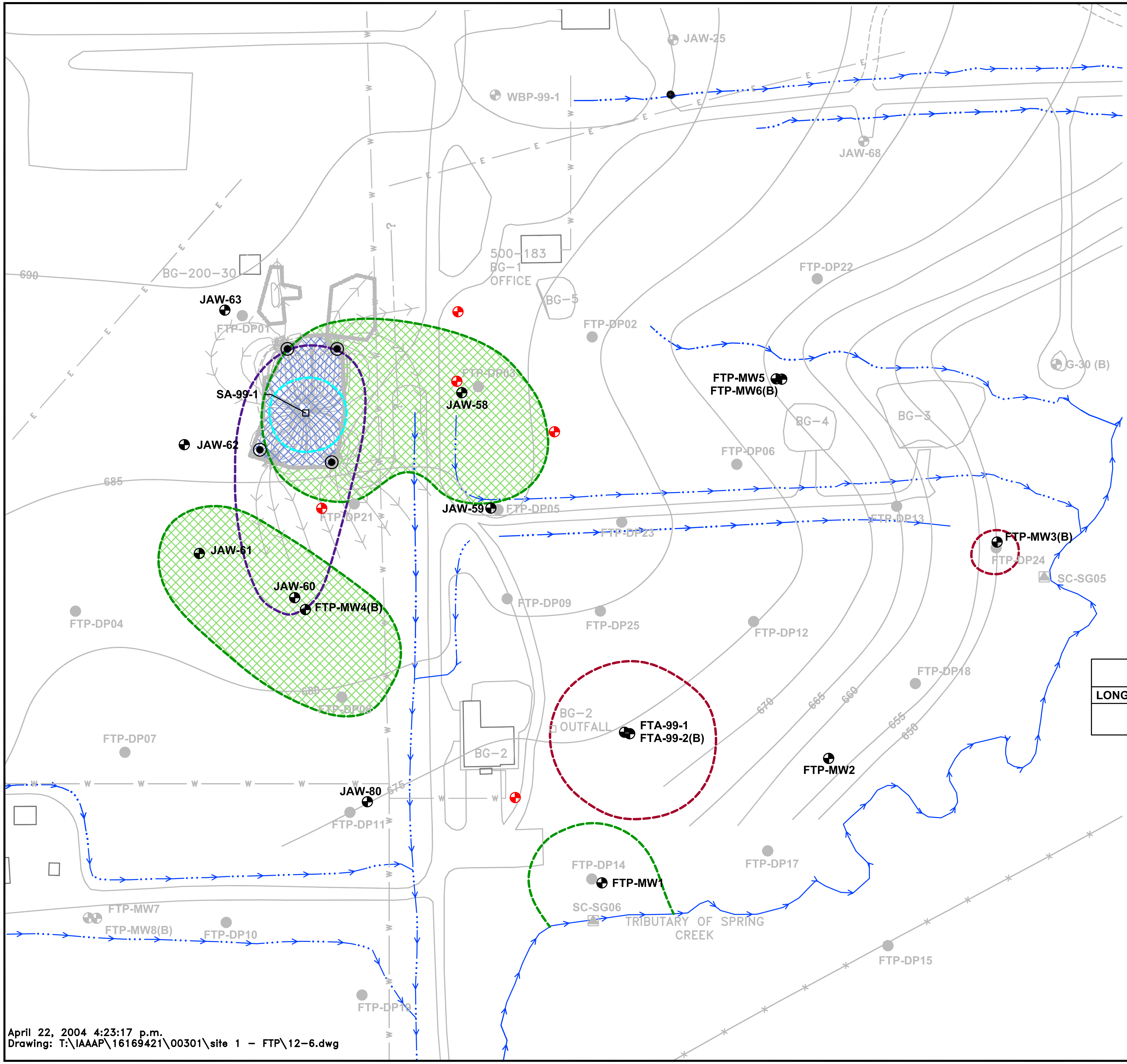


April 22, 2004 4:23:17 p.m.
Drawing: T:\IAAAP\16169421\00301\site 1 – FTP\12-6.dwg

LEGEND:

- PROPOSED MONITORING WELL (SAMPLED)
- MONITORING WELL (SAMPLED)
- MONITORING WELL (NOT SAMPLED)
- DIRECT PUSH GROUNDWATER SAMPLE LOCATION - FALL 2002
- INJECTION WELL
- (B) BEDROCK WELL
- SC-SG05 STAFF GAUGE LOCATION
- APPROXIMATE BOUNDARY OF SOILS REMOVAL ACTIONS - 1998/2003
- LOCATION OF PREVIOUS SITE FEATURE
- TRIBUTARY
- INTERMITTENT TRIBUTARY/DRAINAGE
- MODEL PREDICTED FLOW LINES (10-YEAR TRAVEL TIME BETWEEN ARROWS)
- FENCE LINE
- W UNDERGROUND WATER SUPPLY LINE
- E UNDERGROUND ELECTRICAL
- T UNDERGROUND TELEPHONE

EXTENT OF CONTAMINANTS EXCEEDING PRGs:

- CHLORINATED VOCs
- BENZENE
- RDX
- ARSENIC
- 🟩 ENHANCED BIODEGRADATION TREATMENT ZONE (HRC™)
- 🟦 CHEMICAL OXIDATION TREATMENT ZONE (HYDROGEN PEROXIDE)

EB INJECTION GRID POINT SPACING (ft)		TREATMENT ZONE	APPROXIMATE SURFACE AREA (ft$_2$)	INJECTION POINTS	DEPTH INTERVAL (ft)
LONGITUDINAL*	TRANSVERSE*				
20	10	ENHANCED BIODEGRADATION	62,000	320	20-30

*RELATIVE TO GROUNDWATER FLOW DIRECTION

N

100 50 0 100
SCALE IN FEET

URS

ALTERNATIVE 5 SITE PLAN
FIRE TRAINING PIT GROUNDWATER
REMEDIAL ALTERNATIVES ANALYSIS

DRN. BY: DAC	DATE: 03/09/04	PROJECT NO. 16169421	FIG. NO. 12-6
CHK'D. BY: DRH	DATE: 05/15/04		

This section presents the detailed analysis of remedial action alternatives for IAAAP FTP groundwater, which were assembled and described in the preceding section. The detailed analysis includes a description of evaluation criteria and both individual and comparative analyses of the alternatives.

Contaminant fate and transport modeling results for each alternative are summarized in **Table 13-1**. The model-predicted extents of benzene, chloroethane, 1,1-DCE, TCE, and vinyl chloride, above PRGs in shallow groundwater for each alternative are shown on **Figures 13-1**, **13-2, 13-3,** and **13-4**.

13.1 DESCRIPTION OF EVALUATION CRITERIA

Remedial action alternatives for FTP groundwater are analyzed in detail using criteria prescribed by the NCP (40 CFR Part 300.430). Nine criteria have been developed and are described below, according to the functional classes of threshold, primary balancing, and modifying criteria:

Threshold Criteria

- **Overall protection of human health and the environment:** This criterion provides a final assessment of whether the alternative provides adequate protection of human health and the environment, focusing on how each risk and associated pathway are eliminated, reduced, or controlled. The assessment of overall protection draws from the assessments conducted under other criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs. This evaluation allows for consideration of whether an alternative poses any unacceptable short-term, long-term, or cross-media impacts resulting from remediation.
- **Compliance with ARARs:** This criterion is used to determine whether each alternative will meet the federal and state ARARs that have been identified during the RAA process. A description of ARARs is provided in **Section 10**. If an identified ARAR is not met by an alternative, then an evaluation on the appropriateness of a waiver should be made. A waiver could be applied in any of six circumstances identified by CERCLA (USEPA 1988b).

Primary Balancing Criteria

- **Long-term effectiveness and permanence:** This criterion addresses the risk remaining at the site after a particular remedial action has taken place and objectives have been met. The focus is on the risk posed by residuals and/or untreated wastes after the cleanup criteria have been reached. The primary considerations of this criterion are:
  - — Magnitude of residual risk
  - — Adequacy and reliability of long-term management controls to protect against residuals
- **Reduction of TMV:** This criterion addresses the statutory preference of CERCLA for remedial actions involving treatment that permanently and significantly reduce the TMV of principal hazardous substances or contaminants at a site. Each alternative is evaluated in terms of quantity reduced, degree of reduction, irreversibility of treatment, type and quantity of residuals remaining after treatment, and how treatment addresses the principal threat.

- **Short-term effectiveness**: This criterion addresses the short-term effectiveness of each alternative by assessing the risk to the community, workers, and environment during the construction and implementation of the remedial action and the time required to achieve the remedial objectives. Efforts to provide protection are a key factor in this determination.
- **Implementability:** This criterion assesses the implementability of each alternative in terms of technical feasibility, administrative feasibility, and availability of services and materials. Technical feasibility considers ease of construction and operation, reliability of technology, ease of undertaking possible additional remedial action, and monitoring. Administrative feasibility considers activities needed to coordinate with other offices and agencies (e.g., permits, rights-of-way). Availability of services and materials includes availability of treatment, storage, and disposal services; necessary equipment and specialists; services and materials; and prospective technologies.
- **Cost**: The cost of each alternative is developed as the sum of capital costs, O&M costs, and periodic costs. Present value is the amount of money needed in the base year to cover the future costs associated with a particular time period at a particular interest or discount rate. Present value is developed at a discount rate of 7 percent for each alternative to provide a common basis for comparing alternatives. A feasibility-level cost estimate, intended to provide an accuracy range of –30 to +50 percent of actual cost, was prepared for each alternative using USEPA guidance (USEPA 2000). The final project cost of the selected alternative will depend on actual labor and material cost, productivity, competitive market conditions, final project scope and schedule, and other variable factors. As such, the estimates provided in this RAA should not be used for final project budgeting.

Modifying Criteria

- **Agency Acceptance**: Agency acceptance will be evaluated after agency review.
- **Community Acceptance**: Community acceptance will not be evaluated until public comments are received on the proposed plan, which follows the RAA and presents the proposed remedy.

13.2 INDIVIDUAL ANALYSIS OF ALTERNATIVES

A detailed individual analysis of the alternatives for FTP groundwater was completed using the criteria described in **Section 13.1**. Results of these analyses are presented in **Table 13-2**. Alternative-specific analysis of compliance with ARARs or TBCs is presented in **Table 13-3**.

13.3 COMPARATIVE ANALYSIS OF ALTERNATIVES

The alternatives were compared to each other using the criteria presented in **Section 13.1**. Results of these analyses are presented below.

Overall Protection of Human Health and the Environment

- Alternative 1 would not provide any protection of human health in the short term. Alternatives 2, 3, 4, and 5 use institutional and engineering controls to prevent human exposure to contaminated groundwater until it can be reduced to its PRGs through natural processes, removal and ex-situ treatment, or in-situ treatment.
- Under Alternatives 1 and 2, contaminants in groundwater would eventually be reduced to PRGs through natural processes. Alternatives 3, 4, and 5 would actively remediate contaminated groundwater through removal and ex-situ treatment or in-situ treatment, combined with MNA.

Compliance with ARARs

ARARs and TBCs were initially screened in **Section 10**. Key ARARs for FTP groundwater were further evaluated in this detailed analysis of alternatives (**Table 13-3**). The results of this evaluation are summarized below:

- Alternative 1 would not meet ARARs. The MCLs would eventually be met through natural processes, but no actions would be taken until then to prevent human exposure to contaminated groundwater.
- Alternatives 2, 3, 4, and 5 would meet ARARs.

Long-Term Effectiveness

- Under Alternatives 1 through 5, upon reduction to PRGs, residual contamination would pose no unacceptable risk.
- Alternative 1 would provide no controls. Groundwater use restrictions, a health and safety program, and groundwater monitoring would be provided under Alternatives 2, 3, 4, and 5. Alternatives 3, 4, and 5 would actively remediate the plume.
- Controls for Alternatives 2, 3, 4, and 5 are considered adequate and reliable.

Reduction of Toxicity, Mobility, and Volume

- Under Alternatives 1 and 2, toxicity and volume of contaminants in groundwater would be reduced slowly through natural processes.
- Under Alternatives 3, 4, and 5, toxicity and volume of contaminants in groundwater would be reduced through removal and ex-situ treatment or in-situ treatment, combined with MNA.
- Alternatives 4 and 5 would reduce the mobility of arsenic in groundwater through chemical oxidation. Alternative 3 would reduce the ability of the contaminant plumes to migrate through removal and ex-situ treatment.

Short-Term Effectiveness

- The modeling results indicate that Alternatives 1 and 2 would reduce contaminants in groundwater to below PRGs in shallow groundwater, in similar time frames, with

Alternatives 3, 4, and 5 being faster (**Table 13-1** and **Figures 13-1, 13-2, 13-3,** and **13-4**). Model-predicted time estimates are considered to be conservative and were made to assist in comparing alternatives only; actual remediation time frames are likely to vary. Estimates for each alternative are summarized as follows:

Alternative	Time (years)
1 – No Action	55
2 – MNA	55
3 – Focused Extraction/MNA	15 to 20
4 – ISCO/MNA	15 to 20
5 – Enhanced Degradation/MNA	15 to 20

- Alternative 1 would have no short-term impacts, because the site remains as is.
- For Alternatives 2, 3, 4, and 5 potential impact to the community would be low. Remedial action and sampling workers would be protected through implementation of a health and safety plan.

Implementability

- Alternative 1 has no action to implement.
- Alternatives 2, 3, 4, and 5 are technically and administratively feasible, although groundwater injection approval and field scale testing would be required under Alternatives 4 and 5 prior to full-scale implementation. Services and equipment are available for these alternatives.
- Alternative 3 would need to meet the substantive requirements of an NPDES surface water discharge permit and applicable air emission standards for hazardous air pollutants.

Cost

The estimated capital cost, O&M costs, periodic costs, total cost, and total present values for alternatives are summarized below and in **Table 13-2**, along with the model estimated project duration. The detailed development of these costs is presented in **Appendix O**. The total present value, using a discount rate of 7 percent, ranges from $711,000 for Alternative 2 to $1,228,000 for Alternative 5.

Description	Alternative 1 No Action	Alternative 2 MNA	Alternative 3 Focused Extraction/ MNA	Alternative 4 ISCO/MNA	Alternative 5 Enhanced Degradation/ MNA
Total Project Duration (years)	55	55	20	20	20
Capital Cost	$0	$114,000	$208,000	$225,000	$504,000
Total O&M Cost	$0	$1,849,000	$1,037,000	$822,000	$822,000
Total Periodic Cost	$0	$113,000	$49,000	$105,000	$305,000
Total Cost of Alternatives	$0	$2,075,000	$1,295,000	$1,152,000	$1,631,000
Total Present Value of Alternative	$0	$711,000	$882,000	$773,000	$1,228,000

Figure 13-5 compares the total costs of Alternatives 1 through 5 graphically.

TABLE 13-1
SUMMARY OF CONTAMINANT FATE AND TRANSPORT MODELING RESULTS OF REMEDIAL ALTERNATIVES
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Alternative	Amount of time for plume concentration to be reduced below:[1]				
	Benzene <6 µg/L	Chloroethane <110 µg/L	TCE <30 µg/L	1,1-DCE <920 µg/L	Vinyl Chloride <2 µg/L
Alternatives 1 and 2 - No Action and MNA	15-20	35-40	5-10	<5	50-55
Alternative 3 - Focused Extraction/MNA	10-15	5-10	5-10	<5	15-20
Alternative 4 - ISCO/MNA	10-15	5-10	5-10	<5	15-20
Alternative 5 - Enhanced Degradation/MNA	10-15	5-10	5-10	<5	15-20

Notes:

< = Less than

µg/L = Micrograms per liter

DCE = Dichloroethene

ISCO = In-Situ Chemical Oxidation

MNA = Monitored Natural Attenuation

TCE = Trichloroethene

VC = Vinyl Chloride

See **Figures 13-1** to **13-4** for the model-predicted extent of chemicals in groundwater for each alternative.

TABLE 13-2
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Evaluation Criterion	**Alternative 1** **No Action**	**Alternative 2** **MNA**	**Alternative 3** **Focused Extraction/MNA**	**Alternative 4** **ISCO/MNA**	**Alternative 5** **Enhanced Degradation/MNA**
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT					
Human Health Protection	None in the short term, although contaminants in groundwater would be expected to eventually decrease below PRGs (approximately 50 to 55 years).	Protects human health through institutional/engineering controls until contaminants in groundwater are reduced to below PRGs through natural attenuation (approximately 50 to 55 years).	Protects human health through institutional/engineering controls, focused plume removal and treatment, and natural attenuation until contaminants in groundwater are reduced to below PRGs (approximately 15 to 20 years).	Protects human health through institutional/engineering controls, focused in-situ treatment, and natural attenuation until contaminants in groundwater are reduced to below PRGs (approximately 15 to 20 years).	Protects human health through institutional/engineering controls, focused in-situ treatment, and natural attenuation until contaminants in groundwater are reduced to below PRGs (approximately 15 to 20 years).
Environmental Protection	Natural processes would be expected to eventually reduce contaminants in groundwater to below PRGs.	Natural processes would be expected to eventually reduce contaminants in groundwater to below PRGs. Monitoring would allow for tracking of the plume.	Would reduce groundwater contamination to below PRGs. Monitoring would allow for tracking of the plume.	Would reduce groundwater contamination to below PRGs. Monitoring would allow for tracking of the plume.	Would reduce groundwater contamination to below PRGs. Monitoring would allow for tracking of the plume.
COMPLIANCE WITH ARARs					
Compliance with ARARs	Not applicable.	Would meet ARARs as evaluated in **Table 13-3**.	Would meet ARARs as evaluated in **Table 13-3**.	Would meet ARARs as evaluated in **Table 13-3**.	Would meet ARARs as evaluated in **Table 13-3**.
Appropriateness of Waivers	Not appropriate.	None would be required.	None would be required.	None would be required.	None would be required.
LONG-TERM EFFECTIVENESS					
Magnitude of Residual Risk	Upon reduction to the PRG (approximately 50 to 55 years), residual contamination would pose no unacceptable risk.	Upon reduction to the PRG (approximately 50 to 55 years), residual contamination would pose no unacceptable risk. Until then, residual risk is managed through institutional/engineering controls.	Upon reduction to the PRG (approximately 15 to 20 years), residual contamination would pose no unacceptable risk. Until then, residual risk is managed through institutional/engineering controls.	Upon reduction to the PRG (approximately 15 to 20 years), residual contamination would pose no unacceptable risk. Until then, residual risk is managed through institutional/engineering controls.	Upon reduction to the PRG (approximately 15 to 20 years), residual contamination would pose no unacceptable risk. Until then, residual risk is managed through institutional/engineering controls.

TABLE 13-2
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Evaluation Criterion	Alternative 1 No Action	Alternative 2 MNA	Alternative 3 Focused Extraction/MNA	Alternative 4 ISCO/MNA	Alternative 5 Enhanced Degradation/MNA
Adequacy and Reliability of Controls	Not applicable.	Groundwater monitoring would track the migration of contaminants. Groundwater use restrictions would prevent human exposure to contaminated groundwater.	Proposed removal and treatment options are field-proven and expected to meet long-term remedial objectives (in combination with MNA). Groundwater use restrictions would prevent human exposure to contaminated groundwater. Groundwater monitoring would track the migration of contaminants.	ISCO is field-proven and is expected to meet long-term remedial objectives (in combination with MNA). Groundwater use restrictions would prevent human exposure to contaminated groundwater. Groundwater monitoring would track the migration of contaminants.	ISCO and EB are field-proven and are expected to meet long-term remedial objectives (in combination with MNA). Groundwater use restrictions would prevent human exposure to contaminated groundwater. Groundwater monitoring would track the migration of contaminants.
REDUCTION OF TOXICITY, MOBILITY, AND VOLUME					
Treatment Process Used	None, except for natural attenuation.	None, except for the natural attenuation processes of dispersion, biodegradation, and adsorption.	An extraction well would remove contaminated groundwater in and around SA-99-1. Extracted groundwater would be treated by air stripping. MNA would remediate the remaining areas of the plume.	ISCO would treat contaminated groundwater in and around SA-99-1. MNA would remediate the remaining areas of the plume.	ISCO would treat contaminated groundwater in and around SA-99-1. EB and MNA would remediate the remaining areas of the plume.
Reduction of TMV	Toxicity and volume of contaminants would be reduced but not documented.	Toxicity and volume of contaminants in groundwater would eventually be reduced to PRGs through natural attenuation.	Toxicity and volume of contaminants in groundwater would be reduced to PRGs through focused removal and treatment and natural attenuation.	Toxicity and volume of contaminants in groundwater would be reduced to PRGs through focused in-situ treatment and natural attenuation.	Toxicity and volume of contaminants in groundwater would be reduced to PRGs through in-situ treatment and natural attenuation.
SHORT-TERM EFFECTIVENESS					
Time Required to Achieve Remedial Action Objectives	Contaminants in groundwater would be reduced to PRGs in approximately 50 to 55 years but would not be documented.	Contaminants in groundwater would be reduced to PRGs in approximately 50 to 55 years.	Contaminants in groundwater would be reduced to PRGs in approximately 15 to 20 years.	Contaminants in groundwater would be reduced to PRGs in approximately 15 to 20 years.	Contaminants in groundwater would be reduced to PRGs in approximately 15 to 20 years.
Protection of Community During Remedial Action	No action taken.	Potential impact to community would be low due to the nature of activities (e.g., groundwater sampling).	Potential impact to community would be low. Access to IAAAP is restricted to the public.	Potential impact to community would be low. Access to IAAAP is restricted to the public.	Potential impact to community would be low. Access to IAAAP is restricted to the public.

TABLE 13-2
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Evaluation Criterion	**Alternative 1** **No Action**	**Alternative 2** **MNA**	**Alternative 3** **Focused Extraction/MNA**	**Alternative 4** **ISCO/MNA**	**Alternative 5** **Enhanced Degradation/MNA**
Protection of Workers During Remedial Action	Workers would need to take proper health and safety precautions during drilling and sampling activities.	Workers would need to take proper health and safety precautions during drilling, sampling construction, and O&M activities.	Workers would need to take proper health and safety precautions during drilling, sampling construction, and O&M activities.	Workers would need to take proper health and safety precautions during drilling, sampling construction, and O&M activities.	Workers would need to take proper health and safety precautions during drilling, sampling construction, and O&M activities.
IMPLEMENTABILITY					
Ability to Construct and Operate	Not applicable.	Sampling and analysis are easily implemented.	Services and equipment are available. Sampling and analysis are easily implemented.	Services and equipment are available. Sampling and analysis are easily implemented.	Services and equipment are available. Sampling and analysis are easily implemented.
Technical Feasibility	Not applicable.	Technology is reliable. Equipment and materials are available.	Technology is reliable. Equipment and materials are available.	Treatability tests would be used to select the most effective concentration of oxidizing agent prior to full-scale implementation.	Treatability tests would be used to select the most effective concentration of oxidizing agent the best EB substrate prior to full-scale implementation.
COST					
Assumed Project Duration (years)	55	55	20	20	20
Capital Cost	$0	$114,000	$208,000	$225,000	$504,000
Total O&M Cost	$0	$1,849,000	$1,037,000	$822,000	$822,000
Total Periodic Cost	$0	$113,000	$49,000	$105,000	$305,000
Total Cost of Alternative	$0	$2,075,000	$1,295,000	$1,152,000	$1,631,000
Total Present Value (7%)	$0	$711,000	$882,000	$773,000	$1,228,000

Notes:

> = Greater Than
ARAR = Applicable or Relevant and Appropriate Requirement
EB = Enhanced Biodegradation
GAC = Granular Activated Carbon
IAAAP = Iowa Army Ammunition Plant
ISCO = In-Situ Chemical Oxidation
MNA = Monitored Natural Attenuation
O&M = Operation and Maintenance
PRG = Preliminary Remediation Goal
TMV = Toxicity, Mobility, and Volume
VER = Vacuum-Enhanced Recovery

TABLE 13-3
ALTERNATIVE-SPECIFIC ANALYSIS OF COMPLIANCE WITH ARARs
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

CITATION	DESCRIPTION	Would Alternative Comply with ARARs or TBCs?				
		Alternative 1 No Action	**Alternative 2 MNA**	**Alternative 3 Focused Extraction/MNA**	**Alternative 4 ISCO/MNA**	**Alternative 5 Enhanced Degradation/MNA**
FEDERAL						
Safe Drinking Water Act, 42 USC Section 300						
40 CFR Part 141, National Primary Drinking Water Regulations and National Revised Primary Drinking Water Regulations	Establishes MCLs, which are health-based standards for specific contaminants.	MCLs would eventually be met through natural processes, but no actions would be taken until then to prevent exposure.	Yes. Groundwater use restrictions would prevent ingestion of contaminated groundwater exceeding MCLs.	Yes. Expected to meet MCLs in groundwater.	Yes. Expected to meet MCLs in groundwater.	Yes. Expected to meet MCLs in groundwater.
40 CFR Part 144, Underground Injection Control Program	Protects underground sources of drinking water by prohibiting injections that may affect water quality.	N/A	N/A	N/A	Yes. Groundwater injection approval may be required.	Yes. Groundwater injection approval may be required.
Water Pollution Control Act (Clean Water Act), as amended, 33 USC Section 1251 et seq.						
40 CFR Part 125 National Pollutant Discharge Elimination System (NPDES) Regulations	Establishes procedures for determination of effluent limitations for discharges of pollutants to navigable waters.	N/A	N/A	Yes. Monitoring would ensure that discharged effluent is treated to acceptable levels before discharge.	N/A	N/A
40 CFR Part 131, Quality Criteria for Water Ambient Water Quality Criteria	Requires states to establish ambient water quality criteria (AWQC) for surface water based on use classifications and the criteria stated under Section 304(a) of the Clean Water Act.	N/A	N/A	Yes. Monitoring would ensure that discharged effluent is treated to acceptable levels before discharge.	N/A	N/A
40 CFR Part 136.1-5 and Appendices A-C Guidelines Establishing Test Procedures for the Analysis of Pollutants	Specific analytical procedures for NPDES applications and reports.	N/A	N/A	Yes. Monitoring would ensure that discharged effluent is treated to acceptable levels before discharge.	N/A	N/A
Solid Waste Disposal Act (SWDA), as amended, 42 USCA Section 6901-6992K						
40 CFR Part 260 Hazardous Waste Management Systems General (Subtitle C)	Provides definitions, general standards, and information applicable to 40 CFR Parts 260-265, 268.	N/A	N/A	N/A	N/A	N/A
40 CFR Part 261 Identification and Listing of Hazardous Wastes (Subtitle C)	Defines those solid wastes which are subject to regulations as hazardous wastes under 40 CFR Parts 262-265 and Parts 124, 270, and 271.	N/A	N/A	N/A	N/A	N/A
40 CFR Part 262 Standards Applicable to Generators of Hazardous Waste	Establishes standards for generators of hazardous waste.	N/A	N/A	N/A	N/A	N/A
40 CFR Part 263 Standards Applicable to Transporters of Hazardous Waste	Establishes standards that apply to transporting hazardous waste within the U.S. if the transportation requires a manifest under 40 CFR Part 262.	N/A	N/A	N/A	N/A	N/A
40 CFR Part 268 Land Disposal Restrictions	Identifies hazardous wastes restricted from land disposal and treatment standards for restricted wastes and waste residuals.	N/A	N/A	N/A	N/A	N/A
Occupational Safety and Health Act, 29 USC 15						
29 CFR Part 1910 Occupational Safety and Health Standards	Regulates occupational health and safety. Requires proper precautions, equipment, and training before certain tasks are completed.	N/A	Yes. A health and safety program would be implemented to ensure worker safety and compliance with applicable requirements.	Yes. A health and safety program would be implemented to ensure worker safety and compliance with applicable requirements.	Yes. A health and safety program would be implemented to ensure worker safety and compliance with applicable requirements.	Yes. A health and safety program would be implemented to ensure worker safety and compliance with applicable requirements.
29 CFR Part 1910.120 Hazardous Waste Operations and Emergency Response	Remediation efforts must be conducted in accordance with health and safety regulations. Requires a Health and Safety Plan for remedial actions that involve potential contact with contaminated environmental media to protect workers health and prepare for any foreseeable emergencies.	N/A	Yes. A health and safety program would be implemented to ensure worker safety and compliance with applicable requirements.	Yes. A health and safety program would be implemented to ensure worker safety and compliance with applicable requirements.	Yes. A health and safety program would be implemented to ensure worker safety and compliance with applicable requirements.	Yes. A health and safety program would be implemented to ensure worker safety and compliance with applicable requirements.
FEDERAL						
29 CFR Part 1926Safety and Health Regulations for Construction	Regulates construction health and safety.	N/A	Yes. A health and safety program would be implemented to ensure worker safety and compliance with applicable requirements.	Yes. A health and safety program would be implemented to ensure worker safety and compliance with applicable requirements.	Yes. A health and safety program would be implemented to ensure worker safety and compliance with applicable requirements.	Yes. A health and safety program would be implemented to ensure worker safety and compliance with applicable requirements.

TABLE 13-3
ALTERNATIVE-SPECIFIC ANALYSIS OF COMPLIANCE WITH ARARs
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

CITATION	DESCRIPTION	Would Alternative Comply with ARARs or TBCs?				
		Alternative 1 No Action	**Alternative 2 MNA**	**Alternative 3 Focused Extraction/MNA**	**Alternative 4 ISCO/MNA**	**Alternative 5 Enhanced Degradation/MNA**
		FEDERAL				
Hazardous Materials Transportation Act, 49 CFR Parts 101, 106-107, 172-173, 178-180, 171, 173-177						
49 CFR Parts 107 and 171-177	Establishes standards applicable to transporters of hazardous materials.	N/A	N/A	N/A	Yes. Transport of bulk hydrogen peroxide would need to comply with applicable requirements.	Yes. Transport of bulk hydrogen peroxide would need to comply with applicable requirements.
Air Pollution Prevention and Control (Clean Air Act), 42USC 7401-7671q						
40 CFR Part 50. National Primary and Secondary Ambient Air Quality Standards	Establishes monitoring requirements for sulfur oxides, particulate matter, carbon monoxide, ozone, nitrogen dioxide and lead during excavation.	N/A	N/A	Yes. Trenching activities may generate airborne particulate matter. Proper procedures would be implemented to ensure compliance with applicable requirements.	N/A	N/A
40 CFR Part 61 National Emission Standards for Hazardous Air Pollutants	Establishes substances considered to be hazardous air pollutants and emissions standards for those substances.	N/A	N/A	Yes. Because the total mass of contaminant removed from the sump area by the treatment system is expected to be small, it is assumed that off-gas discharged from the groundwater treatment process will meet or exceed regulatory emission standards for hazardous air pollutants. If not, additional off-gas treatment could be added.	N/A	N/A
Endangered Species Act, 16 USC Section 1531 et seq.						
50 CFR Part 17 Endangered and Threatened Wildlife and Plants 50 CFR Part 402 Interagency Cooperation--Endangered Species Act of 1973, as amended	Protects endangered species and the critical habitats upon which endangered species depend.	N/A	Yes. No critical habitat would be disturbed by remedial activities.	Yes. No critical habitat would be disturbed by remedial activities.	Yes. No critical habitat would be disturbed by remedial activities.	Yes. No critical habitat would be disturbed by remedial activities.
Bald and Golden Eagle Protection Act, 16 USC Section 668 et seq.						
16 USC 668 et seq.	Prohibits the taking, possession, and transportation or any bald or golden eagle, dead or alive, or any part, nest or egg.	N/A	Yes. The alternative does not involve taking, possessing or transporting eagles.	Yes. The alternative does not involve taking, possessing or transporting eagles.	Yes. The alternative does not involve taking, possessing or transporting eagles.	Yes. The alternative does not involve taking, possessing or transporting eagles.
Migratory Bird Treaty Act of 1972, 16 USC Section 703						
16 USC Section 703	Protects native migratory bird species from unregulated "take." Poisoning due to exposure at hazardous waste sites can be included under this Act.	N/A	Yes. The alternative does not involve taking native migratory birds. Birds would not be exposed to hazardous waste.	Yes. The alternative does not involve taking native migratory birds. Birds would not be exposed to hazardous waste.	Yes. The alternative does not involve taking native migratory birds. Birds would not be exposed to hazardous waste.	Yes. The alternative does not involve taking native migratory birds. Birds would not be exposed to hazardous waste.
National Archaeological and Historic Preservation Act of 1974, 16 USC Section 469						
16 USC Section 469 36 CFR Part 65	Must recover and preserve artifacts in area where alteration of terrain threatens significant scientific, prehistoric, historical, or archaeological data.	N/A	Yes. No terrain would be altered. No scientific, prehistoric, or historical data would be threatened.	Yes. No terrain would be altered. No scientific, prehistoric, or historical data would be threatened.	Yes. No terrain would be altered. No scientific, prehistoric, or historical data would be threatened.	Yes. No terrain would be altered. No scientific, prehistoric, or historical data would be threatened.
The Antiquities Act of 1906, 16 USC Section 433						
43 CFR Part 3	Provides for protection of historic and prehistoric ruins and objects on federal lands.	N/A	Yes. No historic or prehistoric ruins or objects would be threatened.	Yes. No historic or prehistoric ruins or objects would be threatened.	Yes. No historic or prehistoric ruins or objects would be threatened.	Yes. No historic or prehistoric ruins or objects would be threatened.

TABLE 13-3
ALTERNATIVE-SPECIFIC ANALYSIS OF COMPLIANCE WITH ARARs
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

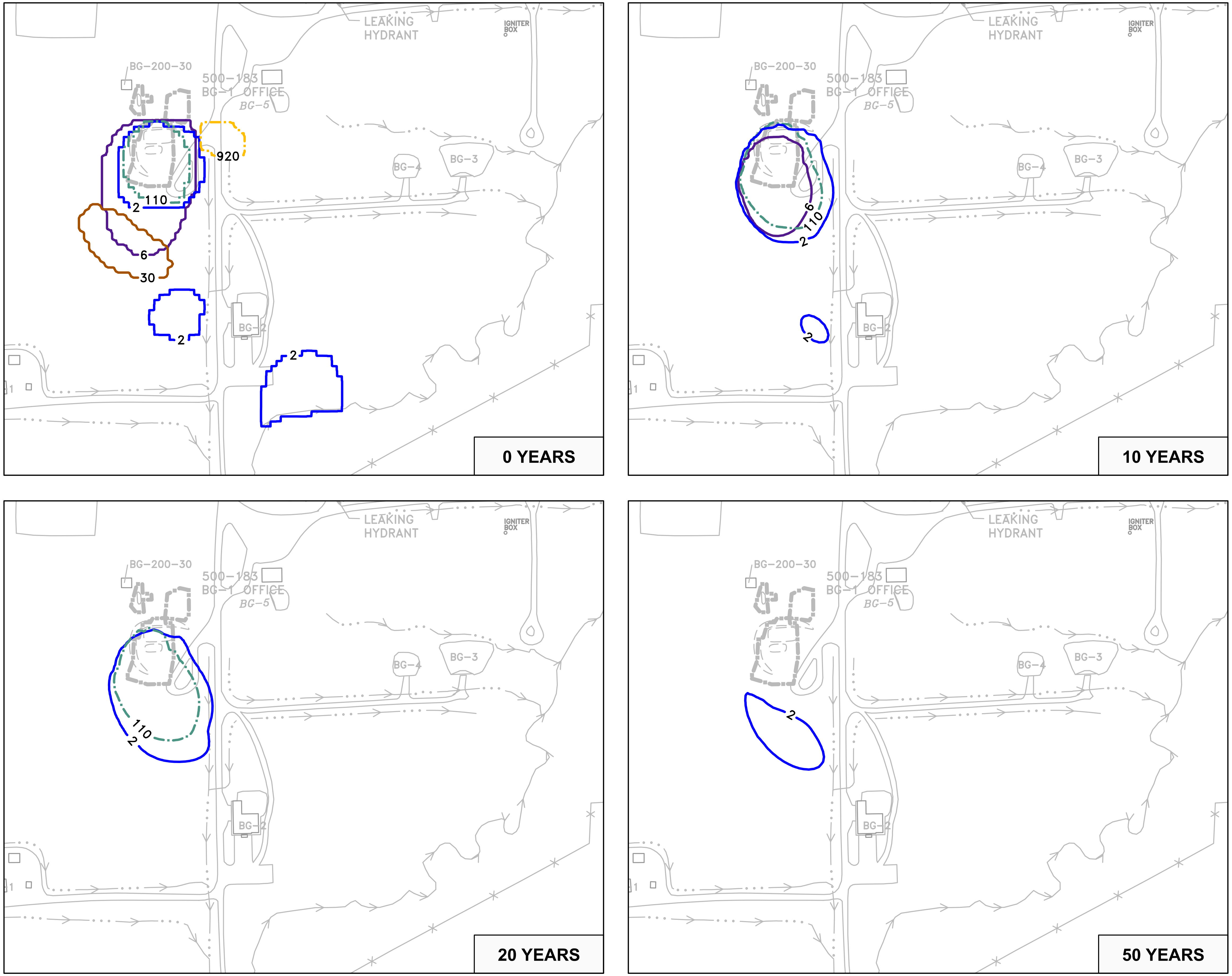
CITATION	DESCRIPTION	Would Alternative Comply with ARARs or TBCs?				
		Alternative 1 No Action	**Alternative 2 MNA**	**Alternative 3 Focused Extraction/MNA**	**Alternative 4 ISCO/MNA**	**Alternative 5 Enhanced Degradation/MNA**
FEDERAL						
Native American Graves Protection and Repatriation Act, 25 USC Section 3001						
Public Law 101-601	Requires that if Native American remains or cultural items are found on federal lands, the appropriate tribe must be notified, and all activity in the area of discovery must cease for at least 30 days.	N/A	Yes. If Native American remains or cultural items are found during remedial activities, proper procedures would be implemented to ensure compliance with applicable requirements.	Yes. If Native American remains or cultural items are found during remedial activities, proper procedures would be implemented to ensure compliance with applicable requirements.	Yes. If Native American remains or cultural items are found during remedial activities, proper procedures would be implemented to ensure compliance with applicable requirements.	Yes. If Native American remains or cultural items are found during remedial activities, proper procedures would be implemented to ensure compliance with applicable requirements.
STATE						
Water Supplies, 567 IAC, Division B, Chapter 41						
567 IAC 41.3(455B)(1)(b) **567 IAC 41.3(455B)(5)(a) and (b)** **567 IAC 41.3(455B)(6)(a)**	Establishes MCLs for specific contaminants that are applicable for drinking water supplied by community water systems and for nontransient, noncommunity drinking water systems.	MCLs would eventually be met through natural processes, but no actions would be taken until then to prevent exposure.	Yes. Groundwater use restrictions would prevent ingestion of contaminated groundwater exceeding MCLs.	Yes. Expected to meet MCLs in groundwater.	Yes. Expected to meet MCLs in groundwater.	Yes. Expected to meet MCLs in groundwater.
Air Quality, 567 IAC, Title II						
567 IAC 23.3 (455B) Emission Standards	Establishes monitoring requirements for emission of particulates or dust from any process.	N/A	N/A	Yes. Trenching activities may generate airborne particulate matter. Proper procedures would be implemented to ensure compliance with applicable requirements.	N/A	N/A
567 IAC 28 (455B) Ambient Air Quality Standards	Establishes monitoring requirements for PM_{10} and lead during excavation.	N/A	N/A	Yes. Trenching activities may generate airborne particulate matter. Proper procedures would be implemented to ensure compliance with applicable requirements.	N/A	N/A
Effluent and Pretreatment Standards, 567 IAC, Title IV, Chapter 62						
567 IAC 62.1(455B)(1)	Establishes NPDES permit conditions for point source discharge of pollutants into navigable waters.	N/A	N/A	Yes.	N/A	N/A
Water Quality Standards, 567 IAC, Title IV, Chapter 61						
567 IAC 61.2(455B)(2) **567 IAC 61.3(455B)**	Establishes an antidegradation policy for surface waters of the State of Iowa, including requirements to maintain certain flows and water quality criteria.	N/A	Yes. Would not affect surface water flows or water quality.	Yes. Following extraction and treatment with air stripping, the effluent water is expected to meet the antidegradation policy requirements.	Yes. Would not affect surface water flows or water quality.	Yes. Would not affect surface water flows or water quality.
Nonpublic Water Supply Wells, 567 IAC, Division B, Chapter 49						
567 IAC 49(455b)	Establishes uniform minimum standards and methods for well construction and reconstruction for nonpublic water supply wells.	N/A	N/A	Yes. Extraction well will not adversely affect existing water supply wells.	N/A	N/A
Criteria and Conditions for Authorizing Withdrawal, Diversion, and Storage of Water, 567 IAC, Division C, Chapter 52						
567 IAC 52(455b)	Establishes criteria for issuance of water permits, permit conditions, and conditions for modification, cancellation, or suspension of permits. Includes special criteria for particular types of water sources such as streams and groundwater.	N/A	N/A.	Yes. A permit, or equivalent requirements thereof, may be required to extract groundwater.	N/A.	N/A.
Wastewater Treatment and Disposal, 567 IAC, Title IV						
567 IAC 61(455b) Establishment of Water Quality Standards	Sets standards for the point or nonpoint source pollution of state waters.	N/A	Yes. Would not affect surface water quality.	Yes. Would not affect surface water quality.	Yes. Would not affect surface water quality.	Yes. Would not affect surface water quality.
567 IAC 62(455b) Effluent and Pretreatment Standards	Sets standards for the treatment of water prior to discharge to either waters of the state or a POTW.	N/A	N/A	Yes. Monitoring would ensure that effluent is treated to acceptable levels before discharge to surface water.	N/A	N/A

TABLE 13-3
ALTERNATIVE-SPECIFIC ANALYSIS OF COMPLIANCE WITH ARARs
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

CITATION	DESCRIPTION	Would Alternative Comply with ARARs or TBCs?				
		Alternative 1 No Action	**Alternative 2 MNA**	**Alternative 3 Focused Extraction/MNA**	**Alternative 4 ISCO/MNA**	**Alternative 5 Enhanced Degradation/MNA**
STATE						
567 IAC 63(455b), 567 IAC 64(455b) Wastewater Disposal Systems	Sets construction, operation, discharge, monitoring, analytical and reporting requirements for the operation of wastewater disposal systems.	N/A	N/A	Yes. Treatment system would be designed, constructed, and operated to meet requirements.	N/A	N/A
567 IAC 69(455b) On-Site Wastewater Treatment and Disposal Systems	Establishes rules for on-site wastewater treatment and disposal systems, including discharge restrictions and minimum distances.	N/A	N/A	Yes. Treatment system would be designed, constructed, and operated to meet requirements.	N/A	N/A
Solid Waste Comprehensive Planning Requirements, 567 IAC, Title VIII, Chapter 101						
567 IAC 101(455b, 455d) Iowa Solid Waste Management and Disposal General Requirements	Defines requirements for disposal of solid wastes.	N/A	Yes. Soil cuttings from monitoring well installation would be handled and disposed of as solid waste.	Yes. Soil cuttings from monitoring well and extraction wells would be handled and disposed of as solid waste.	Yes. Soil cuttings from monitoring well installation would be handled and disposed of as solid waste.	Yes. Soil cuttings from monitoring well installation would be handled and disposed of as solid waste.
Hazardous Waste, 567 IAC, Title XI, Chapter 141						
567 IAC 141(455b)	Defines criteria for characterization and listing of RCRA hazardous waste.	N/A	N/A	N/A	N/A	N/A
Endangered Plants and Wildlife, 571 IAC, Chapter 77						
571 IAC 77(481b)	Protects endangered species and the critical habitats upon which endangered species depend.	N/A	Yes. No critical habitat would be disturbed by remedial activities.	Yes. No critical habitat would be disturbed by remedial activities.	Yes. No critical habitat would be disturbed by remedial activities.	Yes. No critical habitat would be disturbed by remedial activities.

Notes:

ARAR = Applicable or Relevant and Appropriate Requirement
AWQC = Ambient Water Quality Criteria
CFR = Code of Federal Regulations
CTO = Catalytic Thermal Oxidation
IAC = Iowa Code
MCL = Maximum Contaminant Levels
N/A = Not Applicable
NPDES = National Pollutant Discharge Elimination System
PCP = Pentachlorophenol
POTW = Publicly Owned Treatment Works
RCRA = Resource Conservation and Recovery Act
SWDA = Solid Waste Disposal Act
TBC = To Be Considered
USC = United States Code
USCA = United States Code Annotated



LEGEND:

▬ ▪ ▬	APPROXIMATE BOUNDARY OF SOILS REMOVAL ACTIONS - 1998/2003
⟶	TRIBUTARY
⟶ · · ·	INTERMITTENT TRIBUTARY/DRAINAGE
—x—	FENCE LINE

HORIZONTAL EXTENT OF CONTAMINANTS (μg/L)

-·-110-·-	CHLOROETHANE
—6—	BENZENE
—30—	TCE
-·-920-·-	1,1-DCE
—2—	VINYL CHLORIDE

NOTES:

0 YEARS = SPRING 2003 INPUT

N

200 100 0 200
SCALE IN FEET

URS

ALTERNATIVES 1 AND 2
MODEL-PREDICTED VOC CONCENTRATIONS
FIRE TRAINING PIT GROUNDWATER
REMEDIAL ALTERNATIVES ANALYSIS

DRN. BY: JJS	DATE: 04/20/04	PROJECT NO. 16169421	FIG. NO. 13-1
CHK'D. BY: TLT	DATE: 04/20/04		

March 11, 2004 12:57:50 p.m.
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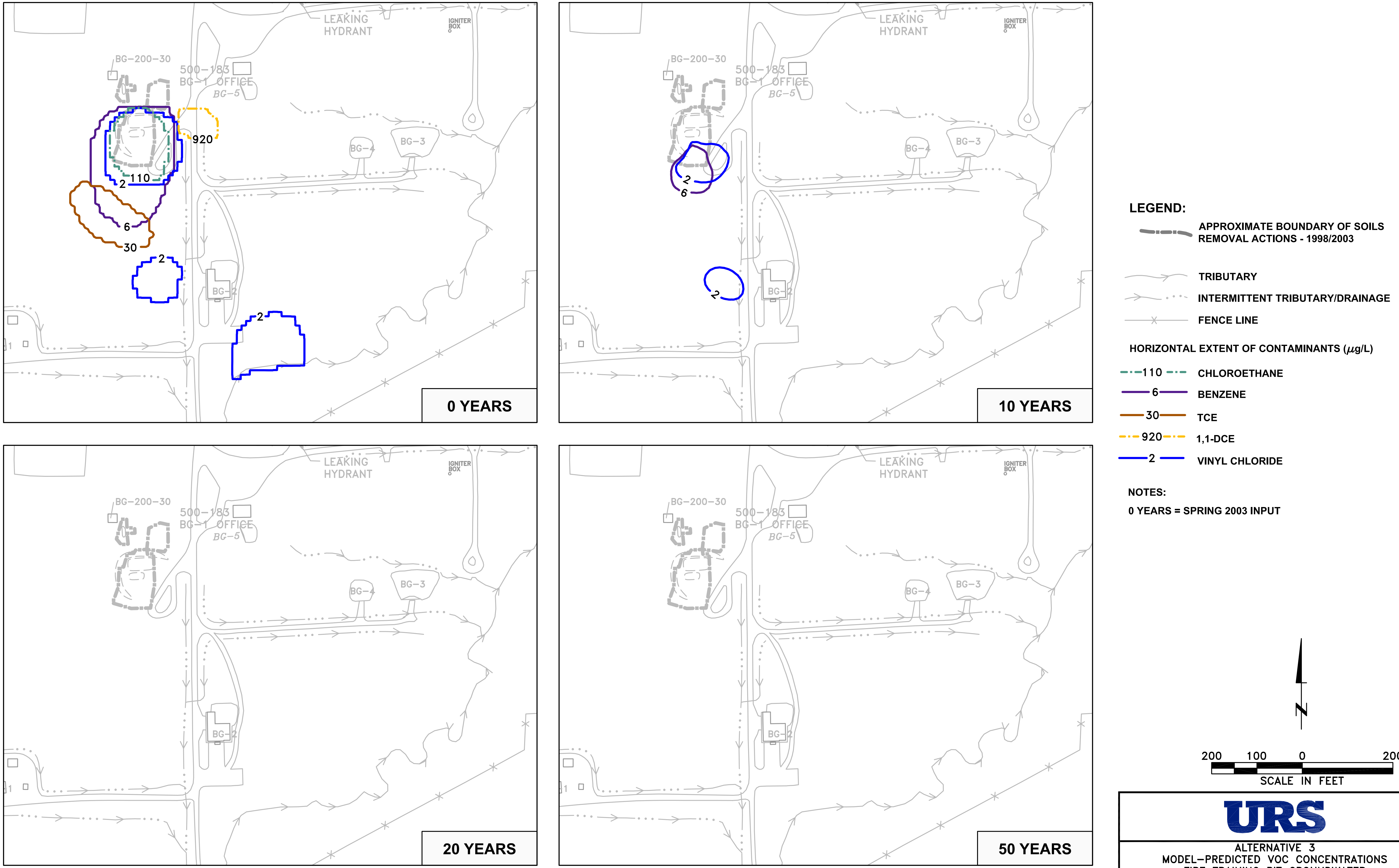

NOTES:

0 YEARS = SPRING 2003 INPUT

URS

ALTERNATIVE 3
MODEL-PREDICTED VOC CONCENTRATIONS
FIRE TRAINING PIT GROUNDWATER
REMEDIAL ALTERNATIVES ANALYSIS

DRN. BY: JJS	DATE: 04/20/04	PROJECT NO.	FIG. NO.
CHK'D. BY: TLT	DATE: 04/20/04	16169421	13-2

March 11, 2004 12:49:08 p.m.
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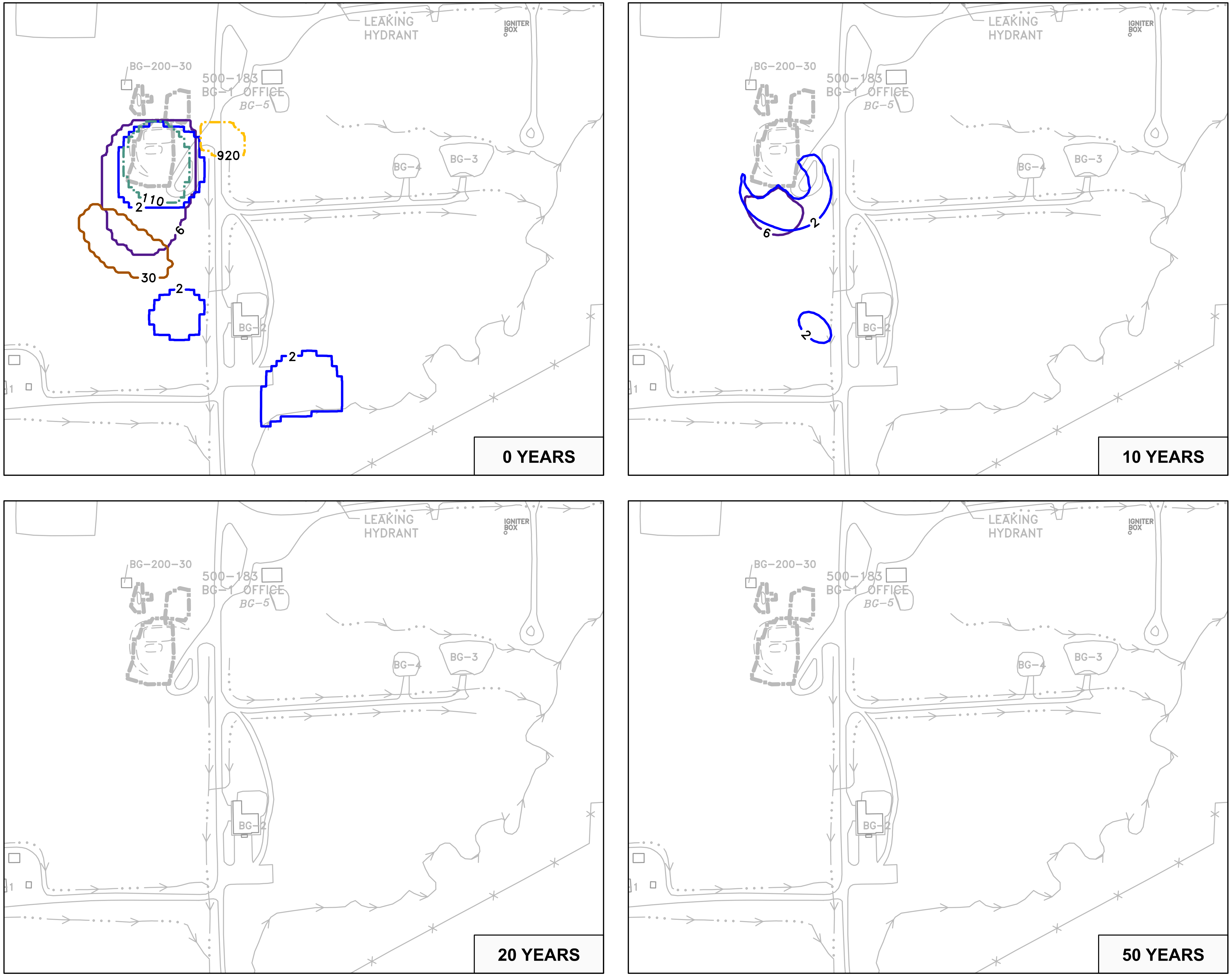

0 YEARS

10 YEARS

20 YEARS

50 YEARS

LEGEND:

▬ · ▬ ·	APPROXIMATE BOUNDARY OF SOILS REMOVAL ACTIONS - 1998/2003
⟶	TRIBUTARY
⟶ · · ·	INTERMITTENT TRIBUTARY/DRAINAGE
—×—	FENCE LINE

HORIZONTAL EXTENT OF CONTAMINANTS (μg/L)

-·-110-·-	CHLOROETHANE
—6—	BENZENE
—30—	TCE
-·-920-·-	1,1-DCE
—2—	VINYL CHLORIDE

NOTES:

0 YEARS = SPRING 2003 INPUT

N

200 100 0 200

SCALE IN FEET

URS

ALTERNATIVE 4
MODEL-PREDICTED VOC CONCENTRATIONS
FIRE TRAINING PIT GROUNDWATER
REMEDIAL ALTERNATIVES ANALYSIS

DRN. BY: JJS	DATE: 04/20/04	PROJECT NO. 16169421	FIG. NO. 13-3
CHK'D. BY: TLT	DATE: 04/20/04		

March 11, 2004 12:47:28 p.m.
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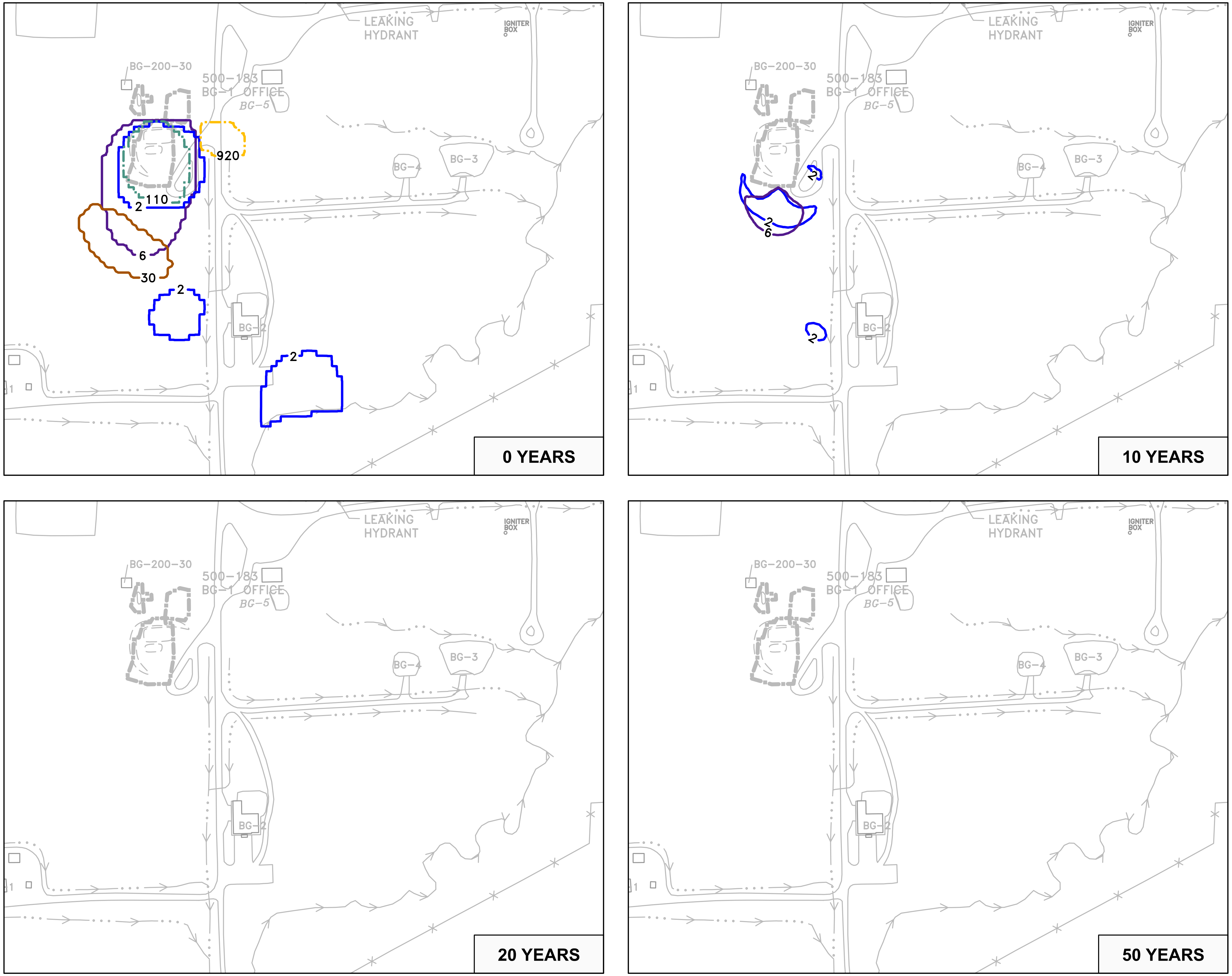


LEGEND:

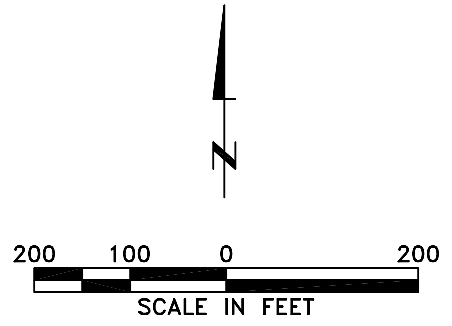
▬ ▬	APPROXIMATE BOUNDARY OF SOILS REMOVAL ACTIONS - 1998/2003
⟶	TRIBUTARY
⟶ · · ·	INTERMITTENT TRIBUTARY/DRAINAGE
—×—	FENCE LINE

HORIZONTAL EXTENT OF CONTAMINANTS (μg/L)

-·-110-·-	CHLOROETHANE
—6—	BENZENE
—30—	TCE
-·-920-·-	1,1-DCE
—2—	VINYL CHLORIDE

NOTES:

0 YEARS = SPRING 2003 INPUT



URS

ALTERNATIVE 5
MODEL-PREDICTED VOC CONCENTRATIONS
FIRE TRAINING PIT GROUNDWATER
REMEDIAL ALTERNATIVES ANALYSIS

DRN. BY: JJS	DATE: 04/20/04	PROJECT NO. 16169421	FIG. NO. 13-4
CHK'D. BY: TLT	DATE: 04/20/04		

March 11, 2004 12:59:59 p.m.
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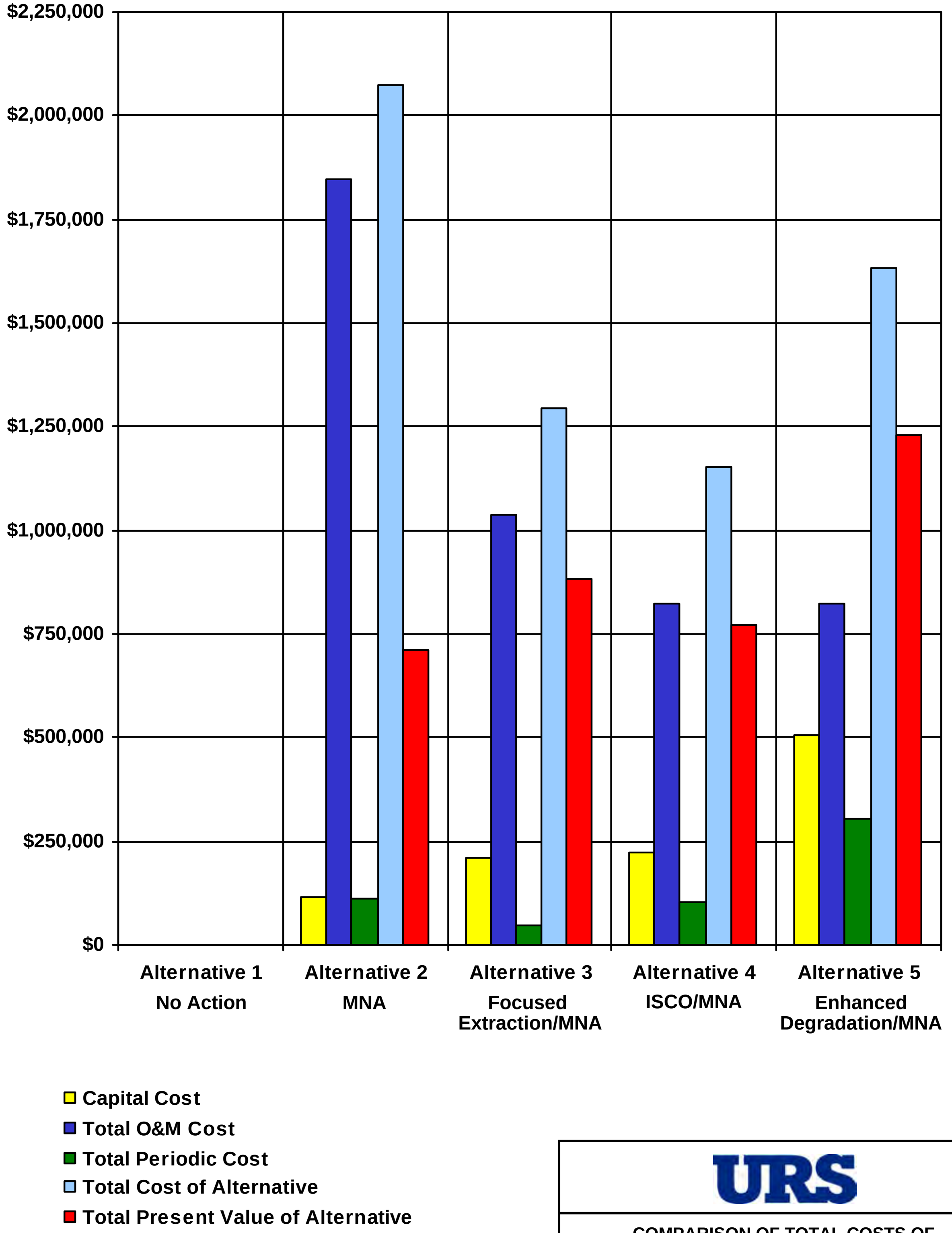

URS

COMPARISON OF TOTAL COSTS OF
REMEDIAL ALTERNATIVES
FIRE TRAINING PIT GROUNDWATER
REMEDIAL ALTERNATIVES ANALYSIS

DRN. BY: DLC	DATE: 03/11/04	PROJECT NO. 16169421	FIG. NO. 13-5
CHK'D. BY: JMR	DATE: 05/10/04		

This section discusses RAA uncertainties and assumptions and describes the remedy selection process for FTP groundwater at IAAAP, based on the detailed analysis (**Section 13**).

14.1 UNCERTAINTIES AND ASSUMPTIONS

Uncertainties identified during the RAA process for FTP groundwater need to be addressed prior to final design and implementation of remedial action. In addition, certain assumptions have been made to complete RAA evaluations. Uncertainties and assumptions for FTP groundwater RAA include:

- Locations of underground utilities at FTP were estimated using as-built drawings provided to URS by IAAAP and observations made during soil removal activities. A utility locator would be used to confirm locations of underground utilities prior to remedial activities.
- Total project durations for Alternatives 2 through 5 were developed based on model-predicted time to reduce contaminant concentrations to PRGs for benzene, chloroethane, TCE, 1,1-DCE, and vinyl chloride. Because the predicted durations are considered conservative, O&M costs for these alternatives may be overestimated.
- For Alternative 3, no off-gas treatment process has been developed because the total mass of contaminant removed from the sump monitoring well area by the treatment system is expected to be small (**Section 11.2**). It is assumed that off-gas discharged to the atmosphere from the groundwater treatment process will meet or exceed regulatory emission standards for hazardous air pollutants. It is also assumed that no additional water treatment processes, other than air stripping, would be required to reduce contaminant concentrations to below PRGs. These could be added if discharge monitoring indicates otherwise.
- For Alternative 4, the ISCO conceptual design was developed through review of technical guidance documents and case studies pertaining to ISCO. A pre-design investigation consisting of bench scale and field scale testing would be performed to determine the most effective oxidant/water mixture ratio, circulation rate, and potential supplemental Fe^{2+} requirements prior to full-scale implementation.
- The overall effectiveness of EB depends on the ability of high-pressure injection techniques to distribute substrates into the FTP shallow till clay and glacial outwash through existing preferential pathways (i.e., sand lenses and naturally occurring micro-fractures).
- Components of Alternatives 4 and 5 may have existing patents. Costs associated with the use of patented technologies have not been included in cost estimates. Applicability of patents would need to be investigated during remedial design.

14.2 REMEDY SELECTION PROCESS

The remedy selection process links the analysis of remedial action alternatives, conducted in an RI/FS (RAA), with documentation of the selected remedy in a record of decision (ROD) (USEPA 1997c). Section 121 of CERCLA established five principal requirements for the selection of remedies. Remedies must:

1. Protect human health and the environment.

2. Comply with ARARs unless a waiver is justified.
3. Be cost-effective.
4. Utilize permanent solutions and alternative treatment technologies to the maximum extent practicable.
5. Satisfy a preference for treatment as a principal element or provide an explanation in the ROD for why this preference was not met.

The nine NCP evaluation criteria (**Section 13.1**) are derived from these principal requirements as well as other important technical and policy considerations (USEPA 1997c). Therefore, a remedial action that meets the nine criteria will satisfy the principal requirements of CERCLA.

The remedy selection process consists of two steps. The first step is presentation of a preferred remedial action to the public for comment in a proposed plan. The proposed plan summarizes the preliminary conclusions as to why the preferred option appears most favorable, based on the information available and considered during the FS (RAA). Following receipt and evaluation of public comments on the proposed plan, a final decision is made and the selected remedy is documented in a ROD.

For FTP groundwater, a preferred remedial alternative is not presented in this RAA. The remedial alternatives presented in this report will be reviewed by USACE, USAEC, IAAAP, USEPA, and the Iowa Department of Natural Resources (IDNR) prior to selection of a preferred remedial alternative. Once a preferred remedial alternative has been selected, it will be presented to the public in a Proposed Plan.

The following is a brief summary of the major findings of the FTP groundwater RAA.

Facility and Site Background

- The FTP is located in the southwest portion of the EDA, southwest of the WBPA, and is in the Spring Creek watershed.
- The FTP was built in the early 1970s and was used for firefighting training sessions. During these training sessions, 55-gallon drums of solvents and fuels were placed in the pit, set ablaze, and extinguished by firefighters.
- Two smaller pits were located to the northwest and northeast of the main pit. The pit to the northeast was also used to burn waste solvents and fuels.
- In 1998, a major source removal action was completed which included the removal of approximately 5,200 cy of contaminated soil from the main pit.
- In May and November 2001, trenching and sampling activities delineated the two other smaller pits north of the FTP. In August 2003, a soil removal action was completed at the second and third pits.

RAA Data Collection Field Activities

- The RAA field activities completed in Fall 2002 and Spring 2003 focused on defining the nature and extent of contamination in the shallow and bedrock groundwater sidegradient and downgradient of the FTP.
- Field activities included a vegetation and land use survey, collection of 24 direct push groundwater samples, installation and development of eight monitoring wells, groundwater sampling at eight monitoring wells, installation of seven staff gauges (two installed near the FTP), slug testing, and surveying.

Physical Site Characteristics

- Surface topography at the FTP exhibits a broad, flat-to-gently sloping terrain, which slopes from the upland area near the FTP to the east and southeast toward an unnamed tributary of Spring Creek. Around the FTP area, shallow, man-made drainage ditches control and direct stormwater flow to the south and southeast toward a tributary of Spring Creek. Approximately 1,200 feet to the east of the FTP, the landscape is dissected by Spring Creek, and the topography changes to a steeply sloping terrain.
- General vegetation types and land usage in Fall 2002 included cropland, grassland, and woodland. No sensitive vegetation types or habitat for T&E species were identified near the FTP plumes.
- The FTP geologic profile consisted of a general upland glacial till plain of unconsolidated and consolidated sediments overlying bedrock. The typical subsurface geologic profile consisted of:

  - Shallow Weathered Glacial Till/Fill/Loess: highly weathered and oxidized silty clay to sandy clay with localized sand seams. Thicknesses ranged from 34 feet near the FTP to 6 feet near the tributary of Spring Creek.
  - Glacial Outwash: oxidized clayey sand to poorly graded sand with fine gravel. The outwash thickness ranged from 0.2 to 4.0 feet and was absent in several borings.
  - Bedrock: fractured and weathered shale and limestone containing isolated voids, in the upper 10 to 16 feet of bedrock. Below the fractured and weathered zone, the bedrock became more competent.

- FTP hydrogeologic units included shallow groundwater (water table) and bedrock groundwater. Shallow groundwater (water table) at the FTP crossed several different geologic units in Spring 2003; therefore, shallow till wells, till/bedrock contact wells, and till/upper bedrock wells were used to interpret and describe the shallow groundwater hydrogeologic characteristics. Bedrock groundwater at the FTP was approximately 3 to 16 feet lower than the shallow groundwater in Spring 2003. This indicated that there was little or no connection between the shallow and bedrock groundwater. Upper bedrock and bedrock groundwater wells were used to interpret and describe the bedrock groundwater hydrogeologic characteristics. Hydrogeologic characteristics in Spring 2003 included:
  - Shallow Groundwater (Water Table): depth to groundwater ranged from 1.8 to 9.6 feet bgs. Horizontal hydraulic gradients ranged from 0.020 to 0.085 ft/ft to the east, southeast, and south. Hydraulic conductivities in the shallow groundwater wells screened only in the glacial till ranged from 0.020 to 0.18 feet/day. Hydraulic conductivities in the shallow groundwater wells screened on top of or across the bedrock contact (typically intercepted glacial outwash sands) ranged from 0.046 to 1.7 feet/day. Estimated groundwater flow velocities ranged from 0.49 to 54 feet/year to the east, southeast, and south.
  - Bedrock Groundwater: depth to groundwater ranged from 7.4 to 20.3 feet bgs. Horizontal hydraulic gradients ranged from 0.028 to 0.045 ft/ft to the east. Hydraulic conductivities ranged from 0.00042 to 0.0076 feet/day. Estimated groundwater flow velocities ranged from 0.023 to 0.33 feet/year to the east.
- Several man-made drainage ditches control stormwater at the FTP and flow east, southeast, and south into an unnamed tributary of Spring Creek. This tributary converges with Spring Creek approximately 1,200 feet to the east. Staff gauges installed in Spring Creek and the tributary south of the FTP indicated that the surface water elevations were lower than the groundwater elevations in the surrounding shallow groundwater wells. These data indicated that the tributary of Spring Creek was a gaining stream along the FTP reach, and Spring Creek was a gaining stream in most of the EDA.

Chemical Site Characteristics/Chemicals of Potential Concern

- The primary VOCs detected in the shallow groundwater at the FTP included 1,1-DCA, 1,1-DCE, cis-1,2-DCE, 1,1,1-TCA, and TCE.
- The primary explosives compounds detected in the shallow groundwater at the FTP included 2,6-DNT, RDX, and HMX.

- The primary metals detected in the shallow groundwater at the FTP included arsenic, barium, cadmium, chromium, and selenium.
- Groundwater at the FTP was evaluated as two distinct zones during the COPCs selection for the HHRA:
  - — Shallow Groundwater (0 to 34 feet bgs)
  - — Bedrock Groundwater (34 to 60 feet bgs)
- Acetone, benzene, bromochloromethane, chloroethane, 1,1-DCE, 1,2-DCA, cis-1,2-DCE, ethylbenzene, MIBK, methylene chloride, PCE, toluene, 1,1,1-TCA, 1,1,2-TCA, TCE, vinyl chloride, m,p-xylene, RDX, 2,6-DNT, and arsenic were retained as COPCs in the shallow groundwater.
- No COPCs were identified in bedrock groundwater.
- NO_3 was not retained as a COPC in groundwater because the maximum concentrations detected were below the risk screening value.
- No COPCs were identified in surface water.

Nature and Extent of Contamination

The FTP groundwater sampling results indicated the following:

- Three small explosives plumes were interpreted to be present in the shallow groundwater at the FTP. The explosives detected consisted primarily of RDX and 2,6-DNT.
- A VOC plume was interpreted to be present in the shallow groundwater, and consisted primarily of chlorinated hydrocarbons (i.e., PCE, 1,1,1-TCA, TCE, cis-1,2-DCE, 1,1-DCE, 1,2-DCA, methylene chloride, chloroethane, and vinyl chloride). 1,1-DCE was the most frequently detected VOC across the FTP site. The highest concentrations of VOCs were detected near surface drainage features and near the former fire training pit. The shallow VOC plume extends from the former fire training pit to the unnamed tributary of Spring Creek.
- No chemicals were detected in the bedrock groundwater at concentrations exceeding IAAAP regulatory standards.
- No chemicals were detected in surface water sample SCT3 above IAAAP groundwater regulatory standards.
- Arsenic was detected above the EDA background concentration in shallow groundwater from well SA-99-1. No other metals were detected in groundwater above IAAAP regulatory standards or the calculated background concentrations.
- NO_3 was not detected in groundwater above the IAAAP regulatory standard.

Contaminant Fate and Transport

- The baseline modeling results indicated that the benzene, chloroethane, TCE, 1,1-DCE, and vinyl chloride plume concentrations are at their highest predicted concentrations. Most of the

VOC plume concentrations will decline below the IAAAP regulatory standards in about 15 to 25 years due to the naturally occurring processes of dispersion and degradation. The benzene plume will decline below the IAAAP regulatory standard (5 µg/L) in about 15 to 20 years, while TCE and 1,1-DCE will take about 20 to 25 years to decline below the standard (7 µg/L). Vinyl chloride will take about 50 to 55 years to decline below the regulatory standard (2 µg/L). Chloroethane will be reduced to below the IAAAP regulatory standard (4.6 µg/L) in just over 70 years.

- The baseline modeling results indicated that the VOC plumes in the high concentration areas would not be transported downgradient any significant distance away from the interpreted groundwater sources (e.g., the sump monitoring well area).
- The baseline modeling results indicated that the low concentrations of 1,1-DCE and vinyl chloride at the distal edges of the FTP VOC plume will attenuate to below IAAAP regulatory standards in less than 20 years.
- This initial natural attenuation evaluation for the FTP groundwater indicated natural attenuation processes may be significant for the FTP RDX plumes and VOCs plume. Key elements supporting natural attenuation included:
  - — Shallow groundwater at sump monitoring well SA-99-1 generally exhibited reducing conditions and moderately low DO concentrations, favoring anaerobic degradation of explosives and VOCs.
  - — VOC degradation products (e.g., cis-1,2-DCE, 1,1-DCE, and vinyl chloride) are present.
  - — Contaminant fate and transport modeling results indicated most of the VOC plumes will degrade to below IAAAP regulatory standards within 15 to 25 years. However, the area of highest VOC concentrations (near SA-99-1) will take considerably longer to meet those levels (greater than 70 years for chloroethane).
  - — RDX concentrations have remained fairly constant (and low) in FTA-99-1. RDX metabolites (e.g., MNX) were also present.
  - — VOC concentrations have generally declined over time, specifically in SA-99-1, while vinyl chloride has increased over time in SA-99-1.

Human Health Risk Assessment

- Acetone, benzene, bromochloromethane, chloroethane, 1,1-DCE, 1,2-DCA, cis-1,2-DCE, ethylbenzene, MIBK, methylene chloride, PCE, toluene, 1,1,1-TCA, 1,1,2-TCA, TCE, vinyl chloride, m,p-xylene, RDX, 2,6-DNT, and arsenic were retained as COPCs in the shallow groundwater. No COPCs were identified in bedrock groundwater or surface water.
- The receptor populations and exposure routes evaluated included current/future construction worker via inhalation, incidental ingestion, and dermal contact; current/future hunter/trespasser via incidental ingestion and dermal contact; and current/future commercial/industrial worker via ingestion.

- The risk assessment results indicated that the estimated total RME lifetime excess cancer risk for the construction worker ($5.7x10^{-6}$) was within the USEPA target risk range of $1x10^{-6}$ to $1x10^{-4}$ (USEPA 1990, 1991b). The HI was 1.2.
- The risk assessment results indicated that the estimated total RME lifetime excess cancer risk for the commercial/industrial worker ($1.2x10^{-3}$) was greater than the USEPA target risk range of $1x10^{-6}$ to $1x10^{-4}$ (USEPA 1990, 1991b). The HI was 7.1.
- Risk-based PRGs were developed for all COPCs. All were based on the commercial/industrial workers' ingestion of shallow groundwater as drinking water with the exception of toluene. The toluene risk-based PRG was based on the construction workers' inhalation of shallow groundwater.
- The risk-based PRGs for 1,1,1-TCA, acetone, bromochloromethane, cis-1,2-DCE, 2,6-DNT, ethylbenzene, MIBK, toluene, and m,p-xylene were higher than the maximum concentrations detected at the FTP.
- The following chemicals had detected concentrations at the FTP that exceeded the risk-based PRGs: 1,2-DCA, 1,1-DCE, 1,1,2-TCA, benzene, chloroethane, methylene chloride, PCE, TCE, vinyl chloride, RDX, and arsenic.

Remedial Action Objectives

- The following RAOs were proposed for FTP groundwater:
  - Prevent commercial/industrial worker ingestion of contaminants of concern above their PRGs in groundwater, as listed below:
    - Benzene = 6 µg/L (10^{-6} risk-based PRG)
    - 1,1,2-TCA = 6 µg/L (10^{-6} risk-based PRG)
    - 1,2-DCA = 5 µg/L (MCL)
    - Chloroethane = 110 µg/L (10^{-6} risk-based PRG)
    - PCE = 6 µg/L (10^{-6} risk-based PRG)
    - TCE = 30 µg/L (10^{-6} risk-based PRG)
    - 1,1-DCE = 920 µg/L (HI = 1.0, risk-based PRG)
    - Vinyl Chloride = 2 µg/L (MCL)
    - Methylene Chloride = 44 µg/L (10^{-6} risk-based PRG)
    - RDX = 3 µg/L (10^{-6} risk-based PRG)
    - Arsenic = 40 µg/L (background UTL)

Screening Technologies

- Following assembly, evaluation, and screening of potential remedial technologies and technology process options to satisfy the RAO, the following GRAs and process options were retained based on effectiveness, implementability, and cost:

- — No Action: No Action
- — Institutional Controls: Groundwater Use Restrictions, Health and Safety Program
- — Engineering Controls: Groundwater Monitoring
- — Removal: Excavated Sump
- — In-Situ Treatment: MNA, ISCO, EB
- — Ex-Situ Treatment: Air Stripping
- — Disposal: Surface Water Discharge

Development of Alternatives

- Remedial action alternatives were assembled from combinations of process options and technologies that survived the screening process, to provide a range from no action to active treatments that will reduce TMV of contaminants at the site.
- Remedial alternatives developed for FTP groundwater included:
  - — Alternative 1 – No Action: No remedial action would be implemented.
  - — Alternative 2 – MNA: Groundwater monitoring would evaluate natural attenuation of the plume. Institutional and engineering controls would prevent human exposure to contaminated groundwater.
  - — Alternative 3 - Focused Extraction/MNA: Involves extracting contaminated groundwater from the existing sump monitoring well SA-99-1 for treatment and discharge to surface water. Alternative 3 also relies on MNA, as described for Alternative 2, to reduce the contaminant mass in portions of the FTP groundwater plume not influenced by the extraction well.
  - — Alternative 4 – ISCO/MNA: Consists of circulating a chemical oxidizing agent within the 1998 limits of excavation surrounding SA-99-1, to degrade commingled benzene and CVOCs and to immobilize arsenic in groundwater. H_2O_2 solution entering the aquifer would combine with dissolved Fe^{2+} and Fe^{2+} contained in soil minerals to create a Fenton-like reagent. Alternative 4 also relies on MNA, as described for Alternative 2, to reduce the contaminant mass in portions of the FTP groundwater plume that is not affected by ISCO.
  - — Alternative 5 – Enhanced Degradation/MNA: Consists of ISCO in the SA-99-1 sump monitoring well area (as described in Alternative 4) combined with EB in surrounding areas. EB using HRC™ is assumed for full-scale implementation in the CVOC plumes east and south of the sump monitoring well area to establish anaerobic conditions within the aquifer to reductively degrade CVOCs. Alternative 5 also relies on MNA, as described for Alternative 2, to reduce the contaminant mass of the FTP groundwater plume that is not affected by EB or ISCO.

Uncertainties and Assumptions

Uncertainties identified during the RAA process for FTP groundwater include the existence of contamination in soil at concentrations that could continue to migrate to groundwater, and locations of underground utilities. Alternative-specific uncertainties and assumptions include:

- Total project durations for Alternatives 2 through 5 were developed based on model-predicted time to reduce contaminant concentrations to PRGs for benzene, chloroethane, TCE, 1,1-DCE, and vinyl chloride. Therefore, O&M costs for these alternatives may be overestimated.
- For Alternative 3, it is assumed that off-gas discharged to the atmosphere from the groundwater treatment process will meet or exceed regulatory emission standards for hazardous air pollutants and that no additional water treatment processes, other than air stripping, would be required to reduce contaminant concentrations to below PRGs.
- For Alternative 4, a pre-design investigation would be required to determine the most effective oxidant/water mixture ratio, circulation rate, and potential supplemental Fe^{2+} requirements prior to full-scale implementation.
- The overall effectiveness of EB (Alternative 5) depends on the ability of high-pressure injection techniques to distribute substrates into the FTP shallow till clay and glacial outwash through existing preferential pathways (i.e., sand lenses and naturally occurring micro-fractures).
- Costs associated with the use of patented technologies for Alternatives 4 and 5 have not been included in cost estimates.

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DRAFT REPORT
VOLUME 2 OF 2
APPENDICES

FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

IOWA ARMY AMMUNITION PLANT
MIDDLETOWN, IOWA

Prepared for
U.S. Army Corps of Engineers
Omaha District

May 2004

12120 Shamrock Plaza, Suite 300
Omaha, Nebraska 68154

Direct Push Investigation
Monitoring Well Installation

Direct Push Investigation

HTRW DRILLING LOG

DISTRICT: Omaha District

HOLE NUMBER: FTP-DP01

1. COMPANY NAME: URS Corporation

2. DRILLING SUBCONTRACTOR: ~~Saberprobe~~, Plains Environmental Services

SHEET 1 OF 5 SHEETS

3. PROJECT: Iowa AAP F.S. Data Collection

4. LOCATION: Burlington, Iowa

5. NAME OF DRILLER: Jesse Kalvig

6. MANUFACTURE'S DESIGNATION OF DRILL: Geoprobe

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: A-rods, 2" macro core sampler
1.8" dual tube sampler

8. HOLE LOCATION: 301,166.42'N 2,275,733'E

9. SURFACE ELEVATION: 688.1'

10. DATE STARTED: 10.21.02

11. DATE: 10.21.02

12. OVERBURDEN THICKNESS: 38' bgs

13. DEPTH DRILLED INTO ROCK: 0

14. TOTAL DEPTH OF HOLE: 38' bgs

15. DEPTH GROUNDWATER ENCOUNTERED: 34' bgs during drilling

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING: NA

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA

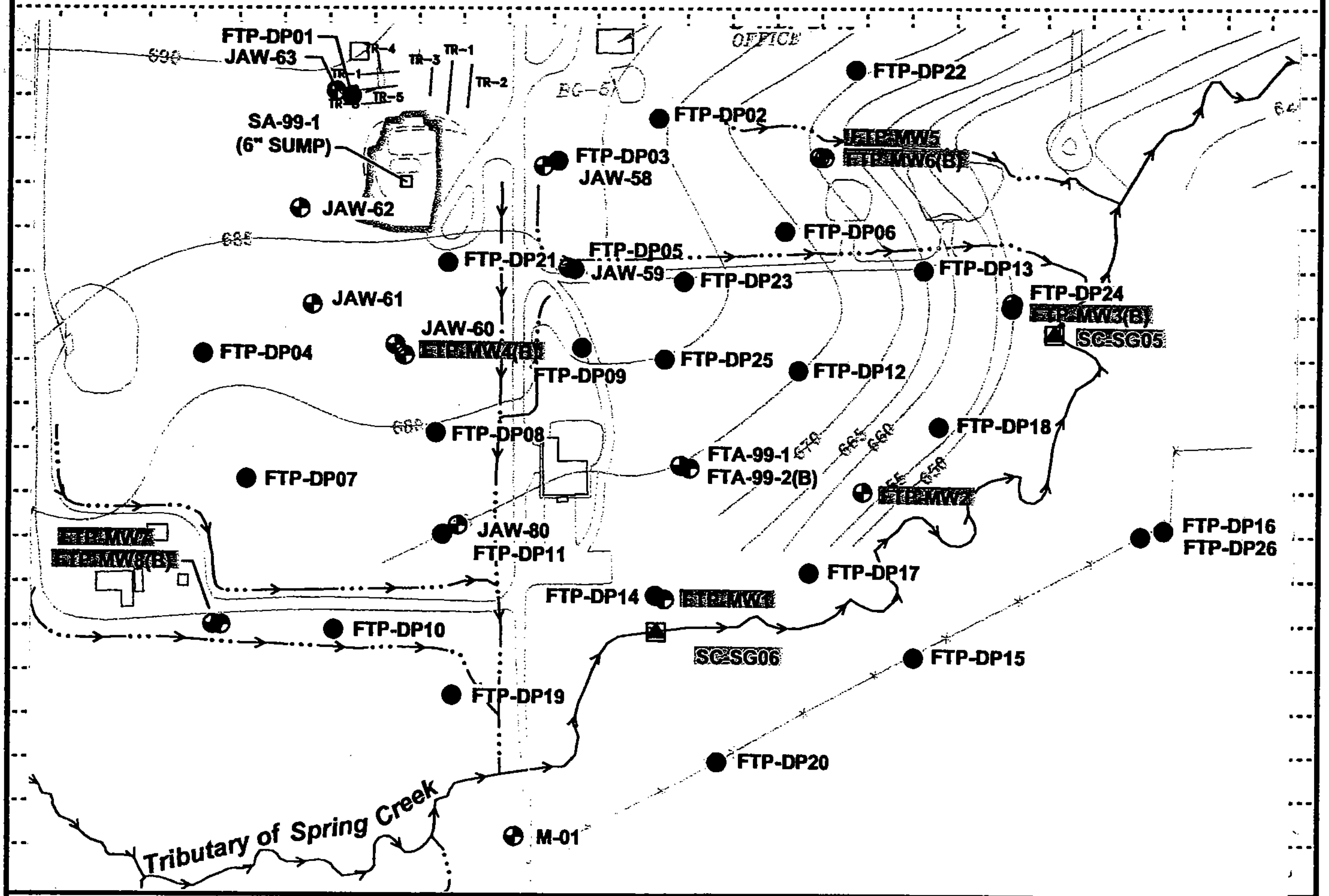
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
—	—	—	—	—	—	NA %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		FTA-DP01-38		

LOCATION SKETCH/COMMENTS

SCALE: 1" = 200'



PROJECT: Iowa AAP F.S. Data Collection

HOLE: FTP-DP01

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NO. FTA-DP01

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 2 OF 5 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ P.P g.	REMARKS h.
		Silty CLAY (CL) - very stiff, brown, dry ~~moist~~, low plastic, trace root hairs					Topsoil/loess
	1.0			R= 12/36		7.0	
	2.0						
	3.0					7.0	
		~~becomes very moist~~ Silty CLAY (CL) - soft, light brown, w/ gray & orange mottling, low plastic, trace iron & magnesium staining					~~loess~~ Till
	4.0			R= 30/36		~~7.0~~/1.0	
		becomes very soft					
	5.0					0	
	6.0		HS = ND			0.0	
		becomes medium stiff					
	7.0			R= 30/36		2.0	
		becomes very soft					
	8.0					0.5	
		becomes soft no iron staining/orange mottling					
	9.0		HS = ND			1.0	
		becomes med ~~st~~ plastic					
	10.0						R = 36/36

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FTA-DP01

HTRW DRILLING LOG

HOLE NO. FTA-DP01

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 3 OF 5 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ KSF	REMARKS h.
		SAME: Silty CLAY (CL) - soft, light brown ~~w/ gray mottling~~, med plastic					Till
	11.0			R=34/36	[illegible]	1.0	
	12.0		HS=ND		[illegible]	1.0	
	13.0	trace wood & organics ~0.25" becomes very stiff w/ trace ~~calcite~~ concretions some iron staining & ~~fine to med gravel~~ fine to med sand w/ trace fine gravel		R=36/36	[illegible]	0.5	Till
	14.0				[illegible]	5.0	
		becomes soft & low plastic	HS=ND		[illegible]	1.0	
	15.0	becomes very soft					
	16.0			R=36/36		0.0	
	17.0					0.0	
		becomes ~~very~~ soft	HS=ND			1.0	
	18.0						
	19.0			R=24/36		2.0	
	20.0		HS=ND			3.0	

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FTA-DP01

HTRW DRILLING LOG

HOLE NO. FT~~A~~-DP01

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. COVEY

SHEET 4 OF 5 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ KSF	REMARKS h.
		SAME: Silty CLAY (CL) - soft, light brown moist, low plastic some iron staining, trace fine to med sand, calcite concretions + fine gravel	HS=ND	R=24/36			Till
	21.0						
	22.0			R=18/36	~~9.0~~	9.0	
	23.0				~~9.0~~	9.0	
			HS=ND		4		
	24.0	0.1' gravel seam becomes gray silty CLAY (CH) high plastic + very stiff w/some iron staining		1.25" dual-tube	~~1.25'~~	8.0	Till
	25.0					8.0	
				R=36/36			
	26.0					5.5	
		trace sand					
	27.0		HS=ND			9.0	
				~~MACROCORE Sampler~~		9.0	~~@ 1644 dual-tube sleeve crushed in boring while sampling, will switch to macrocore~~
	28.0			R=36/36		9.0	
	29.0					6.0	
	30.0		HS=ND			6.0	

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FT~~A~~-DP01

HTRW DRILLING LOG

HOLE NO. FTA-DP01

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. COVEY

SHEET 5 OF 5 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW~~ COUNTS tsf P	REMARKS h.
		SAME: Silty CLAY (CH) - stiff, gray, moist, high plastic, some iron staining, trace sand.				3.0	Till
	31.0			R=36/36		3.0	
	32.0					2.0	
	33.0		HS=ND	macro core		0.0	1644 dual tube sleeve crushed in boring while sampling, will switch to macro-core & retrieve dual tube sleeve
	34.0	Silty SAND (SM) - med dense, light brown, wet, trace fine gravel, fine to med. grained		R=18/36	Ground Water Sample FTP-DP01-38 For VOC's + Freon113 Collected 10/22/02 T=1730		Glacial Outwash
	35.0						
	36.0		HS=ND				
	37.0			R=24/24			
	38.0		HS=ND				Tempwell is 33-38' bgs
		Bedrock Refusal					b.o.b. @ 38.0' bgs @ bedrock Temp Well Installed

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FTA-DP01

HTRW DRILLING LOG

DISTRICT: Omaha District

HOLE NUMBER: FTP-DP02

1. COMPANY NAME: URS Corporation

2. DRILLING SUBCONTRACTOR: ~~Saberprobe,~~ Plains Environmental Services

SHEET 1 OF 4 SHEETS

3. PROJECT: Iowa AAP F.S. Data Collection

4. LOCATION: Burlington, Iowa

5. NAME OF DRILLER: Jesse Kalvig

6. MANUFACTURE'S DESIGNATION OF DRILL: Geoprobe

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: A-rods, MacroCore Sampler

8. HOLE LOCATION: 301,145.65'N 2,276,076.72'E

9. SURFACE ELEVATION: 678.2

10. DATE STARTED: 10.23.02

11. DATE: 10.23.02

12. OVERBURDEN THICKNESS: 25.0' bgs

13. DEPTH DRILLED INTO ROCK: 0

14. TOTAL DEPTH OF HOLE: 25.0' bgs

15. DEPTH GROUNDWATER ENCOUNTERED: NA

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING: NA

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA

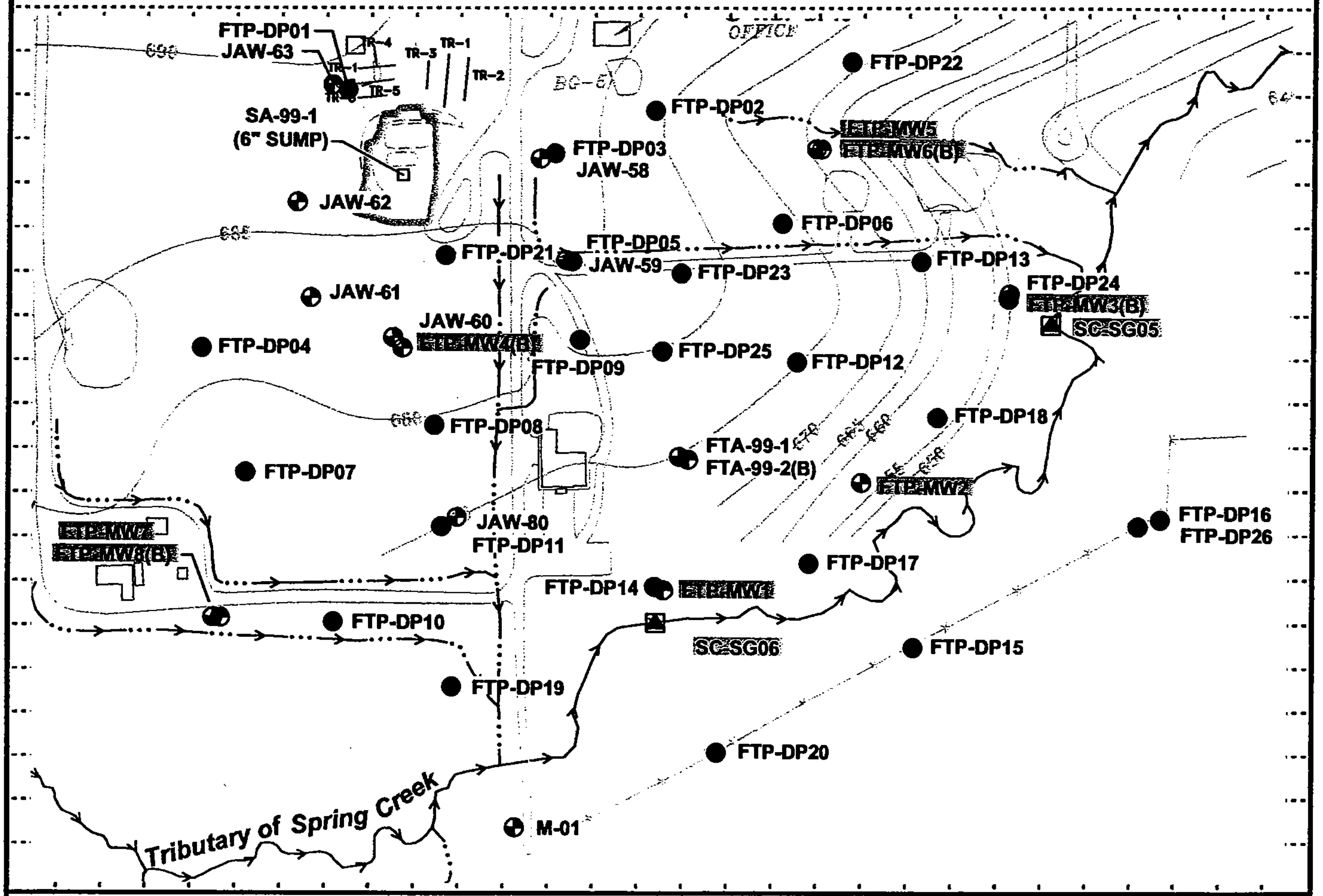
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
—	—	—	—	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		FTP-DP02		

LOCATION SKETCH/COMMENTS

SCALE: 1" = 200'



PROJECT: Iowa AAP F.S. Data Collection

HOLE: FTP-DP02

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NO. FTP-DP02

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 2 OF 4 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ KSF	REMARKS h.
		Clayey SILT(ML) - very stiff, brown, moist, low to non-plastic, trace root hairs & organics					FILL/ Topsoil
	1	Silty CLAY(CL) - very stiff, brown w/ orange mottling/iron staining, trace root hairs		R=48/48		4.0	Loess
	2	trace drk gray mottling				7.0	
	3					4.5	
	4		HS=ND			3.0	
		~~no root hairs, trace fine sand~~ & becomes soft Becomes Sandy CLAY					Till
	5					1.0	
	6	becomes gray w/ orange mottling & trace calcite concretions		R=36/48		1.0	
	7	becomes stiff				4.0	
	8	becomes very stiff				6.0	
	9	becomes orange/brown w/ gray mottling & trace fine to coarse sand				7.5	
	10	trace black mottling	HS=ND			6.0	

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP02

HTRW DRILLING LOG

HOLE NO. FTP-DP02

PROJECT: Iowa AAP F.S. Data Collection

INSPECTOR: J. Corey

SHEET 3 OF 4 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ KSF	REMARKS h.
		SAME: Sandy CLAY (CL) - Very stiff, moist, gray w/orange, low plastic				6.0	TILL
	11			R = 40/48		6.0	
	12					8.0	
	13					4.0	
	14			R = 42/48		4.0	
	15					5.0	
	16		HS=ND			5.0	
		Silty CLAY (CH) - med stiff, orange/brown, moist, high plastic, trace calcite concretions					Till
	17					4.0	
		~~becomes gray~~					
	18			R = 44/48		4.0	
		gray mottling present					
	19					9.0	
	20					9.0	

PROJECT: Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP02

HTRW DRILLING LOG

HOLE NO. FTP-DP02

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 4 OF 4 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ FSF	REMARKS h.
		SAME: Silty CLAY (CH) medium stiff, moist, orange/brown, highplastic			Ground Water Sample FTP-DP02-25 for VOC's + Freon113 collected 10/27/02 T= 1138		Till
21		Silty CLAY (CL) - stiff, orange/brown, moist, low plastic, trace gray mottling				3.0	
22		some ~~trace~~ fine to med sand		R= 44/48		2.0	
23						1.0	
24			HS=ND			1.0	Temp Well is 20-25' bgs
		Sandy SILT (ML) - very soft, orange/brown, moist, low to non plastic fine to med grained		R= 12/12			
25						1.0	
		Bedrock Refusal					b.o.b. @ 25' bgs @ bedrock Temp well installed

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP02

HTRW DRILLING LOG

DISTRICT: Omaha District

HOLE NUMBER: FTP-DP03

1. COMPANY NAME: URS Corporation

2. DRILLING SUBCONTRACTOR: ~~Saberprobe,~~ Plains Environmental Services

SHEET 1 OF 5 SHEETS

3. PROJECT: Iowa AAP F.S. Data Collection

4. LOCATION: Burlington, Iowa

5. NAME OF DRILLER: Jesse Kalvig

6. MANUFACTURE'S DESIGNATION OF DRILL: GeoProbe

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: A-Rods, MacroCore Sampler

8. HOLE LOCATION: 30,1096.82'N 2275,965.19'E

9. SURFACE ELEVATION: 683.7'

10. DATE STARTED: 10.23.02

11. DATE: 10.23.02

12. OVERBURDEN THICKNESS: 31.0' bgs

13. DEPTH DRILLED INTO ROCK: 0

14. TOTAL DEPTH OF HOLE: 31.0' bgs

15. DEPTH GROUNDWATER ENCOUNTERED: NA

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING: NA

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA

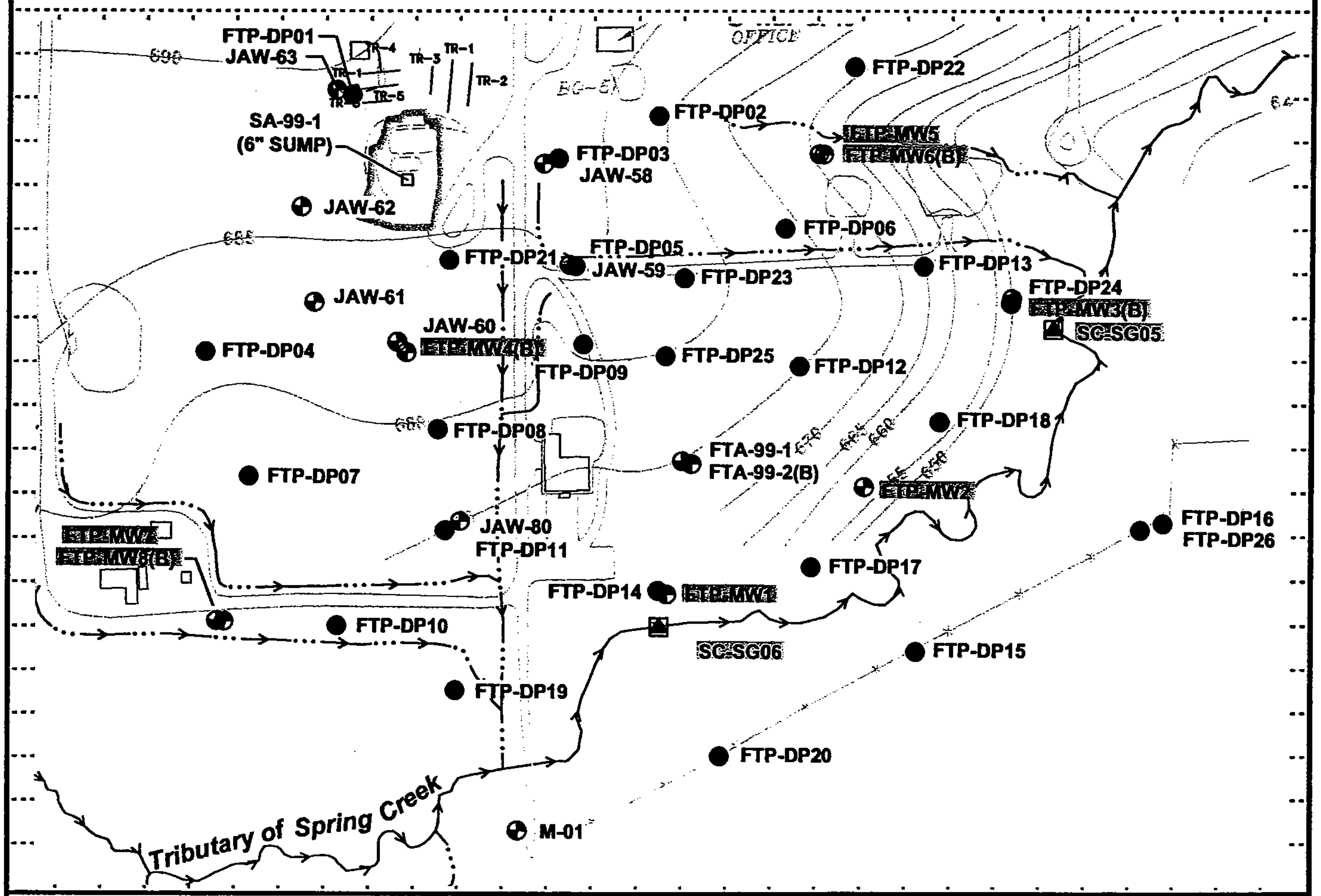
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
—	—	—	—	—	—	%

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		Temp Well DP03		

LOCATION SKETCH/COMMENTS

SCALE: 1" = 200'



PROJECT: Iowa AAP F.S. Data Collection

HOLE: FTP-DP03

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NO. FTP-DP03

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 2 OF 5 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ KSF	REMARKS h.
		Silty CLAY (CL) - stiff, brown, moist, low plastic trace roothairs				3.0	Top Soil
							Fill/Loess
						2.0	
1		becomes light brown w/ black mottling & iron staining & medium stiff					
		becomes soft		R=48/48		1.0	
2							
						2.0	
3							
						1.0	
4							
		becomes very soft					
						0	
5		becomes stiff					
				R=40/48		2.0	
6		Silty CLAY (CL) - stiff, moist, brown, low plastic w/ sand.					Till
		becomes brown/orange w/ no mottling					
7						2.0	
8						2.0	
9						2.5	
				R=/48			
10							

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP03

HTRW DRILLING LOG

HOLE NO. FTP-DP03

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 3 OF 5 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ KSF g.	REMARKS h.
		silty CLAY(CL) - very stiff, ~~brown~~ orange/brown, moist, low plastic, trace black mottling & calcite concretions & iron staining. & trace med to coarse sand					Till
	11	trace gray mottling		R=36/48		7.0	
	12					6.0	
	13					5.0	
		no mottling becomes soft					
	14			R=36/48		1.0	
		becomes stiff					
	15					4.0	
	16						
	17	silty CLAY(CH) - very stiff, orange/brown, moist, med to high plastic, trace black & gray mottling, calcite concretions				5.0	Shallow Till
		becomes med stiff					
	18			R=36/48		1.5	
		becomes very soft					
	19					0	
	20	becomes very stiff & gray w/no mottling & trace iron staining				6.0	

HTRW DRILLING LOG

HOLE NO. FTP-DP03

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 4 OF 5 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ FSC	REMARKS h.
		SAME;					Till
	21	w/ trace ~~orange mottling~~ JLC ironstaining					
				R=30/48		4.0	
	22					4.0	
	23					4.0	
	24					4.0	
	25					5.0	
						4.0	
	26			R=36/48	Ground Water Sample FTP-DP03-31 for VOC's + Freon113 Collected 10/27/02 T: 1225		
		becomes orange/brown w/ gray mottling				5.0	
	27						
	28					6.0	
		no mottling					
	29					3.0	
	30					3.0	

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP03

HTRW DRILLING LOG

HOLE NO. FTP - DP03

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 5 OF 5 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ KPF	REMARKS h.
		Same:					Till
		~~Sandy~~ Clayey SAND(SC) - Stiff, orange/ brown, moist, low plastic a ~~to~~ dense fine to med grained.	HS=	R= 34/36		30	Glacial Outwash Temp Well is 26-31' bgs
31		Bedrock Refusal					b.o.b. @ 31' bgs @ bedrock Temp well installed

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP03

HTRW DRILLING LOG

DISTRICT: Omaha District

HOLE NUMBER: FTP-DP04

1. COMPANY NAME: URS Corporation

2. DRILLING SUBCONTRACTOR: ~~[illegible]~~ Plains Environmental Services

SHEET 1 OF 4

3. PROJECT: Iowa AAP F.S. Data Collection

4. LOCATION: Burlington, Iowa

5. NAME OF DRILLER: Jesse Kalvig

6. MANUFACTURE'S DESIGNATION OF DRILL: Geoprobe Track Rig

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: A-Rods, Macro Core sampler, dual tube sampler

8. HOLE LOCATION: 300876.60'N 2275570.22'E

9. SURFACE ELEVATION: 680.4'

10. DATE STARTED: 10.22.02

11. DATE: 10.22.02

12. OVERBURDEN THICKNESS: 27' bgs

13. DEPTH DRILLED INTO ROCK: 0

14. TOTAL DEPTH OF HOLE: 27' bgs

15. DEPTH GROUNDWATER ENCOUNTERED: 24.4' bgs during drilling

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING: NA

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA

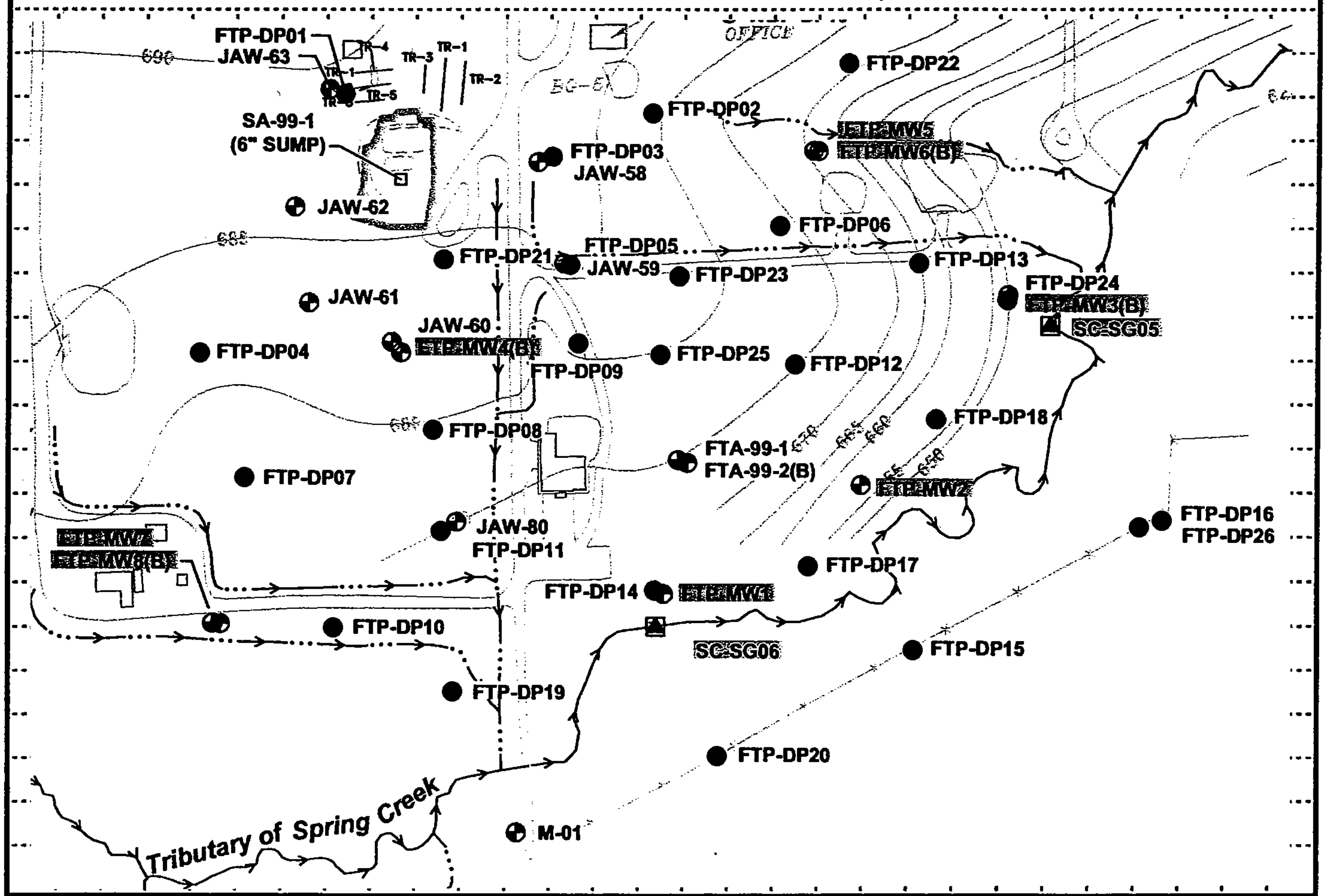
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
—	—	—	—	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		←	FTP-DP04	

LOCATION SKETCH/COMMENTS

SCALE: 1"=200'



PROJECT: Iowa AAP F.S. Data Collection

HOLE: FTP-DP04

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NO. FTP-DP04

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 2 OF 4 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	PP ~~BLOW COUNTS~~ g.	REMARKS h.
		Silty CLAY (CL) - stiff, drk brown, moist, low plastic, trace root hairs & organics				3.0	Topsoil
	1					3.0	
	2			R=42/48		4.0	
		becomes light brn					loess
	3	Trace iron staining + orange mottling				5.0	
	4		HS= ND			4.0	
	5						
	6	becomes light gray w/ orange mottling + iron staining		R=48/48		3.0	Till
		~~blue~~ trace black mottling					
	7					3.0	
	8		HS=ND			3.0	
	9			R=36/48	▨	4.0	
	10		HS=ND		▨	4.0	

HTRW DRILLING LOG

HOLE NO. FTP-DP04

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR S. Covey

SHEET 3 OF 4 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ PP	REMARKS h.
		SAME; Silty CLAY(CL) - ~~s~~ stiff light gray w/orange mottling, moist, low plastic, trace black mottling			///	4.0	Till
		becomes very stiff w/ trace fine to med sand & fine gravel & calcite concretions		R: 36/48	Ground Water Sample FTP-DP04-13 For VOC's + Freon 113 Collected 11/05/02 T=0915		
11						6.0	
		becomes stiff					
12			HS=0			4.0	
13					///		Temp well is 8-13' bgs
		becomes very soft					
14				R=30/48		0.0	
		becomes soft					
15						2.0	
		becomes stiff					
16			HS=0			5.0	
17						5.0	
		trace					
18				R=30/48		4.5	
		becomes hard w/ some fine to med sand					~~Lower~~ Till
19						9.0	
20			HS=0			9.0	

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP04

HTRW DRILLING LOG

PROJECT Iowa AAP F.S. Data Collection	INSPECTOR J. Covey	HOLE NO. FTP-DP04.	SHEET 4 OF 4 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ PP	REMARKS h.
		Silty CLAY (CL) hard, light gray, moist, low plastic, trace orange + black mottling w/calcite concretions + fine to med sand + fine gravel					Till
	21					8.0	
		~~Fra~~		R= 34/48			
	22					7.0	
		Trace fine to med sand				--	
	23					5.5	
		Clayey SILT (ML) - very stiff, light gray w/ iron staining, low plastic, trace fine to med sand, moist	HS=ND		Ground Water	5.0	
	24				Sample FTP-DP04-27		
		becomes wet					
	25			R= 36/36	for VOC's + Freon113	0.0	
		becomes moist			Collected		
	26				10/23/02 T= 0945	0.0	
						9.0	Glacial Outwash
		Silty SAND (SM) Med dense, fine to med grained, light brown moist					Temp Well is 22-27' bgs
	27					[illegible]	
		Bedrock refusal					b.o.b. @ 27' bgs @ bedrock Temp Well Installed.

