samples is valid and conservative within the context of the scope of this investigation. For this site, the highest concentration of contaminants is present at the surface of each source. Typically the concentrations decrease with depth in the type of soil present at this site. For this project, most determinations of release were based on Item 2.

Table 2 lists the test results above detection limits (hits), J and B values for the samples collected from the four (4) boring locations at the site. Table 3 lists the test results above detection limits, J and B values for the three (3) background samples. EPA "Guidance for Performing Site Inspection under CERCLA" (OSWER Directive 9345.1-05) states that meeting either of the following establishes that a release has occurred:

1. On-site concentrations exceed background concentrations by three (3) times (background greater than detection limit).
2. On-site concentrations exceed detection limit when background concentration is less than detection limit.

Background Samples

The background samples have **total chromium** at 4.3 to 6.3 times the detection limit. **Total lead** in the background samples is 11.1 to 14.5 times the detection limit. **Total zinc** in the background samples is 6.2 to 10.4 times the detection limit. Arsenic was detected at 1.1 to 1.3 times detection limits. The organic compound 1,1,2 Trichloroethane were present above detection limit in one (1) background sample 4006.

Location 2001

At location 2001, the contaminant levels did not constitute a release by criteria of number 1 or 2.

Location 2002

At location 2002, the contaminant levels did not constitute a release by criteria of number 1 or 2.

Location 2003

At location 2003, the contaminant levels did not constitute a release by criteria of number 1 or 2.

Location 2004

At location 2004, the contaminant levels did not constitute a release by criteria of number 1 or 2.

Full TCLP data was collected from four (4) samples at the deep soil boring locations. The results show that there were no extractable hazardous constituents in soils at this location.

TABLE 2
ANALYTICAL RESULTS FOR SOIL BORINGS

SOIL CHEMISTRY DATA BY LOCATION
SITE: BLN10
LOCATION: 2001
NORTH COORDINATE: UNKNOWN
EAST COORDINATE: UNKNOWN
05/25/93 TO 06/30/93
REPORT DATE: 10/21/93

PARAMETER NAME	LOG DATE	SAMPLE ID	DEPTH RANGE (FT)	UNITS OF MEASURE	PVI	PARAMETER VALUE	DETECTION LIMIT	LAB CODE	DILUTION FACTOR
% SOLIDS	06/30/93	0004	3.0- 4.0	%		83.9	0.10	RWL	1.0
	06/30/93	0009	8.0- 9.0	%		88.8	0.10	RWL	1.0
	06/30/93	0016	15.0- 16.0	%		97.4	0.10	RWL	1.0
1,1,2-TRICHLOROETHANE	06/30/93	0009	8.0- 9.0	UG/KG	J	3.	6.	RWL	1.
ACETONE	06/30/93	0004	3.0- 4.0	UG/KG	B	15.	12.	RWL	1.
	06/30/93	0009	8.0- 9.0	UG/KG	B	18.	11.	RWL	1.
	06/30/93	0016	15.0- 16.0	UG/KG	B	10.	10.	RWL	1.
ARSENIC, TOTAL	06/30/93	0004	3.0- 4.0	MG/KG		1.9	1.2	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		1.1	1.1	RWL	1.0
BICARBONATE	06/30/93	0004	3.0- 4.0	MG/KG		167.	10.0	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		135.	10.0	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		41.1	10.0	RWL	1.0
BIS(2-ETHYLHEXYL)PHTHALATE	06/30/93	0004	3.0- 4.0	UG/KG	J	89.	380.	RWL	1.
CALCIUM, TOTAL	06/30/93	0004	3.0- 4.0	MG/KG		161000.	59600.	RWL	100.
	06/30/93	0009	8.0- 9.0	MG/KG		45900.	548.	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		18700.	508.	RWL	1.0
CARBONATE	06/30/93	0004	3.0- 4.0	MG/KG		47.7	10.0	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		90.1	10.0	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		82.2	10.0	RWL	1.0
CHEMICAL OXYGEN DEMAND	06/30/93	0004	3.0- 4.0	MG/KG		122.	29.8	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		32.5	28.2	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		95.3	25.7	RWL	1.0
CHROMIUM, TOTAL	06/30/93	0004	3.0- 4.0	MG/KG		2.4	1.2	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		4.1	1.1	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		1.5	1.0	RWL	1.0
COPPER, TOTAL	06/30/93	0009	8.0- 9.0	MG/KG		3.2	2.7	RWL	1.0
DELTA-BHC	06/30/93	0009	8.0- 9.0	UG/KG	J	0.75	4.5	RWL	1.00

Notes:
B = Compound was found in the blank and sample.
J = Result is an estimated value below the reporting limit.

TABLE 2
ANALYTICAL RESULTS FOR SOIL BORINGS

SOIL CHEMISTRY DATA BY LOCATION
SITE: BLN10
LOCATION: 2001
NORTH COORDINATE: UNKNOWN
EAST COORDINATE: UNKNOWN
05/25/93 TO 06/30/93
REPORT DATE: 10/21/93

PARAMETER NAME	LOG DATE	SAMPLE ID	DEPTH RANGE (FT)	UNITS OF MEASURE	PVI	PARAMETER VALUE	DETECTION LIMIT	LAB CODE	DILUTION FACTOR
DI-N-BUTYL PHTHALATE	06/30/93	0004	3.0- 4.0	UG/KG	JB	120.	380.	RWL	1.
	06/30/93	0009	8.0- 9.0	UG/KG	JB	92.	360.	RWL	1.
	06/30/93	0016	15.0- 16.0	UG/KG	JB	97.	340.	RWL	1.
DICHLOROMETHANE-METHYLENE CHLORIDE	06/30/93	0004	3.0- 4.0	UG/KG	B	11.	6.	RWL	1.
LEAD, TOTAL	06/30/93	0004	3.0- 4.0	MG/KG		4.4	0.36	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		3.8	0.34	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		1.5	0.30	RWL	1.0
MAGNESIUM, TOTAL	06/30/93	0004	3.0- 4.0	MG/KG		2680.	596.	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		2810.	548.	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		520.	508.	RWL	1.0
POTASSIUM, TOTAL	06/30/93	0009	8.0- 9.0	MG/KG		578.	548.	RWL	1.0
SILICON, TOTAL	06/30/93	0004	3.0- 4.0	MG/KG		289.	11.9	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		274.	10.9	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		149.	10.1	RWL	1.0
SODIUM, TOTAL	06/30/93	0004	3.0- 4.0	MG/KG		637.	596.	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		597.	548.	RWL	1.0
TOTAL ORGANIC CARBON	06/30/93	0004	3.0- 4.0	MG/KG		10400.	571.	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		2170.	328.	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		3160.	270.	RWL	1.0
ZINC, TOTAL	06/30/93	0004	3.0- 4.0	MG/KG		8.1	2.4	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		12.4	2.2	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		5.0	2.0	RWL	1.0

Table 2 continued

TABLE 2
ANALYTICAL RESULTS FOR SOIL BORINGS

SOIL CHEMISTRY DATA BY LOCATION
SITE: BLM10
LOCATION: 2002
NORTH COORDINATE: UNKNOWN
EAST COORDINATE: UNKNOWN
05/25/93 TO 06/30/93
REPORT DATE: 10/21/93