PROJECT Iowa AAP F.S. Data Collection	HOLE NO. FTP-DP04

HTRW DRILLING LOG

DISTRICT: Omaha District

HOLE NUMBER: FTP-DP05

1. COMPANY NAME: URS Corporation

2. DRILLING SUBCONTRACTOR: ~~Saberprobe~~, Plains Environmental Services

SHEET 1 OF 4 SHEETS

3. PROJECT: Iowa AAP F.S. Data Collection

4. LOCATION: Burlington, Iowa

5. NAME OF DRILLER: Jesse Kalvig

6. MANUFACTURE'S DESIGNATION OF DRILL: GeoProbe

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: A-rods, MacroCore Sampler

8. HOLE LOCATION: 300975.05'N 2275988.40'E

9. SURFACE ELEVATION: 681.5'

10. DATE STARTED: 10.23.02

11. DATE: 10.23.02

12. OVERBURDEN THICKNESS: 23.0' bgs

13. DEPTH DRILLED INTO ROCK: 0

14. TOTAL DEPTH OF HOLE: 23.0' bgs

15. DEPTH GROUNDWATER ENCOUNTERED: NA

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING: NA

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA

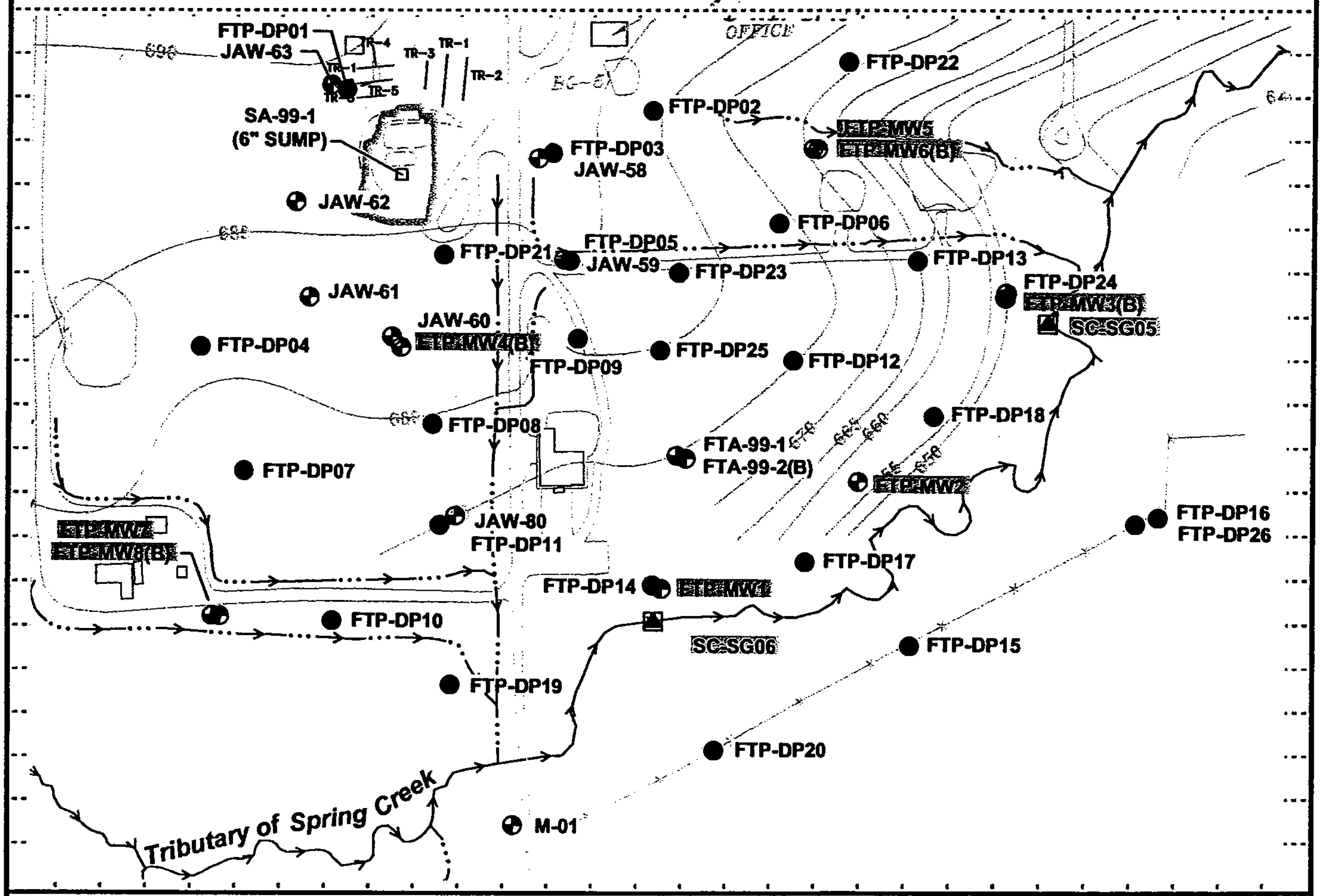
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
—	—	—	—	—	—	—

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		FTP-DP05		

LOCATION SKETCH/COMMENTS

SCALE: 1" = 200'



PROJECT: Iowa AAP F.S. Data Collection

HOLE: FTP-DP05

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NO. FTP-DP05

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 2 OF 4 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	R. ~~BLOW~~ COUNTS g.	REMARKS h.
		silty CLAY(CL) - stiff, brown, moist, low plastic, trace root hairs 6" limestone gravel fill				4.0	Fill/Loess
						4.5	
	1						
		becomes med stiff and gray w/ trace iron staining + black mottling		R=48/48		1.5	
	2	becomes very soft					
						0.5	
	3						
	4		HS:			0	
	5	becomes orange/brown				0	
	6			R=48/48		2.0	
	7	Clayey SILT(ML) - soft, orange/brown, moist, low plastic, trace fine sand/ black mottling #				1.0	Till
	8		HS=			2.0	
	9	silty CLAY (CH) - very stiff, orange/brown, moist, med. to high plastic, trace fine to coarse sand & black mottling		R=36/48		7.0	
	10					6.0	

HTRW DRILLING LOG

HOLE NO. FTP-DP05

PROJECT: Iowa AAP F.S. Data Collection

INSPECTOR: J-Covey

SHEET 3 OF 4 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ PP g.	REMARKS h.
		SAME: Silty CLAY (CH) - very stiff, orange/brown, moist, med to high plastic, trace fine to coarse sand & black mottling					Till
	11			R=36/48		6.0	
	12					5.0	
	13					4.0	
	14			R=24/48		4.0	
	15						
	16	Silty CLAY (CL) - very soft, brownish-gray, moist, low plastic, trace fine sand					
	17					0.0	
		becomes gray & high plastic (CH)					
	18			R=39/48	▨	4.0	
		becomes orange w/ gray mottling & trace calcite concretions			▨		
	19				▨	5.0	
	20				▨	5.0	

PROJECT: Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP05

HTRW DRILLING LOG

HOLE NO. FTP-DP05

PROJECT: Iowa AAP F.S. Data Collection

INSPECTOR: J. Covey

SHEET 4 OF 4 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW~~ COUNTS DP g.	REMARKS h.
	 21 22	SAME:			Ground Water Sample FTP-DP05-23 For VOC's + Freon 113 Collected 10/25/02 T= 1435 Duplicate FTP-DP05-00	4.0 4.0 4.0	Till Temp Well is 18'-23' bgs
	23	Bedrock Refusal					b.o.b. @ 23' bgs set temp well w/ filterpack ~~to~~

PROJECT: Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP05

HTRW DRILLING LOG

DISTRICT: Omaha District

HOLE NUMBER: FTP-DP06

1. COMPANY NAME: URS Corporation

2. DRILLING SUBCONTRACTOR: ~~Saberprobe,~~ Plains Environmental Services

SHEET 1 OF 4 SHEETS

3. PROJECT: Iowa AAP F.S. Data Collection

4. LOCATION: Burlington, Iowa

5. NAME OF DRILLER: Jesse Kalvig

6. MANUFACTURE'S DESIGNATION OF DRILL: GeoProbe.

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: A Rods, MacroCore Sampler

8. HOLE LOCATION: 301020.67'N 2276218.50'E

9. SURFACE ELEVATION: 677.6'

10. DATE STARTED: 10.23.02

11. DATE: 10.23.02

12. OVERBURDEN THICKNESS: 24.0'

13. DEPTH DRILLED INTO ROCK: 0

14. TOTAL DEPTH OF HOLE: 24.0'

15. DEPTH GROUNDWATER ENCOUNTERED: 23.1' bgs

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING: NA

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA

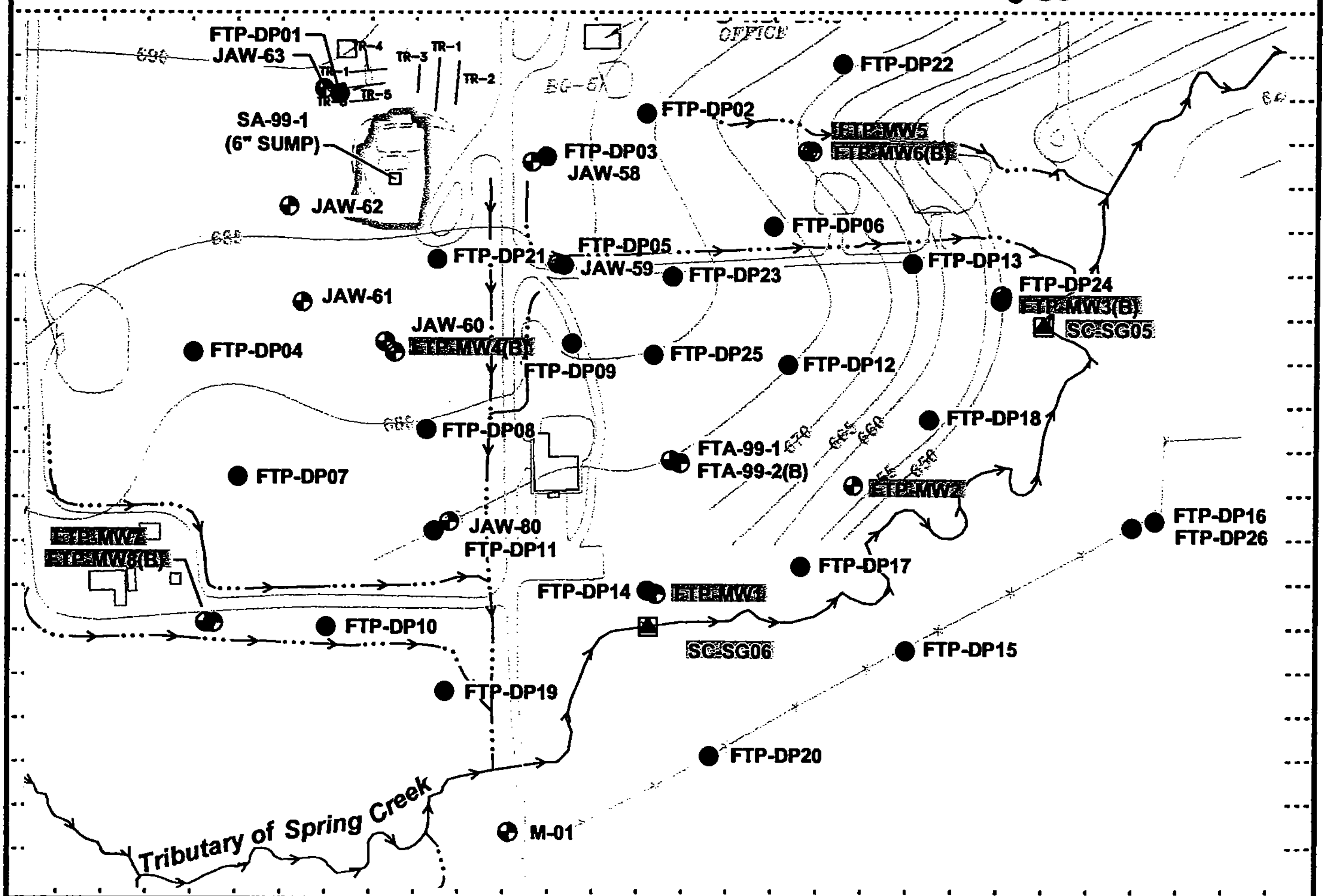
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
—	—	—	—	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		FTP-DP06		

LOCATION SKETCH/COMMENTS

SCALE: 1" = 200'



PROJECT: Iowa AAP F.S. Data Collection

HOLE: FTP-DP06

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NO. FTP-DP06

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J Covey

SHEET 2 OF 4 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ PP	REMARKS h.
		silty CLAY(CL) - stiff, brown, moist, low plastic, trace root hairs				3.0	TopSoil/loess Fill
		becomes orange/brown					
	1					3.0	
	2			R=48/48		4.0	
		trace gray mottling					
	3	becomes very stiff				5.0	
	4		HS=			5.0	
		becomes soft w/ black mottling					
	5					1.0	
				R=48/48		2.0	
	6	Clayey SILT (ML) med stiff to soft, orange/brown, moist, trace gray + black mottling w/ trace fine sand					Shallow Till
	7					1.0	
						2.0	
	8						
	9					3.5	
		Silty CLAY (CH) - stiff, orange/brown, moist, high plastic, trace black + gray mottling, fine to med sand, fine gravel + calcite concretions		R=47/48			Shallow Till
	10					4.0	

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP06

HTRW DRILLING LOG

HOLE NO. FTP-DP06

PROJECT: Iowa AAP F.S. Data Collection

INSPECTOR: J. Covey

SHEET 3 OF 4 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ PP	REMARKS h.
		SAME: Silty CLAY (CH) - stiff, orange/brown, moist, high plastic, trace black & gray mottling, fin to med sand, fine gravel & calcite concretion's					Till
				R = 42/48	7.0 →		
	11						
					8.0 →		
	12						
		becomes very soft					
					0.5 →		
	13						
		becomes stiff					
				R = 40/48	3.0 →		
	14						
		becomes hard					
					9.0+ →		
	15						
					9.0+ →		
	16						
		~~becom~~ silty CLAY (CL) ~~are~~ very stiff, orange/brown, moist, low plastic, trace gray mottling, calcite concretions & fine to med sand					
					5.0 →		
	17						
				R = 42/48	5.0 →		
	18						
					4.0 →		
	19						
					→	6.0	
	20						

PROJECT: Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP06

HTRW DRILLING LOG

HOLE NO. FTP-DP06

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 4 OF 4 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ PP	REMARKS h.
		SAME:				1,0	Till
	21	thin fine grained sand seam			Ground Water Sample FTP-DP06-24 For VOC's + Freon113 Collected 10/27/02 T= 1255	0,0	
		Clayey SILT (ML) - very soft, orange brown, Moist, low plastic, trace fine sand		R= 36/36			
		thin fine grained sand seam					
	22	2" med. to coarse grained sand seam				0,0	
	23					2.0	
		Silty SAND (SM) - loose, orange/brown, wet, fine to med grained trace clay		R= 12/12			Glacial Outwash
							Temp well is 19'-24' bgs
	24	Bedrock Refusal					b.o.b. @ 24' bgs, set temp well after offsetting
	25						
	26						
	27						
	28						
	29						
	30						

HTRW DRILLING LOG

DISTRICT: Omaha District

HOLE NUMBER: FTP-DP07

1. COMPANY NAME: URS Corporation

2. DRILLING SUBCONTRACTOR: Saberprobe, Plains Environmental Services

SHEET 1 OF 4 SHEETS

3. PROJECT: Iowa AAP F.S. Data Collection

4. LOCATION: Burlington, Iowa

5. NAME OF DRILLER: Jesse Kalvig

6. MANUFACTURE'S DESIGNATION OF DRILL: GeoProbe

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: A-Rod, MacroCore Sampler

8. HOLE LOCATION: 300738.21' N 2275618.68' E

9. SURFACE ELEVATION: 680.4'

10. DATE STARTED: 10.22.02

11. DATE: 10.22.02

12. OVERBURDEN THICKNESS: 27' bgs

15. DEPTH GROUNDWATER ENCOUNTERED: 25.1' bgs during drilling

13. DEPTH DRILLED INTO ROCK: 0

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING: NA

14. TOTAL DEPTH OF HOLE: 27' bgs

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA

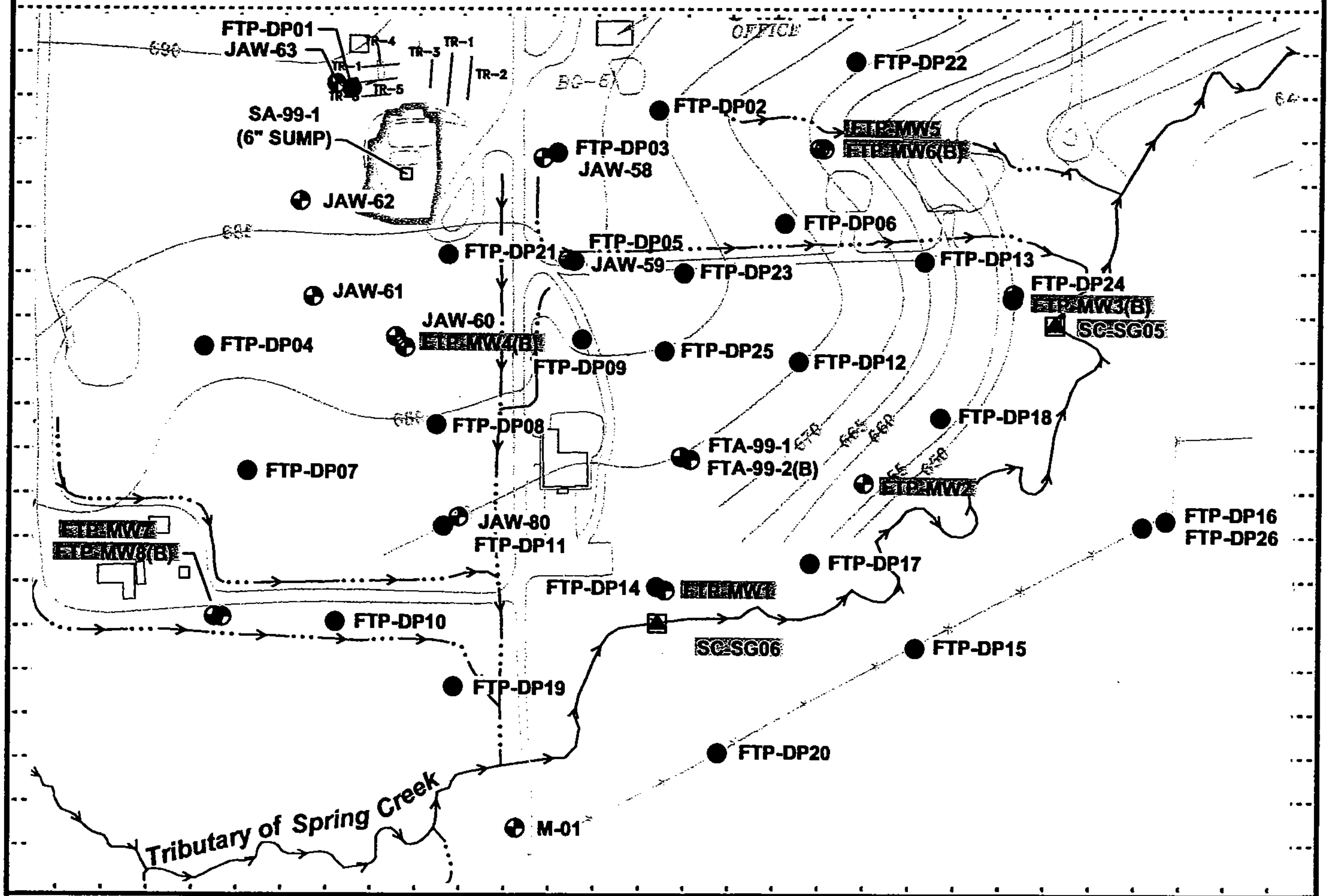
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
—	—	—	—	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		FTP-DP07		

LOCATION SKETCH/COMMENTS

SCALE: 1" = 200'



PROJECT: Iowa AAP F.S. Data Collection

HOLE: FTP-DP07

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NO. FTP-DP07

PROJECT: Iowa AAP F.S. Data Collection

INSPECTOR: J. Covey

SHEET 2 OF 4 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	ft ~~BLOW COUNTS~~ g.	REMARKS h.
		silty CLAY(CL) - very stiff, brown, moist, low plastic, trace organics				6.0	Top soil
1		becomes light brown w/ orange & gray mottling & trace iron staining				5.0	loess
				R= 36/48			
2						2.0	
3						3.0	
4			HS=ND				
5						3.0	
6		becomes brown		R= 18/48		3.0	
7						3.0	
		trace wood					
8			HS=ND			4.0	
9				R= 34/48		5.0	
		trace calcite concretions					Till
10		becomes ~~br light brown~~ light gray w/ orange & black mottling					

HTRW DRILLING LOG

HOLE NO. FTP-DP07

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 3 OF 4 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW-COUNTS~~ PP	REMARKS h.
		Silty CLAY(CL) stiff - light gray, moist, low plastic, trace orange & black mottling w/ fine to med sand & fine gravel				4.0	Till
11				R=39/48		3,0	
12			HS=ND			3.0	
13						3.0	
14				R=40/48		3.0	
15						4,0	
		becomes very stiff, high plastic no gravel ~~ore~~ or black mottling					Till
16			HS=ND			6.0	
						4.0	
17						4.0	
18				R=46/48		4.0	
19						4,0	
20			HS=ND			4.0	

HTRW DRILLING LOG

HOLE NO. FTP-DP07

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR S. Covey

SHEET 4 OF 4 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ PP	REMARKS h.
		SAME: Silty CLAY (CH) very stiff, light gray, moist, high plastic, trace orange mottling & fine to med sand w/ fine gravel					Till
21						4.0	
22				Rs		4.5	
		1/4" fine grained sand seam, gray					
23						5.0	
		CLAYEY SILT (ML) - very stiff, brown to orange, moist, low to non plastic, trace fine to med sand.			Ground Water Sample FTP-DP07-27 for VOC's + Freon 113 Collected 10/23/02 T= 1020		
24			HS=ND			6.0	
25						6.0	
		SAND (SP) loose, brown to orange, wet, fine to med grained					Glacial Outwash
26		Sandy Silt (ML) - very stiff, brown to orange, w/ trace iron staining, moist fine to med sand				7.0	
							Temp Well is 22'-27' bgs
27		Bedrock Refusal					b.o.b. @ 27 bgs @ bedrock Temp well Installed
28							
29							
30							

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP07

HTRW DRILLING LOG

DISTRICT: Omaha District

HOLE NUMBER: FTP-DP08

1. COMPANY NAME: URS Corporation

2. DRILLING SUBCONTRACTOR: ~~Saberprobe~~, Plains Environmental Services

SHEET 1 OF 4 SHEETS

3. PROJECT: Iowa AAP F.S. Data Collection

4. LOCATION: Burlington, Iowa

5. NAME OF DRILLER: Jesse Kaluza

6. MANUFACTURE'S DESIGNATION OF DRILL: GeoProbe

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: A-Rods, MacroCore Sampler

8. HOLE LOCATION: 300792.34'N 2275831.22'E

9. SURFACE ELEVATION: 677.5'

10. DATE STARTED: 10.24.02

11. DATE: 10.24.02

12. OVERBURDEN THICKNESS: 23' bgs

13. DEPTH DRILLED INTO ROCK: 0

14. TOTAL DEPTH OF HOLE: 23' bgs

15. DEPTH GROUNDWATER ENCOUNTERED: NA

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING: NA

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA

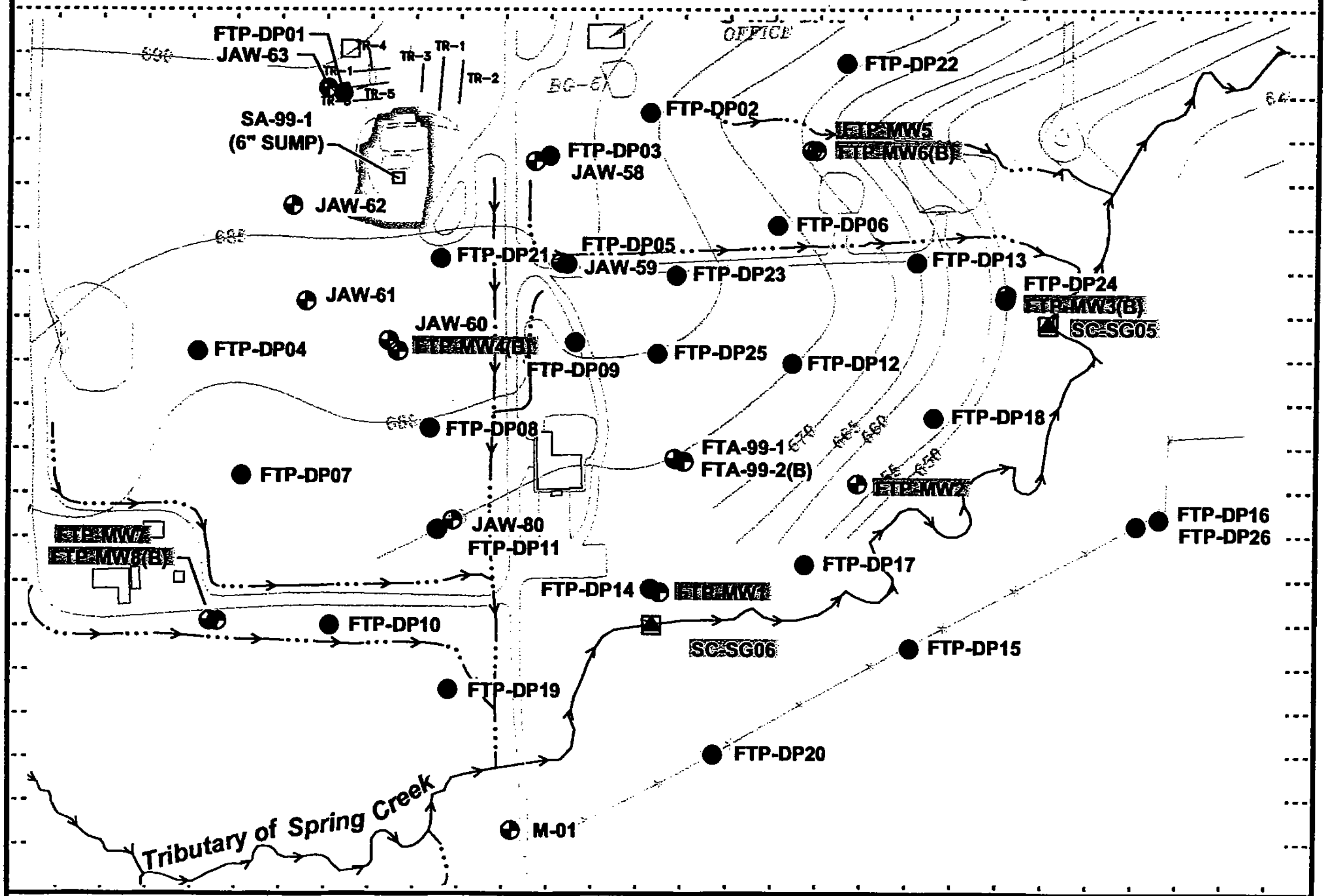
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
4 samples	—	X	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
—	—	—	—	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		FTP-DP08		

LOCATION SKETCH/COMMENTS

SCALE: 1"=200'



PROJECT: Iowa AAP F.S. Data Collection

HOLE: FTP-DP08

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NO. FTP-DP08

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 2 OF 4 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW~~ COUNTS KSF	REMARKS h.
		Silty CLAY (CL) - Stiff, moist, dark gray / black, low plastic with organics				3	Keeping samples in sleeves for analysis
	1						
						3	Topsoil
				R = 48/48			
	2	Silty CLAY (CL) - very stiff, moist yellowish - brown, low plastic w/ iron stains					Loess
						4	
	3						
						4	
	4	Sandy CLAY (CL) - Stiff, moist, reddish brown, medium to high plastic ~~w/ Sand~~ fine-grained					Till
						4	
	5						
				R = 48/48		5	
	6						
						4	
	7						
		Becomes high plastic				6	
	8						
				Geo		4	
	9						
				R = 48/48		3	
	10						

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP08

HTRW DRILLING LOG

PROJECT Iowa AAP F.S. Data Collection	INSPECTOR J. Covey	HOLE NO. FTP-DP08 SHEET 3 OF 4 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW~~ COUNTS FSP	REMARKS h.
		SAME: Sandy CLAY(CH) - stiff, moist, reddish brown, high plastic - fine-grained				6	Till
11						5	
12							
13						6	
				R=48/48		5	
14		Silty CLAY (CH) - Stiff, moist, reddish/yellowish-brown, high plastic with Sand				6	Till
15				Geo		7	
16		Becomes medium to low plastic					
17						7	
				R=48/48		7	
18		Sandy CLAY(CL) - V. stiff, moist, reddish-brown, medium to low plastic, medium to fine-grained			▨	6	Till
19				Geo	▨	7	
20							

	PROJECT Iowa AAP F.S. Data Collection	HOLE NO. FTP-DP08

HTRW DRILLING LOG

HOLE NO. FTP-DP08

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR D. Covey

SHEET 4 OF 4 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ FSP	REMARKS h.
		SAME: Sandy CLAY (CL) - V. Stiff, moist, reddish brown, medium to low plastic, medium to fine-grained			Ground Water Sample FTP-DP08-23 for VOC's + Freon 113 Collected 10/25/02 T=0940	7	Till
	21			R = 36/36		7	
	22	Becomes Silty CLAY with Sand + low plastic wet		Geo		6	Temp Well is 18'-23' bgs
	23	Bedrock Refusal					b.o.b. @ 23' bgs @ bedrock & installed Temp Well
	24						
	25						
	26						
	27						
	28						
	29						
	30						

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP08

HTRW DRILLING LOG

HTRW DRILLING LOG	DISTRICT Omaha District	HOLE NUMBER FTP-DP09
1. COMPANY NAME URS Corporation	2. DRILLING SUBCONTRACTOR ~~Schumpro~~be, Plains Environmental Services	SHEET 1 OF 4 SHEETS

3. PROJECT Iowa AAP F.S. Data Collection	4.LOCATION Burlington, Iowa
5. NAME OF DRILLER Jesse Kalvig	6. MANUFACTURE'S DESIGNATION OF DRILL GeoProbe
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT A-Rods, Macro Core Sampler	8. HOLE LOCATION 300888.77'N 2275993.44'E
	9. SURFACE ELEVATION 682.3'
	10. DATE STARTED 10.22.02 / 11. DATE 10.22.02
12. OVERBURDEN THICKNESS 29.5' bgs	15. DEPTH GROUNDWATER ENCOUNTERED NA
13. DEPTH DRILLED INTO ROCK 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING NA
14. TOTAL DEPTH OF HOLE 29.5' bgs	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA

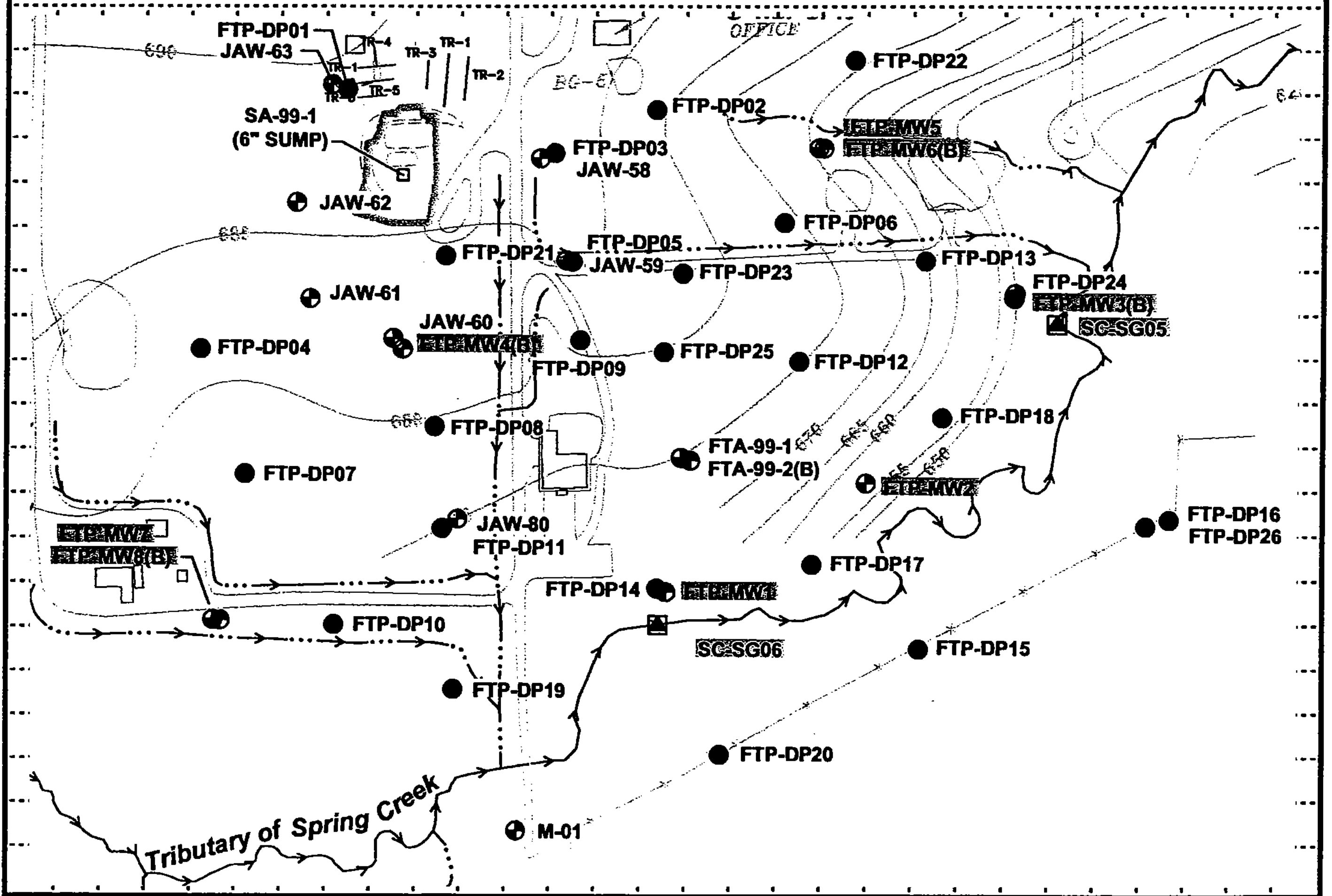
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
—	—	—	—	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		FTP-DP09D		

LOCATION SKETCH/COMMENTS

SCALE: 1" = 200'



PROJECT	HOLE
Iowa AAP F.S. Data Collection	FTP-DP09

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NO. FTP-DP09

PROJECT: Iowa AAP F.S. Data Collection

INSPECTOR: J. Covey

SHEET 2 OF 4

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW~~ ~~COUNTS~~ PP	REMARKS h.
		Silty CLAY (CL) - stiff, brown, moist, low plastic, trace root hairs & organics				4.0	Topsoil / FILL
	1					4.0	
	2			R=24/48			
	3						
		no organics	HS° 0				
	4	trace gray & orange mottling				5.0	~~Loess~~ Till
	5	No root hairs ~~or organics~~			5.0 →		
		becomes soft		R=40/48			
	6				1.0 →		
	7				1.0 →		
		becomes very soft w/ no mottling	HS° 0		0 →		
	8	trace very fine sand			0 →		
	9			R=[illegible]/48	1.0 →		
	10				1.0 →		

PROJECT: Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP09

HTRW DRILLING LOG

HOLE NO. FTA-DP09

PROJECT: Iowa AAP F.S. Data Collection

INSPECTOR: J. Covey

SHEET 3 OF 4 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ PP	REMARKS h.
		SAME: Silty CLAY (CL) - soft, brown, trace gray + orange mottling, moist, low plastic, trace very fine sand				1.0	Till
	11	Trace fine ~~sand~~ to coarse sand + calcite concretions		R= 40/48		4.0	~~[illegible]~~ Till
	12		HS=ND			7.0	
	13	becomes gray w/ iron staining + orange mottling + trace fine gravel				7.0	
	14			R=38/48		7.0	
	15					7.0	
	16		HS=ND			5.0	
	17					4.0	
	18	black + orange mottling		R= 36/48		7.0	Till
	19					70	
	20		HS=ND			4.0	Temp Well 15'-20' bgs remained Dry

PROJECT: Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP09

HTRW DRILLING LOG

HOLE NO. FTP-DPØ9

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR

SHEET 4 OF 4 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ R.P g.	REMARKS h.
		SAME: Silty CLAY (CL) stiff, gray, moist, low plastic, trace iron staining & black & orange mottling, trace fine to coarse sand w/ calcite concretions & fine gravel				4.0	Till
	21	No mottling				5.0	
				R=40/48			
	22					7.0	
	23	becomes orange/brown				7.0	
			HS=ND				
	24					7.0	
	25					7.0	
	26	Clayey SILT (ML) - Very stiff, orange/brown, moist, low plastic, trace fine to coarse sand & fine gravel		R=38/48	Ground Water Sample FTP-DP09-30 for Explosives + VOC's + Freon 113 Collected 10/23/02 T=1205	7.0	
	27					7.0	
			HS=ND				
	28			R=18/18		6.0	
	29	Silty SAND (SM) - medium dense, orange/brown, moist,				10.5	Glacial Outwash Temp Well is 25-29.5' bgs
		Bedrock Refusal					B.o.b. @ 29.5 @ bedrock Temp well installed
	30						

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FTP-DPØ9

HTRW DRILLING LOG

DISTRICT: Omaha District

HOLE NUMBER: FTP-DP10

1. COMPANY NAME: URS Corporation

2. DRILLING SUBCONTRACTOR: ~~Subconpro~~be, Plains Environmental Services

SHEET 1 OF 3 SHEETS

3. PROJECT: Iowa AAP F.S. Data Collection

4. LOCATION: Burlington, Iowa

5. NAME OF DRILLER: Jesse Kalvig

6. MANUFACTURE'S DESIGNATION OF DRILL: Geoprobe

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: A-Rods, Macro Core Sampler

8. HOLE LOCATION: 300571.34'N 2275717.97'E

9. SURFACE ELEVATION: 669.9'

10. DATE STARTED: 10.22.02

11. DATE: 10.22.02

12. OVERBURDEN THICKNESS: 18' bgs

15. DEPTH GROUNDWATER ENCOUNTERED: NA

13. DEPTH DRILLED INTO ROCK: 0

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING: NA

14. TOTAL DEPTH OF HOLE: 18' bgs

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA

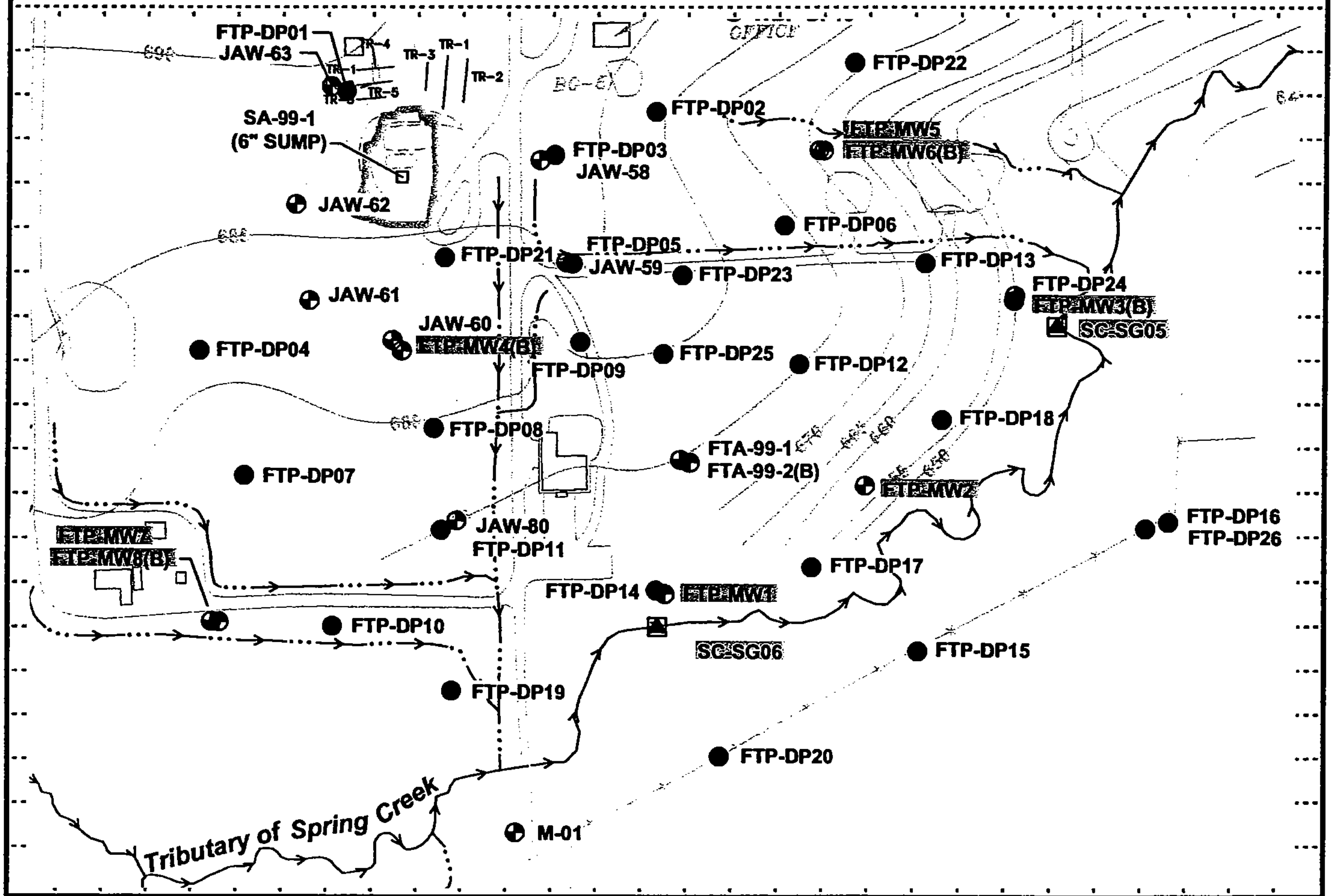
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—		—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
—	—	—	—	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		FTP-DP10		

LOCATION SKETCH/COMMENTS

SCALE: 1"=200'



PROJECT: Iowa AAP F.S. Data Collection

HOLE: FTP-DP10

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NO. FTP-DP10

PROJECT
Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 2 OF 3 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ KSF	REMARKS h.
		Silty CLAY (CL) - soft, brown, moist, low plastic, trace root hairs & organics				2.0	Topsoil
	1	becomes light brown				2.0	
				R=42/48			
	2	trace calcite concretions & becomes very stiff				7.0	Shallow Till
		becomes hard & gray w/iron staining					
	3					9.0+	
		becomes very stiff					
	4		HS=0			9.0	
						9.0	
		becomes stiff					
	5					4.0	
				R=46/48			
	4					4.0	
	7					4.0	
		becomes very stiff to hard w/orange mottling					
	8		HS=0			6.0	Till
		~~becom becomes hard~~					
	9					8.0	
				R=42/48			
	10					6.0	

PROJECT
Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP10

HTRW DRILLING LOG

HOLE NO. FTP-DP10

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 3 OF 3 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ FS&F	REMARKS h.
		SAME: Silty CLAY (CL) - very stiff, gray w/ iron staining, moist, low plastic, trace calcite concretions + orange mottling				6.0	Till
11						5.0	
12			HS=0			5.0	
13		~~no mottling present~~ ~~CLA~~ Clayey SILT (ML) - medium stiff, gray, moist, low plastc				2.0	
14		SAND (SP) - brown, loose, wet, med to coarse sand, trace silt					
15		Clayey SILT (ML) - hard, brown to orange, moist, low to non plastic, trace calcite concretions + ~~f~~ fine to coarse sand			Ground Water Sample FTP-DP10-18 for VOC's + Froon 113 collected	9.0	
16			HS=0		10/23/02 T= 1100		
17						8.0	
18		Bedrock refusal	HS=0				Temp Well is 13'-18' bgs b.o.b. @ 18' bgs @ bedrock Temp well installed
19							
20							

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP10

HTRW DRILLING LOG

DISTRICT: Omaha District

HOLE NUMBER: FTP-DP11

1. COMPANY NAME: URS Corporation

2. DRILLING SUBCONTRACTOR: ~~Saberprobe~~, Plains Environmental Services

SHEET 1 OF 3 SHEETS

3. PROJECT: Iowa AAP F.S. Data Collection

4. LOCATION: Burlington, Iowa

5. NAME OF DRILLER: Jesse Kalvig

6. MANUFACTURE'S DESIGNATION OF DRILL: GeoProbe

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: A-Rods, Macro Core Sampler

8. HOLE LOCATION: 300679.31'N 2275839.27'E

9. SURFACE ELEVATION: 671.7'

10. DATE STARTED: 10.24.02

11. DATE: 10.24.02

12. OVERBURDEN THICKNESS: 20' bgs

13. DEPTH DRILLED INTO ROCK: 0

14. TOTAL DEPTH OF HOLE: 20' bgs

15. DEPTH GROUNDWATER ENCOUNTERED: NA

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING: NA

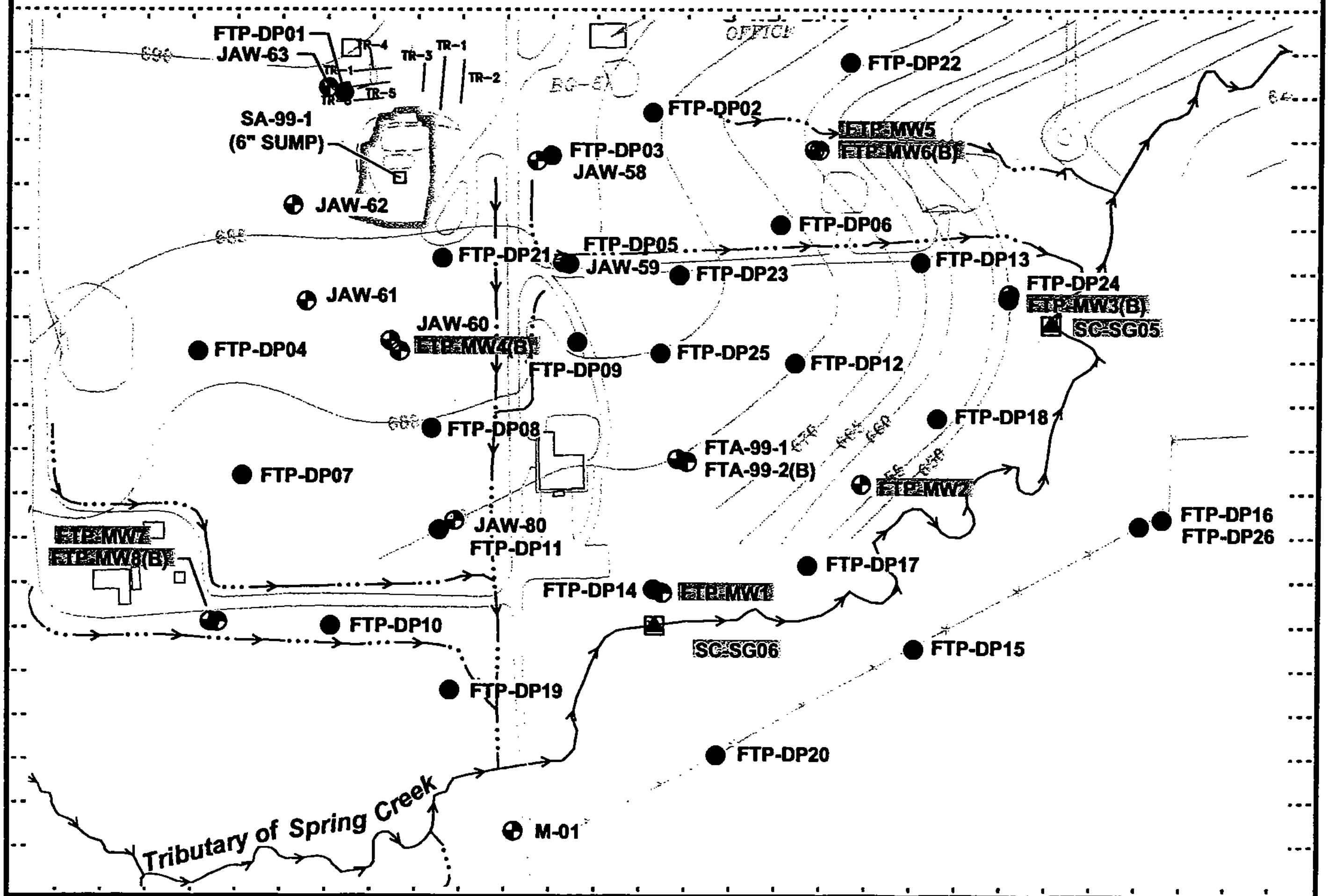
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
—	—	—	—	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		FTP-DP11 ·	sampled & pulled	

LOCATION SKETCH/COMMENTS SCALE: 1":200'



PROJECT: Iowa AAP F.S. Data Collection

HOLE: FTP-DP11

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NO. FTP-DP11

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 2 OF SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ KSF	REMARKS h.
		~~Clayey~~ SILT(ML) - very stiff, brown, moist, low to non-plastic, trace root hairs & organics				6.0	FILL / Loess
	1	becomes lt brown to gray w/ orange mottling				4.0	
		becomes brown w/ lt brown mottling		R=48/48			
	2					5.0	
	3					4.0	
	4					4.0	
		becomes gray w/ orange mottling					
	5					4.0	
				R=42/48		3.0	
	6	Silty CLAY (CL) - stiff, gray, moist, low plastic, trace orange mottling					Till
	7	black mottling present				3.0	
	8					3.0	
	9	becomes med plastic trace fine sand		R=40/48	3.0		
	10				3.0		

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP11

HTRW DRILLING LOG

HOLE NO. FTP-DP11

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 3 OF 3 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ FSP	REMARKS h.
		SAME: Silty CLAY-(CL) stiff, moist, orange & gray, low plastic, w/ sand					Till
	11	1" med to coarse sand seam no black mottling				3.0	
		trace calcite concretions					Till
	12					7.0	
	13	becomes low plastic				7.0	
				R: 36/36			
	14	becomes orange brown w/ no mottling				7.0	
	15					5.0	
							installed Temp well (had to redrill boring)
	16	Silty CLAY (CL) - very stiff, orange brown, moist, low plastic, trace calcite concretions & med to coarse sand			Ground Water Sample FTP-DP11-20 for Explosives + VOC's + Freon 113 Collected 10/24/02 T= 0935		while redrilling got to depth of 20' bgs, installed well offset + got descrete sample from 16'-20'
	17					6.0	
	18	1" fine grained sand seam		R: 48/48		7.0	
	19	4" fine to coarse sand seam				6.0	
	20	Bedrock Refusal				9.0	Temp Well is 15'-20' bgs

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP11

HTRW DRILLING LOG

DISTRICT: Omaha District

HOLE NUMBER: FTP-DP12

1. COMPANY NAME: URS Corporation

2. DRILLING SUBCONTRACTOR: ~~Saberprob~~e, Plains Environmental Services

SHEET 1 OF 4 SHEETS

3. PROJECT: Iowa AAP F.S. Data Collection

4.LOCATION: Burlington, Iowa

5. NAME OF DRILLER: Jesse Kalvig

6. MANUFACTURE'S DESIGNATION OF DRILL: GEOPROBE

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: A-Rod, Macro Core Sampler

8. HOLE LOCATION: 300866.41'N 2276235.00'E

9. SURFACE ELEVATION: 676.8'

10. DATE STARTED: 10.22.02

11. DATE: 10.22.02

12. OVERBURDEN THICKNESS: 23' bgs

15. DEPTH GROUNDWATER ENCOUNTERED: NA

13. DEPTH DRILLED INTO ROCK: Ø

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING: NA

14. TOTAL DEPTH OF HOLE: 23' bgs

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA

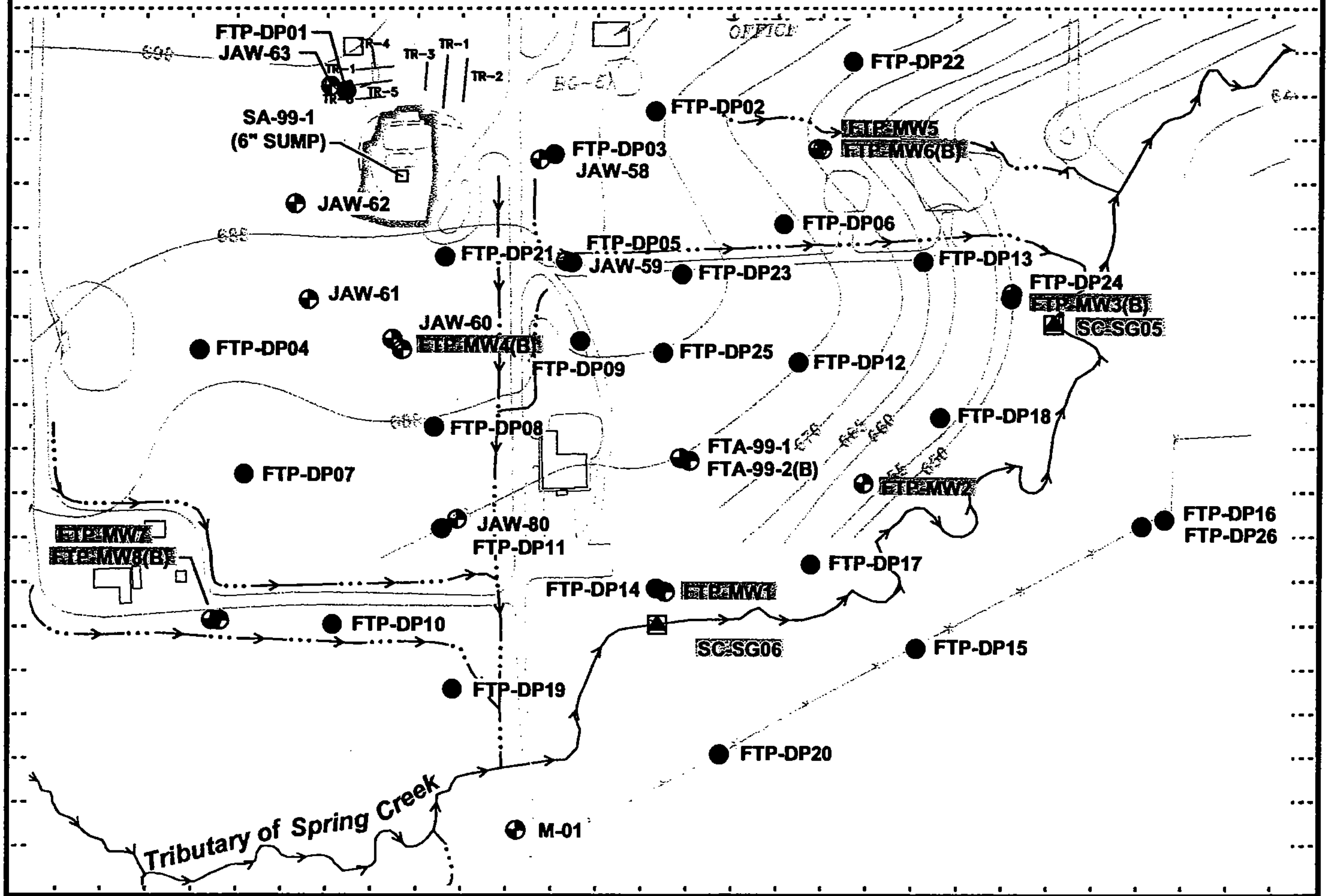
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
—	—	—	—	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		FTP-DP12		

LOCATION SKETCH/COMMENTS

SCALE: 1" = 200'



PROJECT: Iowa AAP F.S. Data Collection

HOLE ~~FTB~~ FTP-DP12

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NO. FTP-DP12

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 2 OF 4 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ KSF	REMARKS h.
		silty CLAY (CL) - ~~stiff~~ ~~soft~~ med stiff, brown, moist, low plastic, trace root hairs + organics				2.0	Topsoil Loess
		~~becomes med stiff~~ becomes very stiff					
1		Clayey SILT (ML) - Very stiff, brown, moist low plastic, trace root hairs				6.0	
				R=48/48			
2						7.0	
							Till
3		trace orange mottling				6.0	
		becomes stiff					
4			HS=ND			4.0	
		becomes med stiff					
5						2.0	
6				R=48/48		3.0	
		Trace fine sand					
7						1.0	
8			HS=ND			2.0	
		trace black mottling					
9						2.0	
				R=30/48			
		silty CLAY (CH) - hard, brown to orange, moist, high plastic, trace calcite concretions, fine to med. sand + black mottling					Shallow Till
10						6.0	

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP12

HTRW DRILLING LOG

HOLE NO. FTP-DP12

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 3 OF 4 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ tsf	REMARKS h.
		SAME: Silty CLAY (CH) - hard, brown/orange moist, high plastic, trace calcite concretions, fine to med sand + black mottling				6.0	Till
11		~~Silty CLAY (CH) - Hard brown to orange, moist, high plastic, trace calcite concretions, fine to med sand.~~		R=36/48		8.0	~~Shallow Till~~
			HS=ND			9.0	
12							
		no mottling					
13						8.0	
14				R=40/48		8.0	
15		gray, black + orange mottling				9.0	
			HS=ND			9.0	Till
16		becomes gray w/orange mottling					
17						8.0	
18		no mottling		R=36/48	▨	8.0	
19					▨	0.0	
20			HS=ND		▨	0.0	

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP12

HTRW DRILLING LOG

HOLE NO. FTP-DP12

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 4 OF 4 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ KSF	REMARKS h.
		Clayey SILT (ML) - Very Stiff, brown/orange, moist, low plastic, trace ~~med~~ fine to coarse sand. 1" Seam Coarse gravel			Ground Water Sample FTP-DP12-23 for Explosives + VOC's + Freon 113 Collected 10/25/02 T= 1125	5.0	Till
21		silty SAND (SM) Med dense, brown/orange, moist, fine to coarse grained trace clay & fine gravel		R= 36/72			Glacial Outwash
22							
		Clayey SILT (ML) - very stiff, brown/orange moist, low plastic, trace fine to coarse sand	AS= ND				Temp Well is 18'-23' bgs
23		Bedrock Refusal					B.o.b. @ 23' bgs @ bedrock. Temp well installed

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP12

HTRW DRILLING LOG

DISTRICT: Omaha District

HOLE NUMBER: 13 FTP-DP~~15~~

1. COMPANY NAME: URS Corporation

2. DRILLING SUBCONTRACTOR: ~~Saberprobe~~, Plains Environmental Services

SHEET 1 OF 3 SHEETS

3. PROJECT: Iowa AAP F.S. Data Collection

4. LOCATION: Burlington, Iowa

5. NAME OF DRILLER: Jesse Kolvig

6. MANUFACTURE'S DESIGNATION OF DRILL: GEOPROBE

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: Atlas Macro core sampler 2"

8. HOLE LOCATION: 300979.51'N 2276375.23E

9. SURFACE ELEVATION: 669.9'

10. DATE STARTED: 10.22.02

11. DATE: 10.22.02

12. OVERBURDEN THICKNESS: 16' bgs

15. DEPTH GROUNDWATER ENCOUNTERED: NA

13. DEPTH DRILLED INTO ROCK: ϕ

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING: NA

14. TOTAL DEPTH OF HOLE: 16' bgs

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA

18. GEOTECHNICAL SAMPLES: — DISTURBED: — UNDISTURBED: —

19. TOTAL NUMBER OF CORE BOXES: —

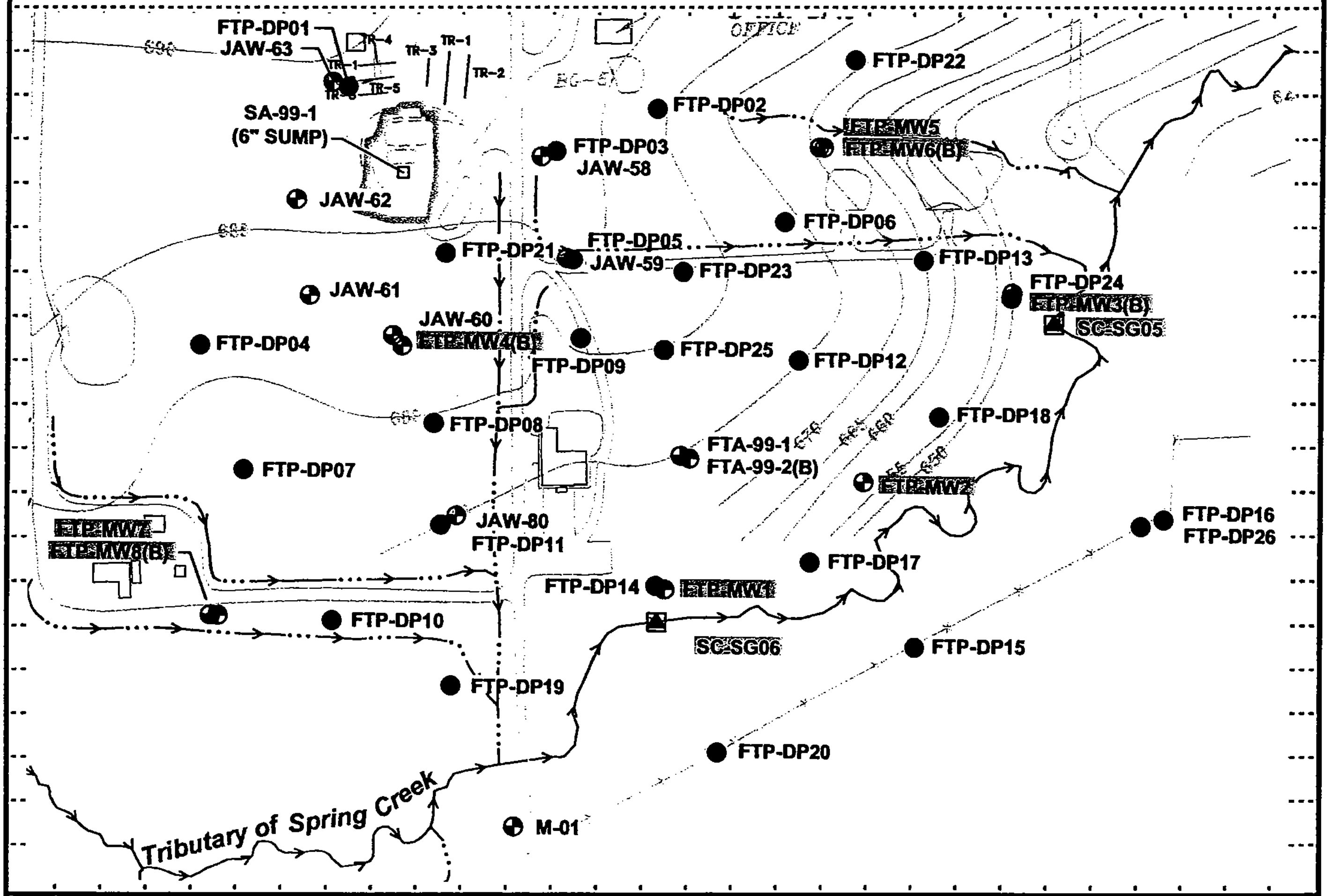
20. SAMPLES FOR CHEMICAL ANALYSIS: — VOC: — METALS: — OTHER (SPECIFY): — OTHER (SPECIFY): — OTHER (SPECIFY): —

21. TOTAL CORE RECOVERY: — %

22. DISPOSITION OF HOLE: BACKFILLED: MONITORING WELL: FTP-DP~~2~~13 OTHER (SPECIFY):

23. SIGNATURE OF INSPECTOR:

LOCATION SKETCH/COMMENTS SCALE: 1" = 200'



PROJECT: Iowa AAP F.S. Data Collection

HOLE: 13 FTP-DP~~15~~

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NO. FTP-DP13~~[illegible]~~

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. COVEY

SHEET 2 OF 3 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW~~ COUNTS PP	REMARKS h.
		Silty CLAY (CL) - stiff, brown, moist, low plastic, trace root hairs					Top Soil
		Clayey SILT (ML) - Very stiff, light brown, moist, low plastic					~~loess~~ Fill
1						6.0	
2				R=48/48		5.0	
3						5.0	
4			HS: ND			7.0	
5						6.0	
6		becomes orange/brown w/ black mottling		R=42/48		5.0	
7						6.0	
8			HS: ND			6.0	
9		limestone rubble seam ~1"		R=40/48	~~R=40~~	3.0	
10						5.0	

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP13~~[illegible]~~

HTRW DRILLING LOG

HOLE NO. 13 FTP-DP ~~14C~~

PROJECT: Iowa AAP F.S. Data Collection

INSPECTOR: J. Covey

SHEET 3 OF 3 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW~~ COUNTS PP	REMARKS h.
		~~CH~~ Clayey SILT (ML) - very stiff, orange/brown, moist, low plastic, black mottling					Fill
		silty CLAY (CH) - very stiff, gray, moist, orange mottling, trace calcite concretions,					Shallow Till
	11			R=40/48		6.0	
			HS: ND			5.0	
	12						
	13						
	14			R=36/48		2.0	
						2.0	
	15	Silty SAND (SM) - loose, orange/brown, moist, fine to med grained, trace clay					Glacial Outwash
			HS: ND			1.0	Temp Well is 11-16' bgs remained Dry
	16	Bedrock Refusal					b.o.b. @ 16' bgs @ bedrock Temp well installed @ b.o.b.

PROJECT: Iowa AAP F.S. Data Collection

HOLE NO. 13 FTP-DP ~~14C~~

HTRW DRILLING LOG

DISTRICT
Omaha District

HOLE NUMBER
FTP-DP14

1. COMPANY NAME
URS Corporation

2. DRILLING SUBCONTRACTOR
~~Subsurprobe~~, Plains Environmental Services

SHEET 1 OF 2 SHEETS

3. PROJECT
Iowa AAP F.S. Data Collection

4.LOCATION
Burlington, Iowa

5. NAME OF DRILLER
Jesse Kalvig

6. MANUFACTURE'S DESIGNATION OF DRILL
GeoProbe

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT
A-Rod, Macro Core Sampler

8. HOLE LOCATION
300613.92'N 2276076.36'E

9. SURFACE ELEVATION
658.3'

10. DATE STARTED
10.23.02

11. DATE
10.23.02

12. OVERBURDEN THICKNESS
9.0'

15. DEPTH GROUNDWATER ENCOUNTERED
7.3' bgs

13. DEPTH DRILLED INTO ROCK
0

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING
NA

14. TOTAL DEPTH OF HOLE
9.0' bgs

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)
NA

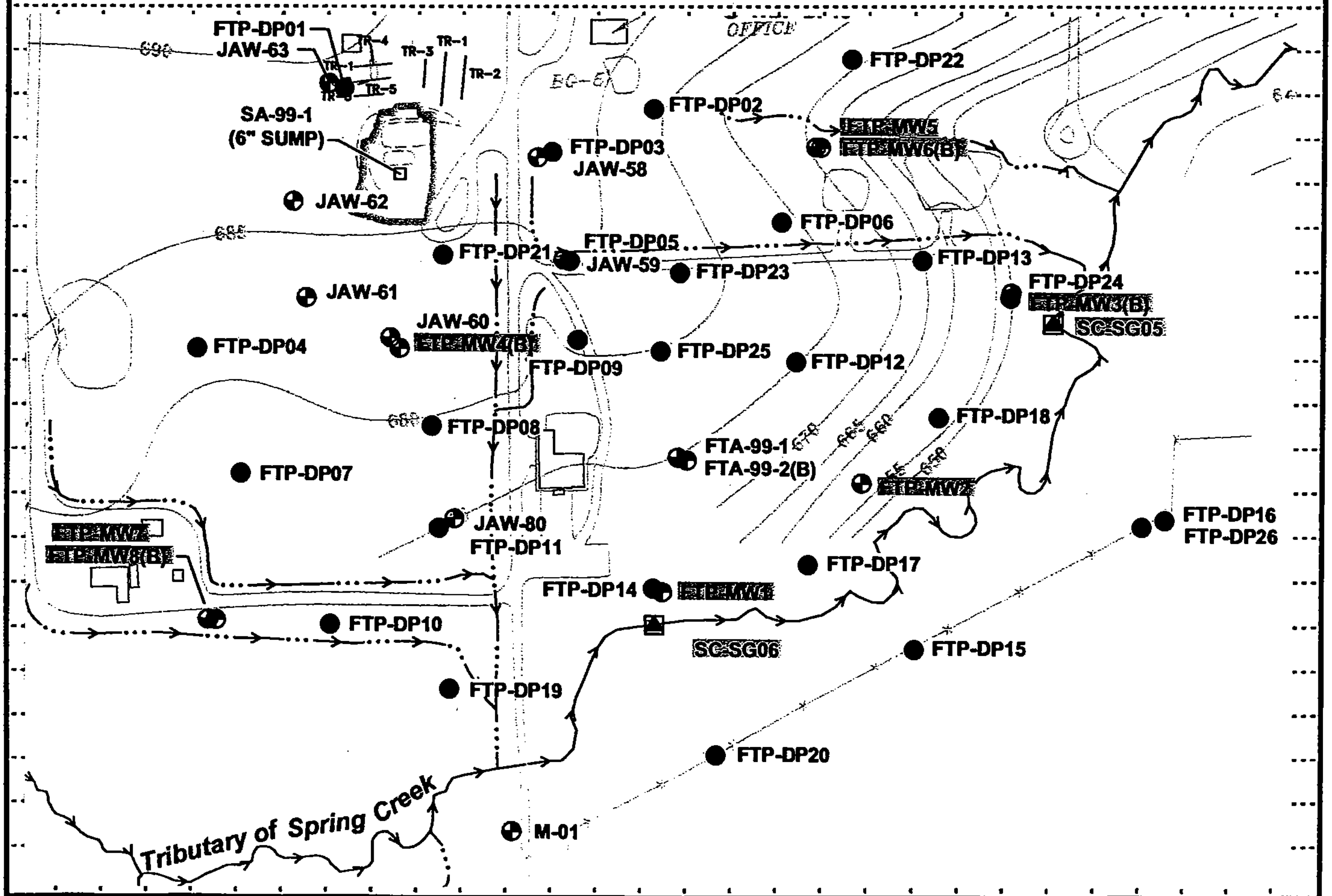
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	3-40mL VOAs		Explosives 2-1L Ambers			%

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
			screen sample pt	

LOCATION SKETCH/COMMENTS

SCALE: 1"=206'



PROJECT
Iowa AAP F.S. Data Collection

HOLE
FTP-DP14

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NO. FTP-DP14

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 2 OF SHEETS 2

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	P.P. ~~BLOW COUNTS~~ g.	REMARKS h.
		Silty CLAY (CL) - very stiff, brown, moist, low plastic, trace root hairs + organics becomes dark brown to black				5.0	Top soil Loess / Fill
	1					4.0	
	2			R: 48/48		6.0	
	3					5.0	
	4		HS= ND			3.0	
		Trace orange mottling + fine to med. sand					
	5					2.0	
	6	becomes yellowish brown + soft 3" Sandy SILT (ML) seam w/ fine to med sand		R: 38/48	Ground Water Sample FTP-DP14-09 For Explosives + VOC's + Freon 113 Collected 10/23/02 T=0833	1.0	Weathered Till
	7	Clayey SILT (ML) - very soft, yellowish-brown, moist, low plastic, trace fine to med. sand, trace calcite concretions				0	
		~~becomes~~ Silty SAND (SM) very loose, yellowish brown, wet, fine to med. sand /					
	8		HS= ND			2.0	
		becomes drk. brown	HS= ND	R: 12/12			Screen point is 5.0'–9.0' bgs
	9	Bedrock Refusal					b.o.b. @ 9.0 @ bedrock
	10						

HTRW DRILLING LOG

DISTRICT: Omaha District

HOLE NUMBER: FTP-DP15

1. COMPANY NAME: URS Corporation

2. DRILLING SUBCONTRACTOR: Saberprobe, ~~Plains Environmental Services~~

SHEET 1 OF 3 SHEETS

3. PROJECT: Iowa AAP F.S. Data Collection

4. LOCATION: Burlington, Iowa

5. NAME OF DRILLER: Tom Payton

6. MANUFACTURE'S DESIGNATION OF DRILL: GeoProbe

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: A-Rods, MacroCore Sampler

8. HOLE LOCATION: 300548.50'N 2276366.76'E

9. SURFACE ELEVATION: 665.7

10. DATE STARTED: 11.19.02

11. DATE: 11.19.02

12. OVERBURDEN THICKNESS: 12.0'

15. DEPTH GROUNDWATER ENCOUNTERED: NA

13. DEPTH DRILLED INTO ROCK: 1.0'

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING: NA

14. TOTAL DEPTH OF HOLE: 13.0' bgs

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA

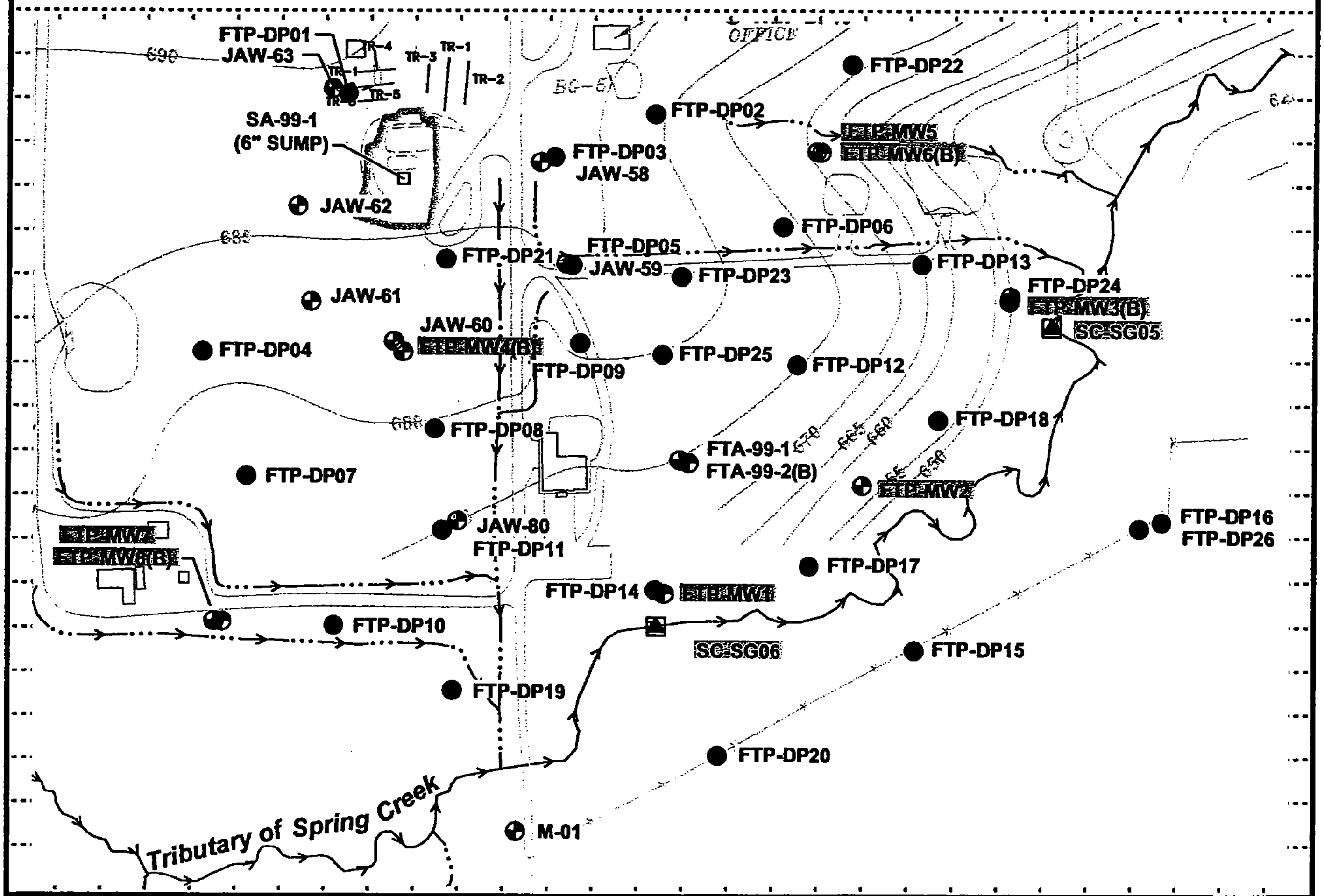
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	NA

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
—	—	—	—	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		FTP-DP15-13		

LOCATION SKETCH/COMMENTS

SCALE: 1" = 200'



PROJECT: Iowa AAP F.S. Data Collection

HOLE: FTP-DP15

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NO. FTP-DP15

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 2 OF SHEETS 3

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ PP	REMARKS h.
		Silty CLAY (CL) - soft, brown, moist, low plastic, trace organics & root hairs				2.0	Top Soil
	1					2.0	
		silty CLAY (CL) stiff to very stiff, orange/brown, moist, low to med plastic, trace fine to coarse sand & fine gravel		R=60/60			weathered Till
	2					6.0	
	3					6.0	
	4					6.5	
	5		HS=0			6.0	
	6						
	7						
	8						
	9						
	10						

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP15

HTRW DRILLING LOG

HOLE NO. FTP-DP15

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 3 OF 3 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ DP	REMARKS h.
		SAME:					Till
		1" fine sand seam					
	11			R=34/36			
		some sand very moist to wet					
	12						Glacial Outwash
		Limestone					Bedrock
							Temp Well is 8'-13' bgs Remained Dry
	13		HS=0				
							b.o.b. @ 13' bgs

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP15

HTRW DRILLING LOG

DISTRICT: Omaha District

HOLE NUMBER: FTP-DP16

1. COMPANY NAME: URS Corporation

2. DRILLING SUBCONTRACTOR: Saberprobe, P~~lains Environmental Services~~

SHEET 1 OF 3 SHEETS

3. PROJECT: Iowa AAP F.S. Data Collection

4. LOCATION: Burlington, Iowa

5. NAME OF DRILLER: Tom Payton

6. MANUFACTURE'S DESIGNATION OF DRILL: GeoProbe

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: A-Rods, Macro Core Sampler

8. HOLE LOCATION: 300693.62'N 2276642.12'E

9. SURFACE ELEVATION: 665.7'

10. DATE STARTED: 11.20.02

11. DATE: 11.20.02

12. OVERBURDEN THICKNESS: 15.2' bgs

13. DEPTH DRILLED INTO ROCK: 0

14. TOTAL DEPTH OF HOLE: 15.2' bgs

15. DEPTH GROUNDWATER ENCOUNTERED: NA

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING: NA

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA

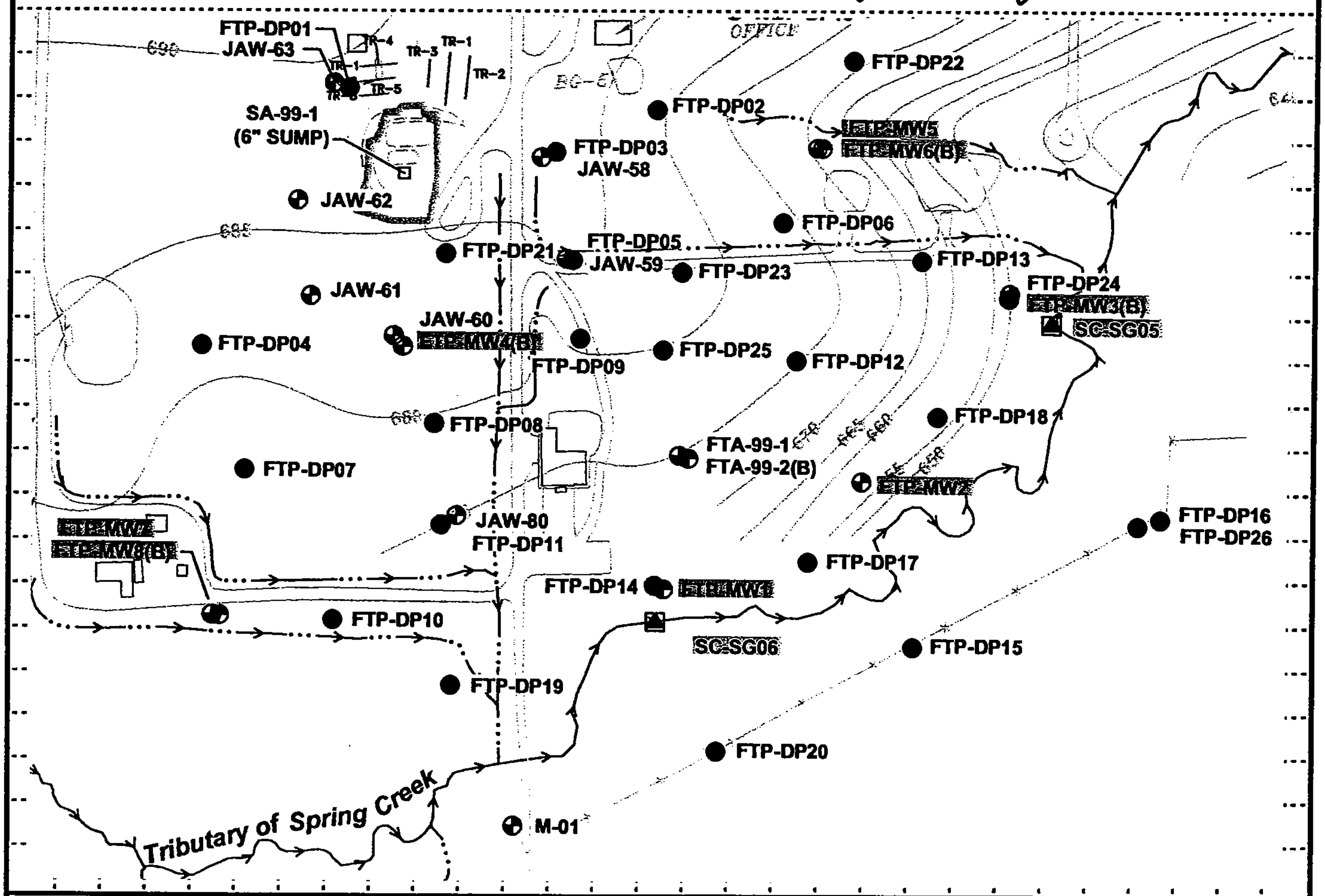
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	NA

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
—	—	—	—	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		FTP-DP16-15		

LOCATION SKETCH/COMMENTS

SCALE: 1"=200'



PROJECT: Iowa AAP F.S. Data Collection

HOLE: FTP-DP16

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NO. FTP-DP16

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 2 OF 3 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ PP	REMARKS h.
		Silty CLAY (CL) - stiff, brown, moist, low plastic, trace organics & root hairs				4.0	Top SOIL
		becomes light brown & very stiff					Loess
	1					6.0	
		trace iron staining & black mottling & gray mottling					
	2					7.0	
				R: 60/60			
	3					6.0	
						5.0	
	4						
		becomes stiff					
			HS=0			4.0	
	5						Till
	6						
	7						
	8						
	9						
	10						

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP16

HTRW DRILLING LOG

HOLE NO. FTP-DP16

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 3 OF 3 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ PP g.	REMARKS h.
		~~SILT~~ Silty CLAY (CL) hard - orange/brown moist, low plastic, trace fine to coarse san				9.0+	TILL
	11	becomes stiff				4.0	
						4.0	
	12			R=60/60			
	13	becomes grayish-brown				5.0	
	14					2.0	
	15	~~Sandy SILT~~ Sandy SILT (ML) soft, grayish-brown, moist, low plastic, fine grained sand w/trace clay + weathered angular limestone bedrock	HS-0			1.0	Temp Well is 10'-15' bgs Remained Dry
		2" fine sand seam					b.a.b. @ 15.2' bgs @ bedrock
	16						
	17						
	18						
	19						
	20						

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP16

HTRW DRILLING LOG

DISTRICT: Omaha District

HOLE NUMBER: ~~B~~FTP-DP17

1. COMPANY NAME: URS Corporation

2. DRILLING SUBCONTRACTOR: ~~Saberprobe~~, Plains Environmental Services

SHEET 1 OF SHEETS 2

3. PROJECT: Iowa AAP F.S. Data Collection

4. LOCATION: Burlington, Iowa

5. NAME OF DRILLER: Jesse Kalvig

6. MANUFACTURE'S DESIGNATION OF DRILL: GeoProbe

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: A-Rod, Macro Core Sampler

8. HOLE LOCATION: 300641.48'N 2276248.81'E

9. SURFACE ELEVATION: 656.9'

10. DATE STARTED: 10.23.02

11. DATE: 10.23.02

12. OVERBURDEN THICKNESS: 6.0' bgs

15. DEPTH GROUNDWATER ENCOUNTERED: NA

13. DEPTH DRILLED INTO ROCK: 0

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING: NA

14. TOTAL DEPTH OF HOLE: 6.0' bgs

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA

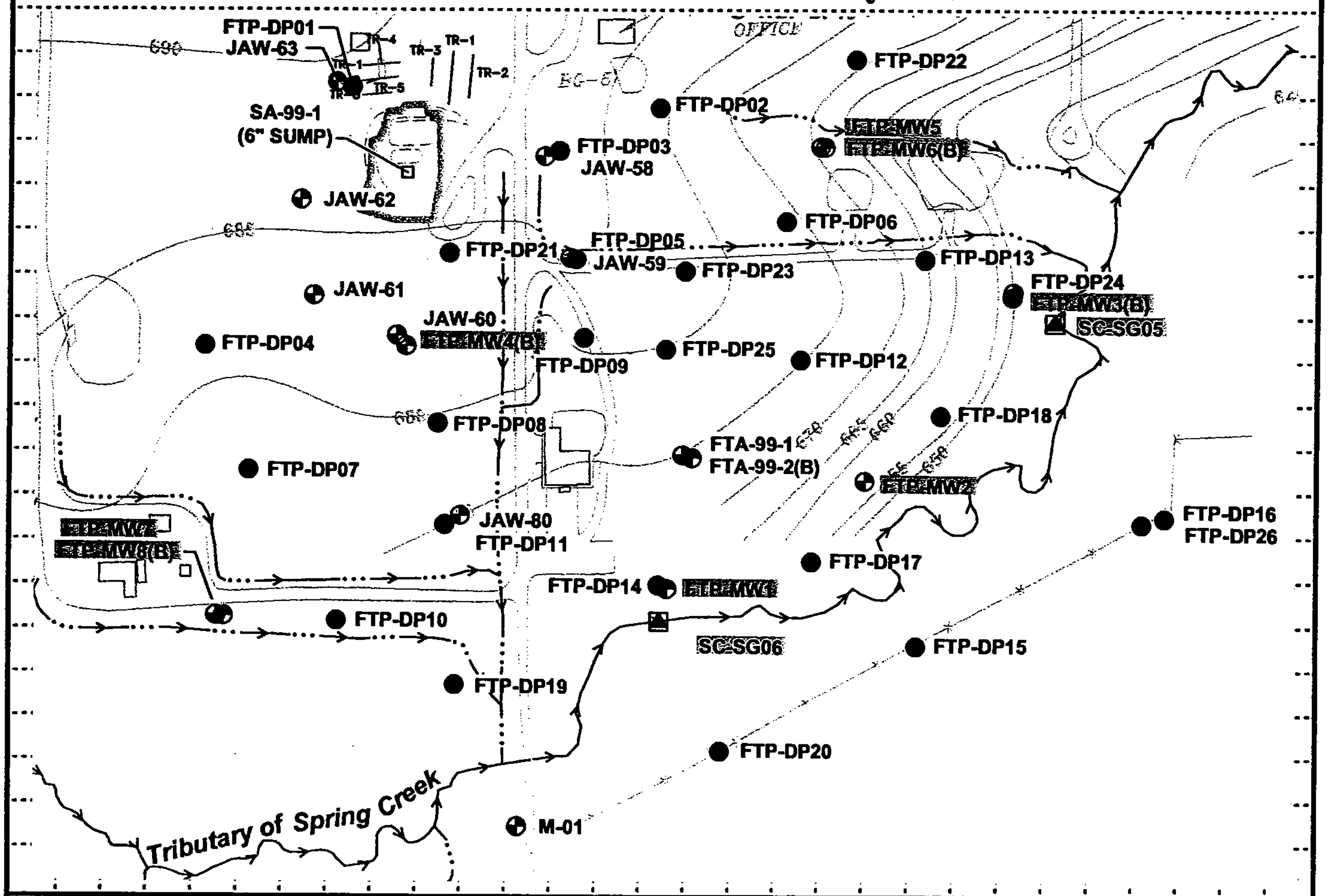
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
—	—	—	—	—	—	%

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		FTP-DP17		

LOCATION SKETCH/COMMENTS

SCALE: 1" = 200'



PROJECT: Iowa AAP F.S. Data Collection

HOLE: FTP-DP17

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NO. FTP-DP17

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 2 OF 2 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ PP	REMARKS h.
		Silty CLAY(CL) - stiff, brown, moist, low plastic, trace root hairs				3.5	Topsoil Fill
1						3.0	
		~~becomes dark brown to black~~					
		SILT (ML) - stiff, dark brown to black, moist, low plastic, trace iron staining					
2				R=46/48	Ground Water Sample FTP-DP17-06 for Explosives + VOC's + Freon 113 Collected 10/25/02 T=1303	3.0	
3						1.0	
		Clayey SILT(ML) - very stiff, drk brown to black, moist, low plastic, trace fine to med. sand					Till
4			HS=ND			1.5	
						6.0	
5		Silty CLAY (CL) - very stiff, yellowish-brown moist, low plastic, trace fine to coarse sand + fine gravel		R=24/24		5.0	
						6.0	Temp Well is 1' - 6' bgs
6		Bedrock Refusal		~~R=/48~~			b.o.b. @ 6.0' bgs @ bedrock. Temp well installed
7							
8							
9				~~R=/48~~			
10							

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP17

HTRW DRILLING LOG

DISTRICT: Omaha District

HOLE NUMBER: FTP-DP18

1. COMPANY NAME: URS Corporation

2. DRILLING SUBCONTRACTOR: ~~Saberprobe~~, Plains Environmental Services

SHEET 1 OF 2 SHEETS

3. PROJECT: Iowa AAP F.S. Data Collection

4. LOCATION: Burlington, Iowa

5. NAME OF DRILLER: Jesse Kalvig

6. MANUFACTURE'S DESIGNATION OF DRILL: GeoProbe

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: A-rods, Macro Core Sampler

8. HOLE LOCATION: 300805.64'N 2276393.57'E

9. SURFACE ELEVATION: 661.0

10. DATE STARTED: 10.23.02

11. DATE: 10.23.02

12. OVERBURDEN THICKNESS: 10' bgs

13. DEPTH DRILLED INTO ROCK: 0

14. TOTAL DEPTH OF HOLE: 10' bgs

15. DEPTH GROUNDWATER ENCOUNTERED: NA

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING: NA

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA

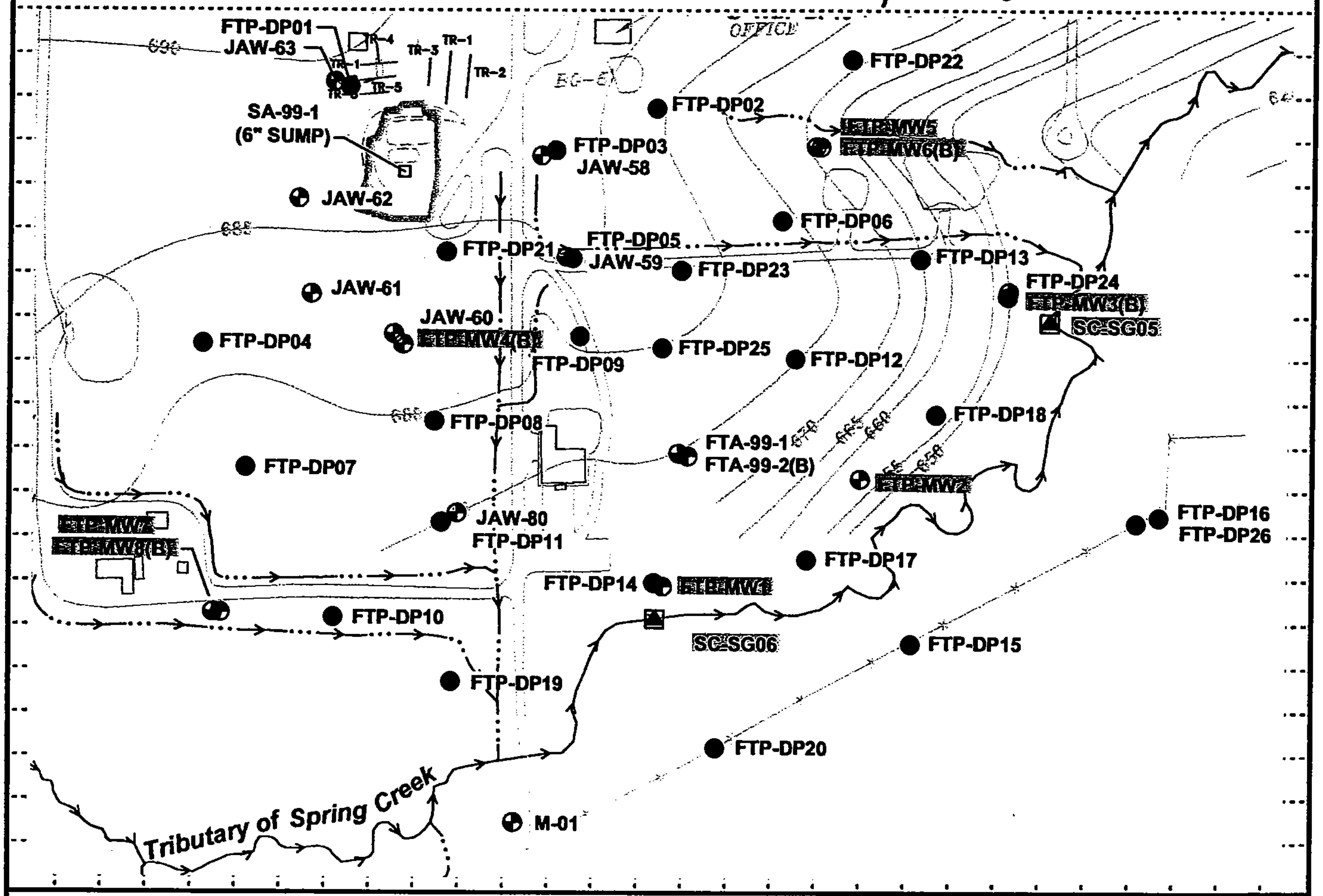
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
—	—	—	—	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		FTP-DP18		

LOCATION SKETCH/COMMENTS

SCALE: 1" = 200'



PROJECT: Iowa AAP F.S. Data Collection

HOLE: FTP-DP18

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NO. FTP-DP18

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 2 OF SHEETS 2

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ AP g.	REMARKS h.
		Clayey SILT(ML) - stiff, brown, moist, low plastic, trace root hairs			3.0 →		Top soil Fill
					3.5 →		
	1						
					5.0 →		
	2	becomes yellowish-brown & very stiff		R=48/48			loess
	3	Silty CLAY(CL) - ~~yell~~ very stiff, yellowish-brown, moist, low plastic, trace iron staining & gray mottling			7.0 →		Till
	4		HS			7.0	
						8.0	
	5	~~Silty~~ Clayey SILT(ML) - very stiff, orang~~ey~~-brown, moist, low plastic, trace fine sand, ~~trace~~				8.5	
				R=48/48			
	6	Silty CLAY (CH) - stiff, orange/brown, moist ~~low~~ high plastic, trace gray mottling			Ground Water Sample FTP-DP18-10 for Explosives + VOC's + Freon113 Collected	3.0	
	7	trace black mottling & iron staining w/fine to coarse sand				4.0	
	8		HS			5.0	
					10/25/02 T=1205		
	9			R=24/24		4.0	
		Silty SAND(SM) - ~~soft, mush~~ loose, orange/brown, moist, fine to med grained trace clay					Temp Well is 5'-10' bgs
	10	Bedrock refusal	HS			2.0	Glacial ~~outwas~~ b.o.b. @ 10' bgs ~~Temp well installed~~

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP18

HTRW DRILLING LOG

DISTRICT: Omaha District

HOLE NUMBER: FTP-DP19

1. COMPANY NAME: URS Corporation

2. DRILLING SUBCONTRACTOR: Saberprobe, Plains Environmental Services

SHEET 1 OF 3 SHEETS

3. PROJECT: Iowa AAP F.S. Data Collection

4. LOCATION: Burlington, Iowa

5. NAME OF DRILLER: Jesse Kalvig

6. MANUFACTURE'S DESIGNATION OF DRILL: GeoProbe

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: A-Rods, MacroCore Sampler

8. HOLE LOCATION: 300500.11'N 2275851.04'E

9. SURFACE ELEVATION: 665.1'

10. DATE STARTED: 10.24.02

11. DATE: 10.24.02

12. OVERBURDEN THICKNESS: 14' bgs

15. DEPTH GROUNDWATER ENCOUNTERED: NA

13. DEPTH DRILLED INTO ROCK: 0

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING: NA

14. TOTAL DEPTH OF HOLE: 14' bgs

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA

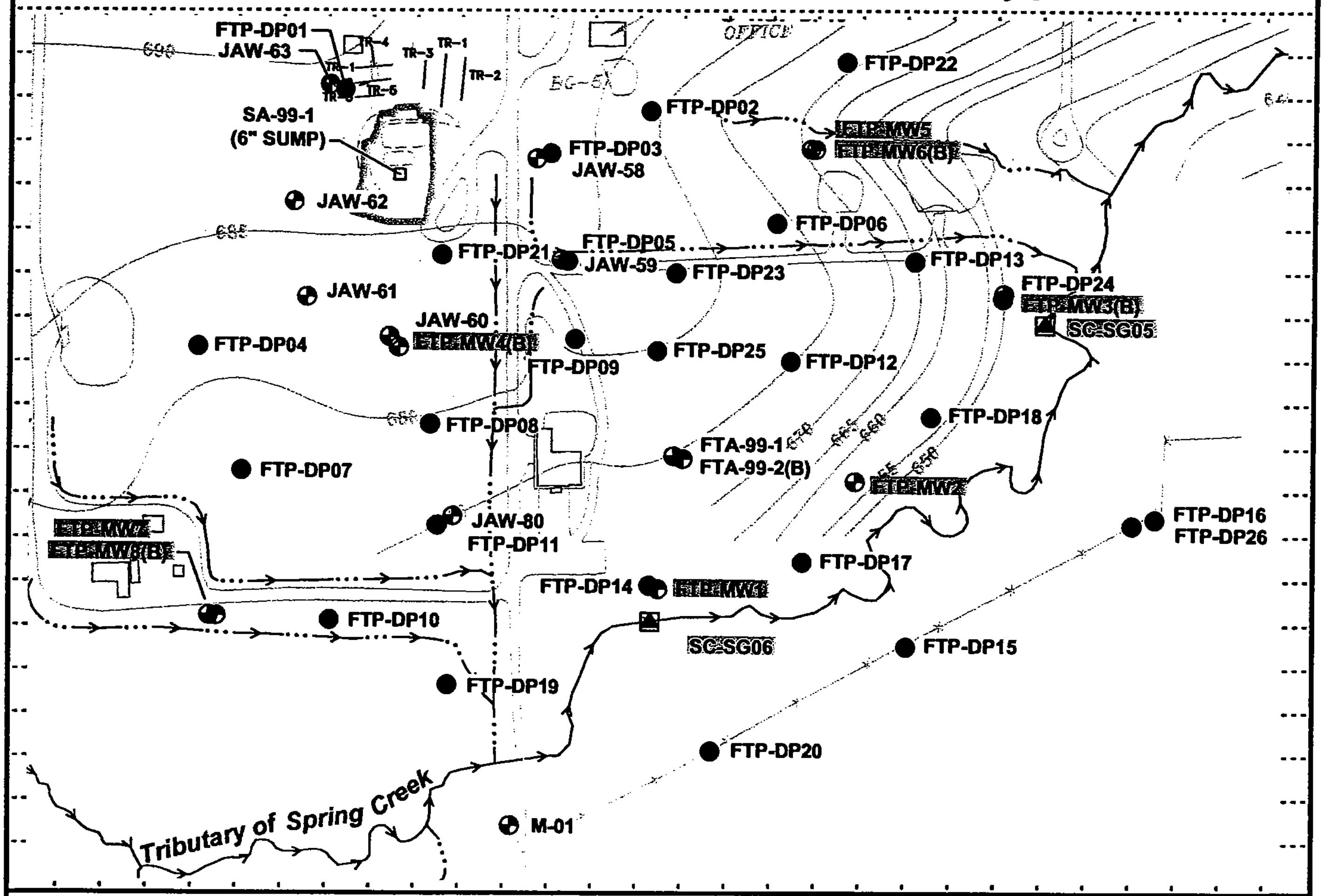
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
—	—	—	—	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		FTP-DP19		

LOCATION SKETCH/COMMENTS

SCALE: 1" = 200'



PROJECT: Iowa AAP F.S. Data Collection

HOLE: FTP-DP19

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NO. FTP-DP19

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 2 OF 3 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW~~ COUNTS PP	REMARKS h.
		Silty CLAY(CCL) - stiff, brown, moist, low plastic, trace root hairs & organics becomes gray w/ orange mottling no organics				2.0	TOPSOIL LOESS
1						4.0	
2		trace calcite concretions becomes very stiff		R= 48/48		6.0	
3		1" fine to med sand seam no root hairs				8.0	
4						8.0	
5		Silty CLAY(CH) - very stiff, gray, moist, med to high plastic, trace calcite concretions & fine sand				4.5	TILL
6				R. 42/48		4.0	
7		Silty CLAY(CL) - very stiff, gray, moist, low plastic, trace calcite concretions & fine sand & orange mottling becomes orange/brown w/ gray mottling				5.0	
8						4.0	
9		Clayey SILT(ML) - very soft, orange/brown w/ gray mottling, moist, low plastic, trace fine to med sand & calcite concretions		R= 40/49	▨	0.0	
10						6.0	

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP19

HTRW DRILLING LOG

HOLE NO. FTP-DP19

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 3 OF 3 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW~~ ~~COU~~NTS DP	REMARKS h.
		SAME;					Till
11				R: 40/48	Ground Water Sample FTP-DP19-14 for VOC's + Freon113 Collected	5.0	
12					10/25/02 T=0905	6.0	
		Silty CLAY (CH) hard, orange/brown, moist, med to high plastic, trace fine to med sand & gray mottling 1" med to coarse sand seam					
13				R: 24/24		9.0	
		1" med to coarse sand seam					Glacial Outwash Temp Well is 9'-14' bgs
14						6.0	
		Bedrock Refusal					b.o.b. @ 14' bgs @ bedrock Installed Temp well

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP19

HTRW DRILLING LOG

DISTRICT: Omaha District

HOLE NUMBER: FTP-DP20

1. COMPANY NAME: URS Corporation

2. DRILLING SUBCONTRACTOR: Saberprobe, Plains Environmental Services

SHEET 1 OF 4 ~~8~~ SHEETS

3. PROJECT: Iowa AAP F.S. Data Collection

4. LOCATION: Burlington, Iowa

5. NAME OF DRILLER: Tom Payton

6. MANUFACTURE'S DESIGNATION OF DRILL: GeoProbe

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: A-Rods, Macro Core Sampler

8. HOLE LOCATION: 300429.27'N 2276145.78'E

9. SURFACE ELEVATION: 670.6'

10. DATE STARTED: 11.20.02

11. DATE: 11.20.02

12. OVERBURDEN THICKNESS: 23' bgs

13. DEPTH DRILLED INTO ROCK: 0

14. TOTAL DEPTH OF HOLE: 23' bgs

15. DEPTH GROUNDWATER ENCOUNTERED: NA

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING: NA

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA

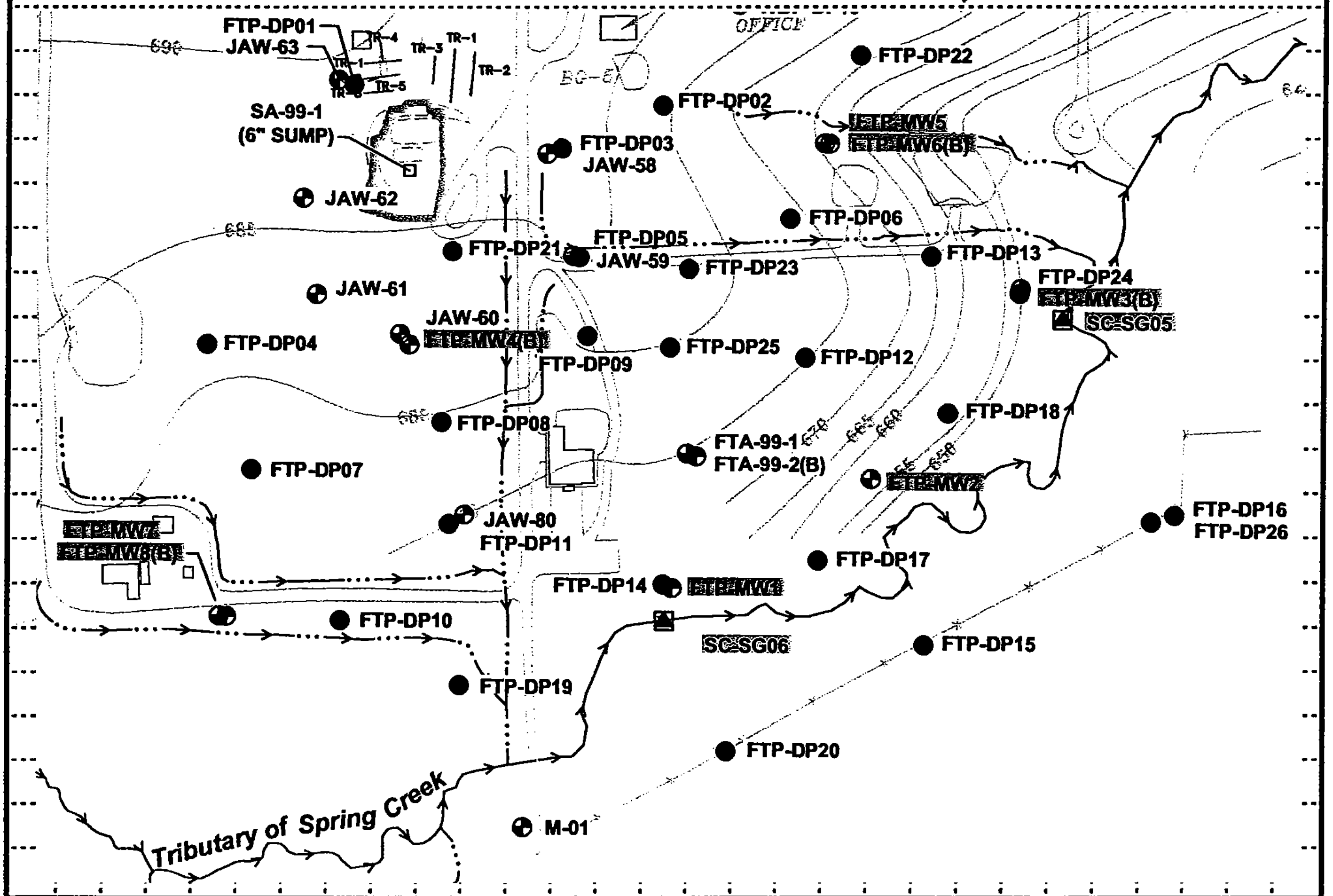
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	NA