PARAMETER NAME	LOG DATE	SAMPLE ID	DEPTH RANGE (FT)	UNITS OF MEASURE	PVI	PARAMETER VALUE	DETECTION LIMIT	LAB CODE	DILUTION FACTOR
% SOLIDS	06/30/93	0004	3.0- 4.0	%		84.9	0.10	RWL	1.0
	06/30/93	0009	8.0- 9.0	%		87.6	0.10	RWL	1.0
	06/30/93	0016	15.0- 16.0	%		96.7	0.10	RWL	1.0
ACETONE	06/30/93	0004	3.0- 4.0	UG/KG	B	16.	12.	RWL	1.
	06/30/93	0009	8.0- 9.0	UG/KG	B	13.	11.	RWL	1.
	06/30/93	0016	15.0- 16.0	UG/KG	B	15.	10.	RWL	1.
ARSENIC, TOTAL	06/30/93	0004	3.0- 4.0	MG/KG		1.2	1.1	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		1.4	1.1	RWL	1.0
BICARBONATE	06/30/93	0004	3.0- 4.0	MG/KG		94.2	10.0	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		91.4	10.0	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		62.0	10.0	RWL	1.0
CALCIUM, TOTAL	06/30/93	0004	3.0- 4.0	MG/KG		2060.	576.	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		1510.	568.	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		42800.	504.	RWL	1.0
CARBONATE	06/30/93	0004	3.0- 4.0	MG/KG		23.6	10.0	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		22.8	10.0	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		41.4	10.0	RWL	1.0
CHEMICAL OXYGEN DEMAND	06/30/93	0004	3.0- 4.0	MG/KG		34.0	29.5	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		29.8	25.8	RWL	1.0
CHROMIUM, TOTAL	06/30/93	0004	3.0- 4.0	MG/KG		2.6	1.2	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		4.4	1.1	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		1.6	1.0	RWL	1.0
COPPER, TOTAL	06/30/93	0009	8.0- 9.0	MG/KG		4.3	2.8	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		2.6	2.5	RWL	1.0
DI-N-BUTYL PHTHALATE	06/30/93	0004	3.0- 4.0	UG/KG	JB	150.	390.	RWL	1.
	06/30/93	0009	8.0- 9.0	UG/KG	JB	100.	370.	RWL	1.
	06/30/93	0009	8.0- 9.0	UG/KG	JB	110.	370.	RWL	1.
	06/30/93	0016	15.0- 16.0	UG/KG	JB	92.	340.	RWL	1.

Table 2 continued

TABLE 2

ANALYTICAL RESULTS FOR SOIL BORINGS

SOIL CHEMISTRY DATA BY LOCATION
SITE: BLM10
LOCATION: 2002
NORTH COORDINATE: UNKNOWN
EAST COORDINATE: UNKNOWN
05/25/93 TO 06/30/93
REPORT DATE: 10/21/93

PARAMETER NAME	LOG DATE	SAMPLE ID	DEPTH RANGE (FT)	UNITS OF MEASURE	PVI	PARAMETER VALUE	DETECTION LIMIT	LAB CODE	DILUTION FACTOR
DI-N-BUTYL PHTHALATE	06/30/93	0016	15.0- 16.0	UG/KG	JB	120.	340.	RWL	1.
DICHLOROMETHANE-METHYLENE CHLORIDE	06/30/93	0016	15.0- 16.0	UG/KG	JB	4.	5.	RWL	1.
LEAD, TOTAL	06/30/93	0004	3.0- 4.0	MG/KG		2.5	0.33	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		3.6	0.33	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		2.1	0.30	RWL	1.0
MAGNESIUM, TOTAL	06/30/93	0004	3.0- 4.0	MG/KG		3640.	576.	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		3500.	568.	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		871.	504.	RWL	1.0
POTASSIUM, TOTAL	06/30/93	0009	8.0- 9.0	MG/KG		732.	568.	RWL	1.0
SILICON, TOTAL	06/30/93	0004	3.0- 4.0	MG/KG		401.	11.5	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		407.	11.4	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		196.	10.1	RWL	1.0
TOTAL ORGANIC CARBON	06/30/93	0004	3.0- 4.0	MG/KG		28700.	909.	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		10800.	645.	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		5820.	400.	RWL	1.0
ZINC, TOTAL	06/30/93	0004	3.0- 4.0	MG/KG		7.6	2.3	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		12.3	2.3	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		5.4	2.0	RWL	1.0

Table 2 continued

TABLE 2
ANALYTICAL RESULTS FOR SOIL BORINGS

SOIL CHEMISTRY DATA BY LOCATION
SITE: BLM10
LOCATION: 2003
NORTH COORDINATE: UNKNOWN
EAST COORDINATE: UNKNOWN
05/25/93 TO 06/30/93
REPORT DATE: 10/21/93

PARAMETER NAME	LOG DATE	SAMPLE ID	DEPTH RANGE (FT)	UNITS OF MEASURE	PVI	PARAMETER VALUE	DETECTION LIMIT	LAB CODE	DILUTION FACTOR
% SOLIDS	06/30/93	0004	3.0- 4.0	%		92.4	0.10	RWL	1.0
	06/30/93	0009	8.0- 9.0	%		96.7	0.10	RWL	1.0
	06/30/93	0016	15.0- 16.0	%		95.4	0.10	RWL	1.0
ACETONE	06/30/93	0004	3.0- 4.0	UG/KG	B	36.	11.	RWL	1.
	06/30/93	0009	8.0- 9.0	UG/KG	B	12.	10.	RWL	1.
	06/30/93	0016	15.0- 16.0	UG/KG	B	11.	11.	RWL	1.
ARSENIC, TOTAL	06/30/93	0004	3.0- 4.0	MG/KG		1.3	1.1	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		1.5	1.0	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		1.0	1.0	RWL	1.0
BICARBONATE	06/30/93	0004	3.0- 4.0	MG/KG		119.	10.0	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		114.	10.0	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		157.	10.0	RWL	1.0
CALCIUM, TOTAL	06/30/93	0004	3.0- 4.0	MG/KG		2430.	534.	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		1440.	508.	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		2010.	518.	RWL	1.0
CARBONATE	06/30/93	0004	3.0- 4.0	MG/KG		64.9	10.0	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		82.7	10.0	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		83.9	10.0	RWL	1.0
CHEMICAL OXYGEN DEMAND	06/30/93	0004	3.0- 4.0	MG/KG		31.2	27.0	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		55.2	25.8	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		102.	26.2	RWL	1.0
CHROMIUM, TOTAL	06/30/93	0009	8.0- 9.0	MG/KG		2.0	1.0	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		4.2	1.0	RWL	1.0
COPPER, TOTAL	06/30/93	0016	15.0- 16.0	MG/KG		2.9	2.6	RWL	1.0
DI-N-BUTYL PHTHALATE	06/30/93	0004	3.0- 4.0	UG/KG	JB	96.	350.	RWL	1.
	06/30/93	0009	8.0- 9.0	UG/KG	JB	110.	350.	RWL	1.
	06/30/93	0009	8.0- 9.0	UG/KG	JB	110.	350.	RWL	1.
	06/30/93	0016	15.0- 16.0	UG/KG	JB	86.	350.	RWL	1.

Table 2 continued

TABLE 2
ANALYTICAL RESULTS FOR SOIL BORINGS

SOIL CHEMISTRY DATA BY LOCATION
SITE: BLM10
LOCATION: 2003
NORTH COORDINATE: UNKNOWN
EAST COORDINATE: UNKNOWN
05/25/93 TO 06/30/93
REPORT DATE: 10/21/93

PARAMETER NAME	LOG DATE	SAMPLE ID	DEPTH RANGE (FT)	UNITS OF MEASURE	PVI	PARAMETER VALUE	DETECTION LIMIT	LAB CODE	DILUTION FACTOR
DICHLOROMETHANE-METHYLENE CHLORIDE	06/30/93	0004	3.0- 4.0	UG/KG	B	11.	5.	RWL	1.
	06/30/93	0009	8.0- 9.0	UG/KG	B	9.	5.	RWL	1.
	06/30/93	0016	15.0- 16.0	UG/KG	B	9.	5.	RWL	1.
LEAD, TOTAL	06/30/93	0004	3.0- 4.0	MG/KG		2.5	0.32	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		1.9	0.31	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		4.0	0.30	RWL	1.0
MAGNESIUM, TOTAL	06/30/93	0004	3.0- 4.0	MG/KG		3080.	534.	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		2320.	508.	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		1540.	518.	RWL	1.0
POTASSIUM, TOTAL	06/30/93	0016	15.0- 16.0	MG/KG		838.	518.	RWL	1.0
SILICON, TOTAL	06/30/93	0004	3.0- 4.0	MG/KG		335.	10.7	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		306.	10.2	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		292.	10.4	RWL	1.0
TOTAL ORGANIC CARBON	06/30/93	0004	3.0- 4.0	MG/KG		22000.	909.	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		7910.	455.	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		98.3	75.2	RWL	1.0
ZINC, TOTAL	06/30/93	0004	3.0- 4.0	MG/KG		4.7	2.1	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		6.2	2.0	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		16.8	2.1	RWL	1.0