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
—	—	—	—	—	—	%

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		X		

LOCATION SKETCH/COMMENTS

SCALE: 1" = 200'



PROJECT: Iowa AAP F.S. Data Collection

HOLE: FTP-DP20

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NO. FTP-DP20

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 2 OF 4 ~~3~~ JC SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW~~ COUNTS PP	REMARKS h.
		Silty CLAY (CL) - stiff, brown, moist, low plastic, trace organics & root hairs				2.0	Top Soil
1		becomes orange/brown & very stiff w/ trace iron staining & black & gray mottling				5.0	Loess
2				R=60/60		6.0	
3		~~bee~~ trace fine to med sand & ~~becomes med plastic~~ JC				4.0	Till
4						6.0	
5			HS-0			5.0	
6							
7							
8							
9							
10							

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP20

HTRW DRILLING LOG

HOLE NO. FTP-DP20

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 3 OF 4

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW~~ COUNTS PP	REMARKS h.
		SAME:				6.0	Till
	11					5.0	
	12					6.0	
		Clayey SILT(ML) - stiff, orange/brown, moist, low plastic, trace fine to coarse sand & fine gravel					
	13					3.0	
	14					3.0	
	15		HS=0			3.0	
	16						
	17						
	18						
	19						
	20						

HTRW DRILLING LOG

HOLE NO. FTP-DP20

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 4 OF 4 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ DP	REMARKS h.
		Clayey SILT (ML) - very stiff, light brown, moist, low to non-plastic, trace angular limestone & fine sand.			Ground Water Sample FTP-DP20-23 For VOC's + Freon 113 Collected 11/21/02 T=1515		Weathered shale/Till
21				R=36/36			
22							
			HS=0				Temp Well is 18'-23' bgs
23		Limestone Bedrock Refusal					b.o.b. @ 23' bgs bedrock
24							
25							
26							
27							
28							
29							
30							

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP20

HTRW DRILLING LOG

DISTRICT: Omaha District

HOLE NUMBER: FTP-DP21

1. COMPANY NAME: URS Corporation

2. DRILLING SUBCONTRACTOR: ~~Saberprobe~~, Plains Environmental Services

SHEET 1 OF 4 SHEETS

3. PROJECT: Iowa AAP F.S. Data Collection

4. LOCATION: Burlington, Iowa

5. NAME OF DRILLER: Jesse Kalvig

6. MANUFACTURE'S DESIGNATION OF DRILL: GeoProbe

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: A-Rods, Macro Core Sampler

8. HOLE LOCATION: 300981.84'N 2275843.51'E

9. SURFACE ELEVATION: 683.7'

10. DATE STARTED: 10.24.02

11. DATE: 10.24.02

12. OVERBURDEN THICKNESS: 30' bgs

15. DEPTH GROUNDWATER ENCOUNTERED: NA

13. DEPTH DRILLED INTO ROCK: 0

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING: NA

14. TOTAL DEPTH OF HOLE: 30' bgs

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA

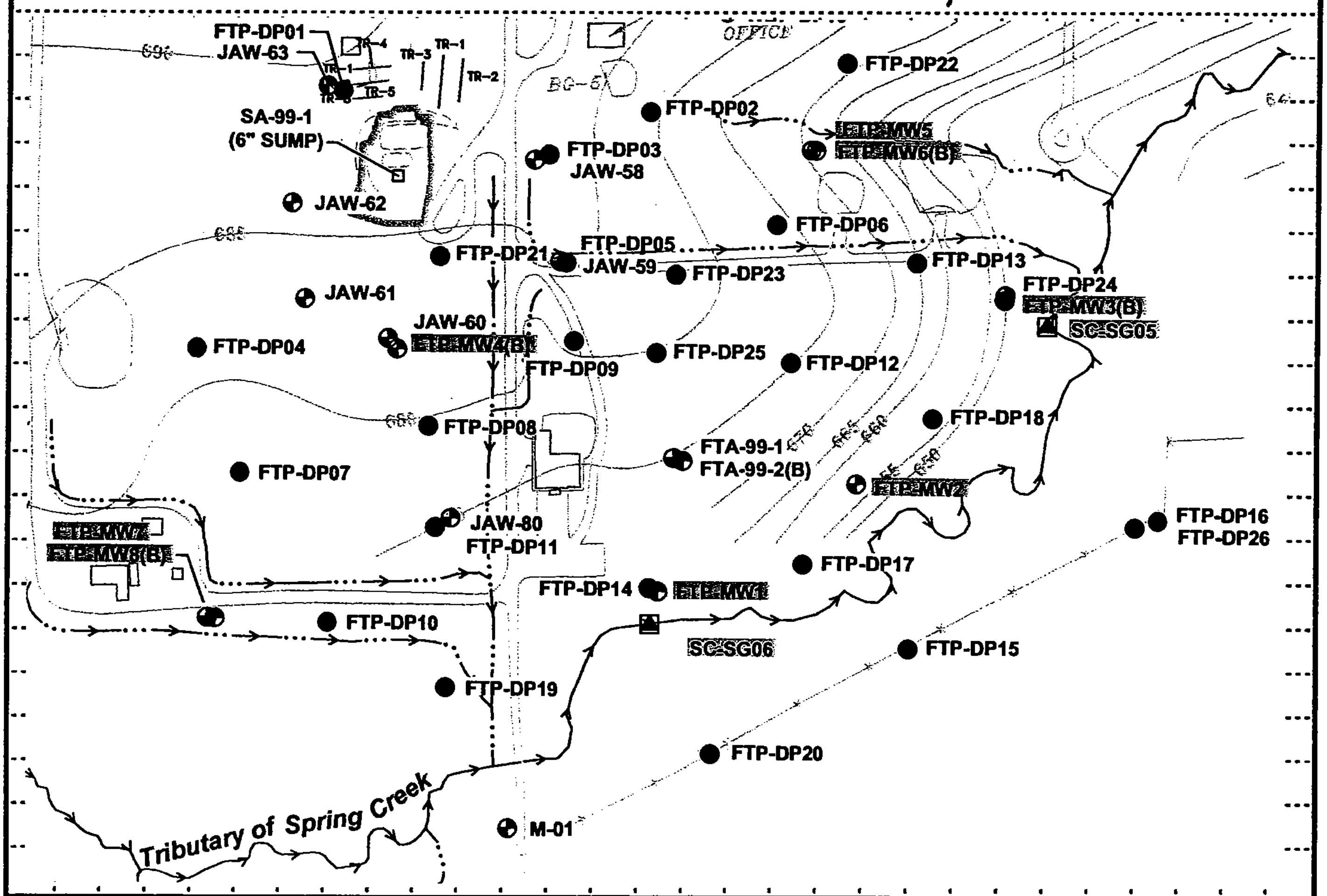
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
—	—	—	—	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		FTP-DP21		

LOCATION SKETCH/COMMENTS

SCALE: 1" = 200'



PROJECT: Iowa AAP F.S. Data Collection

HOLE: FTP-DP21

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NO. FTP-DP21

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 2 OF 4 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW~~ COUNTS PP	REMARKS h.
		~~Silty CLAY (CL).~~ Clayey SILT (ML) - very stiff, brown, moist, low plastic, trace root hairs + organics				8.0	Fill
	1	becomes light brown to gray w/ orange mottling				6.0	loess
				R= 48/48			
	2					7.0	
	3	+ trace black mottling				6.0	
	4		HS= ND			2.0	
	5					0.5	
	6	becomes orange/brown		R= 42/48		0.5	Till
	7					2.0	
	8		HS= ND			2.0	
	9			R= 24/48			
	10						

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP21

HTRW DRILLING LOG

HOLE NO. FTP-DP21

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 3 OF 4 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW~~ COUNTS PP	REMARKS h.
		trace fine to coarse sand				3.0	
11				R=24/48		4.0	Till
12			HS=ND			4.0	
							Not Enough sample
13							
14				R=10/48			
15							
16							
							not enough sample
17							
18				R=4/48			
19							
20							

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP21

HTRW DRILLING LOG

HOLE NO. FTP-DP21

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 4 OF 4 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	BLOW COUNTS g.	REMARKS h.
		~~Sam~~ SAME :					Till
	21	Silty CLAY (CH) - very stiff, light brown to gray, moist, med to high plastic, trace orange & black mottling				4.0	TILL
	22			R=18/48		4.0	
						4.0	
	23						
	24	becomes orange/brown					
	25					4.0	
						4.0	
	26			R=16/36	Ground Water Sample FTP-DP21-30 for VOC's + Freon 113 Collected 10/25/02 T=1020		
	27	trace fine to med sand, & fine gravel				2.0	
	28					2.0	
	29			R=26/36		4.0	
	30	Bedrock refusal				6.0	Temp Well is 25'-30' bgs b.o.b. @ 30' bgs install Temp well

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP21

HTRW DRILLING LOG

DISTRICT: Omaha District

HOLE NUMBER: FTP-DP22

1. COMPANY NAME: URS Corporation

2. DRILLING SUBCONTRACTOR: Saberprobe, ~~Plains Environmental Services~~

SHEET 1 OF 3

3. PROJECT: Iowa AAP F.S. Data Collection

4. LOCATION: Burlington, Iowa

5. NAME OF DRILLER: Tom Payton

6. MANUFACTURE'S DESIGNATION OF DRILL: GeoProbe

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: A-Rod- Macro Core Sampler

8. HOLE LOCATION: 301202.60' N 2276297.39' E

9. SURFACE ELEVATION: 672.1'

10. DATE STARTED: 11.20.02

11. DATE: 11.20.02

12. OVERBURDEN THICKNESS: 19.5' bgs

15. DEPTH GROUNDWATER ENCOUNTERED: 18.5' bgs during drilling

13. DEPTH DRILLED INTO ROCK: 0

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING: NA

14. TOTAL DEPTH OF HOLE: 19.5' bgs

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA

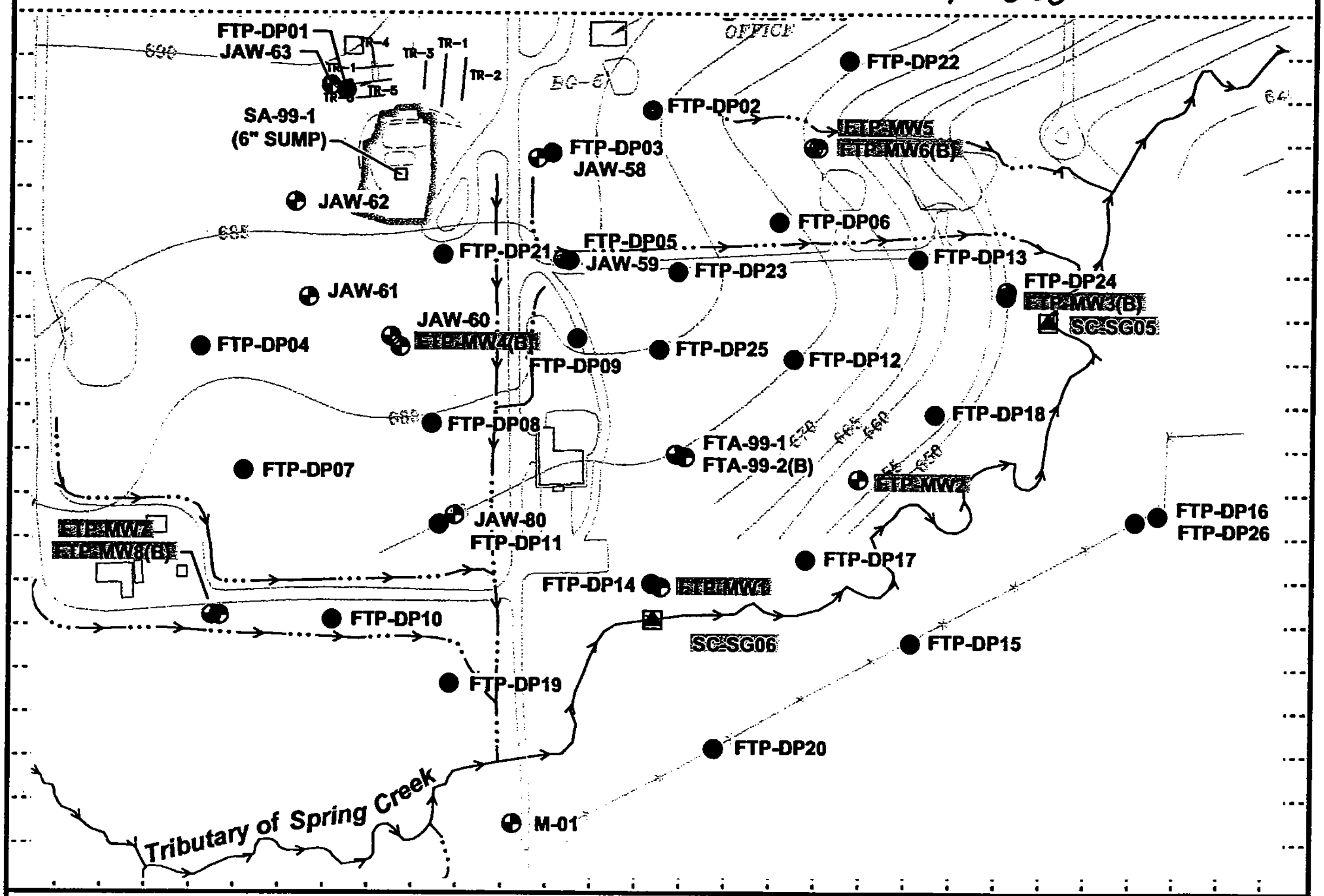
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
—	—	—	—	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		0		

LOCATION SKETCH/COMMENTS

SCALE: 1" = 200'



PROJECT	HOLE
Iowa AAP F.S. Data Collection	FTP-DP22

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NO. FTP-DP22

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 2 OF 3 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ tsf	REMARKS h.
		silty CLAY (CL) - very soft, brown, moist, low plastic, trace organics & root hairs				0	Fill
1						0	
2		becomes orange/brown w/ trace fine to coarse sand				0	- - - - - - TILL
		becomes very stiff					
3						5.0	
4						5.0	
5			HS=0			4.0	
6							
7							
8							
9							
10							

HTRW DRILLING LOG

HOLE NO. FTP-DPZZ

PROJECT: Iowa AAP F.S. Data Collection

INSPECTOR: d. Covey

SHEET 3 OF 3 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ g.	REMARKS h.
		Silty CLAY (CL) - stiff, brown/orange, moist, low plastic, trace fine to coarse sand + gray mottling				4.0	TiLL
	11	becomes very stiff				8.0	
	12					8.0	
				R=60/60			
	13					8.0	
						4.0	
	14	becomes stiff					
						4.0	
			HS=0			~~4.0~~	
	15						
	16						
	17				Ground Water Sample FTP-DP22-20 for VOC's + Freon 113 Collected 11/21/02		
	18						
		Clayey SILT (ML) very soft, brown, wet, low to non-plastic, trace fine to coarse sand			T=1615	ϕ	
	19			R=12/12			
		trace angular limestone				ϕ	Temp Well is 15'-19.5' bgs
	20	Bedrock Refusal					D.o.b. @ 19.5' bgs @ bedrock

PROJECT: Iowa AAP F.S. Data Collection

HOLE NO. FTP-DPZZ

HTRW DRILLING LOG

DISTRICT: Omaha District

HOLE NUMBER: FTP-DP23

1. COMPANY NAME: URS Corporation

2. DRILLING SUBCONTRACTOR: Saberprobe, ~~Plains Environmental Services~~

SHEET 1 OF 4 SHEETS

3. PROJECT: Iowa AAP F.S. Data Collection

4. LOCATION: Burlington, Iowa

5. NAME OF DRILLER: TOM PAYTON

6. MANUFACTURE'S DESIGNATION OF DRILL: GeoProbe

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: A-Rods, MacroCore Sampler

8. HOLE LOCATION: 300963.95'N 2276105.72'E

9. SURFACE ELEVATION: 677.4'

10. DATE STARTED: 11.20.02

11. DATE: 11.20.02

12. OVERBURDEN THICKNESS: 25' bgs

15. DEPTH GROUNDWATER ENCOUNTERED: 21.0' bgs during drilling

13. DEPTH DRILLED INTO ROCK: Ø

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING: NA

14. TOTAL DEPTH OF HOLE: 25' bgs

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA

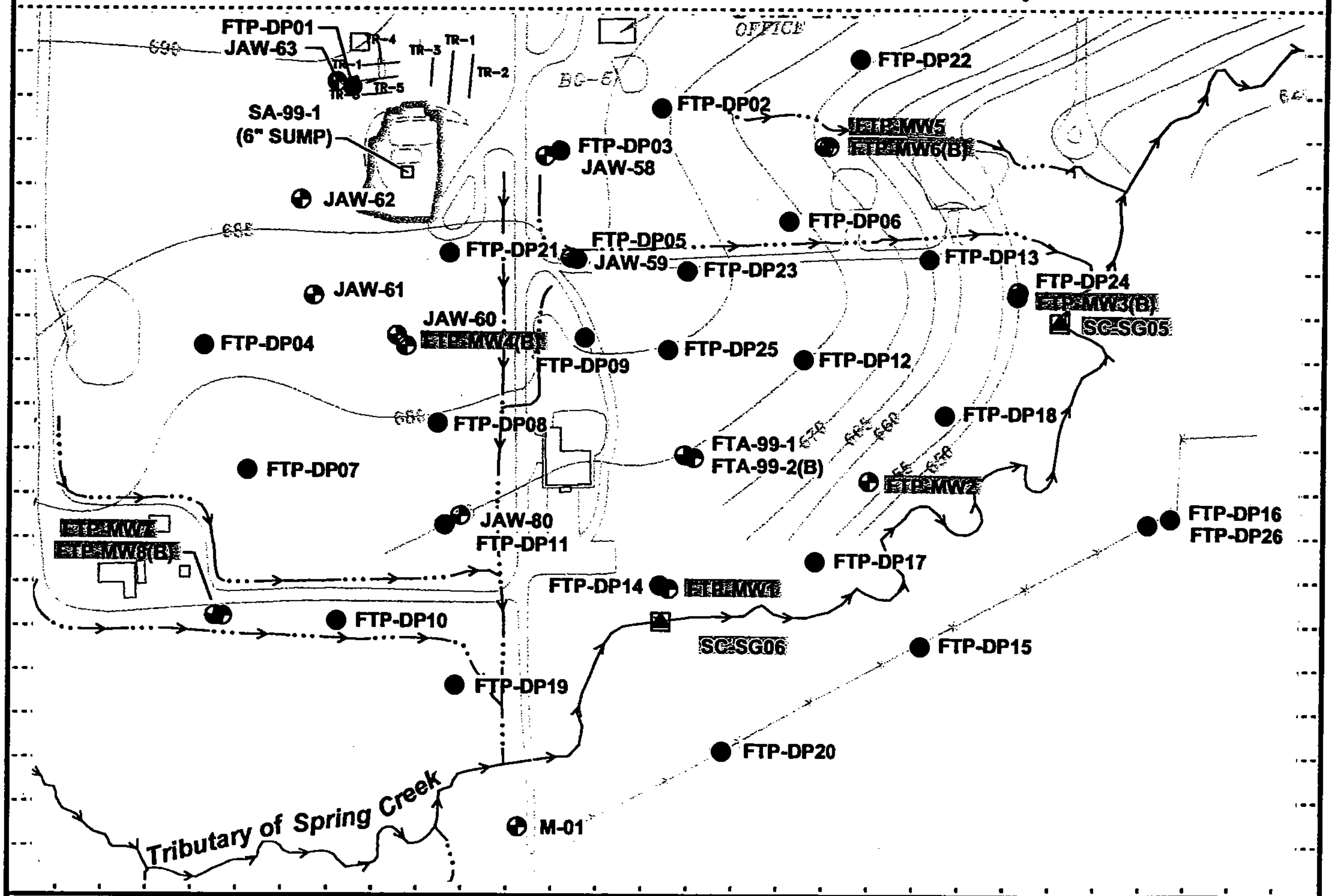
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
NA	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	—	—	—	—	—	%

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		X		

LOCATION SKETCH/COMMENTS

SCALE: 1" = 200'



PROJECT: Iowa AAP F.S. Data Collection

HOLE: FTP-DP23

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NO. FTP-DP23

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 2 OF 4 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW~~ COUNTS PP	REMARKS h.
		Silty CLAY (CL) - very stiff, light brown, moist, low plastic, trace root hairs.				5.0	FILL
	1	becomes stiff				4.0	
	2			R=60/60		3.0	
	3					3.0 ~~3.0~~	
	4					3.0	
	5		HS:0			3.0	
	6						Till
	7						
	8						
	9						
	10						

HTRW DRILLING LOG

HOLE NO. FTP-DP23

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 3 OF 4

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ PP g.	REMARKS h.
		Silty CLAY (CL) - stiff, orange/brown, moist, low plastic, trace fine to coarse sand & fine gravel & gray mottling			4.0 →		TILL
	11				3.0 →		
	12	1" seam w/ some gravel		R=60/60	3.0 →		
	13	becomes very stiff			6.0 →		
	14				5.0 →		
	15		HS=0		6.0 →		
	16			R=60/60		6.0	
	17					8.0	
	18	becomes stiff				6.0	
	19	~~be~~				2.0	
	20					2.0	

HTRW DRILLING LOG

PROJECT Iowa AAP F.S. Data Collection	INSPECTOR J. Corey	HOLE NO. FTP-DP23 SHEET 4 OF 4 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW~~ COUNTS Pp	REMARKS h.
		SAME: w/ some fine sand				2.0	Till
	21	silty SAND(SM) loose, orange/brown, ~~moist~~ wet, fine to med grained			Ground Water Sample FTP-DP23-25	3.0	
	22	silty CLAY(CL) - very stiff, orange/brown, moist, low plastic, fine to coarse sand		R=60/60	for Explosives + VOC's + Freon113	6.0	
	23				Collected 11/21/02 T=1545	6.0	
	24				+ 11/22/02 T=1315 Duplicate 10 (VOC's) + Freon 113)	9.0+	
			HS=0			8.0	Temp Well is 20'-25' bgs
	25	Bedrock Refusal					b.o.b. @ 25' bgs
	26						
	27						
	28						
	29						
	30						

PROJECT Iowa AAP F.S. Data Collection	HOLE NO. FTP-DP23

HTRW DRILLING LOG

DISTRICT: Omaha District

HOLE NUMBER: FTP-DP24

1. COMPANY NAME: URS Corporation

2. DRILLING SUBCONTRACTOR: Saberprobe, Plains Environmental Services

SHEET 1 OF 2 SHEETS

3. PROJECT: Iowa AAP F.S. Data Collection

4. LOCATION: Burlington, Iowa

5. NAME OF DRILLER: Tom Payton

6. MANUFACTURE'S DESIGNATION OF DRILL: GeoProbe

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4 Rod, MacroCore Sampler

8. HOLE LOCATION: 300938.78'N 2276472.81'E

9. SURFACE ELEVATION: 654.53'

10. DATE STARTED: 11.20.02

11. DATE: 11.20.02

12. OVERBURDEN THICKNESS:

15. DEPTH GROUNDWATER ENCOUNTERED: 5.5' bgs during drilling

13. DEPTH DRILLED INTO ROCK: 1.1' ~~bgs~~ ATC

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING:

14. TOTAL DEPTH OF HOLE: 7.0' bgs

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):

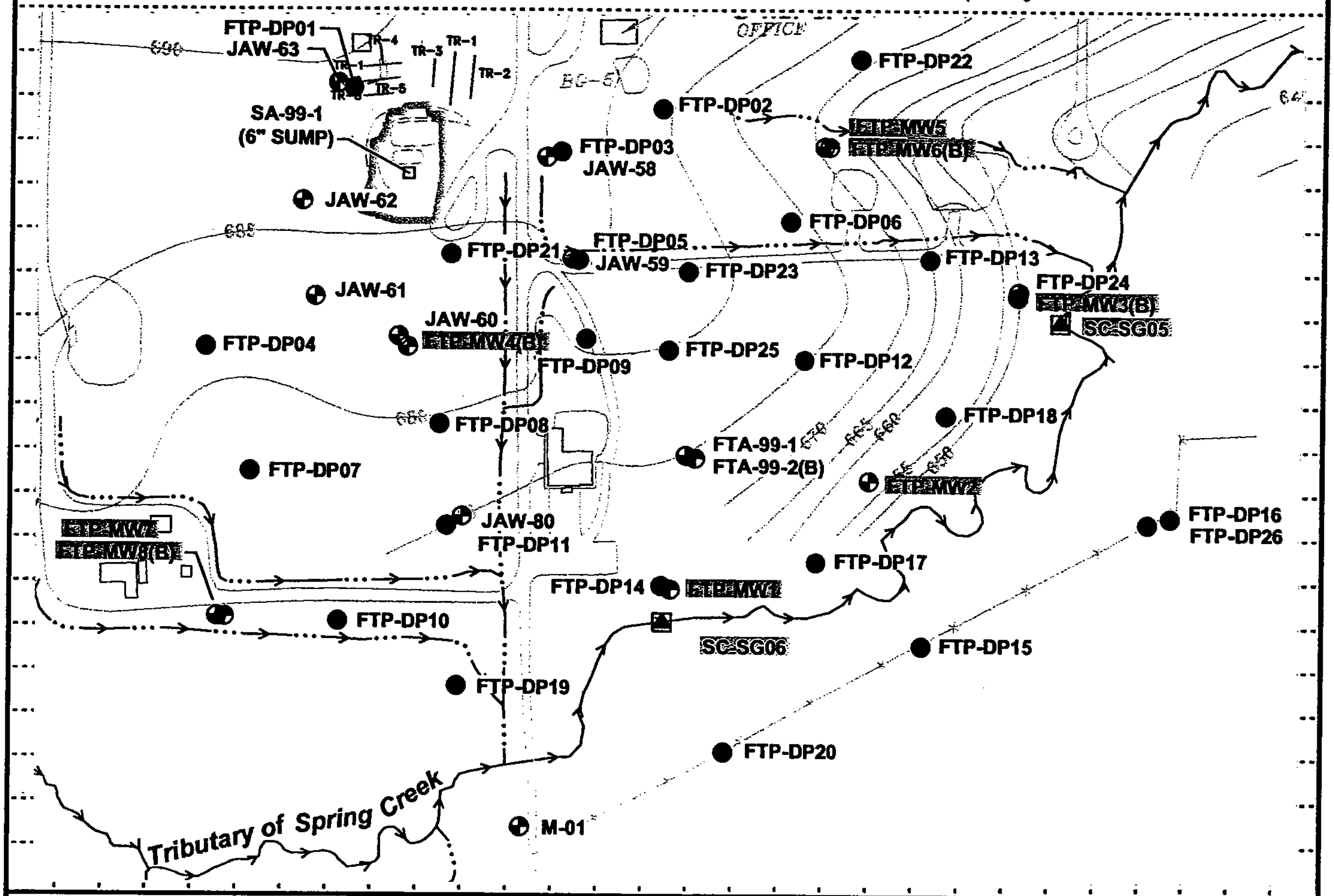
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
						%

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		X		

LOCATION SKETCH/COMMENTS

SCALE: 1" = 200'



PROJECT: Iowa AAP F.S. Data Collection

HOLE: FTP-DP24

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NO. FTP-DP24

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 2 OF 2 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ PP	REMARKS h.
		Silty CLAY (CL) - stiff, brown, moist, low plastic, trace root hairs				3.0	Topsoil
	1					2.0	
	2	trace iron staining + black mottling				5.0	Till
				R=60/60			
	3				Ground Water Sample FTP-DP24-07 for Explosives + VOC's + Freon113 Collected 11/22/02 T=1350 + 11/24/02 T=1410	5.0	
	4					3.0	
	5		HS=0			3.0	
		wet					Glacial outwash
	6	Clayey SILT/weathered shale, white		R=18/18		NA	weathered bedrock Temp Well is 2'-7' bgs
	7	Refusal on Bedrock.					b.o.b. @ 7' bgs
	8						
	9						
	10						

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP24

HTRW DRILLING LOG

DISTRICT: Omaha District

HOLE NUMBER: FTP-DP25

1. COMPANY NAME: URS Corporation

2. DRILLING SUBCONTRACTOR: Saberprobe, ~~Plains Environmental Services~~

SHEET 1 OF 4 SHEETS

3. PROJECT: Iowa AAP F.S. Data Collection

4. LOCATION: Burlington, Iowa

5. NAME OF DRILLER: Tom Payton

6. MANUFACTURE'S DESIGNATION OF DRILL: GeoProbe

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: A-Rods, MacroCore Sampler

8. HOLE LOCATION: 300876.76'N 2276084.78'E

9. SURFACE ELEVATION: 674.9'

10. DATE STARTED: 11.20.02

11. DATE: 11.20.02

12. OVERBURDEN THICKNESS: 22' bgs

15. DEPTH GROUNDWATER ENCOUNTERED: 20' bgs during drilling

13. DEPTH DRILLED INTO ROCK: ϕ

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING: NA

14. TOTAL DEPTH OF HOLE: 22' bgs

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA

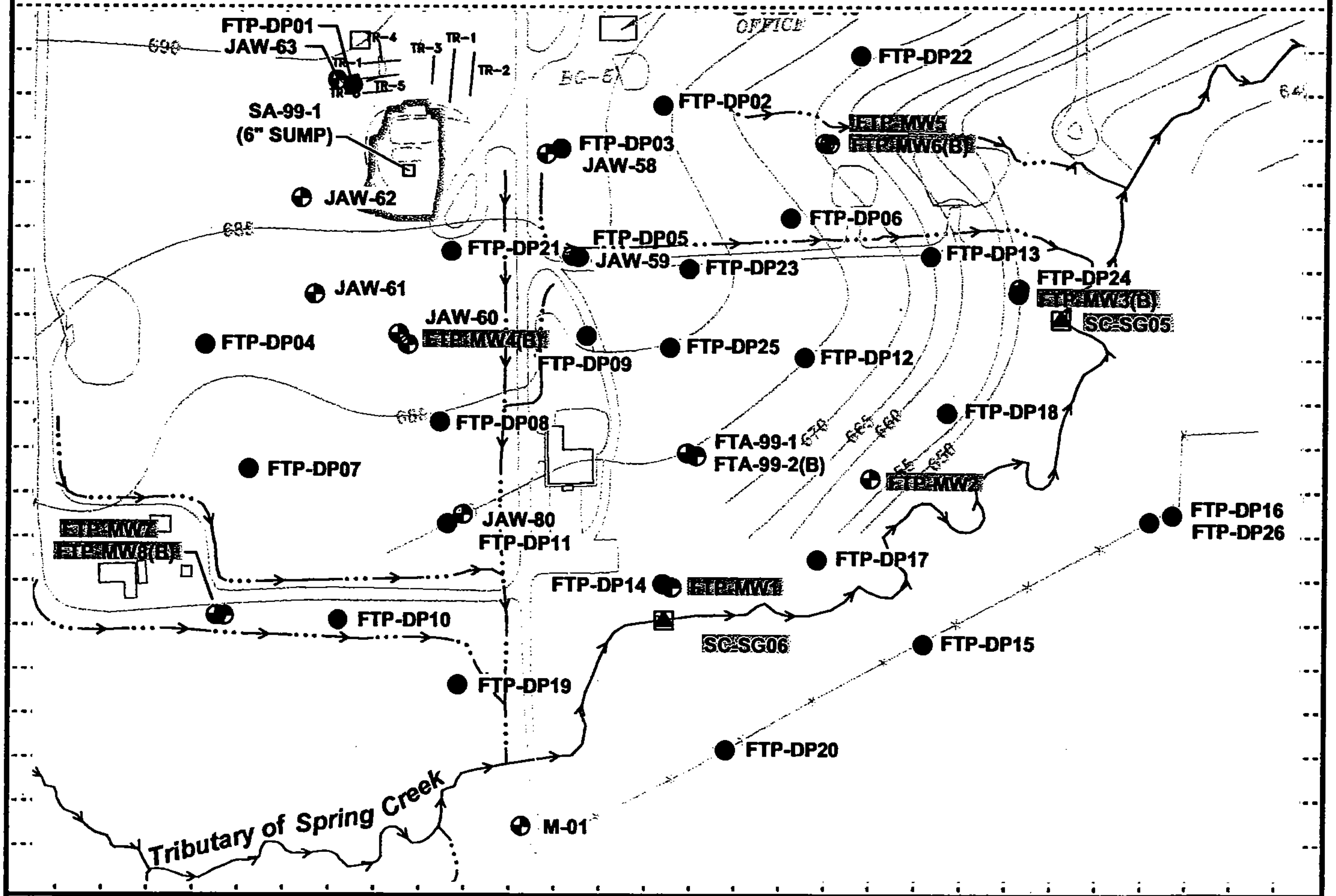
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
—	—	—	—	—	—	%

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		X		

LOCATION SKETCH/COMMENTS

SCALE: 1" = 200'



PROJECT: Iowa AAP F.S. Data Collection

HOLE: FTP-DP25

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NO. FTP-DP25

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 2 OF 4 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW COUNTS~~ PP	REMARKS h.
		silty CLAY (CL) - stiff, brown, moist, low plastic, trace root hairs & organics				3.0	Top Soil
		becomes orange/brown					
1						3.0	
2						4.0	
		becomes very stiff		R=60/60		5.0	Till
3							
4						6.0	
5						5.0	
6							
7							
8							
9							
10							

HTRW DRILLING LOG

HOLE NO. FTP-DP25

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 3 OF 4 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c. very stiff	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW~~ COUNTS PP g.	REMARKS h.
		Silty CLAY (CH) - ~~hard~~, orange/brown moist, ~~high~~ plastic, trace fine to coarse sand + gray mottling				~~[illegible]~~ 6.0	TILL
		~~hard~~ becomes hard				8.0	
	11	becomes gray ~~w/ orange mottling~~ JLC					
				R = 60/60		8.0	
	12	becomes orange/brown w/ gray mottling					
						8.0	
	13						
						8.0	
	14						
						8.0	
	15						
	16						
	17				Ground Water Sample FTP-DP25-22 for Explosives + VOC's + Freon 113 Collected 11/22/02 T= 1335 + T= 1545		
	18						
	19						
	20						

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP25

HTRW DRILLING LOG

HOLE NO. FTP-DP25

PROJECT: Iowa AAP F.S. Data Collection

INSPECTOR: J. Covey

SHEET 4 OF 4 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	~~BLOW~~ COUNTS PID	REMARKS h.
		~~SA~~ Silty SAND(SM) - loose, orange/brown, wet, fine grained			Duplicate 11 (VOC's) + (Freon 113)		Till
		Clayey SILT (ML) - very stiff, orange/brown, moist, low plastic, trace fine to coarse sand					
	21					7.0	
	22					7.0	Temp Well is 17'-22' bgs
		Bedrock refusal					b.o.b. @ 22' bgs

PROJECT: Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP25

HTRW DRILLING LOG

DISTRICT: Omaha District

HOLE NUMBER: FTP-DP26

SHEET 1 OF 4 SHEETS

1. COMPANY NAME: URS Corporation

2. DRILLING SUBCONTRACTOR: Saberprobe, Plains Environmental Services

3. PROJECT: Iowa AAP F.S. Data Collection

4.LOCATION: Burlington, Iowa

5. NAME OF DRILLER: Tom Payton

6. MANUFACTURE'S DESIGNATION OF DRILL: GeoProbe

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: A-Rod, 4" flight Augers

8. HOLE LOCATION: 300686.27'N 2276617.12'E

9. SURFACE ELEVATION: 663.9'

10. DATE STARTED: 11.23.02

11. DATE: 11.23.02

12. OVERBURDEN THICKNESS: 14'

13. DEPTH DRILLED INTO ROCK: 9'

14. TOTAL DEPTH OF HOLE: 23' bgs

15. DEPTH GROUNDWATER ENCOUNTERED: NA

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING: NA

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA

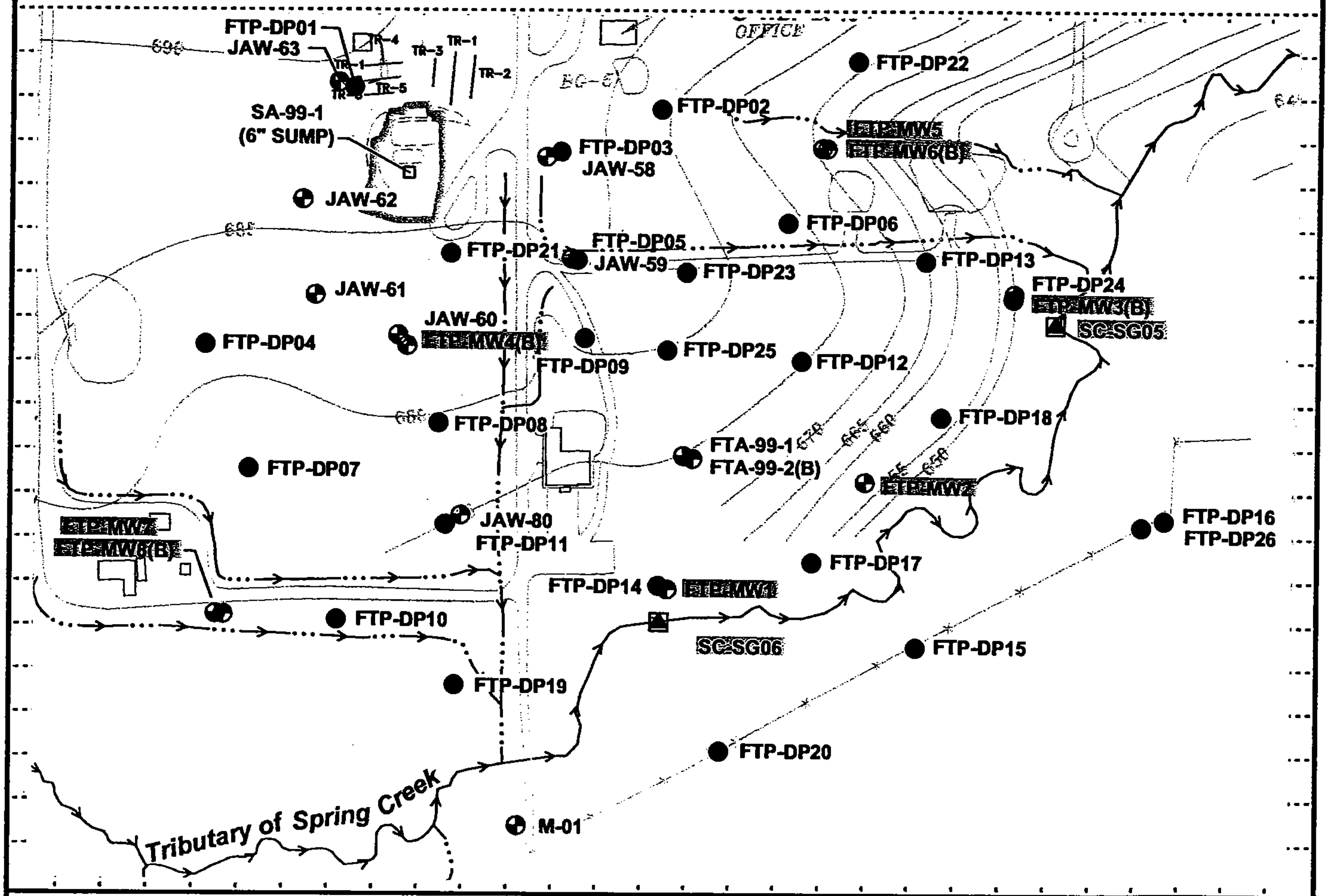
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	NA

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
—	—	—	—	—	—	%

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		X		

LOCATION SKETCH/COMMENTS

SCALE: 1" = 200'



PROJECT: Iowa AAP F.S. Data Collection

HOLE: FTP-DP26

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NO. FTP-DP26

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 2 OF 4 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	BLOW COUNTS g.	REMARKS h.
		silty CLAY (CL) - brown, med stiff, moist, low plastic					See FTP-DP16 for description of materials
	1						
	2						
	3						
	4						
	5						
	6						
	7						
	8						
	9						
	10						

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP26

HTRW DRILLING LOG

HOLE NO. FTP-DP26

PROJECT Iowa AAP F.S. Data Collection

INSPECTOR J. Covey

SHEET 3 OF 4 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	BLOW COUNTS g.	REMARKS h.
	11						See FTP-DP16 for description of materials
	12						
	13						
	14	Limestone					Bedrock
	15	interbedded shale					
	16						
	17						
	18				▨		
	19				▨		
	20				▨		

PROJECT Iowa AAP F.S. Data Collection

HOLE NO. FTP-DP26

HTRW DRILLING LOG

HOLE NO.	FTP-DP26
PROJECT	Iowa AAP F.S. Data Collection
INSPECTOR	J. Covey
SHEET	4 OF 4 SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	BLOW COUNTS g.	REMARKS h.
		SAME:			Ground Water Sample FTP-DP26-23 for Explosives + VOC's + Freon 113 Collected 11/25/02 T= 1000 + 11/26/02 T=0945		
	21						
	22						
	23						Temp Well is 18'-23' bgs b.o.b. @ 23' bgs
	24						
	25						
	26						
	27						
	28						
	29						
	30						

	PROJECT Iowa AAP F.S. Data Collection	HOLE NO. FTP-DP26

Monitoring Well Installation

HTRW DRILLING LOG

	DISTRICT Omaha District	HOLE NUMBER FTP-MW1
1. COMPANY NAME ***URS Corporation***	2. DRILLING CONTRACTOR Aquadrill	SHEET 1 OF SHEETS 3

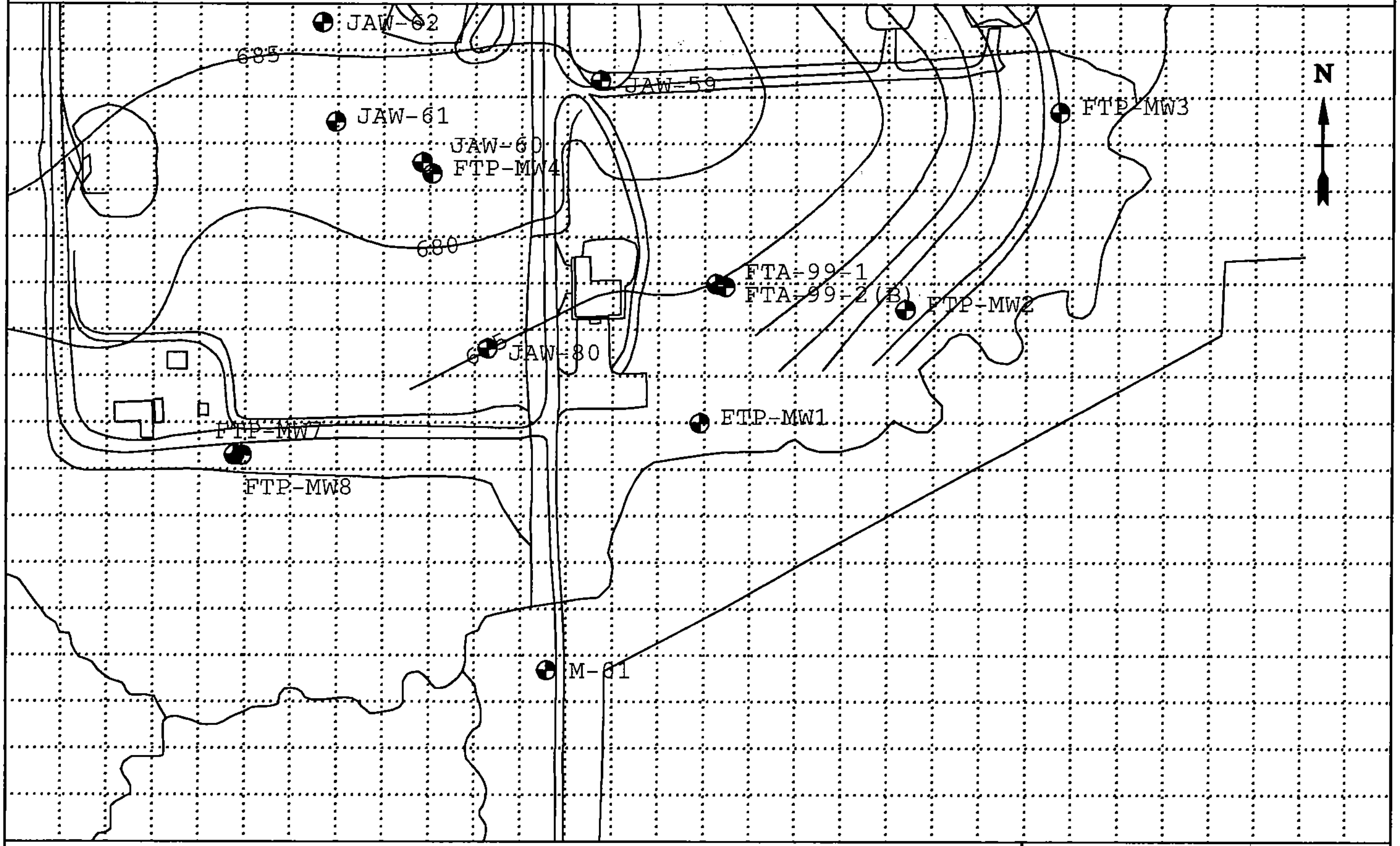
3. PROJECT IAAAP F.S. DATA COLLECTION - FTP	4. LOCATION Burlington, IA
5. NAME OF DRILLER Denis Auld	6. MANUFACTURER'S DESIGNATION OF DRILL Gus Pech GP1000AR
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 5' Laskey sampler with liners, 3" stainless steel split-spoon, 6 5/8" ID HSAs, 6" nominal diameter tricone rotary bit	8. HOLE LOCATION 91,626.060m N 693,752.480m E 300,609.83N 2,276,086.26E
	9. SURFACE ELEVATION 657.6' 659.83' (TOC)
	10. DATE STARTED 3/25/03 · 11. DATE COMPLETED 3/25/03
12. OVERBURDEN THICKNESS 5.5'	15. DEPTH GROUNDWATER ENCOUNTERED 4.7'
13. DEPTH DRILLED INTO ROCK 10.5'	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA
14. TOTAL DEPTH OF HOLE 16'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA

18. GEOTECHNICAL SAMPLES (TESTED)	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
1	0	1	NA

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
1	NA	NA	TOC = 1 (Soil)	NA	NA	NA %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
FTP-MW1	NA	X	NA	M. Sonderman

LOCATION SKETCH/COMMENTS SCALE: 1" = 200'



PROJECT IAAAP F.S. DATA COLLECTION - FTP Burlington, IA	**HOLE NO.** FTP-MW1

HTRW DRILLING LOG (CONTINUATION SHEET)

PROJECT	IAAAP F.S. DATA COLLECTION - FTP Burlington, IA	INSPECTOR	M. Sonderman
HOLE NUMBER	FTP-MW1	SHEET 2 OF 3 SHEETS	

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
657.6	0	Sandy CLAY (CL) - Soft, moist, brown and dark brown, low plastic, fine-grained Sand, with organics					Glacial Till
							BG = Background BZ = Breathing Zone R = Recovery T = Time
656.6	1						
		With iron staining	BG & BZ PID = 0				
655.6	2					NA	
		Becomes dark brown to black					
654.6	3						
		Becomes dark gray-black and gray mottled, low to medium plastic					
653.6	4			Geo	TOC = 1.6	Laskey	T = 0950 ▼ ATD
	▼						
652.6	5						R = 55/58
		LIMESTONE - Light gray, weathered					Taped hole at 5.5' bgs. Bedrock Drilled out with augers to rock.
651.6	6						
650.6	7						Advanced augers to 7.0' bgs. Then switched to air rotary. Air pressure = 75 psi Rig hydraulic pressure = 600-700 lbs.
649.6	8						
648.6	9						
647.6	10						

PROJECT IAAAP F.S. DATA COLLECTION - FTP Burlington, IA	**HOLE NO.** FTP-MW1

ENG FORM 5056A-R, AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG (CONTINUATION SHEET)

PROJECT IAAAP F.S. DATA COLLECTION - FTP Burlington, IA	INSPECTOR M. Sonderman	HOLE NUMBER FTP-MW1 SHEET 3 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
647.6	10	SAME: LIMESTONE - Light gray, weathered					Bedrock Logged from cuttings
646.6	11	Becomes weathered, with brown Clay					Drilling becomes easier.
645.6	12						
644.6	13	Becomes Shaley, gray to dark gray, soft, dry					Cuttings go from wet to completely dry.
643.6	14						
642.6	15						Screened interval for FTP-MW1 is 5.5' to 15.5' bgs.
641.6	16						B.O.B. @ 16.0' bgs
640.6	17						
639.6	18						
638.6	19						
637.6	20						

PROJECT IAAAP F.S. DATA COLLECTION - FTP Burlington, IA

HOLE NO. FTP-MW1

HTRW DRILLING LOG

DISTRICT: Omaha District

HOLE NUMBER: FTP-MW2

1. COMPANY NAME: ***URS Corporation***

2. DRILLING CONTRACTOR: Aquadrill

SHEET 1 OF 3 SHEETS

3. PROJECT: IAAAP F.S. DATA COLLECTION - FTP

4. LOCATION: Burlington, IA

5. NAME OF DRILLER: Jay Joslyn

6. MANUFACTURER'S DESIGNATION OF DRILL: Mobile B-57 ORV

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' Laskey sampler with liners, 6 5/8" ID HSAs, 6" nominal diameter tricone rotary bit

8. HOLE LOCATION: 91,663.270m N 693,820.150m E
300,731.91N 2,276,308.27E

9. SURFACE ELEVATION: 660.8' 663.18' (TOC)

10. DATE STARTED: 4/14/03

11. DATE COMPLETED: 4/15/03

12. OVERBURDEN THICKNESS: 7.2'

13. DEPTH DRILLED INTO ROCK: 10.2'

14. TOTAL DEPTH OF HOLE: 17.4'

15. DEPTH GROUNDWATER ENCOUNTERED: 7.0'

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA

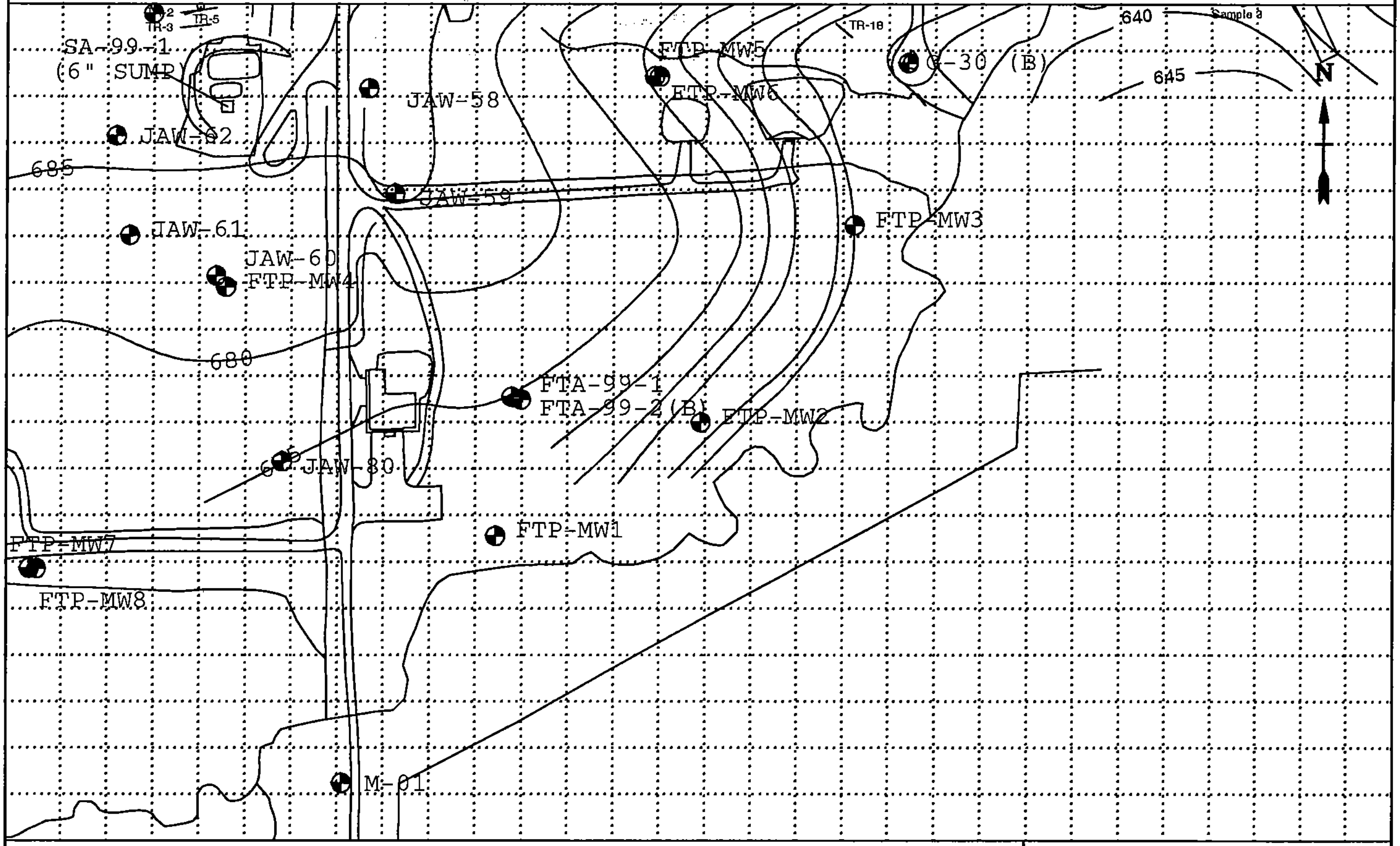
18. GEOTECHNICAL SAMPLES (TESTED)	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
1	0	1	NA

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
1	NA	NA	TOC = 1 (Soil)	NA	NA	NA %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
FTP-MW2	NA	X	NA	M. Sonderman

LOCATION SKETCH/COMMENTS

SCALE: 1" = 200'



PROJECT: IAAAP F.S. DATA COLLECTION - FTP Burlington, IA

HOLE NO. FTP-MW2

ENG FORM 5056-R, AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER	FTP-MW2
PROJECT	IAAAP F.S. DATA COLLECTION - FTP Burlington, IA
INSPECTOR	M. Sonderman
SHEET 2 OF 4 SHEETS	

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
660.8	0	Silty CLAY (CL) - Stiff, moist, dark brown, low plastic, with Sand and organics				2ksf	Topsoil
659.8	1					2ksf	R = Recovery T = Time BG = Background BZ = Breathing Zone HS = Head Space FID = Flame Ionization Detector
			BG/FID = 0 BZ = ND HS = ND				
658.8	2						
		Silty CLAY (CL) - Medium stiff, moist, dark brown with faint gray mottling, low plastic, with Sand					Shallow Weathered Glacial Till
657.8	3					2ksf	
656.8	4	Gray mottling more pronounced				2ksf	
655.8	5	With iron staining				Laskey	R=55/60
						2ksf	
654.8	6		BZ = ND HS = ND		TOC = 0.28	2ksf	
				Geo		1.5ksf	T = 1638 R = 27/27
653.8 ▼	7	Becomes wet, with Sand, coarse-grained Limestone pieces				Laskey	▼ ATD 4/14/03 stopped at bedrock. 4/15/03 resumed drilling with 6" tricone rotary wash. Bedrock
		LIMESTONE - Whitish-gray, highly weathered					
652.8	8	With fossil fragments					Logged from cuttings
651.8	9						
650.8	10						

PROJECT IAAAP F.S. DATA COLLECTION - FTP Burlington, IA

HOLE NO. FTP-MW2

ENG FORM 5056A-R, AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: FTP-MW2

PROJECT: IAAAP F.S. DATA COLLECTION - FTP
Burlington, IA

INSPECTOR: M. Sonderman

SHEET 3 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
650.8	10	SAME: LIMESTONE - Whitish-gray, highly weathered					Bedrock Logged from cuttings
649.8	11						
648.8	12						
		Thin Shale seam					Driller noted easier drilling.
647.8	13	Becomes bluish-gray, weathered					Driller notes harder drilling.
646.8	14						
645.8	15						
644.8	16						
643.8	17						Screened Interval for FTP-MW2 is 6.9' to 16.9' bgs.
							B.O.B. @ 17.4' bgs
642.8	18						
641.8	19						
640.8	20						

PROJECT IAAAP F.S. DATA COLLECTION - FTP Burlington, IA

HOLE NO. FTP-MW2

HTRW DRILLING LOG

HTRW DRILLING LOG	DISTRICT Omaha District	HOLE NUMBER FTP-MW3
1. COMPANY NAME ***URS Corporation***	2. DRILLING CONTRACTOR Aquadrill	SHEET 1 OF 4 SHEETS

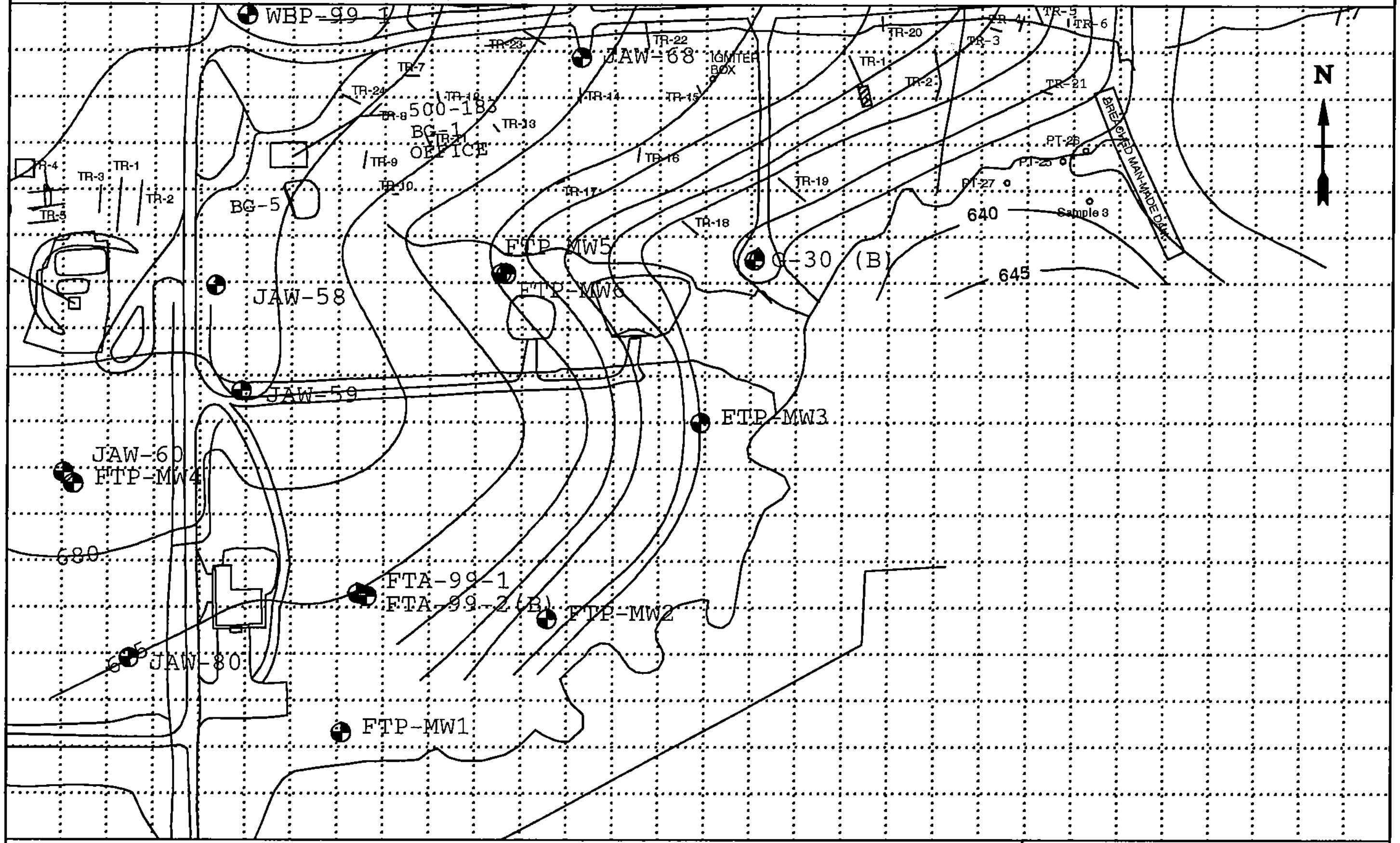
3. PROJECT IAAAP F.S. DATA COLLECTION - FTP	4. LOCATION Burlington, IA
5. NAME OF DRILLER Jay Joslyn	6. MANUFACTURER'S DESIGNATION OF DRILL Mobile B-57 ORV
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 5' Laskey sampler with liners, 6 5/8" ID HSAs, 6" air percussion hammer bit	8. HOLE LOCATION 91,727.920m N 693,870.650m E 300,944.02N 2,276,473.95E
	9. SURFACE ELEVATION 655.0' 657.46' (TOC)
	10. DATE STARTED 4/15/03 11. DATE COMPLETED 4/15/03
12. OVERBURDEN THICKNESS 5.75'	15. DEPTH GROUNDWATER ENCOUNTERED 13.5'
13. DEPTH DRILLED INTO ROCK 15.25'	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA
14. TOTAL DEPTH OF HOLE 21'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA

18. GEOTECHNICAL SAMPLES (TESTED)	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
1	0	1	NA

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
1	NA	NA	TOC = 1 (Soil)	NA	NA	NA %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
FTP-MW3	NA	X	NA	M. Sonderman

LOCATION SKETCH/COMMENTS SCALE: 1" = 200'



PROJECT IAAAP F.S. DATA COLLECTION - FTP Burlington, IA	**HOLE NO.** FTP-MW3

ENG FORM 5056-R, AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: FTP-MW3

PROJECT: IAAAP F.S. DATA COLLECTION - FTP
Burlington, IA

INSPECTOR: M. Sonderman

SHEET 2 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
655.0	0	Silty CLAY (CL) - Medium stiff, moist, brown to dark brown, low plastic, with Sand and organics				1.5ksf	Topsoil
							R = Recovery T = Time BG = Background BZ = Breathing Zone HS = Head Space
654.0	1						
						5ksf	
		CLAY (CH) - Stiff, brownish-gray and dark brown mottled, high plastic, with Sand and iron nodules	BG = 0 BZ = 0 HS = 0				Shallow Weathered Glacial Till
653.0	2						
						3ksf	
652.0	3						
						3ksf	
651.0	4						
		Becomes yellowish-brown to brown and gray mottled		Geo	TOC = 0.23	5ksf	
							T = 1320
650.0	5					Laskey	R=60/60
						9ksf 9ksf	
		SHALE - Gray, fissile, highly weathered				Laskey	R = 9/9 Bedrock
		LIMESTONE - Whitish-gray, highly weathered					
649.0	6						Logged from cuttings.
648.0	7						
647.0	8						
646.0	9	Becomes Crystalline, slightly weathered to unweathered					
645.0	10						

PROJECT IAAAP F.S. DATA COLLECTION - FTP Burlington, IA

HOLE NO. FTP-MW3

ENG FORM 5056A-R, AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER	FTP-MW3
PROJECT	IAAAP F.S. DATA COLLECTION - FTP Burlington, IA
INSPECTOR	M. Sonderman
SHEET	3 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
645.0	10	SAME: LIMESTONE - Whitish-gray, crystalline, slightly weathered					Bedrock Logged from cuttings.
644.0	11						
643.0	12	SHALE - Gray, fissile, weathered					
642.0	13						
	▼	LIMESTONE - Shaley, brownish-gray to gray, weathered, with occasional Shale stringers					▼ ATD
641.0	14						
640.0	15						
639.0	16						
638.0	17						
637.0	18						
636.0	19						
635.0	20						

PROJECT	IAAAP F.S. DATA COLLECTION - FTP Burlington, IA
HOLE NO.	FTP-MW3

ENG FORM 5056A-R, AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG (CONTINUATION SHEET)

PROJECT IAAAP F.S. DATA COLLECTION - FTP Burlington, IA	INSPECTOR M. Sonderman	HOLE NUMBER FTP-MW3	SHEET 4 OF SHEETS 4

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
635.0	20	SAME: LIMESTONE - Shaley, brownish-gray to gray, weathered					Bedrock Logged from cuttings. Screened interval for FTP-MW3 is 10.5' to 20.5' bgs.
634.0	21						B.O.B. @ 21.0' bgs
633.0	22						
632.0	23						
631.0	24						
630.0	25						
629.0	26						
628.0	27						
627.0	28						
626.0	29						
625.0	30						

PROJECT IAAAP F.S. DATA COLLECTION - FTP Burlington, IA **HOLE NO.** FTP-MW3

HTRW DRILLING LOG

DISTRICT: Omaha District

HOLE NUMBER: FTP-MW4

1. COMPANY NAME: ***URS Corporation***

2. DRILLING CONTRACTOR: Aquadrill

SHEET 1 OF 8 SHEETS

3. PROJECT: IAAAP F.S. DATA COLLECTION - FTP

4. LOCATION: Burlington, IA

5. NAME OF DRILLER: Denis Auld (set casing/rock cored/installed well)

6. MANUFACTURER'S DESIGNATION OF DRILL: CME-75 (setcasing/rock cored/install well)

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' Laskey sampler with liners, 3" stainless steel split-spoon with liners, 4 1/4" ID HSAs, NX - drill rods, 7 7/8" Tricone roller bit

8. HOLE LOCATION: 91,707.740m N 693,663.860m E
300,877.80N 2,275,795.51E

9. SURFACE ELEVATION: 680.5' 682.85' (TOC)

10. DATE STARTED: 4/13/03 (set casing)

11. DATE COMPLETED: 4/23/03 (rock core/installed well)

12. OVERBURDEN THICKNESS: 27.0'

13. DEPTH DRILLED INTO ROCK: 33.7'

14. TOTAL DEPTH OF HOLE: 60.7'

15. DEPTH GROUNDWATER ENCOUNTERED: 16'

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA

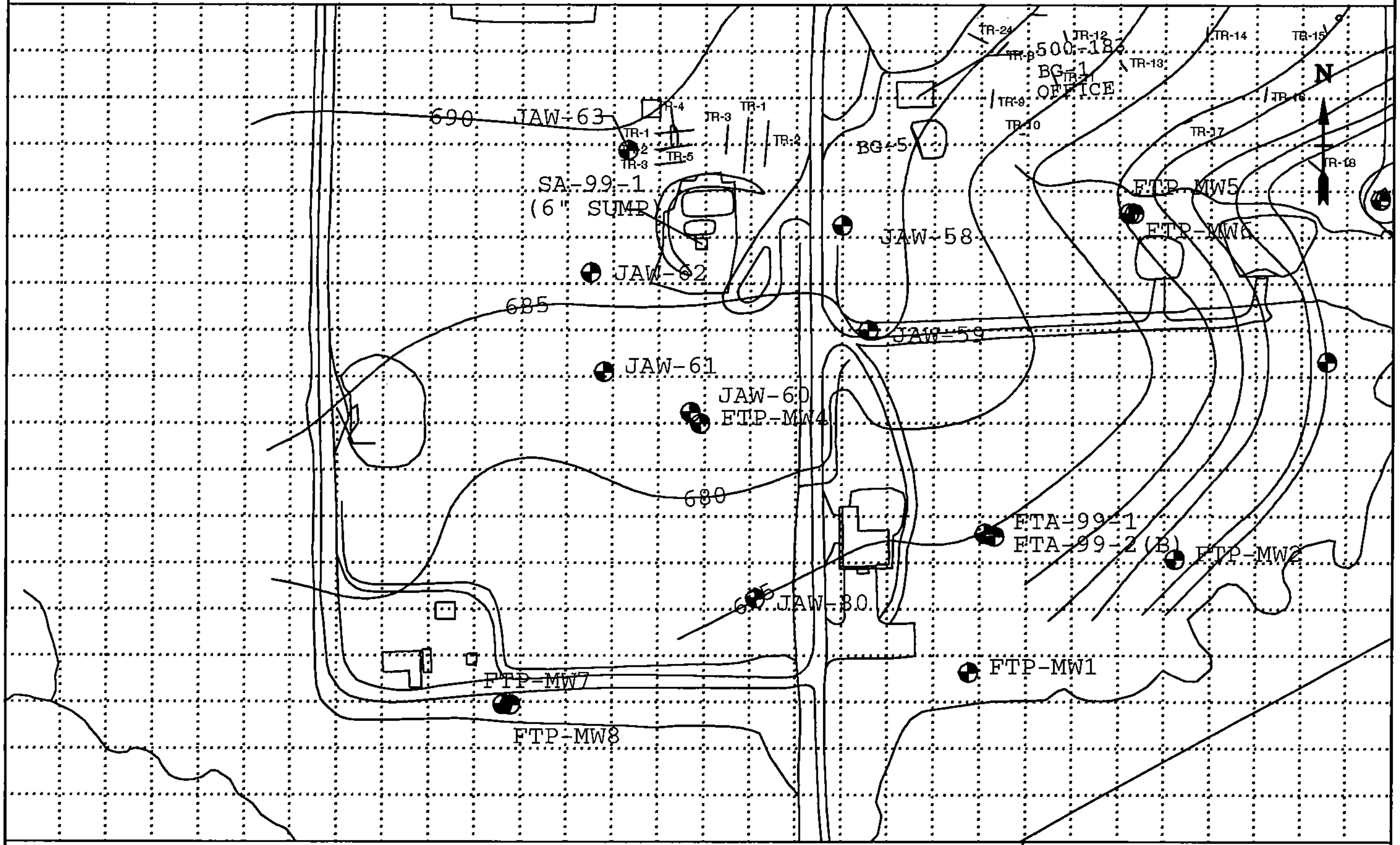
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA

18. GEOTECHNICAL SAMPLES (TESTED)	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
2	0	2	NA

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
2	NA	NA	TOC = 2 (Soil)	NA	NA	NA %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
FTP-MW4	NA	X	NA	D. Berger/M. Sonderman

LOCATION SKETCH/COMMENTS SCALE: 1" = 200'



ENG FORM 5056-R, AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER	FTP-MW4
PROJECT	IAAAP F.S. DATA COLLECTION - FTP Burlington, IA
INSPECTOR	D. Berger/M. Sonderman
SHEET 2 OF 8 SHEETS	

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
680.5	0	Silty CLAY (CL) - Stiff, moist, dark brown to black, low plastic, with organics				4ksf	Topsoil
679.5	1						
		Silty CLAY (CL) - Stiff, moist, brown with black mottling and iron staining, low plastic	HS = ND			3ksf	Loess
678.5	2						
						3ksf	
677.5	3						
						3ksf	
676.5	4						
						2ksf	
675.5	5					Laskey 2ksf	R=60/60
674.5	6						
			HS = ND			2ksf	
673.5	7						
		Silty CLAY (CL) - Stiff, moist, orangish-brown with orange mottling and iron staining, medium plastic, with Sand				4ksf	Shallow Weathered Glacial Till
672.5	8						
						4ksf	
671.5	9						
						7ksf	
670.5	10	Becomes very stiff, gray laminar mottling, with more Sand				Laskey	R=60/60

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER FTP-MW4

PROJECT IAAAP F.S. DATA COLLECTION - FTP
Burlington, IA

INSPECTOR D. Berger/M. Sonderman

SHEET 3 OF 8 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
670.5	10	SAME: Silty CLAY (CL) - Stiff, moist, orangish-brown with orange and gray laminar mottling and iron staining, medium plastic, with Sand				2ksf	Shallow Weathered Glacial Till
669.5	11						Highly Weathered
						2ksf	
		Becomes low to medium plastic, with less Sand and mottling	HS = ND				
668.5	12						
						4ksf	
667.5	13						
						4ksf	
666.5	14						
		Becomes very stiff, low to medium plastic, with more Sand and laminar gray mottling					
						7ksf	
		Silty CLAY (CH) - Very stiff, moist, gray with dark gray and orange mottling, high plastic, with Sand				Laskey	Shallow Glacial Till R=60/60
665.5	15					6	
		Becomes Stiff					
						10	
		With less Sand					
664.5 ▼	16			Geo	TOC = 0.08		▼ ATD
			HS = ND			13	
663.5	17	With orange laminar mottling and Sand				18 S3	R=24/24
						6ksf	
						6ksf	
662.5	18						
		Sandy CLAY (CL) - Very stiff, moist, gray with orange and dark gray mottling, medium to high plastic, medium- to coarse-grained Sand					Shallow Glacial Till
661.5	19						
						7ksf	
						8ksf Laskey	R=36/36
660.5	20						

PROJECT IAAAP F.S. DATA COLLECTION - FTP Burlington, IA

HOLE NO. FTP-MW4

ENG FORM 5056A-R, AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER: FTP-MW4

PROJECT: IAAAP F.S. DATA COLLECTION - FTP
Burlington, IA

INSPECTOR: D. Berger/M. Sonderman

SHEET 4 OF 8 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
660.5	20	SAME: Sandy CLAY (CL) - Very stiff, moist, gray with orange and dark gray mottling, medium to high plastic, medium- to coarse-grained Sand				7ksf	Shallow Glacial Till
		With less Sand					
659.5	21						
						5ksf	
		Becomes stiff, low to medium plastic					
658.5	22						
						3ksf	
657.5	23						
		Becomes orangish-brown with gray mottling and Sand				3ksf	
656.5	24						
		Becomes medium stiff				2ksf	
655.5	25					Laskey	R=60/60
			HS = ND			7	
						12	
654.5	26			Geo			
					TOC = 0.05	15	Sampler refusal on Limestone cobble.
		Clayey Sand (SC) - Dense, wet, orangish-brown, coarse-grained, with Limestone cobbles				58/3"S3	Glacial Outwash R = 21/21
653.5	27	LIMESTONE					Driller notes resistance to Laskey sampler and augers at 27.0' bgs Bedrock
652.5	28						
651.5	29						Refusal to auger at 29.2' bgs. Switched to rotary wash bore. Logged from cuttings.
650.5	30						

PROJECT: IAAAP F.S. DATA COLLECTION - FTP Burlington, IA

HOLE NO. FTP-MW4

ENG FORM 5056A-R, AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG
(CONTINUATION SHEET)

HOLE NUMBER FTP-MW4

PROJECT IAAAP F.S. DATA COLLECTION - FTP
Burlington, IA

INSPECTOR D. Berger/M. Sonderman

SHEET 5 OF 8 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
650.5	30	SAME: LIMESTONE					Bedrock
649.5	31						
648.5	32						
647.5	33						
646.5	34						HS = Head Space BZ = Breathing Zone MB = Mechanical Break SO = Spin Out R = Recovery RQD = Rock Quality Designation
645.5	35	With Shale					
644.5	36	With less Shale					Stopped drilling on 4/13/03 at 37.1' bgs. Set 6" double casing to 37.1' bgs. 4/23/03 reamed out 0.4' and started coring at 37.5' bgs.
643.5	37	Siliceous, bluish-gray, with small (<1 mm) pyrite concretions, abundant chert					
642.5	38	Thin Shale stringer with crinoids, highly fractured, fracture surfaces dark stained Becomes Shaley, dark gray		BOX # 1			Run = 5.5' R = 5.3' RQD = 77% MB
641.5	39	SHALE - Dark gray, soft, fractured, slightly fissile, highly weathered LIMESTONE - Shaley, medium gray, with some chert					MB SO
640.5	40						

PROJECT IAAAP F.S. DATA COLLECTION - FTP Burlington, IA

HOLE NO. FTP-MW4

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG (CONTINUATION SHEET)

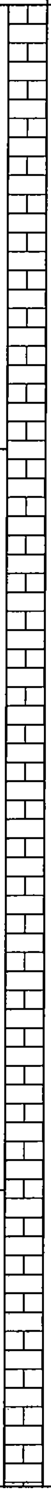
HOLE NUMBER: FTP-MW4

PROJECT: IAAAP F.S. DATA COLLECTION - FTP
Burlington, IA

INSPECTOR: D. Berger/M. Sonderman

SHEET 6 OF 8 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
640.5	40	SAME: LIMESTONE - Shaley, medium gray, with some chert					Bedrock
							SO
639.5	41		BZ = ND				
				BOX # 1			MB
638.5	42	Becomes Shaley, light brown and gray, partially crystalline, with healed vertical fractures, isolated vugs up to several mm, very small clear crystals in vugs Moderately Fractured					
637.5	43						
		With some pyrite and healed vertical fractures					
636.5	44	Becomes Shaley, gray and blue-gray, with chert, fracture surfaces weathered					MB
			BZ = ND				Run = 5.0' R = 4.9' RQD = 83%
635.5	45						Box Break
		With little to no Shale		BOX # 2			
		Becomes bluish-gray, with chert					
634.5	46						
		Fracture surfaces weathered, dark stained					
633.5	47						Box Break
632.5	48	Highly fractured, fracture surfaces weathered, dark stained					
		With thin black Shaley partings at fractures					Run = 5.0' R = 5.0' RQD = 80%
631.5	49			BOX # 2			
630.5	50						



PROJECT: IAAAP F.S. DATA COLLECTION - FTP Burlington, IA

HOLE NO. FTP-MW4

HTRW DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER FTP-MW4

PROJECT IAAAP F.S. DATA COLLECTION - FTP
Burlington, IA

INSPECTOR D. Berger/M. Sonderman

SHEET 7 OF 8 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
630.5	50	SAME: LIMESTONE - Bluish-gray					Bedrock
							MB
629.5	51		BZ = ND				
				BOX # 2			
628.5	52						
							Box Break
							Box Break
627.5	53						
		With numerous vugs filled with calcite crystals, and chert					
626.5	54	Becomes bluish-gray, moderately fractured, unweathered with chert					Run = 5.0' R = 4.8' RQD = 84%
			BZ = ND				
							MB
625.5	55	Becomes dark blue					
		Becomes Shaley					
		SHALE - Black, fractured, fissile, slightly weathered		BOX # 3			
							MB
		LIMESTONE - Siliceous, Shaley, blue-gray and gray					
624.5	56						
							Box Break
		SHALE - Black, soft, fissile, slightly weathered					
623.5	57						MB
622.5	58						Box Break
							SO SO
		LIMESTONE - Shaley, Siliceous, dark gray and brownish-gray					
621.5	59			BOX # 3			Box Break
		Becomes lighter in color					
							Run = 2.7' R = 2.5' RQD = 85%
620.5	60						

PROJECT IAAAP F.S. DATA COLLECTION - FTP Burlington, IA

HOLE NO. FTP-MW4

ENG FORM 5056A-R, AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER FTP-MW4

PROJECT IAAAP F.S. DATA COLLECTION - FTP
Burlington, IA

INSPECTOR D. Berger/M. Sonderman

SHEET 8 **OF** 8 **SHEETS**

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
620.5	60	SAME: LIMESTONE - Shaley, Siliceous, dark gray and brownish-gray	BZ = ND				Stopped coring at 60.7' bgs on 4/23/03. Hole reamed to 60.4' bgs.
							B.O.B. @ 60.7 bgs Screened interval for FTP-MW4 is 49.1' to 59.1' bgs.
619.5	61						
618.5	62						
617.5	63						
616.5	64						
615.5	65						
614.5	66						
613.5	67						
612.5	68						
611.5	69						
610.5	70						

PROJECT IAAAP F.S. DATA COLLECTION - FTP Burlington, IA

HOLE NO. FTP-MW4

ENG FORM 5056A-R, AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG

DISTRICT: Omaha District

HOLE NUMBER: FTP-MW5

1. COMPANY NAME: ***URS Corporation***

2. DRILLING CONTRACTOR: Aquadrill

SHEET 1 OF 3 SHEETS

3. PROJECT: IAAAP F.S. DATA COLLECTION - FTP

4. LOCATION: Burlington, IA

5. NAME OF DRILLER: Jay Joslyn

6. MANUFACTURER'S DESIGNATION OF DRILL: Mobile ORV-57

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4 1/4" ID HSA, 5' Laskey Sampler, 2" and 3" split spoon with liners

8. HOLE LOCATION: 91,776.700m N 693,804.610m E 301,104.05N 2,276,257.30E

9. SURFACE ELEVATION: 668.2' 670.59' (TOC)

10. DATE STARTED: 4/14/03

11. DATE COMPLETED: 4/14/03

12. OVERBURDEN THICKNESS: 14.4'

15. DEPTH GROUNDWATER ENCOUNTERED: 11'

13. DEPTH DRILLED INTO ROCK: NA

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA

14. TOTAL DEPTH OF HOLE: 14.4'

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA

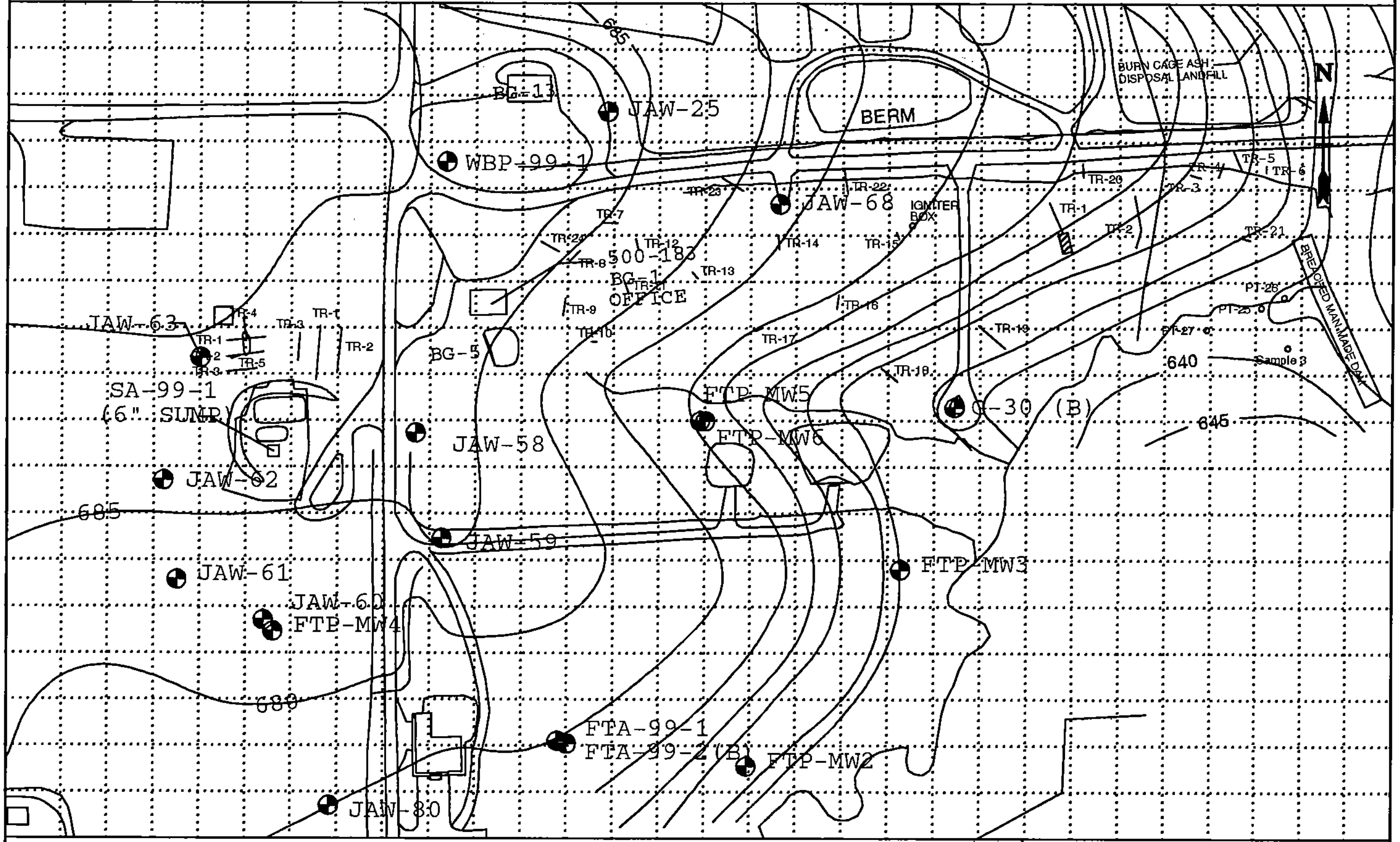
18. GEOTECHNICAL SAMPLES (TESTED)	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
1	0	1	NA

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
1	NA	NA	TOC = 1 (Soil)	NA	NA	99 %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
FTP-MW5	NA	X	NA	M. Sonderman

LOCATION SKETCH/COMMENTS

SCALE: 1" = 200'



PROJECT IAAAP F.S. DATA COLLECTION - FTP Burlington, IA

HOLE NO. FTP-MW5

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER
FTP-MW5

PROJECT IAAAP F.S. DATA COLLECTION - FTP
Burlington, IA

INSPECTOR
M. Sonderman

SHEET 2 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
668.2	0	Lean CLAY (CL-ML) - Medium stiff, moist, dark brown, low plastic with organics				1ksf	Topsoil
667.2	1	Becomes brown to yellowish-brown with organics				1.5ksf	R = Recovery T = Time BG = Background BZ = Breathing Zone HS = Head Space ND = Non-detect PID = Photo Ionization Detector
666.2	2		BG/PID = 0 BZ = 0 HS = ND				
		Grades to medium plastic				3ksf	
665.2	3	Sandy CLAY (CL) - Very stiff, moist, yellowish-brown and gray mottled, medium to high plastic, fine-grained Sand with iron staining					Shallow Weathered Glacial Till
						4ksf	
664.2	4						
						5ksf	T = 1020
663.2	5					Laskey	R=60/60
						5	
			HS = ND			7	
662.2	6						
						8	T = 1025
661.2	7					12 S3	R=17/24
						6ksf	
		Becomes medium plastic					
660.2	8		HS = ND				
						4ksf	
659.2	9						
						5ksf	T = 1030
658.2	10	Becomes soft				Laskey	R=30/36

PROJECT IAAAP F.S. DATA COLLECTION - FTP Burlington, IA

HOLE NO. FTP-MW5

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER FTP-MW5

PROJECT IAAAP F.S. DATA COLLECTION - FTP Burlington, IA

INSPECTOR M. Sonderman

SHEET 3 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
658.2	10	SAME: Sandy CLAY (CL) - Soft, moist, yellowish-brown and gray mottled, medium plastic, fine-grained Sand with iron staining				2	Shallow Weathered Glacial Till
						3	
657.2 ▼	11	Becomes wet		Geo	TOC = 0.6		▼ ATD
						3	
						5 S2	T = 1038 R=21/24
656.2	12					1ksf	
655.2	13		HS = ND			0.5ksf	
							Screened interval for FTP-MW5 is 8.9' to 13.9' bgs.
654.2	14	Becomes Clayey SAND (SC) - With pieces of Limestone				1ksf Laskey	T = 1042 R=29/29
							B.O.B. @ 14.4 bgs
653.2	15						
652.2	16						
651.2	17						
650.2	18						
649.2	19						
648.2	20						

PROJECT IAAAP F.S. DATA COLLECTION - FTP Burlington, IA

HOLE NO. FTP-MW5

ENG FORM 5056A-R, AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG

DISTRICT Omaha District	HOLE NUMBER FTP-MW6	
1. COMPANY NAME ***URS Corporation***	2. DRILLING CONTRACTOR Aquadrill	SHEET 1 OF 6 SHEETS

3. PROJECT
IAAAP F.S. DATA COLLECTION - FTP

4. LOCATION
Burlington, IA

5. NAME OF DRILLER
Denis Auld (set casing), Jay Joslyn (rock coring/installed well)

6. MANUFACTURER'S DESIGNATION OF DRILL
Gus Pech GP1000AR (set casing), Mobile ORV-57 (rock coring/install well)

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT
6" drag bit, 10" rotary bit with centralizers on drill rod, NX2 core barrel, 6" air percussion hammer

8. HOLE LOCATION 91,776.620m N 693,806.230m E
301,103.79N 2,276,262.60E

9. SURFACE ELEVATION
667.8' 670.44' (TOC)

10. DATE STARTED
3/26/03 (set casing)

11. DATE COMPLETED
4/14/03 (installed well)

12. OVERBURDEN THICKNESS
14.4'

13. DEPTH DRILLED INTO ROCK
35.6'

14. TOTAL DEPTH OF HOLE
50'

15. DEPTH GROUNDWATER ENCOUNTERED
11'

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
NA

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)
NA

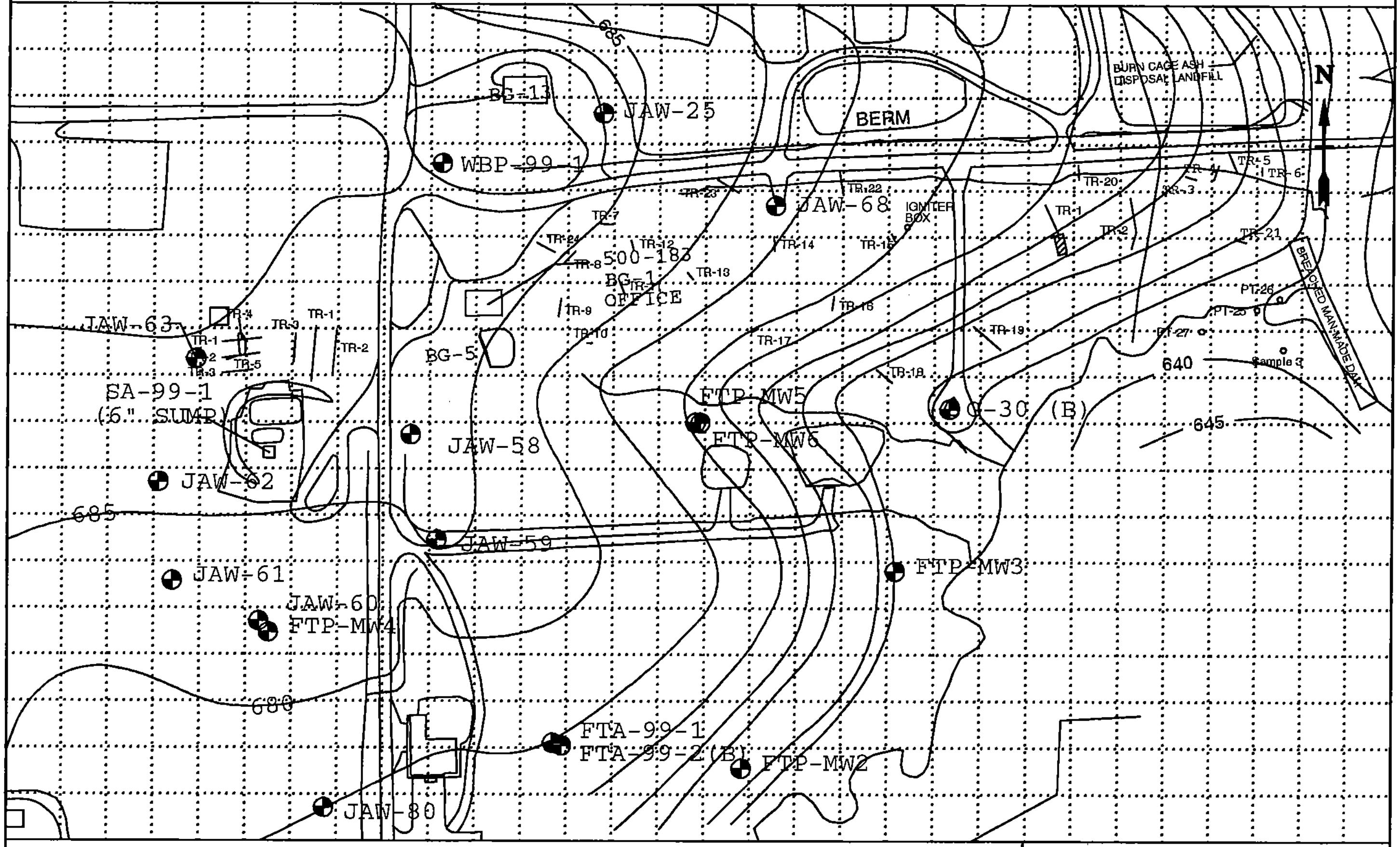
18. GEOTECHNICAL SAMPLES (TESTED)	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
0	0	0	3

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
0	NA	NA	NA	NA	NA	99 %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
FTP-MW6	NA	X	NA	M. Sonderman

LOCATION SKETCH/COMMENTS

SCALE: 1" = 200'



PROJECT
IAAAP F.S. DATA COLLECTION - FTP Burlington, IA

HOLE NO.
FTP-MW6

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER FTP-MW6

PROJECT IAAAP F.S. DATA COLLECTION - FTP
Burlington, IA

INSPECTOR M. Sonderman

SHEET 2 OF 6 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
667.8	0	Lean CLAY (CL-ML) - Medium stiff, moist, dark brown, low plastic with organics					Topsoil Overburden sampled in adjacent boring FTP-MW5.
666.8	1	Becomes brown to yellowish-brown with organics					R = Recovery T = Time BG = Background BZ = Breathing Zone HS = Head Space ND = Non-detect PID = Photo Ionization Detector
665.8	2	Grades to medium plastic					
		Sandy CLAY (CL) - Very stiff, moist, yellowish-brown and gray mottled, medium to high plastic, fine-grained Sand with iron staining					Shallow Weathered Glacial Till
664.8	3						
663.8	4						
							T = 1020
662.8	5						
661.8	6						
							T = 1025
660.8	7						
		Becomes medium plastic					
659.8	8						
658.8	9						
							T = 1030
657.8	10	Becomes soft					

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER FTP-MW6

PROJECT IAAAP F.S. DATA COLLECTION - FTP Burlington, IA

INSPECTOR M. Sonderman

SHEET 3 OF 6 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
657.8	10	SAME: Sandy CLAY (CL) - Soft, moist, yellowish-brown and gray mottled, medium plastic, fine-grained Sand with iron staining					Shallow Weathered Glacial Till Overburden sampled in adjacent boring FTP-MW5.
656.8	▼ 11	Becomes wet					▼ ATD
							T = 1038
655.8	12						
654.8	13						
653.8	14	Becomes Clayey SAND (SC) - With pieces of Limestone					T = 1042
		LIMESTONE - Light gray, fossiliferous, slightly weathered					Bedrock Logged from cuttings.
652.8	15						Driller noted bit is catching on fracture.
		With brown, medium plastic, Clay with rock chips, fracture zone from 15.2' to 16.5' bgs					
651.8	16		BG/PID = ND BZ = ND				
							Driller noted end of fracture zone at 16.5' bgs.
650.8	17						
649.8	18						
648.8	19						May be weathered Shale.
		Hit fracture zone at about 19' bgs, with dark gray Clay					
		Back into solid rock, becomes gray	BZ = ND				
647.8	20						

PROJECT IAAAP F.S. DATA COLLECTION - FTP Burlington, IA

HOLE NO. FTP-MW6

ENG FORM 5056A-R, AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG

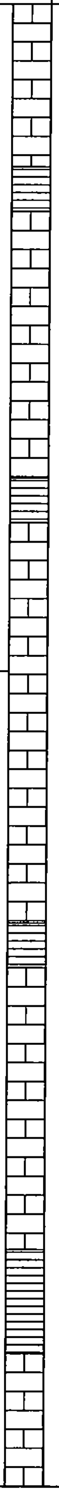
(CONTINUATION SHEET)

HOLE NUMBER FTP-MW6

PROJECT IAAAP F.S. DATA COLLECTION - FTP Burlington, IA

INSPECTOR M. Sonderman

SHEET 4 OF 6 SHEETS



ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
647.8	20	SAME: LIMESTONE - Calcareous, gray, hard, fine-grained, slightly weathered					Bedrock
646.8	21						
		SHALE- Dark gray, soft, fissile, highly weathered					
		LIMESTONE - Light bluish-gray to gray, unweathered	BZ = ND				
645.8	22						MB = Mechanical Break SO = Spin Out RQD = Rock Quality Designation FID = Flame Ionization Detector
644.8	23						
		SHALE - Gray, soft, blocky, highly weathered					
		LIMESTONE - Gray, unweathered with thin Shale stringers					
643.8	24						Stopped drilling on 3/26/03. Set 6" double casing at 24.5' bgs. 4/13/03 resumed drilling. Started rock coring at 24.5' bgs with NX2 wireline system.
642.8	25	Bryozoan on break surface					MB
							MB
641.8	26						SO
		SHALE - Dark gray, very soft, blocky, highly weathered	BZ = ND with FID				MB
		LIMESTONE - Gray, with calcite deposits (calcite crystal), and thin calcite healed vertical fractures below					MB MB
640.8	27			BOX #1			MB
							Run = 6.2' R = 5.7' RQD = 65%
639.8	28						
		SHALE - Dark gray, very soft, fissile, highly weathered	BZ = ND				MB
638.8	29						Missing rock core from 28.6' to 29.1' bgs.
		LIMESTONE - Shaley, Siliceous, light gray and brownish-gray interbeds, slightly weathered					
637.8	30						

PROJECT IAAAP F.S. DATA COLLECTION - FTP Burlington, IA

HOLE NO. FTP-MW6

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER: FTP-MW6

PROJECT: IAAAP F.S. DATA COLLECTION - FTP
Burlington, IA

INSPECTOR: M. Sonderman

SHEET 5 OF 6 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
637.8	30	SAME: LIMESTONE - Shaley, Siliceous, light gray and brownish-gray interbeds, with horizontal fracture surfaces and a healed vertical fracture, slightly weathered	BZ = ND				Bedrock
636.8	31	Becomes light bluish-gray, crystalline, moderately fractured, unweathered with horizontal stylolites End of stylolites					Fracture surfaces stained black to dark gray from 31' to 35.5' bgs.
635.8	32						
634.8	33		BZ = ND				
633.8	34						Run = 10.0' R = 10.0' RQD = 92%
		Becomes Siliceous, Shaley, with small vugs					
632.8	35						Box Break
		End of Shaley zone Becomes bluish-gray, crystalline, no vugs		BOX # 2			
631.8	36						
		Becomes Shaley, brownish-gray, small sulfide nodule Becomes Siliceous					Box Break
630.8	37						
629.8	38						MB Box Break
628.8	39	Vertical fracture healed with calcite Grades to bluish-gray					
		SHALE - Black, fissile, weathered					MB
627.8	40	LIMESTONE - Light gray, slightly weathered					MB

PROJECT: IAAAP F.S. DATA COLLECTION - FTP Burlington, IA

HOLE NO. FTP-MW6

HTRW DRILLING LOG
(CONTINUATION SHEET)

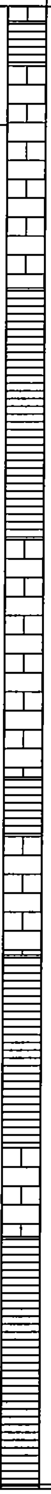
HOLE NUMBER
FTP-MW6

PROJECT
IAAAP F.S. DATA COLLECTION - FTP
Burlington, IA

INSPECTOR
M. Sonderman

SHEET 6 OF 6 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
627.8	40	Becomes Shaley with black Shaley interbeds SHALE: Black, fissile, weathered LIMESTONE - Shaley, grading to light gray	BZ = ND				Bedrock MB MB
626.8	41	Becomes crystalline, unweathered					Run = 9.2' R = 9.1'
625.8	42	SHALE - Dark gray to black, medium soft, fissile, unweathered to slightly weathered, with calcareous clasts					RQD = 99% MB MB
624.8	43	Increasing carbonate contents LIMESTONE - Shaley, light gray and gray, isolated 1-2 mm diameter vugs	BZ = ND				Box Break Box Break Numerous box breaks occured by trying to fit into core box. MB
623.8	44	Some chert					Box Break Box Break
622.8	45	SHALE - Black, fissile, unweathered LIMESTONE - Shaley, gray to dark gray, partly crystalline, small pyrite concretions		BOX # 3			Reamed hole to 45.3' bgs. MB MB
621.8	46	SHALE - Black, fissile, unweathered					Screened interval for FTP-MW6 is 34.8' to 44.8' bgs. Many box breaks from 46.4' to 47.2' bgs.
620.8	47	LIMESTONE - Shaley, brownish-gray, unweathered					
619.8	48	SHALE - Black, fissile, unweathered to slightly weathered					MB
618.8	49	With 1-5 mm length pyrite nodules With interbedded carbonate seams					Stopped rock coring at 50.0' bgs. Box Break SO Missing bottom 0.1'
617.8	50						B.O.B. @ 50.0' bgs



PROJECT
IAAAP F.S. DATA COLLECTION - FTP Burlington, IA

HOLE NO.
FTP-MW6

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

HTRW W/GFX G:\GINTW\IAAAP\FTP\FTP.GPJ APR_03.GDT 9/17/2003 2:00:59 PM

HTRW DRILLING LOG

DISTRICT: Omaha District

HOLE NUMBER: FTP-MW7

1. COMPANY NAME: ***URS Corporation***

2. DRILLING CONTRACTOR: Aquadrill

SHEET 1 OF 4 SHEETS

3. PROJECT: IAAAP F.S. DATA COLLECTION - FTP

4. LOCATION: Burlington, IA

5. NAME OF DRILLER: Denis Auld

6. MANUFACTURER'S DESIGNATION OF DRILL: CME-75

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4 1/4" ID HSA, 5' Laskey Sampler, 2" split spoon with liners

8. HOLE LOCATION: 91,615.610m N 693,599.030m E
300,575.55N 2,275,582.83E

9. SURFACE ELEVATION: 674.5' 676.87' (TOC)

10. DATE STARTED: 4/16/03

11. DATE COMPLETED: 4/16/03

12. OVERBURDEN THICKNESS: 21'

15. DEPTH GROUNDWATER ENCOUNTERED: 13'

13. DEPTH DRILLED INTO ROCK: 1'

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA

14. TOTAL DEPTH OF HOLE: 22'

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA

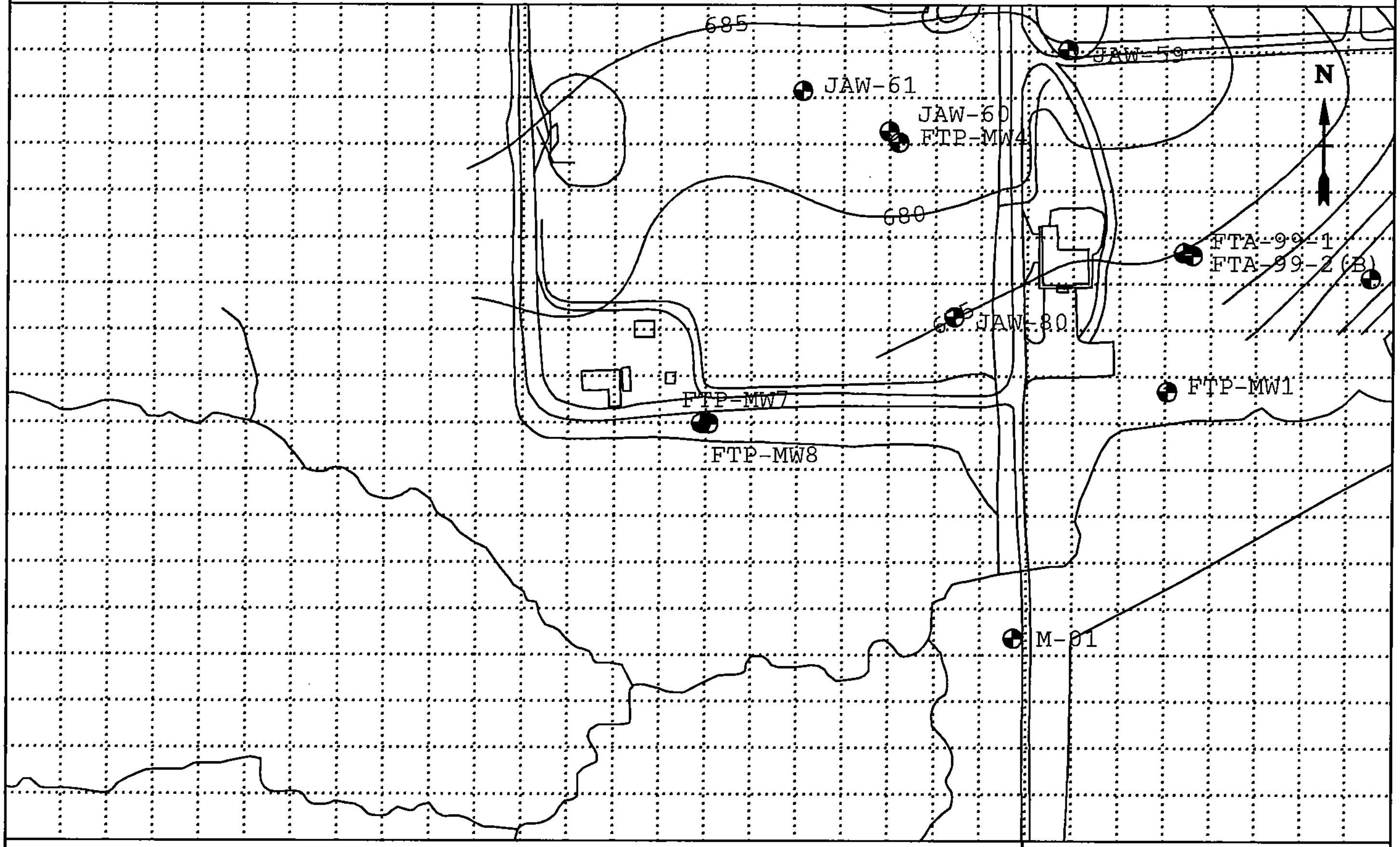
18. GEOTECHNICAL SAMPLES (TESTED)	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
3	0	3	NA

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
2	NA	NA	TOC = 2 (Soil)	NA	NA	NA %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
FTP-MW7	NA	X	NA	C. Anderson

LOCATION SKETCH/COMMENTS

SCALE: 1" = 200'



PROJECT: IAAAP F.S. DATA COLLECTION - FTP Burlington, IA

HOLE NO. FTP-MW7

ENG FORM 5056-R, AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER FTP-MW7

PROJECT IAAAP F.S. DATA COLLECTION - FTP
Burlington, IA

INSPECTOR C. Anderson

SHEET 2 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
674.5	0	Silty CLAY (CL) - Very stiff, moist, brown and gray mottled with black, low to medium plastic, with iron staining, black organics, and crushed round Gravel				5ksf	Fill
							R = Recovery BZ = Breathing Zone HS = Head Space ND = Non-detect
673.5	1					6ksf	
		Silty CLAY (CL) - Stiff, moist, black, low to medium plastic, with organics	HS = 0.0 ppm BZ = 0.0 ppm				Topsoil
672.5	2					4ksf	
		Silty CLAY (CL) - Stiff, moist, reddish-brown and gray mottled, medium to high plastic					Shallow Weathered Glacial Till
671.5	3					3ksf	
						4ksf	
670.5	4					Laskey	R=48/48
						4ksf	
		Becomes gray with reddish-brown					
669.5	5						
						4ksf	
			HS = 0.0 ppm BZ = 0.0 ppm				
668.5	6						
						3ksf	
		Silty CLAY (CL) - Stiff, moist, gray with reddish-brown, low to medium plastic, with Sand					Shallow Weathered Glacial Till
667.5	7						
						3ksf	
666.5	8						
						4ksf	
665.5	9					Laskey	R=60/60
						3	
			HS = 0.0 ppm	Geo	TOC = 0.05	5	
664.5	10						

HTRW DRILLING LOG

(CONTINUATION SHEET)

PROJECT	IAAAP F.S. DATA COLLECTION - FTP Burlington, IA	INSPECTOR	C. Anderson
HOLE NUMBER	FTP-MW7	SHEET 3 OF 4 SHEETS	

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
664.5	10	SAME: Silty CLAY (CL) - Stiff, moist, gray with reddish-brown, low to medium plastic, with Sand	BZ = 0.0 ppm	Geo	TOC = 0.05	7	Shallow Weathered Glacial Till
663.5	11					10 S2	R=20/24
						6ksf	
662.5	12		HS = 0.0 ppm BZ = 0.0 ppm			6ksf	
661.5 ▼	13	0.2' seam of gray fine-grained Sand (dry)					▼ ATD
		With Sand				7ksf	
		Encountered water					
		Sandy CLAY (CL) - Soft, moist to wet, reddish-brown, low plastic, fine-grained Sand with iron stains				1ksf Laskey	R=36/36
660.5	14					1ksf	Shallow Weathered Glacial Till
659.5	15		HS = 0.0 ppm BZ = 0.0 ppm			1ksf	
658.5	16	Highly weathered				2ksf	
		Becomes medium stiff				3ksf	
657.5	17						
						4ksf	
656.5	18	Chert nodule inclusions at 18' bgs				Laskey	R=48/48
						20	
		Becomes wet				8	
655.5	19		HS = 0.0 ppm BZ = 0.0 ppm	Geo	TOC = 0.05		
						12	
654.5	20	Chert nodule inclusions at 20' bgs				>50 S2	R=20/24

PROJECT IAAAP F.S. DATA COLLECTION - FTP Burlington, IA	**HOLE NO.** FTP-MW7

ENG FORM 5056A-R, AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER FTP-MW7

PROJECT IAAAP F.S. DATA COLLECTION - FTP
Burlington, IA

INSPECTOR C. Anderson

SHEET 4 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
654.5	20	SAME: Sandy CLAY (CL) - Medium stiff, wet, reddish-brown, low plastic, fine-grained Sand					Shallow Weathered Glacial Till
		Clayey SAND (SC) - Loose, wet, reddish-brown, medium- to fine-grained, with Clay and Gravel	HS = 0.0 ppm BZ = 0.0 ppm	Geo		NA	Glacial Outwash
653.5	21	LIMESTONE - Fractured, weathered, with Clay and Sand					Bedrock
		Limestone - Bedrock					
652.5	22					Laskey	R=24/24
							B.O.B. @ 22.0' bgs Screened interval for FTP-MW7 is 11.0' to 21.0' bgs.
651.5	23						
650.5	24						
649.5	25						
648.5	26						
647.5	27						
646.5	28						
645.5	29						
644.5	30						

PROJECT IAAAP F.S. DATA COLLECTION - FTP Burlington, IA

HOLE NO. FTP-MW7

ENG FORM 5056A-R, AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG

DISTRICT: Omaha District

HOLE NUMBER: FTP-MW8

SHEET 1 OF 7 SHEETS

1. COMPANY NAME: ***URS Corporation***

2. DRILLING CONTRACTOR: Aquadrill

3. PROJECT: IAAAP F.S. DATA COLLECTION - FTP

4. LOCATION: Burlington, IA

5. NAME OF DRILLER: Denis Auld

6. MANUFACTURER'S DESIGNATION OF DRILL: Gus Pech GP1000AR (set casing), CME-75 (rock coring/install well)

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 6" drag bit, 10" rotary bit, NX2 core rods and barrel,