Table 2 continued

TABLE 2
ANALYTICAL RESULTS FOR SOIL BORINGS

SOIL CHEMISTRY DATA BY LOCATION
SITE: BLM10
LOCATION: 2004
NORTH COORDINATE: UNKNOWN
EAST COORDINATE: UNKNOWN
05/25/93 TO 06/30/93
REPORT DATE: 10/21/93

PARAMETER NAME	LOG DATE	SAMPLE ID	DEPTH RANGE (FT)	UNITS OF MEASURE	PVI	PARAMETER VALUE	DETECTION LIMIT	LAB CODE	DILUTION FACTOR
% SOLIDS	06/30/93	0004	3.0- 4.0	%		93.3	0.10	RWL	1.0
	06/30/93	0009	8.0- 9.0	%		91.5	0.10	RWL	1.0
	06/30/93	0016	15.0- 16.0	%		90.4	0.10	RWL	1.0
1,1,2-TRICHLOROETHANE	06/30/93	0009	8.0- 9.0	UG/KG	J	3.	5.	RWL	1.
ACETONE	06/30/93	0004	3.0- 4.0	UG/KG	B	19.	11.	RWL	1.
	06/30/93	0009	8.0- 9.0	UG/KG	B	20.	11.	RWL	1.
	06/30/93	0016	15.0- 16.0	UG/KG	B	22.	11.	RWL	1.
AROCLOR-1254	06/30/93	0004	3.0- 4.0	UG/KG	JB	34.	86.	RWL	1.00
	06/30/93	0016	15.0- 16.0	UG/KG	JB	38.	84.	RWL	1.00
ARSENIC, TOTAL	06/30/93	0004	3.0- 4.0	MG/KG		1.6	1.1	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		4.8	1.1	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		2.4	1.1	RWL	1.0
BICARBONATE	06/30/93	0004	3.0- 4.0	MG/KG		139.	10.0	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		120.	10.0	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		133.	10.0	RWL	1.0
CALCIUM, TOTAL	06/30/93	0004	3.0- 4.0	MG/KG		1030.	492.	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		3890.	541.	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		35200.	534.	RWL	1.0
CARBONATE	06/30/93	0004	3.0- 4.0	MG/KG		10.7	10.0	RWL	1.0
CHEMICAL OXYGEN DEMAND	06/30/93	0004	3.0- 4.0	MG/KG		110.	26.8	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		85.3	27.3	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		31.9	27.7	RWL	1.0
CHROMIUM, TOTAL	06/30/93	0004	3.0- 4.0	MG/KG		4.8	0.98	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		7.4	1.1	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		6.3	1.1	RWL	1.0
COPPER, TOTAL	06/30/93	0009	8.0- 9.0	MG/KG		3.3	2.7	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		7.3	2.7	RWL	1.0

Table 2 continued

TABLE 2
ANALYTICAL RESULTS FOR SOIL BORINGS

SOIL CHEMISTRY DATA BY LOCATION
SITE: BLM10
LOCATION: 2004
NORTH COORDINATE: UNKNOWN
EAST COORDINATE: UNKNOWN
05/25/93 TO 06/30/93
REPORT DATE: 10/21/93

PARAMETER NAME	LOG DATE	SAMPLE ID	DEPTH RANGE (FT)	UNITS OF MEASURE	PVI	PARAMETER VALUE	DETECTION LIMIT	LAB CODE	DILUTION FACTOR
DI-N-BUTYL PHTHALATE	06/30/93	0004	3.0- 4.0	UG/KG	JB	70.	350.	RWL	1.
	06/30/93	0009	8.0- 9.0	UG/KG	JB	120.	350.	RWL	1.
	06/30/93	0016	15.0- 16.0	UG/KG	JB	100.	350.	RWL	1.
DICHLOROMETHANE-METHYLENE CHLORIDE	06/30/93	0009	8.0- 9.0	UG/KG	B	12.	5.	RWL	1.
	06/30/93	0016	15.0- 16.0	UG/KG	B	17.	5.	RWL	1.
LEAD, TOTAL	06/30/93	0004	3.0- 4.0	MG/KG		3.8	0.32	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		6.7	0.32	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		4.7	0.33	RWL	1.0
MAGNESIUM, TOTAL	06/30/93	0004	3.0- 4.0	MG/KG		608.	492.	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		1390.	541.	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		1800.	534.	RWL	1.0
POTASSIUM, TOTAL	06/30/93	0004	3.0- 4.0	MG/KG		672.	492.	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		1040.	541.	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		1220.	534.	RWL	1.0
SILICON, TOTAL	06/30/93	0004	3.0- 4.0	MG/KG		290.	9.8	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		331.	10.8	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		390.	10.7	RWL	1.0
SODIUM, TOTAL	06/30/93	0004	3.0- 4.0	MG/KG		887.	492.	RWL	1.0
TOTAL ORGANIC CARBON	06/30/93	0004	3.0- 4.0	MG/KG		812.	60.4	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		311.	66.4	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		928.	70.9	RWL	1.0
ZINC, TOTAL	06/30/93	0004	3.0- 4.0	MG/KG		10.4	2.0	RWL	1.0
	06/30/93	0009	8.0- 9.0	MG/KG		11.7	2.2	RWL	1.0
	06/30/93	0016	15.0- 16.0	MG/KG		12.8	2.1	RWL	1.0

Notes:
B = Compound was found in the blank and sample.
J = Result is an estimated value below the reporting limit.

Table 2 concluded

TABLE 3
ANALYTICAL RESULTS FOR BACKGROUND SAMPLES

SOIL CHEMISTRY DATA BY LOCATION
SITE: BLM10
LOCATION: 4004
NORTH COORDINATE: UNKNOWN
EAST COORDINATE: UNKNOWN
05/25/93 TO 06/30/93
REPORT DATE: 10/21/93

PARAMETER NAME	LOG DATE	SAMPLE ID	DEPTH RANGE (FT)	UNITS OF MEASURE	PVI	PARAMETER VALUE	DETECTION LIMIT	LAB CODE	DILUTION FACTOR
% SOLIDS	05/26/93	0001	0.5- 1.0	%		99.1	0.10	RWL	-
BICARBONATE	05/26/93	0001	0.5- 1.0	MG/KG		321.	10.0	RWL	-
CALCIUM, TOTAL	05/26/93	0001	0.5- 1.0	MG/KG		2320.	440.	RWL	1.0
CARBONATE	05/26/93	0001	0.5- 1.0	MG/KG		40.2	10.0	RWL	-
CHEMICAL OXYGEN DEMAND	05/26/93	0001	0.5- 1.0	MG/KG		296.	25.1	RWL	1.0
CHROMIUM, TOTAL	05/26/93	0001	0.5- 1.0	MG/KG		3.8	0.88	RWL	1.0
DI-N-BUTYL PHTHALATE	05/26/93	0001	0.5- 1.0	UG/KG	JB	130.	340.	RWL	1.
LEAD, TOTAL	05/26/93	0001	0.5- 1.0	MG/KG		4.2	0.29	RWL	1.0
MAGNESIUM, TOTAL	05/26/93	0001	0.5- 1.0	MG/KG		537.	440.	RWL	1.0
POTASSIUM, TOTAL	05/26/93	0001	0.5- 1.0	MG/KG		655.	440.	RWL	1.0
SILICON, TOTAL	05/26/93	0001	0.5- 1.0	MG/KG		560.	8.8	RWL	1.0
TOTAL ORGANIC CARBON	05/26/93	0001	0.5- 1.0	MG/KG		2370.	177.	RWL	1.0
ZINC, TOTAL	05/26/93	0001	0.5- 1.0	MG/KG		11.1	1.8	RWL	1.0

Notes:
B = Compound was found in the blank and sample.
J = Result is an estimated value below the reporting limit.