8. HOLE LOCATION: 91,615.490m N 693,601.480m E
300,575.15N 2,275,590.86E

9. SURFACE ELEVATION: 674.1' 676.81' (TOC)

10. DATE STARTED: 3/30/03 (set casing)

11. DATE COMPLETED: 4/23/03 (installed well)

12. OVERBURDEN THICKNESS: 21'

13. DEPTH DRILLED INTO ROCK: 31.1'

14. TOTAL DEPTH OF HOLE: 52.1'

15. DEPTH GROUNDWATER ENCOUNTERED: 13'

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 12.26' BTOC ~1hr after grouting

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA

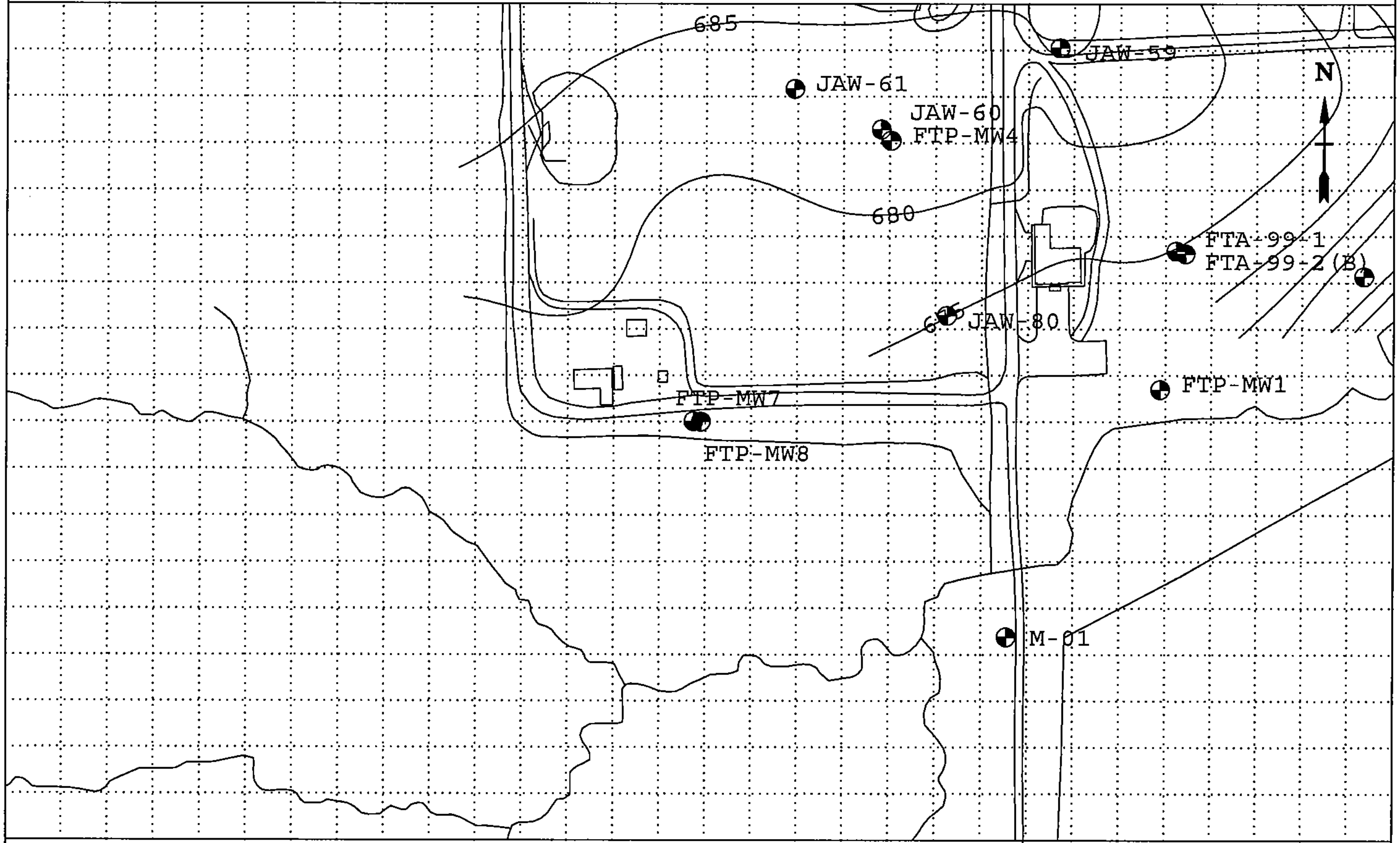
18. GEOTECHNICAL SAMPLES (TESTED)	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
0	0	0	3

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
0	NA	NA	NA	NA	NA	96 %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
FTP-MW8	NA	X	NA	M. Sonderman

LOCATION SKETCH/COMMENTS

SCALE: 1" = 200'



PROJECT IAAAP F.S. DATA COLLECTION - FTP Burlington, IA

HOLE NO. FTP-MW8

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER FTP-MW8

PROJECT IAAAP F.S. DATA COLLECTION - FTP
Burlington, IA

INSPECTOR M. Sonderman

SHEET 2 OF 7 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
674.1	0	Silty CLAY (CL) - Very stiff, moist, brown and gray mottled with black, low to medium plastic, with iron staining, black organics, and crushed round Gravel					Geologic descriptions of materials and remarks from 0.0' to 21.0' bgs are based on samples collected from adjacent boring FTP-MW7. Fill
673.1	1						
		Silty CLAY (CL) - Stiff, moist, black, low to medium plastic, with organics					Topsoil
672.1	2						
		Silty CLAY (CL) - Stiff, moist, reddish-brown and gray mottled, medium to high plastic					Shallow Weathered Glacial Till
671.1	3						
670.1	4						
		Becomes gray with reddish-brown					
669.1	5						
668.1	6						
		Silty CLAY (CL) - Stiff, moist, gray with reddish-brown, low to medium plastic, with Sand					Shallow Weathered Glacial Till
667.1	7						
666.1	8						
665.1	9						
664.1	10						

PROJECT IAAAP F.S. DATA COLLECTION - FTP Burlington, IA

HOLE NO. FTP-MW8

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER	FTP-MW8
PROJECT	IAAAP F.S. DATA COLLECTION - FTP Burlington, IA
INSPECTOR	M. Sonderman
SHEET 3 OF 7 SHEETS	

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
664.1	10	SAME: Silty CLAY (CL) - Stiff, moist, gray with reddish-brown, low to medium plastic, with Sand					Geologic descriptions of materials and remarks from 0.0' to 21.0' bgs are based on samples collected from adjacent boring FTP-MW7. Shallow Weathered Glacial Till
663.1	11						
662.1	12						
661.1 ▼	13	0.2' seam of gray fine-grained Sand (dry) With Sand Encountered water					▼ ATD
660.1	14	Sandy CLAY (CL) - Soft, moist to wet, reddish-brown, low plastic, fine-grained Sand with iron stains					Shallow Weathered Glacial Till
659.1	15						
658.1	16	Highly weathered Becomes medium stiff					
657.1	17						
656.1	18	Chert nodule inclusions at 18' bgs Becomes wet					
655.1	19						
654.1	20	Chert nodule inclusions at 20' bgs					

PROJECT IAAAP F.S. DATA COLLECTION - FTP Burlington, IA

HOLE NO. FTP-MW8

HTRW DRILLING LOG (CONTINUATION SHEET)

PROJECT	IAAAP F.S. DATA COLLECTION - FTP Burlington, IA	INSPECTOR M. Sonderman	HOLE NUMBER FTP-MW8 SHEET 4 OF 7 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
654.1	20	SAME: Sandy CLAY (CL) - Medium stiff, wet, reddish-brown, low plastic, fine-grained Sand					Glacial Till Geologic descriptions of materials and remarks from 0.0' to 21.0' bgs are based on samples collected from adjacent boring FTP-MW7.
		Clayey SAND (SC) - Loose, wet, reddish-brown, medium- to fine-grained, with Clay and Gravel					Glacial Outwash
653.1	21	LIMESTONE - Light gray to whitish-gray, weathered					Bedrock Started drilling with 10" tricone rotary bit at 21.0' bgs. Pulldown pressure gauge at 600 psi. Logged from cuttings.
		Becomes less weathered					
652.1	22						
651.1	23						R = Recovery MB = Mechanical Break RQD = Rock Quality Designation
650.1	24						
649.1	25	More weathered and fractured with brown, medium plastic Clay					Drilling becomes easier.
648.1	26						Driller noted much harder drilling.
647.1	27	Becomes bluish-gray					Stopped drilling on 3/30/03, installed 6" steel double casing at 27.7' bgs. 4/22/03 started rock coring with 20 to 30 psi downward pressure at 27.7' bgs.
646.1	28	Becomes highly fractured and highly weathered Clay filled fractures and voids		BOX # 1			
645.1	29	SHALE - Gray to dark gray, soft, highly fractured, fissile, highly weathered to mostly Clay					Run = 4.45' R = 3.7' RQD = 22%
644.1	30	0.2' Limestone seam					

PROJECT IAAAP F.S. DATA COLLECTION - FTP Burlington, IA	**HOLE NO.** FTP-MW8

ENG FORM 5056A-R, AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG (CONTINUATION SHEET)

PROJECT	IAAAP F.S. DATA COLLECTION - FTP Burlington, IA	INSPECTOR M. Sonderman	HOLE NUMBER FTP-MW8 SHEET 5 OF 7 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
644.1	30	SAME: SHALE - Gray to olive-gray, soft, highly fractured, slightly fissile, highly weathered					Bedrock
		Becomes slightly Calcareous, slightly harder	BZ FID = ND				Hole started taking water.
643.1	31			BOX # 1			
642.1	32	Grades to Shaley LIMESTONE					
		LIMESTONE - Shaley, Siliceous, medium gray, moderately fractured, unweathered except along fracture surface, few isolated vugs ~1 mm in diameter					MB
641.1	33						MB
							Run = 5.0' R = 5.0' RQD = 86%
		Becomes light reddish-brown and medium gray	BZ FID = ND				
640.1	34						
				BOX # 1			
639.1	35						
		Fracture surfaces very weathered					
638.1	36						
637.1	37						Drillers picked up 470 gallons of water.
		0.2' Shale Stringer					Run = 0.55' R = 0.45' No rock core recovery from 37.6' to 37.7' bgs.
		Becomes light gray, some styolites					
636.1	38						
				BOX # 2			Run = 4.45' R = 4.45' RQD = 72%
635.1	39	Moderately fractured					
							All observed fracture surfaces weathered.
634.1	40						

PROJECT IAAAP F.S. DATA COLLECTION - FTP Burlington, IA	**HOLE NO.** FTP-MW8

ENG FORM 5056A-R, AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER	FTP-MW8
PROJECT	IAAAP F.S. DATA COLLECTION - FTP Burlington, IA
INSPECTOR	M. Sonderman
SHEET	6 OF 7 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
634.1	40	SAME: LIMESTONE - Light gray					Bedrock
		Becomes Shaley	BZ FID = ND	BOX # 2			
633.1	41	Very fractured chert layer, some fracture surfaces stained dark					
		Becomes bluish-gray, little to no Shale					
632.1	42						
		Becomes light gray and medium gray, some Shale, abundant chert					Multiple machanical breaks from 42.2' to 42.5' bgs. Run = 5.0' R = 5.0' RQD = 91%
631.1	43						
							Box Break
630.1	44		BZ FID = ND				
		Fracture surfaces slightly weathered					MB
				BOX # 2			
629.1	45	Shale content increasing					MB
							Box Break
628.1	46						MB
		Becomes blue-gray					
627.1	47	Fracture surfaces weathered and dark stained					
		Becomes very Shaley and gray to black					MB
626.1	48	SHALE - Black to dark gray, fissile, moderately fractured, weathered					Multiple mechanical breaks from 47.8' to 48.6' bgs.
				BOX # 3			Run = 5.0' R = 4.9' RQD = 94%
625.1	49						
		LIMESTONE - Bluish-gray					
624.1	50	Becomes Shaley, Siliceous, brownish-gray to dark gray					

PROJECT IAAAP F.S. DATA COLLECTION - FTP Burlington, IA

HOLE NO. FTP-MW8

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER FTP-MW8

PROJECT IAAAP F.S. DATA COLLECTION - FTP
Burlington, IA

INSPECTOR M. Sonderman

SHEET 7 OF 7 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
624.1	50	SAME: LIMESTONE - Shaley, Siliceous, brownish-gray to dark gray Vertical fractures					Bedrock
623.1	51		BZ FID = ND	BOX # 3			Cored to 52.1' bgs. Reamed to 52.1' bgs. Missing rock core from 52' to 52.1' bgs.
622.1	52						B.O.B. @ 52.1' bgs Screened interval for FTP-MW8 is 41.1' to 51.1' bgs.
621.1	53						
620.1	54						
619.1	55						
618.1	56						
617.1	57						
616.1	58						
615.1	59						
614.1	60						

PROJECT IAAAP F.S. DATA COLLECTION - FTP Burlington, IA

HOLE NO. FTP-MW8

APPENDIX B

Geotechnical Data

TABLE B-1
SUMMARY OF GEOTECHNICAL PARAMETER RESULTS
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Sample Type and Well/ Sample Number	Sample Depth (ft bgs)	Geotechnical Parameters												Notes
		Unified Soil Classification	Water Content (%)	Dry Unit Weight (pcf)	Volumetric Water Content	Dry Bulk Density (g/cc)	Specific Gravity (g/cc)	Porosity (%)	% Passing No. 200 Sieve	Grain Size Figure No. (Appendix B)	Liquid Limit (%)	Plastic Limit (%)	TOC (% dry basis)	
FTP Direct Push Geotechnical Analysis														
FTP-DP08	9.0	CH	18	104	0.30	1.67	2.639	37	58	--	53	21	--	
FTP-DP08	16.0	CH	22	106	0.38	1.70	2.667	36	80	--	66	23	--	
FTP-DP08	20.0	CL	17	113	0.31	1.81	2.660	32	68	--	42	18	--	
FTP-DP08	23.0	CL	16	123	0.32	1.97	2.653	26	71	--	33	17	--	
FTP Monitoring Well Geotechnical Analysis														
FTP-MW1	4.6	CL	23	103	0.38	1.64	2.577	36	57	--	44	17	1.6	
FTP-MW2	6.5	CL	22	104	0.36	1.67	2.611	36	75	--	36	18	0.28	
FTP-MW3 (B)	5.0	CH	22	102	0.37	1.63	2.611	38	73	--	51	20	0.23	
FTP-MW4 (B)	16.5	CH	24	103	0.40	1.65	2.639	37	78	--	64	20	0.08	
FTP-MW4 (B)	26.5	CL	17	116	0.32	1.85	2.646	30	60	--	32	17	0.05	
FTP-MW5	12.0	CL	19	113	0.34	1.81	2.564	30	52	--	32	17	0.06	
FTP-MW7	10.5	CH	23	102	0.38	1.64	2.558	36	82	--	62	18	0.05	
FTP-MW7	19.5	CL	16	119	0.31	1.90	2.577	26	61	--	29	17	0.05	
FTP-MW7	21.0	SC	12	125	0.24	2.01	2.611	23	32	1	27	15	--	

Notes:

-- = Not Analyzed

% = Percent

bgs = Below Ground Surface

ft = Foot or Feet

g/cc = Grams per Cubic Centimeter

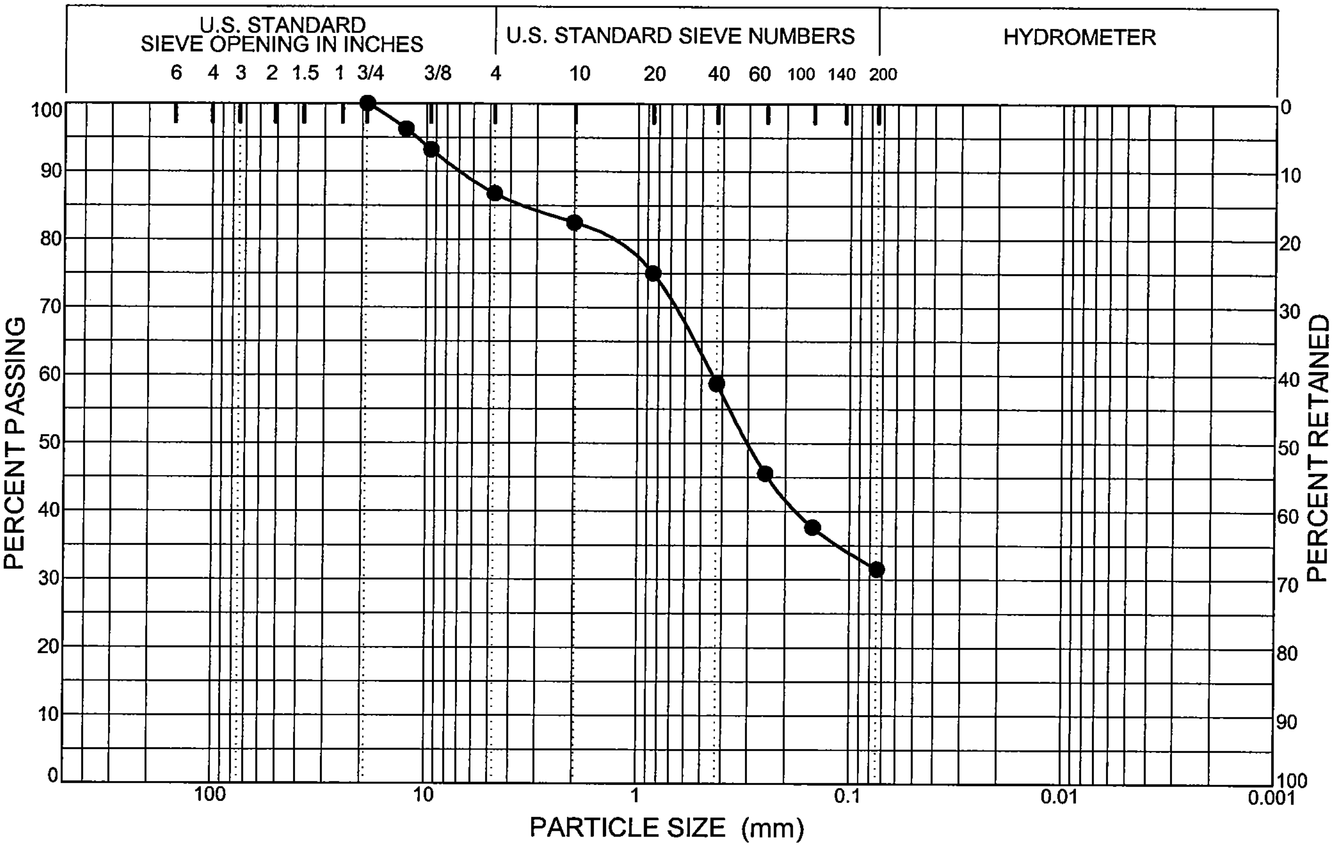
Harza = Montgomery Watson Harza

pcf = Pounds per cubic foot

TOC = Total Organic Carbon

URS = URS Group, Inc.

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Depth (feet)	Symbol	LL	PI	Description
FTPMW7	21.0	●	27	12	Clayey SAND (SC) - Brown, fine - grained

Checked by:

Project: IAAAP 6 SITE FS DATA COLLECTION
Burlington, Iowa

Project Number: 16169428

PARTICLE SIZE DISTRIBUTION CURVES

Figure No. 1

Direct Push – Groundwater

Monitoring Well – Soil (Total Organic Carbon)

Monitoring Well – Groundwater

Direct Push – Groundwater

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: **Iowa Army Ammunition Plant**
PROJECT NO. 16169421.00201

SITE NAME: **IAAAP FS Data Collection**
WELL NO. FTP-DP01-38

DATE/TIME COLLECTED: 10/22/02 1730
PERSONNEL: RC, BM
SAMPLE METHOD: Peristaltic Pump / Bailer

SAMPLE MEDIA: Groundwater
SAMPLE STATUS: 3 TAT [✓ 7 TAT]
SAMPLE QA SPLIT: YES [✓ NO] SPLIT SAMPLE NO.
SAMPLE QC DUPLICATE: YES [✓ NO] DUPLICATE SAMPLE NO.
MS/MSD REQUESTED YES [✓ NO] MS/MSD SAMPLE NO.

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
(3) 40 mL VOA	4C, HCL	Volatile Organic Compounds (8260B) + Freon 113

WELL PURGING DATA

Date: N/A
Time Started: N/A
Time Completed: N/A
PID/FID Measurements
Background: 0.0 ppm
Breathing Zone: 0.0 ppm
Well Head: 0.0 ppm
Head Space: 0.0 ppm

Well Depth (ft. BGS): 38.0
Depth to Water (ft BGS): 15.9
Water Column Length: 22.1
Volume of Water in Well (liters): 6.9
Purge Rate (liters/min): N/A
Level of Drawdown (ft. BTOC): N/A
Amount Purged (liters): 0.0

FIELD MEASUREMENTS

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate

Field Measurements N/A

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Photoionization Detector	MiniRAE 10.6eV	Calibration Verification Daily
FID (1-50,000 ppm)	Photovac Micro	Calibration Verification Daily
Water Level Probe	Slope Indicator	

GENERAL COMMENTS

Well Diameter = 1"
Screen Interval = 33' - 38'
Turbidity of Sample = 31.1 NTUs

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: **Iowa Army Ammunition Plant** PROJECT NO. 16169421.00201

SITE NAME: **IAAAP FS Data Collection** WELL NO. FTP-DP02-25

DATE/TIME COLLECTED: 10/27/02 1138 PERSONNEL: CA

SAMPLE METHOD: Peristaltic Pump / Bailer

SAMPLE MEDIA: Groundwater

SAMPLE STATUS: 3 TAT [✓ 7 TAT]

SAMPLE QA SPLIT: YES [✓ NO] SPLIT SAMPLE NO.

SAMPLE QC DUPLICATE: YES [✓ NO] DUPLICATE SAMPLE NO.

MS/MSD REQUESTED YES [✓ NO] MS/MSD SAMPLE NO.

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
(3) 40 mL VOA	4C, HCL	Volatile Organic Compounds (8260B) + Freon 113

WELL PURGING DATA

Date: 10/27

Time Started: 1123

Time Completed: 1135

PID/FID Measurements

Background: 0.0 ppm

Breathing Zone: 0.0 ppm

Well Head: 0.0 ppm

Head Space: 0.0 ppm

Well Depth (ft. BGS): 25.0

Depth to Water (ft BGS): 15.5

Water Column Length: 9.5

Volume of Water in Well (liters): 2.8

Purge Rate (liters/min): N/A

Level of Drawdown (ft. BTOC): N/A

Amount Purged (liters): 1.5

FIELD MEASUREMENTS

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate
		Field Measurements N/A							

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Photoionization Detector	MiniRAE 10.6eV	Calibration Verification Daily
FID (1-50,000 ppm)	Photovac Micro	Calibration Verification Daily
Water Level Probe	Slope Indicator	

GENERAL COMMENTS

Well Diameter = 1"

Screen Interval = 20' - 25'

Turbidity of Sample = 550 NTUs

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: **Iowa Army Ammunition Plant**
PROJECT NO. 16169421.00201
SITE NAME: **IAAAP FS Data Collection**
WELL NO. FTP-DP03-31
DATE/TIME COLLECTED: 10/27/02 1225
PERSONNEL: CA
SAMPLE METHOD: Peristaltic Pump / Bailer

SAMPLE MEDIA: Groundwater
SAMPLE STATUS: 3 TAT [✓ 7 TAT]
SAMPLE QA SPLIT: YES [✓ NO] SPLIT SAMPLE NO.
SAMPLE QC DUPLICATE: YES [✓ NO] DUPLICATE SAMPLE NO.
MS/MSD REQUESTED YES [✓ NO] MS/MSD SAMPLE NO.

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
(3) 40 mL VOA	4C, HCL	Volatile Organic Compounds (8260B) + Freon 113

WELL PURGING DATA

Date: 10/27
Time Started: 1215
Time Completed: 1220
PID/FID Measurements
Background: 0.0 ppm
Breathing Zone: 0.0 ppm
Well Head: 0.0 ppm
Head Space: 0.0 ppm

Well Depth (ft. BGS): 31.0
Depth to Water (ft BGS): 17.3
Water Column Length: 13.7
Volume of Water in Well (liters): 4.1
Purge Rate (liters/min): N/A
Level of Drawdown (ft. BTOC): N/A
Amount Purged (liters): 2.0

FIELD MEASUREMENTS

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate

Field Measurements N/A

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Photoionization Detector	MiniRAE 10.6eV	Calibration Verification Daily
FID (1-50,000 ppm)	Photovac Micro	Calibration Verification Daily
Water Level Probe	Slope Indicator	

GENERAL COMMENTS

Well Diameter = 1"
Screen Interval = 26' - 31'
Turbidity of Sample = 52.7 NTUs

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: **Iowa Army Ammunition Plant** PROJECT NO. 16169421.00201

SITE NAME: **IAAAP FS Data Collection** WELL NO. FTP-DP04-13

DATE/TIME COLLECTED: 11/05/02 0915 PERSONNEL: RC, BM

SAMPLE METHOD: Peristaltic Pump / Bailer

SAMPLE MEDIA: Groundwater

SAMPLE STATUS: 3 TAT [✓ 7 TAT]

SAMPLE QA SPLIT: YES [✓ NO] SPLIT SAMPLE NO.

SAMPLE QC DUPLICATE: YES [✓ NO] DUPLICATE SAMPLE NO.

MS/MSD REQUESTED YES [✓ NO] MS/MSD SAMPLE NO.

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
(2) 40 mL VOA	4C, HCL	Volatile Organic Compounds (8260B) + Freon 113

WELL PURGING DATA

Date: N/A

Time Started: N/A

Time Completed: N/A

PID/FID Measurements

Background: 0.0 ppm

Breathing Zone: 0.0 ppm

Well Head: 0.0 ppm

Head Space: 0.0 ppm

Well Depth (ft. BGS): 13.0

Depth to Water (ft BGS): 10.1

Water Column Length: 2.9

Volume of Water in Well (liters): 0.9

Purge Rate (liters/min): N/A

Level of Drawdown (ft. BTOC): N/A

Amount Purged (liters): 0.0

FIELD MEASUREMENTS

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate

Field Measurements N/A

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Photoionization Detector	MiniRAE 10.6eV	Calibration Verification Daily
FID (1-50,000 ppm)	Photovac Micro	Calibration Verification Daily
Water Level Probe	Slope Indicator	

GENERAL COMMENTS

Well Diameter = 1"

Screen Interval = 8' - 13'

Turbidity of Sample = 110 NTUs

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: **Iowa Army Ammunition Plant**

PROJECT NO. 16169421.00201

SITE NAME: **IAAAP FS Data Collection**

WELL NO. FTP-DP04-27

DATE/TIME COLLECTED: 10/23/02 0945

PERSONNEL: RC

SAMPLE METHOD: Peristaltic Pump / Bailer

SAMPLE MEDIA: Groundwater

SAMPLE STATUS: 3 TAT [✓ 7 TAT]

SAMPLE QA SPLIT: YES [✓ NO] SPLIT SAMPLE NO.

SAMPLE QC DUPLICATE: YES [✓ NO] DUPLICATE SAMPLE NO.

MS/MSD REQUESTED YES [✓ NO] MS/MSD SAMPLE NO.

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
(3) 40 mL VOA	4C, HCL	Volatile Organic Compounds (8260B) + Freon 113

WELL PURGING DATA

Date: N/A

Time Started: N/A

Time Completed: N/A

PID/FID Measurements

Background: 0.0 ppm

Breathing Zone: 0.0 ppm

Well Head: 0.0 ppm

Head Space: 0.0 ppm

Well Depth (ft. BGS): 27.0

Depth to Water (ft BGS): 11.4

Water Column Length: 15.6

Volume of Water in Well (liters): 4.9

Purge Rate (liters/min): N/A

Level of Drawdown (ft. BTOC): N/A

Amount Purged (liters): 0.0

FIELD MEASUREMENTS

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate

Field Measurements N/A

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Photoionization Detector	MiniRAE 10.6eV	Calibration Verification Daily
FID (1-50,000 ppm)	Photovac Micro	Calibration Verification Daily
Water Level Probe	Slope Indicator	

GENERAL COMMENTS

Well Diameter = 1"

Screen Interval = 22' - 27'

Turbidity of Sample = 51.2 NTUs

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: **Iowa Army Ammunition Plant**
PROJECT NO. 16169421.00201

SITE NAME: **IAAAP FS Data Collection**
WELL NO. FTP-DP05-23

DATE/TIME COLLECTED: 10/25/02 1435
PERSONNEL: RC

SAMPLE METHOD: Peristaltic Pump / Bailer

SAMPLE MEDIA: Groundwater
SAMPLE STATUS: 3 TAT [✓ 7 TAT]
SAMPLE QA SPLIT: YES [✓ NO]
SPLIT SAMPLE NO.
SAMPLE QC DUPLICATE: [✓ YES] NO
DUPLICATE SAMPLE NO. **FTP-DP05-00 @ 1500**
MS/MSD REQUESTED: YES [✓ NO]
MS/MSD SAMPLE NO.

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
(3) 40 mL VOA	4C, HCL	Volatile Organic Compounds (8260B) + Freon 113

WELL PURGING DATA

Date: N/A
Time Started: N/A
Time Completed: N/A
PID/FID Measurements
Background: 0.0 ppm
Breathing Zone: 0.0 ppm
Well Head: 0.0 ppm
Head Space: 0.0 ppm

Well Depth (ft. BGS): 23.0
Depth to Water (ft BGS): 21.5
Water Column Length: 1.5
Volume of Water in Well (liters): 0.5
Purge Rate (liters/min): N/A
Level of Drawdown (ft. BTOC): N/A
Amount Purged (liters): 0.0

FIELD MEASUREMENTS

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate

Field Measurements N/A

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Photoionization Detector	MiniRAE 10.6eV	Calibration Verification Daily
FID (1-50,000 ppm)	Photovac Micro	Calibration Verification Daily
Water Level Probe	Slope Indicator	

GENERAL COMMENTS

Well Diameter = 1"
Screen Interval = 18' - 23'
Turbidity of Sample = 89.1 NTUs

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: **Iowa Army Ammunition Plant** PROJECT NO. 16169421.00201

SITE NAME: **IAAAP FS Data Collection** WELL NO. FTP-DP06-24

DATE/TIME COLLECTED: 10/27/02 1255 PERSONNEL: CA
SAMPLE METHOD: Peristaltic Pump / Bailer

SAMPLE MEDIA: Groundwater
SAMPLE STATUS: 3 TAT [✓ 7 TAT]
SAMPLE QA SPLIT: YES [✓ NO] SPLIT SAMPLE NO.
SAMPLE QC DUPLICATE: YES [✓ NO] DUPLICATE SAMPLE NO.
MS/MSD REQUESTED YES [✓ NO] MS/MSD SAMPLE NO.

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
(3) 40 mL VOA	4C, HCL	Volatile Organic Compounds (8260B) + Freon 113

WELL PURGING DATA

Date:	10/27	Well Depth (ft. BGS):	24.0
Time Started:	1250	Depth to Water (ft BGS):	19.3
Time Completed:	1255	Water Column Length:	4.7
PID/FID Measurements		Volume of Water in Well (liters):	1.4
Background:	0.0 ppm	Purge Rate (liters/min):	N/A
Breathing Zone:	0.0 ppm	Level of Drawdown (ft. BTOC):	N/A
Well Head:	0.0 ppm	Amount Purged (liters):	0.5
Head Space:	0.0 ppm		

FIELD MEASUREMENTS

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate
		Field Measurements N/A							

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Photoionization Detector	MiniRAE 10.6eV	Calibration Verification Daily
FID (1-50,000 ppm)	Photovac Micro	Calibration Verification Daily
Water Level Probe	Slope Indicator	

GENERAL COMMENTS

Well Diameter = 1"
Screen Interval = 19' - 24'
Turbidity of Sample = N/A

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: **Iowa Army Ammunition Plant**
PROJECT NO. 16169421.00201

SITE NAME: **IAAAP FS Data Collection**
WELL NO. FTP-DP07-27

DATE/TIME COLLECTED: 10/23/02 1020
PERSONNEL: RC
SAMPLE METHOD: Peristaltic Pump / Bailer

SAMPLE MEDIA: Groundwater
SAMPLE STATUS: 3 TAT [✓ 7 TAT]
SAMPLE QA SPLIT: YES [✓ NO] SPLIT SAMPLE NO.
SAMPLE QC DUPLICATE: YES [✓ NO] DUPLICATE SAMPLE NO.
MS/MSD REQUESTED YES [✓ NO] MS/MSD SAMPLE NO.

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
(3) 40 mL VOA	4C, HCL	Volatile Organic Compounds (8260B) + Freon 113

WELL PURGING DATA

Date: N/A
Time Started: N/A
Time Completed: N/A
PID/FID Measurements
Background: 0.0 ppm
Breathing Zone: 0.0 ppm
Well Head: 0.0 ppm
Head Space: 0.0 ppm

Well Depth (ft. BGS): 27.0
Depth to Water (ft BGS): 15.7
Water Column Length: 11.3
Volume of Water in Well (liters): 3.5
Purge Rate (liters/min): N/A
Level of Drawdown (ft. BTOC): N/A
Amount Purged (liters): 0.0

FIELD MEASUREMENTS

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate
		Field Measurements N/A							

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Photoionization Detector	MiniRAE 10.6eV	Calibration Verification Daily
FID (1-50,000 ppm)	Photovac Micro	Calibration Verification Daily
Water Level Probe	Slope Indicator	

GENERAL COMMENTS

Well Diameter = 1"
Screen Interval = 22' - 27'
Turbidity of Sample = 64.2 NTUs

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: **Iowa Army Ammunition Plant**
PROJECT NO. 16169421.00201

SITE NAME: **IAAAP FS Data Collection**
WELL NO. FTP-DP08-23

DATE/TIME COLLECTED: 10/25/02 0940
PERSONNEL: RC
SAMPLE METHOD: Peristaltic Pump / Bailer

SAMPLE MEDIA: Groundwater
SAMPLE STATUS: 3 TAT [✓ 7 TAT]
SAMPLE QA SPLIT: YES [✓ NO] SPLIT SAMPLE NO.
SAMPLE QC DUPLICATE: YES [✓ NO] DUPLICATE SAMPLE NO.
MS/MSD REQUESTED YES [✓ NO] MS/MSD SAMPLE NO.

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
(3) 40 mL VOA	4C, HCL	Volatile Organic Compounds (8260B) + Freon 113

WELL PURGING DATA

Date: N/A
Time Started: N/A
Time Completed: N/A
PID/FID Measurements
Background: 2.4 ppm
Breathing Zone: 2.0 ppm
Well Head: 1.9 ppm
Head Space: 2.3 ppm

Well Depth (ft. BGS): 70.0
Depth to Water (ft BGS): N/A
Water Column Length: N/A
Volume of Water in Well (liters): N/A
Purge Rate (liters/min): N/A
Level of Drawdown (ft. BTOC): N/A
Amount Purged (liters): 0.0

FIELD MEASUREMENTS

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate

Field Measurements N/A

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Photoionization Detector	MiniRAE 10.6eV	Calibration Verification Daily
FID (1-50,000 ppm)	Photovac Micro	Calibration Verification Daily
Water Level Probe	Slope Indicator	

GENERAL COMMENTS

Well Diameter = 1"
Screen Interval = 18' - 23'
Turbidity of Sample = 33.1 NTUs

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: **Iowa Army Ammunition Plant**
PROJECT NO. 16169421.00201

SITE NAME: **IAAAP FS Data Collection**
WELL NO. FTP-DP09-30

DATE/TIME COLLECTED: 10/23/02 1205
PERSONNEL: RC, BM

SAMPLE METHOD: Peristaltic Pump / Bailer

SAMPLE MEDIA: Groundwater
SAMPLE STATUS: 3 TAT [✓ 7 TAT]
SAMPLE QA SPLIT: YES [✓ NO] SPLIT SAMPLE NO.
SAMPLE QC DUPLICATE: YES [✓ NO] DUPLICATE SAMPLE NO.
MS/MSD REQUESTED YES [✓ NO] MS/MSD SAMPLE NO.

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
(3) 40 mL VOA	4C, HCL	Volatile Organic Compounds (8260B) + Freon 113
(2) 1 L Glass Amber	4C	Explosives (8330) + MNX

WELL PURGING DATA

Date:	N/A	Well Depth (ft. BGS):	30.0
Time Started:	N/A	Depth to Water (ft BGS):	19.3
Time Completed:	N/A	Water Column Length:	10.7
PID/FID Measurements		Volume of Water in Well (liters):	3.3
Background:	0.0 ppm	Purge Rate (liters/min):	N/A
Breathing Zone:	0.0 ppm	Level of Drawdown (ft. BTOC):	N/A
Well Head:	0.0 ppm	Amount Purged (liters):	0.0
Head Space:	0.0 ppm		

FIELD MEASUREMENTS

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate

Field Measurements N/A

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Photoionization Detector	MiniRAE 10.6eV	Calibration Verification Daily
FID (1-50,000 ppm)	Photovac Micro	Calibration Verification Daily
Water Level Probe	Slope Indicator	

GENERAL COMMENTS

Well Diameter = 1"
Screen Interval = 25' - 30'
Turbidity of Sample = 66.1 NTUs

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: **Iowa Army Ammunition Plant**
PROJECT NO. 16169421.00201

SITE NAME: **IAAAP FS Data Collection**
WELL NO. FTP-DP10-18

DATE/TIME COLLECTED: 10/23/02 1100
PERSONNEL: RC
SAMPLE METHOD: Peristaltic Pump / Bailer

SAMPLE MEDIA: Groundwater
SAMPLE STATUS: 3 TAT [✓ 7 TAT]
SAMPLE QA SPLIT: YES [✓ NO] SPLIT SAMPLE NO.
SAMPLE QC DUPLICATE: YES [✓ NO] DUPLICATE SAMPLE NO.
MS/MSD REQUESTED YES [✓ NO] MS/MSD SAMPLE NO.

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
(3) 40 mL VOA	4C, HCL	Volatile Organic Compounds (8260B) + Freon 113

WELL PURGING DATA

Date: N/A
Time Started: N/A
Time Completed: N/A
PID/FID Measurements
Background: 0.0 ppm
Breathing Zone: 0.0 ppm
Well Head: N/A
Head Space: N/A

Well Depth (ft. BGS): 18.0
Depth to Water (ft BGS): 10.4
Water Column Length: 7.6
Volume of Water in Well (liters): 2.3
Purge Rate (liters/min): N/A
Level of Drawdown (ft. BTOC): N/A
Amount Purged (liters): 0.0

FIELD MEASUREMENTS

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate

Field Measurements N/A

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Photoionization Detector	MiniRAE 10.6eV	Calibration Verification Daily
FID (1-50,000 ppm)	Photovac Micro	Calibration Verification Daily
Water Level Probe	Slope Indicator	

GENERAL COMMENTS

Well Diameter = 1"
Screen Interval = 13' - 18'
Turbidity of Sample = 81.0 NTUs

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: **Iowa Army Ammunition Plant**
PROJECT NO. 16169421.00201

SITE NAME: **IAAAP FS Data Collection**
WELL NO. FTP-DP11-20

DATE/TIME COLLECTED: 10/24/02 0935
PERSONNEL: JC
SAMPLE METHOD: Peristaltic Pump / Bailer

SAMPLE MEDIA: Groundwater
SAMPLE STATUS: 3 TAT [✓ 7 TAT]
SAMPLE QA SPLIT: YES [✓ NO] SPLIT SAMPLE NO.
SAMPLE QC DUPLICATE: YES [✓ NO] DUPLICATE SAMPLE NO.
MS/MSD REQUESTED YES [✓ NO] MS/MSD SAMPLE NO.

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
(3) 40 mL VOA	4C, HCL	Volatile Organic Compounds (8260B) + Freon 113
(2) 1 L Glass Amber	4C	Explosives (8330) + MNX

WELL PURGING DATA

Date: N/A
Time Started: N/A
Time Completed: N/A
PID/FID Measurements
Background: 0.0 ppm
Breathing Zone: 0.0 ppm
Well Head: 0.0 ppm
Head Space: 0.0 ppm

Well Depth (ft. BGS): 20.0
Depth to Water (ft BGS): 17.0
Water Column Length: 3.0
Volume of Water in Well (liters): 0.9
Purge Rate (liters/min): N/A
Level of Drawdown (ft. BTOC): N/A
Amount Purged (liters): 0.0

FIELD MEASUREMENTS

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate

Field Measurements N/A

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Photoionization Detector	MiniRAE 10.6eV	Calibration Verification Daily
FID (1-50,000 ppm)	Photovac Micro	Calibration Verification Daily
Water Level Probe	Slope Indicator	

GENERAL COMMENTS

Well Diameter = 1"
Screen Interval = 15' - 20'
Turbidity of Sample = > 1000 NTUs

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: **Iowa Army Ammunition Plant**
PROJECT NO. 16169421.00201

SITE NAME: **IAAAP FS Data Collection**
WELL NO. FTP-DP12-23

DATE/TIME COLLECTED: 10/25/02 1125
PERSONNEL: RC

SAMPLE METHOD: Peristaltic Pump / Bailer

SAMPLE MEDIA: Groundwater
SAMPLE STATUS: 3 TAT [✓ 7 TAT]
SAMPLE QA SPLIT: YES [✓ NO] SPLIT SAMPLE NO.
SAMPLE QC DUPLICATE: YES [✓ NO] DUPLICATE SAMPLE NO.
MS/MSD REQUESTED YES [✓ NO] MS/MSD SAMPLE NO.

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
(3) 40 mL VOA	4C, HCL	Volatile Organic Compounds (8260B) + Freon 113
(1) 1 L Glass Amber	4C	Explosives (8330) + MNX

WELL PURGING DATA

Date: N/A
Time Started: N/A
Time Completed: N/A
PID/FID Measurements
Background: 0.0 ppm
Breathing Zone: 0.0 ppm
Well Head: 0.0 ppm
Head Space: 0.0 ppm

Well Depth (ft. BGS): 23.0
Depth to Water (ft BGS): 21.2
Water Column Length: 1.8
Volume of Water in Well (liters): 0.5
Purge Rate (liters/min): N/A
Level of Drawdown (ft. BTOC): N/A
Amount Purged (liters): 0.0

FIELD MEASUREMENTS

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate

Field Measurements N/A

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Photoionization Detector	MiniRAE 10.6eV	Calibration Verification Daily
FID (1-50,000 ppm)	Photovac Micro	Calibration Verification Daily
Water Level Probe	Slope Indicator	

GENERAL COMMENTS

Well Diameter = 1"
Screen Interval = 18' - 23'
Turbidity of Sample = > 1000 NTUs

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: **Iowa Army Ammunition Plant** PROJECT NO. 16169421.00201

SITE NAME: **IAAAP FS Data Collection** WELL NO. FTP-DP14-09

DATE/TIME COLLECTED: 10/23/02 0833 PERSONNEL: RC

SAMPLE METHOD: Peristaltic Pump / Bailer

SAMPLE MEDIA: Groundwater

SAMPLE STATUS: 3 TAT [✓ 7 TAT]

SAMPLE QA SPLIT: YES [✓ NO] SPLIT SAMPLE NO.

SAMPLE QC DUPLICATE: YES [✓ NO] DUPLICATE SAMPLE NO.

MS/MSD REQUESTED YES [✓ NO] MS/MSD SAMPLE NO.

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
(3) 40 mL VOA	4C, HCL	Volatile Organic Compounds (8260B) + Freon 113
(2) 1 L Glass Amber	4C	Explosives (8330) + MNX

WELL PURGING DATA

Date: N/A

Time Started: N/A

Time Completed: N/A

PID/FID Measurements

Background: 0.0 ppm

Breathing Zone: 0.0 ppm

Well Head: 0.0 ppm

Head Space: 0.0 ppm

Well Depth (ft. BGS): 9.0

Depth to Water (ft BGS): N/A

Water Column Length: N/A

Volume of Water in Well (liters): N/A

Purge Rate (liters/min): N/A

Level of Drawdown (ft. BTOC): N/A

Amount Purged (liters): 0.0

FIELD MEASUREMENTS

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate

Field Measurements N/A

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Photoionization Detector	MiniRAE 10.6eV	Calibration Verification Daily
FID (1-50,000 ppm)	Photovac Micro	Calibration Verification Daily
Water Level Probe	Slope Indicator	

GENERAL COMMENTS

Well Diameter = Screen Point Sampler Used.

Screen Interval = 5' - 9'

Turbidity of Sample = > 1000 NTUs

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: **Iowa Army Ammunition Plant** PROJECT NO. 16169421.00201

SITE NAME: **IAAAP FS Data Collection** WELL NO. L9-DP17-06

DATE/TIME COLLECTED: 10/25/02 1303 PERSONNEL: RC

SAMPLE METHOD: Peristaltic Pump / Bailer

SAMPLE MEDIA: Groundwater

SAMPLE STATUS: 3 TAT [✓ 7 TAT]

SAMPLE QA SPLIT: YES [✓ NO] SPLIT SAMPLE NO.

SAMPLE QC DUPLICATE: YES [✓ NO] DUPLICATE SAMPLE NO.

MS/MSD REQUESTED YES [✓ NO] MS/MSD SAMPLE NO.

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
(3) 40 mL VOA	4C, HCL	Volatile Organic Compounds (8260B) + Freon 113
(I) 1 L Glass Amber	4C	Explosives (8330) + MNX

WELL PURGING DATA

Date: N/A

Time Started: N/A

Time Completed: N/A

PID/FID Measurements

Background: 0.0 ppm

Breathing Zone: 0.0 ppm

Well Head: 0.0 ppm

Head Space: 12.0 ppm

Well Depth (ft. BGS): 6.0

Depth to Water (ft BGS): 4.4

Water Column Length: 1.6

Volume of Water in Well (liters): 0.5

Purge Rate (liters/min): N/A

Level of Drawdown (ft. BTOC): N/A

Amount Purged (liters): 0.0

FIELD MEASUREMENTS

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate

Field Measurements N/A

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Photoionization Detector	MiniRAE 10.6eV	Calibration Verification Daily
FID (1-50,000 ppm)	Photovac Micro	Calibration Verification Daily
Water Level Probe	Slope Indicator	

GENERAL COMMENTS

Well Diameter = 1"

Screen Interval = 1' - 6'

Turbidity of Sample = 107 NTUs

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: **Iowa Army Ammunition Plant** PROJECT NO. 16169421.00201

SITE NAME: **IAAAP FS Data Collection** WELL NO. FTP-DP18-10

DATE/TIME COLLECTED: 10/25/02 1205 PERSONNEL: RC, BM

SAMPLE METHOD: Peristaltic Pump / Bailer

SAMPLE MEDIA: Groundwater

SAMPLE STATUS: 3 TAT [✓ 7 TAT]

SAMPLE QA SPLIT: YES [✓ NO] SPLIT SAMPLE NO.

SAMPLE QC DUPLICATE: YES [✓ NO] DUPLICATE SAMPLE NO.

MS/MSD REQUESTED YES [✓ NO] MS/MSD SAMPLE NO.

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
(3) 40 mL VOA	4C, HCL	Volatile Organic Compounds (8260B) + Freon 113
(1) 1 L Glass Amber	4C	Explosives (8330) + MNX

WELL PURGING DATA

Date:	N/A	Well Depth (ft. BGS):	10.0
Time Started:	N/A	Depth to Water (ft BGS):	8.2
Time Completed:	N/A	Water Column Length:	1.8
PID/FID Measurements		Volume of Water in Well (liters):	0.6
Background:	0.0 ppm	Purge Rate (liters/min):	N/A
Breathing Zone:	0.0 ppm	Level of Drawdown (ft. BTOC):	N/A
Well Head:	0.0 ppm	Amount Purged (liters):	0.0
Head Space:	0.0 ppm		

FIELD MEASUREMENTS

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate

Field Measurements N/A

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Photoionization Detector	MiniRAE 10.6eV	Calibration Verification Daily
FID (1-50,000 ppm)	Photovac Micro	Calibration Verification Daily
Water Level Probe	Slope Indicator	

GENERAL COMMENTS

Well Diameter = 1"

Screen Interval = 5' - 10'

Turbidity of Sample = > 1000 NTUs

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: **Iowa Army Ammunition Plant** PROJECT NO. 16169421.00201

SITE NAME: **IAAAP FS Data Collection** WELL NO. FTP-DP19-14

DATE/TIME COLLECTED: 10/25/02 0905 PERSONNEL: RC

SAMPLE METHOD: Peristaltic Pump / Bailer

SAMPLE MEDIA: Groundwater

SAMPLE STATUS: 3 TAT [✓ 7 TAT]

SAMPLE QA SPLIT: YES [✓ NO] SPLIT SAMPLE NO.

SAMPLE QC DUPLICATE: YES [✓ NO] DUPLICATE SAMPLE NO.

MS/MSD REQUESTED YES [✓ NO] MS/MSD SAMPLE NO.

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
(3) 40 mL VOA	4C, HCL	Volatile Organic Compounds (8260B) + Freon 113

WELL PURGING DATA

Date: N/A

Time Started: N/A

Time Completed: N/A

PID/FID Measurements

Background: 2.0 ppm

Breathing Zone: 2.0 ppm

Well Head: 1.1 ppm

Head Space: 1.1 ppm

Well Depth (ft. BGS): 14.0

Depth to Water (ft BGS): 5.8

Water Column Length: 8.2

Volume of Water in Well (liters): 2.5

Purge Rate (liters/min): N/A

Level of Drawdown (ft. BTOC): N/A

Amount Purged (liters): 0.0

FIELD MEASUREMENTS

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate
		Field Measurements N/A							

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Photoionization Detector	MiniRAE 10.6eV	Calibration Verification Daily
FID (1-50,000 ppm)	Photovac Micro	Calibration Verification Daily
Water Level Probe	Slope Indicator	

GENERAL COMMENTS

Well Diameter = 1"

Screen Interval = 9' - 14'

Turbidity of Sample = 10.4 NTUs

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: **Iowa Army Ammunition Plant** PROJECT NO. 16169421.00201

SITE NAME: **IAAAP FS Data Collection** WELL NO. FTP-DP20-23

DATE/TIME COLLECTED: 11/21/02 1515 PERSONNEL: RC, BM

SAMPLE METHOD: Peristaltic Pump / Bailer

SAMPLE MEDIA: Groundwater

SAMPLE STATUS: 3 TAT [✓ 7 TAT]

SAMPLE QA SPLIT: YES [✓ NO] SPLIT SAMPLE NO.

SAMPLE QC DUPLICATE: YES [✓ NO] DUPLICATE SAMPLE NO.

MS/MSD REQUESTED YES [✓ NO] MS/MSD SAMPLE NO.

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
(3) 40 mL VOA	4C, HCL	Volatile Organic Compounds (8260B) + Freon 113

WELL PURGING DATA

Date: N/A

Time Started: N/A

Time Completed: N/A

PID/FID Measurements

Background: 0.0 ppm

Breathing Zone: 0.0 ppm

Well Head: N/A

Head Space: N/A

Well Depth (ft. BGS): 23.0

Depth to Water (ft BGS): 18.2

Water Column Length: 4.2

Volume of Water in Well (liters): 1.5

Purge Rate (liters/min): N/A

Level of Drawdown (ft. BTOC): N/A

Amount Purged (liters): 0.0

FIELD MEASUREMENTS

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate

Field Measurements N/A

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Photoionization Detector	MiniRAE 10.6eV	Calibration Verification Daily
FID (1-50,000 ppm)	Photovac Micro	Calibration Verification Daily
Water Level Probe	Slope Indicator	

GENERAL COMMENTS

Well Diameter = 1"

Screen Interval = 18' - 23'

Turbidity of Sample = 11.9 NTUs

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: **Iowa Army Ammunition Plant**
PROJECT NO. 16169421.00201

SITE NAME: **IAAAP FS Data Collection**
WELL NO. FTP-DP21-30

DATE/TIME COLLECTED: 10/25/02 1020
PERSONNEL: RC, BM
SAMPLE METHOD: Peristaltic Pump / Bailer

SAMPLE MEDIA: Groundwater
SAMPLE STATUS: 3 TAT [✓ 7 TAT]
SAMPLE QA SPLIT: YES [✓ NO] SPLIT SAMPLE NO.
SAMPLE QC DUPLICATE: YES [✓ NO] DUPLICATE SAMPLE NO.
MS/MSD REQUESTED YES [✓ NO] MS/MSD SAMPLE NO.

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
(3) 40 mL VOA	4C, HCL	Volatile Organic Compounds (8260B) + Freon 113

WELL PURGING DATA

Date: N/A
Time Started: N/A
Time Completed: N/A
PID/FID Measurements
Background: 2.4 ppm
Breathing Zone: 2.4 ppm
Well Head: 2.0 ppm
Head Space: 0.0 ppm

Well Depth (ft. BGS): 30.0
Depth to Water (ft BGS): 18.0
Water Column Length: 12.0
Volume of Water in Well (liters): 3.7
Purge Rate (liters/min): N/A
Level of Drawdown (ft. BTOC): N/A
Amount Purged (liters): 0.0

FIELD MEASUREMENTS

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate

Field Measurements N/A

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Photoionization Detector	MiniRAE 10.6eV	Calibration Verification Daily
FID (1-50,000 ppm)	Photovac Micro	Calibration Verification Daily
Water Level Probe	Slope Indicator	

GENERAL COMMENTS

Well Diameter = 1"
Screen Interval = 25' - 30'
Turbidity of Sample = 4.4 NTUs

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: **Iowa Army Ammunition Plant**

PROJECT NO. 16169421.00201

SITE NAME: **IAAAP FS Data Collection**

WELL NO. FTP-DP22-20

DATE/TIME COLLECTED: 11/21/02 1615

PERSONNEL: RC, BM

SAMPLE METHOD: Peristaltic Pump / Bailer

SAMPLE MEDIA: Groundwater
SAMPLE STATUS: 3 TAT [✓ 48 Hr TAT]
SAMPLE QA SPLIT: YES [✓ NO] SPLIT SAMPLE NO.
SAMPLE QC DUPLICATE: YES [✓ NO] DUPLICATE SAMPLE NO.
MS/MSD REQUESTED YES [✓ NO] MS/MSD SAMPLE NO.

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
(3) 40 mL VOA	4C, HCL	Volatile Organic Compounds (8260B) + Freon 113

WELL PURGING DATA

Date: N/A
Time Started: N/A
Time Completed: N/A
PID/FID Measurements
Background: 0.0 ppm
Breathing Zone: 0.0 ppm
Well Head: 0.0 ppm
Head Space: 0.0 ppm

Well Depth (ft. BGS): 20.0
Depth to Water (ft BGS): 10.6
Water Column Length: 9.4
Volume of Water in Well (liters): 2.9
Purge Rate (liters/min): N/A
Level of Drawdown (ft. BTOC): N/A
Amount Purged (liters): 0.0

FIELD MEASUREMENTS

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate

Field Measurements N/A

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Photoionization Detector	MiniRAE 10.6eV	Calibration Verification Daily
FID (1-50,000 ppm)	Photovac Micro	Calibration Verification Daily
Water Level Probe	Slope Indicator	

GENERAL COMMENTS

Well Diameter = 1"
Screen Interval = 15' - 20'
Turbidity of Sample = 16.1 NTUs

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: **Iowa Army Ammunition Plant**
PROJECT NO. 16169421.00201

SITE NAME: **IAAAP FS Data Collection**
WELL NO. FTP-DP23-25

DATE/TIME COLLECTED: 11/21/02 1545
PERSONNEL: RC, BM

SAMPLE METHOD: Peristaltic Pump / Bailer

SAMPLE MEDIA: Groundwater
SAMPLE STATUS: 3 TAT [✓ 48 Hr TAT]
SAMPLE QA SPLIT: YES [✓ NO]
SPLIT SAMPLE NO.
SAMPLE QC DUPLICATE: [✓ YES] NO
DUPLICATE SAMPLE NO. **Duplicate 10 @ 1200 (VOCs Only)**
MS/MSD REQUESTED YES [✓ NO]
MS/MSD SAMPLE NO.

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
(3) 40 mL VOA	4C, HCL	Volatile Organic Compounds (8260B) + Freon 113
(2) 1 L Glass Amber	4C	Explosives (8330) + MNX

WELL PURGING DATA

Date:	N/A	Well Depth (ft. BGS):	25.0
Time Started:	N/A	Depth to Water (ft BGS):	18.0
Time Completed:	N/A	Water Column Length:	7.0
PID/FID Measurements		Volume of Water in Well (liters):	2.1
Background:	0.0 ppm	Purge Rate (liters/min):	N/A
Breathing Zone:	0.0 ppm	Level of Drawdown (ft. BTOC):	N/A
Well Head:	0.0 ppm	Amount Purged (liters):	0.0
Head Space:	0.9 ppm		

FIELD MEASUREMENTS

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate

Field Measurements N/A

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Photoionization Detector	MiniRAE 10.6eV	Calibration Verification Daily
FID (1-50,000 ppm)	Photovac Micro	Calibration Verification Daily
Water Level Probe	Slope Indicator	

GENERAL COMMENTS

Well Diameter =	1"
Screen Interval =	20' - 25'
Turbidity of Sample =	953 NTUs

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: **Iowa Army Ammunition Plant** PROJECT NO. 16169421.00201

SITE NAME: **IAAAP FS Data Collection** WELL NO. FTP-DP24-07

DATE/TIME COLLECTED: 11/22/02 1350 PERSONNEL: RC, BM

SAMPLE METHOD: Peristaltic Pump / Bailer

SAMPLE MEDIA: Groundwater

SAMPLE STATUS: 3 TAT [✓ 48 Hr TAT]

SAMPLE QA SPLIT: YES [✓ NO] SPLIT SAMPLE NO.

SAMPLE QC DUPLICATE: YES [✓ NO] DUPLICATE SAMPLE NO.

MS/MSD REQUESTED YES [✓ NO] MS/MSD SAMPLE NO.

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
(2) 40 mL VOA	4C, HCL	Volatile Organic Compounds (8260B) + Freon 113
(1) 1 L Glass Amber	4C	Explosives (8330) + MNX

WELL PURGING DATA

Date:	N/A	Well Depth (ft. BGS):	7.0
Time Started:	N/A	Depth to Water (ft BGS):	6.5
Time Completed:	N/A	Water Column Length:	0.5
PID/FID Measurements		Volume of Water in Well (liters):	0.2
Background:	0.0 ppm	Purge Rate (liters/min):	N/A
Breathing Zone:	0.0 ppm	Level of Drawdown (ft. BTOC):	N/A
Well Head:	0.0 ppm	Amount Purged (liters):	0.0
Head Space:	0.0 ppm		

FIELD MEASUREMENTS

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate

Field Measurements N/A

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Photoionization Detector	MiniRAE 10.6eV	Calibration Verification Daily
FID (1-50,000 ppm)	Photovac Micro	Calibration Verification Daily
Water Level Probe	Slope Indicator	

GENERAL COMMENTS

Well Diameter = 1"

Screen Interval = 2' - 7'

Turbidity of Sample = N/A

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: **Iowa Army Ammunition Plant**

PROJECT NO. 16169421.00201

SITE NAME: **IAAAP FS Data Collection**

WELL NO. FTP-DP25-22

DATE/TIME COLLECTED: 11/22/02 1335

PERSONNEL: RC, BM

SAMPLE METHOD: Peristaltic Pump / Bailer

SAMPLE MEDIA: Groundwater

SAMPLE STATUS: 3 TAT [✓ 48 Hr TAT]

SAMPLE QA SPLIT: YES [✓ NO]

SPLIT SAMPLE NO.

SAMPLE QC DUPLICATE: [✓ YES] NO

DUPLICATE SAMPLE NO. **Duplicate 11 @ 1100 (VOCs Only)**

MS/MSD REQUESTED YES [✓ NO]

MS/MSD SAMPLE NO.

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
(3) 40 mL VOA	4C, HCL	Volatile Organic Compounds (8260B) + Freon 113
(1) 1 L Glass Amber	4C	Explosives (8330) + MNX

WELL PURGING DATA

Date: N/A

Time Started: N/A

Time Completed: N/A

PID/FID Measurements

Background: 0.0 ppm

Breathing Zone: 0.0 ppm

Well Head: 0.0 ppm

Head Space: 0.0 ppm

Well Depth (ft. BGS): 22.0

Depth to Water (ft BGS): 18.3

Water Column Length: 3.7

Volume of Water in Well (liters): 1.1

Purge Rate (liters/min): N/A

Level of Drawdown (ft. BTOC): N/A

Amount Purged (liters): 0.0

FIELD MEASUREMENTS

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate

Field Measurements N/A

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Photoionization Detector	MiniRAE 10.6eV	Calibration Verification Daily
FID (1-50,000 ppm)	Photovac Micro	Calibration Verification Daily
Water Level Probe	Slope Indicator	

GENERAL COMMENTS

Well Diameter = 1"

Screen Interval = 17' - 22'

Turbidity of Sample = N/A

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: **Iowa Army Ammunition Plant**
PROJECT NO. 16169421.00201

SITE NAME: **IAAAP FS Data Collection**
WELL NO. FTP-DP26-23

DATE/TIME COLLECTED: 11/25/02 1000
PERSONNEL: RC, BM
SAMPLE METHOD: Peristaltic Pump / Bailer

SAMPLE MEDIA: Groundwater
SAMPLE STATUS: 3 TAT [✓ 48 Hr TAT]
SAMPLE QA SPLIT: YES [✓ NO] SPLIT SAMPLE NO.
SAMPLE QC DUPLICATE: YES [✓ NO] DUPLICATE SAMPLE NO.
MS/MSD REQUESTED YES [✓ NO] MS/MSD SAMPLE NO.

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
(3) 40 mL VOA	4C, HCL	Volatile Organic Compounds (8260B) + Freon 113
(1) 1 L Glass Amber	4C	Explosives (8330) + MNX

WELL PURGING DATA

Date: N/A
Time Started: N/A
Time Completed: N/A
PID/FID Measurements
Background: 0.0 ppm
Breathing Zone: 0.0 ppm
Well Head: 0.0 ppm
Head Space: 0.0 ppm

Well Depth (ft. BGS): 23.0
Depth to Water (ft BGS): 16.3
Water Column Length: 6.7
Volume of Water in Well (liters): 2.0
Purge Rate (liters/min): N/A
Level of Drawdown (ft. BTOC): N/A
Amount Purged (liters): 0.0

FIELD MEASUREMENTS

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate

Field Measurements N/A

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Photoionization Detector	MiniRAE 10.6eV	Calibration Verification Daily
FID (1-50,000 ppm)	Photovac Micro	Calibration Verification Daily
Water Level Probe	Slope Indicator	

GENERAL COMMENTS

Well Diameter = 1"
Screen Interval = 18' - 23'
Turbidity of Sample = 343 NTUs

Monitoring Well – Soil (Total Organic Carbon)

SOIL SAMPLE COLLECTION FIELD SHEET

SITE NAME Iowa AAP Six Site FS Data Collection

PROJECT NO. 16169421.00201

SAMPLE NO. FTP-MW1-05

WELL NO. FTP-MW1

DATE/TIME COLLECTED 3/25/2003 / 1010

PERSONNEL M. Sonderman

SAMPLE METHOD AND DEPTH Laskey Sampler 4.0' - 4.8'

SAMPLE MEDIA (Circle 1): [✓ Soil] Sediment Sludge MS/MSD

SAMPLE SPLIT (Circle 1): Yes [✓ No] SPLIT SAMPLE NUMBER

FIELD DUPLICATE (Circle 1): Yes [✓ No] DUPLICATE SAMPLE NUMBER

Sample Container	Preservative	Analysis Requested
4 oz. Glass jar	None	Method 9060 (Soil TOC)

DESCRIPTION:

DEPTH:	DESCRIPTION:
4.0' - 4.8'	Sandy CLAY (CL) - Soft, moist, dark gray-black and graymottled, low to medium plastic, fine-grained Sand

Comments

SOIL SAMPLE COLLECTION FIELD SHEET

SITE NAME Iowa AAP Six Site FS Data Collection

PROJECT NO. 16169421.00201

SAMPLE NO. FTP-MW2-07

WELL NO. FTP-MW2

DATE/TIME COLLECTED 4/14/03 / 1638

PERSONNEL M. Sonderman

SAMPLE METHOD AND DEPTH Lasky Sampler 6.0' - 7.0'

SAMPLE MEDIA (Circle 1): [✓ Soil] Sediment Sludge MS/MSD

SAMPLE SPLIT (Circle 1): Yes [✓ No] SPLIT SAMPLE NUMBER

FIELD DUPLICATE (Circle 1): Yes [✓ No] DUPLICATE SAMPLE NUMBER

Sample Container	Preservative	Analysis Requested
4 oz. Glass jar	None	Method 9060 (Soil TOC)

DESCRIPTION:

DEPTH:	DESCRIPTION:
6.0' - 7.0'	Silty CLAY (CL) - Medium stiff, wet, dark brown and gray mottled, low plasitc, with Sand and pieces of Limestone

Comments

SOIL SAMPLE COLLECTION FIELD SHEET

SITE NAME Iowa AAP Six Site FS Data Collection PROJECT NO. 16169421.00201

SAMPLE NO. FTP-MW3-06 WELL NO. FTP-MW3

DATE/TIME COLLECTED 4/15/03 / 1320 PERSONNEL M. Sonderman

SAMPLE METHOD AND DEPTH Lasky Sampler 4.0' - 5.0'

SAMPLE MEDIA (Circle 1): [✓ Soil] Sediment Sludge MS/MSD

SAMPLE SPLIT (Circle 1): Yes [✓ No] SPLIT SAMPLE NUMBER

FIELD DUPLICATE (Circle 1): Yes [✓ No] DUPLICATE SAMPLE NUMBER

Sample Container	Preservative	Analysis Requested
4 oz. Glass jar	None	Method 9060 (Soil TOC)

DESCRIPTION:

DEPTH:	DESCRIPTION:
4.0' - 5.0'	Clay (CH) - Stiff, moist, yellowish-brown, high plastic, with Sand

Comments

SOIL SAMPLE COLLECTION FIELD SHEET

SITE NAME Iowa AAP Six Site FS Data Collection

PROJECT NO. 16169421.00201

SAMPLE NO. FTP-MW4(B)-17

WELL NO. FTP-MW4 (B)

DATE/TIME COLLECTED 4/13/03 / 0955

PERSONNEL M. Sonderman

SAMPLE METHOD AND DEPTH 3" Split Spoon 16.0' - 17.0'

SAMPLE MEDIA (Circle 1): [✓ Soil] Sediment Sludge MS/MSD

SAMPLE SPLIT (Circle 1): Yes [✓ No] SPLIT SAMPLE NUMBER

FIELD DUPLICATE (Circle 1): Yes [✓ No] DUPLICATE SAMPLE NUMBER

Sample Container	Preservative	Analysis Requested
4 oz. Glass jar	None	Method 9060 (Soil TOC)

DESCRIPTION:

DEPTH:	DESCRIPTION:
16.0' - 17.0'	Silty CLAY (CL) - Very stiff, moist, gray dark gray, high plastic, with Sand

Comments

SOIL SAMPLE COLLECTION FIELD SHEET

SITE NAME Iowa AAP Six Site FS Data Collection

PROJECT NO. 16169421.00201

SAMPLE NO. FTP-MW4(B)-26

WELL NO. FTP-MW4 (B)

DATE/TIME COLLECTED 4/13/2003 / 1030

PERSONNEL D. Berger

SAMPLE METHOD AND DEPTH 3" Split Spoon 26.0' - 26.5'

SAMPLE MEDIA (Circle 1): [✓ Soil] Sediment Sludge MS/MSD

SAMPLE SPLIT (Circle 1): Yes [✓ No] SPLIT SAMPLE NUMBER

FIELD DUPLICATE (Circle 1): Yes [✓ No] DUPLICATE SAMPLE NUMBER

Sample Container	Preservative	Analysis Requested
4 oz. Glass jar	None	Method 9060 (Soil TOC)

DESCRIPTION:

DEPTH:	DESCRIPTION:
26.0' - 26.5'	Sandy CLAY (CL) - Very stiff, moist, orangish-brown with gray mottling, low to medium plastic, medium- to coarse-grained Sand

Comments

SOIL SAMPLE COLLECTION FIELD SHEET

SITE NAME Iowa AAP Six Site FS Data Collection
PROJECT NO. 16169421.00201
SAMPLE NO. FTP-MW5-11
WELL NO. FTP-MW5
DATE/TIME COLLECTED 4/13/2003 / 1038
PERSONNEL M. Sonderman
SAMPLE METHOD AND DEPTH 2" Split Spoon 11.0' - 12.0'
SAMPLE MEDIA (Circle 1): [✓ Soil] Sediment Sludge MS/MSD
SAMPLE SPLIT (Circle 1): Yes [✓ No] SPLIT SAMPLE NUMBER
FIELD DUPLICATE (Circle 1): Yes [✓ No] DUPLICATE SAMPLE NUMBER

Sample Container	Preservative	Analysis Requested
4 oz. Glass jar	None	Method 9060 (Soil TOC)

DESCRIPTION:

DEPTH:	DESCRIPTION:
11.0' - 12.0'	Sandy CLAY (CL) - Soft, moist, yellowish-brown and gray mottled, medium plastic, iron staining, fine-grained Sand

Comments

SOIL SAMPLE COLLECTION FIELD SHEET

SITE NAME Iowa AAP Six Site FS Data Collection PROJECT NO. 16169421.00201

SAMPLE NO. FTP-MW7-11 WELL NO. FTP-MW7

DATE/TIME COLLECTED 4/16/2003 / 0853 PERSONNEL C. Anderson

SAMPLE METHOD AND DEPTH 2" Split Spoon 9.5' - 10.5'

SAMPLE MEDIA (Circle 1): [✓ Soil] Sediment Sludge MS/MSD

SAMPLE SPLIT (Circle 1): Yes [✓ No] SPLIT SAMPLE NUMBER

FIELD DUPLICATE (Circle 1): Yes [✓ No] DUPLICATE SAMPLE NUMBER

Sample Container	Preservative	Analysis Requested
4 oz. Glass jar	None	Method 9060 (Soil TOC)

DESCRIPTION:

DEPTH:	DESCRIPTION:
9.5' - 10.5'	Silty CLAY (CL) - Stiff, moist, gray with reddish-brown, low to medium plastic, with Sand

Comments

SOIL SAMPLE COLLECTION FIELD SHEET

SITE NAME Iowa AAP Six Site FS Data Collection
PROJECT NO. 16169421.00201
SAMPLE NO. FTP-MW7-20
WELL NO. FTP-MW7
DATE/TIME COLLECTED 4/16/2003 / 0945
PERSONNEL C. Anderson
SAMPLE METHOD AND DEPTH 2" Split Spoon 18.5' - 19.5'
SAMPLE MEDIA (Circle 1): [✓ Soil] Sediment Sludge MS/MSD
SAMPLE SPLIT (Circle 1): Yes [✓ No] SPLIT SAMPLE NUMBER
FIELD DUPLICATE (Circle 1): Yes [✓ No] DUPLICATE SAMPLE NUMBER

Sample Container	Preservative	Analysis Requested
4 oz. Glass jar	None	Method 9060 (Soil TOC)

DESCRIPTION:

DEPTH:	DESCRIPTION:
18.5' - 19.5'	Sandy CLAY (CL) - Medium stiff, moist to wet, reddish-brown, low plastic, fine grained Sand

Comments

Monitoring Well – Groundwater

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: **Iowa Army Ammunition Plant**
PROJECT NO. 16169421.00201

SITE NAME: **IAAAP 6-Site FS Data Collection**
WELL NO. **FTP-MW1**
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DATE/TIME COLLECTED: 5/13/03 1005
PERSONNEL: RC, MS
SAMPLE METHOD: Fultz Pump

SAMPLE MEDIA: Groundwater
SAMPLE QA SPLIT: [✓ **YES**] NO
SPLIT SAMPLE NO. **FTP-MW1**
SAMPLE QC DUPLICATE: [✓ **YES**] NO
DUPLICATE SAMPLE NO. **FTP-MW9**
MS/MSD REQUESTED YES [✓ **NO**]
MS/MSD SAMPLE NO.

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
(3) 1 L HDPE	4C, HNO3	Metals As, Ba, Cd, Cr, Pb, Hg, Se, Ag (6020/7470)
(6) 1 L Glass Amber	4C	Explosives (8330) + MNX
(9) 40 mL VOA	4C, HCL	Volatile Organic Compound (8260B) + Freon 113
(4) 40 mL VOA	4C, H3PO4	Total Organic Carbon (415.1)
(2) 1 L HDPE	4C, H2SO4	TKN (351.2), Ammonia (350), NO2+NO3 (353.2)
(2) 500 mL HDPE	4C, ZnAcetate/NaOH	Sulfide (376.2)
(2) 1 L HDPE	4C	Alk (310.1), SO4 (300), Ortho P (300), CL (300), CO2 (SM4500D)

WELL PURGING DATA

Date: 5/13/03
Time Started: 0854
Time Completed 1004
PID/FID Measurements
Background: ND \ ND
Breathing Zone ND \ ND
Well Head: 3.6 \ ND

Well Depth (ft. BTOC): 18.31
Depth to Water (ft BTOC): 6.11
Water Column Length: 12.20
Volume of Water in Well (liters): 7.6
Purge Rate (liters/min): 0.5
Level of Drawdown (ft. BTOC): 0.15
Amount Purged (liters): 38.0

FIELD MEASUREMENTS

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate (lpm)
0855	0	6.74	9.95	0.540	1.85	-6.3	45	6.30	0.5
0859	2.0	6.86	10.00	0.530	0.30	-48.1	31	6.49	0.5
0903	4.0	6.81	10.10	0.515	0.17	-54.8	6.8	6.60	0.5
0907	6.0	6.79	10.06	0.514	0.13	-54.3	4.1	6.61	0.5
0911	8.0	6.77	10.07	0.508	0.15	-54.3	3	6.55	0.5
0915	10.0	6.75	9.94	0.504	0.09	-51.7	8.1	6.55	0.5

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Photo ionization Detector	MiniRAE 10.6eV	Twice Daily Calibration Verification also Calibrated Weekly
Flame ionization Detector	Photovac MicroFID (1-50,000 ppm)	Twice Daily Calibration Verification also Calibrated Weekly
Water Level Probe	Slope Indicator	Checked Against Calibrated Length
Water Quality Meter	YSI 556	Twice Daily Calibration Verification also Calibrated Weekly

GENERAL COMMENTS

Ferrous Iron = 1.21 mg/L
Multi-Parameter Probe Unit # 02J1177
Field Parameters Measured in Flow Through Cell
Pump Placement Depth = 12' BTOC
Well Diameter = 2-inch
Screen Interval = 6' - 16' BTOC
Turbidity of Sample = 0.0 NTUs

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: **Iowa Army Ammunition Plant** PROJECT NO. 16169421.00201

SITE NAME: **IAAAP 6-Site FS Data Collection** WELL NO. **FTP-MW1** **Page 2 of 2**

FIELD MEASUREMENTS cont.

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (μS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate (lpm)
0919	12	6.74	9.90	0.504	0.08	-51.5	7.3	6.55	0.5
0923	14	6.73	9.89	0.500	0.07	-48.8	2.5	6.55	0.5
0927	16	6.72	9.85	0.499	0.06	-47.2	0	6.57	0.5
0931	18	6.73	10.18	0.500	0.05	-45.0	0	6.55	0.5
0935	20	6.74	10.01	0.501	0.05	-44.7	0	6.55	0.5
0939	22	6.72	10.16	0.498	0.04	-42.8	0	6.55	0.5
0943	26	6.72	10.12	0.496	0.04	-41.8	0	6.50	0.5
0947	28	6.72	10.11	0.496	0.05	-40.1	0	6.55	0.5
0951	30	6.70	9.77	0.494	0.04	-39.5	0	6.57	0.5
0955	32	6.72	9.88	0.495	0.04	-39.9	0	6.55	0.5
0959	36	6.70	9.86	0.494	0.04	-40.1	0	6.55	0.5
1004	38	6.70	9.85	0.493	0.05	-40.4	0	6.55	0.5

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: **Iowa Army Ammunition Plant**

PROJECT NO. 16169421.00201

SITE NAME: **IAAAP 6-Site FS Data Collection**

WELL NO. **FTP-MW2**

DATE/TIME COLLECTED: 5/13/03 0905

PERSONNEL: RC, MS

SAMPLE METHOD: Disposable Teflon Bailer

SAMPLE MEDIA: Groundwater

SAMPLE QA SPLIT: YES [✓ NO] SPLIT SAMPLE NO.

SAMPLE QC DUPLICATE: YES [✓ NO] DUPLICATE SAMPLE NO.

MS/MSD REQUESTED: YES [✓ NO] MS/MSD SAMPLE NO.

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
(1) 1 L HDPE	4C, HNO3	Metals As, Ba, Cd, Cr, Pb, Hg, Se, Ag (6020/7470)
(2) 1 L Glass Amber	4C	Explosives (8330) + MNX
(3) 40 mL VOA	4C, HCL	Volatile Organic Compound (8260B) + Freon 113
(2) 40 mL VOA	4C, H3PO4	Total Organic Carbon (415.1)
(1) 1 L HDPE	4C, H2SO4	TKN (351.2), Ammonia (350), NO2+NO3 (353.2)
(1) 500 mL HDPE	4C, ZnAcetate/NaOH	Sulfide (376.2)
(1) 1 L HDPE	4C	Alk (310.1), SO4 (300), Ortho P (300), CL (300), CO2 (SM4500D)

WELL PURGING DATA

Date: 5/12/03

Time Started: 1638

Time Completed 1650

PID/FID Measurements

Background: ND \ ND

Breathing Zone ND \ ND

Well Head: ND \ ND

Well Depth (ft. BTOC): 19.73

Depth to Water (ft BTOC): 11.08

Water Column Length: 8.65

Volume of Water in Well (liters): 5.4

Purge Rate (liters/min): 0.5

Level of Drawdown (ft. BTOC): 8.65

Amount Purged (liters): 14.0

FIELD MEASUREMENTS

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate (lpm)
1639	0	7.40	12.01	0.309	5.00	142.8	>1100	11.74	0.5
1643	2	7.30	10.52	0.300	4.64	142.6	49	12.25	0.5
1647	4	7.17	9.51	0.293	5.56	142.3	315	16.10	0.5
1649	12	7.28	10.15	0.374	9.66	150.1	70	17.53	2.0
1650	14	Well is Dry							
0905	14.2	6.79	10.70	0.227	4.38	157.5	14	11.27	-

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Photo ionization Detector	MiniRAE 10.6eV	Twice Daily Calibration Verification also Calibrated Weekly
Flame ionization Detector	Photovac MicroFID (1-50,000 ppm)	Twice Daily Calibration Verification also Calibrated Weekly
Water Level Probe	Slope Indicator	Checked Against Calibrated Length
Water Quality Meter	YSI 556	Twice Daily Calibration Verification also Calibrated Weekly

GENERAL COMMENTS Water level is in screened interval. Well purged dry before 3 volumes were collected.

Ferrous Iron = 0.72 mg/L

Multi-Parameter Probe Unit # 02J1177

Field Parameters Measured in Flow Through Cell

Pump Placement Depth = 19' BTOC

Well Diameter = 2-inch

Screen Interval = 9.2' - 19.2' BTOC

Turbidity of Sample = 14 NTUs

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: **Iowa Army Ammunition Plant**

PROJECT NO. 16169421.00201

SITE NAME: **IAAAP 6-Site FS Data Collection**

WELL NO. **FTP-MW3**

DATE/TIME COLLECTED: 5/13/03 0945

PERSONNEL: BO, RC, MS

SAMPLE METHOD: Disposable Teflon Bailer

SAMPLE MEDIA: Groundwater

SAMPLE QA SPLIT: YES [✓ NO] SPLIT SAMPLE NO.

SAMPLE QC DUPLICATE: YES [✓ NO] DUPLICATE SAMPLE NO.

MS/MSD REQUESTED YES [✓ NO] MS/MSD SAMPLE NO.

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
(1) 1 L HDPE	4C, HNO3	Metals As, Ba, Cd, Cr, Pb, Hg, Se, Ag (6020/7470)
(2) 1 L Glass Amber	4C	Explosives (8330) + MNX
(3) 40 mL VOA	4C, HCL	Volatile Organic Compound (8260B) + Freon 113
(2) 40 mL VOA	4C, H3PO4	Total Organic Carbon (415.1)
(1) 1 L HDPE	4C, H2SO4	TKN (351.2), Ammonia (350), NO2+NO3 (353.2)
(1) 500 mL HDPE	4C, ZnAcetate/NaOH	Sulfide (376.2)
(1) 1 L HDPE	4C	Alk (310.1), SO4 (300), Ortho P (300), CL (300), CO2 (SM4500D)

WELL PURGING DATA

Date: 5/12/03

Time Started: 1745

Time Completed 1754

PID/FID Measurements

Background: ND \ ND

Breathing Zone ND \ ND

Well Head: ND \ ND

Well Depth (ft. BTOC): 24.00

Depth to Water (ft BTOC): 14.68

Water Column Length: 9.32

Volume of Water in Well (liters): 5.8

Purge Rate (liters/min): 0.4

Level of Drawdown (ft. BTOC): 9.32

Amount Purged (liters): 11.5

FIELD MEASUREMENTS

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate (lpm)
1746	0	7.30	11.73	0.485	6.20	172.5	55	15.45	0.5
1750	2	7.18	11.13	0.478	5.41	171.9	16	16.40	0.4
1752	9	7.13	10.22	0.456	8.73	163.1	375	21.07	2.0
1754	11.5	Well is dry							
0945	12	7.24	12.44	0.473	3.97	101.2	9.1	20.49	-

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Photo ionization Detector	MiniRAE 10.6eV	Twice Daily Calibration Verification also Calibrated Weekly
Flame ionization Detector	Photovac MicroFID (1-50,000 ppm)	Twice Daily Calibration Verification also Calibrated Weekly
Water Level Probe	Slope Indicator	Checked Against Calibrated Length
Water Quality Meter	YSI 556	Twice Daily Calibration Verification also Calibrated Weekly

GENERAL COMMENTS

Ferrous Iron = 0.05 mg/L

Multi-Parameter Probe Unit # 02J1177

Field Parameters Measured in Flow Through Cell

Pump Placement Depth = 23' BTOC

Well Diameter = 2-inch

Screen Interval = 13.5' - 23.5' BTOC

Turbidity of Sample = 9.1 NTUs

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: **Iowa Army Ammunition Plant** PROJECT NO. 16169421.00201

SITE NAME: **IAAAP 6-Site FS Data Collection** WELL NO. **FTP-MW4** **Page 1 of 2**

DATE/TIME COLLECTED: 5/14/03 0840 PERSONNEL: RC

SAMPLE METHOD: Disposable Teflon Bailer

SAMPLE MEDIA: Groundwater

SAMPLE QA SPLIT: YES [✓ NO] SPLIT SAMPLE NO.

SAMPLE QC DUPLICATE: YES [✓ NO] DUPLICATE SAMPLE NO.

MS/MSD REQUESTED YES [✓ NO] MS/MSD SAMPLE NO.

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
(1) 1 L HDPE	4C, HNO3	Metals As, Ba, Cd, Cr, Pb, Hg, Se, Ag (6020/7470)
(2) 1 L Glass Amber	4C	Explosives (8330) + MNX
(3) 40 mL VOA	4C, HCL	Volatile Organic Compound (8260B) + Freon 113
(2) 40 mL VOA	4C, H3PO4	Total Organic Carbon (415.1)
(1) 1 L HDPE	4C, H2SO4	TKN (351.2), Ammonia (350), NO2+NO3 (353.2)
(1) 500 mL HDPE	4C, ZnAcetate/NaOH	Sulfide (376.2)
(1) 1 L HDPE	4C	Alk (310.1), SO4 (300), Ortho P (300), CL (300), CO2 (SM4500D)

WELL PURGING DATA

Date: 5/13/03

Time Started: 1614

Time Completed 1648

PID/FID Measurements

Background: ND \ ND

Breathing Zone ND \ ND

Well Head: ND \ ND

Well Depth (ft. BTOC): 62.28

Depth to Water (ft BTOC): 17.03

Water Column Length: 45.25

Volume of Water in Well (liters): 28.1

Purge Rate (liters/min): 0.1

Level of Drawdown (ft. BTOC): 17.03

Amount Purged (liters): 53.0

FIELD MEASUREMENTS

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate (lpm)
1615	0	7.19	16.12	0.528	7.50	132.1	15	16.85	0.1
1619	0.5	7.01	16.80	0.535	3.99	127.3	17	17.19	0.1
1628	22	6.94	12.63	0.533	5.75	102.1	4.9	49.03	0.1
1632	22.5	6.97	14.27	0.528	6.96	87.7	3	49.33	0.1
1636	23	6.98	15.21	0.534	6.98	79.7	2.5	19.50	0.1
1647	50	6.97	12.42	0.572	6.98	34.1	450	60.20	2.0

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Photo ionization Detector	MiniRAE 10.6eV	Twice Daily Calibration Verification also Calibrated Weekly
Flame ionization Detector	Photovac MicroFID (1-50,000 ppm)	Twice Daily Calibration Verification also Calibrated Weekly
Water Level Probe	Slope Indicator	Checked Against Calibrated Length
Water Quality Meter	YSI 556	Twice Daily Calibration Verification also Calibrated Weekly

GENERAL COMMENTS

Well purged dry prior during attempt at 3 to 5 well volumes.

Ferrous Iron = 0.04 mg/L

Multi-Parameter Probe Unit # 02J1177

Field Parameters Measured in Flow Through Cell

Pump Placement Depth = 57' BTOC

Well Diameter = 2-inch

Screen Interval = 52' - 62' BTOC

Turbidity of Sample = 3.0 NTUs

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: **Iowa Army Ammunition Plant** PROJECT NO. 16169421.00201

SITE NAME: **IAAAP 6-Site FS Data Collection** WELL NO. **FTP-MW4** **Page 2 of 2**

FIELD MEASUREMENTS cont.

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate (lpm)
1648	53	Well is dry							
0840	53.2	7.11	15.62	0.537	6.00	108.9	3	-	-

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: **Iowa Army Ammunition Plant** PROJECT NO. 16169421.00201

SITE NAME: **IAAAP 6-Site FS Data Collection** WELL NO. **FTP-MW5** **Page 1 of 2**

DATE/TIME COLLECTED: 5/13/03 1245 PERSONNEL: RC
SAMPLE METHOD: Fultz Pump

SAMPLE MEDIA: Groundwater
SAMPLE QA SPLIT: YES NO SPLIT SAMPLE NO.
SAMPLE QC DUPLICATE: YES NO DUPLICATE SAMPLE NO.
MS/MSD REQUESTED YES NO MS/MSD SAMPLE NO.

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
(1) 1 L HDPE	4C, HNO3	Metals As, Ba, Cd, Cr, Pb, Hg, Se, Ag (6020/7470)
(2) 1 L Glass Amber	4C	Explosives (8330) + MNX
(3) 40 mL VOA	4C, HCL	Volatile Organic Compound (8260B) + Freon 113
(2) 40 mL VOA	4C, H3PO4	Total Organic Carbon (415.1)
(1) 1 L HDPE	4C, H2SO4	TKN (351.2), Ammonia (350), NO2+NO3 (353.2)
(1) 500 mL HDPE	4C, ZnAcetate/NaOH	Sulfide (376.2)
(1) 1 L HDPE	4C	Alk (310.1), SO4 (300), Ortho P (300), CL (300), CO2 (SM4500D)

WELL PURGING DATA

Date: 5/13/03
Time Started: 1150
Time Completed 1243
PID/FID Measurements
Background: ND \ ND
Breathing Zone ND \ ND
Well Head: 0.5 \ ND

Well Depth (ft. BTOC): 16.74
Depth to Water (ft BTOC): 8.00
Water Column Length: 8.74
Volume of Water in Well (liters): 5.4
Purge Rate (liters/min): 0.5
Level of Drawdown (ft. BTOC): 8.74
Amount Purged (liters): 26.0

FIELD MEASUREMENTS

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate (lpm)
1151	0	6.93	11.71	0.483	2.52	81.7	50	9.08	0.5
1203	6	6.98	9.79	0.499	1.56	78.5	13	9.80	0.5
1215	12	6.92	9.90	0.498	1.55	79.8	11	9.80	0.5
1227	18	6.92	9.99	0.497	1.87	83.1	8.3	9.80	0.5
1233	21	6.90	9.86	0.497	0.44	86.4	7.1	9.50	0.5
1239	24	6.89	9.89	0.493	0.88	87.8	5.2	9.52	0.5

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Photo ionization Detector	MiniRAE 10.6eV	Twice Daily Calibration Verification also Calibrated Weekly
Flame ionization Detector	Photovac MicroFID (1-50,000 ppm)	Twice Daily Calibration Verification also Calibrated Weekly
Water Level Probe	Slope Indicator	Checked Against Calibrated Length
Water Quality Meter	YSI 556	Twice Daily Calibration Verification also Calibrated Weekly

GENERAL COMMENTS

Ferrous Iron = 0.12 mg/L
Multi-Parameter Probe Unit # 02J1177
Field Parameters Measured in Flow Through Cell
Pump Placement Depth = 10' BTOC
Well Diameter = 2-inch
Screen Interval = 6.2' - 16.2' BTOC
Turbidity of Sample = 0.05 NTUs

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: **Iowa Army Ammunition Plant**

PROJECT NO. 16169421.00201

SITE NAME: **IAAAP 6-Site FS Data Collection**

WELL NO. **FTP-MW5**

Page 2 of 2

FIELD MEASUREMENTS cont.

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (μS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate (lpm)
1243	26	6.88	9.91	0.494	0.47	87.6	0.05	9.52	0.5

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: **Iowa Army Ammunition Plant** PROJECT NO. 16169421.00201

SITE NAME: **IAAAP 6-Site FS Data Collection** WELL NO. **FTP-MW6** **Page 1 of 2**

DATE/TIME COLLECTED: 5/14/03 1230 PERSONNEL: BO, RC, MS

SAMPLE METHOD: Disposable Teflon Bailer

SAMPLE MEDIA: Groundwater

SAMPLE QA SPLIT: YES [✓ NO] SPLIT SAMPLE NO.

SAMPLE QC DUPLICATE: YES [✓ NO] DUPLICATE SAMPLE NO.

MS/MSD REQUESTED YES [✓ NO] MS/MSD SAMPLE NO.

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
(1) 1 L HDPE	4C, HNO3	Metals As, Ba, Cd, Cr, Pb, Hg, Se, Ag (6020/7470)
(2) 1 L Glass Amber	4C	Explosives (8330) + MNX
(3) 40 mL VOA	4C, HCL	Volatile Organic Compound (8260B) + Freon 113
(2) 40 mL VOA	4C, H3PO4	Total Organic Carbon (415.1)
(1) 1 L HDPE	4C, H2SO4	TKN (351.2), Ammonia (350), NO2+NO3 (353.2)
(1) 500 mL HDPE	4C, ZnAcetate/NaOH	Sulfide (376.2)
(1) 1 L HDPE	4C	Alk (310.1), SO4 (300), Ortho P (300), CL (300), CO2 (SM4500D)

WELL PURGING DATA

Date: 10/13/03

Time Started: 1114

Time Completed 1134

PID/FID Measurements

Background: ND \ ND

Breathing Zone ND \ ND

Well Head: 0.2 \ ND

Well Depth (ft. BTOC): 47.83

Depth to Water (ft BTOC): 22.91

Water Column Length: 24.92

Volume of Water in Well (liters): 15.5

Purge Rate (liters/min): 0.1

Level of Drawdown (ft. BTOC): 24.92

Amount Purged (liters): 29.0

FIELD MEASUREMENTS

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate (lpm)
1115	0	7.21	12.41	0.694	4.19	57.9	17	23.14	0.1
1119	0.5	6.99	12.41	0.697	4.31	58.1	15	23.62	0.1
1122	3	7.18	11.48	0.594	4.48	59.0	7.1	28.19	0.1
1126	3.5	7.17	11.68	0.592	4.01	60.4	6.7	28.49	0.1
1131	18	7.17	11.34	0.675	5.35	60.9	32	21.00	2.0
1134	29	Well is Dry						46.00	

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Photo ionization Detector	MiniRAE 10.6eV	Twice Daily Calibration Verification also Calibrated Weekly
Flame ionization Detector	Photovac MicroFID (1-50,000 ppm)	Twice Daily Calibration Verification also Calibrated Weekly
Water Level Probe	Slope Indicator	Checked Against Calibrated Length
Water Quality Meter	YSI 556	Twice Daily Calibration Verification also Calibrated Weekly

GENERAL COMMENTS

Ferrous Iron = Insufficient volume

Multi-Parameter Probe Unit # 02J1177

Field Parameters Measured in Flow Through Cell

Pump Placement Depth = 40' BTOC

Well Diameter = 2-inch

Screen Interval = 37' - 47' BTOC

Turbidity of Sample = 4.7 NTUs

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: **Iowa Army Ammunition Plant** PROJECT NO. 16169421.00201

SITE NAME: **IAAAP 6-Site FS Data Collection** WELL NO. **FTP-MW6** **Page 2 of 2**

FIELD MEASUREMENTS cont.

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate (lpm)
1230	29.2	7.29	13.83	0.782	5.90	118.3	4.7	-	-

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: **Iowa Army Ammunition Plant**

PROJECT NO. 16169421.00201

SITE NAME: **IAAAP 6-Site FS Data Collection**

WELL NO. **FTP-MW7** **Page 1 of 2**

DATE/TIME COLLECTED: 5/14/03 1110

PERSONNEL: RC, MS

SAMPLE METHOD: Fultz Pump

SAMPLE MEDIA: Groundwater

SAMPLE QA SPLIT: YES NO

SPLIT SAMPLE NO.

SAMPLE QC DUPLICATE: YES NO

DUPLICATE SAMPLE NO.

MS/MSD REQUESTED YES NO

MS/MSD SAMPLE NO.

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
(1) 1 L HDPE	4C, HNO3	Metals As, Ba, Cd, Cr, Pb, Hg, Se, Ag (6020/7470)
(2) 1 L Glass Amber	4C	Explosives (8330) + MNX
(3) 40 mL VOA	4C, HCL	Volatile Organic Compound (8260B) + Freon 113
(2) 40 mL VOA	4C, H3PO4	Total Organic Carbon (415.1)
(1) 1 L HDPE	4C, H2SO4	TKN (351.2), Ammonia (350), NO2+NO3 (353.2)
(1) 500 mL HDPE	4C, ZnAcetate/NaOH	Sulfide (376.2)
(1) 1 L HDPE	4C	Alk (310.1), SO4 (300), Ortho P (300), CL (300), CO2 (SM4500D)

WELL PURGING DATA

Date: 5/14/03

Time Started: 0945

Time Completed 1108

PID/FID Measurements

Background:	ND	\ ND
Breathing Zone	ND	\ ND
Well Head:	ND	\ ND

Well Depth (ft. BTOC): 24.17

Depth to Water (ft BTOC): 8.00

Water Column Length: 16.17

Volume of Water in Well (liters): 10.0

Purge Rate (liters/min): 0.15

Level of Drawdown (ft. BTOC): 0.02

Amount Purged (liters): 10.0

FIELD MEASUREMENTS

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate (lpm)
0946	0	7.37	13.23	0.4	3.18	99.2	251	8.68	0.1
0950	0.5	7.34	14.88	0.399	2.73	96.7	110	8.66	0.15
0954	1	7.34	13.63	0.398	2.70	91.1	93	8.71	0.15
0958	1.5	7.33	13.28	0.397	2.54	88.6	54	8.73	0.15
1002	2	7.32	13.55	0.396	2.42	86.7	65	8.70	0.15
1006	2.5	7.33	13.54	0.398	2.40	84.1	51	8.70	0.15

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Photo ionization Detector	MiniRAE 10.6eV	Twice Daily Calibration Verification also Calibrated Weekly
Flame ionization Detector	Photovac MicroFID (1-50,000 ppm)	Twice Daily Calibration Verification also Calibrated Weekly
Water Level Probe	Slope Indicator	Checked Against Calibrated Length
Water Quality Meter	YSI 556	Twice Daily Calibration Verification also Calibrated Weekly

GENERAL COMMENTS

Ferrous Iron = 0.14 mg/L

Multi-Parameter Probe Unit # 02J1177

Field Parameters Measured in Flow Through Cell

Pump Placement Depth = 20' BTOC

Well Diameter = 2-inch

Screen Interval = 13.6' - 23.6' BTOC

Turbidity of Sample = 6.1 NTUs

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: **Iowa Army Ammunition Plant** PROJECT NO. 16169421.00201

SITE NAME: **IAAAP 6-Site FS Data Collection** WELL NO. **FTP-MW7** **Page 2 of 2**

FIELD MEASUREMENTS cont.

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate (lpm)
1010	3	7.33	13.39	0.398	2.37	82.6	35	8.69	0.15
1014	3.5	7.33	13.43	0.398	2.31	83.5	40	8.70	0.15
1018	4	7.32	13.35	0.399	2.19	83.4	37	8.70	0.15
1022	4.5	7.32	13.36	0.399	2.17	83.3	29	8.70	0.15
1026	5	7.32	13.45	0.400	2.32	80.8	35	8.70	0.15
1030	5.5	7.32	13.31	0.401	2.17	81.1	37	8.70	0.15
1034	6	7.31	13.11	0.401	2.13	80.1	29	8.72	0.15
1038	6.5	7.31	13.07	0.403	2.10	78.9	11	8.70	0.15
1042	7	7.31	13.20	0.404	2.05	78.3	10	8.71	0.15
1046	7.5	7.31	13.09	0.403	2.05	78.2	9	8.71	0.15
1050	8	7.32	13.29	0.404	2.03	78.0	11	8.71	0.15
1054	8.5	7.31	13.43	0.404	2.04	77.9	10	8.70	0.15
1100	9	7.30	13.39	0.405	2.05	77.6	6.3	8.70	0.15
1104	9.5	7.31	13.29	0.404	2.04	77.5	5.5	8.70	0.15
1108	10	7.31	13.31	0.404	2.02	77.6	6.1	8.71	0.15

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: **Iowa Army Ammunition Plant**
PROJECT NO. 16169421.00201

SITE NAME: **IAAAP 6-Site FS Data Collection**
WELL NO. **FTP-MW8** **Page 1 of 2**

DATE/TIME COLLECTED: 5/14/03 1215
PERSONNEL: RC, MS
SAMPLE METHOD: Disposable Teflon Bailer

SAMPLE MEDIA: Groundwater
SAMPLE QA SPLIT: YES [✓ **NO**] SPLIT SAMPLE NO.
SAMPLE QC DUPLICATE: YES [✓ **NO**] DUPLICATE SAMPLE NO.
MS/MSD REQUESTED [✓ **YES**] NO MS/MSD SAMPLE NO. **FTP-MW8 MS/MSD**

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
(2) 1 L HDPE	4C, HNO3	Metals As, Ba, Cd, Cr, Pb, Hg, Se, Ag (6020/7470)
(4) 1 L Glass Amber	4C	Explosives (8330) + MNX
(6) 40 mL VOA	4C, HCL	Volatile Organic Compound (8260B) + Freon 113
(4) 40 mL VOA	4C, H3PO4	Total Organic Carbon (415.1)
(2) 1 L HDPE	4C, H2SO4	TKN (351.2), Ammonia (350), NO2+NO3 (353.2)
(2) 500 mL HDPE	4C, ZnAcetate/NaOH	Sulfide (376.2)
(2) 1 L HDPE	4C	Alk (310.1), SO4 (300), Ortho P (300), CL (300), CO2 (SM4500D)

WELL PURGING DATA

Date: 5/14/03
Time Started: 0818
Time Completed 0921
PID/FID Measurements
Background: ND \ ND
Breathing Zone ND \ ND
Well Head: ND \ ND

Well Depth (ft. BTOC): 54.12
Depth to Water (ft BTOC): 9.99
Water Column Length: 44.13
Volume of Water in Well (liters): 27.4
Purge Rate (liters/min): 0.15
Level of Drawdown (ft. BTOC): 44.13
Amount Purged (liters): 41.0

FIELD MEASUREMENTS

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate (lpm)
0819	0	7.15	13.99	0.660	5.29	106.3	19	9.35	0.1
0824	0.5	7.07	14.68	0.670	3.67	112.7	15	9.81	0.1
0828	19	7.07	12.22	0.539	4.65	92.7	11	36.57	0.2
0832	20	7.09	13.09	0.540	4.36	94.7	9.5	36.27	0.2
0836	22	7.09	13.64	0.540	4.27	96.0	3.6	36.60	0.3
0840	23	7.10	13.63	0.541	4.11	95.2	2.7	36.21	0.2

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Photo ionization Detector	MiniRAE 10.6eV	Twice Daily Calibration Verification also Calibrated Weekly
Flame ionization Detector	Photovac MicroFID (1-50,000 ppm)	Twice Daily Calibration Verification also Calibrated Weekly
Water Level Probe	Slope Indicator	Checked Against Calibrated Length
Water Quality Meter	YSI 556	Twice Daily Calibration Verification also Calibrated Weekly

GENERAL COMMENTS

Ferrous Iron = 0.10 mg/L
Multi-Parameter Probe Unit # 02J1177
Field Parameters Measured in Flow Through Cell
Pump Placement Depth = 50' BTOC
Well Diameter = 2-inch
Screen Interval = 44' - 54' BTOC
Turbidity of Sample = 2.1 NTUs

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME: **Iowa Army Ammunition Plant** PROJECT NO. 16169421.00201

SITE NAME: **IAAAP 6-Site FS Data Collection** WELL NO. **FTP-MW8** **Page 2 of 2**

FIELD MEASUREMENTS cont.

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate (lpm)
0849	24	7.08	13.43	0.544	3.83	78.3	9	36.51	0.15
0848	25	7.08	13.47	0.544	3.74	70.9	11.3	36.60	0.15
0852	26	7.09	13.90	0.545	3.52	64.1	10.7	36.68	0.15
0856	27	7.08	14.39	0.545	3.41	61.9	3.6	36.64	0.15
0900	28	7.08	15.68	0.548	3.19	50.7	2.3	36.65	0.15
0904	28.5	7.08	15.98	0.552	3.06	47.0	0.1	36.69	0.15
0908	29	7.08	15.88	0.554	3.11	43.2	0.5	36.80	0.15
0912	29.5	7.06	15.78	0.557	2.97	43.0	2.3	36.85	0.15
0916	30	7.07	15.84	0.557	2.95	44.9	2.1	36.89	0.15
1215	30.2	7.33	13.74	0.566	6.10	109.1	2.1	-	-

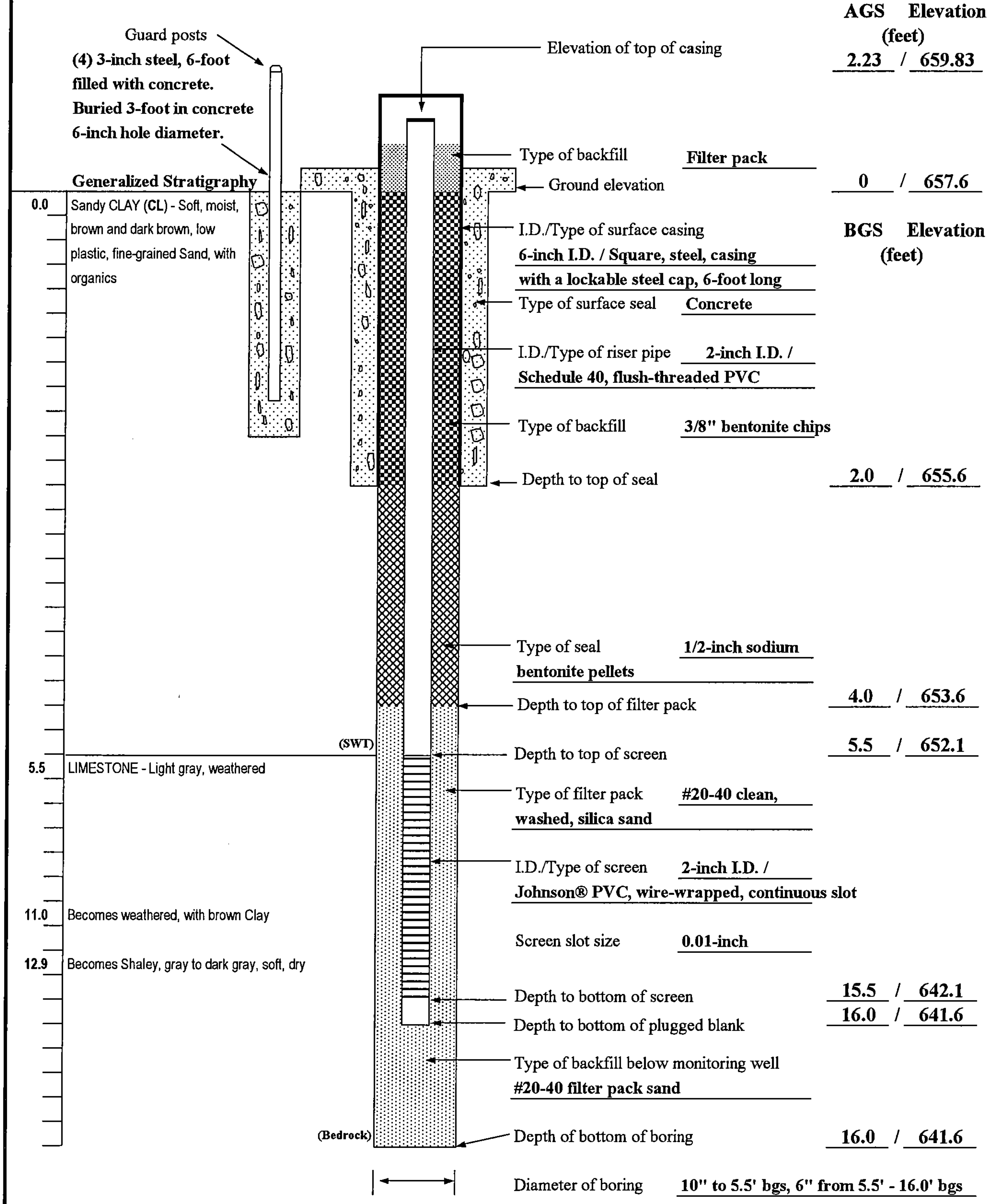
Monitoring Well Construction Diagrams

Staff Gauge Construction Diagrams

Monitoring Well Construction Diagrams

MONITORING WELL CONSTRUCTION LOG

Project Name Iowa AAP Six Site FS Data Collection
Well No. FTP-MW1
Location Burlington, Iowa
Proiect No. 16169421
Installed By Aquadrill, Jay Joslyn
Date 3/25/03 **Time** 1625
Inspected By URS, Mike Sonderman
Method of Installation 6 5/8" ID HSAs, 6" RWB
Remarks Upper 5.5 feet of boring drilled with 6 5/8" HSA, remaining depth drilled with 6" tricone rotary.
SWT = Shallow Weathered Till



Guard posts
(4) 3-inch steel, 6-foot filled with concrete. Buried 3-foot in concrete 6-inch hole diameter.