TABLE 3
ANALYTICAL RESULTS FOR BACKGROUND SAMPLES

SOIL CHEMISTRY DATA BY LOCATION
SITE: BLM10
LOCATION: 4005
NORTH COORDINATE: UNKNOWN
EAST COORDINATE: UNKNOWN
05/25/93 TO 06/30/93
REPORT DATE: 10/21/93

PARAMETER NAME	LOG DATE	SAMPLE ID	DEPTH RANGE (FT)	UNITS OF MEASURE	PVI	PARAMETER VALUE	DETECTION LIMIT	LAB CODE	DILUTION FACTOR
% SOLIDS	05/26/93	0001	0.5- 1.0	%		99.3	0.10	RWL	-
ARSENIC, TOTAL	05/26/93	0001	0.5- 1.0	MG/KG		0.99	0.91	RWL	1.0
BICARBONATE	05/26/93	0001	0.5- 1.0	MG/KG		231.	10.0	RWL	-
CALCIUM, TOTAL	05/26/93	0001	0.5- 1.0	MG/KG		1360.	444.	RWL	1.0
CARBONATE	05/26/93	0001	0.5- 1.0	MG/KG		20.1	10.0	RWL	-
CHEMICAL OXYGEN DEMAND	05/26/93	0001	0.5- 1.0	MG/KG		271.	25.1	RWL	1.0
CHROMIUM, TOTAL	05/26/93	0001	0.5- 1.0	MG/KG		4.0	0.89	RWL	1.0
DI-N-BUTYL PHTHALATE	05/26/93	0001	0.5- 1.0	UG/KG	JB	35.	340.	RWL	1.
LEAD, TOTAL	05/26/93	0001	0.5- 1.0	MG/KG		3.0	0.27	RWL	1.0
MAGNESIUM, TOTAL	05/26/93	0001	0.5- 1.0	MG/KG		510.	444.	RWL	1.0
POTASSIUM, TOTAL	05/26/93	0001	0.5- 1.0	MG/KG		744.	444.	RWL	1.0
SILICON, TOTAL	05/26/93	0001	0.5- 1.0	MG/KG		474.	8.9	RWL	1.0
TOTAL ORGANIC CARBON	05/26/93	0001	0.5- 1.0	MG/KG		2080.	127.	RWL	1.0
ZINC, TOTAL	05/26/93	0001	0.5- 1.0	MG/KG		18.8	1.8	RWL	1.0

Table 3 continued

TABLE 3
ANALYTICAL RESULTS FOR BACKGROUND SAMPLES

SOIL CHEMISTRY DATA BY LOCATION
SITE: BLM10
LOCATION: 4006
NORTH COORDINATE: UNKNOWN
EAST COORDINATE: UNKNOWN
05/25/93 TO 06/30/93
REPORT DATE: 10/21/93

PARAMETER NAME	LOG DATE	SAMPLE ID	DEPTH RANGE (FT)	UNITS OF MEASURE	PVI	PARAMETER VALUE	DETECTION LIMIT	LAB CODE	DILUTION FACTOR
% SOLIDS	05/26/93	0001	0.5- 1.0	%		99.4	0.10	RWL	-
1,1,2-TRICHLOROETHANE	05/26/93	0001	0.5- 1.0	UG/KG		6.	5.	RWL	1.
ARSENIC, TOTAL	05/26/93	0001	0.5- 1.0	MG/KG		1.2	0.89	RWL	1.0
BICARBONATE	05/26/93	0001	0.5- 1.0	MG/KG		231.	10.0	RWL	-
BIS(2-ETHYLHEXYL)PHTHALATE	05/26/93	0001	0.5- 1.0	UG/KG	J	50.	330.	RWL	1.
CALCIUM, TOTAL	05/26/93	0001	0.5- 1.0	MG/KG		1300.	455.	RWL	1.0
CARBONATE	05/26/93	0001	0.5- 1.0	MG/KG		20.1	10.0	RWL	-
CHEMICAL OXYGEN DEMAND	05/26/93	0001	0.5- 1.0	MG/KG		291.	25.1	RWL	1.0
CHROMIUM, TOTAL	05/26/93	0001	0.5- 1.0	MG/KG		5.7	0.91	RWL	1.0
DI-N-BUTYL PHTHALATE	05/26/93	0001	0.5- 1.0	UG/KG	JB	76.	330.	RWL	1.
LEAD, TOTAL	05/26/93	0001	0.5- 1.0	MG/KG		3.2	0.27	RWL	1.0
MAGNESIUM, TOTAL	05/26/93	0001	0.5- 1.0	MG/KG		811.	455.	RWL	1.0
POTASSIUM, TOTAL	05/26/93	0001	0.5- 1.0	MG/KG		1030.	455.	RWL	1.0
SILICON, TOTAL	05/26/93	0001	0.5- 1.0	MG/KG		536.	9.1	RWL	1.0
TOTAL ORGANIC CARBON	05/26/93	0001	0.5- 1.0	MG/KG		2370.	118.	RWL	1.0
ZINC, TOTAL	05/26/93	0001	0.5- 1.0	MG/KG		15.0	1.8	RWL	1.0