Generalized Stratigraphy

0.0	Sandy CLAY (**CL**) - Soft, moist, brown and dark brown, low plastic, fine-grained Sand, with organics
5.5	LIMESTONE - Light gray, weathered
11.0	Becomes weathered, with brown Clay
12.9	Becomes Shaley, gray to dark gray, soft, dry

AGS Elevation (feet)

Elevation of top of casing 2.23 / 659.83
Type of backfill **Filter pack**
Ground elevation 0 / 657.6
I.D./Type of surface casing **6-inch I.D. / Square, steel, casing with a lockable steel cap, 6-foot long**

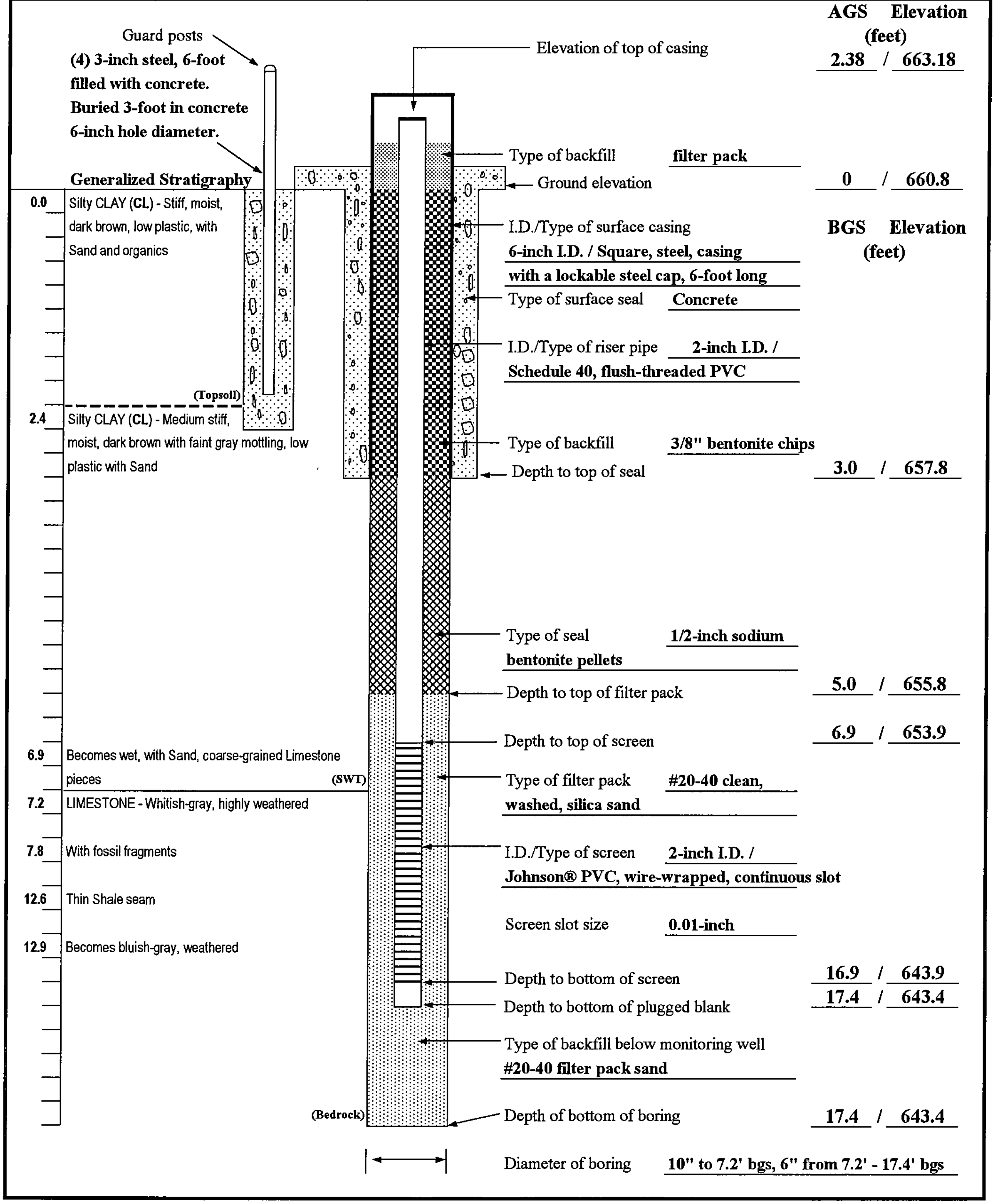
BGS Elevation (feet)

Type of surface seal **Concrete**
I.D./Type of riser pipe **2-inch I.D. / Schedule 40, flush-threaded PVC**
Type of backfill **3/8" bentonite chips**
Depth to top of seal 2.0 / 655.6
Type of seal **1/2-inch sodium bentonite pellets**
Depth to top of filter pack 4.0 / 653.6
Depth to top of screen 5.5 / 652.1
Type of filter pack **#20-40 clean, washed, silica sand**
I.D./Type of screen **2-inch I.D. / Johnson® PVC, wire-wrapped, continuous slot**
Screen slot size **0.01-inch**
Depth to bottom of screen 15.5 / 642.1
Depth to bottom of plugged blank 16.0 / 641.6
Type of backfill below monitoring well **#20-40 filter pack sand**
Depth of bottom of boring 16.0 / 641.6
Diameter of boring **10" to 5.5' bgs, 6" from 5.5' - 16.0' bgs**

MONITORING WELL CONSTRUCTION LOG

Project Name Iowa AAP Six Site FS Data Collection
Location Burlington, Iowa
Installed By Aquadrill, Jay Joslyn
Inspected By URS, Mike Sonderman
Method of Installation 6 5/8" ID HSAs, 6" RWB
Remarks Upper 7.2 feet of boring drilled with 10" HSA, remaining depth drilled with 6" tricone rotary.
SWT = Shallow Weathered Till

Well No. FTP-MW2
Project No. 16169421
Date 4/15/03 **Time** 1030



AGS Elevation (feet)

Elevation of top of casing 2.38 / 663.18

Type of backfill **filter pack**

Ground elevation 0 / 660.8

BGS Elevation (feet)

I.D./Type of surface casing **6-inch I.D. / Square, steel, casing with a lockable steel cap, 6-foot long**

Type of surface seal **Concrete**

I.D./Type of riser pipe **2-inch I.D. / Schedule 40, flush-threaded PVC**

Type of backfill **3/8" bentonite chips**

Depth to top of seal 3.0 / 657.8

Type of seal **1/2-inch sodium bentonite pellets**

Depth to top of filter pack 5.0 / 655.8

Depth to top of screen 6.9 / 653.9

Type of filter pack **#20-40 clean, washed, silica sand**

I.D./Type of screen **2-inch I.D. / Johnson® PVC, wire-wrapped, continuous slot**

Screen slot size **0.01-inch**

Depth to bottom of screen 16.9 / 643.9

Depth to bottom of plugged blank 17.4 / 643.4

Type of backfill below monitoring well **#20-40 filter pack sand**

Depth of bottom of boring 17.4 / 643.4

Diameter of boring **10" to 7.2' bgs, 6" from 7.2' - 17.4' bgs**

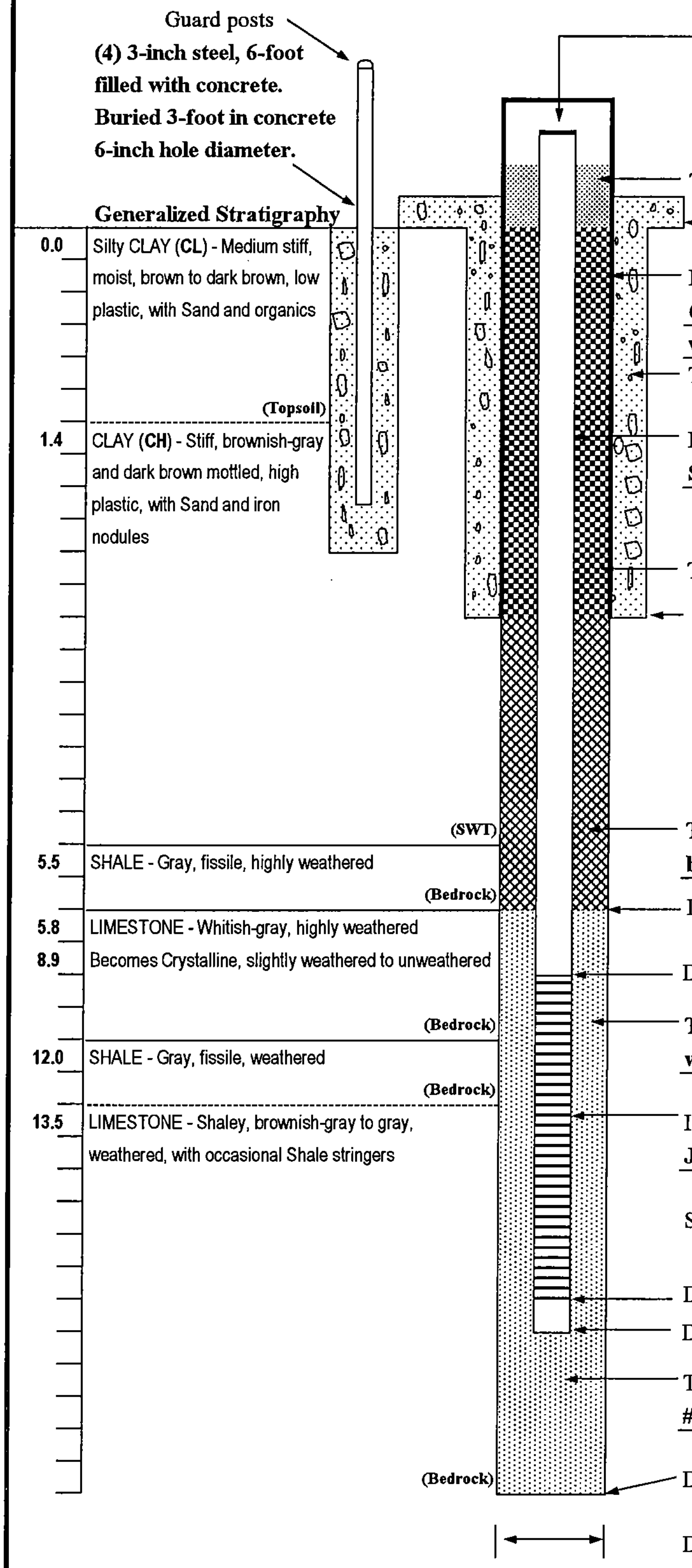
Generalized Stratigraphy

0.0	Silty CLAY (CL) - Stiff, moist, dark brown, low plastic, with Sand and organics
2.4	Silty CLAY (CL) - Medium stiff, moist, dark brown with faint gray mottling, low plastic with Sand
6.9	Becomes wet, with Sand, coarse-grained Limestone pieces
7.2	LIMESTONE - Whitish-gray, highly weathered
7.8	With fossil fragments
12.6	Thin Shale seam
12.9	Becomes bluish-gray, weathered

MONITORING WELL CONSTRUCTION LOG

Project Name Iowa AAP Six Site FS Data Collection
Location Burlington, Iowa
Installed By Aquadrill, Jay Joslyn
Inspected By URS, Mike Sonderman
Method of Installation 6 5/8" ID HSAs, 6" AR
Remarks Upper 5.5 feet of boring drilled with 6 5/8" HSA, remaining depth drilled with 6" AR.
SWT = Shallow Weathered Till

Well No. FTP-MW3
Proiect No. 16169421
Date 4/15/03 **Time** 1530



0.0	Silty CLAY (CL) - Medium stiff, moist, brown to dark brown, low plastic, with Sand and organics (Topsoil)
1.4	CLAY (CH) - Stiff, brownish-gray and dark brown mottled, high plastic, with Sand and iron nodules (SWT)
5.5	SHALE - Gray, fissile, highly weathered (Bedrock)
5.8	LIMESTONE - Whitish-gray, highly weathered
8.9	Becomes Crystalline, slightly weathered to unweathered (Bedrock)
12.0	SHALE - Gray, fissile, weathered (Bedrock)
13.5	LIMESTONE - Shaley, brownish-gray to gray, weathered, with occasional Shale stringers (Bedrock)

AGS / Elevation (feet)

Elevation of top of casing 2.46 / 657.46

Type of backfill **Filter pack**

Ground elevation 0 / 655.0

BGS / Elevation (feet)

I.D./Type of surface casing **6-inch I.D. / Square, steel, casing with a lockable steel cap, 6-foot long**

Type of surface seal **Concrete**

I.D./Type of riser pipe **2-inch I.D. / Schedule 40, flush-threaded PVC**

Type of backfill **3/8" bentonite chips**

Depth of surface seal 3.0 / 652.0

Type of seal **1/2-inch sodium bentonite pellets**

Depth to top of filter pack 8.0 / 647.0

Depth to top of screen 10.5 / 644.5

Type of filter pack **#20-40 clean, washed, silica sand**

I.D./Type of screen **2-inch I.D. / Johnson® PVC, wire-wrapped, continuous slot**

Screen slot size **0.01-inch**

Depth to bottom of screen 20.5 / 634.5

Depth to bottom of plugged blank 21.0 / 634.0

Type of backfill below monitoring well **#20-40 filter pack sand**

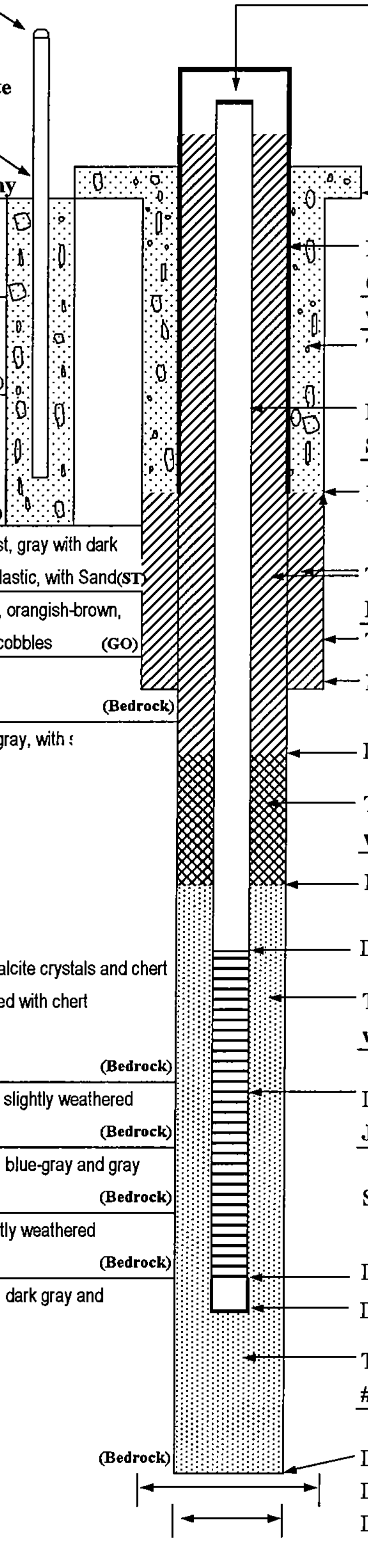
Depth of bottom of boring 21.0 / 634.0

Diameter of boring **10" to 5.5' bgs, 6" from 5.5' - 21.0' bgs**

MONITORING WELL CONSTRUCTION LOG

Project Name Iowa AAP Six Site FS Data Collection
Well No. FTP-MW4
Location Burlington, Iowa
Proiect No. 16169421
Installed By Aquadrill, Dennis Auld
Date 4/24/03 **Time** 1100
Inspected By URS, Dave Berger
Method of Installation 6 5/8" ID HSA, 6" RWB
Remarks 6 5/8" HSA to 37.0' bgs, 6" tricone rotary from 37.0' to 60.4' bgs
SWT = Shallow Weathered Till, ST = Shallow Till, GO = Glacial Outwash

Guard posts
(4) 3-inch steel, 6-foot filled with concrete. Buried 3-foot in concrete 6-inch hole diameter.



Generalized Stratigraphy

0.0	Silty CLAY (CL) - Stiff, moist, dark brown to black, low plastic, with organics (Topsoil)
1.2	Silty CLAY (CL) - Stiff, moist, brown with black mottling and iron staining, low plastic (Loess)
7.2	Silty CLAY (CL) - Stiff, moist, orangish-brown with orange mottling and iron staining, medium plastic, with Sand(SWT)
14.7	Silty CLAY (CH) - Very stiff, moist, gray with dark gray and orange mottling, high plastic, with Sand(ST)
26.5	Clayey SAND (SC) - Dense, wet, orangish-brown, coarse-grained, with Limestone cobbles (GO)
27.0	LIMESTONE (Bedrock)
39.4	LIMESTONE - Shaley, medium gray, with
45.6	Becomes bluish-gray
53.5	With numerous vugs filled with calcite crystals and chert
53.9	Moderately fractured, unweathered with chert
55.2	Becomes Shaley (Bedrock)
55.4	SHALE - Black, fractured, fissile, slightly weathered (Bedrock)
55.7	LIMESTONE - Siliceous, Shaley, blue-gray and gray (Bedrock)
56.6	SHALE - Black, soft, fissile, slightly weathered (Bedrock)
58.3	LIMESTONE - Shaley, Siliceous, dark gray and (Bedrock)

AGS / Elevation (feet)

Elevation of top of casing 2.35 / 682.85
Ground elevation 0 / 680.5

BGS / Elevation (feet)

I.D./Type of surface casing **6-inch I.D. / Square, steel, casing with a lockable steel cap, 6-foot long**
Type of surface seal **Concrete**
I.D./Type of riser pipe **2-inch I.D. / Schedule 40, flush-threaded PVC**
Depth of surface seal 3.4 / 677.1
Type of backfill **High solids bentonite grout**
Type of double casing **6-inch steel**
Depth of double casing 37.0 / 643.5
Depth to top of seal 42.6 / 637.9
Type of seal **#100 clean, washed, silica buffer sand**
Depth to top of filter pack 46.4 / 634.1
Depth to top of screen 49.1 / 631.4
Type of filter pack **#20-40 clean, washed, silica sand**
I.D./Type of screen **2-inch I.D. / Johnson® PVC, wire-wrapped, continuous slot**
Screen slot size **0.01-inch**
Depth to bottom of screen 59.1 / 621.4
Depth to bottom of plugged blank 59.6 / 620.9
Type of backfill below monitoring well **#20-40 filter pack sand**
Depth of bottom of boring 60.4 / 620.1
Diameter of boring **10"**
Diameter of boring **6"**

MONITORING WELL CONSTRUCTION LOG

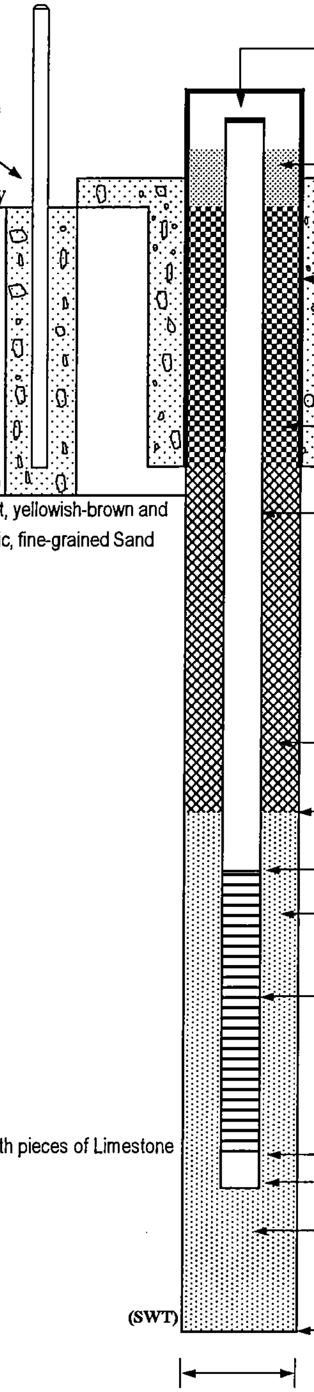
Project Name Iowa AAP Six Site FS Data Collection
Location Burlington, Iowa
Installed By Aquadrill, Jay Joslyn
Inspected By URS, Mike Sonderman
Method of Installation 4 1/4" ID HSA
Remarks

Well No. FTP-MW5
Project No. 16169421
Date 4/14/03 **Time** 1420

Guard posts
(4) 3-inch steel, 6-foot filled with concrete. Buried 3-foot in concrete 6-inch hole diameter.

Generalized Stratigraphy

0.0	Lean CLAY (**CL-ML**) - Medium stiff, moist, dark brown, low plastic with organics (Topsoil)
2.6	Sandy CLAY (**CL**) - Very stiff, moist, yellowish-brown and gray mottled, medium to high plastic, fine-grained Sand with iron staining
7.3	Becomes medium plastic
9.8	Becomes soft
11.0	Becomes wet
13.9	Becomes Clayey SAND (**SC**) - With pieces of Limestone



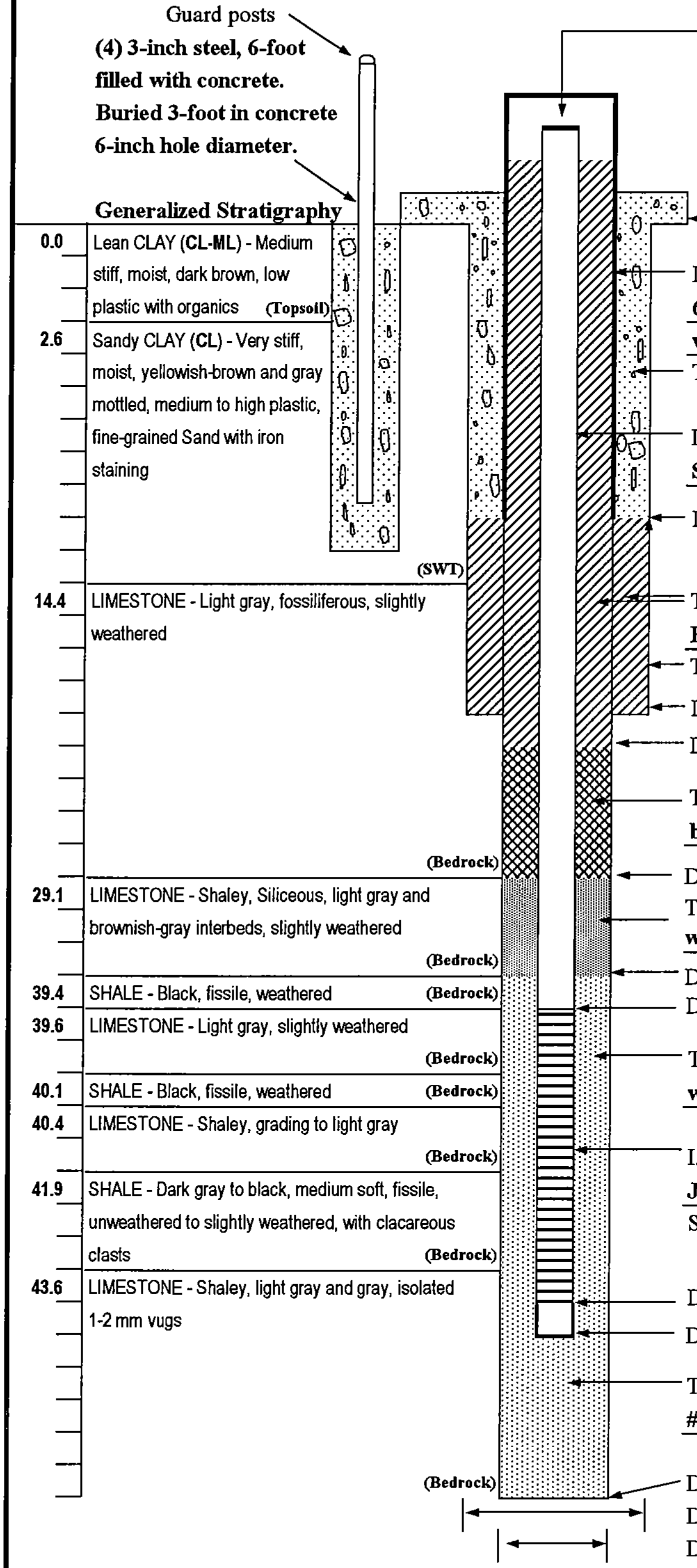
	AGS	Elevation (feet)
Elevation of top of casing	2.39	670.59
Type of backfill: Filter pack		
Ground elevation	0	668.2

	BGS	Elevation (feet)
I.D./Type of surface casing: 6-inch I.D. / Square, steel casing with a lockable steel cap, 6-foot long		
Type of surface seal: Concrete		
Type of backfill: 3/8" bentonite chips		
Depth to top of seal	3.0	665.2
I.D./Type of riser pipe: 2-inch I.D. / Schedule 40, flush-threaded PVC		
Type of seal: 1/2-inch sodium bentonite pellets		
Depth to top of filter pack	6.0	662.2
Depth to top of screen	8.9	659.3
Type of filter pack: #20-40 clean, washed, silica sand		
I.D./Type of screen: 2-inch I.D. / Johnson® PVC wire-wrapped continuous slot		
Screen slot size: 0.01-inch		
Depth of bottom of screen	13.9	654.3
Depth of bottom of plugged	14.4	653.8
Type of backfill below monitoring well: #20-40 filter pack sand		
Depth of bottom of boring	14.4	653.8
Diameter of boring: 8 1/4"		

MONITORING WELL CONSTRUCTION LOG

Project Name Iowa AAP Six Site FS Data Collection
Location Burlington, Iowa
Installed By Aquadrill, Jay Joslyn
Inspected By URS, Mike Sonderman
Method of Installation 6 1/4" ID HSA, 6" AR
Remarks 6 5/8" ID HSA to 24.4' bgs and set a steel casing, 6" AR from 24.4' to 45.3' bgs.
SWT = Shallow Weathered Till

Well No. FTP-MW6
Project No. 16169421
Date 4/14/03 **Time** 0930



Guard posts (4) 3-inch steel, 6-foot filled with concrete. Buried 3-foot in concrete 6-inch hole diameter.

Generalized Stratigraphy

0.0	Lean CLAY (CL-ML) - Medium stiff, moist, dark brown, low plastic with organics	(Topsoil)
2.6	Sandy CLAY (CL) - Very stiff, moist, yellowish-brown and gray mottled, medium to high plastic, fine-grained Sand with iron staining	(SWT)
14.4	LIMESTONE - Light gray, fossiliferous, slightly weathered	(Bedrock)
29.1	LIMESTONE - Shaley, Siliceous, light gray and brownish-gray interbeds, slightly weathered	(Bedrock)
39.4	SHALE - Black, fissile, weathered	(Bedrock)
39.6	LIMESTONE - Light gray, slightly weathered	(Bedrock)
40.1	SHALE - Black, fissile, weathered	(Bedrock)
40.4	LIMESTONE - Shaley, grading to light gray	(Bedrock)
41.9	SHALE - Dark gray to black, medium soft, fissile, unweathered to slightly weathered, with clacareous clasts	(Bedrock)
43.6	LIMESTONE - Shaley, light gray and gray, isolated 1-2 mm vugs	(Bedrock)

	AGS	Elevation (feet)
Elevation of top of casing	2.64	670.44
Ground elevation	0	667.8

I.D./Type of surface casing 6-inch I.D. / Square, steel, casing with a lockable steel cap, 6-foot long
Type of surface seal Concrete
I.D./Type of riser pipe 2-inch I.D. / Schedule 40, flush-threaded PVC
Type of backfill High solids bentonite grout
Type of double casing 6-inch steel
Type of seal 1/2-inch sodium bentonite pellets
Type of buffer sand #100 clean, washed, silica buffer sand
Type of filter pack #20-40 clean, washed, silica sand
I.D./Type of screen 2-inch I.D. / Johnson® PVC, wire-wrapped, continuous slot
Screen slot size 0.01-inch
Type of backfill below monitoring well #20-40 filter pack sand
Diameter of boring 10"
Diameter of boring 6"

	BGS	Elevation (feet)
Depth of surface seal	2.0	665.8
Depth of double casing	24.4	643.4
Depth to top of seal	26.0	641.8
Depth to top of buffer sand	29.0	638.8
Depth to top of filter pack	30.0	637.8
Depth to top of screen	34.8	633.0
Depth to bottom of screen	44.8	623.0
Depth to bottom of plugged blank	45.3	622.5
Depth of bottom of boring	45.3	622.5

MONITORING WELL CONSTRUCTION LOG

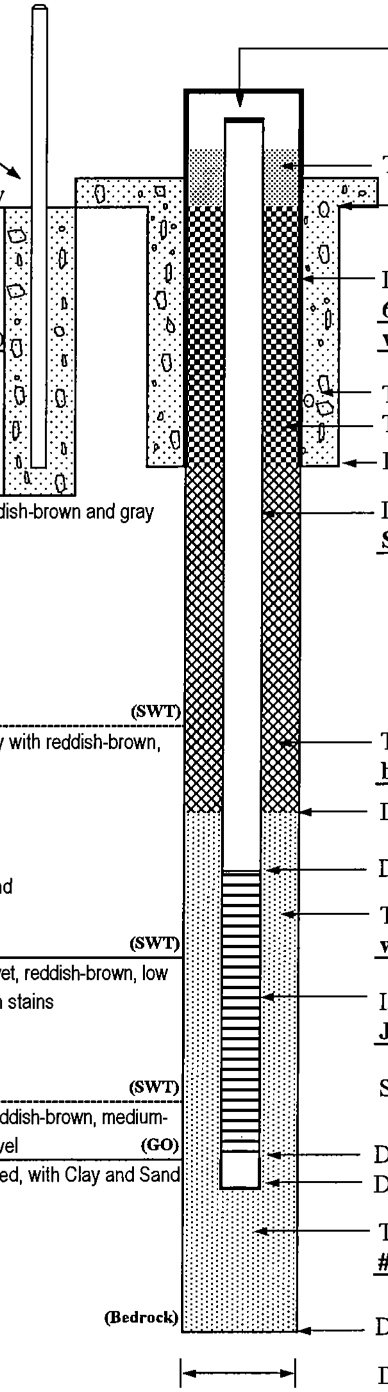
Project Name Iowa AAP Six Site FS Data Collection
Location Burlington, Iowa
Installed By Aquadrill, Dennis Auld
Inspected By URS, Corey Anderson
Method of Installation CME-75 with 4 1/4" ID HSAs, 2" SS with liners
Remarks Till/Bedrock Contact Well
SWT = Shallow Weathered Till, GO = Glacial Outwash

Well No. FTP-MW7
Project No. 16169421
Date 4/16/03 **Time** 1100

Guard posts →
(4) 3-inch steel, 6-foot filled with concrete. Buried 3-foot in concrete 6-inch hole diameter.

Generalized Stratigraphy

0.0	Silty CLAY (**CL**) - Very stiff, moist, brown and gray mottled with black, low to medium plastic, with iron staining, black organics, and crushed round Gravel **(Fill)**
1.4	Silty CLAY (**CL**) - Stiff, moist, black, low to medium plastic, with organics **(Topsoil)**
2.3	Silty CLAY (**CL**) - Stiff, moist, reddish-brown and gray mottled, medium to high plastic **(SWT)**
6.4	Silty CLAY (**CL**) - Stiff, moist, gray with reddish-brown, low to medium plastic, with Sand
12.8	0.2' seam of gray fine-grained Sand
13.1	With Sand **(SWT)**
13.7	Sandy CLAY (**CL**) - Soft, moist to wet, reddish-brown, low plastic, fine-grained Sand with iron stains **(SWT)**
20.5	Clayey SAND (**SC**) - Loose, wet, reddish-brown, medium- to fine-grained, with Clay and Gravel **(GO)**
21.0	LIMESTONE - Fractured, weathered, with Clay and Sand **(Bedrock)**



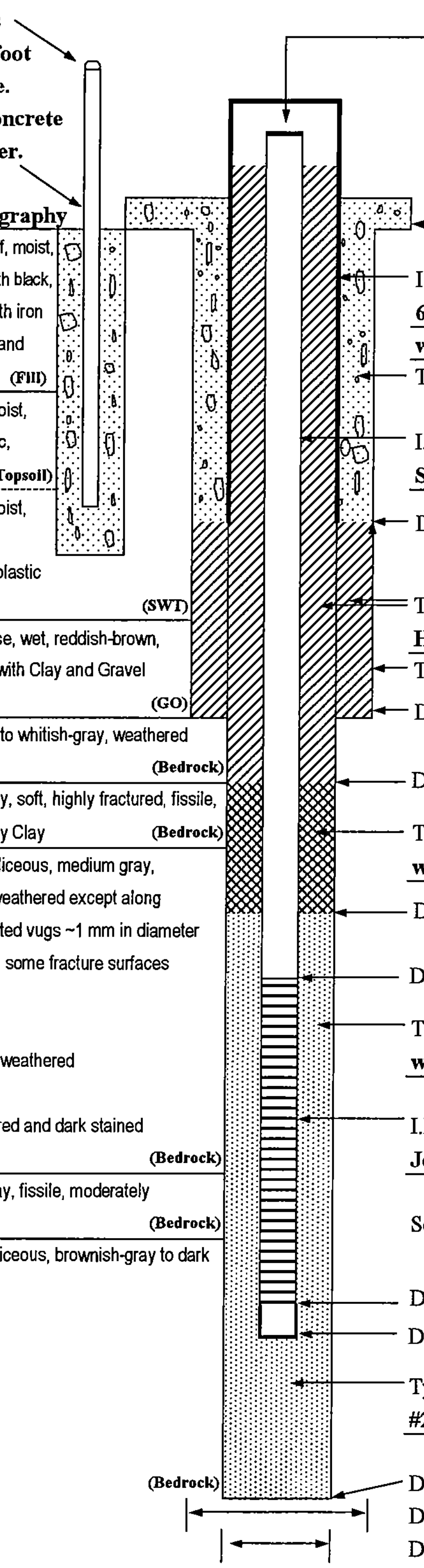
	AGS	Elevation (feet)
Elevation of top of casing	2.37	676.87
Type of backfill **Filter pack**		
Ground elevation	0	674.5

	BGS	Elevation (feet)
I.D./Type of surface casing **6-inch I.D. / Square, steel casing with a lockable steel cap, 6-foot long**		
Type of surface seal **Concrete**		
Type of backfill **3/8" bentonite chips**		
Depth of surface seal	3.0	671.5
I.D./Type of riser pipe **2-inch I.D. / Schedule 40, flush-threaded PVC**		
Type of seal **1/2-inch sodium bentonite pellets**		
Depth to top of filter pack	8.0	666.5
Depth to top of screen	11.0	663.5
Type of filter pack **#20-40 clean, washed, silica sand**		
I.D./Type of screen **2-inch I.D. / Johnson® PVC wire-wrapped continuous slot**		
Screen slot size **0.01-inch**		
Depth of bottom of screen	21.0	653.5
Depth of bottom of plugged	21.5	653.0
Type of backfill below monitoring well **#20-40 filter pack sand**		
Depth of bottom of boring	22.0	652.5
Diameter of boring **8"**		

MONITORING WELL CONSTRUCTION LOG

Project Name Iowa AAP Six Site FS Data Collection
Location Burlington, Iowa
Installed By Aquadrill, Dennis Auld
Inspected By URS, Mike Sonderman
Method of Installation 10" RWB, 6" AR
Remarks 10" RWB to 27.7' bgs and set a steel casing, 6" AR from 27.7' to 52.1' bgs.
SWT = Shallow Weathered Till, GO = Glacial Outwash

Well No. FTP-MW8
Project No. 16169421
Date 4/23/03 **Time** 1150



Generalized Stratigraphy

0	Silty CLAY (CL) - Very stiff, moist, brown and gray mottled with black, low to medium plastic, with iron staining, black organics, and crushed round Gravel	(Fill)
1.4	Silty CLAY (CL) - Stiff, moist, black, low to medium plastic, with organics	(Topsoil)
2.3	Silty CLAY (CL) - Stiff, moist, reddish-brown and gray mottled, medium to high plastic	(SWT)
20.5	Clayey SAND (SC) - Loose, wet, reddish-brown, medium- to fine-grained, with Clay and Gravel	(GO)
21.0	LIMESTONE - Light gray to whitish-gray, weathered	(Bedrock)
29.0	SHALE - Gray to dark gray, soft, highly fractured, fissile, highly weathered to mostly Clay	(Bedrock)
32.1	LIMESTONE - Shaley, Siliceous, medium gray, moderately fractured, unweathered except along fracture surface, few isolated vugs ~1 mm in diameter	
41.0	Very fractured chert layer, some fracture surfaces stained dark	
42.0	Some Shale	
44.3	Fracture surfaces slightly weathered	
45.0	Shale content increasing	
46.7	Fracture surfaces weathered and dark stained	(Bedrock)
47.7	SHALE - Black to dark gray, fissile, moderately fractured, weathered	(Bedrock)
49.2	LIMESTONE - Shaley, Siliceous, brownish-gray to dark gray	
50.4	Vertical fractures	
		(Bedrock)

AGS **Elevation (feet)**

Elevation of top of casing 2.71 / 676.81

Ground elevation 0 / 674.1

BGS **Elevation (feet)**

I.D./Type of surface casing **6-inch I.D. / Square, steel, casing with a lockable steel cap, 6-foot long**

Type of surface seal **Concrete**

I.D./Type of riser pipe **2-inch I.D. / Schedule 40, flush-threaded PVC**

Depth of surface seal 3.0 / 671.1

Type of backfill **High solids bentonite grout**

Type of double casing **6-inch steel**

Depth of double casing 27.7 / 646.4

Depth to top of seal 35.0 / 639.1

Type of seal **#100 clean, washed, silica buffer sand**

Depth to top of filter pack 39.0 / 635.1

Depth to top of screen 41.1 / 633.0

Type of filter pack **#20-40 clean, washed, silica sand**

I.D./Type of screen **2-inch I.D. / Johnson® PVC, wire-wrapped, continuous slot**

Screen slot size **0.01-inch**

Depth to bottom of screen 51.1 / 623.0

Depth to bottom of plugged blank 51.5 / 622.6

Type of backfill below monitoring well **#20-40 filter pack sand**

Depth of bottom of boring 52.1 / 622.0

Diameter of boring **10"**

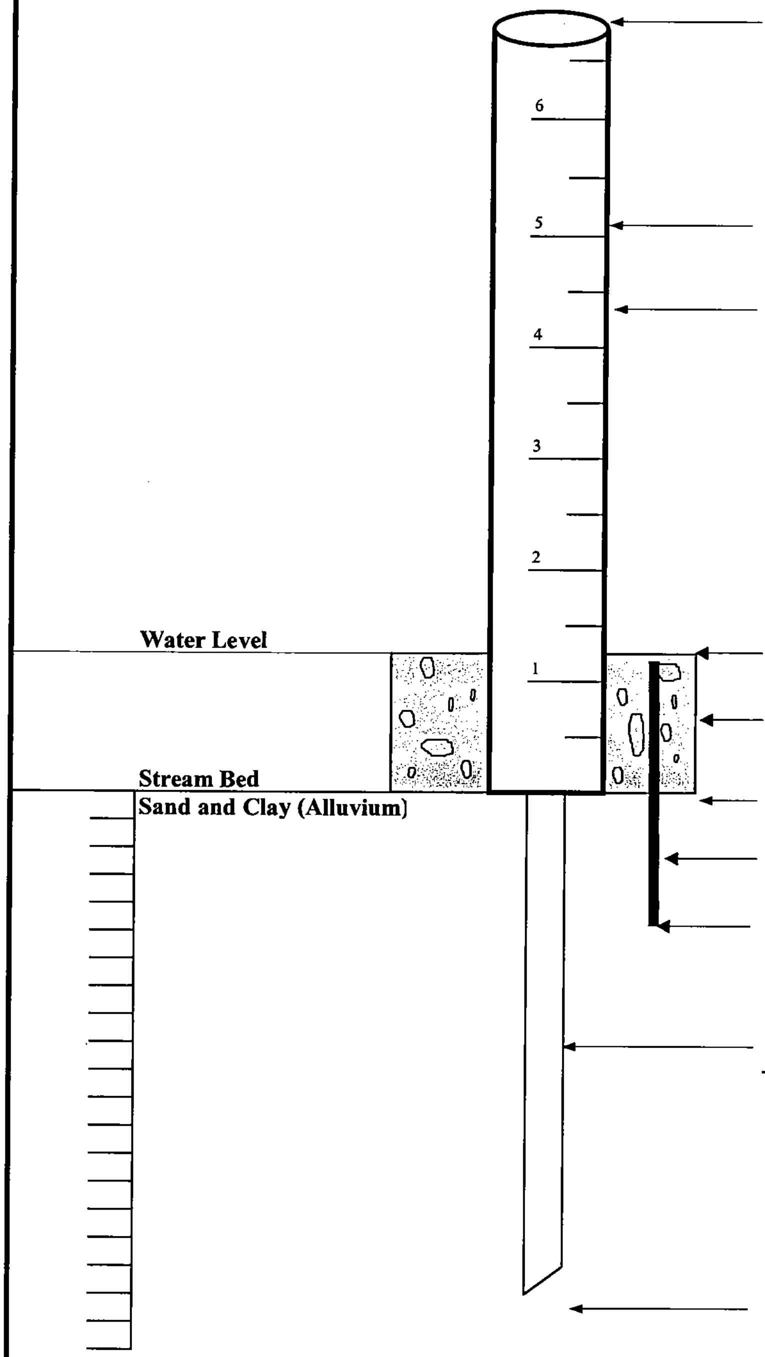
Diameter of boring **6"**

Staff Gauge Construction Diagrams

STAFF GAUGE CONSTRUCTION LOG

Project Name Iowa AAP Six Site FS Data Collection
Location Burlington, Iowa
Installed By Corey Anderson / Dave Berger (URS)
Method of Installation Driven anchor post and concrete blocks
Remarks SC-SG01 is located in Spring Creek, approximately 400 feet northeast of JAW-24 and WBP-MW2(B). A permanent benchmark was installed on the west bank and surveyed Elevation of the benchmark is 642.04 feet.

Gauge No. SC-SG01
Project No. 16169421/503
Date 4/25/03



	AGS / Elevation (feet)
Top of staff gauge	6.66 / 641.83
Measurement rod surveyed to 0.01'	
2-inch wide, metal, measurement rod, graduated to 0.01'	
Height of concrete block	1.33 / 636.50
(2) 8-inch concrete block	
Stream bed elevation	0.0 / 635.17

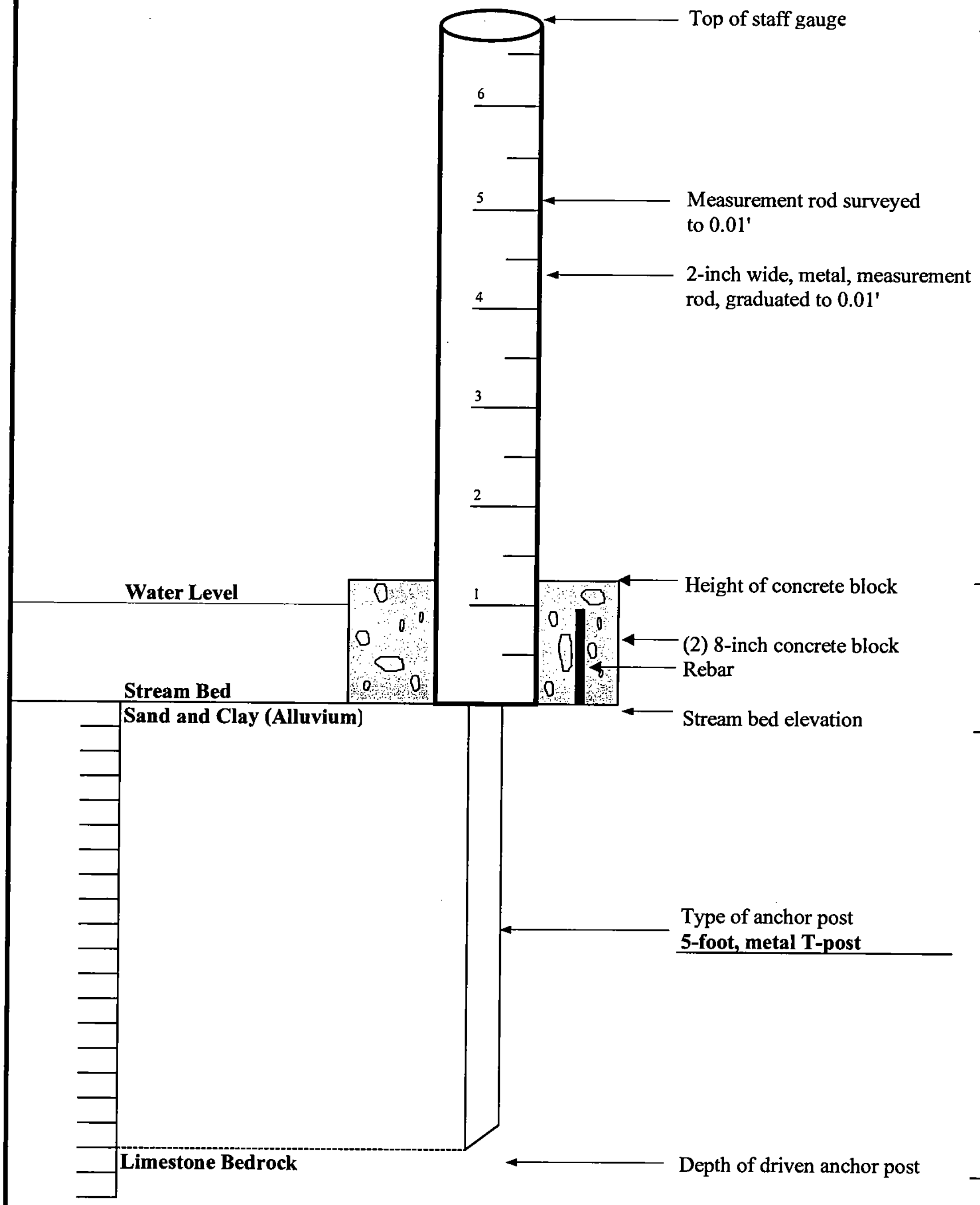
	BGS / Elevation (feet)
Rebar	
Depth of rebar	0.5 / 634.7
Type of anchor post 5-foot, metal T-post	
Depth of driven anchor post	3.0 / 632.2

STAFF GAUGE CONSTRUCTION LOG

Project Name Iowa AAP Six Site FS Data Collection
Location Burlington, Iowa
Installed By Corey Anderson / Dave Berger (URS)
Method of Installation Driven anchor post and concrete blocks
Remarks SC-SG02 is located in a tributary of Spring Creek, approximately 150 feet north of WBP-99-4(B).

Gauge No. SC-SG02
Project No. 16169421/503
Date 4/26/03

AGS Elevation (feet)



Top of staff gauge 6.66 / 658.99

Measurement rod surveyed to 0.01'

2-inch wide, metal, measurement rod, graduated to 0.01'

Height of concrete block 1.33 / 653.66

(2) 8-inch concrete block

Rebar

Stream bed elevation 0.0 / 652.33

BGS Elevation (feet)

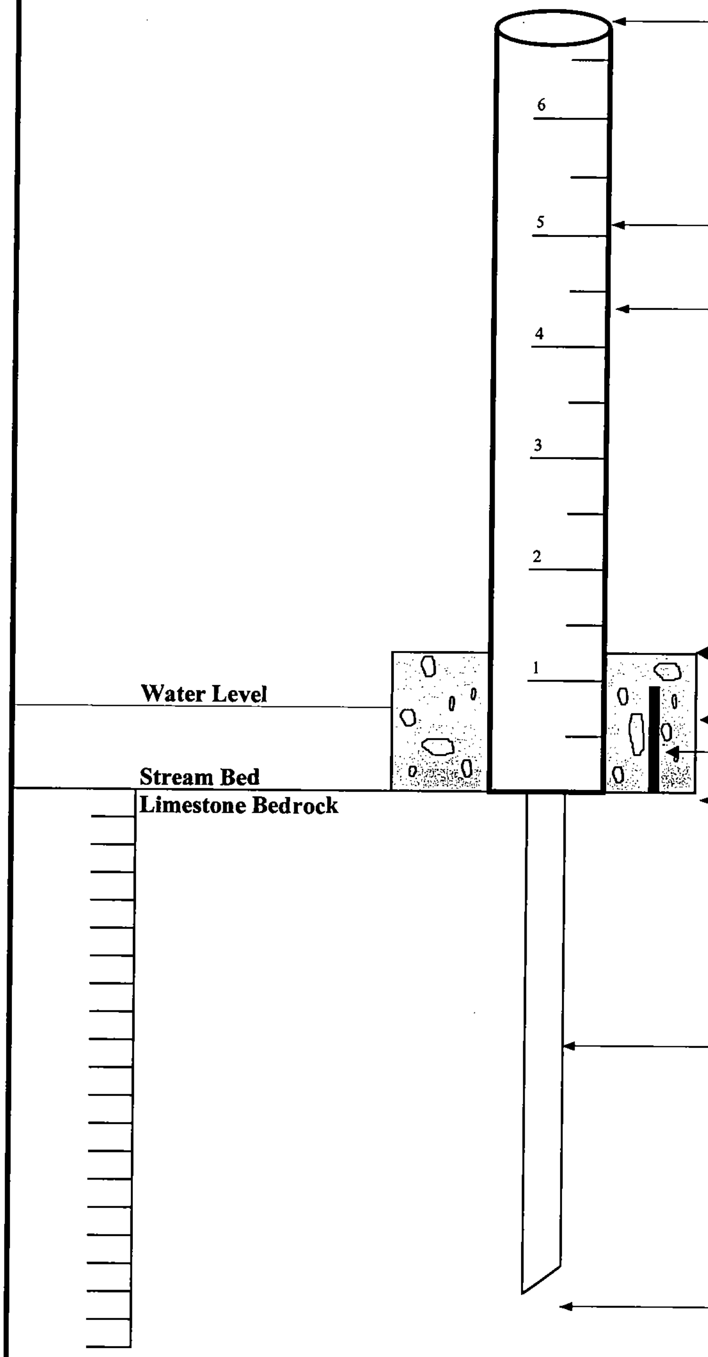
Type of anchor post 5-foot, metal T-post

Depth of driven anchor post 2.0 / 650.3

STAFF GAUGE CONSTRUCTION LOG

Project Name Iowa AAP Six Site FS Data Collection
Location Burlington, Iowa
Installed By Corey Anderson / Dave Berger (URS)
Method of Installation Core hole, anchor post, and concrete blocks
Remarks SC-SG03 is located in a tributary of Spring Creek, approximately 75 feet northeast of WBP-99-5(B) and WBP-MW1(B).

Gauge No. SC-SG03
Project No. 16169421/503
Date 4/26/03

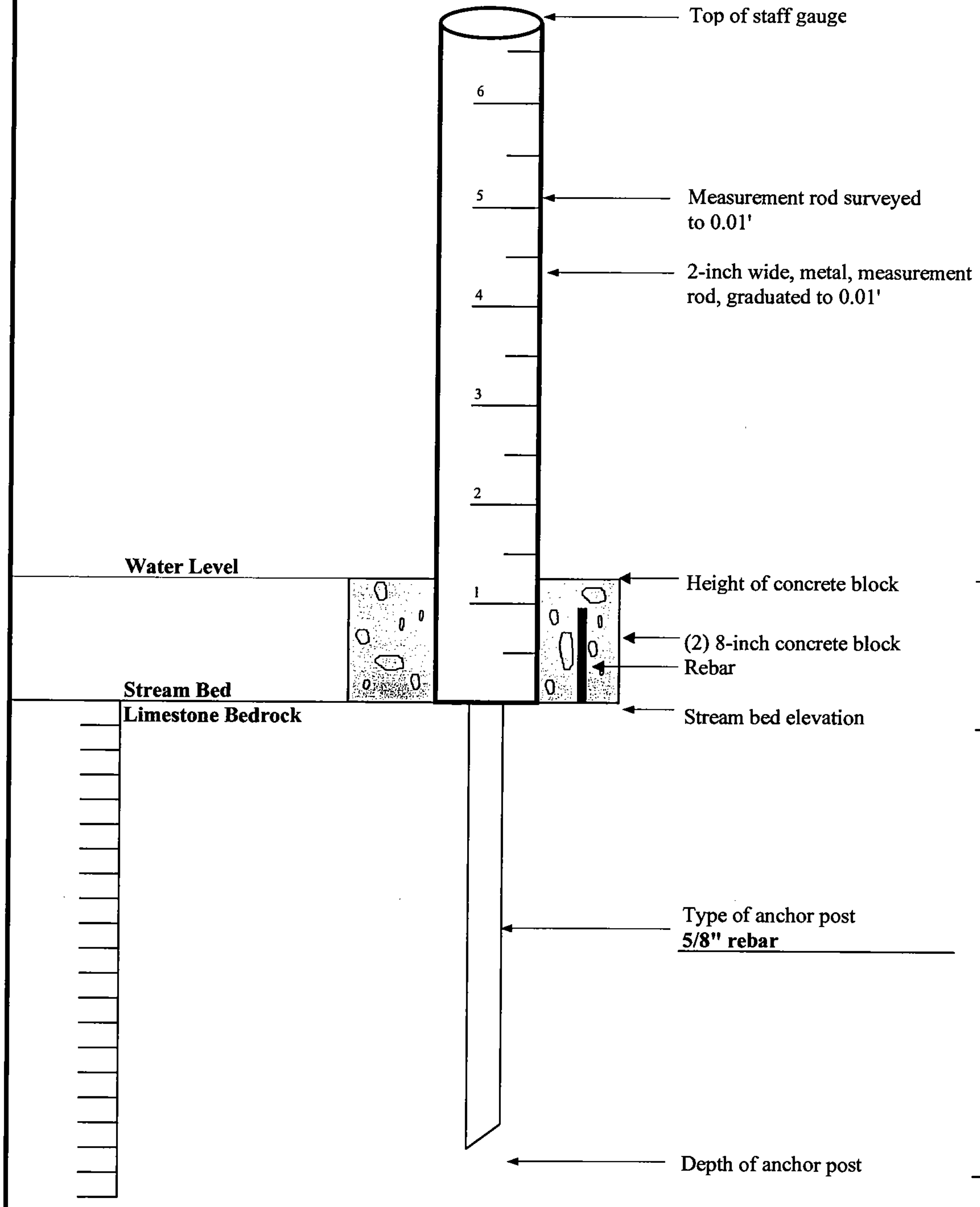


	AGS / Elevation (feet)
Top of staff gauge	6.66 / 645.99
Measurement rod surveyed to 0.01'	
2-inch wide, metal, measurement rod, graduated to 0.01'	
Height of concrete block	1.33 / 640.66
(2) 8-inch concrete block	
Rebar	
	BGS / Elevation (feet)
Stream bed elevation	0.0 / 639.33
Type of anchor post 5/8" rebar	
Depth of anchor post	1.0 / 638.3

STAFF GAUGE CONSTRUCTION LOG

Project Name Iowa AAP Six Site FS Data Collection
Location Burlington, Iowa
Installed By Corey Anderson / Dave Berger (URS)
Method of Installation Core hole, anchor post, and concrete blocks
Remarks SC-SG04 is located in Spring Creek, immediately south of the East Burn Pads road and approximately 100 feet east of WBP-99-3(B) and WBP-99-7(B).

Gauge No. SC-SG04
Project No. 16169421/503
Date 4/29/03



	AGS	Elevation (feet)
Top of staff gauge	6.66	641.83
Height of concrete block	1.33	636.50
Stream bed elevation	0.0	635.17
	BGS	**Elevation (feet)**
Depth of anchor post	2.0	633.2

STAFF GAUGE CONSTRUCTION LOG

Project Name Iowa AAP Six Site FS Data Collection

Location Burlington, Iowa

Installed By Corey Anderson / Dave Berger (URS)

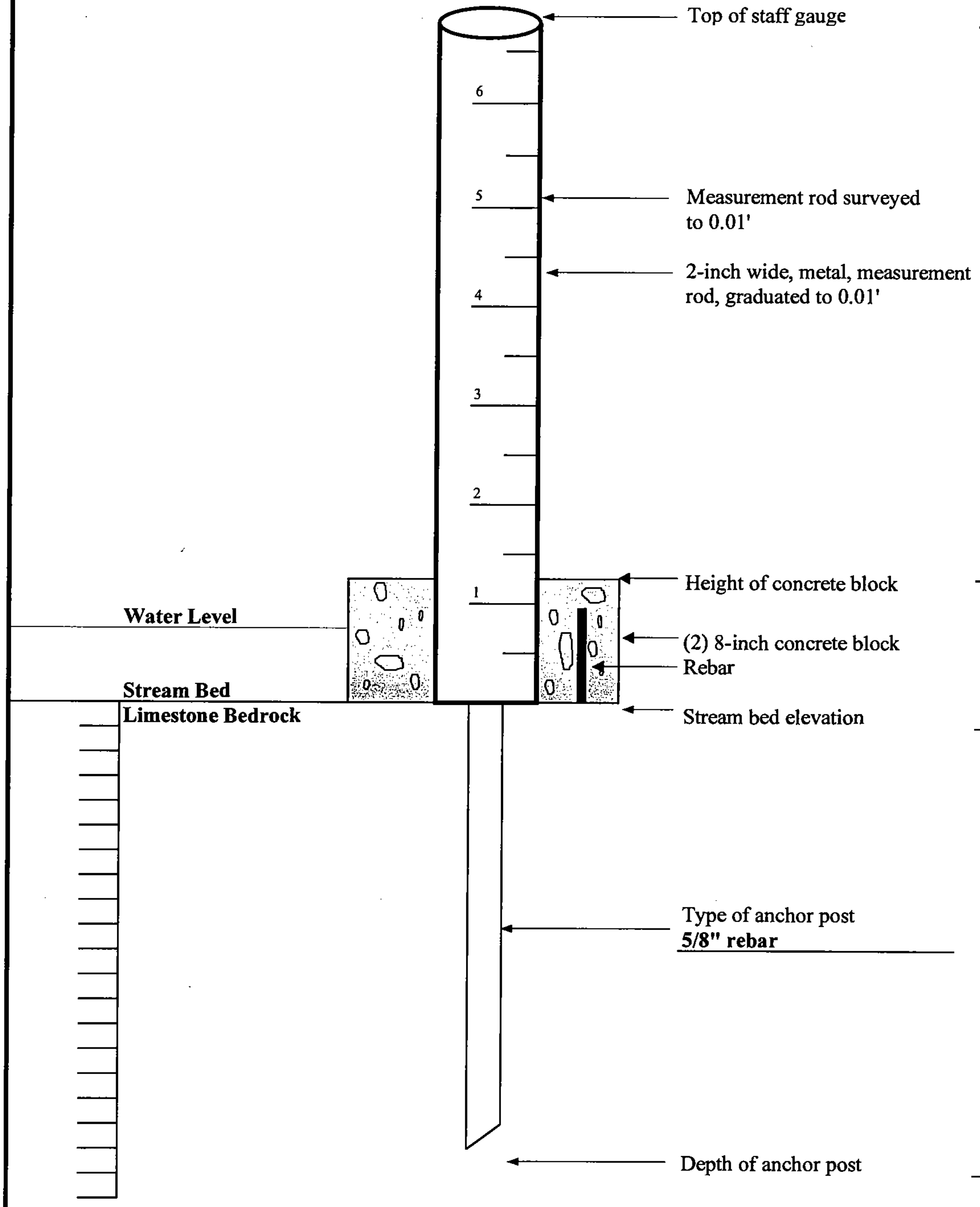
Method of Installation Core hole, anchor post, and concrete blocks

Remarks SC-SG05 is located in a tributary of Spring Creek, approximately 100 feet east of FTP-MW3(B).

Gauge No. SC-SG05

Project No. 16169421/503

Date 4/29/03



	AGS Elevation (feet)
Top of staff gauge	6.66 / 648.76
Measurement rod surveyed to 0.01'	
2-inch wide, metal, measurement rod, graduated to 0.01'	
Height of concrete block	1.33 / 643.43
(2) 8-inch concrete block	
Rebar	
Stream bed elevation	0.0 / 642.10
	BGS Elevation (feet)
Type of anchor post 5/8" rebar	
Depth of anchor post	2.0 / 640.1

STAFF GAUGE CONSTRUCTION LOG

Project Name Iowa AAP Six Site FS Data Collection

Location Burlington, Iowa

Installed By Corey Anderson / Dave Berger (URS)

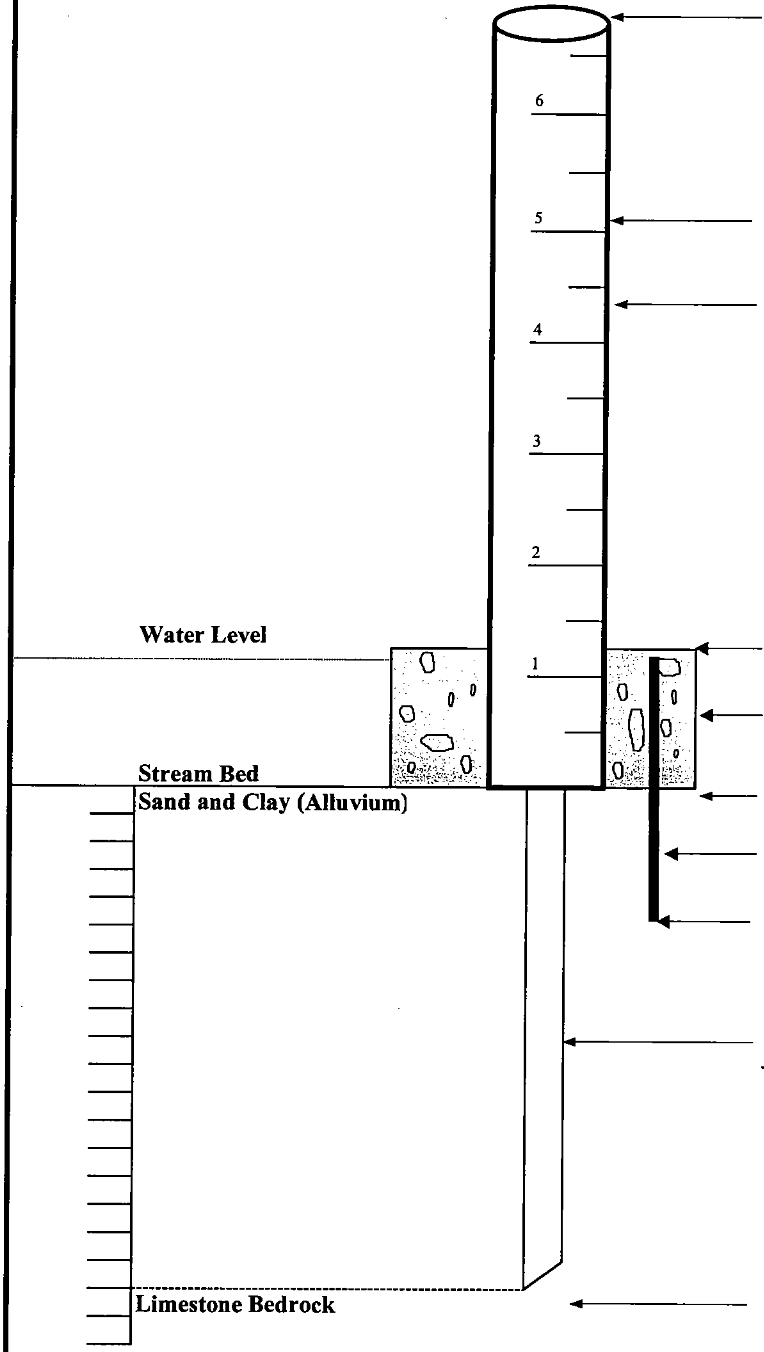
Method of Installation Driven anchor post and concrete blocks

Remarks SC-SG06 is located in a tributary of Spring Creek, approximately 20 feet southeast of FTP-MW1.

Gauge No. SC-SG06

Project No. 16169421/503

Date 4/27/03



AGS Elevation (feet)

Top of staff gauge 6.66 / 658.50

Measurement rod surveyed to 0.01'

2-inch wide, metal, measurement rod, graduated to 0.01'

Height of concrete block 1.33 / 653.17

(2) 8-inch concrete block

Stream bed elevation 0.0 / 651.84

Rebar

BGS Elevation (feet)

Depth of rebar 0.5 / 651.3

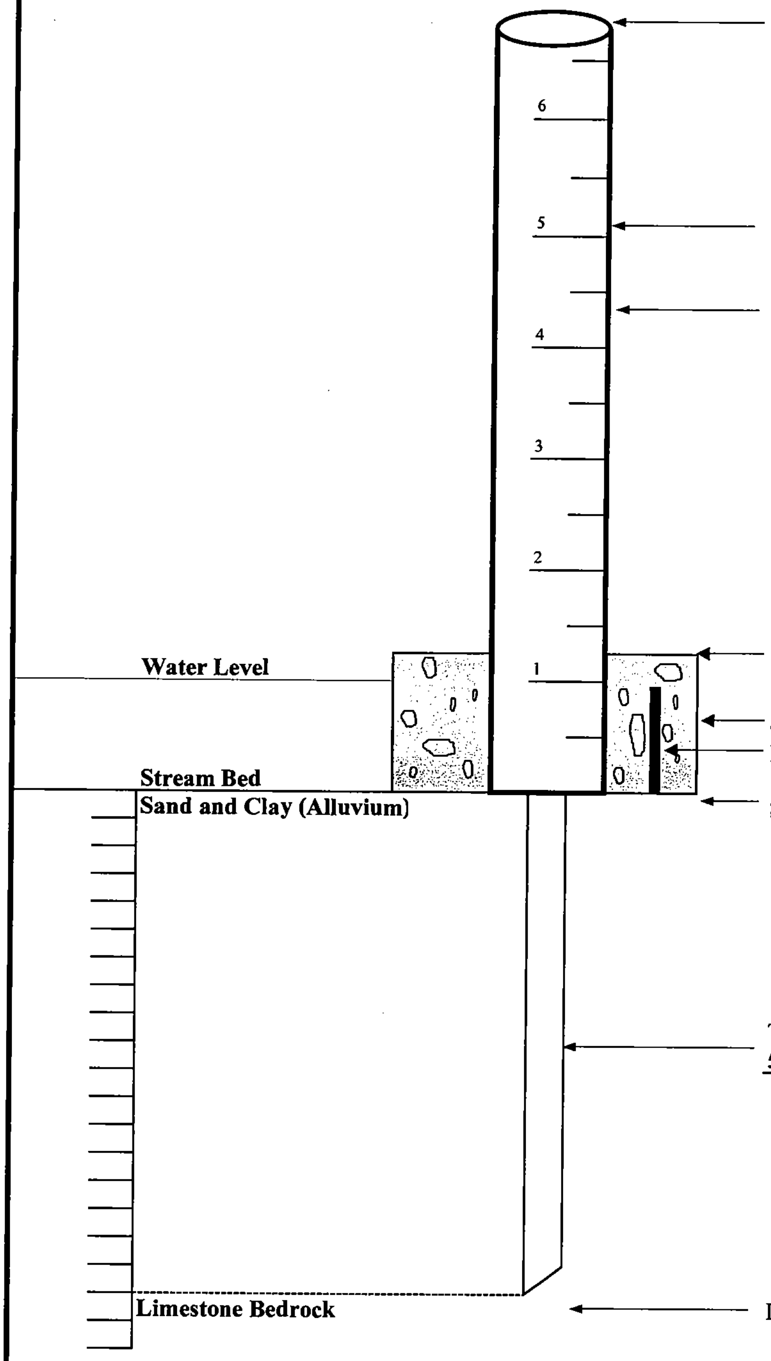
Type of anchor post 5-foot, metal T-post

Depth of driven anchor post 1.5 / 650.3

STAFF GAUGE CONSTRUCTION LOG

Project Name Iowa AAP Six Site FS Data Collection
Location Burlington, Iowa
Installed By Corey Anderson / Dave Berger (URS)
Method of Installation Driven anchor post and concrete blocks
Remarks SC-SG07 is located in Spring Creek, approximately 280 feet southwest of EBP-MW5(B) and EBP-MW6(B). A permanent benchmark was installed on the east bank and surveyed. Elevation of the benchmark is 632.67 feet.

Gauge No. SC-SG07
Project No. 16169421/503
Date 4/29/03



	AGS	**Elevation (feet)**
Top of staff gauge	6.66	634.33
Measurement rod surveyed to 0.01'		
2-inch wide, metal, measurement rod, graduated to 0.01'		
Height of concrete block	1.33	629.00
(2) 8-inch concrete block		
Rebar		
Stream bed elevation	0.0	627.67
	BGS	**Elevation (feet)**
Type of anchor post 5/8" rebar		
Depth of driven anchor post	1.0	626.7

APPENDIX E

Development Logs

WELL DEVELOPMENT LOG

Project: Iowa AAP Six Site FS Data Collection
Well No: FTP-MW1
Project No: 16169421.00201
Date: 3/27/2003

WELL MEASUREMENTS

Well inside diameter: 2 in.
Depth of well casing: 18.31 ft.
Initial water level: 6.95 ft. below MP
Measuring point (MP): Top of Casing
Fluid well casing volume: 1.8 gal.
Weather conditions: Partly cloudy, wind 20 to 30 mph, 40 to 50 degrees Fahrenheit

SAMPLING MEASUREMENT

DATE 3/27 4/12

DISCHARGE

Water level (ft. BMP)	-	9.08	16.38	16.12	16.23	15.38	14.4	13.74	12.8					
Time	1830	1425	1430	1432	1434	1436	1439	1442	1445					
Discharge (Gal.)	10	14	19	21	23	25	27	29	32					
Flow Rate (gpm)	-	1	1	1	1	1	1	1	1					

PUMPING/SURGING

Depth of Pump Intake	-	18	16	18	18	18	18	18	18					
Duration of Surging	-	-	-	-	-	-	-	-	-					

WATER QUALITY DATA

pH	-	6.99	7.05	7.15	7.18	7.18	7.21	7.18	7.18					
Conductivity (µS/cm)	-	0.791	0.830	0.800	0.806	0.772	0.769	0.777	0.774					
Temperature (°C)	-	11.5	10.3	10.7	10.6	10.7	10.7	10.3	10.5					
Color	-	Brown	Brown	Gray	Gray	Clear	Clear	Clear	Clear					
Turbidity (NTUs)	-	100	400	310	160	90	16	2.3	1.8					

Total discharge: 32 Gallons
Casing volumes removed: 18
Method of disposal of discharged water: Inert Disposal Area

QUALITY ASSURANCE

Water Level Meter: Solinst
Type of Bailer/Rope: Disposable teflon bailer / nylon twine
Water Quality meter: Horiba U-10 / LaMotte 2020
Calibrated: Daily
Submersible Pump: Geosquirt 12V
Surge Block: N/A
Comments: Well installed on 3/25/03; 5 gallons of water used during installation

WELL DEVELOPMENT LOG

Project: Iowa AAP Six Site FS Data Collection
Project No: 16169421.00201
Well No: FTP-MW2 Page 1 of 3
Date: 4/21/2003 to 4/27/2003

WELL MEASUREMENTS

Well inside diameter: 2 in.
Depth of well casing: 19.73 ft.
Initial water level: 11.41 ft. below MP
Measuring point (MP): Top of Casing
Fluid well casing volume: 1.3 gal.
Weather conditions: Overcast, wind 15 to 20 mph, 50 degrees Fahrenheit

SAMPLING MEASUREMENT

DATE	4/21				4/23								4/24	
DISCHARGE														
Water level (ft. BMP)	-	-	-	Dry	17.00	Dry	13.02	Dry	12.10	15.85	18.00	Dry	11.61	14.00
Time	1653	1658	1702	1705	0948	0952	1237	1241	1525	1535	1540	1542	0837	0841
Discharge (Gal.)	0.3	2	4	5	10	12	-	17	-	19	21	22	-	24
Flow Rate (gpm)	-	-	-	-	1	0.5	-	1	-	0.2	0.4	0.4	-	0.5
PUMPING/SURGING														
Depth of Pump Intake	-	-	-	-	19	19.5	-	19.5	-	19	19	19	-	19
Duration of Surging	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WATER QUALITY DATA														
pH	6.61	6.73	6.76	-	6.82	-	-	6.88	-	7.00	6.85	-	-	6.38
Conductivity (µS/cm)	0.448	0.461	0.470	-	0.454	-	-	0.466	-	0.463	0.461	-	-	0.474
Temperature (ºC)	8.2	8.1	8.3	-	10.2	-	-	11.0	-	12.9	10.6	-	-	8.4
Color	Brown	Brown	Gray	-	Gray	-	-	Gray	-	Gray	Clear	-	-	Clear
Turbidity (NTUs)	>1100	>1100	>1100	-	272	-	-	171	-	233	84	-	-	42

Total discharge: 66.5 Gallons Casing volumes removed: 51
Method of disposal of discharged water: Inert Disposal Area

QUALITY ASSURANCE

Water Level Meter: Solinst
Type of Bailer/Rope: PVC bailer / poly twine
Water Quality meter: Horiba U-10 / LaMotte 2020 Calibrated: Daily
Submersible Pump: Geosquirt 12V Surge Block: N/A
Comments: Well installed on 4/14/03; 20 gallons of water used during installation

WELL DEVELOPMENT LOG

Project: Iowa AAP Six Site FS Data Collection
Project No: 16169421.00201

Well No: FTP-MW2 Page 2 of 3
Date: 4/21/2003 to 4/27/2003

WELL MEASUREMENTS

Well inside diameter: 2 in.
Depth of well casing: 19.73 ft.
Initial water level: 11.41 ft. below MP
Measuring point (MP): Top of Casing
Fluid well casing volume: 1.3 gal.
Weather conditions: Overcast, wind 15 to 20 mph, 50 degrees Fahrenheit

SAMPLING MEASUREMENT

DATE							4/25				4/26			
DISCHARGE														
Water level (ft. BMP)	18.00	Dry	17.00	Dry	16.00	Dry	15.00	Dry	13.50	Dry	Dry	Dry	13.60	14.95
Time	0847	0851	1120	1121	1631	1639	0848	0852	1241	1244	1208	-	1537	1543
Discharge (Gal.)	27	29	31	33	37.5	39.5	41	43	44	47	49.5	52	53	54.5
Flow Rate (gpm)	0.5	0.5	1	1	0.1	0.3	0.5	0.5	0.5	1	1	1	0.3	0.3
PUMPING/SURGING														
Depth of Pump Intake	19	19	19	-	19	19	19	19	19	19	19.7	19.7	19	17
Duration of Surging	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WATER QUALITY DATA														
pH	6.31	-	6.46	-	6.74	-	5.97	6.02	6.82	-	-	-	6.69	6.71
Conductivity (µS/cm)	0.471	-	0.487	-	0.487	-	0.268	0.461	0.287	-	-	-	0.33	0.339
Temperature (ºC)	8.7	-	8.1	-	12.5	-	7.7	8.3	9.7	-	-	-	12.9	12.2
Color	Clear	-	Clear	-	Clear	-	Clear	Clear	Clear	-	-	-	Clear	Clear
Turbidity (NTUs)	40	-	23	-	43	-	52	50	55	-	-	-	32	23

Total discharge: 66.5 Gallons
Casing volumes removed: 51
Method of disposal of discharged water: Inert Disposal Area

QUALITY ASSURANCE

Water Level Meter: Solinst
Type of Bailer/Rope: PVC bailer / poly twine
Water Quality meter: Horiba U-10 / LaMotte 2020 Calibrated: Daily
Submersible Pump: Geosquirt 12V Surge Block: N/A
Comments: Well installed on 4/14/03; 20 gallons of water used during installation

WELL DEVELOPMENT LOG

Project: Iowa AAP Six Site FS Data Collection
Project No: 16169421.00201
Well No: FTP-MW2 Page 3 of 3
Date: 4/21/2003 to 4/27/2003

WELL MEASUREMENTS

Well inside diameter: 2 in.
Depth of well casing: 19.73 ft.
Initial water level: 11.41 ft. below MP
Measuring point (MP): Top of Casing
Fluid well casing volume: 1.3 gal.
Weather conditions: Overcast, wind 15 to 20 mph, 50 degrees Fahrenheit

SAMPLING MEASUREMENT

DATE

DISCHARGE

Water level (ft. BMP)	Dry	-	Dry	13.20	14.20	15.78	16.80	18.45	18.75					
Time	1548	1753	1755	1119	1202	1221	1226	1231	1243					
Discharge (Gal.)	56.5	57.5	59	60	61.5	63	64	65.5	66.5					
Flow Rate (gpm)	0.5	1	1	0.1	0.05	0.3	0.3	0.3	0.3					

PUMPING/SURGING

Depth of Pump Intake	19.5	19.5	19.5	17.5	16	18	19	19.5	19.5					
Duration of Surging	-	-	-	-	-	-	-	-	-					

WATER QUALITY DATA

pH	-	6.72	-	6.70	6.69	6.59	6.57	6.58	6.47					
Conductivity (µS/cm)	-	0.323	-	0.399	0.409	0.403	0.387	0.382	0.391					
Temperature (°C)	-	11.1	-	15.0	18.7	13.8	13.1	13.5	13.9					
Color	-	Clear	-	Clear	Clear	Clear	Clear	Clear	Clear					
Turbidity (NTUs)	-	43	-	19	12	7.7	3.9	8.5	11					

Total discharge: 66.5 Gallons
Casing volumes removed: 51
Method of disposal of discharged water: Inert Disposal Area

QUALITY ASSURANCE

Water Level Meter: Solinst
Type of Bailer/Rope: PVC bailer / poly twine
Water Quality meter: Horiba U-10 / LaMotte 2020 Calibrated: Daily
Submersible Pump: Geosquirt 12V Surge Block: N/A
Comments: Well installed on 4/14/03; 20 gallons of water used during installation

WELL DEVELOPMENT LOG

Project: Iowa AAP Six Site FS Data Collection
Project No: 16169421.00201
Well No: FTP-MW3(B)
Date: 4/21/2003 to 4/30/2003

WELL MEASUREMENTS

Well inside diameter: 2 in.
Depth of well casing: 24.00 ft.
Initial water level: 19.72 ft. below MP
Measuring point (MP): Top of Casing
Fluid well casing volume: 0.7 gal.
Weather conditions: Sunny, calm, 80 degrees Fahrenheit

SAMPLING MEASUREMENT

DATE	4/21		4/23			4/28			4/30					
DISCHARGE														
Water level (ft. BMP)	19.72	Dry	20.74	-	Dry	20.80	23.10	Dry	22.30	23.47	Dry			
Time	1635	1640	0920	0923	0926	1422	1426	1428	0816	0820	0822			
Discharge (Gal.)	0.3	1	-	1.5	2	2.2	3	3.5	3.7	4.3	4.5			
Flow Rate (gpm)	-	-	-	-	-	0.2	0.2	0.5	0.1	0.1	0.1			
PUMPING/SURGING														
Depth of Pump Intake	-	-	-	-	-	21	23.5	24	23.5	23.5	23.5			
Duration of Surging	-	-	-	-	-	-	-	-	-	-	-			
WATER QUALITY DATA														
pH	6.61	6.63	-	6.57	-	6.90	6.90	6.73	6.44	6.56	-			
Conductivity (µS/cm)	1.28	1.06	-	1.08	-	0.797	0.813	0.837	0.808	0.772	-			
Temperature (°C)	9.9	9.4	-	10.6	-	12.0	12.0	12.0	11.2	11.6	-			
Color	Brown	Brown	-	Brown	-	Brown	Brown	Brown	Clear	Clear	-			
Turbidity (NTUs)	>1100	>1100	-	>1100	-	250	210	260	60	36	-			

Total discharge: 4.5 Gallons Casing volumes removed: 6
Method of disposal of discharged water: Inert Disposal Area

QUALITY ASSURANCE

Water Level Meter: Solinst
Type of Bailer/Rope: PVC bailer / poly twine
Water Quality meter: Horiba U-10 / LaMotte 2020 Calibrated: Daily
Submersible Pump: Geosquirt 12V Surge Block: N/A
Comments: Well installed on 4/14/03; 0 gallons of water used during installation

WELL DEVELOPMENT LOG

Project: Iowa AAP Six Site FS Data Collection
Well No: FTP-MW4(B)
Project No: 16169421.00201
Date: 4/21/2003 to 4/30/2003

WELL MEASUREMENTS

Well inside diameter: 2 in.
Depth of well casing: 62.28 ft.
Initial water level: 17.85 ft. below MP
Measuring point (MP): Top of Casing
Fluid well casing volume: 7.1 gal.
Weather conditions: Sunny, wind 5 to 10 mph, 75 degrees Fahrenheit

SAMPLING MEASUREMENT

DATE 4/26 4/23 4/28 4/30

DISCHARGE

Water level (ft. BMP)	-	-	Dry	Dry	33.10	54.20	56.44	44.30	52.60					
Time	1347	1411	1437	1730	1659	1716	1727	0816	0823					
Discharge (Gal.)	0.5	6.5	13	26	27	34	36	39.5	42					
Flow Rate (gpm)	-	-	-	-	0.5	0.4	0.2	0.2	0.2					

PUMPING/SURGING

Depth of Pump Intake	-	-	-	-	59	57	61.5	53	55					
Duration of Surging	-	-	-	-	-	-	-	-	-					

WATER QUALITY DATA

pH	6.75	6.44	6.39	-	6.79	6.61	-	6.16	6.00					
Conductivity (µS/cm)	0.751	0.764	0.810	-	0.797	0.809	-	0.796	0.815					
Temperature (°C)	14.5	13.1	13.1	-	14.1	14.2	-	11.7	11.9					
Color	Gray	Gray	Gray	-	Clear	Clear	-	Clear	Clear					
Turbidity (NTUs)	>1100	>1100	>1100	-	40	75	-	23	11					

Total discharge: 42 Gallons
Casing volumes removed: 6
Method of disposal of discharged water: Inert Disposal Area

QUALITY ASSURANCE

Water Level Meter: Solinst
Type of Bailer/Rope: PVC bailer / poly twine
Water Quality meter: Horiba U-10 / LaMotte 2020
Calibrated: Daily
Submersible Pump: Geosquirt 12V
Surge Block: N/A
Comments: Well installed on 4/24/03; 0 gallons of water used during installation

WELL DEVELOPMENT LOG

Project: Iowa AAP Six Site FS Data Collection
Project No: 16169421.00201
Well No: FTP-MW5
Date: 4/16/2003 to 4/22/2003

WELL MEASUREMENTS

Well inside diameter: 2 in.
Depth of well casing: 16.74 ft.
Initial water level: 11.63 ft. below MP
Measuring point (MP): Top of Casing
Fluid well casing volume: 0.8 gal.
Weather conditions: Cloudy, light rain, wind 5 to 10 mph, 70 degrees Fahrenheit

SAMPLING MEASUREMENT

DATE 4/16 4/22

DISCHARGE

Water level (ft. BMP)	-	-	Dry	12.52	12.80	12.85	13.53	13.40	13.55	13.55				
Time	0935	0940	0945	1714	1722	1726	1731	1731	1735	1739				
Discharge (Gal.)	0.2	1.5	4.5	5.5	6.3	7.1	7.9	8.7	9.5	10.3				
Flow Rate (gpm)	-	-	-	0.2	0.2	0.2	0.2	0.2	0.2	0.2				

PUMPING/SURGING

Depth of Pump Intake	-	-	-	16	16	15	15	15	15	15				
Duration of Surging	-	-	-	-	-	-	-	-	-	-				

WATER QUALITY DATA

pH	6.66	6.61	6.54	6.54	6.40	6.30	6.31	6.30	6.23	6.22				
Conductivity (µS/cm)	0.770	0.792	0.791	0.777	0.791	0.801	0.795	0.787	0.785	0.782				
Temperature (°C)	9.0	8.5	8.6	11.5	11.0	10.9	10.3	10.6	10.7	10.5				
Color	Light Brown	Light Brown	Light Brown	Light Brown	Light Brown	Light Brown	Clear	Clear	Clear	Clear				
Turbidity (NTUs)	>1100	>1100	>1100	1004	227	250	92	42	17	12.5				

Total discharge: 10.3 Gallons
Casing volumes removed: 13
Method of disposal of discharged water: Inert Disposal Area

QUALITY ASSURANCE

Water Level Meter: Solinst
Type of Bailer/Rope: PVC bailer / poly twine
Water Quality meter: Horiba U-10 / LaMotte 2020 Calibrated: Daily
Submersible Pump: Geosquirt 12V Surge Block: N/A
Comments: Well installed on 4/14/03; 0 gallons of water used during installation

WELL DEVELOPMENT LOG

Project: Iowa AAP Six Site FS Data Collection
Project No: 16169421.00201
Well No: FTP-MW6(B) Page 1 of 2
Date: 4/16/2003 to 4/30/2003

WELL MEASUREMENTS

Well inside diameter: 2 in.
Depth of well casing: 47.83 ft.
Initial water level: 40.13 ft. below MP
Measuring point (MP): Top of Casing
Fluid well casing volume: 1.2 gal.
Weather conditions: Cloudy, light rain, wind 5 to 10 mph, 70 degrees Fahrenheit

SAMPLING MEASUREMENT

DATE 4/16 4/23 4/27

DISCHARGE

Water level (ft. BMP)	-	43.15	Dry	Dry	25.91	30.05	33.90	37.08	38.09	39.45	43.08	46.50	31.72	36.42
Time	0910	0914	0920	0925	0825	0828	0833	0838	0843	0848	0855	0902	1319	1324
Discharge (Gal.)	0.2	1.5	3	4.5	-	5	6	7	8	9	10.2	12	13	14.5
Flow Rate (gpm)	-	-	-	-	-	0.2	0.2	0.2	0.2	0.2	0.2	1	0.3	0.3

PUMPING/SURGING

Depth of Pump Intake	-	-	-	-	-	47	47	47	47	45	47.5	47.5	43	41
Duration of Surging	-	-	-	-	-	-	-	-	-	-	-	-	-	-

WATER QUALITY DATA

pH	7.03	6.97	6.98	-	-	6.31	6.65	6.56	6.52	6.55	6.49	-	6.63	6.63
Conductivity (µS/cm)	0.744	0.765	0.800	-	-	1.00	0.980	0.980	0.990	1.01	1.07	-	1.12	1.03
Temperature (°C)	12.4	12.1	11.5	-	-	11.6	11.8	12.2	12.3	12.5	12.2	-	14.9	14.9
Color	Gray	Gray	Gray	-	-	Gray	Gray	Gray	Gray	Gray	Brown	-	Clear	Brown
Turbidity (NTUs)	>1100	>1100	>1100	-	-	724	386	528	292	156	>1100	-	60	110

Total discharge: 19.7 Gallons Casing volumes removed: 16
Method of disposal of discharged water: Inert Disposal Area

QUALITY ASSURANCE

Water Level Meter: Solinst
Type of Bailer/Rope: PVC bailer / poly twine
Water Quality meter: Horiba U-10 / LaMotte 2020 Calibrated: Daily
Submersible Pump: Geosquirt 12V Surge Block: N/A
Comments: Well installed on 4/14/03; 0 gallons of water used during installation

WELL DEVELOPMENT LOG

Project: Iowa AAP Six Site FS Data Collection
Project No: 16169421.00201

Well No: FTP-MW6(B) Page 2 of 2
Date: 4/16/2003 to 4/30/2003

WELL MEASUREMENTS

Well inside diameter: 2 in.
Depth of well casing: 47.83 ft.
Initial water level: 40.13 ft. below MP
Measuring point (MP): Top of Casing
Fluid well casing volume: 1.2 gal.
Weather conditions: Sunny, wind 10 to 15 mph, 80 degrees Fahrenheit

SAMPLING MEASUREMENT

DATE

DISCHARGE

Water level (ft. BMP)	38.12	41.55	45.80	40.60	41.80	45.48	Dry							
Time	1329	1338	1343	0840	0842	0846	0847							
Discharge (Gal.)	15.5	16.5	17.5	18.5	19	19.5	19.7							
Flow Rate (gpm)	0.2	0.2	0.5	0.5	0.3	0.2	0.2							

PUMPING/SURGING

Depth of Pump Intake	41	45	47	43	43	47	47.5							
Duration of Surging	-	-	-	-	-	-	-							

WATER QUALITY DATA

pH	6.47	6.52	6.43	6.50	6.41	6.48	-							
Conductivity (µS/cm)	0.959	1.03	1.09	1.06	0.970	1.07	-							
Temperature (°C)	14.4	15.2	13.5	11.7	12.1	12.1	-							
Color	Clear	Brown	Brown	Clear	Brown	Brown	-							
Turbidity (NTUs)	90	320	700	26	600	180	-							

Total discharge: 19.7 Gallons Casing volumes removed: 16
Method of disposal of discharged water: Inert Disposal Area

QUALITY ASSURANCE

Water Level Meter: Solinst
Type of Bailer/Rope: PVC bailer / poly twine
Water Quality meter: Horiba U-10 / LaMotte 2020 Calibrated: Daily
Submersible Pump: Geosquirt 12V Surge Block: N/A
Comments: Well installed on 4/14/03; 0 gallons of water used during installation

WELL DEVELOPMENT LOG

Project: Iowa AAP Six Site FS Data Collection
Project No: 16169421.00201
Well No: FTP-MW7 Page 1 of 2
Date: 4/21/2003 to 4/25/2003

WELL MEASUREMENTS

Well inside diameter: 2 in.
Depth of well casing: 24.17 ft.
Initial water level: 10.92 ft. below MP
Measuring point (MP): Top of Casing
Fluid well casing volume: 2.1 gal.
Weather conditions: Overcast, wind 15 to 20 mph, 50 degrees Fahrenheit

SAMPLING MEASUREMENT

DATE	4/21					4/25								
DISCHARGE														
Water level (ft. BMP)	-	-	-	-	15.85	15.00	22.00	Dry	15.65	16.50	17.85	17.22	18.70	21.00
Time	1725	1729	1733	1736	1738	0921	0932	0936	1001	1009	1017	1026	1034	1043
Discharge (Gal.)	0.3	2.5	4.5	6.5	9	12	25	29	30	33	35	38	41	45
Flow Rate (gpm)	-	-	-	-	-	0.3	1	1	0.3	0.3	0.3	0.3	0.3	1
PUMPING/SURGING														
Depth of Pump Intake	-	-	-	-	-	24	24	24	18	18	24	22	21	24
Duration of Surging	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WATER QUALITY DATA														
pH	6.68	6.73	6.76	6.70	6.75	6.31	6.21	-	6.54	6.58	6.61	6.68	6.57	6.44
Conductivity (µS/cm)	0.637	0.657	0.671	0.659	0.611	0.657	0.701	-	0.654	0.657	0.670	0.659	0.642	0.674
Temperature (°C)	9.8	9.6	9.5	9.9	9.7	9.9	10.3	-	10.5	10.7	11.3	11.3	11.1	11.1
Color	Brown	Brown	Brown	Brown	Brown	Brown	Brown	-	Brown	Brown	Brown	Brown	Brown	Brown
Turbidity (NTUs)	>1100	>1100	>1100	>1100	>1100	687	>1100	-	261	466	331	120	206	>1100

Total discharge: 57 Gallons Casing volumes removed: 27
Method of disposal of discharged water: Inert Disposal Area

QUALITY ASSURANCE

Water Level Meter: Solinst
Type of Bailer/Rope: PVC bailer / poly twine
Water Quality meter: Horiba U-10 / LaMotte 2020 Calibrated: Daily
Submersible Pump: Geosquirt 12V Surge Block: N/A
Comments: Well installed on 4/16/03; 0 gallons of water used during installation

WELL DEVELOPMENT LOG

Project: Iowa AAP Six Site FS Data Collection
Project No: 16169421.00201
Well No: FTP-MW7 Page 2 of 2
Date: 4/21/2003 to 4/25/2003

WELL MEASUREMENTS

Well inside diameter: 2 in.
Depth of well casing: 24.17 ft.
Initial water level: 10.92 ft. below MP
Measuring point (MP): Top of Casing
Fluid well casing volume: 2.1 gal.
Weather conditions: Overcast, wind 15 to 20 mph, 50 degrees Fahrenheit

SAMPLING MEASUREMENT

DATE

DISCHARGE

Water level (ft. BMP)	Dry	14.50	14.74	14.55	15.02	15.05								
Time	1045	1257	1306	1312	1319	1326								
Discharge (Gal.)	46	47	50	52	54	57								
Flow Rate (gpm)	1	0.3	0.3	0.3	0.3	0.3								

PUMPING/SURGING

Depth of Pump Intake	-	21	21	19	17	22								
Duration of Surging	-	-	-	-	-	-								

WATER QUALITY DATA

pH	-	6.69	6.78	6.75	6.70	6.68								
Conductivity (µS/cm)	-	0.647	0.664	0.647	0.655	0.655								
Temperature (°C)	-	11.9	12.8	13.0	12.9	13.0								
Color	-	Brown	Clear	Clear	Clear	Clear								
Turbidity (NTUs)	-	255	84	41	40	32								

Total discharge: 57 Gallons Casing volumes removed: 27
Method of disposal of discharged water: Inert Disposal Area

QUALITY ASSURANCE

Water Level Meter: Solinst
Type of Bailer/Rope: PVC bailer / poly twine
Water Quality meter: Horiba U-10 / LaMotte 2020 Calibrated: Daily
Submersible Pump: Geosquirt 12V Surge Block: N/A
Comments: Well installed on 4/16/03; 0 gallons of water used during installation

WELL DEVELOPMENT LOG

Project: Iowa AAP Six Site FS Data Collection
Well No: FTP-MW8(B)
Project No: 16169421.00201
Date: 4/25/2003 to 4/27/2003

WELL MEASUREMENTS

Well inside diameter: 2 in.
Depth of well casing: 54.12 ft.
Initial water level: 11.17 ft. below MP
Measuring point (MP): Top of Casing
Fluid well casing volume: 6.9 gal.
Weather conditions: Overcast, wind 15 to 20 mph, 50 degrees Fahrenheit

SAMPLING MEASUREMENT

DATE 4/25 4/26 4/27

DISCHARGE

Water level (ft. BMP)	-	-	Almost Dry	-	28.00	27.05	Dry	26.28	43.87	52.03				
Time	1030	1107	1117	1337	1226	1237	1245	1600	1613	1629				
Discharge (Gal.)	0.5	7	10	17	20	27	29	31	37.5	44				
Flow Rate (gpm)	-	-	-	-	1.5	0.3	0.7	0.2	0.3	0.3				

PUMPING/SURGING

Depth of Pump Intake	-	-	-	-	54	49	54	49	47	53.5				
Duration of Surging	-	-	-	-	-	-	-	-	-	-				

WATER QUALITY DATA

pH	6.61	6.42	-	6.49	6.56	6.47	-	6.44	6.48	6.34				
Conductivity (µS/cm)	0.617	0.646	-	0.770	0.837	0.840	-	0.811	0.830	0.824				
Temperature (°C)	11.3	11.5	-	12.3	14.2	16.2	-	15.8	14.8	15.2				
Color	Gray	Gray	-	Gray	Clear	Gray	-	Clear	Clear	Clear				
Turbidity (NTUs)	>1100	>1100	-	>1100	92	156	-	85	34	75				

Total discharge: 44 Gallons
Casing volumes removed: 6
Method of disposal of discharged water: Inert Disposal Area

QUALITY ASSURANCE

Water Level Meter: Solinst
Type of Bailer/Rope: PVC bailer / poly twine
Water Quality meter: Horiba U-10 / LaMotte 2020
Calibrated: Daily
Submersible Pump: Geosquirt 12V
Surge Block: N/A
Comments: Well installed on 4/23/03; 550 gallons of water used during installation

APPENDIX F

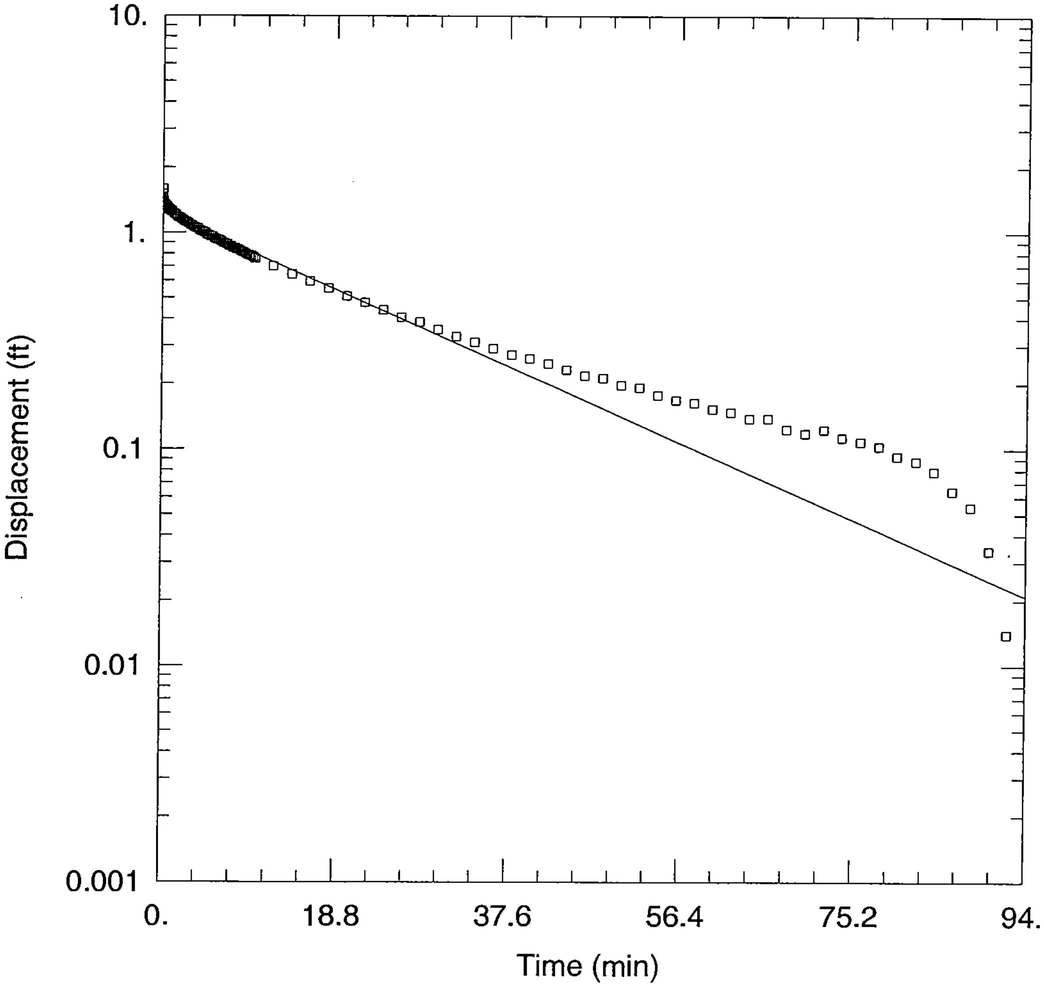
Monitoring Well Slug Test Data

TABLE F-1
SLUG TEST RESULTS
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Well No. Test No.	Hydraulic Conductivity (ft/min)	(ft/day)	(cm/sec)	(gpd/ft^2)	Screened Geologic Unit
JAW-58	4.20E-05	6.05E-02	2.13E-05	0.45	Shallow Till
JAW-61	7.70E-05	1.11E-01	3.91E-05	0.83	Shallow Till
JAW-61 2ND	1.42E-05	2.04E-02	7.22E-06	0.15	Shallow Till
JAW-62	1.24E-04	1.79E-01	6.30E-05	1.34	Shallow Till
JAW-62 2ND	1.47E-05	2.12E-02	7.47E-06	0.16	Shallow Till
FTA-99-1	5.54E-05	7.98E-02	2.82E-05	0.60	Till/Bedrock Contact
FTA-99-2	2.94E-07	4.23E-04	1.49E-07	0.00	Bedrock
FTP-MW1	1.19E-03	1.71E+00	6.05E-04	12.82	Till/Upper Bedrock
FTP-MW1R	1.97E-04	2.84E-01	1.00E-04	2.12	Till/Upper Bedrock
FTP-MW2	3.16E-05	4.55E-02	1.61E-05	0.34	Till/Upper Bedrock
FTP-MW3(B)	1.18E-06	1.70E-03	6.00E-07	0.01	Upper Bedrock
FTP-MW4(B)	1.16E-06	1.67E-03	5.90E-07	0.01	Bedrock
FTP-MW5	4.88E-04	7.03E-01	2.48E-04	5.26	Till/Upper Bedrock
FTP-MW5 2ND	1.50E-04	2.16E-01	7.62E-05	1.62	Till/Upper Bedrock
FTP-MW6(B)	1.20E-06	1.73E-03	6.10E-07	0.01	Bedrock
FTP-MW7	1.34E-04	1.93E-01	6.81E-05	1.44	Till/Upper Bedrock
FTP-MW8(B)	5.28E-06	7.60E-03	2.68E-06	0.06	Bedrock

Notes:

2ND = Second response (clays)
cm = Centimeter(s)
ft = Foot or Feet
ft^2 = Square Foot
min = Minute(s)
R = Retest
sec = Second(s)



JAW-58

Data Set: H:\slug\MINI TROLL\Data\IAAAP\on-base\HMT-1\JAW-58.aqt
Date: 05/20/03 Time: 08:28:09

PROJECT INFORMATION

Company: URS
Client: USACE
Project: 16169503
Test Location: FIRE TRAINING PIT
Test Well: JAW-58

AQUIFER DATA

Saturated Thickness: 18. ft
Anisotropy Ratio (Kz/Kr): 1.

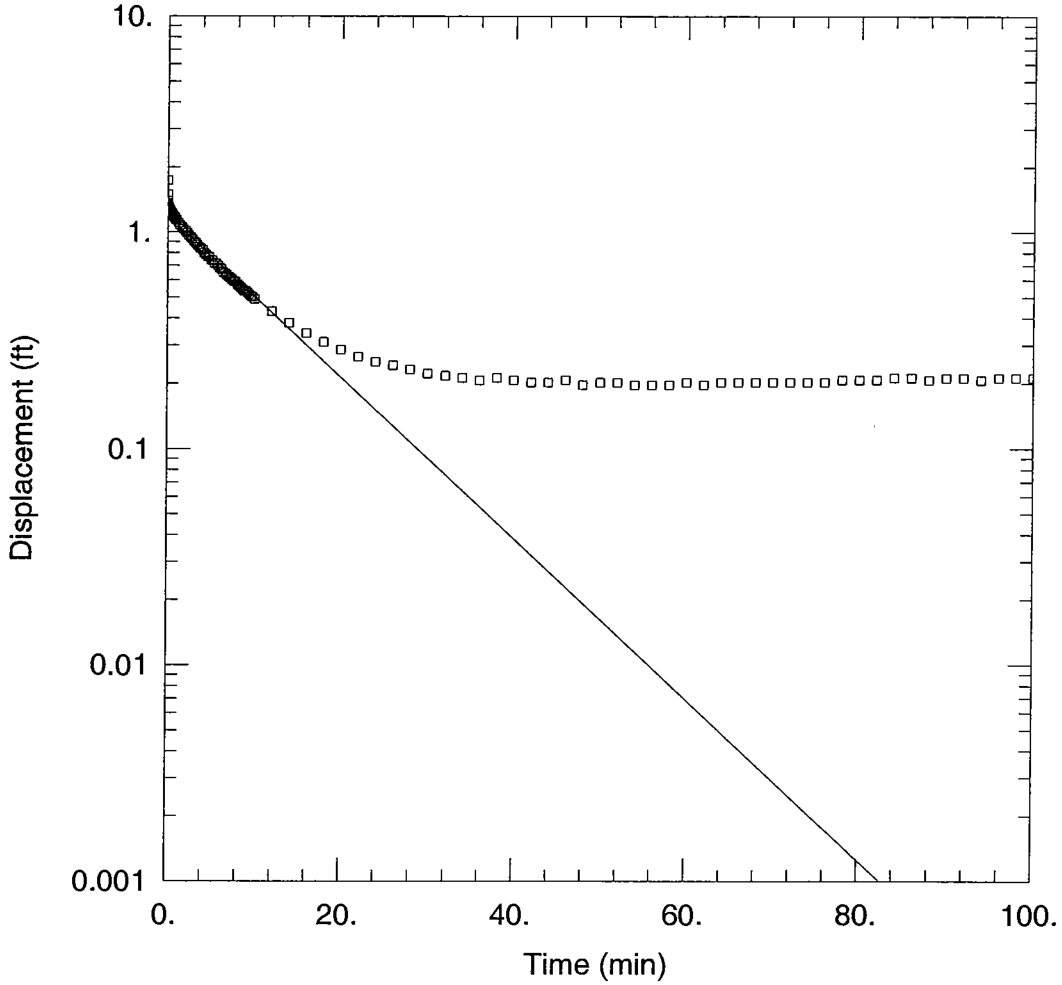
WELL DATA (JAW-58)

Initial Displacement: 1.585 ft
Water Column Height: 17.72 ft
Casing Radius: 0.083 ft
Wellbore Radius: 0.333 ft
Screen Length: 10. ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 4.195E-05 ft/min
y0 = 1.23 ft



JAW-61

Data Set: H:\slug\MINI TROLL\Data\IAAAP\on-base\HMT-2\JAW-61.aqt
Date: 05/20/03 Time: 09:06:38

PROJECT INFORMATION

Company: URS
Client: USACE
Project: 16169503
Test Location: FIRE TRAINING PIT
Test Well: JAW-61

AQUIFER DATA

Saturated Thickness: 16. ft
Anisotropy Ratio (Kz/Kr): 1.

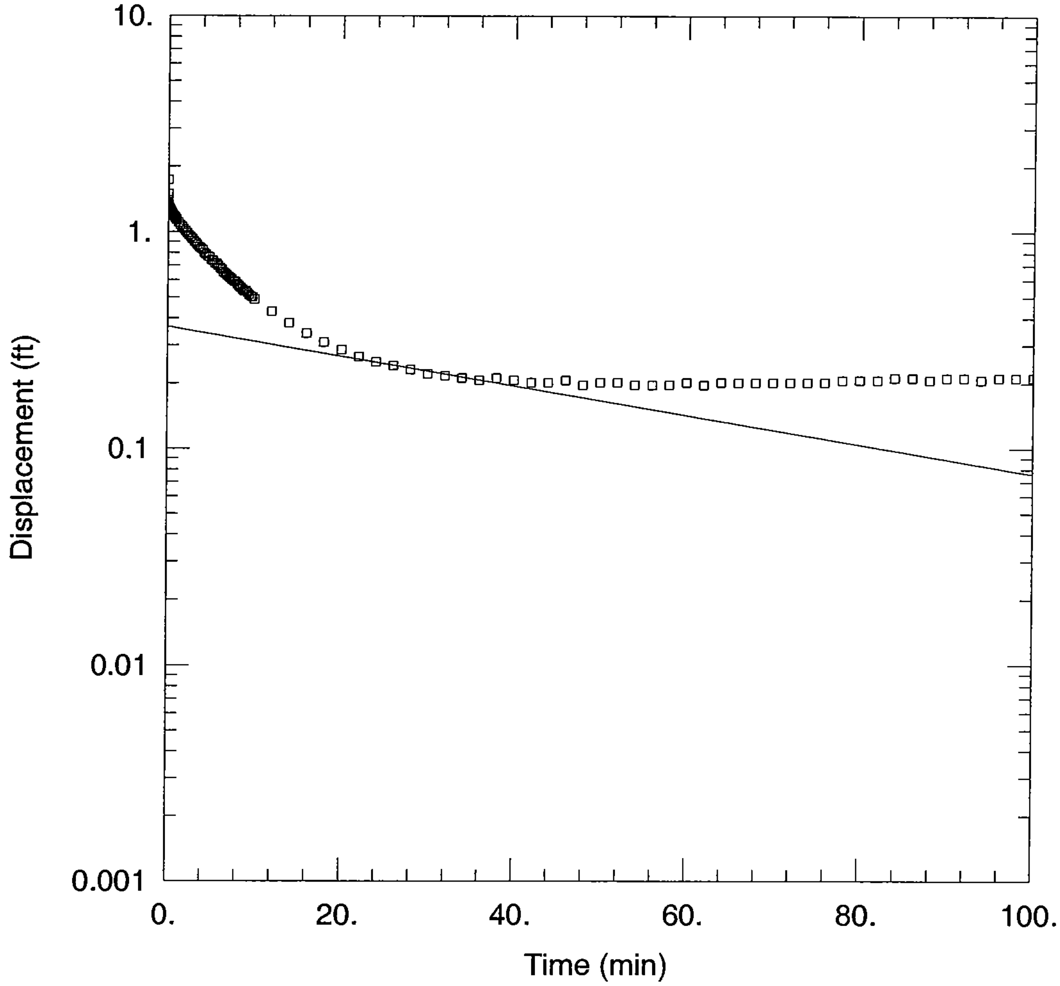
WELL DATA (JAW-61)

Initial Displacement: 1.735 ft
Water Column Height: 15.1 ft
Casing Radius: 0.083 ft
Wellbore Radius: 0.333 ft
Screen Length: 10. ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 7.703E-05 ft/min
y0 = 1.185 ft



JAW-61 2ND RESPONSE

Data Set: H:\slug\MINI TROLL\Data\IAAAP\on-base\HMT-2\JAW-61 2ND.aqt
Date: 05/21/03 Time: 14:10:19

PROJECT INFORMATION

Company: URS
Client: USACE
Project: 16169503
Test Location: FIRE TRAINING PIT
Test Well: JAW-61

AQUIFER DATA

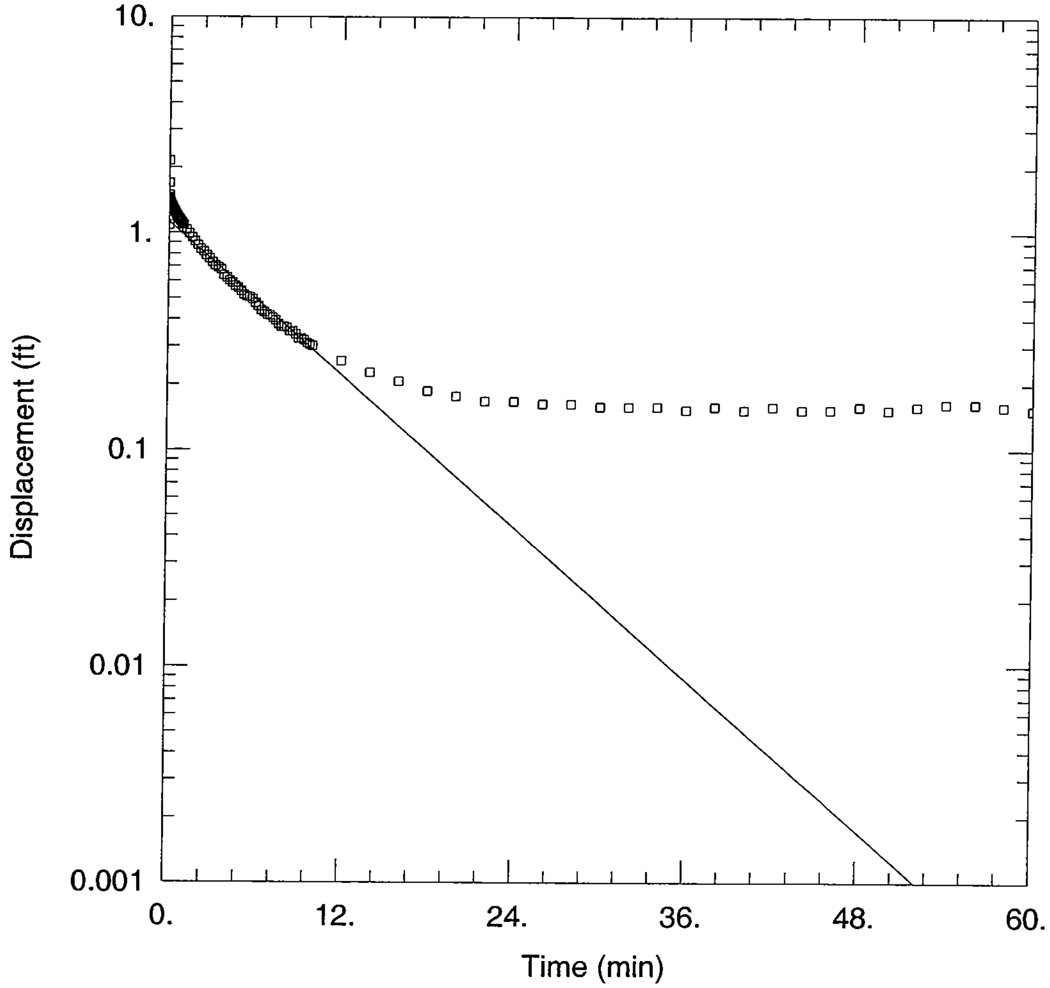
Saturated Thickness: 16. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (JAW-61)

Initial Displacement: 1.735 ft
Water Column Height: 15.1 ft
Casing Radius: 0.083 ft
Wellbore Radius: 0.333 ft
Screen Length: 10. ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 1.415E-05 ft/min
y0 = 0.3657 ft



JAW-62

Data Set: H:\slug\MINI TROLL\Data\IAAAP\on-base\HMT-1\JAW-62.aqt
Date: 05/20/03 Time: 09:24:58

PROJECT INFORMATION

Company: URS
Client: USACE
Project: 16169503
Test Location: FIRE TRAINING PIT
Test Well: JAW-62

AQUIFER DATA

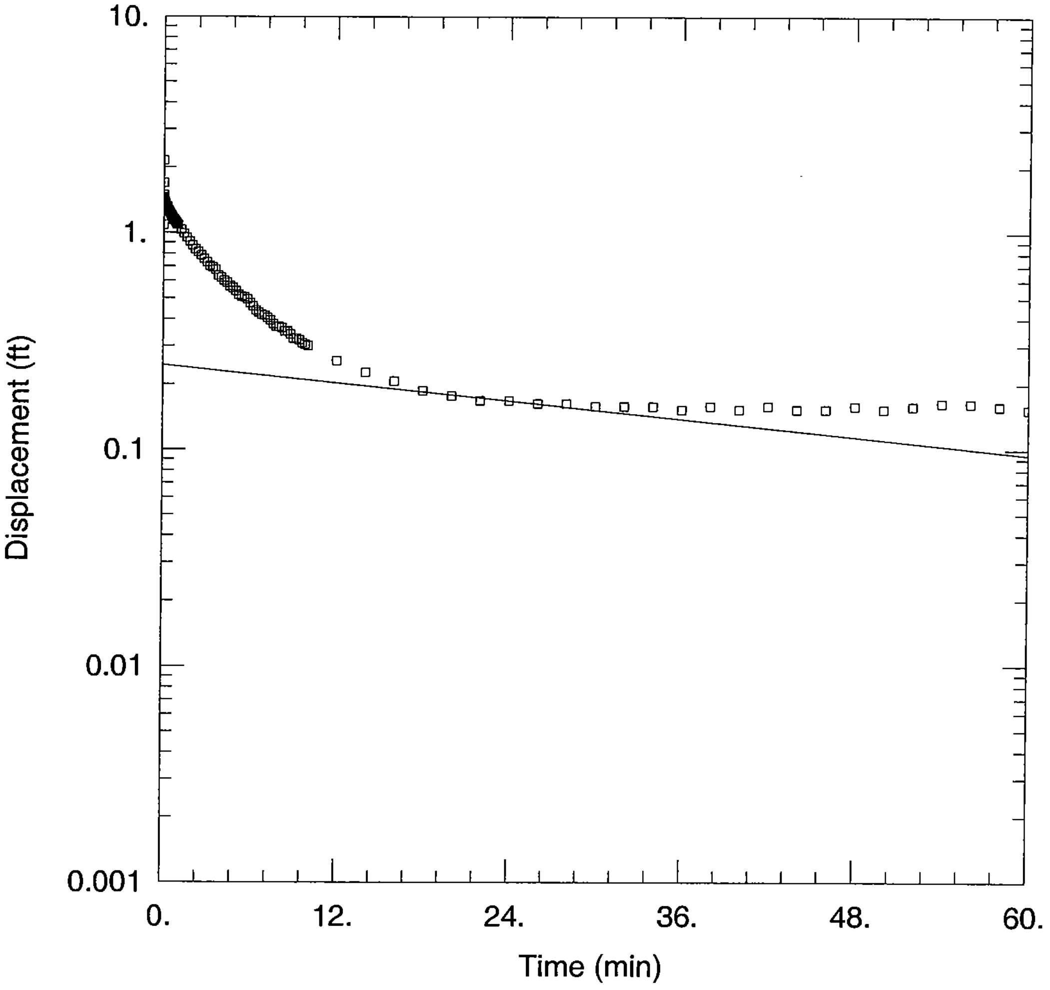
Saturated Thickness: 17. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (JAW-62)

Initial Displacement: 2.154 ft
Water Column Height: 16.22 ft
Casing Radius: 0.083 ft
Wellbore Radius: 0.333 ft
Screen Length: 10. ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.0001235 ft/min
y0 = 1.119 ft



JAW-62 2ND RESPONSE

Data Set: H:\slug\MINI TROLL\Data\IAAAP\on-base\HMT-1\JAW-62 2ND.aqt
Date: 05/21/03 Time: 14:20:18

PROJECT INFORMATION

Company: URS
Client: USACE
Project: 16169503
Test Location: FIRE TRAINING PIT
Test Well: JAW-62

AQUIFER DATA

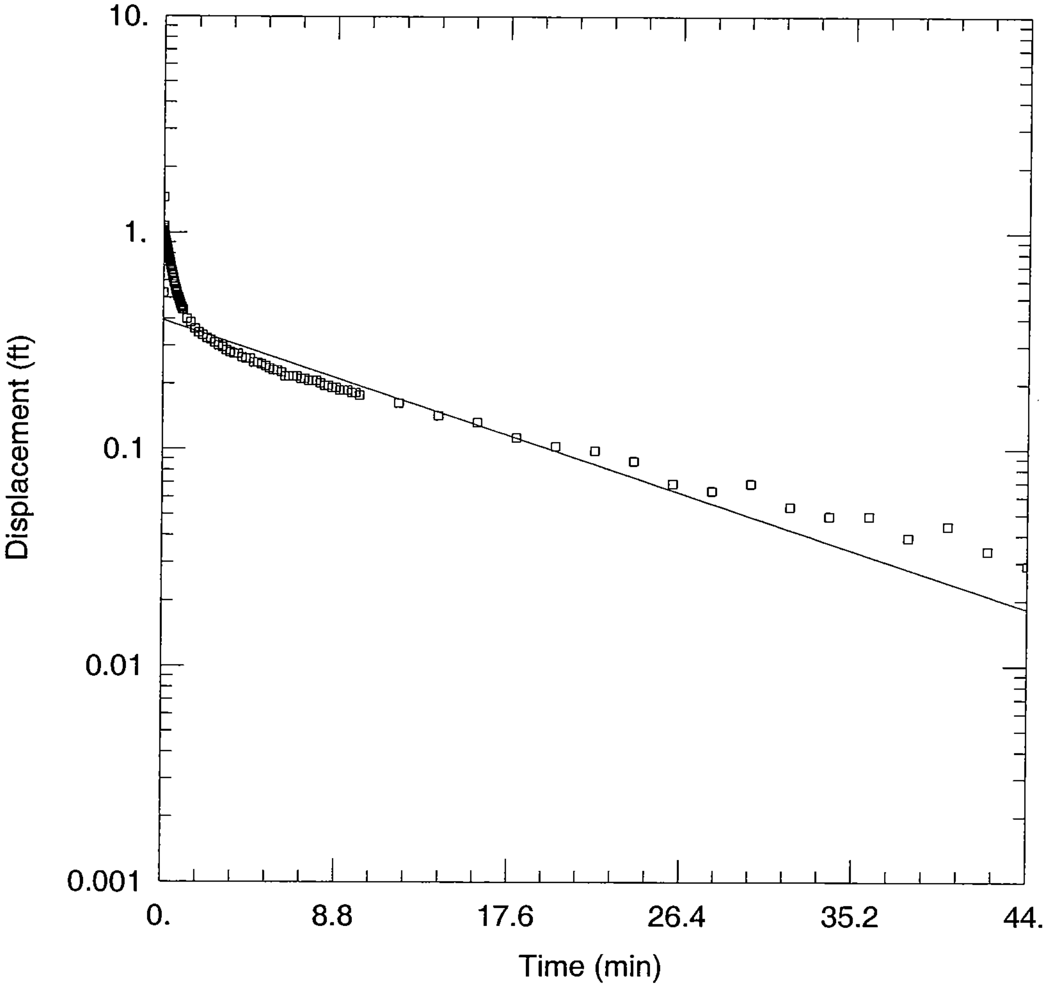
Saturated Thickness: 17. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (JAW-62)

Initial Displacement: 2.154 ft
Water Column Height: 16.22 ft
Casing Radius: 0.083 ft
Wellbore Radius: 0.333 ft
Screen Length: 10. ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 1.466E-05 ft/min
y0 = 0.2458 ft



FTP-99-1

Data Set: H:\slug\MINI TROLL\Data\IAAAP\on-base\HMT-2\FTP-99-1.aqt
Date: 05/20/03 Time: 08:34:22

PROJECT INFORMATION

Company: URS
Client: USACE
Project: 16169503
Test Location: FIRE TRAINING PIT
Test Well: FTP-99-1

AQUIFER DATA

Saturated Thickness: 9. ft
Anisotropy Ratio (Kz/Kr): 1.

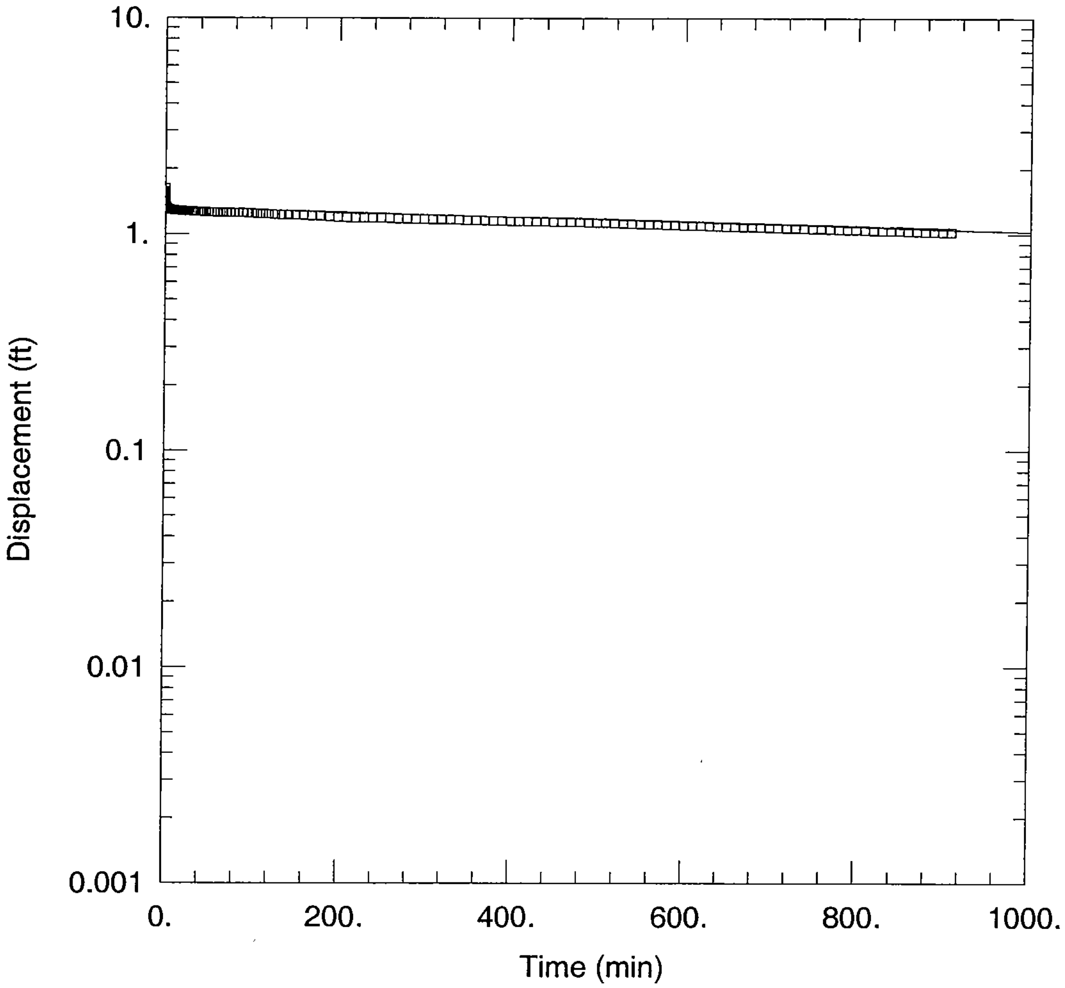
WELL DATA (FTP-99-1)

Initial Displacement: 1.453 ft
Water Column Height: 8.28 ft
Casing Radius: 0.083 ft
Wellbore Radius: 0.333 ft
Screen Length: 10. ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 5.54E-05 ft/min
y0 = 0.3947 ft



FTP-99-2

Data Set: H:\slug\MINI TROLL\Data\IAAAP\on-base\FTA-99-2.aqt
Date: 05/20/03 Time: 08:53:05

PROJECT INFORMATION

Company: URS
Client: USACE
Project: 16169503
Test Location: FIRE TRAINING PIT
Test Well: FTP-99-2

AQUIFER DATA

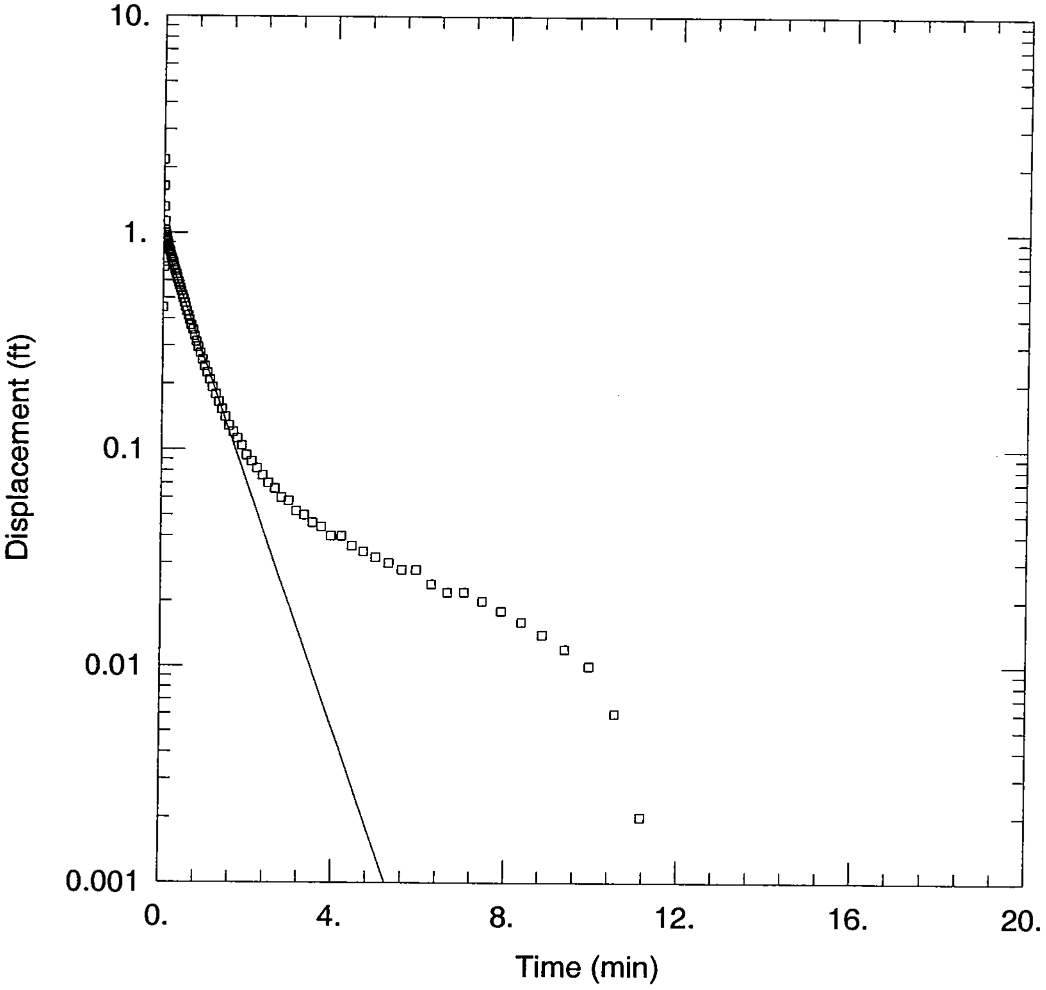
Saturated Thickness: 33. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (FTP-99-2)

Initial Displacement: 1.625 ft
Water Column Height: 32.9 ft
Casing Radius: 0.083 ft
Wellbore Radius: 0.333 ft
Screen Length: 10. ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 2.935E-07 ft/min
y0 = 1.329 ft



FTP-MW1

Data Set: H:\slug\MINI TROLL\Data\IAAAP\TROL\FTP-MW1B.aqt
Date: 05/27/03 Time: 13:24:14

PROJECT INFORMATION

Company: URS
Client: USACE
Project: 16169503
Test Location: FIRE TRAINING PIT
Test Well: FTP-MW1

AQUIFER DATA

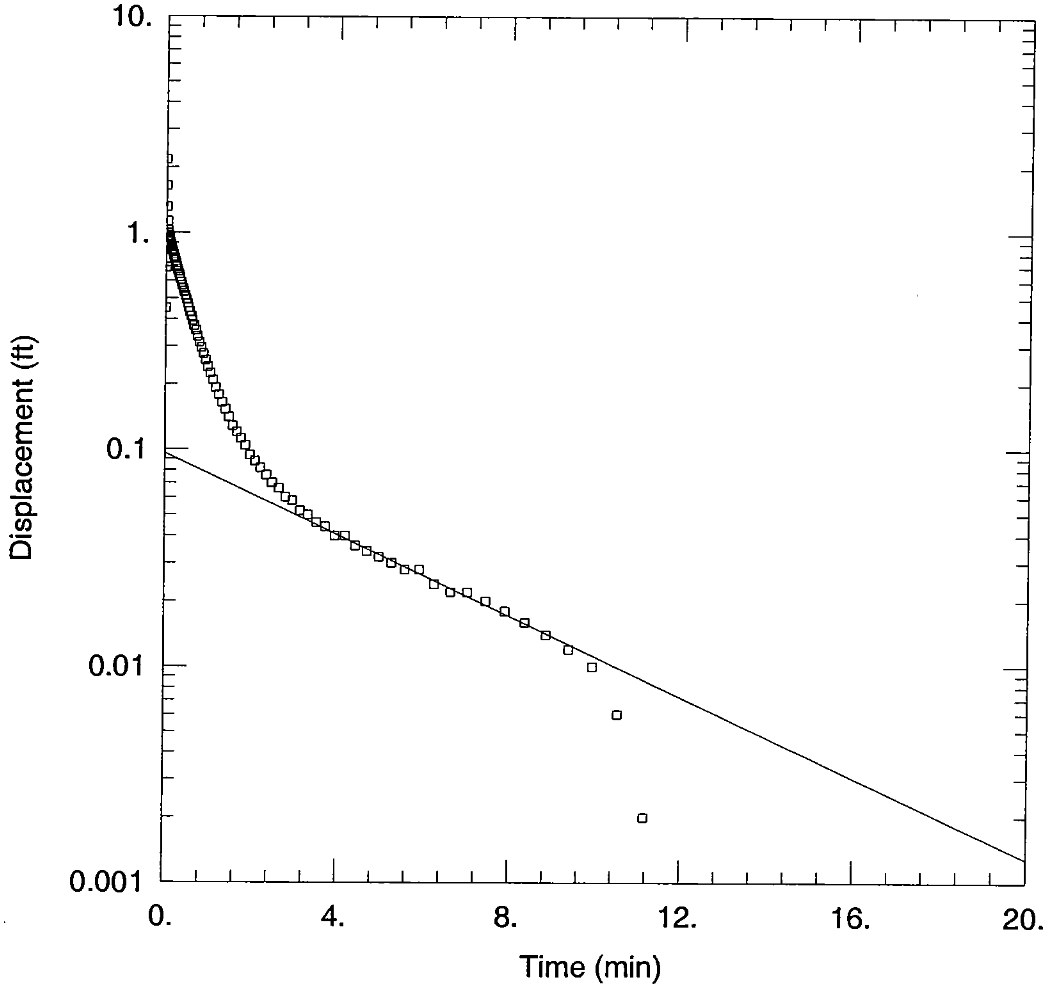
Saturated Thickness: 12. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (FTP-MW1)

Initial Displacement: 2.173 ft
Casing Radius: 0.083 ft
Screen Length: 10. ft
Water Column Height: 11.86 ft
Wellbore Radius: 0.333 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.001187 ft/min
y0 = 0.9261 ft



FTP-MW1 2ND RESPONSE

Data Set: H:\slug\MINI TROLL\Data\IAAAP\TROL\FTP-MW1B 2ND.aqt
Date: 05/27/03 Time: 13:24:40

PROJECT INFORMATION

Company: URS
Client: USACE
Project: 16169503
Test Location: FIRE TRAINING PIT
Test Well: FTP-MW1

AQUIFER DATA

Saturated Thickness: 12. ft Anisotropy Ratio (Kz/Kr): 1.

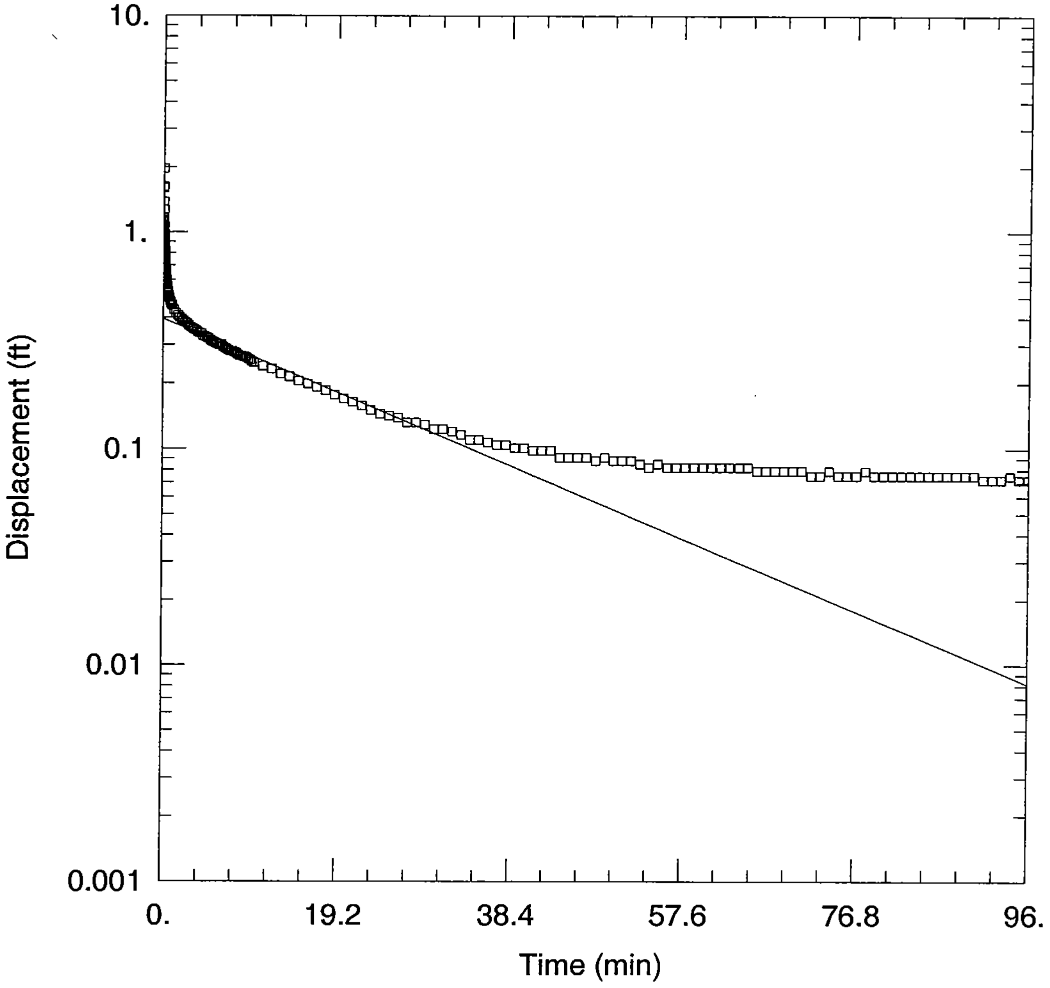
WELL DATA (FTP-MW1)

Initial Displacement: 2.173 ft Water Column Height: 11.86 ft
Casing Radius: 0.083 ft Wellbore Radius: 0.333 ft
Screen Length: 10. ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.0001966 ft/min y0 = 0.09574 ft



FTP-MW2

Data Set: H:\slug\MINI TROLL\Data\IAAAP\HMT3\FTP-MW2.aqt
Date: 05/23/03 Time: 11:50:38

PROJECT INFORMATION

Company: URS
Client: USACE
Project: 16169503
Test Location: FIRE TRAINING PIT
Test Well: FTP-MW2

AQUIFER DATA

Saturated Thickness: 9. ft Anisotropy Ratio (Kz/Kr): 1.

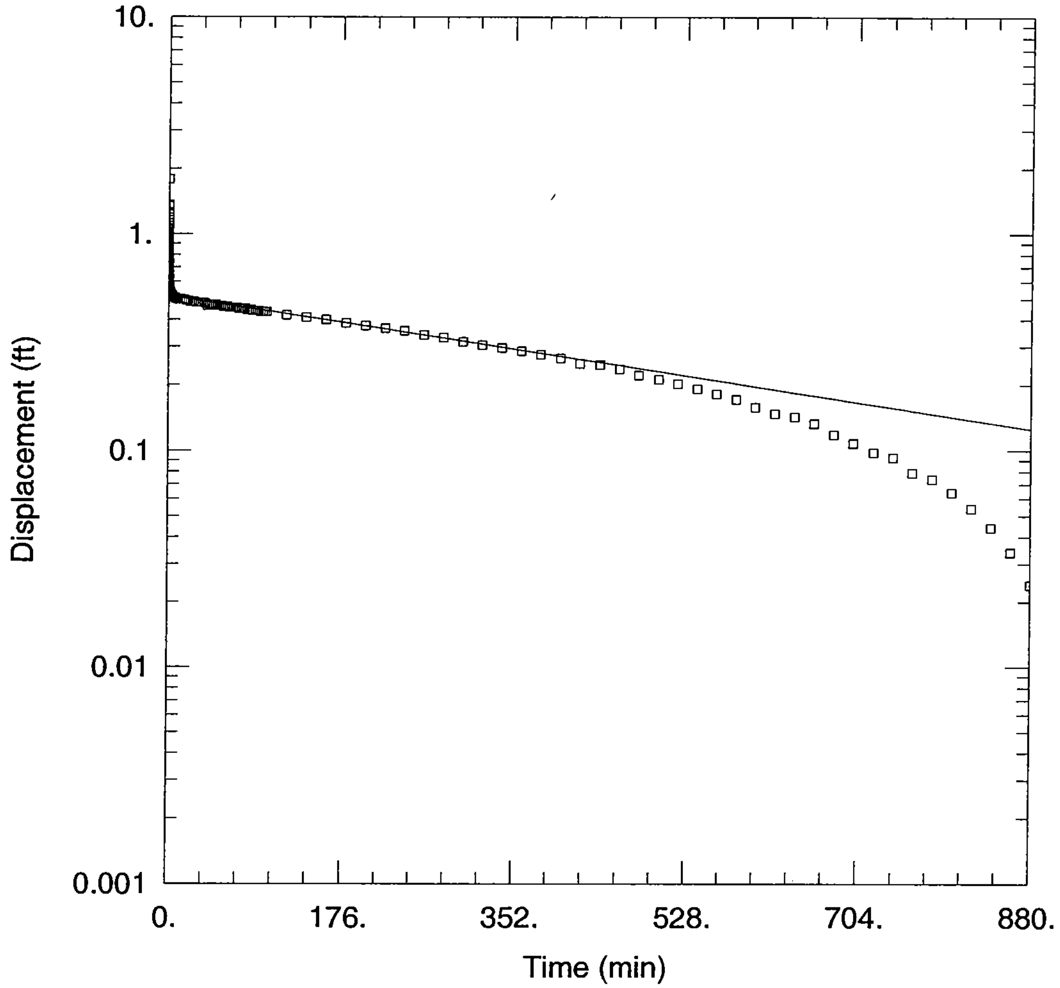
WELL DATA (FTP-MW2)

Initial Displacement: 1.966 ft Water Column Height: 8.07 ft
Casing Radius: 0.083 ft Wellbore Radius: 0.333 ft
Screen Length: 10. ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 3.162E-05 ft/min y0 = 0.3954 ft



FTP-MWS3

Data Set: H:\slug\MINI TROLL\Data\IAAAP\HMT2\FTP-MW3.aqt
Date: 05/23/03 Time: 12:06:16

PROJECT INFORMATION

Company: URS
Client: USACE
Project: 16169503
Test Location: FIRE TRAINING PIT
Test Well: FTP-MW3

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 1.

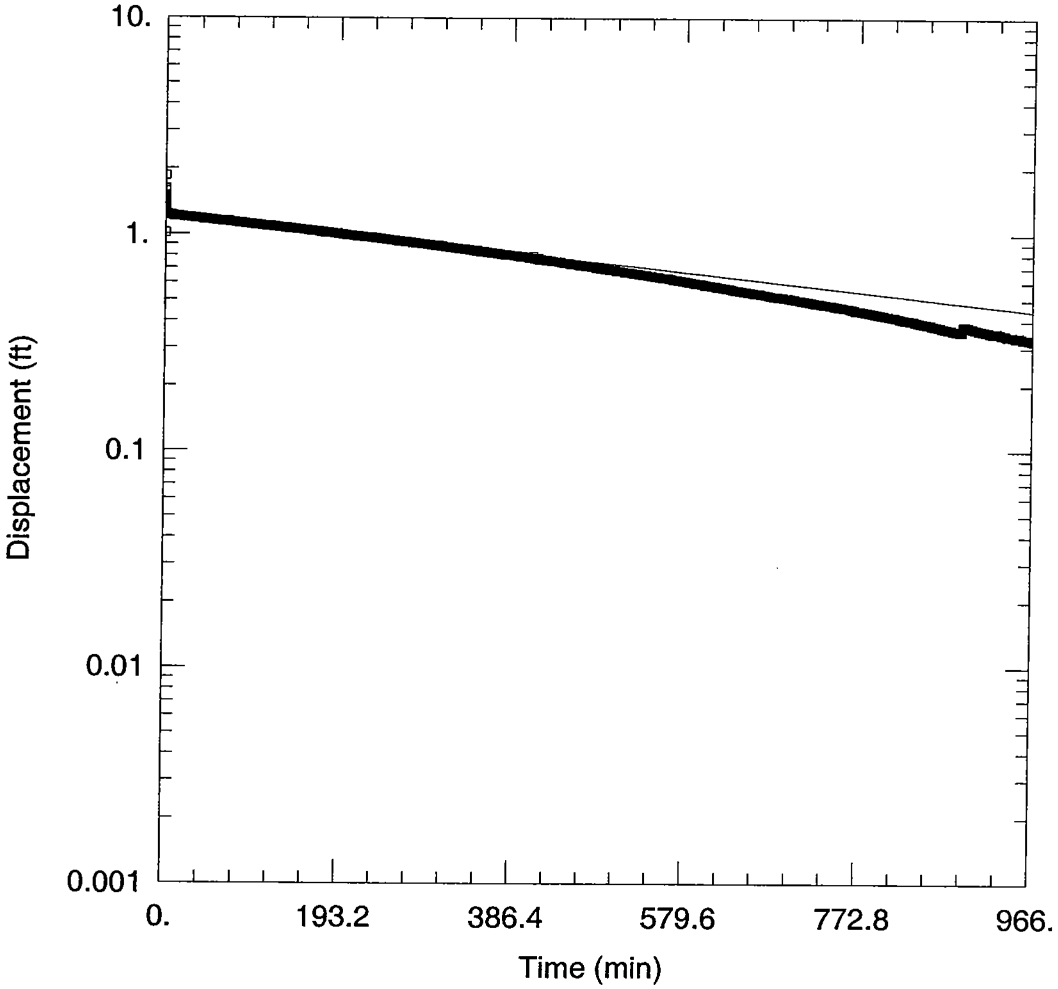
WELL DATA (FTP-MW3)

Initial Displacement: 1.788 ft
Water Column Height: 6.13 ft
Casing Radius: 0.083 ft
Wellbore Radius: 0.333 ft
Screen Length: 10. ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 1.176E-06 ft/min
y0 = 0.5162 ft



FTP-MW4

Data Set: H:\slug\MINI TROLL\Data\IAAAP\HMT3\FTP-MW4.aqt
Date: 05/23/03 Time: 11:51:26

PROJECT INFORMATION

Company: URS
Client: USACE
Project: 16169503
Test Location: FIRE TRAINING PIT
Test Well: FTP-MW4

AQUIFER DATA

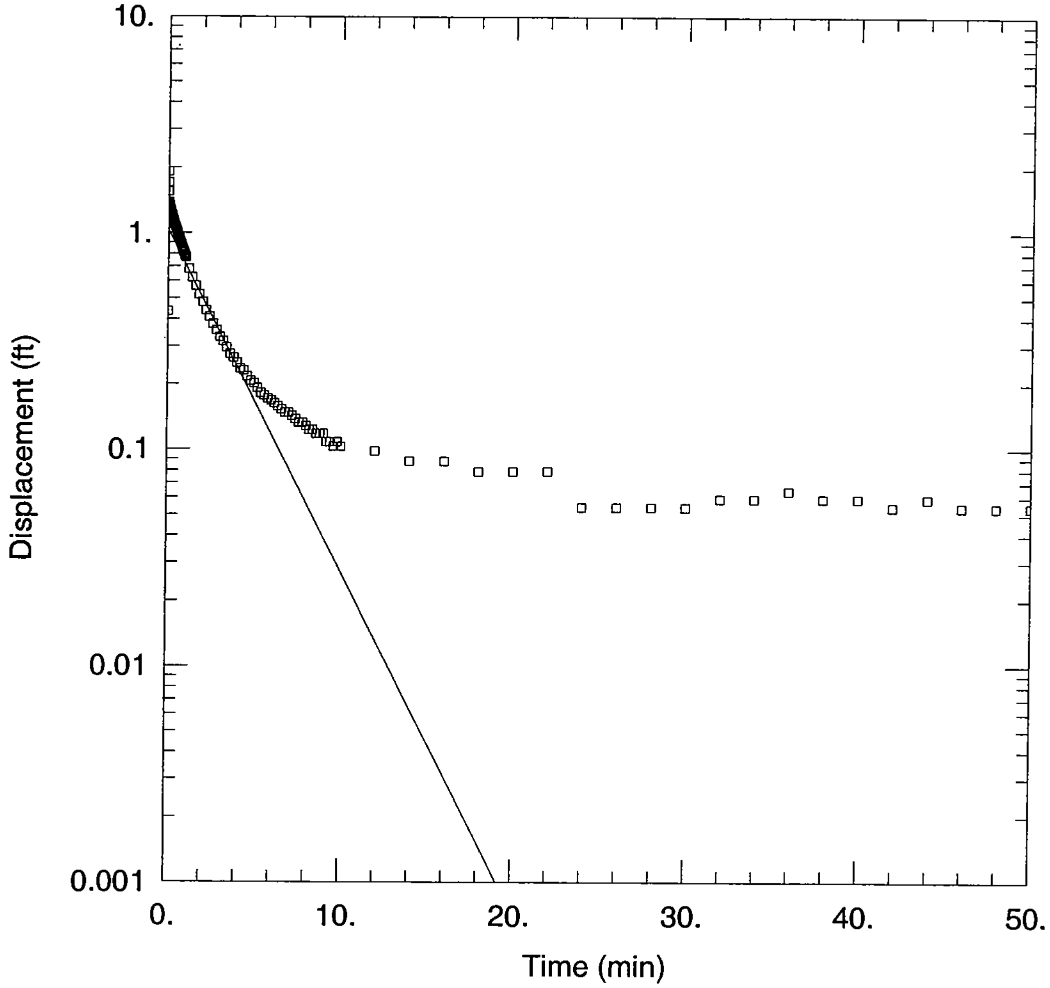
Saturated Thickness: 46. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (FTP-MW4)

Initial Displacement: 1.849 ft
Water Column Height: 45.18 ft
Casing Radius: 0.083 ft
Wellbore Radius: 0.333 ft
Screen Length: 10. ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 1.164E-06 ft/min
y0 = 1.249 ft



FTP-MWS

Data Set: H:\slug\MINI TROLL\Data\IAAAP\HMT2\FTP-MW5.aqt
Date: 05/27/03 Time: 14:07:09

PROJECT INFORMATION

Company: URS
Client: USACE
Project: 16169503
Test Location: FIRE TRAINING PIT
Test Well: FTP-MW5

AQUIFER DATA

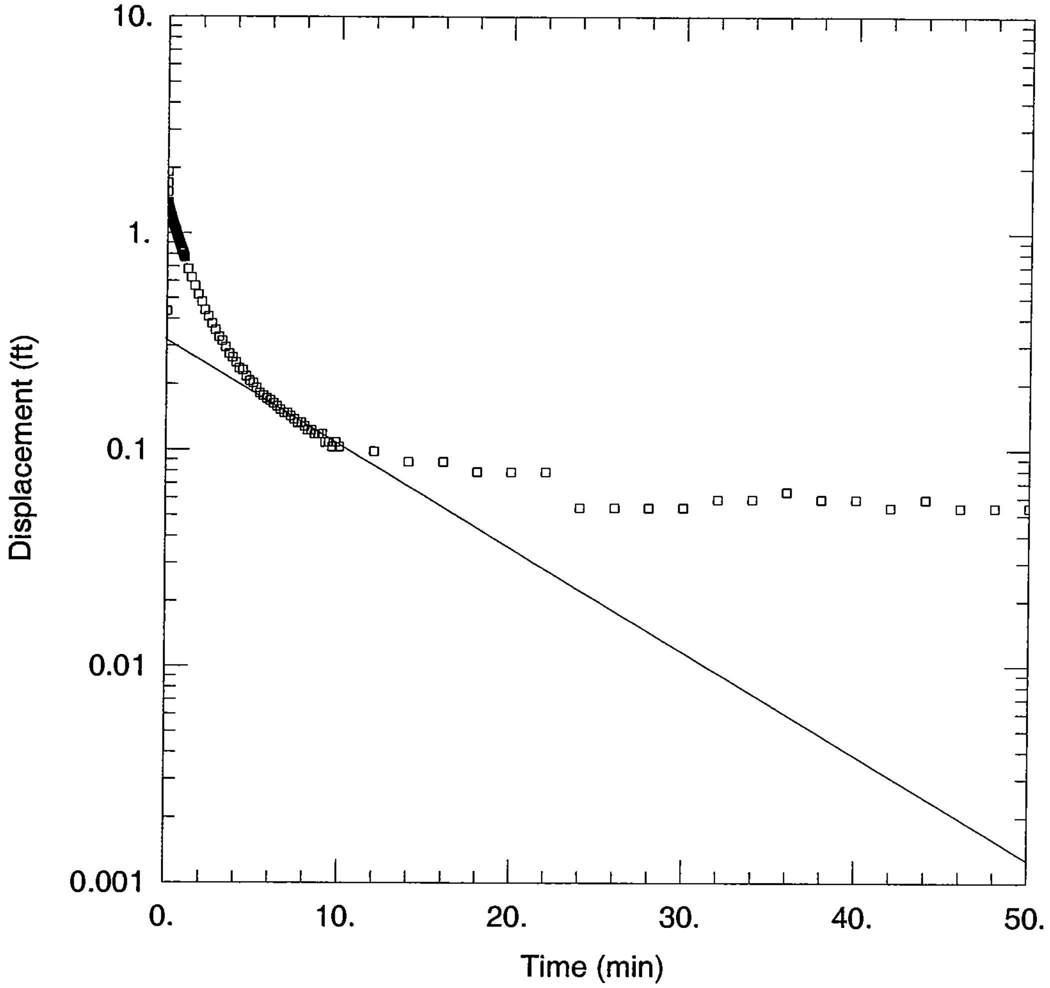
Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (FTP-MW5)

Initial Displacement: 1.912 ft
Water Column Height: 6.56 ft
Casing Radius: 0.083 ft
Wellbore Radius: 0.333 ft
Screen Length: 5. ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.0004881 ft/min
y0 = 1.025 ft



FTP-MW5 2ND RESPONSE

Data Set: H:\slug\MINI TROLL\Data\IAAAP\HMT2\FTP-MW5 2ND.aqt
Date: 05/27/03 Time: 14:07:06

PROJECT INFORMATION

Company: URS
Client: USACE
Project: 16169503
Test Location: FIRE TRAINING PIT
Test Well: FTP-MW5

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 1.

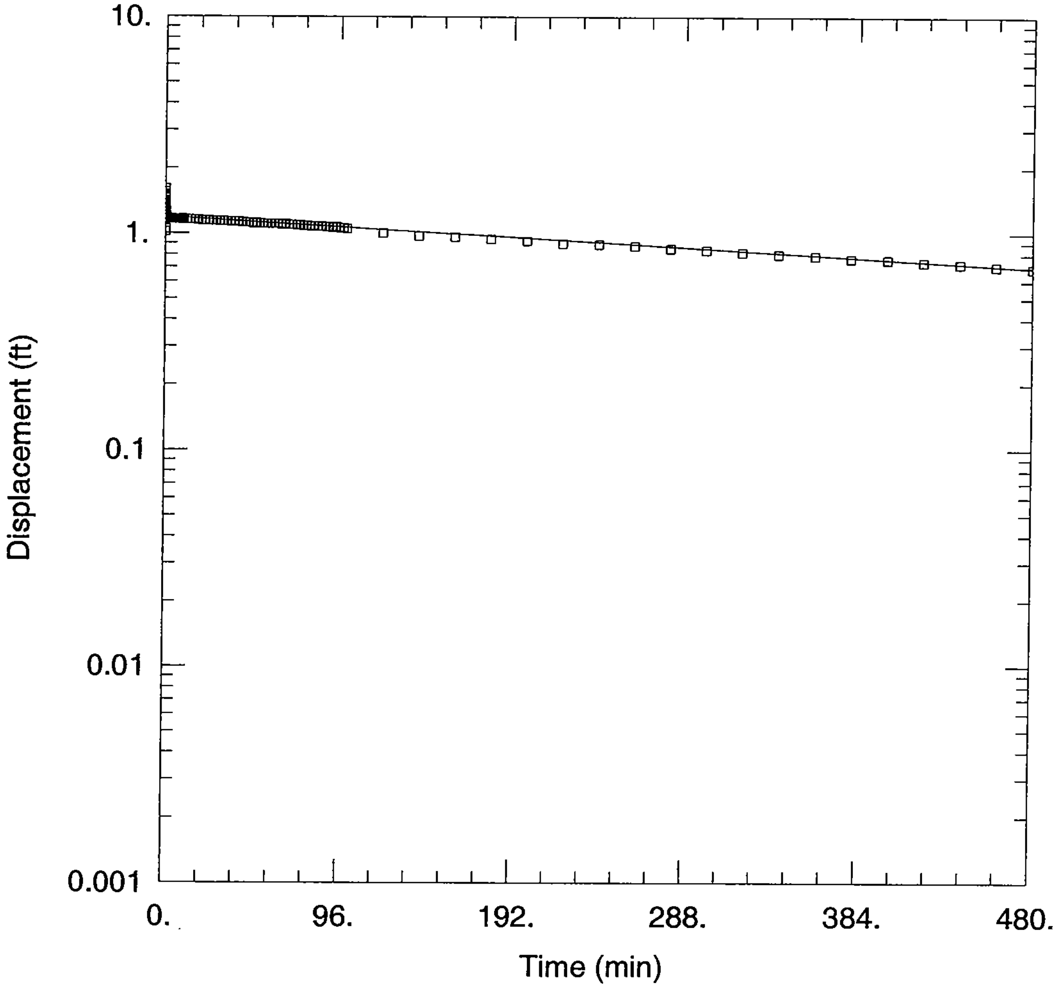
WELL DATA (FTP-MW5)

Initial Displacement: 1.912 ft
Casing Radius: 0.083 ft
Screen Length: 5. ft
Water Column Height: 6.56 ft
Wellbore Radius: 0.333 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.0001495 ft/min
y0 = 0.3195 ft



FTP-MWG

Data Set: H:\slug\MINI TROLL\Data\IAAAP\HMT1\FTP-MW6.aqt
Date: 05/23/03 Time: 12:28:15

PROJECT INFORMATION

Company: URS
Client: USACE
Project: 16169503
Test Location: FIRE TRAINING PIT
Test Well: FTP-MW6

AQUIFER DATA

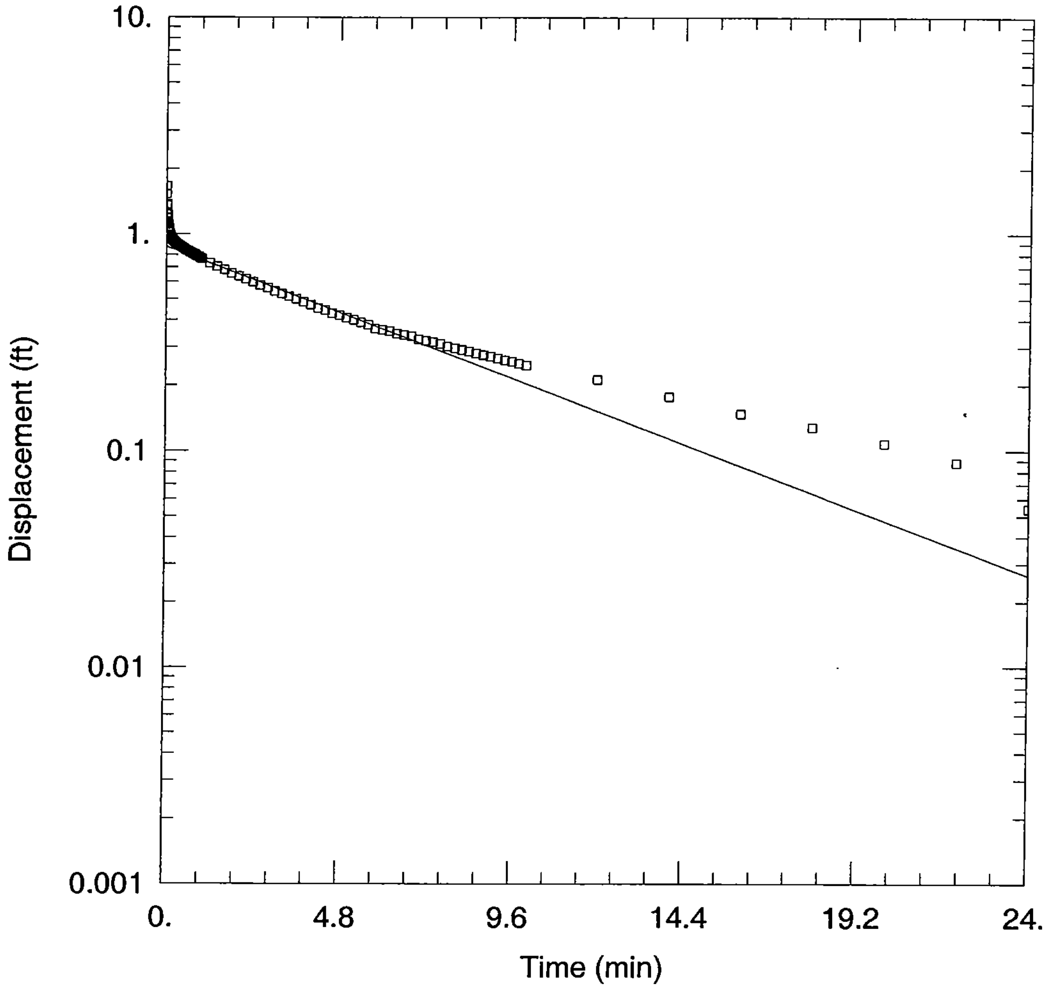
Saturated Thickness: 24. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (FTP-MW6)

Initial Displacement: 1.605 ft
Water Column Height: 23.88 ft
Casing Radius: 0.083 ft
Wellbore Radius: 0.333 ft
Screen Length: 10. ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 1.195E-06 ft/min
y0 = 1.193 ft



FTP-MW7

Data Set: H:\slug\MINI TROLL\Data\IAAAP\HMT2\FTP-MW7.aqt
Date: 05/23/03 Time: 12:14:54

PROJECT INFORMATION

Company: URS
Client: USACE
Project: 16169503
Test Location: FIRE TRAINING PIT
Test Well: FTP-MW7

AQUIFER DATA

Saturated Thickness: 16. ft Anisotropy Ratio (Kz/Kr): 1.

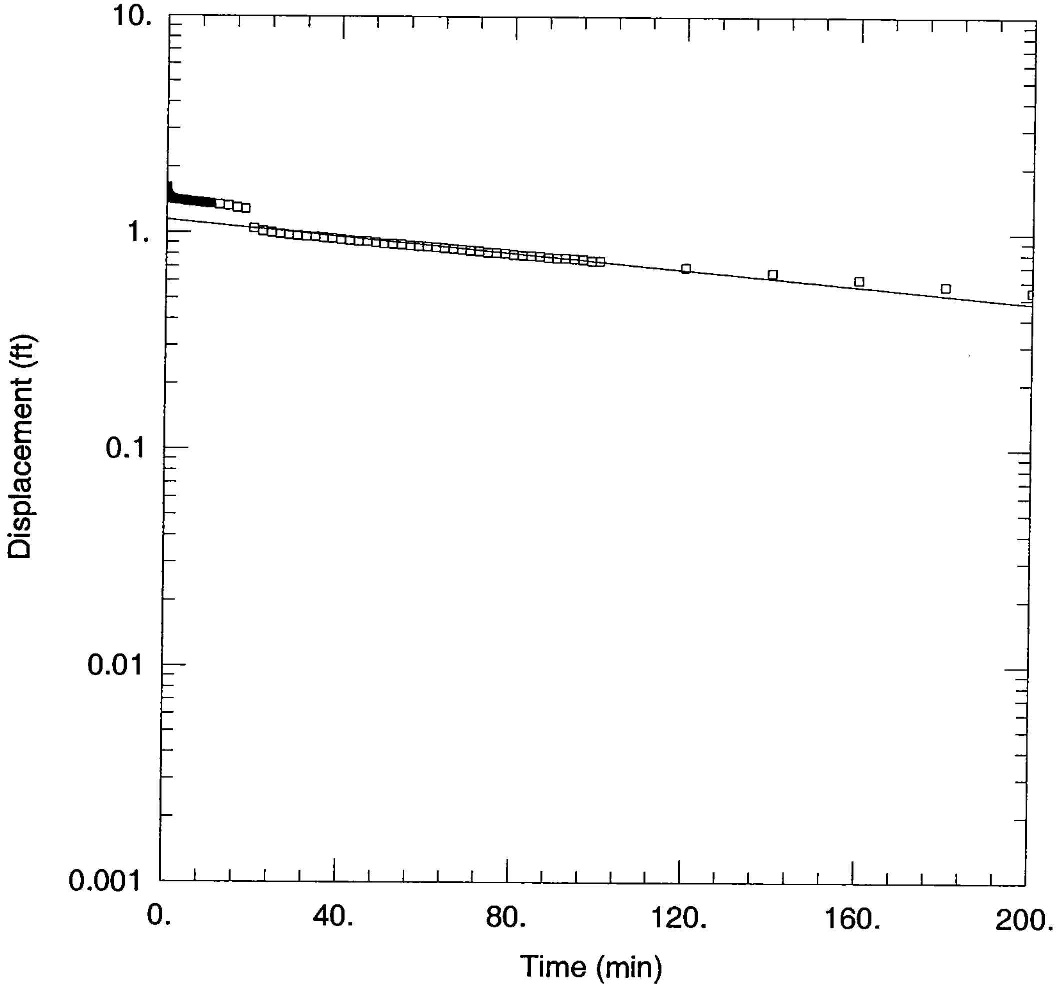
WELL DATA (FTP-MW7)

Initial Displacement: 1.665 ft Water Column Height: 15.51 ft
Casing Radius: 0.083 ft Wellbore Radius: 0.333 ft
Screen Length: 10. ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.0001343 ft/min y0 = 0.8704 ft



FTP-MW8

Data Set: H:\slug\MINI TROLL\Data\IAAAP\HMT1\FTP-MW8.aqt
Date: 05/23/03 Time: 12:30:37

PROJECT INFORMATION

Company: URS
Client: USACE
Project: 16169503
Test Location: FIRE TRAINING PIT
Test Well: FTP-MW8

AQUIFER DATA

Saturated Thickness: 44. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (FTP-MW8)

Initial Displacement: 1.61 ft
Casing Radius: 0.083 ft
Screen Length: 10. ft
Water Column Height: 43.93 ft
Wellbore Radius: 0.333 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 5.282E-06 ft/min
y0 = 1.143 ft

APPENDIX G

Survey Data

TABLE G-1
SUMMARY OF SURVEY RESULTS
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Identification Number	Coordinates		Coordinates		Well TOC (msl)		Ground (msl)		Screen (feet)				Bedrock (feet)	
	Northing (feet)	Easting (feet)	Northing (meters)	Easting (meters)	Elevation (feet)	Elevation (meters)	Elevation (feet)	Elevation (meters)	Top of Screen (bgs)	Bottom of Screen (bgs)	Top of Screen Elevation (msl)	Bottom of Screen Elevation (msl)	Depth (bgs)	Elevation (msl)
FTP Monitoring Wells														
FTP-MW1	300,609.83	2,276,086.26	91,626.06	693,752.48	659.83	201.12	657.59	200.43	5.5	15.5	652.1	642.1	5.5	652.1
FTP-MW2	300,731.91	2,276,308.27	91,663.27	693,820.15	663.18	202.14	660.81	201.42	6.9	16.9	653.9	643.9	7.2	653.6
FTP-MW3	300,944.02	2,276,473.95	91,727.92	693,870.65	657.46	200.39	654.95	199.63	10.5	20.5	644.5	634.5	5.7	649.3
FTP-MW4(B)	300,877.80	2,275,795.51	91,707.74	693,663.86	682.85	208.13	680.47	207.41	49.1	59.1	631.4	621.4	27.0	653.5
FTP-MW5	301,104.05	2,276,257.30	91,776.70	693,804.61	670.59	204.40	668.16	203.66	8.9	13.9	659.3	654.3	14.4	653.8
FTP-MW6(B)	301,103.79	2,276,262.61	91,776.62	693,806.23	670.44	204.35	667.81	203.55	34.8	44.8	633.0	623.0	14.4	653.4
FTP-MW7	300,575.55	2,275,582.83	91,615.61	693,599.03	676.87	206.31	674.52	205.60	11.0	21.0	663.5	653.5	21.0	653.5
FTP-MW8(B)	300,575.15	2,275,590.86	91,615.49	693,601.48	676.81	206.29	674.12	205.47	41.1	51.1	633.0	623.0	21.0	653.1
FTP Direct Push Borings														
FTP-DP01	301,166.42	2,275,733.78	N/A	N/A	N/A	N/A	688.09	N/A	33.0	38.0	655.1	650.1	38.0	650.1
FTP-DP02	301,145.65	2,276,076.72	N/A	N/A	N/A	N/A	678.16	N/A	20.0	25.0	658.2	653.2	25.0	653.2
FTP-DP03	301,096.82	2,275,965.19	N/A	N/A	N/A	N/A	683.70	N/A	26.0	31.0	657.7	652.7	31.0	652.7
FTP-DP04	300,876.60	2,275,570.22	N/A	N/A	N/A	N/A	680.41	N/A	8.0	13.0	672.4	667.4	27.0	653.4
									22.0	27.0	658.4	653.4		
FTP-DP05	300,975.05	2,275,988.40	N/A	N/A	N/A	N/A	681.48	N/A	18.0	23.0	663.5	658.5	23.0	658.5
FTP-DP06	301,020.67	2,276,218.50	N/A	N/A	N/A	N/A	677.61	N/A	19.0	24.0	658.6	653.6	24.0	653.6
FTP-DP07	300,738.21	2,275,618.68	N/A	N/A	N/A	N/A	680.35	N/A	22.0	27.0	658.4	653.4	27.0	653.4
FTP-DP08	300,792.34	2,275,831.22	N/A	N/A	N/A	N/A	677.47	N/A	18.0	23.0	659.5	654.5	23.0	654.5
FTP-DP09	300,888.77	2,275,993.44	N/A	N/A	N/A	N/A	682.25	N/A	15.0	20.0	667.3	662.3	30.0	652.3
									25.0	30.0	657.3	652.3		
FTP-DP10	300,571.34	2,275,717.97	N/A	N/A	N/A	N/A	669.91	N/A	13.0	18.0	656.9	651.9	18.0	651.9
FTP-DP11	300,679.31	2,275,839.27	N/A	N/A	N/A	N/A	671.74	N/A	15.0	20.0	656.7	651.7	20.0	651.7
FTP-DP12	300,866.41	2,276,235.00	N/A	N/A	N/A	N/A	676.79	N/A	18.0	23.0	658.8	653.8	23.0	653.8
FTP-DP13	300,979.51	2,276,375.23	N/A	N/A	N/A	N/A	669.87	N/A	11.0	16.0	658.9	653.9	16.0	653.9
FTP-DP14	300,613.92	2,276,076.36	N/A	N/A	N/A	N/A	658.27	N/A	5.0	9.0	653.3	649.3	9.0	649.3
FTP-DP15	300,548.50	2,276,366.76	N/A	N/A	N/A	N/A	665.70	N/A	9.0	13.0	656.7	652.7	13.0	652.7
FTP-DP16	300,693.62	2,276,642.12	N/A	N/A	N/A	N/A	665.70	N/A	10.0	15.0	655.7	650.7	15.0	650.7
FTP-DP17	300,641.48	2,276,248.81	N/A	N/A	N/A	N/A	656.86	N/A	1.0	6.0	655.9	650.9	6.0	650.9
FTP-DP18	300,805.64	2,276,393.57	N/A	N/A	N/A	N/A	661.00	N/A	5.0	10.0	656.0	651.0	10.0	651.0
FTP-DP19	300,500.11	2,275,851.04	N/A	N/A	N/A	N/A	665.10	N/A	9.0	14.0	656.1	651.1	14.0	651.1

TABLE G-1
SUMMARY OF SURVEY RESULTS
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Identification Number	Coordinates		Coordinates		Well TOC (msl)		Ground (msl)		Screen (feet)				Bedrock (feet)	
	Northing (feet)	Easting (feet)	Northing (meters)	Easting (meters)	Elevation (feet)	Elevation (meters)	Elevation (feet)	Elevation (meters)	Top of Screen (bgs)	Bottom of Screen (bgs)	Top of Screen Elevation (msl)	Bottom of Screen Elevation (msl)	Depth (bgs)	Elevation (msl)
FTP-DP20	300,429.27	2,276,145.78	N/A	N/A	N/A	N/A	670.55	N/A	18.0	23.0	652.6	647.6	23.0	647.6
FTP-DP21	300,981.84	2,275,843.51	N/A	N/A	N/A	N/A	683.73	N/A	25.0	30.0	658.7	653.7	30.0	653.7
FTP-DP22	301,202.60	2,276,297.39	N/A	N/A	N/A	N/A	672.07	N/A	15.0	20.0	657.1	652.1	20.0	652.1
FTP-DP23	300,963.95	2,276,105.72	N/A	N/A	N/A	N/A	677.41	N/A	20.0	25.0	657.4	652.4	25.0	652.4
FTP-DP24	300,938.78	2,276,472.81	N/A	N/A	N/A	N/A	654.53	N/A	2.0	7.0	652.5	647.5	6.0	648.5
FTP-DP25	300,876.76	2,276,084.78	N/A	N/A	N/A	N/A	674.93	N/A	17.0	22.0	657.9	652.9	22.0	652.9
FTP-DP26	300,686.27	2,276,617.12	N/A	N/A	N/A	N/A	663.94	N/A	18.0	23.0	645.9	640.9	14.0	649.9
FTP Staff Gauges														
SC-SG01	302,077.80	2,276,937.05	92,073.50	694,011.80	N/A	N/A	635.17	195.43	N/A	N/A	N/A	N/A	N/A	N/A
SC-SG02	301,907.15	2,276,003.77	92,021.48	693,727.34	N/A	N/A	652.33	200.66	N/A	N/A	N/A	N/A	N/A	N/A
SC-SG03	301,788.11	2,276,558.38	91,985.20	693,896.38	N/A	N/A	639.33	196.70	N/A	N/A	N/A	N/A	N/A	N/A
SC-SG04	301,308.49	2,276,935.84	91,839.01	694,011.43	N/A	N/A	629.91	193.83	N/A	N/A	N/A	N/A	N/A	N/A
SC-SG05	300,910.29	2,276,519.88	91,717.64	693,884.65	N/A	N/A	642.10	197.54	N/A	N/A	N/A	N/A	N/A	N/A
SC-SG06	300,573.07	2,276,077.77	91,614.86	693,749.89	N/A	N/A	651.84	200.51	N/A	N/A	N/A	N/A	N/A	N/A
SC-SG07	300,870.76	2,277,116.80	91,705.59	694,066.59	N/A	N/A	627.67	193.14	N/A	N/A	N/A	N/A	N/A	N/A

Notes:

bgs = Below Ground Surface

msl = Mean Sea Level (NAVD88)

N/A = Not Available

TOC = Top of Casing

NAVD88 = North American Vertical Datum of 1988

NAD83 = North American Datum of 1983

Survey was completed using the Iowa State Planar Coordinates - South Zone. Datums used were NAD83 (horizontal) and NAVD88 (vertical)

Iowa Army Ammunition Plant, Burlington, Iowa

May 2003

Field Survey Points and Control

NAD83 (1996) Iowa South zone (meters), NAVD88 (meters)

IOWA ARMY AMMUNITION PLANT			**UNITS=METERS**				
PT #	**SPC N**	**SPC E**	**NAVD 88**	**DESC**	**Diff N**	**Diff E**	**Diff elev**
CONTROL							
IAAP 041	87491.147	692559.177	208.441	CP			
IAAP 024	91471.259	692482.323	212.151	CP			
5000	91471.261	692482.323	212.217	CHECK#O24			
IAAP 011	93598.232	690878.328	221.470	CP-IAAP140			
IAAP 119	93730.281	691667.520	219.264	CP			
IAAP 111	93582.332	690201.780	221.013	CP			
LINE 3							
5001	93730.284	691667.514	219.260	CHECK #119	0.003	-0.006	-0.004
5002	93582.334	690201.776	221.015	CHECK #111	0.002	-0.004	0.002
16-C-G	91440.846	691485.230	211.870	MW			
16-C	91440.773	691485.245	212.472	MW			
16-B-G	91653.859	691405.892	212.913	MW			
16-B	91653.774	691405.876	213.514	MW			
16-E-G	91131.190	691352.564	211.872	MW			
16-D-G	91130.212	691355.806	211.908	MW			
16-D	91130.226	691355.737	212.504	MW			
16-E	91131.157	691352.498	212.444	MW			
L3-MW1-G	91327.791	691251.473	211.885	MW			
L3-MW1	91327.682	691251.489	212.328	MW			
JAW-54-G	91324.876	691250.194	211.966	MW			
JAW-54	91324.817	691250.213	212.649	MW			
L3-MW2-G	91316.324	691277.739	211.448	MW			
L3-MW2	91316.239	691277.786	212.092	MW			
16-A-G	91318.517	691278.026	211.484	MW			
16-A	91318.459	691278.054	212.079	MW			
LINE 2							
L2-MW2-G	91350.559	692182.417	208.439	MW			
L2-MW2	91350.420	692182.486	209.162	MW			
L2-MW1-G	91230.763	692185.417	206.438	MW			
L2-MW1	91230.646	692185.408	207.004	MW			
L2-MW4-G	91079.906	692253.145	207.715	MW			
L2-MW4	91079.930	692253.288	208.410	MW			
JAW-70-G	91078.066	692252.595	207.829	MW			
JAW-70	91078.058	692252.665	208.702	MW			
JAW-71-G	91048.995	692232.746	207.814	MW			
JAW-71	91048.958	692232.823	208.555	MW			
L2-MW5-G	91071.040	692132.530	206.767	MW			
L2-MW5	91070.938	692132.520	207.480	MW			
12-C-G	90806.765	692144.657	209.957	MW			
12-D-G	90803.878	692145.687	209.974	MW			
12-B-G	90804.931	692148.535	209.947	MW			
12-B	90804.909	692148.635	210.624	MW			
12-D	90803.804	692145.759	210.578	MW			

Iowa Army Ammunition Plant, Burlington, Iowa

May 2003

Field Survey Points and Control

NAD83 (1996) Iowa South zone (meters), NAVD88 (meters)

12-C	90806.710	692144.716	210.699	MW			
L2-MW7-G	90695.861	692028.100	206.889	MW			
L2-MW7	90695.747	692028.095	207.525	MW			
L2-MW6-G	90695.87	692030.065	206.889	MW			
L2-MW6	90695.757	692030.076	207.608	MW			
L2-MW8-G	90551.669	691921.333	199.973	MW			
L2-MW8 (B)	90551.544	691921.316	200.704	MW			
G-15-G	90553.587	691922.634	199.860	MW			
G-15	90553.434	691922.587	200.952	MW			
6000	90402.010	691862.572	201.429	CP			
6001	90392.832	691850.513	201.663	CP			
6002	90699.940	691990.338	205.982	CP			
6003	90718.456	691993.913	206.322	CP			
6004	90991.765	691979.780	201.770	CP			
6005	91020.023	692003.857	202.390	CP			
LINE 9							
JAW-612-G	91307.493	690267.106	215.626	CP			
JAW-612	91307.459	690267.164	216.275	CP			
L9-MW11-G	91314.641	690216.351	215.811	CP			
L9-MW12-G	91313.476	690215.096	215.715	MW			
L9-MW13-G	91312.365	690213.61	215.686	MW			
L9-MW13	91312.246	690213.575	216.439	MW			
L9-MW12	91313.351	690215.091	216.429	MW			
L9-MW11	91314.516	690216.321	216.518	MW			
L9-MW6-G	91246.808	690302.462	215.312	MW			
L9-MW5-G	91247.972	690303.523	215.342	MW			
L9-MW5	91247.836	690303.537	216.061	MW			
L9-MW6	91246.674	690302.549	215.998	MW			
JAW-611-G	91389.419	690297.994	216.496	MW			
JAW-611	91389.349	690297.945	217.206	MW			
JAW-30-G	91391.208	690260.914	216.673	MW			
L9-MW2-G	91390.355	690242.657	216.449	MW			
L9-MW1-G	91391.159	690240.811	216.450	MW			
L9-MW1	91391.052	690240.825	217.091	MW			
L9-MW2	91390.254	690242.672	217.103	MW			
JAW-31-G	91397.186	690241.368	216.540	MW			
JAW-31	91397.097	690241.33	217.278	MW			
JAW-30	91391.170	690260.887	217.520	MW			
JAW-29-G	91424.472	690240.776	216.602	MW			
JAW-29	91424.362	690240.746	217.430	MW			
L9-MW4-G	91490.212	690328.264	217.128	MW			
L9-MW3-G	91491.724	690329.162	217.122	MW			
L9-MW3	91491.610	690329.245	217.843	MW			
L9-MW4	91490.136	690328.313	217.702	MW			
JAW--610-G	91454.149	690240.193	216.297	MW			
JAW--610	91454.025	690240.192	216.999	MW			
L9-MW10-G	91371.939	690051.432	215.762	MW			
L9-MW9-G	91371.509	690049.970	215.881	MW			
L9-MW9	91371.394	690049.930	216.520	MW			
L9-MW10	91371.799	690051.443	216.427	MW			
5003	93730.299	691667.527	219.263	CHECK 119	0.018	0.007	-0.001
5004	93730.282	691667.509	219.266	CHECK 119	0.001	-0.011	0.002
L9-MW7-G	91177.393	690179.928	212.278	MW			

L9-MW8-G	91176.748	690181.393	212.249	MW			
L9-MW8	91176.642	690181.418	212.921	MW			
L9-MW7	91177.313	690179.902	213.012	MW			
FIRE TRAINING PIT							
SA 99-1-G	91766.615	693664.006	208.859	SUMP			
SA 99-1	91766.547	693663.995	209.307	SUMP			
FTP-MW4-G	91707.856	693663.888	207.408	MW			
FTP-MW4 (B)	91707.737	693663.858	208.134	MW			
JAW-60-G	91711.407	693660.696	207.558	MW			
JAW-60	91711.318	693660.678	208.401	MW			
JAW-80-G	91650.405	693682.418	204.892	MW			
JAW-80	91650.317	693682.405	205.682	MW			
FTP-MW8-G	91615.573	693601.481	205.473	MW			
FTP-MW7-G	91615.677	693599.029	205.595	MW			
FTP-MW7	91615.610	693599.033	206.310	MW			
FTP-MW8 (B)	91615.489	693601.482	206.293	MW			
M-01-G	91545.063	693702.145	203.556	MW			
M-01	91545.010	693702.128	204.236	MW			
FTP-MW1-G	91626.158	693752.501	200.434	MW			
FTP-MW1	91626.058	693752.481	201.118	MW			
FTA-99-1-G	91670.741	693760.786	203.660	MW			
FTA-99-2-G	91671.634	693757.704	203.731	MW			
FTA-99-1	91670.573	693760.787	204.577	MW			
FTA-99-2	91671.502	693757.631	204.550	MW			
FTP-MW-2-G	91663.368	693820.255	201.415	MW			
FTP-MW2	91663.269	693820.148	202.138	MW			
FTP-MW3-G	91728.047	693870.581	199.630	MW			
FTP-MW3	91727.922	693870.647	200.393	MW			
FTP-MW6-G	91776.731	693806.234	203.548	MW			
FTP-MW5-G	91776.828	693804.577	203.657	MW			
FTP-MW5	91776.699	693804.613	204.395	MW			
FTP-MW6 (B)	91776.618	693806.230	204.352	MW			
WEST BURN PAD							
WBP-99-1-G	91861.680	693720.629	209.771	MW			
WBP-99-1	91861.570	693720.575	210.555	MW			
JAW-25-G	91878.164	693773.777	209.345	MW			
JAW-25	91878.107	693773.721	210.135	MW			
WBP-MW3-G	91909.256	693813.125	205.542	MW			
WBP-MW3 (B)	91909.122	693813.127	206.303	MW			
WBP-99-2-G	91942.599	693713.654	206.051	MW			
WBP-99-2	91942.538	693713.671	206.852	MW			
WBP-99-4-G	91978.932	693718.169	202.985	MW			
WBP-99-4	91978.895	693718.224	203.723	MW			
WBP-99-6-G	91969.201	693807.818	199.149	MW			
WBP-99-6 (B)	91969.066	693807.826	199.922	MW			
WBP-99-5-G	91969.520	693877.081	197.195	MW			
WBP-99-5	91969.450	693877.056	197.979	MW			
WBP-MW1-G	91970.005	693881.077	197.110	MW			
WBP-MW1 (B)	91969.887	693881.095	197.879	MW			
WBP-MW2-G	91952.618	693960.748	195.136	MW			

WBP-MW2 (B)	91952.535	693960.683	195.916	MW			
JAW-24-G	91951.509	693957.677	195.105	MW			
JAW-24	91951.479	693957.584	195.891	MW			
G-30-G	91781.166	693888.290	198.571	MW			
G-30	91781.023	693888.333	199.449	MW			
6007	91856.971	693887.445	202.872	CP			
6006	91869.176	694007.128	197.963	CP			
WBP-99-3-G	91853.991	693979.058	197.942	MW			
WBP-99-3	91853.886	693979.111	198.768	MW			
WBP-99-7-G	91844.080	693973.872	198.002	MW			
WBP-99-7	91844.024	693973.892	198.817	MW			
6008	91947.512	693899.417	200.325	CP			
5005	93582.339	690201.772	221.024	CHECK 111	0.007	-0.008	0.011
EAST BURN PAD							
5006	93582.354	690201.779	221.011	CHECK 111	0.022	-0.001	-0.002
EBP-MW4-G	92025.346	694099.615	206.395	MW			
EBP-MW4 (B)	92025.209	694099.592	207.199	MW			
6009	91788.725	694192.026	204.523	CP			
6010	91817.507	694151.117	202.792	CP			
EBP-MW2-G	91937.625	694454.848	207.895	MW			
EBP-MW2	91937.514	694454.843	208.550	MW			
EDA-4-G	92150.875	694483.080	208.100	MW			
EDA-4	92150.760	694483.042	208.668	MW			
EDA-3-G	91907.261	694264.074	205.366	MW			
EDA-3	91907.219	694263.981	206.034	MW			
JAW-614-G	91905.125	694260.346	205.136	MW			
JAW-614	91904.993	694260.441	205.819	MW			
6011	91434.820	692045.395	203.058	CP			
6012	91428.275	692090.608	210.737	CP			
5007	93582.348	690201.786	221.011	CHECK 111	0.016	0.006	-0.002
5011	91817.509	694151.115	202.791	CHECK 6010	0.002	-0.002	-0.001
EBP-MW1-G	91752.060	694279.800	203.578	MW			
EBP-MW1	91751.946	694279.894	204.300	MW			
EBP-MW5-G	91821.722	694117.102	202.092	MW			
EBP-MW5 (B)	91821.554	694117.130	202.793	MW			
EBP-MW6-G	91824.264	694116.065	201.936	MW			
EBP-MW6 (B)	91824.144	694116.011	202.664	MW			
STAFF GAUGES AND BORE							
5010	91869.177	694007.127	197.968	CHECK 6006	0.001	-0.001	0.005
SC-SG01	92073.497	694011.801	195.429	STAFF			
SC-SG01-BM	92073.305	694005.26	195.694	BM			
WBP-SB01	91969.919	693811.284	199.268	BORE			
SC-SG03	91985.199	693896.382	196.698	STAFF			
SC-SG06	91614.855	693749.892	200.511	STAFF			
5013	91817.509	694151.118	202.790	CHECK 6010	0.002	0.001	-0.002
SC-SG07	91705.592	694066.588	193.144	STAFF			
SC-SG07-BM	91700.449	694064.651	192.839	BM			

5014	91942.565	693713.650	206.050	CHECK WBP-99-2-G	-0.034	-0.004	-0.001
SC-SG02	92021.484	693727.338	200.660	STAFF			
5015	91020.023	692003.857	202.388	CHECK 6005	0	0	-0.002
BC-SG02	90992.930	691940.526	200.918	STAFF			
BC-SG02-BM	90986.723	691939.157	201.493	BM			
5019	90392.833	691850.514	201.664	CHECK 6001	0.001	0.001	0.001
BC-SG04-BM	90420.287	691864.115	198.183	BM			
BC-SG04	90423.759	691860.130	199.193	STAFF			
5017	90699.941	691990.336	205.979	CHECK 6002	0.001	-0.002	-0.003
BC-SG03-BM	90680.459	691917.324	199.678	BM			
5018	91428.278	692090.587	210.741	CHECK 6012	0.003	-0.021	0.004
BC-SG01-BM	91416.370	692004.574	203.151	BM			
BC-SG01	91416.694	691998.018	202.489	STAFF			
5008	91856.974	693887.446	202.878	CHECK 6007	0.003	0.001	0.006
SC-SG05	91717.640	693884.648	197.54	STAFF			
5009	91856.971	693887.450	202.874	CHECK 6007	0	0.005	0.002
SC-SG04	91839.011	694011.431	193.825	STAFF			

Iowa Army Ammunition Plant, Burlington, Iowa

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Monitor Wells

NAD83 (1996) Iowa South zone (meters), NAVD88 (meters)

Name	Elevation Point	Northings m	Eastings m	Elevation m	Remarks
LINE 2					
12-B	North rim PVC	90804.909	692148.635	210.624	
12-B-G	Ground North side	90804.931	692148.535	209.947	
12-C	North rim PVC	90806.710	692144.716	210.699	
12-C-G	Ground North side	90806.765	692144.657	209.957	
12-D	North rim PVC	90803.804	692145.759	210.578	
12-D-G	Ground North side	90803.878	692145.687	209.974	
G-15	North rim PVC	90553.434	691922.587	200.952	
G-15-G	Ground North side	90553.587	691922.634	199.860	
JAW-70	North rim PVC	91078.058	692252.665	208.702	
JAW-70-G	Ground North side	91078.066	692252.595	207.829	
JAW-71	North rim PVC	91048.958	692232.823	208.555	
JAW-71-G	Ground North side	91048.995	692232.746	207.814	
L2-MW1	North rim PVC	91230.646	692185.408	207.004	
L2-MW1-G	Ground North side	91230.763	692185.417	206.438	
L2-MW2	North rim PVC	91350.420	692182.486	209.162	
L2-MW2-G	Ground North side	91350.559	692182.417	208.439	
L2-MW4	North rim PVC	91079.930	692253.288	208.410	
L2-MW4-G	Ground North side	91079.906	692253.145	207.715	
L2-MW5	North rim PVC	91070.938	692132.520	207.480	
L2-MW5-G	Ground North side	91071.040	692132.530	206.767	
L2-MW6	North rim PVC	90695.757	692030.076	207.608	
L2-MW6-G	Ground North side	90695.870	692030.065	206.889	
L2-MW7	North rim PVC	90695.747	692028.095	207.525	
L2-MW7-G	Ground North side	90695.861	692028.100	206.889	
L2-MW8	North rim PVC	90551.544	691921.316	200.704	
L2-MW8-G	Ground North side	90551.669	691921.333	199.973	
LINE 3					
16-A	North rim PVC	91318.459	691278.054	212.079	
16-A-G	Ground North side	91318.517	691278.026	211.484	
16-B	North rim PVC	91653.774	691405.876	213.514	
16-B-G	Ground North side	91653.859	691405.892	212.913	
16-C	North rim PVC	91440.773	691485.245	212.472	
16-C-G	Ground North side	91440.846	691485.230	211.870	
16-D	North rim PVC	91130.226	691355.737	212.504	
16-D-G	Ground North side	91130.212	691355.806	211.908	
16-E	North rim PVC	91131.157	691352.498	212.444	
16-E-G	Ground North side	91131.190	691352.564	211.872	
JAW-54	North rim PVC	91324.817	691250.213	212.649	
JAW-54-G	Ground North side	91324.876	691250.194	211.966	Concrete pad is broken & heaved +/- 0.03
L3-MW1	North rim PVC	91327.682	691251.489	212.328	
L3-MW1-G	Ground North side	91327.791	691251.473	211.885	
L3-MW2	North rim PVC	91316.239	691277.786	212.092	
L3-MW2-G	Ground North side	91316.324	691277.739	211.448	
LINE 9					
JAW-29	North rim PVC	91424.362	690240.746	217.430	
JAW-29-G	Ground North side	91424.472	690240.776	216.602	
JAW-30	North rim PVC	91391.170	690260.887	217.520	
JAW-30-G	Ground North side	91391.208	690260.914	216.673	

Iowa Army Ammunition Plant, Burlington, Iowa

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Monitor Wells

NAD83 (1996) Iowa South zone (meters), NAVD88 (meters)

Name	Elevation Point	Northings m	Eastings m	Elevation m	Remarks
JAW-31	North rim PVC	91397.097	690241.330	217.278	
JAW-31-G	Ground North side	91397.186	690241.368	216.540	
JAW--610	North rim PVC	91454.025	690240.192	216.999	
JAW--610-G	Ground North side	91454.149	690240.193	216.297	
JAW-611	North rim PVC	91389.349	690297.945	217.206	
JAW-611-G	Ground North side	91389.419	690297.994	216.496	
JAW-612	North rim PVC	91307.459	690267.164	216.275	
JAW-612-G	Ground North side	91307.493	690267.106	215.626	
L9-MW1	North rim PVC	91391.052	690240.825	217.091	
L9-MW1-G	Ground North side	91391.159	690240.811	216.450	
L9-MW10	North rim PVC	91371.799	690051.443	216.427	
L9-MW10-G	Ground North side	91371.939	690051.432	215.762	
L9-MW11	North rim PVC	91314.516	690216.321	216.518	
L9-MW11-G	Ground North side	91314.641	690216.351	215.811	
L9-MW12	North rim PVC	91313.351	690215.091	216.429	
L9-MW12-G	Ground North side	91313.476	690215.096	215.715	
L9-MW13	North rim PVC	91312.246	690213.575	216.439	
L9-MW13-G	Ground North side	91312.365	690213.610	215.686	
L9-MW2	North rim PVC	91390.254	690242.672	217.103	
L9-MW2-G	Ground North side	91390.355	690242.657	216.449	
L9-MW3	North rim PVC	91491.610	690329.245	217.843	
L9-MW3-G	Ground North side	91491.724	690329.162	217.122	
L9-MW4	North rim PVC	91490.136	690328.313	217.702	
L9-MW4-G	Ground North side	91490.212	690328.264	217.128	
L9-MW5	North rim PVC	91247.836	690303.537	216.061	
L9-MW5-G	Ground North side	91247.972	690303.523	215.342	
L9-MW6	North rim PVC	91246.674	690302.549	215.998	
L9-MW6-G	Ground North side	91246.808	690302.462	215.312	
L9-MW7	North rim PVC	91177.313	690179.902	213.012	
L9-MW7-G	Ground North side	91177.393	690179.928	212.278	
L9-MW8	North rim PVC	91176.642	690181.418	212.921	
L9-MW8-G	Ground North side	91176.748	690181.393	212.249	
L9-MW9	North rim PVC	91371.394	690049.930	216.520	
L9-MW9-G	Ground North side	91371.509	690049.970	215.881	
FIRE TRAINING PIT					
FTA-99-1	North rim PVC	91670.573	693760.787	204.577	
FTA-99-1-G	Ground North side	91670.741	693760.786	203.660	
FTA-99-2	North rim PVC	91671.502	693757.631	204.550	
FTA-99-2-G	Ground North side	91671.634	693757.704	203.731	
FTP-MW1	North rim PVC	91626.058	693752.481	201.118	
FTP-MW1-G	Ground North side	91626.158	693752.501	200.434	
FTP-MW2	North rim PVC	91663.269	693820.148	202.138	
FTP-MW-2-G	Ground North side	91663.368	693820.255	201.415	
FTP-MW3	North rim PVC	91727.922	693870.647	200.393	
FTP-MW3-G	Ground North side	91728.047	693870.581	199.630	
FTP-MW4	North rim PVC	91707.737	693663.858	208.134	
FTP-MW4-G	Ground North side	91707.856	693663.888	207.408	
FTP-MW5	North rim PVC	91776.699	693804.613	204.395	
FTP-MW5-G	Ground North side	91776.828	693804.577	203.657	
FTP-MW6	North rim PVC	91776.618	693806.230	204.352	
FTP-MW6-G	Ground North side	91776.731	693806.234	203.548	
FTP-MW7	North rim PVC	91615.610	693599.033	206.310	

Iowa Army Ammunition Plant, Burlington, Iowa

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Monitor Wells

NAD83 (1996) Iowa South zone (meters), NAVD88 (meters)

Name	Elevation Point	Northings m	Eastings m	Elevation m	Remarks
FTP-MW7-G	Ground North side	91615.677	693599.029	205.595	
FTP-MW8	North rim PVC	91615.489	693601.482	206.293	
FTP-MW8-G	Ground North side	91615.573	693601.481	205.473	
JAW-60	North rim PVC	91711.318	693660.678	208.401	
JAW-60-G	Ground North side	91711.407	693660.696	207.558	
JAW-80	North rim PVC	91650.317	693682.405	205.682	
JAW-80-G	Ground North side	91650.405	693682.418	204.892	
M-01	North rim PVC	91545.010	693702.128	204.236	
M-01-G	Ground North side	91545.063	693702.145	203.556	
SA 99-1	North rim PVC	91766.547	693663.995	209.307	SUMP
SA 99-1-G	Ground North side	91766.615	693664.006	208.859	SUMP
WEST BURN PAD					
G-30	North rim PVC	91781.023	693888.333	199.449	
G-30-G	Ground North side	91781.166	693888.290	198.571	No concrete pad
JAW-24	North rim PVC	91951.479	693957.584	195.891	Elevation corrected to top pvc from top cap
JAW-24-G	Ground North side	91951.509	693957.677	195.105	No concrete pad
JAW-25	North rim PVC	91878.107	693773.721	210.135	
JAW-25-G	Ground North side	91878.164	693773.777	209.345	
WBP-99-1	North rim PVC	91861.570	693720.575	210.555	
WBP-99-1-G	Ground North side	91861.680	693720.629	209.771	
WBP-99-2	North rim PVC	91942.538	693713.671	206.852	
WBP-99-2-G	Ground North side	91942.599	693713.654	206.051	
WBP-99-3	North rim PVC	91853.886	693979.111	198.768	
WBP-99-3-G	Ground North side	91853.991	693979.058	197.942	
WBP-99-4	North rim PVC	91978.895	693718.224	203.723	
WBP-99-4-G	Ground North side	91978.932	693718.169	202.985	
WBP-99-5	North rim PVC	91969.450	693877.056	197.979	
WBP-99-5-G	Ground North side	91969.520	693877.081	197.195	
WBP-99-6	North rim PVC	91969.066	693807.826	199.922	
WBP-99-6-G	Ground North side	91969.201	693807.818	199.149	
WBP-99-7	North rim PVC	91844.024	693973.892	198.817	
WBP-99-7-G	Ground North side	91844.080	693973.872	198.002	
WBP-MW1	North rim PVC	91969.887	693881.095	197.879	
WBP-MW1-G	Ground North side	91970.005	693881.077	197.110	
WBP-MW2	North rim PVC	91952.535	693960.683	195.916	
WBP-MW2-G	Ground North side	91952.618	693960.748	195.136	
WBP-MW3	North rim PVC	91909.122	693813.127	206.303	
WBP-MW3-G	Ground North side	91909.256	693813.125	205.542	
EAST BURN PAD					
EBP-MW1	North rim PVC	91751.946	694279.894	204.300	
EBP-MW1-G	Ground North side	91752.060	694279.800	203.578	
EBP-MW2	North rim PVC	91937.514	694454.843	208.550	
EBP-MW2-G	Ground North side	91937.625	694454.848	207.895	
EBP-MW4	North rim PVC	92025.209	694099.592	207.199	
EBP-MW4-G	Ground North side	92025.346	694099.615	206.395	
EBP-MW5	North rim PVC	91821.554	694117.130	202.793	
EBP-MW5-G	Ground North side	91821.722	694117.102	202.092	
EBP-MW6	North rim PVC	91824.144	694116.011	202.664	
EBP-MW6-G	Ground North side	91824.264	694116.065	201.936	
EDA-3	North rim PVC	91907.219	694263.981	206.034	

Iowa Army Ammunition Plant, Burlington, Iowa

Monitor Wells

NAD83 (1996) Iowa South zone (meters), NAVD88 (meters)

Name	Elevation Point	Northings m	Eastings m	Elevation m	Remarks
EDA-3-G	Ground North side	91907.261	694264.074	205.366	
EDA-4	North rim PVC	92150.760	694483.042	208.668	
EDA-4-G	Ground North side	92150.875	694483.080	208.100	
JAW-614	North rim PVC	91904.993	694260.441	205.819	
JAW-614-G	Ground North side	91905.125	694260.346	205.136	
Total new monitor wells = 34					
Total existing monitor wells = 41					

Iowa Army Ammunition Plant, Burlington, Iowa

May 2003

Staff Gauges

NAD83 (1996) Iowa South zone (meters), NAVD88 (meters)

Name	Elevation Point	Northing m	Easting m	Elevation m	Remarks
BC-SG01	6' mark on staff gauge	91416.694	691998.018	202.489	STAFF
BC-SG01-BM	Rebar in concrete	91416.370	692004.574	203.151	BM
BC-SG02	6' mark on staff gauge	90992.930	691940.526	200.918	STAFF
BC-SG02-BM	Rebar in concrete	90986.723	691939.157	201.493	BM
BC-SG03-BM	6' mark on staff gauge	90680.459	691917.324	199.678	BM
BC-SG04	6' mark on staff gauge	90423.759	691860.130	199.193	STAFF
BC-SG04-BM	Rebar in concrete	90420.287	691864.115	198.183	BM
SC-SG01	6' mark on staff gauge	92073.497	694011.801	195.429	STAFF
SC-SG01-BM	Rebar in concrete	92073.305	694005.26	195.694	BM
SC-SG02	6' mark on staff gauge	92021.484	693727.338	200.660	STAFF
SC-SG03	6' mark on staff gauge	91985.199	693896.382	196.698	STAFF
SC-SG04	6' mark on staff gauge	91839.011	694011.431	193.825	STAFF
SC-SG05	6' mark on staff gauge	91717.640	693884.648	197.54	STAFF
SC-SG06	6' mark on staff gauge	91614.855	693749.892	200.511	STAFF
SC-SG07	6' mark on staff gauge	91705.592	694066.588	193.144	STAFF
SC-SG07-BM	Rebar in concrete	91700.449	694064.651	192.839	BM
Total staff gauges = 11					

Iowa Army Ammunition Plant, Burlington, Iowa

Soil Boring

NAD83 (1996) Iowa South zone (meters), NAVD88 (meters)

Name	Northing m	Easting m	Elevation	Remarks
WBP-SB01	91969.919	693811.284	199.268	BORE
Total borings = 1				

APPENDIXH

Daily Quality Control Reports

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 10-14-02

Day	S	M	T	W	TH	F	S
		X					

On Site Hours 5.0
Travel Time 6.0
Office Time —

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun X	Clear	Overcast	Rain	Snow
Temp	To 32	32-50	50-70 X	70-85	85 up
Wind	Still	Moderate	High X	**Report No.**	
Humidity	Dry	Moderate X	Humid	1	

Subcontractors on Site:

~~Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge.~~ CA

~~Plains Environmental Service - Jessie Kalvig and Darin DeGruson.~~ CA

Equipment on Site:

~~DP Rigs~~, URS trucks, ~~well materia~~ls, water levels, ~~PIDs, FIDs, Freon detector, peristaltic pump~~ CA, turbidity meters, water tanks
Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.

Visitors on Site: None

URS Personnel on Site:

Corey Anderson, ~~Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey~~ CA.

Field Work Performed (including sampling):

- Start of field Event
- Set up field Trailer
- meeting with Dave Pranger (AO)
- Talk to Millie Nelson
- Mob to FTP, WBAA, EBP, Line 2 for initial site visit

Quality Control Activities (including field calibration): None

Health and Safety and Activities: None

Observations/Problems Encountered/Corrective Action Taken: None

Office Work Performed: Paper work.

By Corey Anderson **Title** Field Manager

DAILY QUALITY CONTROL REPORT

Date 10-15-02

Day	S	M	T	W	TH	F	S
			☒				

IAAAP F.S. Data Collection

On Site Hours 10.0
Travel Time –
Office Time –

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear ☒	Overcast	Rain	Snow
Temp	To 32	32-50 ☒	50-70	70-85	85 up
Wind	Still	Moderate ☒	High	**Report No.**	
Humidity	Dry	Moderate ☒	Humid	2	

Subcontractors on Site:

~~Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge.~~

~~Plains Environmental Service - Jessie Kalvig and Darin DeGruson.~~

Equipment on Site:

~~DP Rigs~~, URS trucks, ~~well materials~~, water levels, ~~PIDs, FIDs, Freon detector, peristaltic pump~~, turbidity meters, water tanks Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.

Visitors on Site: None

URS Personnel on Site:

Corey Anderson, ~~Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey.~~

Field Work Performed (including sampling):

Staked locations @ FTP
Relocate FTP 97-1 + 2 cluster on map
Stake location @ EBP

Quality Control Activities (including field calibration): None

Health and Safety and Activities: None

Observations/Problems Encountered/Corrective Action Taken: None

Office Work Performed: paperwork

By Corey Anderson **Title** Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 10-16-02

Day	S	M	T	W	TH	F	S
				X			

On Site Hours 16.0
Travel Time —
Office Time —

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear X	Overcast	Rain	Snow
Temp	To 32	32-50 X	50-70	70-85	85 up
Wind	Still X	Moderate	High	**Report No.**	
Humidity	Dry	Moderate X	Humid	3	

Subcontractors on Site:
~~Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge.~~ CA
~~Plains Environmental Service - Jessie Kalvig and Darin DeGruson.~~ CA

Equipment on Site:
~~DP Rigs~~, URS trucks, ~~well materials,~~ water levels, ~~PIDs, FIDs~~, Freon detector, peristaltic pump, turbidity meters, water tanks
Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.

Visitors on Site: Deb Wallin (USACE)

URS Personnel on Site:
Corey Anderson, ~~Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey.~~ CA

Field Work Performed (including sampling):
Staking locations @ EBP
Pickup equipment @ Central Stores
mob to pick up Hydrogen for FID ~~cal~~ CA
located chunks @ WBPA

Quality Control Activities (including field calibration): calibration check of PID's + FID

Health and Safety and Activities: none

Observations/Problems Encountered/Corrective Action Taken: Located chunks + staked holes at WBPA

Office Work Performed: paperwork

By Corey Anderson **Title** Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date: 10-17-02

Day	S	M	T	W	TH	F	S
					X		

On Site Hours	5.0
Travel Time	6.0
Office Time	—

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	Overcast X	Rain X	Snow
Temp	To 32	32-50 X	50-70	70-85	85 up
Wind	Still	Moderate X	High	**Report No.**	
Humidity	Dry	Moderate X	Humid	4	

Subcontractors on Site:

~~Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge.~~

~~Plains Environmental Service - Jessie Kalvig and Darin DeGruson.~~

Equipment on Site:

~~DP Rigs~~, URS trucks, ~~well materials~~, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.

Visitors on Site: None

URS Personnel on Site:

Corey Anderson, ~~Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey.~~

Field Work Performed (including sampling):

Staked locations Line 3
Staked location @ Line 2 outside fence
located G-15

Quality Control Activities (including field calibration): None

Health and Safety and Activities: none

Observations/Problems Encountered/Corrective Action Taken: Relocated G-15

Office Work Performed: paperwork.

By Corey Anderson **Title** Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 10-20-02

Day	S	M	T	W	TH	F	S
	X						

On Site Hours 2.0
Travel Time 6.0
Office Time —

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear X	Overcast	Rain	Snow
Temp	To 32	32-50 X	50-70	70-85	85 up
Wind	Still	Moderate X	High	**Report No.**	
Humidity	Dry	Moderate X	Humid	5	

Subcontractors on Site:
Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge.
Plains Environmental Service - Jessie Kalvig and Darin DeGruson.

Equipment on Site:
DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks
Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.

Visitors on Site: None

URS Personnel on Site:
Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. (Covey hrs 6 Travel + 3 onsite)

Field Work Performed (including sampling): None

Quality Control Activities (including field calibration): none

Health and Safety and Activities: none

Observations/Problems Encountered/Corrective Action Taken: none

Office Work Performed: Had meeting with crew.

By Corey Anderson **Title** Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 10-21-02

Day	S	M	T	W	TH	F	S
		X					

On Site Hours	13.0 /14.0
Travel Time	—
Office Time	—

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear X	Overcast	Rain	Snow
Temp	To 32	32-50 X	50-70	70-85	85 up
Wind	Still	Moderate X	High	**Report No.**	
Humidity	Dry	Moderate X	Humid	6	

Subcontractors on Site:

Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge.
Plains Environmental Service - Jessie Kalvig and Darin DeGruson.

Equipment on Site:

DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks
Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.

Visitors on Site: None

URS Personnel on Site:

Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. (Covey hours - 13.0 hrs)

Field Work Performed (including sampling):

FTP DP 01 - Soil Boring (38), well (38), new hole - Plaines / Covey
EBP DP 08 - SB (3[illegible]'), well (18\36), new hole - Saberprobe / Hatfield
EBP DP 09 - SB (29), well (12.1\NA), new hole - " / Berger

Quality Control Activities (including field calibration): Calibration check of PID, WL

Health and Safety and Activities: Had safety / Pre-con meeting @ Admin bld.
Had URS Safety meeting / Signed safety comp. Agreement.

Observations/Problems Encountered/Corrective Action Taken: none

Office Work Performed: paperwork.

By Corey Anderson **Title** Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 10-22-02

Day	S	M	T	W	TH	F	S
			X				

On Site Hours 12.5
Travel Time —
Office Time

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear X	Overcast	**Rain**	Snow
Temp	To 32	32-50 X	50-70	70-85	85 up
Wind	Still	Moderate X	High	**Report No.**	
Humidity	Dry	Moderate X	Humid	7	

Subcontractors on Site:
Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge.
Plains Environmental Service - Jessie Kalvig and Darin DeGruson.

Equipment on Site:
DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks
Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.

Visitors on Site: None

URS Personnel on Site:
Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. ((Covey hours - 12.5 hours)

Field Work Performed (including sampling):
FTP DP04 - SB (27'), well (13'/27'), newhole, plaines / JC
FTP DP07 - SB (27'), well (27), newhole, plaines / JC
FTP DP10 - SB (18'), well (18'), newhole, plaines / JC
FTP DP09 - SB (30 ~~29.5~~), well (20', 30 ~~29.5~~), newhole, plains / JC
FTP DP12 - SB (23)', well (23), newhole, plaines / JC
FTP DP13 - SB (16'), well (16), newhole, plaine / JC
(over)

Quality Control Activities (including field calibration): Calibration check of PID, WL

Health and Safety and Activities: Had 5 min H&S meeting

Observations/Problems Encountered/Corrective Action Taken: None

Office Work Performed: paperwork.

By Corey Anderson **Title** Field Manager

Date 10-22-02 Report No. 7

EBP DP 12 - SB (26'), well (26'), newhole, SP / DH
EBP DP 07 - SB (53'), well (20'/53') newholes, SP / DH
EBP DP 09 - well (~~25.8'~~ 26) newhole, SP, DB
EBP DP 11 - SB (~~24.2'~~ 24), well (~~11.6'~~ 12/~~22.2'~~ 22) newhole, SP / DB
EBP DP 13 - SB (6.0'), well (~~5.6'~~ 6.0), newhole, SP/ DB
EBP DP 15 - SB (15.0), well (~~14.3~~ 14), newhole, SP/ DB
EBPDP 16 - SB (~~19.7~~ 20), well (~~19.3~~ 19), newhole, SP / DB

Sampled : FTP DP 01 - 38 (VOC')
EBP DP 08 - 36 (Exp.)

Saberprobe + DB Soil Sample EBPDP 21 to 26' bss and stopped for the day

DAILY QUALITY CONTROL REPORT

Date 10-23-02

Day	S	M	T	W	TH	F	S
				✓			

IAAAP F.S. Data Collection

On Site Hours 13/14
Travel Time –
Office Time –

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear ☒	Overcast ☒	Rain ☒	Snow
Temp	To 32	32-50 ☒	50-70	70-85	85 up
Wind	Still	Moderate	High	**Report No.**	
Humidity	Dry	Moderate	Humid	8	

Subcontractors on Site:
Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge.
Plains Environmental Service - Jessie Kalvig and Darin DeGruson.

Equipment on Site:
DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks
Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.

Visitors on Site: ~~None~~ CP utility locaters.

URS Personnel on Site:
Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. (Covey hours – 13.0 hours

Field Work Performed (including sampling):
FTP DP 14 - SB (9'), screen poin sample (9') new hole, plains / JC
FTP DP 17 - SB (6'), well (6'), new hole, plains / JC
FTP DP 18 - SB (10'), well (10'), newhole, plains / JC
FTP DP 06 - SB (24'), well (24') Tried-Failed SP @ 24, newhole, plains / JC
FTP DP 05 - SB (23), well (23'), new hole, plains / JC
FTDPP 03 - SB (31'), well (31'), newhole, plains / JC
FTPPP 02 - SB (25'), well (25'), new hole, Plains / JC

Quality Control Activities (including field calibration): Calibration check of PID, WL (over)

Health and Safety and Activities: Had 5min H+S meeting

Observations/Problems Encountered/Corrective Action Taken: problems w/ hole squeezing during Temp well install.

Office Work Performed: paper work

By Corey Anderson **Title** Field Manager

Date 10-23-02 Report No. 8

EBP DP 22 - SB (65'), well (25/65'), Failed 1st well attempt (Drillererer), new hole, saberprobe / DH

EBPDP 14 - SB (34'), well (25,34'), failed SP to 34', newhole, SP/DH

EBP DP 21 - SB (68') attempted well @ 68' (pulled well)
attempted well @ 66' (hole colapsed after pulled rods)
newholes, saberprobe / DB
- Installed shallow well EBPDP21 - 26'
newhole, saberprobe / DB.

Sampled :

~~EBP DP 08-36 (explosives)~~ CA
~~FTP DP 01-38 (VOCS)~~ CA
Source 1 (Explosive + VOCS)
EBP DP 07 - 53 (Explosives)
FTP DP 07 - 27 (VOCs)
FTP DP 14 - 09 (VOC + explosives
FTP DP 04 - 27 (VOCs)
EBP DP 07 - 20 (VOCs) - Still needs explosives (explosives collected on 10-24)
FTP DP 10 - 18 (VOCs)
FTP DP 09 - 30 (VOCs + Explosives)
~~FTP DP 14 - 09 (Explosives)~~ CA

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 10-24-02

Day	S	M	T	W	TH	F	S
					X		

On Site Hours 12.0
Travel Time –
Office Time –

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	Overcast X	Rain X	Snow
Temp	To 32	32-50 X	50-70	70-85	85 up
Wind	Still X	Moderate	High	**Report No.**	
Humidity	Dry	Moderate	Humid X	9	

Subcontractors on Site:
Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge.
Plains Environmental Service - Jessie Kalvig and Darin DeGruson.

Equipment on Site:
DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks
Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.

Visitors on Site: Brian Ryndel (Tech Law - consultant to EPA)

URS Personnel on Site:
Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. (Covey hours - 12.0)

Field Work Performed (including sampling):
FTP DP19 - SB (14'), well (14'), new hole, plains / JC
FTP DP 11 - SB (20), ~~screen point~~ well (20'), new hole, plains / JC
FTP DP21 - SB (30), well (30'), new hole, plains / JC
FTP DP 08 - SB (23), well (23'), new hole, plains / JC
WBP DP 08 - SB (41') ~~new well (41'), NH, plains / JC~~ CA, well (41), NH, Plains / JC
WBP DP03 - SB (39'), well (38'), new hole, SP / DB
WBP DP04 - SB (0-12' + stopped) - no well yet - SP / DB (OVER)

Quality Control Activities (including field calibration): Calibration check of PID + FID

Health and Safety and Activities: Held 5min H+S meeting

Observations/Problems Encountered/Corrective Action Taken: Stopped setting Intermediate + deep wells. The subcontractors ordered 3/4" PVC which should allow for more filter pack around the screens

Office Work Performed: paper work

By Corey Anderson **Title** Field Manager

Date 10-24-02 Report No. 9

EBP DP 02-SB (60'), no well yet - SP/DH

EBP DP 03-SB (55'), no well yet. - SP/DH

Sampled:

EBP DP 07-20 (Explosives)
EBP DP 14-25 (Explosives + duplicate (EBPDP 1400 Time 1400)
FTP DP 11-20 (Explosives + VOC's)
EBPDP 22-65 (Explosives)
EBPDP 14-34 (Explosives)

DAILY QUALITY CONTROL REPORT

Date 10-25-02

Day

S	M	T	W	TH	F	S
					X	

IAAAP F.S. Data Collection

On Site Hours 12.5
Travel Time —
Office Time —

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Hazy	Clear	Overcast Y	Rain Y	Snow
Temp	To 32	32-50 Y	50-70	70-85	85 up
Wind	Still	Moderate Y	High	**Report No.**	
Humidity	Dry	Moderate	Humid Y	10	

Subcontractors on Site:

Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge.

Plains Environmental Service - Jessie Kalvig and Darin DeGruson. — was out sick today

Equipment on Site:

DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks

Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.

Visitors on Site: Brian Ryndel (Tech Law consultant to the EPA)

URS Personnel on Site:

Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. (Covey hours - ~~12.5 hrs~~ 13.0)

Field Work Performed (including sampling):

WBP DP 10 - SB (28'), well (28'), newhole, plains / JC
WBP DP 14 - SB (14'), well (14'), newhole, plains / JC
WBP DP 16 - SB (8'), well (8'), newhole, plains / JC
WBP DP 13 - SB (12'), well (12'), newhole, plains / JC odor @ 4' & 8' bgs
WBP DP 15 - SB (12'), well (12'), newhole, plains / JC
WBP DP 11 - SB (12'), well (12'), newhole, plains / JC
WBP DP 09 - SB (13'), well (13'), newhole, plains / JC (over)

Quality Control Activities (including field calibration): calibration check of PID & FID

Health and Safety and Activities: Had 5 min H + S meeting

Observations/Problems Encountered/Corrective Action Taken: DP Locations
WBP-DP 13, WBP DP 06 and WBP DP 05 had odors during sampling
Head space reading were recorded in the log books and on the boring logs. Still not setting Int. wel

Office Work Performed: paperwork

By Corey Anderson **Title** Field Manager

Date 10-25-02 Report No. 10

WBP-DP06 - SB (16'), well (16'), newhole, plains / JC - odor @ 5' and 10'

WBP-PP04 - SB (25'), well (25'), new hole, SP / DB (drilled 0-12 on 10-24)

WBP-DP01 - SB (10), well (10'), newhole, SP / DB

WBP-PD02 - SB (8), well (8), newhole, SP / DB

WBP DP05 - SB (6'), well (9'), newhole, SP / DB

EBP DP01 - SB (60'), well (18'), newhole, SP / DH, waiting on materials for Deepwell.

EBP DP05 - SB (50'), well (25'), newhole, SP / DH, waiting on materials for Deepwell.

Samples:

FTP DP12-23	voc (still needs Exp.)
FTP DP 17-06	voc (still needs Exp.)
FTP DP 21-30	voc
FTP DP 08-23	voc
FTP DP 19-14	voc
FTP DP 18-10	voc + Explosive (only 1 Amber)
WBP DP 03-38	voc + Explosives
FTP DP 05-23	voc (Duplicate FTP DP 05-00 Time 1500) only 1 VOA for dup was collected.
~~FTP DP 0~~	

Located

All DP's Inside Line 2

DAILY QUALITY CONTROL REPORT

Date 10-26-02

Day	S	M	T	W	TH	F	S
							X

IAAAP F.S. Data Collection

On Site Hours	11.5 / 12.5
Travel Time	—
Office Time	—

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	Overcast X	Rain X	Snow
Temp	To 32	32-50 X	50-70	70-85	85 up
Wind	Still X	Moderate	High	Report No.	
Humidity	Dry	Moderate X	Humid X	11	

Subcontractors on Site:

Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge.

Plains Environmental Service - Jessie Kalvig and Darin DeGruson.

Equipment on Site:

DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks

Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.

Visitors on Site: None

URS Personnel on Site:

Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. (Covey hours = ~~11.5~~ 11.0)

↳ Not on site today.

Field Work Performed (including sampling):

L2-DP13 - SB (56'), wells (20'/56'), new holes, plains /JC
L2-DP08 - SB (56'), wells (24'/57'), new holes, plains /JC
EBP-DP05 - screen point (46'), SP / DH
EBP-DP04 - SB (55'), wells ('25, 45'), new holes, SP / DH
EBP-DP02 - well (45'), new hole, SP / DH
EBP-DP03 - well (45), new hole, SP / DH
WBP-DP07 - SB (25'), well ('25'), new hole, SP DB (over)

Quality Control Activities (including field calibration): Calibration check of PID + FID

FID is not functioning properly - ~~we~~ recharged w/ hydrogen + cleaned + dried out.

Health and Safety and Activities: 1 hr and 5 min H+S meeting

Observations/Problems Encountered/Corrective Action Taken: Staked locations @ Line 9

several utilities in the area - utility locate is needed for several points

- Located utilities (w/ Matt (AA)) - moved L2 DP06 all others @ L2+3 are OK.

Office Work Performed: paper work.

By Corey Anderson **Title** Field Manager

Date 10-26-02 Report No. 11

EBP-DP17 - SB (33), well (35), newhole, SP/DB

L2-DP05-SB (57') only.

<u>Samples:</u>

EBP-DP05-46' (Explosives + VOC)

DAILY QUALITY CONTROL REPORT

Date 10-27-02

Day	S	M	T	W	TH	F	S
	X						

IAAAP F.S. Data Collection

On Site Hours 10/105
Travel Time —
Office Time —

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	Overcast	Rain	Snow
			X	X	
Temp	To 32	32-50	50-70	70-85	85 up
		X			
Wind	Still	Moderate	High	**Report No.**	
		X			
Humidity	Dry	Moderate	Humid	12	
		X			

Subcontractors on Site:

Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge.

Plains Environmental Service - Jessie Kalvig and Darin DeGruson.

Equipment on Site:

DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks

Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.

Visitors on Site: None

URS Personnel on Site:

Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. (Justin Covey hours = 10.0)
hours 4.0

Field Work Performed (including sampling):

L2DP09 - SB (56'), wells (20/56'), newholes, plains/JC
L2DP12 - SB (56'), wells (28/52'), newholes, plains/JC
EBP DP01 - well (45'), new hole, SP/DH
L2DP16 - SB (55'), well (20'), screen point (42'), newholes, SP/DH
L2DP05 - ~~SB~~ (cA, well (54'), Screen point (25'), newholes, SP/DB
L2DP21 - SB (0-38') only.
over for samples collected

Quality Control Activities (including field calibration): Calibration check of PID,
FID was cleaned out and dried off - it's now working properly, calibrated
FID w/ 100 ppm methane

Health and Safety and Activities: Had 5min H+S meeting

Observations/Problems Encountered/Corrective Action Taken: none.

Office Work Performed: paperwork.

By Corey Anderson **Title** Field Manager

Date 10-27-02 Report No. 12

Samples:

L2 DP 16 - 42 (explosives)
FTP DP 02 - 25 (VOCs)
FTP DP 03 - 31 (VOCs)
FTP DP 06 - 24 (VOCs)

Partial samples Collected @:

FTP DP 12 - 23
FTP DP 17 - 6
EBP DP 08 - 18
EBP DP 22 - 25

DAILY QUALITY CONTROL REPORT

Date 10-28-02

Day

S	M	T	W	TH	F	S
	☒					

IAAAP F.S. Data Collection

On Site Hours 12.0 / 12.5
Travel Time –
Office Time –

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather

Bright Sun	Clear	Overcast	Rain	Snow
		☒		

Temp

To 32	32-50	50-70	70-85	85 up
	☒			

Wind

Still	Moderate	High
	☒	

Humidity

Dry	Moderate	Humid
	☒	

Report No. 13

Subcontractors on Site:
Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge.
Plains Environmental Service - Jessie Kalvig and Darin DeGruson.

Equipment on Site:
DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks
Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.

Visitors on Site: None

URS Personnel on Site:
Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. Brandon Miner (Cover hours = 12.0)

Field Work Performed (including sampling):
L3 DP01 - SB (48'), wells (25'/52'), new holes, plains / JC
L3 DP03 - SB (52'), wells (25'/48'), new holes, plains / JC
L3 DP06 - SB (52'), well (25'), new hole, plains / JC
L2 DP02 - SB (35'), wells (23/35'), new holes, SP / DH + Screen Point @ 33'
L2 DP06 - SB (50'), wells (25/45'), new holes, SP / DH
L2 DP ~~05~~ 21 - SB (52') wells (12'/49'), new holes, SP / DB
L9 DP07 - SB (0-59') not completed. (over)

Quality Control Activities (including field calibration): Calibration check of PID and FID

Health and Safety and Activities: Had 5min H+S meeting, discussed Line 9 with Dave Breger and Saberprobe crew - potential modified Level D.

Observations/Problems Encountered/Corrective Action Taken: - Release Point Zone (open hole) DP07 at Line 9 = 29 ppm @ 30 bgs. Monitored OBZ and upgrade to modified level D OBZ = 0.0 ppm for the remainder of the day. Still have 4 ppm @ 61' bgs.

Office Work Performed: paper work.

By Corey Anderson **Title** Field Manager

Date 10-28-02 Report No. 13

Samples:

FTP DP12-23 (Explosives) 1-Liter Amber (partial collected 10-27)
EBP DP 22-25 (Explosives) 1-Liter Amber (partial collected on 10-27)
L2 DP 02-33 (Explosives)
L2 DP 05-25 (Explosive) Dup = L2DS 05-25 (one liter each)
FTP DP 17-06 (Explosives) 1-Liter Amber (partial collected on 10-25)
EBP DP 17-35 (Explosives)
WBP DP04-25 (VOC's) waiting on Exp.
EBP DP 02-45 (VOC's) waiting on Exp.
EBP DP 03 - 45 (VOC's) waiting on Exp.
WBPDP08 - 41 (Explosives + VOC's)

Partial samples

EBP DP08-18
EBPDP03-45
WBP DP04-25
EBPDP 21-26

DAILY QUALITY CONTROL REPORT

Date 10-29-02

Day	S	M	T	W	TH	F	S
			X				

IAAAP F.S. Data Collection

On Site Hours 12.0/12.0
Travel Time —
Office Time —

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	Overcast X	Rain X	Snow
Temp	To 32	32-50 X	50-70	70-85	85 up
Wind	Still	Moderate X	High	**Report No.**	
Humidity	Dry	Moderate X	Humid X	14	

Subcontractors on Site:

Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge.
Plains Environmental Service - Jessie Kalvig and Darin DeGruson.

Equipment on Site:

DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks
Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.