Notes:
B = Compound was found in the blank and sample.
J = Result is an estimated value below the reporting limit.

Table 3 concluded

5.0 SUMMARY AND CONCLUSIONS

The I & W Hot Oil Service, South FSI attempted to gather data necessary to evaluate the site as a candidate for the NPL. Soil samples were collected and analyzed to characterize the types of substances deposited at the site and potential migration pathways. Additionally, information was collected to confirm target populations and environments potentially at risk from the site. Previous investigation information was also utilized in the evaluation process.

I & W Hot Oil Service South site had an unknown quantity of oil field waste deposited on the property. The oil field waste consisted of approximately 2164 yd^3 of oil sludge and soil mixture dumped in four (4) locations. A chain link fence was erected after discovery of dumping by a third party.

Groundwater was not encountered within 200 feet depth of the Loco Hills site surface elevation therefore no analysis was possible. However, soils samples were obtained to depths of approximately 17 feet in each of the four (4) source locations. Even though the borehole samples had detectable levels of metals and organics, the levels detected were similar to the background samples, thus the quantities encountered are not considered to be releases.

There are no targets for surface water and groundwater migration from the site.

6.0 REFERENCES

1. Bureau of Land Management (BLM). 1988. I & W Hot Oil Service Preliminary Assessment Final Report by ICF Technology Incorporated, September 1988.

2. Al Collar, former Hazardous Waste Coordinator, Roswell District Office, Bureau of Land Management (BLM). November 1992. Personal Communication with ATL/Weston.

3. C.H. Dane and G.O. Bachman. 1965. Geologic map of New Mexico. Scale 1:500,000. US Geological Survey.

4. EPA. 1988. "Laboratory Data Validation Functional Guidelines for Evaluating ORGANICS Analyses". Prepared for the Hazardous Site Evaluation Division, U.S. Environmental Protection Agency, by the U.S. Environmental Protection Agency Data Review Work Group. February 1, 1988.

5. EPA. 1990. "U.S. EPA Contract Laboratory Program, Statement of work for Organic Analysis, Multi-Media, Multi-Concentration". Document No. ILM01.0 including revisions 1.1 through 1.8. U.S. Environmental Protection Agency. March 1990.

6. V.E. Kelley, University of New Mexico. 1971. Stratigraphy of the Pecos Country.

7. R.J. Lewis. 1991. Hazardous Chemicals Desk Reference. Van Nostrand Reinhold. New York, New York.

8. New Mexico State Engineers Office (NMSEO). 1966. Rules and regulations governing drilling of wells and appropriation and use of groundwater in New Mexico.

9. David Putt, P.E., Vice President, Urban Engineering. 1993. Loco Hills Landfill Topographic Survey.

10. E.L. Reed and Associates. 1982. Letter to J.T. Jennings, Jennings and Christy, Roswell, New Mexico. May 25, 1982.

11. V. Steve Reed, E.L. Reed and Associates, Consulting Hydrologists. 1981. Proposed Salt Water Disposal Facility for the Loco Hills Water Disposal Company. Eddy County, New Mexico. Report to the New Mexico State Oil Conservation Commission. August 1981.

12. U.S. Department of Commerce, 1973. Precipitation-Frequency Atlas of Western United States, Volume IV - New Mexico, 1973.

13. J.L. Williams. 1986. New Mexico in Maps. University of New Mexico Press. Albuquerque, New Mexico.