Visitors on Site: None

URS Personnel on Site:

Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. Brandon Moore (Justin Covey hrs: 12.5)

Field Work Performed (including sampling):

L3DP06 - wells (52'), newhole, plains / JC
L3DP05 - SB (60'), wells (20'/60'), newholes, plains / JC
L3PP10 - SB (60'), wells (26'), newhole, plains / JC
L3DP02 - SB (55'), wells (22/45') newholes, SP / DH
L3PP04 - SB (55'), wells (22/45) newholes, SP / DH
L9DP07 - SB (59'-80'), wells (62') newhole, SP / DB
Completed HA @ EBP DP06-02, WBP DP17-02 (over)

Quality Control Activities (including field calibration): Calibration check of PIDs and FID

Health and Safety and Activities: Had 5min H&S meeting

Observations/Problems Encountered/Corrective Action Taken: Still having problem w/ Saberprobe (John Willinson) w/ setting wells @ depth

Office Work Performed: paperwork

By Corey Anderson **Title** Field Manager

Date 10-29-02 Report No. 14

Samples collected:

WBP DP 10-28 (Explosive + VOC's) (1 Amber)

L2 DP 05-54 (Explosives)

EBP DP 03-45 (Explosives) (partial collected on 10-28) (voc s collected on 10-28)
(only 1 Amber)

WBP DP 04-25 (Explosives) (partial collected on 10-28) (vocs collected on 10-28)
(only 1 Amber)

Partial Samples

EBPDP 08-18

EBP DP 2[illegible]-[illegible]26

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 10-30-02

Day	S	M	T	W	TH	F	S
				X			

On Site Hours	8/9
Travel Time	–
Office Time	–

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	Overcast X	Rain	Snow
Temp	To 32	32-50 X	50-70	70-85	85 up
Wind	Still	Moderate X	High	**Report No.**	
Humidity	Dry	Moderate X	Humid	15	

Subcontractors on Site:
Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge.
Plains Environmental Service - Jessie Kalvig and Darin DeGruson.

Equipment on Site:
DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks
Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.

Visitors on Site: none

URS Personnel on Site:
Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey &M (Justin Covey hours = 7.5)
not on site

Field Work Performed (including sampling):
L3DP10 – well (58'), newhole, plains/JC
L9DP05 – well (73'), newhole, plains/JC
L3DP08 – SB (55'), wells (25/55), SP/DH
L9DP07 – well (26), SP/DB
Samples Collected @ L2DP21-12, L2DP21-40, L2DP08-24,
L2DP08-57 – all explosives only.
Samples collected @ L9DP07-62, L9DP05-73 – VOC's only

Quality Control Activities (including field calibration): Calibration check of PID, FID

Health and Safety and Activities: Daily 5min H&S meeting

Observations/Problems Encountered/Corrective Action Taken: Attempted set well @
L9DP07-50 – casing pulled and filter pack entered casing joint – well abandoned

Office Work Performed: paperwork.

By Corey Anderson **Title** Field Manager

DAILY QUALITY CONTROL REPORT

Date 11-4-02

Day	S	M	T	W	TH	F	S
		X					

IAAAP F.S. Data Collection

On Site Hours 7.5/8.0
Travel Time —
Office Time —

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear X	Overcast	Rain	Snow
Temp	To 32	32-50 X	50-70	70-85	85 up
Wind	Still	Moderate X	High	**Report No.** 16	
Humidity	Dry	Moderate X	Humid		

Subcontractors on Site:

Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge.
Plains Environmental Service - Jessie Kalvig and ~~Darin DeGruson~~ Blake Couch

Equipment on Site:

DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks
Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.

Visitors on Site: 0 Matt (AO utility clearance)

URS Personnel on Site:

Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. (Justin Covey hours. 8.0 hrs)
Brandon Minor

Field Work Performed (including sampling):

L9 DP05 - (SB - 72') only.
L3 DP09 - SB - (59') only
L3 DP08 - well (55) - replacement well.
L9 DP07 - screen point - 75'
Samples Collected: EBPDP01-18 (voc only), EBPPP01-45 (Exp + voc),
WBPDP05-9 (voc's only)

Quality Control Activities (including field calibration): Calibrated PID, FID,
Freon Detector

Health and Safety and Activities: Held 5 min H+S meeting, Gave H+S briefing to
Blake Couch - PES.

Observations/Problems Encountered/Corrective Action Taken: We are at the
limit of what DP will do 73' well, 80' sample, 75' SP.

Office Work Performed: paperwork.

By Corey Anderson **Title** Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 11-5-02

Day	S	M	T	W	TH	F	S
			X	X			

On Site Hours	11.5 / 12.0
Travel Time	—
Office Time	—

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	Overcast X	Rain X	Snow
Temp	To 32	32-50 X	50-70	70-85	85 up
Wind	Still	Moderate X	High	**Report No.**	
Humidity	Dry	Moderate X	Humid	17	

Subconctractors on Site:

Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge.
Plains Environmental Service - Jessie Kalvig and ~~Darin DeGruson~~. Blake Couch

Equipment on Site:

DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks
Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.

Visitors on Site: None

URS Personnel on Site:

Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. (Justin Covey hours = 11.5)
Brandon Minor.

Field Work Performed (including sampling):

L9DP05 - well (25'), screen point (53'), Plains / DB
L9DP10 - SB (68'), well (25), screen points (55/65), Plains / DB
L9DP06 - SB (0-24), well (25'), Plains / DB
L9DP04 - SB (72'), well (24), screenpoints (53/69), SP / DH
L3DP09 - wells (18/55), SP / JC
L3DP07 - SB (0-43), SP / JC
(over)

Quality Control Activities (including field calibration): Calibration check of PID's & FID' ~~PT~~ FID is ~~reading~~ not working properly. The Response factor may have been reset, which will give higher readings. we have noticed higher readings on the FID. Re Calibrated.

Health and Safety and Activities: Had a 5 min H+S meeting

Observations/Problems Encountered/Corrective Action Taken: Located Piezometer (PZ-10) @ Line 9, the headspace was 8100ppm, potential sample point. Release point zone @ L9DP04 > 5 ppm → monitored OBZ, upgraded to modified Level D.

Office Work Performed: paperwork

By Corey Anderson **Title** Field Manager

Date 11-5-02 Report No. 17

Samples collected and sent to Lab

L2DP06-25 (expl.)
L2DP06-45 (exp.)
L2DP13-20 (exp.)
L2DP13-56 (exp.)
L2DP16-20 (exp)
L9 DP05-53 (voc)
L9 DP07-75 (voc) - collected 11/4
EBP DP01-18 (exp)
EBPDP04-45 (exp+VOC's)
EBPDP 15-14 (exp)
EBPDP 05-25 (voc)
EBPDP 04-25 (voc)
FTP DP 04-13 (voc)

Samples Collected

L9 DP16 - 25 (VOC's)
L9DP10 - 55 (voc)
L9DP10 - 65 (voc)
L9 DP 04 - 53 (voc)
L9DP04 - 69 (voc)

Collected Field Blanks

Duplicate 1 = DI water only
Duplicate 2 = DI water collected with a bailer

DAILY QUALITY CONTROL REPORT

Date 11-6-02

Day	S	M	T	W	TH	F	S
				X			

IAAAP F.S. Data Collection

On Site Hours 12.0/ 12.5/ 13.0
Travel Time —
Office Time —

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	Overcast X	Rain	Snow
Temp	To 32	32-50 X	50-70	70-85	85 up
Wind	Still	Moderate X	High	**Report No.**	
Humidity	Dry	Moderate X	Humid	18	

Subcontractors on Site:

Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge.

Plains Environmental Service - Jessie Kalvig and ~~Darin DeGruson~~. Blake Couch

Equipment on Site:

DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks

Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.

Visitors on Site: None

URS Personnel on Site:

Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. (JC hours = 12.0)

Brandon Minor

Field Work Performed (including sampling):

L9DP06 - SB (24-63'), screen point (67), wells (52'), PES / DB
L9DP14 - SB (0-16') only, PES / DB.
L3DP07 - SB (43-54'), wells (18'/55'), SP / JC
L2DP18 - SB (0-21') only, SP / JC
L9DP03 - SB (72'), wells (22 / 53), screen point (70'), SP / DH
L9DP11 - SB (0-65') only, SP / DH
(6 in for sample)

Quality Control Activities (including field calibration): Calibration check of PID. FID will not start flame. Called FIE. They will send a new FID overnite

Health and Safety and Activities: Had 5min H+S meeting, upgrade to Modified Level D @ L9.

Observations/Problems Encountered/Corrective Action Taken: Sample crew identified 2 wells with obstructions in the well casing L2DP09-56 and L3DP03-48. Also encountered substance (suspect high free concentrations) at L9DP14 during Soil Boring. Stopped work to evaluate.

Office Work Performed: paperwork.

By Corey Anderson **Title** Field Manager

Date 11-6-02 Report No. 18

Samples collected and sent to the lab:

L2 DP 02-23 (explosives only)
L2 DP 09-20 (exp.)
L2 DP 12-28 (exp.) → Duplicate 3 (only 1 Amber)
L2 DP 12-52 (exp.)

L3 DP 01-25 (exp)
L3 DP 01-52 (exp)
L3 DP 02-45 (exp)
L3 DP 03-25 (exp)
L3 DP 04-22 (exp) → Duplicate 4
L3 DP 05-20 (exp)
L3 DP 05-60 (exp.)
L3 DP 06-25 (exp.)
L3 DP 06-52 (exp.)
L3 DP 10-25 (exp.)

L9 DP 04-53 (VOC) - collected 11-5
L9 DP 04-69 (VOC) - collected 11-5
L9 DP 06-67 (VOC)
L9 DP 10-25 (VOC) - collected 11-5
L9 DP 10-55 (VOC) - collected 11-5
L9 DP 10-65 (VOC) - collected 11-5

Samples collected and not sent:

L9 DP 03-71 (VOC)
L9 DP 06-52 (VOC)

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date: 11-7-02

Day	S	M	T	W	TH ✓	F	S

On Site Hours	12.0 / 13.0
Travel Time	—
Office Time	—

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear ✓	Overcast	Rain	Snow
Temp	To 32	32-50	50-70 ✓	70-85	85 up
Wind	Still	Moderate ✓	High	**Report No.**	
Humidity	Dry	Moderate ✓	Humid	19	

Subcontractors on Site:

Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge.
Plains Environmental Service - Jessie Kalvig and ~~Darin DeGruson~~. Blake Couch

Equipment on Site:

DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks
Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.

Visitors on Site: Matt (PO utility locate)

URS Personnel on Site:

Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. (Justin Covey hrs = 11.5)
Brandon Minor.

Field Work Performed (including sampling):

L9 DP14 - SB (67'), well (25'), screen points (53/66), PES/DB
L9 DP18 - SB (0-48') only, PES/DB
L2 DP18 - SB (21-32'), well (26), screen point (12/32), SP/JC
L2 DP15 - SB (0-21) only, SP/JC
L9 DP11 - SB (65-70), well (23'), Screen point (55/69), SP/DH
L9 DP13 - SB (64'), well (20), screen point (55'), SP/DH
(over for samples)

Quality Control Activities (including field calibration): Calibration check of PID
Tried FID/not working. New FID will arrive 11-8-02. Freon detector cal check.

Health and Safety and Activities: Had 5 min H+S meeting. Upgraded to Mod Level D.

Observations/Problems Encountered/Corrective Action Taken: Encountered more freon @ L9 DP 18 - stopped work to find additional PPE alternatives.
Added 3 DP locations @ Line 9 16, 17, 18

Office Work Performed: paperwork.

By Corey Anderson **Title** Field Manager

Date 11-7-02 Report No. 19

Samples collect and sent to the Lab :

EBP DP 02-45 (Explosives) (1 Amber) Started collection on 11/5
EBPDP 05-25 (Explosives) (1 Amber) started collection on 11/5

L2 DP 18-12 (Explosives)
L2 DP 18-32 (Explosives)

L3 DP04-45 (Exp) started collection on 11/5 (1 Amber)
L3 DP 08-25 (Exp)
L3 DP 08-55 (Exp)

L9 DP03-22 (VOC)
L9 DP03 - 53 (VOC)
L9 DP03 - 71 (VOC) collected on 11/6
L9 DP04 - 24 (VOC)
L9 DP05 - 25 (VOC)
L9 DP06 - 25 (VOC)
L9 DP06 - 52 (VOC) collected on 11/6
L9 DP07 - 26 (VOC) → Duplicate 5
L9 DP11 - 55 (VOC)
L9 DP11 - 69 (VOC)
L9 DP 14 - 53 (VOC)
L9 DP 14 - 66 (VOC)
R10 PZ 02 (VOC) - existing Piezometer.

- All samples collect were sent to the lab.
- Several partial explosives sample remain.

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 11-8-02

Day	S	M	T	W	TH	F	S
						X	

On Site Hours 12.0
Travel Time –
Office Time

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear X	Overcast	Rain	Snow
Temp	To 32	32-50 X	50-70 X	70-85	85 up
Wind	Still	Moderate X	High	Report No. 20	
Humidity	Dry	Moderate X	Humid		

Subcontractors on Site:
Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge.
Plains Environmental Service - Jessie Kalvig and Darin DeGruson. – Blake Couch left

Equipment on Site:
DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks
Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.

Visitors on Site: None

URS Personnel on Site:
Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. JC hrs = 12.0
Brandon Minor

Field Work Performed (including sampling):
L9DP16 - SB (67'), well (28'), screenpoint (62'), PES / DB
L9DP15 - SB (63'), well (25'), screenpoint (60'), PES / DB
L9DP13 - screenpoint (64'), SP / DH
L9DP02 - SB (60), well (22/60), SP / DH
L2DP15 - SB (21-41), well (17'), screenpoint (44'), SP / JC
L2DP14 - SB (0-17'), SP / JC
Installed HA holes @ WBP DP01, 02, 21, 12 Samples over

Quality Control Activities (including field calibration): Calibration check of PID + FID.

Health and Safety and Activities: Had 5 min H+S meeting, Upgraded to Modified Level D @ Line 9

Observations/Problems Encountered/Corrective Action Taken: L9 plume extent is much further to the South west. Added 2 DP locations @ Line 9 19 + 20
– observed oily substance w/ sheen in Spring creek tributary near WBP99-6 + Bedrock outcrops in SB are dry.

Office Work Performed: paperwork.

By Corey Anderson **Title** Field Manager

Date 11-8-02 Report No. 20

Samples collected and sent to the Lab:

EBP DP 08-18 , expl., partial Amber, started on 11/4.

EBPDP 04-45 , exp, 1 Amber, started on 11/5.

EBPDP 21-26 , exp, 1 Amber, started on 11/4.

WBPDP 05-09 , exp, 1 Amber, started on 11/4.

L2 BP 15-44 , exp,

WBP DP 07-22 , voc , 2-VOAs. – Actual depth is 25'

WBPPP 13-12 , voc , 1-VOA.

WBPPP 14-14 , voc .

L9 DP 11-23 , VOCs.

L9PP 13-20 , vocs.

L9DP 13-55 , voc.

L9DP 13-64 , voc.

L9DP 15-60, voc .

L9DP 16-28, voc.

L9DP 16-62, voc.

DAILY QUALITY CONTROL REPORT

Date 11-9-02

Day	S	M	T	W	TH	F	S
							X

IAAAP F.S. Data Collection

On Site Hours	9.5/11.5
Travel Time	—
Office Time	—

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear X	Overcast	Rain	Snow
Temp	To 32	32-50 X	50-70	70-85	85 up
Wind	Still	Moderate X	High X	**Report No.**	
Humidity	Dry	Moderate X	Humid	21	

Subcontractors on Site:
Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge.
Plains Environmental Service - Jessie Kalvig and Darin DeGruson.

Equipment on Site:
DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks
Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.

Visitors on Site: None

URS Personnel on Site:
Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. (JC hrs = 11.0)
Brandon Miner

Field Work Performed (including sampling):
L9DP12 - SB (64'), well (25), Screen Point (54), PES/DB
L9DP09 - SB (67) PES/DB SB from well depth to 67' → (16'-67')
L9DP08 - SB (60'), wells (25/55), SP/DH
L9DP01 - SB (73'), SP/DH
L2DP14 - SD (17-41), SP/JC ~~[illegible]~~ @
Tried HA holes @ EBPDP-10, WBP DP18
(samples over)

Quality Control Activities (including field calibration): Calibration check of PID+FID

Health and Safety and Activities: Had 5 min H+S meeting, upgraded to MOD level D @ Line 9

Observations/Problems Encountered/Corrective Action Taken:
- Identified area of contamination @ close to surface walking ditch between Line 9+7
- SP has all samples locked up w/ soil - They have been down for part of the day.

Office Work Performed: paperwork

By Corey Anderson **Title** Field Manager

Date 11-9-02 Report No. 21

Samples Collected :

WBPP02-01 (VOC)
L9DP02-22 (VOC)
L9DP02-65 (VOC) - Labled wrong (should be 60')
L9DP15-25 (VOC)
L9DP12-54 (voc)

L2DP15-17 (exp) 1 Amber
L2DP18-26 (Exp.)

DAILY QUALITY CONTROL REPORT

Date 11-10-02

Day	S	M	T	W	TH	F	S
	X						

IAAAP F.S. Data Collection

On Site Hours 8/10.5
Travel Time –
Office Time –

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	Overcast X	Rain X	Snow
Temp	To 32	32-50 X	50-70	70-85	85 up
Wind	Still	Moderate	High X	**Report No.**	
Humidity	Dry	Moderate X	Humid X	22	

Subcontractors on Site:

Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge.

Plains Environmental Service - Jessie Kalvig and Darin DeGruson.

Equipment on Site:

DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks

Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.

Visitors on Site: None

URS Personnel on Site:

Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. (JC hrs = 9.5)
Brandon Minor

Field Work Performed (including sampling):

L9DP09 - wells (52/66), PES/DB
L9DP19 - SB (56'), well (54), screen point (25), PES/DB
L9DP20 - SB (56), well (20'), screen point (43) drove only, PES/DB
L2DP14 - SB (41-60'), SP/JC
L9DP01 - wells (20), screen points (63/71), SP/DH
L9DP21 - SB (65), SP/DH
(Samples o/n)

Quality Control Activities (including field calibration): Calibration check of PID & FID

Health and Safety and Activities: Had 5min H+S meeting, upgraded to MOD Level D @ Line 9.

Observations/Problems Encountered/Corrective Action Taken: SP/JC crew has sampler still locked up. Identified 2 outfall locations where surface soil samples collected had high headspace @ L9 near bld 9-60. Upgradient ditches were ND for headspace - ditches lead to L9DP18. Added 2D
21+2

Office Work Performed: paperwork

By Corey Anderson **Title** Field Manager

Date 11-10-02 Report No. 22

Samples collected:

- WBPDP02-01 (explosives) 1 Amber

- L9DP09-52 (VOC)
- L9DP08-55 (VOC)
- L9DP09-66 (VOC)
- L9DP01-63 (VOC)
- L9PP08-25 (VOC)
- L9DP12-25 (VOC)
- L9DP01-71 (VOC)
- L9DP19-25 (VOC)

DAILY QUALITY CONTROL REPORT

Date 11-11-02

Day	S	M	T	W	TH	F	S
		X					

IAAAP F.S. Data Collection

On Site Hours 11.5 / 13.0
Travel Time —
Office Time —

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear X	Overcast	Rain	Snow
Temp	To 32	32-50 X	50-70	70-85	85 up
Wind	Still	Moderate X	High	**Report No.** 23	
Humidity	Dry	Moderate X	Humid		

Subcontractors on Site:

Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge.
Plains Environmental Service - Jessie Kalvig and Darin DeGruson.

Equipment on Site:

DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks
Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.

Visitors on Site: None, LTM + offsite Sampling crew, arrived.

URS Personnel on Site:

Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. (JC hours - 11.5)
Brandon Minor

Field Work Performed (including sampling):

L9DP20 - Collected screen point sample only (@ 39' bgs), PES/DB
L2DP03 - SB (32' refusal), screen points (14/61), PES/DB
L2DP04 - SB (0-37'), PES/DB
L2DP14 - wells (23/~~55~~), SP/JC ~~drove screen point to 55'~~
L2DP11 - SB (55), screen point (8'), SP/JC Drove sp to 8' set overnight
L9DP21 - well (20'), screen point (62'), SP/DH
L9DP22 - SB (60), well (20), screen point (54')

Quality Control Activities (including field calibration): Calibration check of PID + FID

Health and Safety and Activities: Had 5 min H+S meeting, upgraded to MOD level D

Observations/Problems Encountered/Corrective Action Taken: Located 2 Tributaries north of Line 2 that discharge into B.C. They are large wash out areas near Sanitary Sewer. We will need to add DP locations between L2DP01 and DP02

Office Work Performed: paperwork

By Corey Anderson **Title** Field Manager

Date 11-11-02 Report No. 23

Samples collected:

L2DP03-14 (explosives)
L2DP03-61 (explosives)

L3DP09-18 (explosives)

L9DP21-62 (VOC)
L9DP22-54 (VOC)
L9DP20-39 (VOC)
~~L9DP19-26 (VOC)~~

DAILY QUALITY CONTROL REPORT

Date 11-12-02

Day	S	M	T	W	TH	F	S
			Y				

IAAAP F.S. Data Collection

On Site Hours 7.0/12.0
Travel Time —
Office Time —

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	Overcast	Rain	Snow
		Y			
Temp	To 32	32-50	50-70	70-85	85 up
		Y			

Wind	Still	Moderate	High
		Y	
Humidity	Dry	Moderate	Humid
		Y	

Report No. 24

Subcontractors on Site:

Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge.
Plains Environmental Service - Jessie Kalvig and Darin DeGruson.

Equipment on Site:

DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks
Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.

Visitors on Site: None

URS Personnel on Site:

Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. JC hours = 11.5
Brandon Minor

Field Work Performed (including sampling):

L2DP04 - screen points (12/37), PES/DB
L2DP07 - SB (28), screen points (14,27), PES/DB
L9 - screen point in ditch (7') nowater
L9DP17 - SB (65), wells (23/62), SP/DH
L2DP20 - SB (63'), well (25), screenpoint (61'), SP/DH
L2DP11 - wal (32'), sampled screen points (55'), SP/JC
L2DP17 - SB (0-53), SP/JC (samples over)

Quality Control Activities (including field calibration): Calibration check of PID & FID

Health and Safety and Activities: Had 5 min H&S meeting. Upgraded to MOD level D @ Line 9

Observations/Problems Encountered/Corrective Action Taken:

- Cleared obstruction in L2DP09-56 and L3DP03-48, PES.
- Screen point sampling in ditches does not work. Headspace on SP rods was ++ on the FD in the NW corner of this site

Office Work Performed: paperwork

By Corey Anderson **Title** Field Manager

Date 11-12-02 Report No. 24

Samples collected:

L2DP04-12 explosives
L2DP04-37 explosives
L2DP07-14 explosives
L2DP07-27 explosives
L2DP11-08 explosives
L2DP11-55 explosives
L3DP07-18 explosives - 1 Amber
L3DP10-58 - explosives - 1 Amber.

L9DP01-20 (VOC) - Duplicate #8
L9DP17-23 (VOC)
L9DP17-62 (VOC)
L9DP19-54 (VOC)
L9DP20-20 (VOC)
L9DP21-20 (VOC)

Samples Collected and not sent to lab
L2DP20-61 (exp)

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 11-13-02

Day	S	M	T	W	TH	F	S
				X			

On Site Hours	60/7.0
Travel Time	—
Office Time	—

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear X	Overcast	Rain	Snow
Temp	To 32	32-50 X	50-70	70-85	85 up
Wind	Still	Moderate X	High	**Report No.**	
Humidity	Dry	Moderate X	Humid	25	

Subcontractors on Site:

Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge.

~~Plains Environmental Service - Jessie Kalvig and Darin DeGruson.~~

Equipment on Site:

DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks
Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.

Visitors on Site: None.

URS Personnel on Site:

Corey Anderson, Ryan Carpenter, Dan Hatfield, ~~Dave Breger~~, and Justin Covey. JC = hours = 7.0
Brandon Miner

Field Work Performed (including sampling):

L2 DP17 - SB (53-90), screen point (10'), SP/JC
L2 DP19 - SB (53), well (20), screenpoint (51), SP/DH
Cleared obstruction and purged dry L3DP09-55
Sampes collected and sent to lab - L2DP20-61 (exp. collected 11-12),
L2DP19-51 (exp), L2DP17-10 (exp), L2DP09-56 (exp),
L3 DP03-48 (exp), L3DP09-55 (exp).

Quality Control Activities (including field calibration): Calibratn Check of PID + FID
FID will not stay on.

Health and Safety and Activities: Had 5 Min H+S meeting,

Observations/Problems Encountered/Corrective Action Taken:

- made list of Equipment + Supplies needed for next to day
- Cleared obstructn in L3 DP09-55

Office Work Performed: paperwork.

By Corey Anderson **Title** Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 11-18-02

Day	S	M	T	W	TH	F	S
		X					

On Site Hours	6.5 | 7.5
Travel Time	–
Office Time	–

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear X	Overcast ✓	Rain	Snow
Temp	To 32	32-50 ✓	50-70	70-85	85 up
Wind	Still X	Moderate	High	**Report No.**	
Humidity	Dry	Moderate ✓	Humid	26	

Subcontractors on Site:
Saberprobe - Tom Payton, ~~Joe Combs, John Willinson~~, and Bruce Birge.
Plains Environmental Service - Jessie Kalvig ~~and Darin DeGruson.~~

Equipment on Site:
DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks
Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.

Visitors on Site: None

URS Personnel on Site:
Corey Anderson, Ryan Carpenter, ~~Dan Hatfield~~, Dave Breger, and Justin Covey. JC hours = 6.5
Brandon Minor

Field Work Performed (including sampling):
L9DP23 - SB (60), well (15'), PES / DB
L2DP17 - Screen point (56'), SP/JC
L2DP10 - SB (32), Screen point (14'), SP/JC
Samples collected and sent to the lab. - L2DP11-32 (exp), L2DP14-23 (exp)
L2DP14-55 (exp), L2DP17-56 (exp), L9DP14-25 (voc), L9DP22-20 (voc)

Quality Control Activities (including field calibration): Calibration check of PID and FID
FID is not working properly. Cal check Turbidity meters

Health and Safety and Activities: Had 5min H+S meeting / mod Level D Line 9

Observations/Problems Encountered/Corrective Action Taken: None

Office Work Performed: paperwork

By Corey Anderson **Title** Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 11-19-02

Day	S	M	T	W	TH	F	S
			✓				

On Site Hours	12.0 / 14.0
Travel Time	—
Office Time	—

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear ✓	Overcast	Rain	Snow
Temp	To 32	32-50 ✓	50-70	70-85	85 up
Wind	Still ✓	Moderate	High	**Report No.** 27	
Humidity	Dry	Moderate ✓	Humid		

Subcontractors on Site:

Saberprobe - Tom Payton, ~~Joe Combs, John Williamson,~~ and Bruce Birge.
Plains Environmental Service - Jessie Kalvig ~~and Darin DeGruson.~~

Equipment on Site:

DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks
Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.

Visitors on Site: None

URS Personnel on Site:

Corey Anderson, Ryan Carpenter, ~~Dan Hatfield,~~ Dave Breger, and Justin Covey. JC hours. = 12.0
Brandon Minor

Field Work Performed (including sampling):

L2 DP10 - SB (32-44'), well (45'), SP / JC · pulled well after sampling.
L2 DP22 - SB (51'), well (10'), screen point (51'), SP / JC
FTP DP 15 - SB (13'), well (13'), same hole, SP / JC
L9 DP23 - well (44'), screen point (59'), PES / DB
L9 DP24 - SB (24'), well (21'), same hole, PES / DB
L9 DP25 - SB (24'), well (24'), same hole, PES / DB
L9 DP 12 - Screen point (64'), PES / DB (over)

Quality Control Activities (including field calibration): Calibration check of PID

Health and Safety and Activities: Had 5 min H&S meeting, upgraded to mod level D @ Line 9

Observations/Problems Encountered/Corrective Action Taken: None

Office Work Performed: paperwork.

By Corey Anderson **Title** Field Manager

Date 11-19-02 Report No. 27

L9 Drainage ditch

L9 DP 27 – pushed hole to 20' + installed TW @ 20' – outfall

L9 DP 28 – pushed hole to 20' + installed TW @ 20' – 100' N of outfall

L9 DP 29 – pushed hole to 20' + installed TW @ 20' – NW corner of drainage ditch

Use

Samples collected + sent to Lab.

L2DP 10-14 (explosives) (collected 11-18-02)

L2DP 10-45 (explosives ~~1 Amber~~)

L2DP 22-51 (explosives)

L9DP 23-15 (VOCs)

L9DP 23-59 (VOCs)

L9DP 12-64 (VOCs)

WBPDP 14-14 (explosives 1 Amber)

Duplicate 9 is Field Blank w/ DI

DAILY QUALITY CONTROL REPORT

Date 11-20-02

Day	S	M	T	W	TH	F	S
				X			

IAAAP F.S. Data Collection

On Site Hours	11.5
Travel Time	—
Office Time	—

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	Overcast X	Rain	Snow
Temp	To 32	32-50 X	50-70	70-85	85 up
Wind	Still	Moderate Y	High	**Report No.**	
Humidity	Dry	Moderate X	Humid	28	

Subcontractors on Site:

Saberprobe - Tom Payton, ~~Joe Combs, John Willinson,~~ and Bruce Birge.

Plains Environmental Service - Jessie Kalvig ~~and Darin DeGruson.~~

Equipment on Site:

DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks

Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.

Visitors on Site: none

URS Personnel on Site:

Corey Anderson, Ryan Carpenter, ~~Dan Hatfield,~~ Dave Breger, and Justin Covey. JC hrs = 11.5

Brandon Minor

Field Work Performed (including sampling):

L9DP02 - SB (60-71') preprobed to 60', screen point (70'), PES / DB
L9DP26 - SB (52'), well (20), screen point (50'), PES, DB
FTPDP16 - SB (15'), well (15'), Same hole, SP / JC
FTPDP20 - SB (23'), well (23'), Same hole, SP / JC
FTPDP 22 - SB (20'), well (20), same hole, SP/JC
FTPDP 23 - SB (25'), well (25), Same hole, Failed Screen point @ 24, SP / JC
FTPDP 24 - SB (7'), well (7'), same hole, SP / JC (over)

Quality Control Activities (including field calibration):

Calibratn check of PID, FID, WL, Turb,

Health and Safety and Activities: Had 5min H&S meeting / mod level D @ L9.

Observations/Problems Encountered/Corrective Action Taken: None

Office Work Performed: paper work, plotted all results on maps.

By Corey Anderson **Title** Field Manager

Date 11-20-02 Report No. 28
Borings / wells

FTP DP25 - SB (22'), well (22'), same hole, SP/JC

Samples Collected and sent to the lab
L9DP02-70 (voc's)
L9DP23-44 (voc's 1 VOA)
L9DP24-21 (voc's)
L9DP25-25 (voc's) Labled wrong should be 25-24
L9DP26-50 (voc's)
L9DP27-20 (voc) - Ditch
L9DP28-20 (voc) - Ditch

L2DP22-10 (explosives)
6-15 (explosives existing well)

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 11-21-02

Day	S	M	T	W	TH	F	S
					X		

On Site Hours 11.5/12.5
Travel Time —
Office Time —

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	Overcast X	Rain X	Snow
Temp	To 32 X	32-50	50-70	70-85	85 up
Wind	Still	Moderate	High X	**Report No.** 29	
Humidity	Dry	Moderate X	Humid		

Subcontractors on Site:
Saberprobe - Tom Payton, ~~Joe Combs, John Willinson~~, and Bruce Birge.
Plains Environmental Service - Jessie Kalvig ~~and Darin DeGruson.~~

Equipment on Site:
DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks
Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.

Visitors on Site: Kevin Howe (USACE)

URS Personnel on Site:
Corey Anderson, Ryan Carpenter, ~~Dan Hatfield~~, Dave Breger, and Justin Covey. JC hrs = 12.0
Brandon Miner

Field Work Performed (including sampling):
EBPDP 20 - SB (49'), wells (22/49), SP/JC
EBPDP 11 - SB (34') 0-23 overburden, 23-34 rock/seam, well (33'), Samehole, SP/JC
L9DP30 - pushed hole to 10', installed well @ 10', same hole, PES/DB
L9DP31 - SB (24'), well (21'), samehole, PES/DB
L9DP32 - SB (24'), screen point (15'), PES/DB
L3DP02 - re installed L3DP02-13, well (13') only, PES/DB
L2DP01 - SB (48'), well (39'), screen point (12'), PES/DB

Quality Control Activities (including field calibration):
Cal check of PID / FID / WL / Turb

Health and Safety and Activities: Had 5 min H+S meeting / Mod Level D L9

Observations/Problems Encountered/Corrective Action Taken: None

Office Work Performed: paperwork.

By Corey Anderson **Title** Field Manager

Date 11-21-02 Report No. 29

Samples collected and Severn Trent lab

FTPDP 20-23 (voc)
FTPPP 22-20 (voc's)
FTPPP 23-25 (voc) Duplicate 10

L9DP 26-19 (voc 2 VOA) wrong ID 26-20 is correct.
L9DP 29-20 (voc)
L9DP 30-10 (voc)
L9DP 32-15 (voc)

L3DP07-55 (exp. started on 11/19/02) 1 Amber.

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 11-22-02

Day	S	M	T	W	TH	F	S
						X	

On Site Hours	14/11.5
Travel Time	–
Office Time	–

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear X	Overcast	Rain	Snow
Temp	To 32 X	32-50 X	50-70	70-85	85 up
Wind	Still	Moderate X	High	**Report No.**	
Humidity	Dry	Moderate X	Humid	30	

Subcontractors on Site:
Saberprobe - Tom Payton, ~~Joe Combs, John Willinson,~~ and Bruce Birge.
Plains Environmental Service - Jessie Kalvig ~~and Darin DeGruson.~~

Equipment on Site:
DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks
Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.

Visitors on Site: Kevin Howe + Ben Letak (USACE)

URS Personnel on Site:
Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey. JC hrs. 11.5
Brandon Minor

Field Work Performed (including sampling):
EBPDP23 ~~280~~ - SB (28'), well (28'), Same hole, 4" FA w/ Rock Ram, SP/JC
WBPDP15 - SB (26'), well (24'), Same hole, 4" FA w/ Rock Ram, SP/JC
WBPDP19 - SB (0-16.5'), 4" FA w/RR, SP/JC
L2DP23 - SB (16'), screen point (12'), PES/DB
L2DP24 - SB (16'), screen point (6'), PES/DB
EBPDP21 - SB (72-84'), well (67'), pre probed to 72 for SB, PES/DB
(Samples over)

Quality Control Activities (including field calibration):
Cal Check of PID/FID/WL/Turb

Health and Safety and Activities: Had 5min H+S meeting / Level D only

Observations/Problems Encountered/Corrective Action Taken: Site Recon @ WBP, FTP, EBP and Line 9 see logbook for Activities and findings

Office Work Performed: paperwork.

By Corey Anderson **Title** Field Manager

Date 11-22-02 Report No. 30

Samples collected and sent to lab.

L2DP 01-12 (explosives collected 11/21)
L2DP19-20 (explosives 1 Amber)
L2DP 23-12 (explosives)
L2DP24-06 (explosives)

EBP DP20-22 (explosives 1 Amber)
EBPDP20-49 (explosive 1 Amber)
EBPDP23-28 (explosives)
FTPDP23-25 (explosives 1 Amber)
FTPDP24-07 (VOC) (2 VOA)
FTPDP25-22 (VOC) (Duplicate 11)
L9DP31-22 (VOC)

DAILY QUALITY CONTROL REPORT

Date 11-23-02

Day S M T W TH F [✓ S]

IAAAP F.S. Data Collection

On Site Hours 12.0/11.5
Travel Time —
Office Time —

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	[✓ Clear]	Overcast	Rain	Snow
Temp	To 32	[✓ 32-50]	50-70	70-85	85 up
Wind	Still	[✓ Moderate]	High	**Report No.**	
Humidity	Dry	[✓ Moderate]	Humid	31	

Subcontractors on Site:

Saberprobe - Tom Payton, ~~Joe Combs, John Willinson~~, and Bruce Birge.
Plains Environmental Service - Jessie Kalvig ~~and Darin DeGruson.~~

Equipment on Site:

DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks
Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.

Visitors on Site: None

URS Personnel on Site:

Corey Anderson, Ryan Carpenter, ~~Dan Hatfield, Dave Broger~~, and Justin Covey. JC hours = 11.5
Brandon Minor

Field Work Performed (including sampling):

WBP DP19 - SB (17'), well (16'), Same hole, bedrock = 9' bgs, SP/JC
WBPDP18 - SB (12'), well (12'), same hole, bedrock = 5' bgs, SP/JC
WBPDP11 - SB (19'), well (18'), same hole, bedrock = 9' bgs, SP/JC
WBPDP12 - SB (9'), well (9'), same hole, bedrock = 6' bgs, SP/JC
WBPDP17 - SB (10'), well (10'), same hole, bedrock = 1' bgs, SP/JC
~~WBPDP26~~ FTP DP26 - SB (23'), ~~same~~ well (23'), same hole, bedrock = 14' bgs, SP/JC
WBPDP01 - SB (14'), well (13'), same hole, bedrock = 9' bgs, SP/JC (over)

Quality Control Activities (including field calibration):

Cal check of PID / FID / WL / Turb

Health and Safety and Activities: Had 5 min H-S meeting / Level D only

Observations/Problems Encountered/Corrective Action Taken: None.

Results indicate L2 G-15 well hit is local only. Possible source area near by NPDES outfall / former discharge area / Potable water line cuts through the area?

Office Work Performed: paperwork

By Corey Anderson **Title** Field Manager

Date 11-23-02 Report No. 31

wBPDP02 - SB(14'), well (14'), samehole, bedrock = 9' bgs, SP / JC

EBPDP21 - SB (84'-116'), well (95'), newhole, PES / CA

EBPDP02 - preprobed to 64' bgs. DES|CA

<u>Samples collected and sent to the lab.</u>

L2 DP01-39 (expl. 1 Amber)

L2 DP20-25 (expl. 1 Amber)

wBPPP 07-22 (expl. ½ Amber) or 07-25? This is correct.

wBPPP 12-09 (exp 1 Amber + VOC's) Duplicate 12 (exp. only)

EB PPP 21-67 (exp. 1 Amber)

FTP DP25-22 (Exp. 1 Amber)

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 11/24/02

Day	S	M	T	W	TH	F	S
	X						

On Site Hours 9.5/10.0
Travel Time –
Office Time

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	Overcast	Rain	Snow
			X		X
Temp	To 32	32-50	50-70	70-85	85 up
	X	X			
Wind	Still	Moderate	High	**Report No.**	
		X		32	
Humidity	Dry	Moderate	Humid		
		X			

Subcontractors on Site:
Saberprobe - Tom Payton, ~~Joe Combs, John Willinson~~, and Bruce Birge.
Plains Environmental Service - Jessie Kalvig ~~and Darin DeGruson~~.

Equipment on Site:
DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks
Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.

Visitors on Site: None

URS Personnel on Site:
Corey Anderson, Ryan Carpenter, ~~Dan Hatfield, Dave Breger~~, and Justin Covey. JC hrs = 11.5
Brandon Minor

Field Work Performed (including sampling):
EBP DP 02 - SB (44-100) only + prepable to 64 (11-23-02), PES/CA
L9DP33 - SB (55'), well (22'), screen point (48'), SP / JC
L9DP34 - SB (60') only, SP / JC
-No Samples collected
-Disposed of IDW from 4" PP holes.

Quality Control Activities (including field calibration):
Cal check PID / FID / WL / Turb.

Health and Safety and Activities: Had 5min H+S meeting / Level D + Mod Level D

Observations/Problems Encountered/Corrective Action Taken: None. PES left site

Office Work Performed: paperwork

By Corey Anderson **Title** Field Manager

DAILY QUALITY CONTROL REPORT

Date 11-25-02

Day	S	M	T	W	TH	F	S
		✗					

IAAAP F.S. Data Collection

On Site Hours 11.0 - 12.0
Travel Time –
Office Time –

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	Overcast ✗	Rain	Snow ✗
Temp	To 32 ✗	32-50	50-70	70-85	85 up
Wind	Still	Moderate	High ✗	**Report No.** 33	
Humidity	Dry ✗	Moderate	Humid		

Subcontractors on Site:
Saberprobe - Tom Payton, J~~oe Combs, John Wilkinson~~, and Bruce Birge.
~~Plains Environmental Service - Jessie Kalvig and Darin DeGruson.~~

Equipment on Site:
DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks
Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.

Visitors on Site: John Carol (AO/NPDES)

URS Personnel on Site:
Corey Anderson, Ryan Carpenter, ~~Dan Hatfield, Dave Breger~~, and Justin Covey. JC hrs - 11.0
Brandon Minor

Field Work Performed (including sampling):
L9DP34 - well (22'), screen point (60'), SP/JC
L9 DP 35 - SB (50'), well (20'), screen point (46'), SP/JC
HA - L9DP37 - SB (7.0'), well (7.0'), CA, RC, BM
HA - L9 DP 38 - SB (7.0'), well (7.0'), CA, RC, BM
Samples collected – L9DP 33-47 (voc collected 11-24), L9DP34 - 19 (voc),
L9DP34 - 60 (voc), L9DP35 - 46 (voc), L9DP 37-07 (voc), L9DP38-07 (voc),
FTPDP 26-23 (voc), EDP DP21-95 (expl.), WBP DP 13-12 (exp.) 1Amber for both exp.
↳ stored (11-19-02)

Quality Control Activities (including field calibration):
Cal check of PID/FID/WL/Turb.

Health and Safety and Activities: Had 5min H+S meeting / Level D + Mod Level D

Observations/Problems Encountered/Corrective Action Taken: Had meeting w/ John Carol about waste water treatment @ L2, Looked @ NPDES 021 + 022, see log book # 1 for notes.
Completed surface soil mapping w/ FID + FD @ Line 9 ditches. Site recon inside Line 9 courtyard.

Office Work Performed: paperwork

By Corey Anderson **Title** Field Manager

DAILY QUALITY CONTROL REPORT

Date 11-26-02

Day	S	M	T	W	TH	F	S
			X				

IAAAP F.S. Data Collection

On Site Hours 12.0
Travel Time —
Office Time —

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	Overcast X	Rain	Snow
Temp	To 32 X	32-50	50-70	70-85	85 up
Wind	Still	Moderate X	High	**Report No.**	
Humidity	Dry	Moderate X	Humid	34	

Subcontractors on Site:
Saberprobe - Tom Payton, ~~Joe Combs, John Willinson~~, and Bruce Birge.
~~Plains Environmental Service - Jessie Kalvig and Darin DeGruson.~~

Equipment on Site:
DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks
Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.

Visitors on Site: None

URS Personnel on Site:
Corey Anderson, Ryan Carpenter, ~~Dan Hatfield, Dave Breger~~, and Justin Covey. JC hrs. = 12.0
Brandon Mann.

Field Work Performed (including sampling):
L9DP36 - SB (50), well (21'), screenpoint (45'), SP / JC
WBPDP06 - SB (23), well (22), Bedrock = 13', SH, SP/JC
WBPPP09 - SB (23), well (22'), bedrock = 13', SH, SP/JC
EBPDP24 - SB (22'), well (21), bedrock = 12', SH / SP/JC
L9DP39 - HA (7), well (7), CA, RC, BM
Samples collected - L9DP33-22 (voc), L9DP36-21 (voc), L9DP36-45 (voc)
L9DP39-07 (voc), FTPPP26-23 (exp.), FTPPP 24-07 (exp.), L3DP 02-13 (exp.).

Quality Control Activities (including field calibration):
Cal Check PID / FID / WL / Turb.

Health and Safety and Activities: Had Safety Meeting

Observations/Problems Encountered/Corrective Action Taken: None, needed to Add 2 wells @ EBP, Completed Line 9 surface mapping,

Office Work Performed: paperwork / Prep for DE-MOB

By Corey Anderson **Title** Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 11-27-02

Day	S	M	T	W	TH	F	S
				X			

On Site Hours 4.0
Travel Time 6.0
Office Time –

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear X	Overcast	Rain	Snow
Temp	To 32 X	32-50	50-70	70-85	85 up
Wind	Still	Moderate X	High	**Report No.**	
Humidity	Dry X	Moderate	Humid	35	

Subcontractors on Site:
Saberprobe - Tom Payton, ~~Joe Combs, John Willinson~~, and Bruce Birge.
~~Plains Environmental Service - Jessie Kalvig and Darin DeGruson.~~

Equipment on Site:
DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks
Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.

Visitors on Site: None

URS Personnel on Site:
Corey Anderson, Ryan Carpenter, ~~Dan Hatfield, Dave Breger~~, and Justin Covey. JC hours, 10.0

Field Work Performed (including sampling):
EPPDP25 - SB (24), well (23'), bedrock = 17', SH, SP/JC

Quality Control Activities (including field calibration):
Cal check OF PID / WL / Turb.

Health and Safety and Activities: Had H+S meeting

Observations/Problems Encountered/Corrective Action Taken:
Sent back all equipment, returned IPA key to building, RC + BM will Return to collect final samples.

Office Work Performed: paperwork / De Mob.

By Corey Anderson **Title** Field Manager

DAILY QUALITY CONTROL REPORT

Date 12/02/03

Day	S	M	T	W	TH	F	S
		☒					

IAAAP F.S. Data Collection

On Site Hours 6.0
Travel Time –
Office Time –

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	Overcast ☒	Rain	Snow
Temp	To 32 ☒	32-50	50-70	70-85	85 up
Wind	Still	Moderate	High ☒	**Report No.**	
Humidity	Dry ☒	Moderate	Humid	36	

Subcontractors on Site:

~~Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge.~~

~~Plains Environmental Service - Jessie Kalvig and Darin DeGruson.~~

Equipment on Site:

~~DP Rigs,~~ [✓ URS trucks], ~~well materials,~~ [✓ water levels], ~~PIDs, FIDs,~~ [✓ Freon detector], ~~peristaltic pump,~~ [✓ turbidity meters], ~~water tanks~~
~~Decon equipment, soil sampling equipment,~~ [✓ water sampling equipment], [✓ PPE], [✓ paperwork.]

Visitors on Site:

NONE

URS Personnel on Site:

~~Corey Anderson,~~ Ryan Carpenter, ~~Dan Hatfield, Dave Bregen, and Justin Covey.~~ Brandon Miner

Field Work Performed (including sampling):

Ground water sampling :
L9DP3520 : 3 Voas
WBDP 1916 : 3 Voas ; 1 Amber
WBDP 1812 : 3 Voas ; Partial Amber

Quality Control Activities (including field calibration):

N/A

Health and Safety and Activities: Had 5 min H+S meeting

Observations/Problems Encountered/Corrective Action Taken:

N/A

Office Work Performed:

N/A

By ~~Corey Anderson~~ RC **Title** Field Manager

DAILY QUALITY CONTROL REPORT

Date 12/03/02

Day	S	M	T	W	TH	F	S
			X				

IAAAP F.S. Data Collection

On Site Hours	11
Travel Time	0
Office Time	0

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	Overcast X	Rain	Snow
Temp	To 32 X	32-50	50-70	70-85	85 up
Wind	Still	Moderate X	High	**Report No.**	
Humidity	Dry	Moderate X	Humid	37	

Subcontractors on Site:

~~Saberprobe - Tom Payton, Joe Combs, John Wilkinson, and Bruce Birg~~e.
~~Plains Environmental Service - Jessie Kalvig and Darin DeGruson.~~

Equipment on Site:

~~DP Rig~~s, URS trucks, well materials, water levels, ~~PIDs, FIDs~~, Freon detector, ~~peristaltic pum~~p, turbidity meters, ~~water tanks.~~ Decon equipment, ~~soil sampling equipme~~nt, water sampling equipment, PPE, paperwork.

Visitors on Site:

N/A

URS Personnel on Site:

~~Corey Anderson~~, Ryan Carpenter, ~~Dan Hatfield, Dave Breger, and Justin Covey.~~ Brandon Miner

Field Work Performed (including sampling):

Groundwater sampling:
WBDP0113 - partial
WBDP1524
WBDP1710
L7DP4005

Quality Control Activities (including field calibration):

N/A

Health and Safety and Activities:

N/A

Observations/Problems Encountered/Corrective Action Taken:

N/A

Office Work Performed:

N/A

By ~~Corey Anderson~~ RC **Title** Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 12/4/02

Day	S	M	T	W	TH	F	S
				X			

On Site Hours 3.5
Travel Time 6
Office Time .5

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	Overcast X	Rain	Snow
Temp	To 32 X	32-50	50-70	70-85	85 up
Wind	Still	Moderate X	High	**Report No.**	
Humidity	Dry	Moderate X	Humid	38	

Subcontractors on Site:
~~Saberprobe - Tom Payton, Joe Combs, John Wilkinson, and Bruce Birge.~~
~~Plains Environmental Service - Jessie Kalvig and Darin DeGruson.~~

Equipment on Site:
~~DP Rigs~~, URS trucks, ~~well materials~~, water levels, ~~PIDs, FIDs~~, Freon detector, ~~peristaltic pump,~~ turbidity meters, ~~water tanks~~
~~Decon equipment, soil sampling equipment,~~ water sampling equipment, PPE, ~~paperwork~~ → kit

Visitors on Site:
None

URS Personnel on Site:
~~Corey Anderson~~, Ryan Carpenter, ~~Dan Hatfield, Dave Breger, and Justin Covey.~~ ~~Ry~~ Brandon Miner

Field Work Performed (including sampling):
- Groundwater sampling - Collected additional sample Vol.
  EBDP113
  WBDP0113 - Sent Partial
- Winterize Trailer

Quality Control Activities (including field calibration):
N/A

Health and Safety and Activities:
N/A

Observations/Problems Encountered/Corrective Action Taken:
N/A

Office Work Performed:
Unload supplies @ office in Omaha

By ~~Corey Anderson~~ RC **Title** Field Manager

DAILY QUALITY CONTROL REPORT

Date 12/16/02

Day	S	[✓ M]	T	W	TH	F	S

IAAAP F.S. Data Collection

On Site Hours 0900-1200
Travel Time 6 hours
Office Time 1.5 hours

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	[✓ Overcast]	Rain	Snow
Temp	To 32	[✓ 32-50]	50-70	70-85	85 up
Wind	Still	[✓ Moderate]	High	**Report No.**	
Humidity	Dry	[✓ Moderate]	Humid	39	

Subcontractors on Site:

~~Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge.~~

~~Plains Environmental Service - Jessie Kalvig and Darin DeGruson.~~

Equipment on Site:

~~DP Rig~~s, URS trucks, ~~well materials,~~ water levels, PIDs, ~~FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks~~ ~~Decon equipment, soil sampling equipment,~~ water sampling equipment, PPE, paperwork.

Visitors on Site:

None

URS Personnel on Site:

~~Corey Anderson, Ryan Carpenter, Dan Hatfield~~, Dave Breger, ~~and Justin Covey~~.

Field Work Performed (including sampling):

Attempted to collect groundwater samples from: WBP-DP0214; WBP-DP0622; WBP-DP0922; WBP-DP1118; EBP-DP2421; and EBP-DP2523. No groundwater observed in any of the aforementioned wells.

Quality Control Activities (including field calibration):

Calibrated PID with 100 ppm Isobutylene

Health and Safety and Activities:

Use of appropriate PPE

Observations/Problems Encountered/Corrective Action Taken:

Office Work Performed:

Equipment preparation. Completion of field paperwork

By ~~Corey Anderson~~ David Berger **Title** ~~Field Manager~~ Sampling Tech.

DAILY QUALITY CONTROL REPORT

Date 2-10-03

Day	S	[✓ M]	T	W	TH	F	S

IAAAP F.S. Data Collection

On Site Hours 6.5
Travel Time 6.0
Office Time —

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	Overcast ☒	Rain	Snow
Temp	To 32 ☒	32-50	50-70	70-85	85 up
Wind	Still	Moderate	High ☒	**Report No.**	
Humidity	Dry ☒	Moderate	Humid	40	

Subcontractors on Site:
~~Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge.~~ NONE
~~Plains Environmental Service - Jessie Kalvig and Darin DeGruson.~~

Equipment on Site:
~~DP Rigs, URS trucks, well materials, water levels~~, PIDs, FIDs, ~~Freon detector, peristaltic pump, turbidity meters, water tanks~~
~~Decon equipment, soil sampling equipment, water sampling~~ equipment, PPE, ~~paperwork~~.
Survey level, Rod, GPS, Abandonment tools, bentonite

Visitors on Site:
None

URS Personnel on Site:
~~Corey Anderson, Ryan Carpenter, Dan Hatfield, Dave Breger, and Justin Covey.~~ CA, RC, BM, BO

Field Work Performed (including sampling):
- Surveyed elevations at FTP all DP locations (26 locations)
- Collect WBP DP06 - VOC + Exp. + 1 Duplicate Exp.

Quality Control Activities (including field calibration): None
~~Calibration check of sampling~~

Health and Safety and Activities: Initial Site Safety meeting

Observations/Problems Encountered/Corrective Action Taken: FTA 99-1 + 2 cluster is off by approx. 4"

Office Work Performed: None

By Corey Anderson **Title** Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 2-11-03

Day	S	M	T	W	TH	F	S
			[✓ T]				

On Site Hours —
Travel Time 11.0
Office Time

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	Overcast X	Rain	Snow
Temp	To 32 X	32-50	50-70	70-85	85 up
Wind	Still	Moderate	High X	**Report No.**	
Humidity	Dry X	Moderate	Humid	**41**	

Subcontractors on Site:
~~Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge.~~ None
~~Plains Environmental Service - Jessie Kalvig and Darin DeGruson.~~

Equipment on Site:
~~DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks~~
~~Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.~~
Survey level, Rod, GPS, Abandonment tools, bentonite

Visitors on Site:
None

URS Personnel on Site:
Corey Anderson, Ryan Carpenter, ~~Dan Hatfield, Dave Breger, and Justin Covey.~~ BM, BO

Field Work Performed (including sampling):
- Surveyed elevations @ Line 3 at all DP Locations (10)
- GPS Locations @ Line 3 all 10 DP Locations
- Abandoned all 10 locations @ Line 3.
- Surveyed elevations @ L2DP 22, 11, 17, 19, 20, 15, + 18.

Quality Control Activities (including field calibration): None

Health and Safety and Activities: 5 min H+S meeting

Observations/Problems Encountered/Corrective Action Taken: None

Office Work Performed: None

By Corey Anderson **Title** Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 2-12-03

Day	S	M	T	[✓ W]	TH	F	S

On Site Hours	11.5
Travel Time	—
Office Time	—

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear ✓	Overcast	Rain	Snow
Temp	To 32 ✓	32-50	50-70	70-85	85 up
Wind	Still	Moderate ✓	High	**Report No.**	
Humidity	Dry ✓	Moderate	Humid	42	

Subcontractors on Site:

~~Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Bir~~ge. None

Plai~~ns Environmental Service - Jessie Kalvig and Darin DeGrus~~on.

Equipment on Site:

D~~P Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water~~ tanks

~~Decon equipment~~, soil sampling ~~equipment, water sampling equipment, PPE, paperwork~~.

Survey equipment, Level, Rod, GPS, Abandonment tools, bentonite

Visitors on Site:

None

URS Personnel on Site:

Corey Anderson, Ryan Carpenter, ~~Dan Hatfield, Dave Breger, and Justin Covey.~~ BM, BO

Field Work Performed (including sampling):

-Surveyed all PP Locations inside Line 2 Fence
- GPS all Locations inside fence
-Abandoned all Locations inside fence.
- Surveyed L2PP07, 10, 04, 14 + tied into 6-15.
-GPS + Abandoned - @ Line 2 -

Quality Control Activities (including field calibration): None

Health and Safety and Activities: 5 min H+S meeting

Observations/Problems Encountered/Corrective Action Taken: ~~[illegible]~~ 6-15 is off according to JAW-71

Office Work Performed: None

By Corey Anderson **Title** Field Manager

DAILY QUALITY CONTROL REPORT

Date 2-13-03

Day						
S	M	T	W	[✓ TH]	F	S

IAAAP F.S. Data Collection

On Site Hours 12.0/12.0
Travel Time —
Office Time —

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	[✓ Clear]	Overcast	Rain	Snow
Temp	[✓ To 32]	32-50	50-70	70-85	85 up
Wind	[✓ Still]	Moderate	High	**Report No.**	
Humidity	Dry	[✓ Moderate]	Humid	43	

Subcontractors on Site:

~~Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge~~. None

Pl~~ains Environmental Service - Jessie Kalvig and Darin DeGruson.~~

Equipment on Site:

~~DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water ta~~nks

~~Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork~~.

Survey equipment, level, Rod, GPS, abandonment tools, bentonite

Visitors on Site: None

URS Personnel on Site:

Corey Anderson, Ryan Carpenter, ~~Dan Hatfield, Dave Breger, and Justin Covey.~~ BM, BO

Field Work Performed (including sampling):

Surveyed all DP locations at EBP
GPS at FTP + EBP
Abandoned all FTP DPs

Quality Control Activities (including field calibration): None

Health and Safety and Activities: 5 min H+S meeting

Observations/Problems Encountered/Corrective Action Taken: None

Office Work Performed: None

By Corey Anderson **Title** Field Manager

Page 1 of 1

DAILY QUALITY CONTROL REPORT

Date 2-14-03

Day	S	M	T	W	TH	[✓ F]	S

IAAAP F.S. Data Collection

On Site Hours	12.0 / 13.0
Travel Time	—
Office Time	—

COE Project Manager Al Kam/Kevin Howe

Project Iowa Army Ammunition Plant

Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302

Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	Overcast X	Rain X	Snow
Temp	To 32 X	32-50	50-70	70-85	85 up
Wind	Still	Moderate X	High	**Report No.** 44	
Humidity	Dry	Moderate X	Humid		

Subcontractors on Site:

~~Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge.~~ None
~~Plains Environmental Service - Jessie Kalvig and Darin DeGruson.~~

Equipment on Site:

~~DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters,~~ water tanks
~~Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.~~
Survey equipment, level, Rod, GPS, abandonment tools, bentonite

Visitors on Site:

URS Personnel on Site:

Corey Anderson, Ryan Carpenter, ~~Dan Hatfield, Dave Breger, and Justin Covey.~~ BM, BO

Field Work Performed (including sampling):

Abandoned all EBP DPs
GPS IAAAP Baker benchmarks. IAAAP 140 + 142
Survey WBPA DPs

Quality Control Activities (including field calibration): None

Health and Safety and Activities: 5 min H+S meeting

Observations/Problems Encountered/Corrective Action Taken: None

Office Work Performed: None

By Corey Anderson **Title** Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 2-15-03

Day							
	S	M	T	W	TH	F	[✓ S]

On Site Hours 12.0
Travel Time —
Office Time —

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	[✓ Overcast]	Rain	[✓ Snow]
Temp	[✓ To 32]	32-50	50-70	70-85	85 up
Wind	Still	[✓ Moderate]	High	**Report No.**	
Humidity	Dry	[✓ Moderate]	Humid	45	

Subcontractors on Site:
~~Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge.~~ None
~~Plains Environmental Service - Jessie Kalvig and Darin DeGruson.~~

Equipment on Site:
~~DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water tanks~~
~~Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.~~
survey equipment, Rod, level, GPS, abandonment tools, bentonite

Visitors on Site: None

URS Personnel on Site:
~~Corey Anderson~~, Ryan Carpenter, ~~Dan Hatfield, Dave Breger, and Justin Covey.~~ BM, BO

Field Work Performed (including sampling):
Abandoned DPs at WBPA
GPS all DPs at WBPA

Quality Control Activities (including field calibration): None

Health and Safety and Activities: 5min H&S meeting

Observations/Problems Encountered/Corrective Action Taken: none

Office Work Performed: none

By ~~Corey Anderson~~ RC **Title** Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 2-16-03

Day						
[✓ S]	M	T	W	TH	F	S

On Site Hours 10.0/11.0
Travel Time –
Office Time –

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	Overcast X	Rain	Snow
Temp	To 32 X	32-50	50-70	70-85	85 up
Wind	Still	Moderate X	High	**Report No.**	
Humidity	Dry	Moderate X	Humid	46	

Subcontractors on Site:

~~Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Bir~~ge. None
P~~lains Environmental Service - Jessie Kalvig and Darin DeGruson~~.

Equipment on Site:

~~DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters, water ta~~nks
~~Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.~~
Survey equipment, Rod, Level, GPS, Abandonment tools, bentonite

Visitors on Site:

URS Personnel on Site:

~~Corey Anderso~~n, Ryan Carpenter, ~~Dan Hatfield, Dave Breger, and Justin Covey~~ BM, BO

Field Work Performed (including sampling):

Abandoned DPs at Line 7
GPS all DPs at Line 9
Survey all DPs at Line 9.

Quality Control Activities (including field calibration): None

Health and Safety and Activities: 5 min H+S meeting

Observations/Problems Encountered/Corrective Action Taken: None

Office Work Performed: None

By Corey Anderson RC **Title** Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 2-17-03

Day: S [✓ M] T W TH F S

On Site Hours	4.0
Travel Time	6.0
Office Time	—

COE Project Manager	Al Kam/Kevin Howe
Project	Iowa Army Ammunition Plant
Project No.	16169421.00201, 16169421.00301 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302
Contract No.	DACA45-96-D-0017, DO 65 DACA45-02-D-0003, DO 10 DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	Overcast X	Rain	Snow	
Temp	To 32 X	32-50	50-70	70-85	85 up	
Wind	Still	Moderate X	High			**Report No.**
Humidity	Dry	Moderate X	Humid			47

Subcontractors on Site:

~~Saberprobe - Tom Payton, Joe Combs, John Willinson, and Bruce Birge.~~ None

Pl~~ains Environmental Service - Jessie Kalvig and Darin DeGru~~son.

Equipment on Site:

~~DP Rigs, URS trucks, well materials, water levels, PIDs, FIDs, Freon detector, peristaltic pump, turbidity meters,~~ water tanks

~~Decon equipment, soil sampling equipment, water sampling equipment, PPE, paperwork.~~

Survey Equipment, Level, Rod, GPS, Abandonment tools

Visitors on Site:

URS Personnel on Site:

~~Corey Anderso~~n, Ryan Carpenter, ~~Dan Hatfield, Dave Breger, and Justin Covey.~~ BM, BO

Field Work Performed (including sampling):

Finish abandonment at Line 9

Pack equipment for De-mob.

Clean out URS trailer

left site

Quality Control Activities (including field calibration): none

Health and Safety and Activities: 5 min H&S meeting

Observations/Problems Encountered/Corrective Action Taken: none

Office Work Performed: none

By ~~Corey Anderson~~ RC **Title** Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 3-23-03

Day	S	M	T	W	TH	F	S
	☒						

On Site Hours	2.0
Travel Time	6.0
Office Time	—

Weather	Bright Sun	Clear ☒	Overcast	Rain	Snow
Temp	To 32	32-50	50-70 ☒	70-85	85 up
Wind	Still	Moderate ☒	High	**Report No.**	
Humidity	Dry	Moderate ☒	Humid	48	

COE Project Manager	Al Kam/Kevin Howe
Project	Iowa Army Ammunition Plant
Project No.	16169421.00201, 16169421.00301
	16169503.00101, 16169556.00101
	16169556.00201, 16169556.00302
Contract No.	DACA45-96-D-0017, DO 65
	DACA45-02-D-0003, DO 10
	DACA45-02-D-0003, DO 16

Subcontractors on Site:

~~Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen~~

Equipment on Site:

~~Drilling Rigs (Mobile 57 & Gus Pech 1000AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB~~, URS trucks, ~~well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment~~, ~~high pressure washer, water levels, soil sampling equipment~~ (2" & 3" split spoons), PPE, paperwork.

Visitors on Site: None.

URS Personnel on Site:

Corey Anderson, Dave Berger, Mike Sonderman, ~~Ryan Carpenter,~~

Field Work Performed (including sampling):

- Mob to Burlington
- Had meeting about SOW & WP, & HSP

Quality Control Activities (including field calibration): None

Health and Safety and Activities: non

Observations/Problems Encountered/Corrective Action Taken: none

Office Work Performed: none

By Corey Anderson **Title** Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 3-24-03

Day	S	M ☒	T	W	TH	F	S

On Site Hours 10.0
Travel Time —
Office Time —

COE Project Manager Al Kaim/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	Overcast ☒	Rain	Snow
Temp	To 32	32-50	50-70 ☒	70-85	85 up
Wind	Still	Moderate ☒	High	**Report No.**	
Humidity	Dry	Moderate ☒	Humid	49	

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen

Equipment on Site: CME-75
Drilling Rigs (~~Mobile~~57 & Gus Pech 1000AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment, high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.

Visitors on Site: Marilyn Smith (AO security), Tonya (Stone & Webster)

URS Personnel on Site:
Corey Anderson, Dave Berger, Mike Sonderman, ~~Ryan Carpenter.~~

Field Work Performed (including sampling):
Pick up equipment from Burlington.
Located and staked MW's @ FTP, Line 9, WBP, EBP.
Setup decon station @ Line 800 decon pad.

Quality Control Activities (including field calibration): Calibration of PID/FID

Health and Safety and Activities: Had Tailgate H&S meeting / Startup with Tonya
Marilyn Smith issued the work permits

Observations/Problems Encountered/Corrective Action Taken: none

Office Work Performed: paperwork

By Corey Anderson **Title** Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 3-25 03

Day	S	M	T	W	TH	F	S
			X				

On Site Hours 12.0
Travel Time –
Office Time –

Weather	Bright Sun	Clear	Overcast	Rain	Snow
		X			
Temp	To 32	32-50	50-70	70-85	85 up
			X		

Wind	Still	Moderate	High	Report No.
		X		
Humidity	Dry	Moderate	Humid	50
		X		

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen

Equipment on Site: CME 75
Drilling Rigs (~~Mobile~~ 57 & Gus Pech 1000AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment, high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.

Visitors on Site: none

URS Personnel on Site:
Corey Anderson, Dave Berger, Mike Sonderman, ~~Ryan Carpenter~~

Field Work Performed (including sampling):
FTP-MW1 - Drilled and Sampled overburden from 0 to 5.0 feet BGS with Gus Pech and 6⅝" ID HSAS.
FTP-MW1 - Drilled in bedrock from 5.0 to 16.0 feet BGS with Gus Pech and 6" AR Roller Bit.
FTP-MW1 - Collected geotech sample from 4.0 to 4.6' BGS + TOC sample FTP-MW1-05.
FTP-MW1 - Used 5.0 gallons of water during well installation.
L9-MW13 - Drilled and Sampled Till from 0 to 65 feet BGS with CME-75 + 4¼ ID HSAS.
L9-MW13 - collected geotech samples from 10-11, 20.5-21.5, 50.5-51.5, 59-59.5 and TOC
Samples L9-MW13 - 12, -22, -60.
FTP-MW1 - Installed well screen 6-16' bgs.

Quality Control Activities (including field calibration): Calibration check of PID + FID.

Health and Safety and Activities: Had 5 min H+S meeting.

Observations/Problems Encountered/Corrective Action Taken: Observed potential free product in soil samples from 20-30' BGS at L9-MW13 (presumed Freon 113).

Office Work Performed: paperwork

By Corey Anderson **Title** Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 3-26-03

Day	S	M	T	W	TH	F	S
				[✓ X]			

On Site Hours 12.5
Travel Time –
Office Time –

Weather	Bright Sun	Clear	[✓ Overcast]	Rain	Snow
Temp	To 32	32-50	[✓ 50-70]	70-85	85 up
Wind	Still	Moderate	[✓ High]	**Report No.** 51	
Humidity	Dry	[✓ Moderate]	Humid		

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen

Equipment on Site:
Drilling Rigs (~~Mobile~~ CME-75 57 & Gus Pech 1000AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment, high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.

Visitors on Site: Fire department to issue Hotwork Permit

URS Personnel on Site:
Corey Anderson, Dave Berger, Mike Sonderman, ~~Ryan Carpenter.~~

Field Work Performed (including sampling):
L9-MW13 – Drilled and sampled till from 65.0' to 85.0' feet BGS with CME-75 + 4¼" ID HSAS.
L9-MW13 – Collected geotech samples from 78.5-79.5, 84.5-85.0, and TOC samples L9-MW13-80
L9-MW13 – Installed screen from 80.0 – 85.0 ft BGS in Glacial Sands. (5' screen)
L9-MW13 - Used 35.0 gallons of water during installation.
FTP-MW6 (B) - Drilled from 0 to 24.5 feet BGS with Gus Pech + 10" RWB
FTP-MW6 (B) - Installed 6" steel casing to 24.5 feet BGS
Measured water levels at FTP + Line 9

Quality Control Activities (including field calibration): Calibration check of PID + FID

Health and Safety and Activities: Had 5 min H+S meeting

Observations/Problems Encountered/Corrective Action Taken: L9-MW13, drillers had problems installing Bentonite seal.

Office Work Performed: paperwork.

By Corey Anderson **Title** Field Manager

DAILY QUALITY CONTROL REPORT

Date 3-27-03

S	M	T	W	TH	F	S
				✓		

IAAAP F.S. Data Collection

On Site Hours	12.5
Travel Time	—
Office Time	—

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	Overcast ✓	Rain	Snow
Temp	To 32	32-50 ✓	50-70	70-85	85 up
Wind	Still	Moderate	High ✓	**Report No.**	
Humidity	Dry	Moderate ✓	Humid	52	

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen

Equipment on Site: cme 75
Drilling Rigs (~~Mobile~~ 57 & Gus Pech 1000AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment, high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.

Visitors on Site: None

URS Personnel on Site:
Corey Anderson, Dave Berger, Mike Sonderman, ~~Ryan Carpenter.~~

Field Work Performed (including sampling):
EBP-MW6(B) - Drilled from 0 to 23.4 feet BGS with GusPech and 10" RWB
EBP-MW6(B) - Installed and grout 6" Steel casing to 23.4 feet BGS.
EBP-MW5(B) - Drilled and sampled Till overburden from 0 - 12.0 feet BGS with GusPech and 6 5/8" ID HSAs
L9-MW12 - Drilled and Sampled from 0 to 60.0 feet BGS with CME-75 + 4 1/4 ID HSAs
L9-MW12 - Collected geotech samples from 25.5 -26.5, 56.5 - 57.5 and TOC Samples L9-MW12-27, -58.
EBP-MW5(B) - collected geotech sample from 4.1 - 4.8' BGS.
L9-MW12 - Installed intermediate till well screen from 50.0 - 60.0 feet BGS. 0 gall H2O used

Quality Control Activities (including field calibration): Calibration check of PID + FID

Health and Safety and Activities: Hd 5 min H+S meeting

Observations/Problems Encountered/Corrective Action Taken: None

Office Work Performed: paperwork.

By **Title** Field Manager

DAILY QUALITY CONTROL REPORT

Date 3-28-03

Day	S	M	T	W	TH	F	S
						X	

IAAAP F.S. Data Collection

On Site Hours 12.0
Travel Time –
Office Time –

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	Overcast X	Rain X	Snow
Temp	To 32	32-50 X	50-70	70-85	85 up
Wind	Still	Moderate X	High	**Report No.**	
Humidity	Dry	Moderate	Humid X	53	

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen

Equipment on Site: CME-75
Drilling Rigs (~~Mobile 57~~ & Gus Pech 1000AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment, high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.

Visitors on Site: None

URS Personnel on Site:
Corey Anderson, Dave Berger, Mike Sonderman, ~~Ryan Carpenter.~~

Field Work Performed (including sampling):
L9-MW11 - Drilled to 30.0 feet BGS with CME-75 and 4¼" ID HSAs
L9-MW11 - Installed Shallow fill well from 15.0 – 30.0' feet BGS.
L9-MW11 - Used 0 gallons of water during well installation.
~~EBP-MW5 - Drilled and sampled from to feet BGS with GusPech and 6 5/8" ID HSAs~~
EBP-MW5 - Drilled from 12.0 to 60.0 feet BGS in bedrock with GusPech and 6" AR
EBP-MW5 - Installed Shallow Groundwater (water table) well in bedrock from 35-45' BGS.
EBP-MW5 - Used 0 gallon of water during well installation.

Quality Control Activities (including field calibration): Calibration check of PID + FID

Health and Safety and Activities: Had 5 min H+S meeting

Observations/Problems Encountered/Corrective Action Taken: Over drilled portion of the boring was backfilled with Pellets (see EBP-MW5 & construction diagram for details)
Danny Moore noticed Pallets missing and the URS garden cart missing.

Office Work Performed:

By

Title Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 3-29-03

Day	S	M	T	W	TH	F	S
							X

On Site Hours	12.5
Travel Time	–
Office Time	–

COE Project Manager Al Kain/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	Overcast X	Rain	Snow X
Temp	To 32	32-50 X	50-70	70-85	85 up
Wind	Still	Moderate	High X	**Report No.**	
Humidity	Dry	Moderate X	Humid	54	

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen

Equipment on Site:
Drilling Rigs (~~Mobile 57~~ CME 75 & Gus Pech 1000AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment, high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.

Visitors on Site: Dean with Stone & webster. + Backhoe

URS Personnel on Site:
Corey Anderson, Dave Berger, Mike Sonderman, ~~Ryan Carpenter~~

Field Work Performed (including sampling):
L9-MW [illegible]1- Drilled [illegible] and Sampled to 70' BGS with CME-75 and 4¼ ID HSAs.
L9-MW [illegible]1- Installed intermediate till well from 55.0-65.0 ft. BGS.
L9-MW[illegible]- Collected Geotech Samples from 65.5 to 66.5 and TOC from 67' (L9-MW2-67
L9-MW13 - Bailed well and removed sediment and 8.0 gallons of water.
L9-MW2 - used [illegible] 40.0 gallons of water were used to install Well.

Quality Control Activities (including field calibration): Calibration Check of PID+FID
FID pump stopped working ~~[illegible]~~ so the unit was recalibrated and started working
ordered 2 more FID's

Health and Safety and Activities: Had 5min H+S meeting

Observations/Problems Encountered/Corrective Action Taken: The Gus Pech Rig got stuck moving off of EBP-MW5 at 0830, Dean with Stone + webster arriving with backhoe at 1600 hrs. Mike Sonderman went to hotel at 12:30 for the day. Security took report on theft at My

Office Work Performed: paperwork

By Corey Anderson **Title** Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 3-30-03

Day	S	M	T	W	TH	F	S
	✗						

On Site Hours 12.5
Travel Time —
Office Time —

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear ✗	Overcast	Rain	Snow
Temp	To 32	32-50 ✗	50-70	70-85	85 up
Wind	Still ✗	Moderate	High	**Report No.**	
Humidity	Dry	Moderate ✗	Humid	55	

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen

Equipment on Site:
Drilling Rigs (~~Mobile~~ CME 75 57 & Gus Pech 1000AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment, high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.

Visitors on Site: None

URS Personnel on Site:
Corey Anderson, Dave Berger, Mike Sonderman, ~~Ryan Carpenter.~~

Field Work Performed (including sampling):
L9-MW10 - Drilled and Sampled from 0 to 65.0' BGS with CME-75 and 4¼" ID HSAs
L9-MW10 - Collected Geotech Samples from 15.5-16.5, 23.5-24.5, 50.5-51.5, 58-58.5 and TOC Samples L9-MW10-17, -25, -52, -59.
L9-MW10 - Installed intermediate Till well from 51.5-61.5' bgs.
L9-MW10 - used 45 gallons of water during installation of well.
FTP-MW8(B) - Drilled to 27.7' BGS with Gus Pech and 10" RWB (rock at 22')
FTP-MW8(B) - Installed and grouted 6" Steel casing from 0 to 27.7' bgs.

Quality Control Activities (including field calibration): Calibration check of PID + FID.

Health and Safety and Activities: Had 5 min H&S meeting

Observations/Problems Encountered/Corrective Action Taken: None

Office Work Performed: paper-work, setup spread sheet, Geotech Login, Development Record.

By Corey Anderson **Title** Field Manager

DAILY QUALITY CONTROL REPORT

Date 3-31-03

Day	S	M	T	W	TH	F	S
		X					

IAAAP F.S. Data Collection

On Site Hours	12.0
Travel Time	–
Office Time	–

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear X	Overcast	Rain	Snow
Temp	To 32	32-50	50-70 X	70-85	85 up
Wind	Still	Moderate X	High	**Report No.**	
Humidity	Dry	Moderate X	Humid	56	

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen

Equipment on Site:
Drilling Rigs (CME 75 ~~Mobile 57~~ & Gus Pech 1000AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment, high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.

Visitors on Site: None.

URS Personnel on Site:
Corey Anderson, Dave Berger, Mike Sonderman, ~~Ryan Carpenter.~~

Field Work Performed (including sampling):
WBP-MW2- Drilled and Sampled to 7.4' BGS w/ 10" RWB and Gus pech Rig (TOP of Rock)
WBP-MW2- Drilled from 7.4 to 18.0 w/ Gus Pech Rig and 10" RWB (Bedrock)
WBP-MW2- Installed and grouted 6" Steel casing. from 0 to 18.0' bgs.
L9-MW9 - Drilled to 28' with CME-75 + 4¼" ID HSA's
L9-MW9 - Installed ~~intermediate~~ Shallow till well from 12.5-27.5' BGS.
L9-MW9 - used 0 gallons of water during installation.
L9-MW6 - Drilled and sampled to 61.0 BGS with CME-75 + 4¼" ID HSAS
L9-MW6 - Collected geotech samples at 10.5-11.5, 18.0-19.5, 50.5-51.5, 58.5-59.5 and TOC Samples L9-MW6-12, -20, -52, -60. - Installed well screen 50-60 ([illegible]), 20 gallons used

Quality Control Activities (including field calibration): Calibration check of PID + FID

Health and Safety and Activities: Had 5 min H+S meeting, Discussed Freon 113 issues w/ drillers at WBPA

Observations/Problems Encountered/Corrective Action Taken: Discussed IDW disposal with Debra Wallin and Dean (Stone + Webster). Dean identified the area for Soil Cutting disposal at TrenCo.

Office Work Performed: paperwork

By Corey Anderson **Title** Field Manager

DAILY QUALITY CONTROL REPORT

Date 4-1-03

Day	S	M	T	W	TH	F	S
			☒				

IAAAP F.S. Data Collection

On Site Hours	13.0
Travel Time	–
Office Time	–

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun ☒	Clear ☒	Overcast	Rain	Snow
Temp	To 32	32-50	50-70 ☒	70-85 ☒	85 up
Wind	Still	Moderate ☒	High ☒	**Report No.**	
Humidity	Dry	Moderate ☒	Humid	57	

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen

Equipment on Site: CME 75
Drilling Rigs (~~Mobile 57~~ & Gus Pech 1000AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment, high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.

Visitors on Site: None

URS Personnel on Site:
Corey Anderson, Dave Berger, Mike Sonderman, ~~Ryan Carpenter~~.

Field Work Performed (including sampling):
L9-MW5 - Drilled to 25' with CME-75 + 4¼" ID HSAs
L9-MW5 - Installed shallow till well from 10.0-25.0' BGS
L9-MW5 - used 0 gallons of water during well installation.
L9-MW4 - Drilled and sampled to 65' BGS with CME-75 + 4¼" ID HSAs.
L9-MW4 - Collected geotech samples at 10.5-11.5, 26.0-26.5, and continously sampled with CME sampler and liners, retained ~~and~~ and capped all liners. Collected TOC
L9-MW4 - Installed intermediate till well from 54.8 to 64.8' BGS
L9-MW4 - used 0 gallons of water during installation
WBP-MW1 - Drilled and sampled from 0 to 6.0' feet BGS with 10" RWB + Gus Pech (Till overburden) (over)

Quality Control Activities (including field calibration): Calibration of Both FIDS and PID.

Health and Safety and Activities: Had 5 min H+S meeting

Observations/Problems Encountered/Corrective Action Taken: none

Office Work Performed: paperwork

By Corey Anderson **Title** Field Manager

Date 4-1-03 Report No. 57

WBP-MW1 - Drilled from 60 to 17.0' feet bgs with Gus Pech + 10' RWB (Bedrock)

WBP-MW1 - Installed and grouted 6" steel casing from 0 to 23.0' feet BGS.

WBP-MW3 - Drilled and Sampled from 0 to 15.0' feet BGS w/ Gus pech + 10" RWB (Till/overburden (Fill))

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 4-2-03

Day	S	M	T	W	TH	F	S
	☐	☐	☐	☒	☐	☐	☐

On Site Hours 7.0
Travel Time –
Office Time –

Weather	Bright Sun	Clear	Overcast	Rain	Snow
	☒	☒	☐	☐	☐
Temp	To 32	32-50	50-70	70-85	85 up
	☐	☐	☒	☒	☐
Wind	Still	Moderate	High		
	☐	☒	☐		
Humidity	Dry	Moderate	Humid		
	☐	☒	☐		

Report No. 58

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen

Equipment on Site: CME-75
Drilling Rigs (~~Mobile 57~~ & Gus Pech 1000AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment, high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.

Visitors on Site: None

URS Personnel on Site:
Corey Anderson, Dave Berger, Mike Sonderman, ~~Ryan Carpenter.~~

Field Work Performed (including sampling):
L9-MW3 - Drilled to 29.5 feet BGS with CME-75 and 4¼" ID HSAs.
L9-MW3 - Installed well screen from 14.0 - 29.0 feet BGS.
L9-MW3 - Used 0 gallons of water during installation
WBP-MW3 - Drilled from 15.0' BGS to 23.0' BGS with Gus Pech + 10" RWB (Fill/Till overburden)
WBP-MW3 - Drilled from 23.0 to 29.0' BGS with Gus Pech + 10" RWB (Bedrock)
WBP-MW3 - Installed and grouted 6" steel casing from 0 to 29.0' BGS.

Quality Control Activities (including field calibration): Calibration check of PID & FID

Health and Safety and Activities: Had 5min H+S meeting

Observations/Problems Encountered/Corrective Action Taken: None

Office Work Performed: paperwork

By Corey Anderson **Title** Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 4-7-03

Day	S	M	T	W	TH	F	S
		✓					

On Site Hours 7.0
Travel Time —
Office Time —

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	Overcast ✓	Rain ✓	Snow ✓
Temp	To 32	32-50 ✓	50-70	70-85	85 up
Wind	Still	Moderate ✓	High	**Report No.**	
Humidity	Dry	Moderate	Humid ✓	59	

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen

Equipment on Site: CME-75
Drilling Rigs (Mobile 57 ~~& Gus Pech 1000AR~~) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment, high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.

Visitors on Site: None

URS Personnel on Site:
Corey Anderson, Dave Berger, Mike Sonderman, ~~Ryan Carpenter~~. Brian Osborn (Started Development)

Field Work Performed (including sampling):
L9-MW2 - Drilled and sampled from 0 to 35' BGS with CME75 and 4¼" ID HSAS (Till)
WBP-SB01 - Drilled and sampled from 0 - 9.0' BGS with Mobile 57 and 4¼" ID HSA (Top of Rock
L9-MW13 - Developed out 14.0 gallon with Bailing and pumping
L9-MW6 - Bailed 3.0 gallons of water
L9-MW2 - Collected geotech Samples 12.5-13.5, 18.5-19.5, 35.5-30.5 + TOC samples L9-MW2-14, -20, -37.
WBP-SB01 - collected geotech sample 2.9-3.5' bgs.

Quality Control Activities (including field calibration): Calibration check of PIDs, FIDs, Turbidity meter, Horiba U-10 water quality meter.

Health and Safety and Activities: Had safety meeting with Brian Osborn + Had 5 min H+S meeting with drillers and crew

Observations/Problems Encountered/Corrective Action Taken: none

Office Work Performed: paperwork

By Corey Anderson **Title** Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 4-8-03

Day	S	M	T	W	TH	F	S
			X				

On Site Hours	12.5
Travel Time	–
Office Time	–

Weather	Bright Sun	Clear	Overcast	Rain	Snow
			X		

Temp	To 32	32-50	50-70	70-85	85 up
		X			

Wind	Still	Moderate	High
		X	

Humidity	Dry	Moderate	Humid
		X	

Report No. 60

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen

Equipment on Site:
Drilling Rigs (Mobile 57 & ~~Gus Pech 1000AR~~ CME-75) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment, high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.

Visitors on Site: Matt with AO utility locate service

URS Personnel on Site:
Corey Anderson, Dave Berger, Mike Sonderman, ~~Ryan Carpenter~~. Brian Osborn

Field Work Performed (including sampling):
MBP-SB01 - Cored from 8.8' to 50.2' BGS and grouted hole
L9-MW2 - Drilled and sampled from 35' to 100.0 BGS with CME-75 & 4¼" ID HSAs (TH)
L9-MW2 - used 35.0 gallons of water during installation
L9-MW2 - Installed well screen from 94.0 to 99.0 feet BGS, sand & grouted.
L9-MW2 - Collected geotech samples at 50.5 - 51.5, 55.5 - 56.5, 60.5 - 61.5, 88.6 - 89.3,
97.0 - 97.6, 97.6 - 98.3 + TOC Samples L9-MW2-52, -57, -62
L9-MW3 - completed development
L9-MW5 - completed development.

Quality Control Activities (including field calibration): Calibration check of PID, FID, Horiba U-10

Health and Safety and Activities: Had 5 min H+S meeting

Observations/Problems Encountered/Corrective Action Taken: None

Office Work Performed: paperwork

By Corey Anderson **Title** Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 4-9-03

Day	S	M	T	W	TH	F	S
				X			

On Site Hours	11.5
Travel Time	–
Office Time	–

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun X	Clear X	Overcast	Rain	Snow
Temp	To 32	32-50 X	50-70	70-85	85 up
Wind	Still	Moderate X	High	**Report No.**	
Humidity	Dry	Moderate X	Humid	61	

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen

Equipment on Site: CME-75
Drilling Rigs (Mobile 57 & ~~Gus Pech 1000AR~~) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment, high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.

Visitors on Site: None

URS Personnel on Site:
Corey Anderson, Dave Berger, Mike Sonderman, ~~Ryan Carpenter~~. Brian Osborn

Field Work Performed (including sampling):
L2-MW4 - Drilled and Sampled from 0 to 35' BGS with CME-75 + 4¼" ID HSAs
L2-MW4 - Collected geotech samples from 24.4-25.0 + 34.5-35.0 ~~+ TOC L2-MW4 42 + 50~~
WBP-MW1 - Cored and Reamed (6" Roller Bit) from 22.9 to 46.2 with ATV Mobile 57 + 2"N Core and 6" Roller bit.
WBP-MW1 - Installed well screen from 35-45' BGS + set protective casing after grouting.
WBP-MW1 - Used 270 gallons of water during install
L9-MW12, -MW3, -MW4 - Completed development.
L9-MW11 - continued development.

Quality Control Activities (including field calibration): Calibration check of PID, FID, Horiba U-10

Health and Safety and Activities: Had 5 min H+S meeting

Observations/Problems Encountered/Corrective Action Taken: None.

Office Work Performed: paperwork

By **Title** Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 4-10-03

Day	S	M	T	W	TH	F	S
					☒		

On Site Hours 11
Travel Time —
Office Time —

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun ☒	Clear ☒	Overcast	Rain	Snow
Temp	To 32	32-50 ☒	50-70	70-85	85 up
Wind	Still	Moderate ☒	High	**Report No.** 6~~1~~2	
Humidity	Dry	Moderate ☒	Humid		

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen

Equipment on Site: CME-75
Drilling Rigs (Mobile 57 & ~~Gus Pech 1000AR~~) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment, high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.

Visitors on Site: None

URS Personnel on Site:
~~Corey Anderson,~~ Dave Berger, Mike Sonderman, ~~Ryan Carpenter~~. Brian Osborn

Field Work Performed (including sampling):
L2-mw4 - Drilled and sampled To 50.0' BGS with CME-75; 4¼" ID HSAs; geotech samples from 40.5-41.5; 48.5-~~49.5~~ 49.5'; TOC Samples L2-mw4-42, -50; used 1.5 gallons of water during installation. Installed well screened from 40-50' BGS
L9-mw9, L9-mw11 - Completed development
L9-mw6, L9-mw1, L9-mw10 - continued development
L9-mw3, L9-mw4, L9-mw9 - began well completions
WBP-mw2 - cored from 18-41' BGS. Reamed with 6" tricone To 40.9'. Installed well screen 30.5-40.5'.
WBP-mw1 - Began development

Quality Control Activities (including field calibration): Calibration check of PID; FID; Horiba U-10

Health and Safety and Activities: Had 5 min. H&S meetings

Observations/Problems Encountered/Corrective Action Taken: None

Office Work Performed: paperwork

By

Title ~~Field Manager~~ Geologist

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 4-11-03

Day	S	M	T	W	TH	F	S.
						X	

On Site Hours	11.5
Travel Time	—
Office Time	—

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear X	Overcast	Rain	Snow
Temp	To 32	32-50	50-70	70-85 X	85 up
Wind	Still	Moderate X	High	**Report No.**	
Humidity	Dry	Moderate X	Humid	3 6	

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen

Equipment on Site: CME-75
Drilling Rigs (Mobile 57 & ~~Gus Pech 1000AR)~~ and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment, high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.

Visitors on Site: None

URS Personnel on Site:
~~Corey Anderson,~~ Dave Berger, Mike Sonderman, ~~Ryan Carpenter.~~ Brian Osborn

Field Work Performed (including sampling):
~~L2~~ L3-MW2 - Drilled and sampled To 50' BGS with CME-75 ; 4¼" ID HSAs; geotech samples from: 7.0-8.0, 10.0-11.0, 16.2-16.7, 27.0-28.0, 30.0-33.0, 39.5-40.0, 40.5-41.5, 43.5-44.0, 49.0-49.5; TOC samples at 42 ; 50'; Installed well screened from 49.7-39.7' BGS.
L3-MW1 - Drilled and sampled To 37' BGS with CME-75 ; 4¼" ID HSAs; geotech samples from: 7.0-8.0, 11.3-11.8, 18.2-15.7, 20.5-21.5, 35.5-36.5 + TOC at 22 + 37' BGS.
L9-MW1, L9-MW6, L9-MW10 - Continued development / L9-MW2 - Began development
L9-MW's 5, 6, 11, 12, 13, 3, 4, 9 - Well completions
WBP-MW3 - Cored from 29.0 - ~~50.0~~ 51.1'. Installed well screened from 40.5 - 50.0'

Quality Control Activities (including field calibration): Calibration of FID; PID ; Horiba U-10

Health and Safety and Activities: Held 5 min H ; S meetings

Observations/Problems Encountered/Corrective Action Taken:
Horiba U-10 ceased operation

Office Work Performed: paperwork

By

Title ~~Field Manager~~ Geologist

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 4/12/03

Day	S	M	T	W	TH	F	S
							X

On Site Hours	11.5
Travel Time	–
Office Time	–

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun X	Clear	Overcast	Rain	Snow
Temp	To 32	32-50	50-70 X	70-85	85 up
Wind	Still	Moderate X	High	**Report No.**	
Humidity	Dry	Moderate X	Humid	6~~5~~4	

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen

Equipment on Site: CME-75
Drilling Rigs (Mobile 57 & ~~Gus Pech 1000AR~~) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment, high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.

Visitors on Site: None

URS Personnel on Site:
~~Corey Anderson,~~ Dave Berger, Mike Sonderman, ~~Ryan Carpenter~~. Brian Osborn

Field Work Performed (including sampling):
L3-MW1 - Drilled and sampled To 55' BGS with CME-75 : 4 1/4" ID HSAs; geotech samples from: 40.5-41.5', 48.5-49.5', 51.5-52.0', 54.2-54.7'; TOC samples from 42' : 50'; Installed well screened from 55.7-45.7'
L9-MW1, L9-MW10, L9-MW6, FTP-MW1 - Completed development
L9-MW2, WBP-MW2(A) - Continued development
L9-MW1, L9-MW2, L9-MW9, L9-MW10 - Continued well completions
EBP-MW6(B) - cored from 23.0 - 75.6'. Installed well screened from 65.1-75.1'.

Quality Control Activities (including field calibration): Calibrated FID, PID, : Horiba U-10

Health and Safety and Activities: 5 minute H:S meetings

Observations/Problems Encountered/Corrective Action Taken:
Auger strip separated during installation of L3-MW1. Removed [redacted], redrilled (cleaned) boring and completed well installation

Office Work Performed: paperwork

By

Title ~~Field Manager~~ Geologist

DAILY QUALITY CONTROL REPORT

Date 4/13/03

Day	S	M	T	W	TH	F	S
	☒						

IAAAP F.S. Data Collection

On Site Hours 10.0
Travel Time —
Office Time —

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun ☒	Clear	Overcast	Rain	Snow
Temp	To 32	32-50	50-70 ☒	70-85	85 up
Wind	Still	Moderate ☒	High	**Report No.**	
Humidity	Dry	Moderate ☒	Humid	65	

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen

Equipment on Site:
Drilling Rigs (Mobile 57 & ~~Gus Pech 1000AR~~ CME-75) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment, high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.

Visitors on Site: None

URS Personnel on Site:
~~Corey Anderson~~, Dave Berger, Mike Sonderman, ~~Ryan Carpenter~~ Brian Osborn

Field Work Performed (including sampling):
FTP-MW4(B) - Drilled and sampled To 27' with CME-75 & 4 1/4" ID HSAs; geotech samples collected from 25.5-26.5 & 15.5-16.5,' TOC samples collected at 17 & 26'; Rotary wash bored To 37' BGS. Set and grouted 6" steel casing at 37' BGS (used 7 7/8 bit to Ream hole)
L3-MW1 - Finish completion
L3-MW2, WBP-MW3(B) - Began development
WBP-MW1(B), WBP-MW2(B), L9-MW2 - Continued development
FTP-MW6(B) - Cored from 24.6-50.0'

Quality Control Activities (including field calibration): Calibrated FID, PID, & Horiba U-10

Health and Safety and Activities: 5 minute H&S meetings

Observations/Problems Encountered/Corrective Action Taken: None

Office Work Performed: Paperwork

By **Title** Geologist ~~Field Manager~~

DAILY QUALITY CONTROL REPORT

Date 4-14-03

Day	S	M	T	W	TH	F	S
		☒					

IAAAP F.S. Data Collection

On Site Hours 12.0
Travel Time —
Office Time —

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear ☒	Overcast	Rain	Snow
Temp	To 32	32-50	50-70	70-85 ☒	85 up
Wind	Still	Moderate	High ☒	**Report No.** 6~~7~~6	
Humidity	Dry	Moderate	Humid ☒		

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen

Equipment on Site:
Drilling Rigs (Mobile 57 & ~~Gus Pech 1000AR~~ CME-75) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment, high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.

Visitors on Site: None

URS Personnel on Site:
Corey Anderson, Dave Berger, Mike Sonderman, ~~Ryan Carpenter~~. Brian Osborn

Field Work Performed (including sampling):
FTP-MW6(B) - Reamed corehole with ORV + 6" AR from 24.5' to 45' bgs, set well screen from 35.8'-45.8' BGS.
FTP-MW5 - Drilled and sampled to 15' with ORV + 4¼" ID HSAs, collected geotech samples from 0.2-1.2, 5.4-6.4, 11.0-12.0, 12.0-14.4 + TOC sample from FTP-MW5-11, Installed screen (5') from 9.4'-14.4' bgs
L2-MW5 - Drilled and sampled with CME-75 + 4¼" ID HSAs from 0 to 51' bgs, collected geotech samples from 11-12, 24-24.5, 34-35, 36.2-37.2, 40.5-41.5, 44-45, 48-50. Installed well screen from 40.5'-50.5'. Collected TOC sample FTP-MW5-42.
Continued development at WBP-MW1, -MW2, -MW3, EBP-MW5, + L9-MW2. Started development at EBP-MW6, L3-MW1, L2-MW4 (Ove

Quality Control Activities (including field calibration): Calibration check of PID, FID, Horiba U-10

Health and Safety and Activities: Had 5 min H+S meeting

Observations/Problems Encountered/Corrective Action Taken: None

Office Work Performed: paperwork

By **Title** Field Manager

Date 4-14-03 Report No. 66

FTP-MW2 - Drilled and Sampled from 0 - 7.2 w ORU + 6 $\frac{5}{8}$" IDHSAS to top of bedrock, collected geotech sample at 6.0-7.0' bgs, collected TOC sample FTP-MW2-07

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 4-15-03

Day	S	M	T ✗	W	TH	F	S

On Site Hours	12.0
Travel Time	—
Office Time	—

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear ✗	Overcast	Rain	Snow
Temp	To 32	32-50	50-70 ✗	70-85 ✗	85 up
Wind	Still	Moderate	High ✗	**Report No.**	
Humidity	Dry	Moderate ✗	Humid ✗	687	

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen

Equipment on Site:
Drilling Rigs (Mobile 57 & ~~Gus Pech 1000AR~~ CME-75) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment, high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.

Visitors on Site: None

URS Personnel on Site:
Corey Anderson, Dave Berger, Mike Sonderman, ~~Ryan Carpenter.~~ Brian Osborn

Field Work Performed (including sampling):
L2-MW7 - Drilled and Sampled to 50.0' bgs with CME-75 + 4¼" ID HSAs, installed wellscreen from 39.5-49.5' bgs, used 5.0 gallons of water during installation, collected geotech samples at 10.0-11.0, 18.0-19.0, 40.0-41.0, 48.5-49.5. Entire boring in liners. Collected TCL samples L2-MW7-11, -19, -41, -50.
~~L2~~FTP-MW2 - Drilled from 7.2 - 17.4 with 6" RWB, set wellscreen from 6.9-16.9' bgs used 0 gallons of water during installation
FTP-MW3 - Drilled and Sampled from 0 to 5.8' bgs with ORV + 6⅝" ID HSAs, ~~install~~ collected geotech sample at 4.0-5.0' bgs. Collected TCL FTP-MW3-06, Drilled from 5.8' to 21.0' bgs with 6" AR, set well from 10.5-20.5' bgs, used 0 gallons of water during install (over

Quality Control Activities (including field calibration): Calibration check of PID, FID, Horiba-U10

Health and Safety and Activities: 5 min H+S meeting

Observations/Problems Encountered/Corrective Action Taken: None

Office Work Performed: paperwork

By **Title** Field Manager

Date 4-15-03 Report No. 67

Finished development at WBP-MW2, EBP-MW5

Continued development at L9-MW2, WBP-MW1, EBP-MW6

over. L2-MW6 - Drilled with CME-75 + 4¼" IDHSAs. to 20.5, installed well screen from 9.9-19.9' bgs, used 0 gallons of water.

DAILY QUALITY CONTROL REPORT

Date 4-16-03

Day	S	M	T	W	TH	F	S
				☒			

IAAAP F.S. Data Collection

On Site Hours	8.5
Travel Time	–
Office Time	–

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	Overcast ☒	Rain ☒	Snow
Temp	To 32	32-50 ☒	50-70	70-85	85 up
Wind	Still	Moderate ☒	High	**Report No.**	
Humidity	Dry	Moderate	Humid ☒	68	

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen

Equipment on Site: CME-75
Drilling Rigs (Mobile 57 & ~~Gus Pech 1000A~~R) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment, high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.

Visitors on Site: Dean with Stone & Webster installed culvert at L2-MW8(B)

URS Personnel on Site:
Corey Anderson, Dave Berger, Mike Sonderman, ~~Ryan Carpenter~~ Brian Osborn

Field Work Performed (including sampling):
FTP-MW7 - Drilled and sampled to 21.5' bgs with CME-75 & 4¼" ID HSAs, Collected geotech samples at 9.5-10.5, 18.5-19.5 & 20.8-21.5, TOC samples at FTP-MW7 ~ 11' & ~20', installed well screen from 11.0-21.0' bgs, used 0 gallons of water during installation.
EBP-MW4 - Rig set up.
Started development at FTP-MW5 & 6
Continued development at WBP-MW1 & EBP-MW6
Completed development at L2-MW5
Installed culvert at L2-MW8(B) → near 6-15.

Quality Control Activities (including field calibration): Calibration check of PID, FID, Horiba U-10

Health and Safety and Activities: 5 Min H&S meeting

Observations/Problems Encountered/Corrective Action Taken: Installed culvert in small ditch west of Brush creek near Line 3 for access to 6-15.

Office Work Performed: paperwork

By Corey Anderson **Title** Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 4-21-03

Day	S	M	T	W	TH	F	S

On Site Hours	7.0
Travel Time	—
Office Time	—

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	Overcast X	Rain X	Snow
Temp	To 32	32-50 X	50-70	70-85	85 up
Wind	Still	Moderate	High X	**Report No.**	
Humidity	Dry	Moderate X	Humid	7069	

Subcontractors on Site:

Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen

Equipment on Site:

Drilling Rigs (Mobile 57 & ~~Gus Pech 1000A~~ CME-25 R) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment, high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.

Visitors on Site: None

URS Personnel on Site:

Corey Anderson, Dave Berger, Mike Sonderman, ~~Ryan Carpenter.~~ Brian Osborn

Field Work Performed (including sampling):

EBP-MW4 → Drilled and sampled from 0 to 24.0' bgs with ORV-57 and 6 5/8' ID HSAs (overburden),
dry cored from 24.0 to 45.4 'bgs with 2" N-series equipment. Collected geotech at 18.0 to 19.9' bgs.
Started development at FTP-MW2, FTP-MW3, FTP-MW7.
Continued development at L9-MW2, WBP-MW1, WBP-MW3.
Set up CME at FTP-MW8 for core, ream, + well.

Quality Control Activities (including field calibration): Calibrate PID, FID, water quality probe (Horiba U-10), Turbidity Meter,

Health and Safety and Activities: 5 min H+S meeting, discussed hunting season and orange vest.

Observations/Problems Encountered/Corrective Action Taken: After 5 days L9-MW2 has recharge up to 70' bgs ~ 30' of water in well, and WBP-MW3 has recharged up to 45 'bgs ~ 6.0 'of water in well.

Office Work Performed: paperwork

By **Title** Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 4-22-03

Day	S	M	T	W	TH	F	S
			☒				

On Site Hours 11.5
Travel Time –
Office Time –

Weather	Bright Sun	Clear	Overcast	Rain	Snow
	☒				
Temp	To 32	32-50	50-70	70-85	85 up
		☒	☒		
Wind	Still	Moderate	High	**Report No.**	
		☒		70	
Humidity	Dry	Moderate	Humid		
		☒			

COE Project Manager Al Kain/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen

Equipment on Site:
Drilling Rigs (Mobile 57 & ~~Gus Pech 1000AR~~ CME-75) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment, high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.

Visitors on Site: None

URS Personnel on Site:
Corey Anderson, Dave Berger, Mike Sonderman, ~~Ryan Carpenter~~. Brian Osborn

Field Work Performed (including sampling):
EBP-MW4 – Reamed from 24.0 to 45.4' bgs with ARV-57 + 6" AR, Installed well from 34.5 to 44.5.
FTP-MW8 – Cored from 27.7' to 52.2' with CME-75 and 2" N series core equipment.
Completed development at L2-MW6, L2-MW7, and FTP-MW5.
Continued development at L2-MW4, EBP-MW6.

Located Spring Creek Staff Gauges. (SC-SG 01 through 07)

Quality Control Activities (including field calibration): Calibration check of PID, FID, Horiba and Turbidity meter.

Health and Safety and Activities: 5 min H&S meeting

Observations/Problems Encountered/Corrective Action Taken: ~~None~~ Driller Jay Joslyn left the site at 1500hrs to pick up some medication and will not be back to the site until 4-23-03

Office Work Performed: paperwork.

By Corey Anderson **Title** Field Manager

DAILY QUALITY CONTROL REPORT

Date 4-23-03

Day	S	M	T	W	TH	F	S
				✓			

IAAAP F.S. Data Collection

On Site Hours 12.5
Travel Time –
Office Time –

COE Project Manager Al Kaim/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun ✓	Clear ✓	Overcast	Rain	Snow
Temp	To 32	32-50	50-70 ✓	70-85	85 up
Wind	Still	Moderate ✓	High	**Report No.**	
Humidity	Dry	Moderate ✓	Humid	72	

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen

Equipment on Site:
Drilling Rigs (Mobile 57 & ~~Gus Pech 1000AR~~ CME-75) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment, high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.

Visitors on Site: Gary Kuminski (AO Safety) extended Line 3 workpermit

URS Personnel on Site:
Corey Anderson, Dave Berger, Mike Sonderman, ~~Ryan Carpenter~~. Brian Osborn

Field Work Performed (including sampling):
FTP-MW8 – Reamed with CME-75 + 6" AR from 27.7-52.1, installed well screen from 41.1' to 51.1' bgs.
FTP-MW4 – Cored with CME-75 + 2" N-series core barrel from 37.5 to 60.7' bgs.
L9-MW8 – Drilled and sampled to 60.0' bgs with ORV and 4" ID HSAs, collected geotech at 11-11.5, 20.5-21.5, 50.5-51.5 + TOC samples at L9-MW8-12, -22, and -52. Installed well screen from 47.0-57.0' bgs.
L9-MW7 – Drilled and sampled to 29.9' bgs with ORV + 4" ID HSAs, collected geotech at 27.5-28.5 + TOC at L9-MW7-29. Installed well screen from 14.4' to 29.4' bgs
Finished development at L3-MW2, continued at EBP-MW5, WBP-MW1, FTP-MW2, FTP-MW3, FTP-MW6, L3-MW1.

Quality Control Activities (including field calibration): Calibration of PID, FID, Horiba U-10, turbidity

Health and Safety and Activities: 5 min H&S meeting

Observations/Problems Encountered/Corrective Action Taken: None.

Office Work Performed: paperwork

By **Title** Field Manager

DAILY QUALITY CONTROL REPORT

Date 4-24-03

Day	S	M	T	W	TH	F	S
					X		

IAAAP F.S. Data Collection

On Site Hours 11.0
Travel Time —
Office Time —

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	Overcast X	Rain X	Snow
Temp	To 32	32-50 X	50-70	70-85	85 up
Wind	Still	Moderate X	High	**Report No.**	
Humidity	Dry	Moderate	Humid X	7~~3~~2	

Subcontractors on Site:

Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen Dennis Auld left site at 3pm

Equipment on Site:

Drilling Rigs (Mobile 57 & Gus Pech 1000AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment, high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.

Visitors on Site: Fire Department extended the Hot work permit to 5-1-03
Rodger Allison (IAAAP) + Melanie Mutchler (AKM) observed well drilling at L2-MW8(B)

URS Personnel on Site:

Corey Anderson, Dave Berger, Mike Sonderman, ~~Ryan Carpenter~~. Brian Osborn

Field Work Performed (including sampling):

FTP-MW4 - Reamed with CME-75 + 6" ~~RWB~~ AR from 37.5' to 60.4' bgs, installed well screen from 49.4' to 59.4' bgs.
L2-MW8 - Drilled and sampled with ORV + 8¼" ID HSAs to 57.5' bgs., grouted hole
Continued development at L9-MW2, L3-MW1, FTP-MW2, WBP-MW1, EBP-MW4, EBP-MW6

Quality Control Activities (including field calibration): Calibrate PID, FID, Horiba U-10, Turbidity

Health and Safety and Activities: 5 min H&S meeting

Observations/Problems Encountered/Corrective Action Taken: Cleared out brush around G-15

Office Work Performed: paperwork

By **Title** Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 4-25-03

Day	S	M	T	W	TH	F	S
						X	

On Site Hours 11.0
Travel Time –
Office Time –

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	Overcast X	Rain X	Snow
Temp	To 32	32-50	50-70 X	70-85	85 up
Wind	Still	Moderate X	High	**Report No.**	
Humidity	Dry	Moderate	Humid X	7~~4~~3	

Subcontractors on Site: ✓
Aquadrill - Jay Joslyn, ~~Dennis Auld~~, Danny Moore, Scott Elsinger, Mark Claassen

Equipment on Site:
Drilling Rigs (Mobile 57 & CME-75 ~~Gus Pech 1000~~AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment, high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork. , Compressor + Rock hammer

Visitors on Site: None

URS Personnel on Site:
Corey Anderson, Dave Berger, Mike Sonderman, ~~Ryan Carpenter~~. Brian Osborn

Field Work Performed (including sampling):
~~FTP~~ L2-MW8 - set 6" casing with ORV to 58.1 'bgs.
Installed SC-SG01
Completed development at FTP-MW7
continued development at L9-MW7, L3-MW1, L2-MW4, FTP-MW2, FTP-MW8, WAP-MW1

Quality Control Activities (including field calibration): Calibration check of PID, FID, Horiba U-10, Turbidity

Health and Safety and Activities: 5 min H+S meeting

Observations/Problems Encountered/Corrective Action Taken: None

Office Work Performed: paperwork

By **Title** Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 4-26-03

Day	S	M	T	W	TH	F	S
							✓

On Site Hours 11.5
Travel Time —
Office Time —

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun ✓	Clear ✓	Overcast	Rain	Snow
Temp	To 32	32-50	50-70	70-85 ✓	85 up
Wind	Still ✓	Moderate	High	**Report No.**	
Humidity	Dry	Moderate ✓	Humid	754	

Subcontractors on Site: 9
Aquadrill - Jay Joslyn, ~~Dennis Auld~~, Danny Moore, Scott Elsinger, Mark Claassen

Equipment on Site:
Drilling Rigs (Mobile 57 & ~~Gus Pech 1000~~ CME-75 AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment, high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork. Compressor & Rock hammer

Visitors on Site: None

URS Personnel on Site:
Corey Anderson, Dave Berger, Mike Sonderman, ~~Ryan Carpenter~~. Brian Osborn Mike Sonderman left site

Field Work Performed (including sampling):
L2-MW8 - cored + Reamed with ORV + 2" Nseries + 6" RWB from 58.5 to 80.5 (cored), 58.5-81.9 (reamed)
set well from 71.4 - 81.4' bgs
Installed SC-SG02, SC-SG03, BC-SG01
Continued development at L3-MW1, FTP-MW2, FTP-MW8, FTP-MW4.

Quality Control Activities (including field calibration): Calibration check of PID, FID, Horiba U-10, turbidity

Health and Safety and Activities: 5 min H&S meeting

Observations/Problems Encountered/Corrective Action Taken: ~~none~~ Completed all drilling.

Office Work Performed: paperwork

By **Title** Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 4-27-03

Day	S	M	T	W	TH	F	S
	X						

On Site Hours 11.0
Travel Time —
Office Time —

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun X	Clear X	Overcast	Rain	Snow
Temp	To 32	32-50	50-70	70-85 X	85 up
Wind	Still	Moderate X	High	**Report No.**	
Humidity	Dry	Moderate X	Humid	785	

Subcontractors on Site:
Aquadrill - Jay Joslyn, ~~Dennis Auld~~, Danny Moore, Scott Elsinger, Mark Claassen

Equipment on Site:
Drilling Rigs (Mobile 57 & ~~Gus Pech 1000AR~~ CME-75) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment, high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork. Compressor + Rock hammer

Visitors on Site: None

URS Personnel on Site:
Corey Anderson, Dave Berger, ~~Mike Sonderman~~, ~~Ryan Carpenter~~. Brian Osborn

Field Work Performed (including sampling):
Installed BC-SG02, BC-SG03, BC-SG04, SC-SG06
Completed development at FTP-MW2, FTP-MW8, E9-MW7
Continued development at L9-MW7, L3-MW1, FTP-MW6, FTP-MW3, WBP-MW1, EBP-MW4
FTP-MW4, L2, MW8.

Quality Control Activities (including field calibration): Calibration check of PID, FID, Horiba U10, Turbidity

Health and Safety and Activities: 5 min H&S meeting

Observations/Problems Encountered/Corrective Action Taken: None

Office Work Performed: paperwork

By **Title** Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 4-28-03

Day	S	[✓ M]	T	W	TH	F	S

On Site Hours	12.0
Travel Time	—
Office Time	—

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	[✓ Overcast]	[✓ Rain]	Snow
Temp	To 32	32-50	[✓ 50-70]	70-85	85 up
Wind	Still	[✓ Moderate]	High	**Report No.**	
Humidity	Dry	Moderate	[✓ Humid]	776	

Subcontractors on Site:

Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen Dennis Auld arrived at 12:00 Noon

Equipment on Site: CME-75

Drilling Rigs (Mobile 57 & ~~Gus Pech 1000~~AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment, high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork. Compressor & Rock hammer

Visitors on Site:

URS Personnel on Site:

Corey Anderson, Dave Berger, ~~Mike Sonderman~~, ~~Ryan Carpentor~~. Brian Osborn

Field Work Performed (including sampling):

Installed BM at SC-SG01, BC-SG04
Finished SG at several locations
Continued development at LD-MW1, LA-MW4, WBP-MW1, EBP-MW6, FPP-MW4, LA-MW8

Quality Control Activities (including field calibration): Calibration check of PID, FID, Horiba U-10, Turbidity

Health and Safety and Activities: 5 min H&S meeting

Observations/Problems Encountered/Corrective Action Taken: none

Office Work Performed: paperwork

By **Title** Field Manager

DAILY QUALITY CONTROL REPORT

Date 4-29-03

Day	S	M	T	W	TH	F	S
	☐	☐	☒	☐	☐	☐	☐

IAAAP F.S. Data Collection

On Site Hours 11.5
Travel Time —
Office Time —

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	Overcast ☒	Rain ☒	Snow
Temp	To 32	32-50	50-70 ☒	70-85	85 up
Wind	Still	Moderate ☒	High	**Report No.**	
Humidity	Dry	Moderate	Humid ☒	7~~8~~7	

Subcontractors on Site:

Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen

Equipment on Site:

Drilling Rigs (Mobile 57 & ~~Gus Pech 1000~~ CME-75 AR) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment, high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork. Compressor & Rockdrill

Visitors on Site: None

URS Personnel on Site:

Corey Anderson, Dave Berger, ~~Mike Sonderman, Ryan Carpenter~~. Brian Olson

Field Work Performed (including sampling):

Installed SC-SG05, SC-SG04, SC-SG07
Installed BM at several wells
Completed development at L9-MW2, WBP-MW1, EBP-MW6, FTP-MW4, L2-MW8
Continued development at L3-MW1, EBP-MW4, WBP-MW3.

Quality Control Activities (including field calibration): Calibration check of PID, FID, Horiba U-10, Turbidity

Health and Safety and Activities: Safety H&S meeting

Observations/Problems Encountered/Corrective Action Taken: None

Office Work Performed: paperwork

By **Title** Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 4-30-03

Day	S	M	T	W	TH	F	S
				X			

On Site Hours 5.5
Travel Time –
Office Time –

Weather	Bright Sun	Clear	Overcast	Rain	Snow
			X		
Temp	To 32	32-50	50-70	70-85	85 up
		X			
Wind	Still	Moderate	High	Report No.	
		X		7~~0~~8	
Humidity	Dry	Moderate	Humid		
		X			

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
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DACA45-02-D-0003, DO 16

Subcontractors on Site:
Aquadrill - Jay Joslyn, Dennis Auld, Danny Moore, Scott Elsinger, Mark Claassen Drillers are leaving the site

Equipment on Site:
Drilling Rigs (Mobile 57 & ~~Gus Pech 1000A~~R CME-75) and support trucks, 4.25" & 6.625" ID HSAs, 10" & 6" RWB, URS trucks, well materials, PIDs, FIDs, Freon detector, turbidity meters, water tanks, development equipment (Grundfos, bailers, water quality probe), decon equipment, high pressure washer, water levels, soil sampling equipment (2" & 3" split spoons), PPE, paperwork.

Visitors on Site:

URS Personnel on Site:
Corey Anderson, Dave Berger, ~~Mike Sonderman~~, ~~Ryan Carpenter~~. Brian Osborn

Field Work Performed (including sampling):
Well drilling, development, Completions, IDW, Decon is all completed – drillers are leaving the site.
Finished development at FTP-MW3, FTP-MW6, L3-MW1
Measured stream velocity and area at Brush Creek and K-Road.

Quality Control Activities (including field calibration): Calibration check of PID, FID, Horiba U-10, Turbidity

Health and Safety and Activities: 5min H&S meeting

Observations/Problems Encountered/Corrective Action Taken: None

Office Work Performed: paperwork

By Corey Anderson **Title** Field Manager

DAILY QUALITY CONTROL REPORT

Date 5-5-03

Day	S	M	T	W	TH	F	S
		X					

IAAAP F.S. Data Collection

On Site Hours 6.5
Travel Time 6
Office Time 0

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear X	Overcast	Rain	Snow
Temp	To 32	32-50	50-70 X	70-85	85 up
Wind	Still	Moderate X	High	**Report No.**	
Humidity	Dry	Moderate X	Humid	8019	

Subcontractors on Site: N/A

Equipment on Site:
Fultz pump, YSI 556, Lamotte turbidity meter, HACH iron kit, MiniRAE PID, Photovac MicroFID, Freon detector, water level indicator
Hermit data logger, water tanks, decontamination equipment.

Visitors on Site: N/A

URS Personnel on Site:
Brian Osborn, Mike Sonderman, Ryan Carpenter.

Field Work Performed (including sampling):
Line 3 water levels & well head readings w/ PID + FID

Quality Control Activities (including field calibration): Calibrated PID, FID, YSI 556, Turbidity meter, HACH kit, and water level indicator

Health and Safety and Activities: 5 min H+S meeting, orange vests in remote areas.

Observations/Problems Encountered/Corrective Action Taken: NONE

Office Work Performed: NONE

By Ryan Carpenter **Title** Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 5/6/03

Day

S	M	T	W	TH	F	S
		X				

On Site Hours RC. ~~13~~ 12
Travel Time 0
Office Time 1

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear X	Overcast	Rain	Snow
Temp	To 32	32-50	50-70 X	70-85	85 up
Wind	Still X	Moderate	High	**Report No.**	
Humidity	Dry	Moderate X	Humid	80	

Subcontractors on Site: [redacted] RC. Survey crew Steve Chappel and co worker arrived approx. 1300 hrs.

Equipment on Site:
Fultz pump, YSI 556, Lamotte turbidity meter, HACH iron kit, MiniRAE PID, Photovac MicroFID, Freon detector, water level indicator
Hermit data logger, water tanks, decontamination equipment.

Visitors on Site: N/A

URS Personnel on Site:
Brian Osborn, Mike Sonderman, Ryan Carpenter.

Field Work Performed (including sampling):
Sampled groundwater @ : Brian Osborn / Ryan Carpen
L3-MW1
L3-MW2
L2-MM5

Line 2 WL round + Stf gauge : Mike Sonderman

Quality Control Activities (including field calibration): Calibrated PID, FID, YSI 556 Turbidity Meter, Hach Kit + WL indicator

Health and Safety and Activities: orange vest in remote areas

Observations/Problems Encountered/Corrective Action Taken: NONE

Office Work Performed: Review of Field Sheets – Fax to office

By Ryan Carpenter **Title** Field Manager

DAILY QUALITY CONTROL REPORT

Date 5/7/03

Day

S	M	T	W	TH	F	S
			X			

IAAAP F.S. Data Collection

On Site Hours 12.0
Travel Time 0.5
Office Time 0

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	Overcast X	Rain	Snow
Temp	To 32	32-50	50-70 X	70-85	85 up
Wind	Still	Moderate X	High	**Report No.**	
Humidity	Dry	Moderate	Humid X	821	

Subcontractors on Site: Surveyors Mike Chappel & co worker

Equipment on Site:
Fultz pump, YSI 556, Lamotte turbidity meter, HACH iron kit, MiniRAE PID, Photovac MicroFID, Freon detector, water level indicator
Hermit data logger, water tanks, decontamination equipment.

Visitors on Site: N/A

URS Personnel on Site:
Brian Osborn, Mike Sonderman, Ryan Carpenter.

Field Work Performed (including sampling):
Sampled MW : Ryan Carpenter / Brian Osborn
L2-MW7
L2-MW6
L9-MW4
L9-MW3
Water level @ L9 - New wells
Sampled Brush Creek surface H2O, helped surveyors : Mike Sonderman

Quality Control Activities (including field calibration): Callibrated PID, FID, YSI 556 (check)
Turbidity meter, Hach Kit + WL

Health and Safety and Activities: N/A, Level D

Observations/Problems Encountered/Corrective Action Taken: NONE

Office Work Performed: Fax COC, Review Fieldsheets

By Ryan Carpenter **Title** Field Manager

DAILY QUALITY CONTROL REPORT

Date 5/8/03

Day						
S	M	T	W	[✓ TH]	F	S

IAAAP F.S. Data Collection

On Site Hours 11.5
Travel Time .5
Office Time 1.0

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	[✓ Overcast]	[✓ Rain]	Snow
Temp	To 32	[✓ 32-50]	50-70	70-85	85 up
Wind	Still	[✓ Moderate]	High	**Report No.**	
Humidity	Dry	Moderate	[✓ Humid]	8~~3~~2	

Subcontractors on Site: Surveyors – Mike Chappell + Co-worker

Equipment on Site:
Fultz pump, YSI 556, Lamotte turbidity meter, HACH iron kit, MiniRAE PID, Photovac MicroFID, Freon detector, water level indicator
Hermit data logger, water tanks, decontamination equipment.

Visitors on Site: N/A

URS Personnel on Site:
Brian Osborn, Mike Sonderman, Ryan Carpenter, Dan Galde

Field Work Performed (including sampling):
Sampled MW: Ryan Carpenter / Mike Sonderman
L2-MW8 – pumped dry
L9-MW6 –
L9-MW5
L9-MW8
Slugtested: Brian Osborn / Dan Galde
12E 16-D
~~L3~~ L2-mw3 16-A
12-B

Quality Control Activities (including field calibration): Calibrate PID, FID, YSI 556 (check)
Turb. meter, Hach kit, WL

Health and Safety and Activities: Level D – orange vest in remote areas

Observations/Problems Encountered/Corrective Action Taken: NONE

Office Work Performed: Fax COC + SCFS – Create WL spreadsheet L2,3,9

By Ryan Carpenter **Title** Field Manager

DAILY QUALITY CONTROL REPORT

Date 5/9/03

Day	S	M	T	W	TH	F	S
						X	

IAAAP F.S. Data Collection

On Site Hours 11.5
Travel Time .5
Office Time 0

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun X	Clear	Overcast	Rain	Snow
Temp	To 32	32-50	50-70	70-85 X	85 up
Wind	Still	Moderate X	High	**Report No.**	
Humidity	Dry	Moderate	Humid X	843	

Subcontractors on Site: Surveyors - Mike Chappell + Co Worker

Equipment on Site:
Fultz pump, YSI 556, Lamotte turbidity meter, HACH iron kit, MiniRAE PID, Photovac MicroFID, Freon detector, water level indicator
Hermit data logger, water tanks, decontamination equipment.

Visitors on Site: N/A

URS Personnel on Site:
Brian Osborn, Mike Sonderman, Ryan Carpenter. Dan Golde

Field Work Performed (including sampling):
Sampled Monitoring Wells: Ryan Carpenter / Mike Sonderman
L2-MW8
L9-MW9
L9-MW10
Pumped L2-MW4, went dry
Slug Tested Monitoring wells: Brian Osborn / Dan Golde

JAW-70	WBP 99-2	WBP 99-5	WBP 99-7
L2-MW2	WBP 99-6	JAW-25	
WBP-99-1	WBP 99-4	WBP 99-3	

Quality Control Activities (including field calibration): Calibrate PID, FID, YSI 556 (check)
Turb Kit, Hach Kit, WL.

Health and Safety and Activities: Level D, orange vest in remote areas

Observations/Problems Encountered/Corrective Action Taken: NONE ~~orange vest in remote areas~~ (R

Office Work Performed: NONE

By Ryan Carpenter **Title** Field Manager

DAILY QUALITY CONTROL REPORT

Date 5/10/03

Day	S	M	T	W	TH	F	S
							X

IAAAP F.S. Data Collection

On Site Hours	12
Travel Time	.5
Office Time	0

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	Overcast	Rain X	Snow
Temp	To 32	32-50	50-70 X	70-85	85 up
Wind	Still	Moderate	High X	**Report No.**	
Humidity	Dry	Moderate	Humid X	804	

Subcontractors on Site: Surveyors until 1300 – they completed all sites –

Equipment on Site:
Fultz pump, YSI 556, Lamotte turbidity meter, HACH iron kit, MiniRAE PID, Photovac MicroFID, Freon detector, water level indicator
Hermit data logger, water tanks, decontamination equipment.

Visitors on Site: N/A

URS Personnel on Site:
Brian Osborn, Mike Sonderman, Ryan Carpenter. Dan Galde

Field Work Performed (including sampling):
Sampling Monitoring wells : Ryan Carpenter / Mike Sonderman
L2-MW4
L9-MW7
L9-MW13
L9-MW12
Slug tested Monitoring wells: Brian Osborn / Dan Galde

JAW-~~62~~58	EBP-mw3	JAW-4	JAW-54
FTA 99-1	EBP-mw2	JAW-7	JAW-55
JAW-68	EBP-mw1	JAW-53	FTA 99-2

Quality Control Activities (including field calibration): Calibrate PID, FID, YSI – Check Turb. Kit, Hach Kit, W.L.

Health and Safety and Activities: Level D – orange vest in remote areas.

Observations/Problems Encountered/Corrective Action Taken: NONE

Office Work Performed: NONE

By Ryan Carpenter **Title** Field Manager

DAILY QUALITY CONTROL REPORT

Date 5/11/03

Day

S	M	T	W	TH	F	S
X						

IAAAP F.S. Data Collection

On Site Hours 11.5
Travel Time .5
Office Time .5

COE Project Manager Al Kaim/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear	Overcast X	Rain	Snow
Temp	To 32	32-50 X	50-70	70-85	85 up
Wind	Still	Moderate	High X	**Report No.** 805	
Humidity	Dry	Moderate X	Humid		

Subcontractors on Site: N/A

Equipment on Site:
Fultz pump, YSI 556, Lamotte turbidity meter, HACH iron kit, MiniRAE PID, Photovac MicroFID, Freon detector, water level indicator
Hermit data logger, water tanks, decontamination equipment.

Visitors on Site: N/A

URS Personnel on Site:
Brian Osborn, Mike Sonderman, Ryan Carpenter. Dan Galde

Field Work Performed (including sampling):
Groundwater sampling @: Ryan Carpenter / Mike Sonderman
L-9MW11
L9-MW1
L9-MW2 - pumped dry
EBP-MW4 - pumped dry
Slugtested Monitoring Wells: Brian Osborn / Dan Galde

L2-mw5	12-E	JAW 61
L2-mw6	JAW-71	G-30
L2-mw7	JAW-62	

Quality Control Activities (including field calibration): Calibrate PID, FID, YSI Check, Turbidity Kit, Hach Kit, W.L.

Health and Safety and Activities: Level D - orange vest in remote areas.

Observations/Problems Encountered/Corrective Action Taken: NONE

Office Work Performed: update spreadsheet, Fax ~~DO~~5CFS's.

By Ryan Carpenter **Title** Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 5/12/03

Day	S	M	T	W	TH	F	S
		X					

On Site Hours	13.5
Travel Time	.5
Office Time	.5

COE Project Manager	Al Kaim/Kevin Howe
Project	Iowa Army Ammunition Plant
Project No.	16169421.00201, 16169421.00301
	16169503.00101, 16169556.00101
	16169556.00201, 16169556.00302
Contract No.	DACA45-96-D-0017, DO 65
	DACA45-02-D-0003, DO 10
	DACA45-02-D-0003, DO 16

Weather	Bright Sun	Clear X	Overcast	Rain	Snow
Temp	To 32	32-50	50-70 X	70-85	85 up
Wind	Still	Moderate	High X	**Report No.**	
Humidity	Dry	Moderate X	Humid	876	

Subcontractors on Site: N/A

Equipment on Site:
Fultz pump, YSI 556, Lamotte turbidity meter, HACH iron kit, MiniRAE PID, Photovac MicroFID, Freon detector, water level indicator Hermit data logger, water tanks, decontamination equipment.

Visitors on Site: N/A

URS Personnel on Site:
Brian Osborn, Mike Sonderman, Ryan Carpenter. Dan Galde

Field Work Performed (including sampling): Ground water samples: Ryan Carpenter / Mike Sond

- L9-MW2 · FTP-MW2 - pumped dry
- EBP-MW4 · WBP-MW1 - pumped dry
- EBP-MW5 · FTP-MW3 - pumped dry
- EBP-MW6 - pumped Dry · WBP-MW3 - pumped d

Slug tested monitoring wells: Brian Osborn / Dan Galde

-L9-mw9	L9-mw4	L9-mw13
-L9-mw5	L9-mw7	G-15
-L9-mw6	L9-mw11	SAW-64
-L9-mw3	L9-mw12	

Quality Control Activities (including field calibration): Calibrate PID, FID, YSI Turb Kit, Hach Kit, W.L. Collect QA split EBP-MW5, Duplicate for EBP-MW5/EBP-MW Rinsate following Decon. of EBP-MW5. (Rinsate #1)

Health and Safety and Activities: Level D orange vest in remote areas

Observations/Problems Encountered/Corrective Action Taken: NONE

Office Work Performed: update spreadsheet, Fax SCFGs.

By Ryan Carpenter **Title** Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 5/13/03

Day	S	M	[✓ T]	W	TH	F	S

On Site Hours	12.5
Travel Time	.5
Office Time	

Weather	Bright Sun	Clear	[✓ Overcast]	Rain	Snow
Temp	To 32	32-50	[✓ 50-70]	70-85	85 up
Wind	Still	[✓ Moderate]	High	**Report No.** 887	
Humidity	Dry	[✓ Moderate]	Humid		

COE Project Manager Al Kain/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
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Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Subcontractors on Site: N/A

Equipment on Site:
Fultz pump, YSI 556, Lamotte turbidity meter, HACH iron kit, MiniRAE PID, Photovac MicroFID, Freon detector, water level indicator
Hermit data logger, water tanks, decontamination equipment.

Visitors on Site: N/A

URS Personnel on Site:
Brian Osborn, Mike Sonderman, Ryan Carpenter. Dan Gable

Field Work Performed (including sampling): Groundwater sampling of MWs:
EWBP-mw2 - pumped dry
WBP-mw1
WBP-mw3
FTP-mw2
FTP-mw3
EBP-mw6
FTP-MW1
FTP-MW6 - pumped Dry
FTP-MW5 - ·
FTP-MW4 - pumped Dry
Repurge F2-MW5 for H_2O quality data

Quality Control Activities (including field calibration): Calibrated YSI (check), PID, FID WL, Turb. Kit, Hach Kit. Collected Duplicate sample FTP-MW9 from FTPMW1 and QA/QC split of FT-P-MW1.

Health and Safety and Activities: Level D

Observations/Problems Encountered/Corrective Action Taken: N/A

Office Work Performed:

By Ryan C **Title** Field Manager

Page 1 of 1

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 5/14/03

Day

S	M	T	W	TH	F	S
			X			

On Site Hours	7.5
Travel Time	5.5
Office Time	0

Weather	Bright Sun	Clear	Overcast X	Rain	Snow
Temp	To 32	32-50	50-70	70-85	85 up
Wind	Still	Moderate X	High	**Report No.**	
Humidity	Dry	Moderate X	Humid	88	

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Subcontractors on Site: N/A

Equipment on Site:
Fultz pump, YSI 556, Lamotte turbidity meter, HACH iron kit, MiniRAE PID, Photovac MicroFID, Freon detector, water level indicator Hermit data logger, water tanks, decontamination equipment.

Visitors on Site: N/A

URS Personnel on Site:
Brian Osborn, Mike Sonderman, Ryan Carpenter. Dan Galde

Field Work Performed (including sampling): Groundwater samples:
FTP-MW6
FTP-MW8
FTP-MW7
FTP-MW4
~~FTP~~ Re. WBP-MW2

Quality Control Activities (including field calibration): Calibrated YSI -(check), PID, FID, WL, Turb. Kit, Hach kit, Collect groundwater sample FTP-MW8 MS/MSD

Health and Safety and Activities: Level D

Observations/Problems Encountered/Corrective Action Taken: N/A

Office Work Performed: N/A

By Ryan Carpenter **Title** Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 5-19-03

Day	S	[✓ M]	T	W	TH	F	S

On Site Hours	7.5
Travel Time	6.0
Office Time	–

Weather	Bright Sun	Clear	[✓ Overcast]	Rain	Snow
Temp	To 32	32-50	[✓ 50-70]	70-85	85 up
Wind	Still	[✓ Moderate]	High	**Report No.**	
Humidity	Dry	Moderate	[✓ Humid]	89	

COE Project Manager Al Kain/Kevin Howe

Project Iowa Army Ammunition Plant

Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302

Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Subcontractors on Site: None

Equipment on Site:
GPS, water level indicator, Hermit data logger, water tanks, decontamination equipment, camara.

Visitors on Site: None

URS Personnel on Site:
Corey Anderson, Brian Osborn, Josh Sales

Field Work Performed (including sampling):
Slugtested: FTP-MW8, FTP-MW7, FTP-MW4, FTP-MW1, FTP-MW3, WBP-MW3
L2-MW8

Quality Control Activities (including field calibration): None

Health and Safety and Activities: 5 min H+S meeting safety breifing for JS

Observations/Problems Encountered/Corrective Action Taken: Called IAAAP Locksmith about well locks

Office Work Performed: None.

By Corey Anderson **Title** Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 5-20-03

Day						
S	M	[✓ T]	W	TH	F	S

On Site Hours	12.0
Travel Time	—
Office Time	—

COE Project Manager	Al Kam/Kevin Howe
Project	Iowa Army Ammunition Plant
Project No.	16169421.00201, 16169421.00301 16169503.00101, 16169556.00101 16169556.00201, 16169556.00302
Contract No.	DACA45-96-D-0017, DO 65 DACA45-02-D-0003, DO 10 DACA45-02-D-0003, DO 16

Weather	Bright Sun	[✓ Clear]	Overcast	Rain	Snow
Temp	To 32	32-50	[✓ 50-70]	70-85	85 up
Wind	Still	[✓ Moderate]	High	**Report No.**	
Humidity	Dry	Moderate	[✓ Humid]	90	

Subcontractors on Site: None

Equipment on Site:
GPS, water level indicator, Hermit data logger, water tanks, decontamination equipment, camara.

Visitors on Site: Jeff Gant (HGL)

URS Personnel on Site:
Corey Anderson, Brian Osborn, Josh Sales

Field Work Performed (including sampling):
Slug tested: FTP-MW2, FTP-MW6, FTP-MW5, WBP-MW2, WBP-MW1
EBP-MW5, EBP-MW6, EBP-MW4
Resurveyed BC-SG03' → 4.74' below BC-BM03.
Walked BC and BC Tributaries around Line 1 + Line 2.

Quality Control Activities (including field calibration): None

Health and Safety and Activities: 5 min H+S meeting

Observations/Problems Encountered/Corrective Action Taken: Drop off well locks to Mike B.

Office Work Performed: None

By Corey Anderson **Title** Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 5-21-03

Day	S	M	T	W X	TH	F	S

On Site Hours	12.0
Travel Time	—
Office Time	—

COE Project Manager Al Kain/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Weather	Bright Sun X	Clear X	Overcast	Rain	Snow
Temp	To 32	32-50	50-70 X	70-85	85 up
Wind	Still	Moderate X	High	**Report No.**	
Humidity	Dry	Moderate	Humid X	91	

Subcontractors on Site: None

Equipment on Site:
GPS, water level indicator, Hermit data logger, water tanks, decontamination equipment, camara.

Visitors on Site: None

URS Personnel on Site:
Corey Anderson, Brian Osborn, Josh Sales

Field Work Performed (including sampling):
Slug tested L2-MW4, L2-MW8, 16-D, L9-MW8, L9-MW2,
Marked sinkholes at FTP
Abandoned last 2 DPs @ EBP
Site Recon at BC from I-Road to D-Road.

Quality Control Activities (including field calibration): none

Health and Safety and Activities: 5 min H+S meeting

Observations/Problems Encountered/Corrective Action Taken:

Office Work Performed: None

By **Title** Field Manager

DAILY QUALITY CONTROL REPORT

IAAAP F.S. Data Collection

Date 5-22-03

Day	S	M	T	W	TH	F	S
					X		

On Site Hours 3.0
Travel Time 6.0
Office Time —

Weather	Bright Sun	Clear X	Overcast	Rain	Snow
Temp	To 32	32-50	50-70 X	70-85	85 up
Wind	Still	Moderate X	High	Report No.	
Humidity	Dry	Moderate	Humid X	92	

COE Project Manager Al Kam/Kevin Howe
Project Iowa Army Ammunition Plant
Project No. 16169421.00201, 16169421.00301
16169503.00101, 16169556.00101
16169556.00201, 16169556.00302
Contract No. DACA45-96-D-0017, DO 65
DACA45-02-D-0003, DO 10
DACA45-02-D-0003, DO 16

Subcontractors on Site: None

Equipment on Site:
GPS, water level indicator, Hermit data logger, water tanks, decontamination equipment, camara.

Visitors on Site: None.

URS Personnel on Site:
Corey Anderson, Brian Osborn, Josh Sales

Field Work Performed (including sampling):
Pickup overnight slug test at 22-MW8
Organize URS Trailer and pickup Yard-M
Left site - F.S. Data Collection Field Activitys are complete!

Quality Control Activities (including field calibration): none

Health and Safety and Activities: 5 min H+S meeting.

Observations/Problems Encountered/Corrective Action Taken: called Mike about locks
Call Jeff G (HGL), he will putch Locks next week.

Office Work Performed: None

By Corey Anderson **Title** Field Manager

Daily Quality Control Reports (DQCRs) are included—electronically only—on the CD-ROM that accompanies this Draft RAA report.

Direct Push Results

Monitoring Well Results

Surface Water Results

Duplicate Sample Pair Results

Quality Assurance Split Sample Pair Results

This appendix presents the review and validation of the analytical data associated with the Six Sites Groundwater RAA field activities.

I.1 SUMMARY OF ANALYTICAL RESULTS

Groundwater, surface water, and soil samples were sent to Laucks for analysis. The preparation methods, analytical methods, and method-specific QA/QC criteria are presented in Section 4 of the QAPP from the IAAAP Facility-Wide Work Plan (URS 2002a) and the Fire Training Pit, West Burn Pads Area, and East Burn Pads Feasibility Study Data Collection Work Plan Addendum (URS 2002b). **Tables I-1** and **I-2** summarize the analytical results in direct push samples and monitoring well samples collected during the groundwater RAA field activities.

I.1.1 Chemicals Detected in Direct Push Samples

The groundwater samples collected during the direct push field activities were analyzed for VOCs and explosives compounds. The primary VOCs detected in direct push groundwater samples included 2-butanone, carbon disulfide, Freon 113, 1,1-DCA, 1,1-dichloroethene, and 1,1,1-trichloroethane. Additional VOCs detected included acetone, benzene, 1,2-DCA, cis-1,2-DCE, and PCE.

The primary explosives compounds detected in direct push groundwater samples included RDX, HMX, MNX, 2-Am-DNT, and 4-Am-DNT. Additional explosives compounds detected included 1,3,5-TNB, 1,3-DNB, 2,4,6-TNT, 2,4-DNT, 2,6-DNT, and tetryl.

I.1.2 Chemicals Detected in Monitoring Well Samples

The groundwater samples collected during the monitoring well installation field activities were analyzed for VOCs, SVOCs, explosives compounds, metals, and natural attenuation parameters. The primary VOCs detected in groundwater samples included 1,1,1-TCA, 1,1-DCA, 1,1-DCE, Freon 113, and xylene.

The primary SVOC detected in groundwater samples was bis(2-ethylhexyl)phthalate.

The primary explosives compounds detected in groundwater samples included RDX, HMX, MNX, 2-Am-DNT, and 4-Am-DNT. Additional explosives compounds detected included 1,3,5-TNB, 1,3-DNB, 2,4,6-TNT, 2,4-DNT, 2,6-DNT, and tetryl.

The primary metal analytes detected in groundwater samples included arsenic, barium, lead, mercury, and selenium.

Natural attenuation parameter analytes in groundwater samples included: alkalinity, ammonia, carbon dioxide, chloride, NO_3+NO_2, sulfate, sulfide, TKN, TOC, calcium, magnesium, and sodium.

I.1.3 Chemicals Detected in Surface Water Samples

Surface water samples collected from Brush Creek were analyzed for explosives compounds. The primary explosives compounds detected in surface water samples collected in Brush Creek included RDX and HMX. MNX was also detected at one surface water sampling location.

Spring Creek surface water samples were collected, analyzed, and reviewed/validated by HGL, and results are presented in the 2003 Groundwater Monitoring Report (HGL 2003b). Spring Creek surface water samples results are not discussed in the following data quality review/validation but are included on **Table I-3** for reference only.

I.2 DATA QUALITY REVIEW/VALIDATION PROCESS

The analytical data generated by the laboratory were checked for accuracy, precision, representativeness, comparability, completeness and sensitivity. The data validation process for this project consisted of data generation, reduction, and two levels of review.

I.2.1 Laboratory Data Reduction and Validation

The first level of chemical data review, which contained multiple sublevels, was conducted by the analytical laboratory. The laboratory had the initial responsibility for the correctness and completeness of the data. Section 4 of the QAPP in the IAAAP Facility-Wide Work Plan (URS 2002a) identifies the laboratory reduction and validation processes.

I.2.2 Data Review

The second level of chemical data review was completed by the URS project chemist. All analytical data were subjected to this review. The data review was completed following the procedures described below, utilizing QA/QC criteria specified in the IAAAP Facility-Wide Work Plan, Section 4 of the QAPP (URS 2002a); the Fire Training Pit, West Burn Pads Area, and East Burn Pads Feasibility Study Data Collection Work Plan Addendum (URS 2002b); United States Environmental Protection Agency (USEPA) Function Guidelines (USEPA 2001b and 2002a); and United States Army Toxic and Hazardous Materials Agency (USATHAMA) QA Program, January, 1990. The QC parameters for the review of the laboratory analytical data packages included the following:

- Completeness of package
- Review of laboratory case narrative
- Compliance with required holding times and sample preservation
- Presence or absence of compounds in method and field blanks
- Results of low spike, high spike, and high spike duplicate samples
- Surrogate spike recovery in samples
- Results of matrix spike and matrix spike duplicate samples
- Field duplicate samples

I.2.3 Validation

The URS project chemist completed full data validation on ten percent of the analytical data, as detailed in the project QAPP. The full validation of the analytical data included reviewing all the parameters identified above and the additional parameters listed below:

- Initial calibration
- Continuing calibration
- Chromatogram review
- Standard preparation log review
- Sample preparation log review
- Analytical run log review
- Recalculation of sample and QC results using the raw data
- Instrument tune

I.3 DIRECT PUSH SAMPLE REVIEW/VALIDATION RESULTS

The data review/validation process was implemented to assess the quality of data resulting from the field sampling program with respect to the QA/QC objectives established for the project. Data were assessed to evaluate the appropriate usage to support decision-making. Data assessment involved a consideration of data use, the decision type, identification of data that were qualified or did not meet project QA/QC requirements, and limitations on data use. The data review/validation was based on the laboratory data summary reports and raw data. Direct push groundwater samples were analyzed for VOCs (5030/8260B) and explosives (8330).

I.3.1 Laboratory Sample Delivery Groups

The following sections collectively summarize the review and validation of the direct push analytical data for Laucks sample delivery groups (SDGs) IAP39 through IAP56. The data review and validation results are presented in the following sections.

I.3.1.1 Data Package Completeness

The data packages were reviewed to verify that each SDG contained the data contractually required in the deliverable and that all samples listed on the chain-of-custody (COC) forms were analyzed for the requested parameters. The review indicated that the data packages were complete.

I.3.1.2 Laboratory Case Narrative

The laboratory case narratives for SDGs IAP39 though IAP56 indicated that the initial VOC calibrations (10/23/03, 11/02/03, 11/05/03, 11/27/03, and 02/03/03) yielded percent relative standard deviation (%RSD) values greater than 15 percent for several analytes. Using linear regression the correlation coefficient (*r*) values were greater that the method required 0.990; therefore, no qualification of data was required based on outlying precision.

The laboratory case narratives for SDGs IAP40, IAP42, IAP45, IAP46, IAP48, IAP49, IAP50, IAP52, IAP54, IAP55, and IAP56 indicated that the pH values for VOC samples FTP-DP11-20, FTP-DP18-10, FTP-DP12-23, WBP-DP05-09, WBP-DP06-22, WBP-DP07-22, WBP-DP12-09, WBP-DP15-24, L9-DP02-70, L9-DP05-53, L9-DP07-75, L9-DP09-52, L9-DP09-66, L9-DP12-54, L9-DP12-64L9-DP15-60, L9-DP16-62, L9-DP20-39, L9-DP22-54, L9-DP23-15, L9-DP26-50, L9-DP32-15, L9-DP36-45 were greater than 2.0. The samples were analyzed within seven days and were not qualified based on outlying preservation criteria.

The laboratory case narratives for SDGs IAP41, IAP43, IAP44, IAP45, IAP46, IAP47, IAP48, IAP51, IAP52, IAP54, and IAP55 indicated that several samples were received at temperatures below the evaluation criteria. The samples were not frozen; therefore, no qualification of data was required based on outlying preservation criteria.

The laboratory case narratives for SDGs IAP42, IAP43, IAP44, IAP45, IAP46, IAP47, IAP48, IAP49, IAP51, IAP53, and IAP54 indicated the reporting limit for Freon 113 was raised from 3 µg/L to 5 µg/L due to instrument contamination. The USEPA Region 9 Tap Water PRG for Freon 113 is 59,00 µg/L; no corrective action was required.

The laboratory case narratives for SDGs IAP48 and IAP50 indicated that the explosives continuing verification (CV) (3B260214) recoveries on the secondary column for HMX and tetryl were outside evaluation criteria. The samples bracketed by the CV were reported as nondetect for HMX and tetryl on the primary column. Only compounds detected on the primary column require secondary column confirmation; therefore, no qualification of data was required based on outlying CV recoveries.

The laboratory case narrative for SDG IAP51 indicated that an unknown peak was detected on the secondary column in the HMX and tetryl retention windows for samples L2-DP24-06 and L2-DP23-13, respectively. The HMX result on the secondary column was biased high due to the contribution of the unknown peak. Results were reported from the primary column; therefore, no qualification of data was required.

The laboratory case narrative for SDG IAP55 indicated the CV (3C140233.d) recovery for 4-Am-DNT exceeded the evaluation criteria. The samples bracketed by the CV were reported as nondetect for 4-Am-DNT; therefore, no qualification of data was required based on outlying CV recoveries.

Additional problems identified in the laboratory case narratives for SDGs IAP39 through IAP56 are discussed in subsequent sections.

I.3.1.3 Holding Times and Sample Preservation

Review of the sample collection and analyses dates involved comparing the chemicals of concern, the chemical results summary forms, and the raw data forms for accuracy, consistency, and holding time compliance. Several samples were received at the laboratory below 2°C), but the samples were not frozen; therefore, no qualification of data was required based on preservation criteria. All samples were extracted and analyzed within the required holding time criteria with the exception of the samples listed in the table below.

Site ID	Field ID	Parameter	Analyte	Qualification
West Burn Pads Area	WBP-DP14-14	8260B	Entire Sample	**J**
Line 9	L9-DP04-53DL	8260B	Freon 113	**J**
Line 9	L9-DP04-69DL	8260B	Freon 113	**J**
Line 9	L9-DP06-67DL	8260B	Freon 113	**J**
Line 9	L9-DP10-25DL	8260B	Freon 113	**J**
Line 9	L9-DP10-65DL	8260B	Freon 113	**J**
Line 9	L9-DP03-71	8260B	Entire Sample	**J**
Line 9	L9-DP06-52	8260B	Freon 113 Only	**J**
Line 9	L9-DP11-55	8260B	Entire Sample	**J**
Line 9	L9-DP11-69	8260B	Entire Sample	**J**
Line 9	L9-DP14-66	8260B	Entire Sample	**J**
Line 9	L9-DP13-20	8260B	Entire Sample except Freon 113	**J**
Line 9	L9-DP13-55	8260B	Entire Sample except Freon 113	**J**
Line 9	L9-DP13-64	8260B	Freon 113	**J**

I.3.1.4 Initial Calibration

Initial calibration criteria were established to assess whether the instrument was capable of producing acceptable qualitative and quantitative data. As identified in various standard operating procedures, the linearity of the calibration curve was established using a blank and five standard concentrations.

The initial VOC calibration response factors (RFs) were reviewed and were greater than 0.10 for chloromethane, 1,1-dichloroethane and bromoform, greater than 0.30 for chlorobenzene and 1,1,2,2-tetrachloroethane, and greater than 0.05 for all other analytes. Review of the initial calibration summary forms indicated %RSDs were less than or equal to 30 percent for calibration check compounds (CCCs) (i.e., 1,1-DCE, toluene, chloroform, ethylbenzene, 1,2-dichloropropane, and vinyl chloride). %RSD values were below 15 percent for non-CCCs. In some instances, linearity was determined using linear regression or quadratic curve fit. All r values were greater than 0.990; therefore, no qualifications of data were required. A recalculation of the RFs and %RSD was performed, and no errors in calculations were noted.

Review of the initial explosives calibration summary forms indicated that %RSDs for the calibration factors were below the method criteria of 20 percent, so no qualification of data was required. In addition, the calibration factor and %RSD values presented on the summary forms for both the primary and secondary columns were recalculated for 10 percent of the target analytes. No calibration or transcription errors were noted.

I.3.1.5 Retention Times

Retention time windows are crucial to the identification of target compounds. USEPA SW-846 defines the retention time windows as plus or minus three standard deviations of the mean absolute retention time. Chromatographs from associated samples with target compound detections were reviewed. The chromatographs were reviewed to determine if VOC and explosives peaks were within known retention time windows and that those compounds were identified correctly. All target compounds were identified correctly, so no qualification of data was required.

I.3.1.6 Calibration Verification

Review of the VOC sample chromatograms indicated the CVs were performed at the required frequency of every 12 hours. Review of continuing calibration summary form indicated all RFs met the evaluation criteria of greater than 0.10 (chloromethane, 1,1-DCA, and bromoform), 0.30 (chlorobenzene and 1,1,2,2-tetrachloroethane), and greater than 0.05 for all other analytes. In addition, percent differences (%Ds) met the evaluation criteria of less than 20 percent for CCCs and less than 50 percent for all other analytes; therefore, no qualification of data was required. Recalculation of the RFs and %Ds was completed, and no errors in calculation were noted.

CV samples were established to assess whether the instrumentation was capable of producing acceptable qualitative and quantitative data established by the initial calibration. Explosives CVs were analyzed at the required frequency of one every 12 hours. Review of the CV summary forms indicated that all percent differences (%Ds) met the evaluation criteria of less than 15 percent for all target compounds; therefore, no qualification of explosives data was required based on outlying CV recoveries. In addition, the calibration factor and %RSD values presented on the summary forms for both the primary and secondary columns were recalculated for 10 percent of the target analytes. No calibration or transcription errors were noted.

I.3.1.7 Blank Samples

Blank samples were analyzed to assess the existence and magnitude of contamination during laboratory activities. All method preparation blank data were reported as nondetect with the exception of Freon 113. Associated samples were reported as nondetect or had Freon 113 concentrations greater than five times the blank contamination; therefore, no qualification of data was required based on preparation blank contamination.

Source water, rinsates, and trip blank data were reported as nondetect, with the exceptions of acetone, chloroform, bromodichloromethane, dibromochloromethane, and methylene chloride. Associated samples qualified as nondetect based on blank contamination are listed below.

Site ID	Field ID	Parameter	Analyte	New RL	Qualification
Fire Training Pit	FTP-DP01-38	8260B	Acetone	**– –**	**U**
Fire Training Pit	FTP-DP03-31	8260B	Acetone	**– –**	**U**
Fire Training Pit	FTP-DP03-31	8260B	Chloroform	**4**	**U**

Site ID	Field ID	Parameter	Analyte	New RL	Qualification
Fire Training Pit	FTP-DP04-27	8260B	Acetone	– –	**U**
Fire Training Pit	FTP-DP05-23	8260B	Acetone	– –	**U**
Fire Training Pit	FTP-DP07-27	8260B	Acetone	– –	**U**
Fire Training Pit	FTP-DP08-23	8260B	Chloroform	– –	**U**
Fire Training Pit	FTP-DP09-30	8260B	Acetone	– –	**U**
Fire Training Pit	FTP-DP10-18	8260B	Acetone	– –	**U**
Fire Training Pit	FTP-DP11-20	8260B	Acetone	– –	**U**
Fire Training Pit	FTP-DP14-09	8260B	Acetone	– –	**U**
Fire Training Pit	FTP-DP17-06	8260B	Acetone	– –	**U**
Fire Training Pit	FTP-DP18-10	8260B	Chloroform	– –	**U**
West Burn Pads Area	WBP-DP03-38	8260B	Acetone	– –	**U**
West Burn Pads Area	WBP-DP05-09	8260B	Chloroform	– –	**U**
West Burn Pads Area	WBP-DP08-41	8260B	Acetone	– –	**U**
West Burn Pads Area	WBP-DP15-24	8260B	Acetone	**25**	**U**
East Burn Pads	EBP-DP01-18	8260B	Acetone	– –	**U**
East Burn Pads	EBP-DP02-45	8260B	Acetone	**22**	**U**
East Burn Pads	EBP-DP03-45	8260B	Acetone	**14**	**U**
East Burn Pads	EBP-DP04-45	8260B	Acetone	– –	**U**
East Burn Pads	EBP-DP05-25	8260B	Acetone	– –	**U**
East Burn Pads	EBP-DP05-46	8260B	Acetone	– –	**U**
East Burn Pads	EBP-DP07-20	8260B	Acetone	– –	**U**
Line 9	L9-DP01-63	8260B	Acetone	**13**	**U**
Line 9	L9-DP04-53	8260B	Chloroform	– –	**U**
Line 9	L9-DP05-73	8260B	Acetone	**11**	**U**
Line 9	L9-DP07-75	8260B	Acetone	**26**	**U**
Line 9	L9-DP08-55	8260B	Acetone	– –	**U**
Line 9	L9-DP09-52	8260B	Acetone	– –	**U**
Line 9	L9-DP11-23	8260B	Acetone	**15**	**U**
Line 9	L9-DP12-54	8260B	Acetone	– –	**U**
Line 9	L9-DP19-54	8260B	Acetone	– –	**U**
Line 9	L9-DP20-20	8260B	Acetone	– –	**U**
Line 9	L9-DP21-20	8260B	Acetone	– –	**U**
Line 9	L9-DP23-44	8260B	Acetone	**17**	**U**
Line 9	L9-DP25-24	8260B	Acetone	– –	**U**
Line 9	L9-DP26-19	8260B	Acetone	**15**	**U**
Line 9	L9-DP27-20	8260B	Acetone	**12**	**U**

Site ID	Field ID	Parameter	Analyte	New RL	Qualification
Line 9	L9-DP28-20	8260B	Acetone	**16**	**U**
Line 9	L9-DP29-20	8260B	Acetone	**11**	**U**
Line 9	L9-DP35-46	8260B	Acetone	**– –**	**U**
Line 9	L9-DP35-46	8260B	Chloroform	**12**	**U**
Line 9	L9-DP36-45	8260B	Acetone	**– –**	**U**
Line 9	R10PZ02	8260B	Chloroform	**– –**	**U**

I.3.1.8 Surrogate Compound Percent Recoveries

Surrogate recoveries were used to evaluate the accuracy of the analytical measurement on a sample-specific basis. Surrogate recoveries for all VOC samples were within evaluation criteria with the exception of sample FTP-DP03-31. The surrogate recovery for dibromofluoromethane was above evaluation criteria, indicating a possible high bias. Associated nondetect results for sample FTP-DP03-31 were not qualified as estimated. Data qualifications based on outlying VOC surrogate recovery are listed in the table below. Ten percent of surrogate recoveries (associated validated data) were recalculated; no calculation or transcription errors were noted.

Site ID	Field ID	Parameter	Analyte	Qualification
Fire Training Pit	FTP-DP03-31	8260B	1,1,1-Trichloroethane	**J**
Fire Training Pit	FTP-DP03-31	8260B	1,1-Dichloroethane	**J**
Fire Training Pit	FTP-DP03-31	8260B	1,1-Dichloroethene	**J**
Fire Training Pit	FTP-DP03-31	8260B	1,2-Dichloroethane	**J**
Fire Training Pit	FTP-DP03-31	8260B	2-Butanone	**J**
Fire Training Pit	FTP-DP03-31	8260B	Trichloroethene	**J**

Surrogate recoveries for all explosives samples were within evaluation criteria, with the exceptions of samples EBP-DP21-95, WBP-DP05-09DL2, and L2-DP18-26. Due to the elevated concentration of RDX in sample WBP-DP05-09, the sample was diluted by a factor of 800. The original sample and the first dilution (40 xf) had surrogate recoveries within evaluation criteria; therefore, no qualifications were required for sample WBP-DP05-09 based on outlying surrogate recovery. Data qualifications based on explosives outlying surrogate recoveries are listed in the table below. Ten percent of surrogate recoveries (associated validated data) were recalculated; no calculation or transcription errors were noted.

Site ID	Field ID	Parameter	Analyte	Qualification
East Burn Pads	EBP-DP21-95	8330	Entire Sample	**J**
Line 2	L2-DP18-26	8330	Entire Sample	**J**

I.3.1.9 Laboratory Control Samples

Laboratory control samples (LCSs) were analyzed to assess the accuracy of the analytical method and demonstrate laboratory performance. LCS recoveries were within the evaluation criteria and therefore, no qualification was required based on outlying LCS recoveries. Ten percent of LCS recoveries (associated validated data) were recalculated; no calculation or transcription errors were noted.

I.3.1.10 Laboratory Duplicate Analysis

Laboratory duplicate sample pairs were not analyzed for VOCs or explosives due to lack of sample volume.

I.3.1.11 Field Duplicate Analysis

Field duplicate sample pairs were established to determine both field and laboratory precision. Thirteen direct push field duplicate sample pairs were collected and submitted to the laboratory for analysis. The field duplicate sample pairs are presented in the table below.

Field Duplicate Sample Pairs

Site ID	Original Sample ID	Duplicate Sample ID	Analysis
Fire Training Pit	FTP-DP05-23	FTP-DP05-00	VOCs
Fire Training Pit	FTP-DP23-25	Duplicate 10	VOCs
Fire Training Pit	FTP-DP25-22	Duplicate 11	VOCs
East Burn Pads	EBP-DP14-25	EBP-DP14-00	Explosives
West Burn Pads Area	WBP-DP06-22	Duplicate 13	Explosives
West Burn Pads Area	WBP-DP12-09	Duplicate 12	Explosives
Line 2	L2-DP05-25	L2-DS05-25	Explosives
Line 2	L2-DP12-28	Duplicate 3	Explosives
Line 3	L3-DP04-22	Duplicate 4	Explosives
Line 9	L9-DP01-20	Duplicate 8	VOCs
Line 9	L9-DP07-26	Duplicate 5	VOCs
Line 9	L9-DP11-23	Duplicate 6	VOCs
Line 9	L9-DP13-20	Duplicate 7	VOCs

Field duplicate sample pair results were within evaluation criteria (25 percent) for all duplicate sample pairs, with one exception. Data qualification based on outlying field duplicate precision is listed in the table below. Analytical results for the field duplicate sample pairs are presented in **Table I-3**.

Site ID	Field ID	Analyte	Qualification
Line 9	L9-DP07-26	Freon 113	**J**

I.3.1.12 Matrix Spike/Matrix Spike Duplicate Analysis

No matrix spike/matrix spike duplicate (MS/MSD) samples were analyzed for VOCs or explosives due to lack of sample volume.

I.3.1.13 PARCC Parameters

Precision and Accuracy

The agreement between duplicate analyses within control limits indicates satisfactory precision in a measurement system. The recovery of predetermined amount of a spike within control limits indicates satisfactory accuracy with respect to the method on the individual sample and general matrix. Ninety-nine percent of the indicators reviewed for accuracy (LCS and surrogate recoveries) were within evaluation criteria. One hundred percent of the indicators reviewed for precision (field duplicates) were within evaluation criteria (with the exception of one compound).

Representativeness

Representativeness expresses the degrees to which sample data accurately and precisely represent the characteristics of a population. Representativeness is a qualitative parameter, which is of concern in the proper design of the sampling program, such that the sampling locations selected will provide representative data for decisions made. Representativeness was assessed using 13 field duplicate sample pairs collected during the direct push phase of the groundwater RAA. Field duplicate sample pairs were within evaluation criteria with the exception of one compound; therefore, it was concluded that the overall representativeness was satisfactory.

Comparability

Comparability expresses the confidence with which one data set can be compared to another. In accordance with the QAPP, data are comparable when siting considerations, collection techniques, measurement methods, and reporting procedures are equivalent for the samples within a sample set. Throughout this investigation, appropriate procedures for sampling and shipping were implemented as specified in the IAAAP Facility Wide Work Plan (URS 2002a) and the Fire Training Pit, West Burn Pads Area, and East Burn Pads Feasibility Study Data Collection Draft Final Work Plan Addendum (URS 2002b). Within this data set, it was concluded that results were comparable to one another.

Completeness

Completeness is defined as the percentage of the total number of analytical results requested which are judged to be valid, including estimated **J** values, in accordance with the IAAAP Facility-Wide Work Plan (URS 2002a). After data review and validation, 100 percent of the direct push groundwater analytical data were considered to be valid.

Sensitivity

Sensitivity is defined as the capability of a method or instrument to discriminate between measurement responses representing different levels of a variable of interest. Method detection limits (MDLs) were determined as outlined in 40 Code of Federal Regulations (CFR) Part 136 and are defined as the minimum concentration of a substance that can be identified, measured and reported with a 99 percent confidence that the analyte concentration is greater that zero, and is determined for analysis of a sample in a given matrix containing the analyte. Laboratory reporting limits (RLs) are generally 3 to 5 times higher than the laboratory MDLs. Values above the MDL and less than the RL were qualified as estimated.

Sample dilutions, volume constraints, and matrix interference will decrease sensitivity. RLs were elevated in SDGs IAP39 through IAP56; however, project sensitivity requirements established in the project DQOs were met.

I.4 MONITORING WELL AND SURFACE WATER REVIEW/VALIDATION RESULTS

The data review/validation process was implemented to assess the quality of data resulting from the field sampling program with respect to the QA/QC objectives established for the project. Data were assessed to evaluate the appropriate usage to support decision-making. Data assessment involved a consideration of data use, the decision type, identification of data that were qualified or did not meet project QA/QC requirements, and limitations on data use. The data review/validation was based on the laboratory data summary reports and raw data.

I.4.1 Laboratory Sample Delivery Groups

The following sections collectively summarize the review and validation of the direct push analytical data for Laucks SDGs IAP57 through IAP63. The data review and validation results are presented in the following sections.

I.4.1.1 Data Package Completeness

The data packages were reviewed to verify that each SDG contained the data contractually required in the deliverable and that all samples listed on the COC forms were analyzed for the requested parameters. The review indicated that the data packages were complete.

I.4.1.2 Laboratory Case Narrative

The laboratory case narratives for SDGs IAP57, IAP61, IAP62, and IAP63 indicated that the initial VOC calibrations (03/20/03, 03/28/03, 05/12/03, and 05/21/03) yielded %RSD values greater than 15 percent for several analytes. Using linear regression the *r* values were greater that the method required 0.990; therefore, no qualification of data was required based on outlying precision.

The laboratory case narratives for SDGs IAP57, IAP61, IAP62, and IAP63 indicated that several samples were received at temperatures below the evaluation criteria. The samples were not frozen; therefore, no qualification of data was required based on outlying preservation criteria.

The laboratory case narratives for SDGs IAP58, IAP59, and IAP60 indicated that several TOC sample results were less than the reporting limit of 0.1 percent. The reported concentration is dependent on the weight of the sample injected into the furnace and the amount of sample/standard sand homogenized for injection. Results below the reporting limit and method detection limit were calculated based on half of the lowest calibration standard. These values were report as estimated values. Soil samples collected during the monitoring well installation field activities were analyzed for TOC and presented in **Section 4**. TOC was detected in 49 of the 53 soil samples collected during the monitoring well installation field activities. The TOC results ranged from nondetect to 1.6 percent dry basis. The highest concentration of TOC was detected at monitoring well location FTP-MW1.

The laboratory case narrative for SDG IAP61 indicated that the VOC CV analyzed on 05/14/03 yielded percent difference (%D) values greater that 25 percent for carbon tetrachloride and 1,3-dichloropropene. Associated sample results were reported as nondetect and qualified as estimated based on the outlying accuracy.

The laboratory case narratives for SDGs IAP61 and IAP62 indicated that the initial SVOC calibration analyzed on 05/13/03 yielded a %RSD value greater than 15 percent for di-n-butylphthalate. Using linear regression the *r* values were greater that the method required 0.990; therefore, no qualification of data was required based on outlying precision.

The laboratory case narratives for SDG IAP61 and IAP62 indicated that the SVOC CV analyzed on 05/19/03, 06/02/03, and 06/04/03 yielded %D values greater that 25 percent for several analytes. Associated sample (05/19/03) results for indeno[1,2,3-cd]pyrene, benzo[g,h,I]perylene and dibenz[a,h]anthracene were reported as nondetect and qualified as estimated based on outlying precision. Associated sample (06/02/03) results for 4-chloroaniline were reported as nondetect and qualified as estimated based on outlying precision. Associated sample (06/04/03) results for 2,2(1-chloropropane) and 2,4-dinitrophenol were reported as nondetect and qualified as estimated based on the outlying precision.

The laboratory case narrative for SDG IAP61 indicated that the VOC CV analyzed on 05/15/03, 5/19/03, and 05/20/03 yielded %D values greater that 25 percent for several analytes. Associated sample (05/15/03) results for bromomethane, chloroethane, chloromethane, methylene chloride, trans-1,3-dichloropropene, trichlorofluoromethane, and dichlorodifluoromethane were reported as nondetect and qualified as estimated based on outlying precision. Associated sample (05/19/03) results for bromomethane, carbon disulfide, methylene chloride, carbon tetrachloride, cis-1,3-dichloropropene, trans-1,3-dichloropropene, dibromochloromethane, dibromomethane, trichlorofluoromethane, and bromoform were reported as nondetect and qualified as estimated based on outlying precision. Associated sample (05/20/03) results for bromomethane, methylene chloride, 2-butanone, carbon tetrachloride, cis-1,3-dichloropropene, trans-1,3-dichloropropene, dibromochloromethane, tichlorofluoromethane, and bromoform were reported as nondetect and qualified as estimated based on the outlying precision.

The laboratory case narratives for SDG IAP61 and IAP62 indicated that the VOC CV analyzed on 05/23 yielded a %D value greater that 25 percent for dichlorodifluoromethane. Associated sample results were reported as nondetect and qualified as estimated based on outlying precision.

The laboratory case narrative for SDG IAP61 indicated that the chromium CV recovery was outside evaluation criteria. The associated sample was qualified as estimated based on outlying accuracy.

Additional problems identified in the laboratory case narratives for SDGs IAP57 through IAP63 are discussed in subsequent sections.

I.4.1.3 Holding Times and Sample Preservation

Review of the sample collection and analyses dates involved comparing the chemicals of concern, the chemical results summary forms, and the raw data forms for accuracy, consistency, and holding time compliance. Several samples were received at the laboratory below 2°C. The samples were not frozen; therefore, no qualification of data was required based on preservation criteria. All samples were extracted and analyzed within the required holding time criteria with the exception of SVOCs and ortho-phosphate. Data qualifications based on the outlying holding time criteria are presented in the following table.

Site ID	Field ID	Parameter	Analyte	Qualification
Line 2	L2-MW4	E300.0	ortho-Phosphate	**J**
Line 3	L3-MW1RE	8270C	Entire Sample	**J**
Line 3	L3-MW2RE	8270C	Entire Sample	**J**
Line 9	L9-MW1	8270C	Entire Sample	**J**
Line 9	L9-MW3RE	8270C	Entire Sample	**J**
Line 9	L9-MW4RE	8270C	Entire Sample	**J**
Line 9	L9-MW5RE	8270C	Entire Sample	**J**
Line 9	L9-MW6RE	8270C	Entire Sample	**J**
Line 9	L9-MW7	8270C	Entire Sample	**J**
Line 9	L9-MW7	E300.0	ortho-Phosphate	**J**
Line 9	L9-MW8RE	8270C	Entire Sample	**J**
Line 9	L9-MW9RE	8270C	Entire Sample	**J**
Line 9	L9-MW10RE	8270C	Entire Sample	**J**
Line 9	L9-MW11	8270C	Entire Sample	**J**
Line 9	L9-MW12	8270C	Entire Sample	**J**
Line 9	L9-MW12	E300.0	ortho-Phosphate	**J**
Line 9	L9-MW13	8270C	Entire Sample	**J**
Line 9	L9-MW13	E300.0	ortho-Phosphate	**J**

I.4.1.4 Initial Calibration

Initial calibration criteria were established to assess whether the instrument was capable of producing acceptable qualitative and quantitative data. As identified in various standard operating procedures, the linearity of the calibration curve was established using a blank and at least five standard concentrations for VOCs, SVOCs, explosives, metals, mercury, and various wet chemistry analyses.

The VOC initial calibration response factors (RFs) were reviewed and were greater than 0.10 for chloromethane, 1,1-dichloroethane and bromoform, greater than 0.30 for chlorobenzene and 1,1,2,2-tetrachloroethane, and greater than 0.05 for all other analytes. Review of the initial calibration summary forms indicated %RSDs were less than or equal to 30 percent for CCCs (1,1-dichloroethene, toluene, chloroform, ethylbenzene, 1,2-dichloropropane, and vinyl chloride). RSD values were below 15 percent for non-CCCs. In some instances, linearity was determined using linear regression or quadratic curve fit. All *r* values were greater than 0.990, therefore, no qualifications of data were required. A recalculation of the RFs and %RSD for four compounds was performed, and no errors in calculations were noted.

The SVOC initial calibration response factors (RFs) were reviewed and were greater than 0.05 for all analytes. Review of the initial calibration summary forms indicated the %RSDs were less than or equal to 30 percent for CCCs and less than or equal to 15 percent for non-CCCs, with the exception of 2,4-dinitrophenol and di-n-butylphthlate. The table below identifies associated samples qualified as estimated based on outlying SVOC %RSD recoveries Recalculation of the RFs and %RSD for six compounds was performed, and no errors in calculations were noted.

Site ID	Field ID	Parameter	Analyte	Qualification
Line 3	L3-MW1	8270C	Di-n-butylphthalate	**J**
Line 3	L3-MW1	8270C	2,4-Dinitrophenol	**J**
Line 3	L3-MW2	8270C	2,4-Dinitrophenol	**J**
Line 3	L3-MW2	8270C	Di-n-butylphthalate	**J**
Line 9	L9-MW3	8270C	2,4-Dinitrophenol	**J**
Line 9	L9-MW3	8270C	Di-n-butylphthalate	**J**
Line 9	L9-MW5	8270C	2,4-Dinitrophenol	**J**
Line 9	L9-MW5	8270C	Di-n-butylphthalate	**J**
Line 9	L9-MW6	8270C	2,4-Dinitrophenol	**J**
Line 9	L9-MW6	8270C	Di-n-butylphthalate	**J**

Review of the explosives initial calibration indicated that the %RSD for the calibration factors of all analytes met the criteria of less than 20 percent RSD. Therefore, no qualification of data was required. In addition, the calibration factor and %RSD values presented on the summary forms for both the primary and secondary columns were recalculated for 10 percent of the target analytes. No calibration or transcription errors were noted.

All initial metals calibration verification recoveries were within evaluation criteria of 90 to 110 percent for inductively coupled plasma (ICP) metals and 80 to 120 percent for mercury. One hundred percent of the initial calibrations and recoveries were recalculated and compared to the raw data; no calculation or transcription errors were noted. No qualification of the data was required based on initial calibration data.

Review of the various initial wet chemistry parameter calibrations indicated that all verification samples were within the method established criteria; therefore, no qualification of wet chemistry data was required based on the initial calibration.

I.4.1.5 Retention Times

Retention time windows are crucial to the identification of explosives target compounds. Retention time windows are established for each explosives analyte and surrogate by injecting each single component compound into the chromatographic system three times over a 72-hour period. EPA SW-846 then defines the width of the retention time windows as plus or minus three standards deviations of the mean absolute retention time established during the 72-hour period. The center of the retention time window for each analyte and surrogate is the absolute retention time determined during the calibration verification standard analyzed at the beginning of each analytical batch.

Chromatographs from associated samples with target compound detections were reviewed. The chromatographs were reviewed to determine if the associated peaks were within known retention time windows and that those compounds were identified correctly. All target compounds were identified correctly; therefore, no qualification of data was required.

I.4.1.6 Calibration Verification

CV samples were established to assess whether the instrumentation was capable of producing acceptable qualitative and quantitative data established by the initial calibration.

Review of the VOC sample chromatograms indicated the CVs were performed at the required frequency of every 12 hours. Review of continuing calibration summary form indicated all RFs met the evaluation criteria of greater than 0.10 (chloromethane, 1,1-DCA, and bromoform), 0.30 (chlorobenzene and 1,1,2,2-tetrachloroethane) and greater than 0.05 for all other analytes. In addition, %Ds met the evaluation criteria of less than 20 percent for CCCs and less than 50 percent for all other analytes with the exception of carbon tetrachloride, dichlorodifluoromethane, 1,3-dichloropropene. The table below identifies associated samples qualified as estimated based on outlying VOC %RSD. Recalculation of the RFs and %Ds (associated validated data from four compounds) was completed and no errors in calculation were noted.

Site ID	Field ID	Parameter	Analyte	Qualification
Line 9	L9-MW1	8260B	Bromoform	**J**
Line 9	L9-MW1	8260B	Bromomethane	**J**
Line 9	L9-MW1	8260B	2-Butanone	**J**
Line 9	L9-MW1	8260B	Carbon Tetrachloride	**J**
Line 9	L9-MW1	8260B	Dibromochloromethane	**J**
Line 9	L9-MW1	8260B	cis-1,3-Dichloropropene	**J**
Line 9	L9-MW1	8260B	trans-1,3-Dichloropropene	**J**

Site ID	Field ID	Parameter	Analyte	Qualification
Line 9	L9-MW1	8260B	Methylene Chloride	**J**
Line 9	L9-MW1	8260B	Trichlorofluoromethane	**J**
Line 9	L9-MW2	8260B	Bromoform	**J**
Line 9	L9-MW2	8260B	Bromomethane	**J**
Line 9	L9-MW2	8260B	Carbon Disulfide	**J**
Line 9	L9-MW2	8260B	Carbon Tetrachloride	**J**
Line 9	L9-MW2	8260B	cis-1,3-Dichloropropene	**J**
Line 9	L9-MW2	8260B	trans-1,3-Dichloropropene	**J**
Line 9	L9-MW2	8260B	Dibromochloromethane	**J**
Line 9	L9-MW2	8260B	Dibromomethane	**J**
Line 9	L9-MW2	8260B	Methylene Chloride	**J**
Line 9	L9-MW2	8260B	Trichlorofluoromethane	**J**
Line 9	L9-MW3	8260B	Carbon Tetrachloride	**J**
Line 9	L9-MW3	8260B	1,3-Dichloropropene	**J**
Line 9	L9-MW4	8260B	Carbon Tetrachloride	**J**
Line 9	L9-MW4	8260B	1,3-Dichloropropene	**J**
Line 9	L9-MW5	8260B	Carbon Tetrachloride	**J**
Line 9	L9-MW5	8260B	1,3-Dichloropropene	**J**
Line 9	L9-MW6	8260B	Carbon Tetrachloride	**J**
Line 9	L9-MW6	8260B	1,3-Dichloropropene	**J**
Line 9	L9-MW7	8260B	Bromomethane	**J**
Line 9	L9-MW7	8260B	Chloroethane	**J**
Line 9	L9-MW7	8260B	Chloromethane	**J**
Line 9	L9-MW7	8260B	Dichlorodifluoromethane	**J**
Line 9	L9-MW7	8260B	trans-1,3-Dichloropropene	**J**
Line 9	L9-MW7	8260B	Methylene Chloride	**J**
Line 9	L9-MW7	8260B	Trichlorofluoromethane	**J**
Line 9	L9-MW8	8260B	Carbon Tetrachloride	**J**
Line 9	L9-MW8	8260B	1,3-Dichloropropene	**J**
Line 9	L9-MW9	8260B	Carbon Tetrachloride	**J**
Line 9	L9-MW9	8260B	1,3-Dichloropropene	**J**
Line 9	L9-MW10	8260B	Carbon Tetrachloride	**J**
Line 9	L9-MW10	8260B	1,3-Dichloropropene	**J**
Line 9	L9-MW11	8260B	Bromomethane	**J**
Line 9	L9-MW11	8260B	Chloroethane	**J**
Line 9	L9-MW11	8260B	Chloromethane	**J**

Site ID	Field ID	Parameter	Analyte	Qualification
Line 9	L9-MW11	8260B	Dichlorodifluoromethane	**J**
Line 9	L9-MW11	8260B	trans-1,3-Dichloropropene	**J**
Line 9	L9-MW11	8260B	Methylene Chloride	**J**
Line 9	L9-MW11	8260B	Trichlorofluoromethane	**J**
Line 9	L9-MW12	8260B	Bromomethane	**J**
Line 9	L9-MW12	8260B	Chloroethane	**J**
Line 9	L9-MW12	8260B	Chloromethane	**J**
Line 9	L9-MW12	8260B	Dichlorodifluoromethane	**J**
Line 9	L9-MW12	8260B	trans-1,3-Dichloropropene	**J**
Line 9	L9-MW12	8260B	Methylene Chloride	**J**
Line 9	L9-MW12	8260B	Trichlorofluoromethane	**J**
Line 9	L9-MW13	8260B	Bromoform	**J**
Line 9	L9-MW13	8260B	Bromomethane	**J**
Line 9	L9-MW13	8260B	Carbon Disulfide	**J**
Line 9	L9-MW13	8260B	Carbon Tetrachloride	**J**
Line 9	L9-MW13	8260B	Dibromochloromethane	**J**
Line 9	L9-MW13	8260B	Dibromomethane	**J**
Line 9	L9-MW13	8260B	cis-1,3-Dichloropropene	**J**
Line 9	L9-MW13	8260B	trans-1,3-Dichloropropene	**J**
Line 9	L9-MW13	8260B	Methylene Chloride	**J**
Line 9	L9-MW13	8260B	Trichlorofluoromethane	**J**
Fire Training Pit	FTP-MW4	8260B	Dichlorodifluoromethane	**J**
Fire Training Pit	FTP-MW5	8260B	Dichlorodifluoromethane	**J**
Fire Training Pit	FTP-MW6	8260B	Dichlorodifluoromethane	**J**
Fire Training Pit	FTP-MW7	8260B	Dichlorodifluoromethane	**J**
Fire Training Pit	FTP-MW8	8260B	Dichlorodifluoromethane	**J**
East Burn Pads	EBP-MW4	8260B	Bromoform	**J**
East Burn Pads	EBP-MW4	8260B	Bromomethane	**J**
East Burn Pads	EBP-MW4	8260B	Carbon Disulfide	**J**
East Burn Pads	EBP-MW4	8260B	Carbon Tetrachloride	**J**
East Burn Pads	EBP-MW4	8260B	Dibromochloromethane	**J**
East Burn Pads	EBP-MW4	8260B	Dibromomethane	**J**
East Burn Pads	EBP-MW4	8260B	cis-1,3-Dichloropropene	**J**
East Burn Pads	EBP-MW4	8260B	trans-1,3-Dichloropropene	**J**
East Burn Pads	EBP-MW4	8260B	Methylene Chloride	**J**
East Burn Pads	EBP-MW4	8260B	Trichlorofluoromethane	**J**

Site ID	Field ID	Parameter	Analyte	Qualification
East Burn Pads	EBP-MW6	8260B	Dichlorodifluoromethane	**J**
West Burn Pads Area	WBP-MW1	8260B	Dichlorodifluoromethane	**J**
West Burn Pads Area	WBP-MW2	8260B	Dichlorodifluoromethane	**J**
West Burn Pads Area	WBP-MW3	8260B	Dichlorodifluoromethane	**J**

Review of the SVOC injection log summary report indicated that the CVs were performed at the required frequency of every 12 hours or batch of 20 samples. Based on the review of continuing calibration raw data and summary forms, all RFs met the evaluation criteria of greater than 0.05 for all analytes. In addition, %Ds met the evaluation criteria of less than 20% for CCCs and for non-CCCs with the exception of benzo(g,h,i perylene), 4-chloroaniline, dibenz(a,h)anthracene, 4,6-dinitro-2-methylphenol, and indeno(1,2,3-cd)pyrene. The table below identifies associated samples qualified as estimated based on outlying SVOC %RSD. Recalculation of the RF and %D for CV was completed (associated validated data for six compounds), and no errors in calculation were noted.

Site ID	Field ID	Parameter	Analyte	Qualification
Line 3	L3-MW1	8270C	Indeno (1,2,3-cd) pyrene	**J**
Line 3	L3-MW1	8270C	Benzo (g,h,i) perylene	**J**
Line 3	L3-MW1	8270C	Dibenz (a,h) anthracene	**J**
Line 3	L3-MW1	8270C	4,6-Dinitro-2-methylphenol	**J**
Line 3	L3-MW2	8270C	Indeno (1,2,3-cd) pyrene	**J**
Line 3	L3-MW2	8270C	Benzo (g,h,i) perylene	**J**
Line 3	L3-MW2	8270C	Dibenz (a,h) anthracene	**J**
Line 3	L3-MW2	8270C	4,6-Dinitro-2-methylphenol	**J**
Line 9	L9-MW1	8270C	4-Chloroaniline	**J**
Line 9	L9-MW3	8270C	Indeno (1,2,3-cd) pyrene	**J**
Line 9	L9-MW3	8270C	Benzo (g,h,i) perylene	**J**
Line 9	L9-MW3	8270C	Dibenz (a,h) anthracene	**J**
Line 9	L9-MW3	8270C	4,6-Dinitro-2-methylphenol	**J**
Line 9	L9-MW4	8270C	Indeno[1,2,3-cd]pyrene	**J**
Line 9	L9-MW4	8270C	Benzo[g,h,i]perylene	**J**
Line 9	L9-MW4	8270C	Dibenz[a,h]anthracene	**J**
Line 9	L9-MW5	8270C	Indeno (1,2,3-cd) pyrene	**J**
Line 9	L9-MW5	8270C	Benzo (g,h,i) perylene	**J**
Line 9	L9-MW5	8270C	Dibenz (a,h) anthracene	**J**
Line 9	L9-MW5	8270C	4,6-Dinitro-2-methylphenol	**J**
Line 9	L9-MW6	8270C	Indeno (1,2,3-cd) pyrene	**J**
Line 9	L9-MW6	8270C	Benzo (g,h,i) perylene	**J**

Site ID	Field ID	Parameter	Analyte	Qualification
Line 9	L9-MW6	8270C	Dibenz (a,h) anthracene	**J**
Line 9	L9-MW6	8270C	4,6-Dinitro-2-methylphenol	**J**
Line 9	L9-MW7	8270C	4-Chloroaniline	**J**
Line 9	L9-MW8	8270C	Indeno[1,2,3-cd]pyrene	**J**
Line 9	L9-MW8	8270C	Benzo[g,h,i]perylene	**J**
Line 9	L9-MW8	8270C	Dibenz[a,h]anthracene	**J**
Line 9	L9-MW11	8270C	4-Chloroaniline	**J**
Line 9	L9-MW12	8270C	4-Chloroaniline	**J**
Line 9	L9-MW12	8270C	4-Chloroaniline	**J**

Explosives CVs were analyzed at the required frequency, one every 12 hours of analysis, as required by the method. Review of the CV summary forms indicated that all %Ds met the evaluation criteria of less than 15 percent for all target compounds, with the exception of 2,4,6-TNT and RDX on the secondary column. Data was quantified using the primary column, so no qualification of explosives data was required based on outlying CV recoveries. Ten percent of the %D (associated validated data) was recalculated for each CV sample and no calculation or transcription errors were noted.

Metals CVs were analyzed at the required frequency of one per ten samples analyzed. Review of the CV summary forms indicated that all recoveries were within the evaluation criteria with the exception of chromium. The associated sample (WBP-MW3) was qualified as estimated based on the outlying CV recovery. Ten percent of the CV recoveries (associated validated data) were recalculated for each CV sample and no calculation or transcription errors were noted.

Wet chemistry CVs were analyzed at the method recommended frequency and were within the evaluation criteria; therefore, no qualification of data was required based on wet chemistry CV recoveries. Ten percent of CV recoveries (associated validated data) were recalculated for each CV sample and no calculation or transcription errors were noted.

I.4.1.7 Blank Samples

Blank samples were analyzed to assess the existence and magnitude of contamination during laboratory activities. All method preparation, source water, rinsate, and trip blanks were reported as nondetect with the exception of acetone, chloroform, bromodichloromethane, dibromochloromethane, Freon 113, arsenic, barium, calcium, chromium, lead, magnesium, silver, and sodium. Associated acetone, bromodichloromethane and dibromochloromethane results were reported as nondetect and did not require qualification. Associated barium, calcium, magnesium, and sodium results were five times greater than the blank contamination and did not require qualification. Associated chloroform, Freon 113, arsenic, chromium, lead, and silver results qualified as nondetect based on blank contamination are listed in the table below.

Site ID	Field ID	Parameter	Analyte	New RL	Qualification
Fire Training Pit	FTP-MW1	6020	Arsenic	– –	**U**
Fire Training Pit	FTP-MW1	6020	Chromium	– –	**U**
Fire Training Pit	FTP-MW2	6020	Arsenic	– –	**U**
Fire Training Pit	FTP-MW2	6020	Chromium	– –	**U**
Fire Training Pit	FTP-MW2	6020	Lead	– –	**U**
Fire Training Pit	FTP-MW3	6020	Arsenic	– –	**U**
Fire Training Pit	FTP-MW3	6020	Chromium	– –	**U**
Fire Training Pit	FTP-MW3	6020	Lead	– –	**U**
Fire Training Pit	FTP-MW4	6020	Arsenic	– –	**U**
Fire Training Pit	FTP-MW4	6020	Chromium	– –	**U**
Fire Training Pit	FTP-MW4	6020	Lead	– –	**U**
Fire Training Pit	FTP-MW4	6020	Silver	– –	**U**
Fire Training Pit	FTP-MW5	6020	Arsenic	– –	**U**
Fire Training Pit	FTP-MW5	6020	Chromium	– –	**U**
Fire Training Pit	FTP-MW5	6020	Lead	– –	**U**
Fire Training Pit	FTP-MW5	6020	Silver	– –	**U**
Fire Training Pit	FTP-MW6	6020	Arsenic	– –	**U**
Fire Training Pit	FTP-MW6	6020	Chromium	– –	**U**
Fire Training Pit	FTP-MW6	6020	Lead	– –	**U**
Fire Training Pit	FTP-MW6	6020	Silver	– –	**U**
Fire Training Pit	FTP-MW7	8260B	Freon 113	– –	**U**
Fire Training Pit	FTP-MW7	6020	Arsenic	– –	**U**
Fire Training Pit	FTP-MW7	6020	Chromium	– –	**U**
Fire Training Pit	FTP-MW7	6020	Lead	– –	**U**
Fire Training Pit	FTP-MW7	6020	Silver	– –	**U**
Fire Training Pit	FTP-MW8	6020	Arsenic	– –	**U**
Fire Training Pit	FTP-MW8	6020	Chromium	– –	**U**
Fire Training Pit	FTP-MW8	6020	Lead	– –	**U**
Fire Training Pit	FTP-MW8	6020	Silver	– –	**U**
West Burn Pads Area	WBP-MW1	6020	Arsenic	– –	**U**
West Burn Pads Area	WBP-MW1	6020	Chromium	– –	**U**
West Burn Pads Area	WBP-MW1	6020	Lead	– –	**U**
West Burn Pads Area	WBP-MW1	6020	Silver	– –	**U**
West Burn Pads Area	WBP-MW2	8260B	Freon 113	– –	**U**
West Burn Pads Area	WBP-MW2	6020	Arsenic	– –	**U**
West Burn Pads Area	WBP-MW2	6020	Chromium	– –	**U**

Site ID	Field ID	Parameter	Analyte	New RL	Qualification
West Burn Pads Area	WBP-MW2	6020	Lead	– –	**U**
West Burn Pads Area	WBP-MW2	6020	Silver	– –	**U**
West Burn Pads Area	WBP-MW3	8260B	Freon 113	– –	**U**
West Burn Pads Area	WBP-MW3	6020	Silver	– –	**U**
East Burn Pads	WBP-MW4	8260B	Freon 113	– –	**U**
East Burn Pads	WBP-MW5	8260B	Freon 113	– –	**U**
Line 2	L2-MW4	6020	Chromium	– –	**U**
Line 2	L2-MW4	6020	Lead	– –	**U**
Line 2	L2-MW5	6020	Chromium	– –	**U**
Line 2	L2-MW5	6020	Lead	– –	**U**
Line 2	L2-MW5	6020	Silver	– –	**U**
Line 2	L2-MW6	6020	Arsenic	– –	**U**
Line 2	L2-MW6	6020	Chromium	– –	**U**
Line 2	L2-MW6	6020	Lead	– –	**U**
Line 2	L2-MW6	6020	Silver	– –	**U**
Line 2	L2-MW7	6020	Arsenic	– –	**U**
Line 2	L2-MW7	6020	Chromium	– –	**U**
Line 2	L2-MW7	6020	Lead	– –	**U**
Line 2	L2-MW7	6020	Silver	– –	**U**
Line 2	L2-MW8	6020	Arsenic	– –	**U**
Line 2	L2-MW8	6020	Chromium	– –	**U**
Line 2	L2-MW8	6020	Lead	– –	**U**
Line 2	L2-MW8	6020	Silver	– –	**U**
Line 3	L3-MW1	6020	Arsenic	– –	**U**
Line 3	L3-MW1	6020	Chromium	– –	**U**
Line 3	L3-MW1	6020	Lead	– –	**U**
Line 3	L3-MW1	6020	Silver	– –	**U**
Line 3	L3-MW2	6020	Arsenic	– –	**U**
Line 3	L3-MW2	6020	Chromium	– –	**U**
Line 3	L3-MW2	6020	Lead	– –	**U**
Line 3	L3-MW2	6020	Silver	– –	**U**
Line 9	L3-MW3	8260B	Freon 113	– –	**U**
Line 9	L3-MW4	8260B	Freon 113	– –	**U**
Line 9	L3-MW6	8260B	Freon 113	– –	**U**
Line 9	L3-MW12	8260B	Chloroform	– –	**U**

I.4.1.8 Surrogate Compound Percent Recoveries

Surrogate recoveries were used to evaluate the accuracy of the analytical measurement on a sample-specific basis. Surrogate recoveries for all samples were within evaluation criteria with the exception of L3-MW1 (2-fluorophenol), L9-MW8 (2-fluorophenol and 2,4,6-tribromophenol) and L9-MW9 (2-fluorophenol). Based on Functional Guidelines (USEPA 1999), two or more SVOC surrogates must be outside evaluation criteria before data qualification is required; therefore, samples L3-MW1 and L9-MW9 were not qualified. Data qualifications based on outlying surrogate recoveries are listed in the table below. Ten percent of surrogate recoveries (associated validated data) were recalculated, no calculation or transcription errors were noted.

Site ID	Field ID	Parameter	Analyte	Qualification
Line 9	L9-MW8	8260B	Acid Fraction	**J**

I.4.1.9 Laboratory Control Samples

LCSs were analyzed to assess the accuracy of the analytical method and demonstrate laboratory performance. LCS recoveries were all within the evaluation criteria with the exception of benzoic acid, 2,4-dinitrophenol, hexachlorocyclopentadiene, nitrobenzene, 2-nitrotoluene, 3-nitrotoluene, and 4-nitrotoluene. Data qualifications based on outlying LCS recoveries are listed in the table below. Ten percent of LCS recoveries (associated validated data) were recalculated, no calculation or transcription errors were noted.

Site ID	Field ID	Parameter	Analyte	Qualification
Line 3	L3-MW1	8260B	Benzoic Acid	**R**
Line 3	L3-MW1	8260B	2,4-Dinitrophenol	**J**
Line 3	L3-MW1	8260B	Hexachlorocyclopentadiene	**R**
Line 3	L3-MW2	8260B	Benzoic Acid	**R**
Line 3	L3-MW2	8260B	2,4-Dinitrophenol	**J**
Line 3	L3-MW2	8260B	Hexachlorocyclopentadiene	**R**
Line 9	L9-MW1	8260B	Hexachlorocyclopentadiene	**R**
Line 9	L9-MW2	8260B	Benzoic Acid	**J**
Line 9	L9-MW2	8260B	2,4-Dinitrophenol	**J**
Line 9	L9-MW2	8260B	Hexachlorocyclopentadiene	**R**
Line 9	L9-MW3	8260B	Benzoic Acid	**R**
Line 9	L9-MW3	8260B	2,4-Dinitrophenol	**J**
Line 9	L9-MW3	8260B	Hexachlorocyclopentadiene	**R**
Line 9	L9-MW4	8260B	Hexachlorocyclopentadiene	**R**
Line 9	L9-MW5	8260B	Benzoic Acid	**R**
Line 9	L9-MW5	8260B	2,4-Dinitrophenol	**J**

Site ID	Field ID	Parameter	Analyte	Qualification
Line 9	L9-MW5	8260B	Hexachlorocyclopentadiene	**R**
Line 9	L9-MW6	8260B	Benzoic Acid	**R**
Line 9	L9-MW6	8260B	2,4-Dinitrophenol	**J**
Line 9	L9-MW6	8260B	Hexachlorocyclopentadiene	**R**
Line 9	L9-MW7	8260B	Hexachlorocyclopentadiene	**R**
Line 9	L9-MW8	8260B	Benzoic Acid	**R**
Line 9	L9-MW8	8260B	2,4-Dinitrophenol	**J**
Line 9	L9-MW8	8260B	Hexachlorocyclopentadiene	**R**
Line 9	L9-MW9	8260B	Benzoic Acid	**R**
Line 9	L9-MW9	8260B	2,4-Dinitrophenol	**J**
Line 9	L9-MW9	8260B	Hexachlorocyclopentadiene	**R**
Line 9	L9-MW10	8260B	Hexachlorocyclopentadiene	**R**
Line 9	L9-MW11	8260B	Hexachlorocyclopentadiene	**R**
Line 9	L9-MW12	8260B	Hexachlorocyclopentadiene	**R**
Line 9	L9-MW13	8260B	Hexachlorocyclopentadiene	**R**
Fire Training Pit	FTP-MW4	Explosives	Nitrobenzene	**J**
Fire Training Pit	FTP-MW4	Explosives	2-Nitrotoluene	**J**
Fire Training Pit	FTP-MW4	Explosives	3-Nitrotoluene	**J**
Fire Training Pit	FTP-MW4	Explosives	4-Nitrotoluene	**J**
Fire Training Pit	FTP-MW6	Explosives	Nitrobenzene	**J**
Fire Training Pit	FTP-MW6	Explosives	2-Nitrotoluene	**J**
Fire Training Pit	FTP-MW6	Explosives	3-Nitrotoluene	**J**
Fire Training Pit	FTP-MW6	Explosives	4-Nitrotoluene	**J**
Fire Training Pit	FTP-MW7	Explosives	Nitrobenzene	**J**
Fire Training Pit	FTP-MW7	Explosives	2-Nitrotoluene	**J**
Fire Training Pit	FTP-MW7	Explosives	3-Nitrotoluene	**J**
Fire Training Pit	FTP-MW7	Explosives	4-Nitrotoluene	**J**
Fire Training Pit	FTP-MW8	Explosives	Nitrobenzene	**J**
Fire Training Pit	FTP-MW8	Explosives	2-Nitrotoluene	**J**
Fire Training Pit	FTP-MW8	Explosives	3-Nitrotoluene	**J**
Fire Training Pit	FTP-MW8	Explosives	4-Nitrotoluene	**J**
West Burn Pads Area	WBP-MW2	Explosives	Nitrobenzene	**J**
West Burn Pads Area	WBP-MW2	Explosives	2-Nitrotoluene	**J**
West Burn Pads Area	WBP-MW2	Explosives	3-Nitrotoluene	**J**
West Burn Pads Area	WBP-MW2	Explosives	4-Nitrotoluene	**J**
East Burn Pads	EBP-MW4	8260B	Hexachlorocyclopentadiene	**R**

Site ID	Field ID	Parameter	Analyte	Qualification
East Burn Pads	EBP-MW5	8260B	Hexachlorocyclopentadiene	**R**
East Burn Pads	EBP-MW6	8260B	Hexachlorocyclopentadiene	**R**

I.4.1.10 Laboratory Duplicate Samples

Laboratory duplicate samples were established to determine laboratory precision. The laboratory duplicated various samples for metals and wet chemistry analysis. All duplicate samples RPDs were within the established evaluation criteria; therefore, no qualification of data was required based on outlying precision. Ten percent of the laboratory sample pair precision (associated validated data) was recalculated; no calculation or transcription errors were noted.

I.4.1.11 Field Duplicate Analysis

Field duplicate sample pairs were established to determine both field and laboratory precision. Two groundwater field duplicate sample pairs collected and submitted to the laboratory for analysis. The field duplicate sample pairs are presented in the following table:

Field Duplicate Sample Pairs		
Site ID	**Original Sample ID**	**Duplicate Sample ID**
Fire Training Pit	FTP-MW1	FTP-MW9
East Burn Pads	EBP-MW5	EBP-MW7

Field duplicate sample pair results were within evaluation criteria (25 percent) for all duplicate sample pairs; therefore, no qualifications were required based on outlying precision. Analytical results for the field duplicate sample pairs are presented in **Table I-3**.

I.4.1.12 Quality Assurance Analysis

QA split samples were collected to determine laboratory accuracy and precision. Two groundwater samples were collected and submitted to a secondary laboratory (USACE Chemistry Quality Assurance Branch) for analysis and comparison. The QA split samples are listed in the table below:

Quality Assurance Split Sample Pairs		
Site ID	**Original Sample ID**	**QA Split Sample ID**
Fire Training Pit	FTP-MW1	FTP-MW1 Split
East Burn Pads	EBP-MW5	EBP-MW5 Split

The USACE places the QA sample evaluations into three categories: major, minor, or data agreed. Major discrepancies for groundwater are defined as relative percent differences (RPDs) greater than five times the QA split sample result. Minor discrepancies for groundwater are defined as RPDs equal to and/or no more than two times the split sample result. Data results categorized as agreed are defined as RPDs of less than two times the split sample result.

Table I-4 presents the data comparison of the original data and the QA samples. All data agreed with the exception of unconfirmed HMX and RDX concentrations in split sample EBP-MW5 (minor).

I.4.1.13 Matrix Spike/Matrix Spike Duplicate Analysis

MS/MSD samples were analyzed to assess laboratory accuracy and the effects of matrix inferences on sample preparation and analyses. Two groundwater well locations (FTP-MW8 and EBP-MW6) were selected prior to the sampling event to be collected and submitted to the laboratory for MS/MSD analyses. The laboratory also spiked various samples that were not submitted for MS/MSD analyses. The MS/MSD samples are presented in the table below.

Matrix Spike/Matrix Spike Duplicate Samples		
Site ID	**Original Sample ID**	**Parameters**
Fire Training Pit	FTP-MW8	8260B, 8330, 6020/7470, Wet Chemistry
East Burn Pads	EBP-MW6	8260B, 8270C, 8330, 6020/7470, Wet Chemistry
Line 2	L2-MW7	Metals
Line 3	L3-MW2	Wet Chemistry
Line 9	L9-MW7	8260B, 8270C, 8330, 6020/7470, Wet Chemistry

The following table identifies the MS/MSD samples with outlying recoveries.

Site ID	Field ID	Parameter	Analyte	MS/MSD Recovery	RPD	Criteria
Fire Training Pit	FTP-MW8	300.0	Chloride	150/115	**26**	73-121/11
Fire Training Pit	FTP-MW8	300.0	ortho-Phosphate	100/113	**12**	81-115/10
Fire Training Pit	FTP-MW8	300.0	Sulfide	**137/139**	2	72-124/10
Fire Training Pit	FTP-MW8	300.0	Total Organic Carbon	76/**68**	11	70-119/11
Fire Training Pit	FTP-MW8	300.0	Calcium	**146**	-	75-125
East Burn Pads	EBP-MW6	8270C	2,4-Dinitrophenol	**0**/79	**200**	20-160/50
East Burn Pads	EBP-MW6	8270C	Hexachlorocyclopentadiene	**0/7**	**200**	20-160/50
East Burn Pads	EBP-MW6	8270C	4-Nitrophenol	**7**/100	**174**	10-98/50
East Burn Pads	EBP-MW6	8270C	4,6-Dinitro-2-Methylphenol	**0**/100	**200**	20-160/50
East Burn Pads	EBP-MW6	8270C	Pentachlorophenol	**9**/79	**159**	10-137/-
East Burn Pads	EBP-MW6	8270C	2-Nitrophenol	22/79	**113**	20-160/50
East Burn Pads	EBP-MW6	8270C	Benzoic Acid	**0**/63	**200**	20-160/50
East Burn Pads	EBP-MW6	8270C	2,4-Dichlorophenol	41/74	50	20-160/57
East Burn Pads	EBP-MW6	8270C	4-Chloro-3-Methylphenol	63/105	16	27-109/50
East Burn Pads	EBP-MW6	8270C	2,4,5-Trichlorophenol	29/84	**73**	20-160/50
East Burn Pads	EBP-MW6	8270C	Pyrene	116/126	8	44-116/20

Site ID	Field ID	Parameter	Analyte	MS/MSD Recovery	RPD	Criteria
East Burn Pads	EBP-MW6	8270C	1,4-Dichlorobenzene	37/63	**52**	24-63/39
East Burn Pads	EBP-MW6	8270C	1,3,4-Trichlorobenzene	43/63	**38**	31-67/28
Line 2	L2-MW7	6020	Calcium	96/72	**29**	68-122/10
Line 2	L2-MW7	6020	Magnesium	**70**	– –	75-125
Line 3	L3-MW2	353.2	NO_3+NO_2	**72**	– –	75-125
Line 9	L9-MW7	300.0	Sulfate	95/107	**12**	81-115/10

Functional guidelines indicate that organic data should not be qualified based on MS/MSD criteria alone. Because surrogate recovery and associated LCS recoveries were within criteria, no qualification of SVOC data was required based on outlying MS/MSD recoveries.

Sulfide results were reported as nondetect; therefore, no qualification of sulfide data was required.

The native calcium and magnesium concentrations in groundwater samples FTP-MW8 and L2-MW7 were four times greater that the spike concentration added; therefore, no qualification of associated calcium or magnesium data was required. Data qualifications based on outlying MS/MSD recoveries are presented in the table below. Ten percent of MS/MSD recoveries (associated validated data) were recalculated; no calculation or transcription errors were noted.

Site ID	Field ID	Analyte	Qualification
Fire Training Pit	FTP-MW8	Chloride	**J**
Fire Training Pit	FTP-MW8	ortho-Phosphate	**J**
Fire Training Pit	FTP-MW8	Total Organic Carbon	**J**
Line 3	L3-MW2	NO_3+NO_2	**J**
Line 9	L9-MW7	Sulfate	**J**

I.4.1.14 PARCC Parameters

Precision and Accuracy

The agreement between duplicate analyses within control limits indicates satisfactory precision in a measurement system. The recovery of a predetermined amount of a spike within control limits indicates satisfactory accuracy with respect to the method on the individual sample and general matrix. For all analyses, ninety-seven percent of the indicators reviewed for accuracy (LCS, MS, and/or surrogate spikes) were within evaluation criteria. Ninety-six percent of the indicators reviewed for precision (matrix spike duplicate and/or field duplicates) were within evaluation criteria.

The overall accuracy and precision of the groundwater and surface water data collected and reported during the sampling event were concluded to be satisfactory.

Representativeness

Representativeness expresses the degrees to which sample data accurately and precisely represent the characteristics of a population. Representativeness is a qualitative parameter that is of concern in the proper design of the sampling program, such that the sampling locations selected will provide representative data for decisions made at IAAAP. Representativeness was assessed using the two field duplicate sample pairs collected during the groundwater RAA field activities. Field duplicate sample pairs were within evaluation criteria; therefore, it was concluded that representativeness was satisfactory.

Comparability

Comparability expresses the confidence with which one data set can be compared to another. In accordance with the QAPP, data are comparable when siting considerations, collection techniques, measurement methods, and reporting procedures are equivalent for the samples within a sample set. Throughout this investigation, appropriate procedures for sampling and analytical shipping were implemented as specified in the IAAAP Facility Wide Work Plan (URS 2002a). Within this data set, it was concluded that results were comparable to one another.

Completeness

Completeness is defined as the percentage of the total number of analytical results requested which are judged to be valid, including estimated J values, in accordance with the IAAAP Facility-Wide Work Plan (URS 2002a). Ninety-nine percent of the analytical data collected was considered to be valid after data review and validation.

Sensitivity

Sensitivity is defined as the capability of a method or instrument to discriminate between measurement responses representing different levels of a variable of interest. MDLs were determined as outlined in 40 CFR Part 136 and are defined as the minimum concentration of a substance that can be identified, measured and reported with 99 percent confidence that the analyte concentration is greater that zero, and is determined for analysis of a sample in a given matrix containing the analyte. Laboratory RLs are generally three to five times higher than the laboratory MDLs. Values above the MDL and less than the RL were qualified as estimated.

Sample dilutions, volume constraints, and matrix interference will decrease sensitivity. RLs were elevated in SDGs IAP57 through IAP63, but project sensitivity requirements established in the project DQOs were met.

I.5 REFERENCES

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Direct Push Results

TABLE I-1
SUMMARY OF CHEMICALS IN DIRECT PUSH SAMPLES
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP Regulatory Standard	Maximum Detection	Detection Frequency	FTP-DP01-38			FTP-DP02-25			FTP-DP03-31			FTP-DP04-13			FTP-DP04-27		
DATE COLLECTED				October 22, 2002			October 27, 2002			October 27, 2002			November 5, 2002			October 23, 2002		
				Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMPOUNDS (µg/L)																		
1,1,1-Trichloroethane	200 (a)	2100 JD	17 / 24	<	3	U	**190**	3		**2100**	150	JD	<	3	U	<	3	U
1,1,2,2-Tetrachloroethane	0.3 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
1,1,2-Trichloroethane	5 (a)	26	3 / 24	<	3	U	**1**	3	J	**26**	3		<	3	U	<	3	U
1,1-Dichloroethane	810 (c)	72 J	11 / 24	<	3	U	**4**	3		**72**	3	J	<	3	U	<	3	U
1,1-Dichloroethene	7 (a)	2800 JD	15 / 24	<	3	U	**150**	6	D	**2800**	150	JD	<	3	U	<	3	U
1,2-Dichloroethane	5 (a)	17	4 / 24	<	3	U	<	3	U	**5**	3	J	<	3	U	<	3	U
1,2-Dichloropropane	5 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
2-Butanone	1900 (c)	14 J	1 / 24	<	10	U	<	10	U	**14**	10	J	<	10	U	<	10	U
2-Hexanone	N/A	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Acetone	610 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Benzene	5 (a)	2 J	1 / 24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromochloromethane	90 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromodichloromethane	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromoform	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Carbon Disulfide	1000 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Carbon Tetrachloride	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chlorobenzene	110 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chlorodibromomethane	5 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloroethane	4.6 (c)	5	1 / 24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloroform	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloromethane	3 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
cis-1,2-Dichloroethene	70 (a)	46	7 / 24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
cis-1,3-Dichloropropene	0.4 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Dichlorodifluoromethane	1000 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Ethylbenzene	700 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Freon 113	59000 (c)	31	3 / 24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methyl Bromide	10 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methyl Isobutyl Ketone	160 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methylene Bromide	61 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methylene Chloride	5 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Styrene	100 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Tetrachloroethene	5 (a)	37	5 / 24	<	3	U	**2**	3	J	**37**	3		<	3	U	<	3	U
Toluene	1000 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
trans-1,2-Dichloroethene	100 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U

TABLE I-1
SUMMARY OF CHEMICALS IN DIRECT PUSH SAMPLES
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP Regulatory Standard	Maximum Detection	Detection Frequency	FTP-DP01-38			FTP-DP02-25			FTP-DP03-31			FTP-DP04-13			FTP-DP04-27		
DATE COLLECTED				October 22, 2002			October 27, 2002			October 27, 2002			November 5, 2002			October 23, 2002		
				Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMPOUNDS (µg/L)																		
trans-1,3-Dichloropropene	N/A	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Trichloroethene	5 (a)	12	6 / 24	<	3	U	<	3	U	**4**	3	J	<	3	U	<	3	U
Trichlorofluoromethane	1300 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Vinyl Chloride	2 (a)	29	3 / 24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Xylenes				<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
m,p-Xylene				<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
o-Xylene				<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
m,p-Xylene	10000 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
o-Xylene	10000 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
EXPLOSIVES (µg/L)																		
1,3,5-Trinitrobenzene	1100 (c)	-	0/10	NE			NE			NE			NE			NE		
1,3-Dinitrobenzene	1 (b)	-	0/10	NE			NE			NE			NE			NE		
2,4,6-Trinitrotoluene	2 (b)	-	0/10	NE			NE			NE			NE			NE		
2,4-Dinitrotoluene	1 (d)	-	0/10	NE			NE			NE			NE			NE		
2,6-Dinitrotoluene	1 (d)	-	0/10	NE			NE			NE			NE			NE		
2-Amino-4,6-Dinitrotoluene	N/A	-	0/10	NE			NE			NE			NE			NE		
2-Nitrotoluene	61 (c)	-	0/10	NE			NE			NE			NE			NE		
3-Nitrotoluene	61 (c)	-	0/10	NE			NE			NE			NE			NE		
4-Amino-2,6-Dinitrotoluene	N/A	-	0/10	NE			NE			NE			NE			NE		
4-Nitrotoluene	61 (c)	-	0/10	NE			NE			NE			NE			NE		
HMX	400 (b)	27	2 / 10	NE			NE			NE			NE			NE		
MNX	N/A	-	0/10	NE			NE			NE			NE			NE		
Nitrobenzene	3.4 (c)	-	0/10	NE			NE			NE			NE			NE		
RDX	2 (b)	3.5 P	1 / 10	NE			NE			NE			NE			NE		
Tetryl	N/A	2.8 P	1 / 10	NE			NE			NE			NE			NE		

Notes:

< = Less Than
µg/L = Micrograms Per Liter
D = Dilution
HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
IAAAP = Iowa Army Ammunition Plant
J = Estimated
MNX = Mono-Nitroso RDX
N/A = Not Available

NE = Not Evaluated
P = Percent difference greater than 25%
Qual = Qualifier
RAA = Remedial Alternatives Analysis
RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine
RL = Reporting Limit
U = Nondetect
Z = Co-Elution

All samples collected during the Six Sites RAA Data Collection (URS 2003).
Bold Result = Concentration Detected
▨ Above IAAAP Regulatory Standard
Regulatory Standards:
(a) Maximum Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region 9 Preliminary Remediation Goal (PRG)
(d) Proposed DNT Mixture Action Level

TABLE I-1
SUMMARY OF CHEMICALS IN DIRECT PUSH SAMPLES
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP			FTP-DP05-23			FTP-DP06-24			FTP-DP07-27			FTP-DP08-23			FTP-DP09-30		
DATE COLLECTED	Regulatory	Maximum	Detection	October 25, 2002			October 27, 2002			October 23, 2002			October 25, 2002			October 23, 2002		
	Standard	Detection	Frequency	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMPOUNDS (µg/L)																		
1,1,1-Trichloroethane	200 (a)	2100 JD	17 / 24	**40**	3		**6**	3		**6**	3		**24**	3		<	3	U
1,1,2,2-Tetrachloroethane	0.3 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
1,1,2-Trichloroethane	5 (a)	26	3 / 24	<	3	U	<	3	U	<	3	U	**2**	3	J	<	3	U
1,1-Dichloroethane	810 (c)	72 J	11 / 24	**3**	3		<	3	U	<	3	U	**41**	3		<	3	U
1,1-Dichloroethene	7 (a)	2800 JD	15 / 24	**51**	3		**4**	3		**4**	3		**74**	3		<	3	U
1,2-Dichloroethane	5 (a)	17	4 / 24	<	3	U	<	3	U	<	3	U	**17**	3		<	3	U
1,2-Dichloropropane	5 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
2-Butanone	1900 (c)	14 J	1 / 24	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
2-Hexanone	N/A	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Acetone	610 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Benzene	5 (a)	2 J	1 / 24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromochloromethane	90 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromodichloromethane	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromoform	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Carbon Disulfide	1000 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Carbon Tetrachloride	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chlorobenzene	110 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chlorodibromomethane	5 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloroethane	4.6 (c)	5	1 / 24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloroform	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloromethane	3 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
cis-1,2-Dichloroethene	70 (a)	46	7 / 24	**1**	3	J	<	3	U	<	3	U	**46**	3		<	3	U
cis-1,3-Dichloropropene	0.4 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Dichlorodifluoromethane	1000 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Ethylbenzene	700 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Freon 113	59000 (c)	31	3 / 24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methyl Bromide	10 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methyl Isobutyl Ketone	160 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methylene Bromide	61 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methylene Chloride	5 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Styrene	100 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Tetrachloroethene	5 (a)	37	5 / 24	**3**	3	J	<	3	U	<	3	U	**3**	3		<	3	U
Toluene	1000 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
trans-1,2-Dichloroethene	100 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U

TABLE I-1
SUMMARY OF CHEMICALS IN DIRECT PUSH SAMPLES
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP			FTP-DP05-23			FTP-DP06-24			FTP-DP07-27			FTP-DP08-23			FTP-DP09-30		
DATE COLLECTED	Regulatory	Maximum	Detection	October 25, 2002			October 27, 2002			October 23, 2002			October 25, 2002			October 23, 2002		
	Standard	Detection	Frequency	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMPOUNDS (μg/L)																		
trans-1,3-Dichloropropene	N/A	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Trichloroethene	5 (a)	12	6 / 24	<	3	U	<	3	U	**1**	3	J	**12** ▨	3		<	3	U
Trichlorofluoromethane	1300 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Vinyl Chloride	2 (a)	29	3 / 24	<	3	U	<	3	U	<	3	U	**3** ▨	3		<	3	U
Xylenes				<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
m,p-Xylene				<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
o-Xylene				<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
m,p-Xylene	10000 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
o-Xylene	10000 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
EXPLOSIVES (μg/L)																		
1,3,5-Trinitrobenzene	1100 (c)	-	0/10		NE			NE			NE			NE		<	0.36	U
1,3-Dinitrobenzene	1 (b)	-	0/10		NE			NE			NE			NE		<	0.36	U
2,4,6-Trinitrotoluene	2 (b)	-	0/10		NE			NE			NE			NE		<	0.36	U
2,4-Dinitrotoluene	1 (d)	-	0/10		NE			NE			NE			NE		<	0.36	U
2,6-Dinitrotoluene	1 (d)	-	0/10		NE			NE			NE			NE		<	0.36	U
2-Amino-4,6-Dinitrotoluene	N/A	-	0/10		NE			NE			NE			NE		<	0.36	U
2-Nitrotoluene	61 (c)	-	0/10		NE			NE			NE			NE		<	0.36	U
3-Nitrotoluene	61 (c)	-	0/10		NE			NE			NE			NE		<	0.36	U
4-Amino-2,6-Dinitrotoluene	N/A	-	0/10		NE			NE			NE			NE		<	0.36	U
4-Nitrotoluene	61 (c)	-	0/10		NE			NE			NE			NE		<	0.36	U
HMX	400 (b)	27	2 / 10		NE			NE			NE			NE		<	0.36	U
MNX	N/A	-	0/10		NE			NE			NE			NE		<	0.36	U
Nitrobenzene	3.4 (c)	-	0/10		NE			NE			NE			NE		<	0.36	U
RDX	2 (b)	3.5 P	1 / 10		NE			NE			NE			NE		<	0.36	U
Tetryl	N/A	2.8 P	1 / 10		NE			NE			NE			NE		<	0.36	U

Notes:

< = Less Than
μg/L = Micrograms Per Liter
D = Dilution
HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
IAAAP = Iowa Army Ammunition Plant
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All samples collected during the Six Sites RAA Data Collection (URS 2003).
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▨ Above IAAAP Regulatory Standard
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TABLE I-1
SUMMARY OF CHEMICALS IN DIRECT PUSH SAMPLES
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID DATE COLLECTED	IAAAP Regulatory Standard	Maximum Detection	Detection Frequency	FTP-DP10-18 October 23, 2002			FTP-DP11-20 October 24, 2002			FTP-DP12-23 October 25, 2002			FTP-DP14-09 October 23, 2002			FTP-DP17-06 October 25, 2002		
				Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMPOUNDS (µg/L)																		
1,1,1-Trichloroethane	200 (a)	2100 JD	17 / 24	**3**	3		**25**	3		**11**	3		**3**	3	J	**5**	3	
1,1,2,2-Tetrachloroethane	0.3 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
1,1,2-Trichloroethane	5 (a)	26	3 / 24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
1,1-Dichloroethane	810 (c)	72 J	11 / 24	<	3	U	**3**	3		<	3	U	**17**	3		**4**	3	
1,1-Dichloroethene	7 (a)	2800 JD	15 / 24	**1**	3	J	**23**	3		**8**	3		**2**	3	J	**1**	3	J
1,2-Dichloroethane	5 (a)	17	4 / 24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
1,2-Dichloropropane	5 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
2-Butanone	1900 (c)	14 J	1 / 24	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
2-Hexanone	N/A	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Acetone	610 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Benzene	5 (a)	2 J	1 / 24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromochloromethane	90 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromodichloromethane	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromoform	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Carbon Disulfide	1000 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Carbon Tetrachloride	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chlorobenzene	110 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chlorodibromomethane	5 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloroethane	4.6 (c)	5	1 / 24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloroform	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloromethane	3 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
cis-1,2-Dichloroethene	70 (a)	46	7 / 24	<	3	U	**1**	3	J	<	3	U	**1**	3	J	<	3	U
cis-1,3-Dichloropropene	0.4 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Dichlorodifluoromethane	1000 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Ethylbenzene	700 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Freon 113	59000 (c)	31	3 / 24	**3**	3	J	**3**	3	J	<	3	U	<	3	U	<	3	U
Methyl Bromide	10 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methyl Isobutyl Ketone	160 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methylene Bromide	61 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methylene Chloride	5 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Styrene	100 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Tetrachloroethene	5 (a)	37	5 / 24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Toluene	1000 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
trans-1,2-Dichloroethene	100 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U

TABLE I-1
SUMMARY OF CHEMICALS IN DIRECT PUSH SAMPLES
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID DATE COLLECTED	IAAAP Regulatory Standard	Maximum Detection	Detection Frequency	FTP-DP10-18 October 23, 2002			FTP-DP11-20 October 24, 2002			FTP-DP12-23 October 25, 2002			FTP-DP14-09 October 23, 2002			FTP-DP17-06 October 25, 2002		
				Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMPOUNDS (µg/L)																		
trans-1,3-Dichloropropene	N/A	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Trichloroethene	5 (a)	12	6 / 24	<	3	U	**2**	3	J	<	3	U	<	3	U	<	3	U
Trichlorofluoromethane	1300 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Vinyl Chloride	2 (a)	29	3 / 24	<	3	U	<	3	U	<	3	U	**29**	3		<	3	U
Xylenes				<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
m,p-Xylene				<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
o-Xylene				<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
m,p-Xylene	10000 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
o-Xylene	10000 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
EXPLOSIVES (µg/L)																		
1,3,5-Trinitrobenzene	1100 (c)	-	0/10		NE		<	0.61	U	<	0.52	U	<	0.33	U	<	0.42	U
1,3-Dinitrobenzene	1 (b)	-	0/10		NE		<	0.61	U	<	0.52	U	<	0.33	U	<	0.42	U
2,4,6-Trinitrotoluene	2 (b)	-	0/10		NE		<	0.61	U	<	0.52	U	<	0.33	U	<	0.42	U
2,4-Dinitrotoluene	1 (d)	-	0/10		NE		<	0.61	U	<	0.52	U	<	0.33	U	<	0.42	U
2,6-Dinitrotoluene	1 (d)	-	0/10		NE		<	0.61	U	<	0.52	U	<	0.33	U	<	0.42	U
2-Amino-4,6-Dinitrotoluene	N/A	-	0/10		NE		<	0.61	U	<	0.52	U	<	0.33	U	<	0.42	U
2-Nitrotoluene	61 (c)	-	0/10		NE		<	0.61	U	<	0.52	U	<	0.33	U	<	0.42	U
3-Nitrotoluene	61 (c)	-	0/10		NE		<	0.61	U	<	0.52	U	<	0.33	U	<	0.42	U
4-Amino-2,6-Dinitrotoluene	N/A	-	0/10		NE		<	0.61	U	<	0.52	U	<	0.33	U	<	0.42	U
4-Nitrotoluene	61 (c)	-	0/10		NE		<	0.61	U	<	0.52	U	<	0.33	U	<	0.42	U
HMX	400 (b)	27	2 / 10		NE		<	0.61	U	<	0.52	U	<	0.33	U	<	0.42	U
MNX	N/A	-	0/10		NE		<	0.61	U	<	0.52	U	<	0.33	U	<	0.42	U
Nitrobenzene	3.4 (c)	-	0/10		NE		<	0.61	U	<	0.52	U	<	0.33	U	<	0.42	U
RDX	2 (b)	3.5 P	1 / 10		NE		<	0.61	U	<	0.52	U	<	0.33	U	<	0.42	U
Tetryl	N/A	2.8 P	1 / 10		NE		<	0.61	U	<	0.52	U	<	0.33	U	<	0.42	U

Notes:

< = Less Than
µg/L = Micrograms Per Liter
D = Dilution
HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
IAAAP = Iowa Army Ammunition Plant
J = Estimated
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P = Percent difference greater than 25%
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RAA = Remedial Alternatives Analysis
RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine
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All samples collected during the Six Sites RAA Data Collection (URS 2003).
Bold Result = Concentration Detected
▨ Above IAAAP Regulatory Standard
Regulatory Standards:
(a) Maximum Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
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(d) Proposed DNT Mixture Action Level

TABLE I-1
SUMMARY OF CHEMICALS IN DIRECT PUSH SAMPLES
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP			FTP-DP18-10			FTP-DP19-14			FTP-DP20-23			FTP-DP21-30			FTP-DP22-20		
DATE COLLECTED	Regulatory	Maximum	Detection	October 25, 2002			October 25, 2002			November 21, 2002			October 25, 2002			November 21, 2002		
	Standard	Detection	Frequency	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMPOUNDS (µg/L)																		
1,1,1-Trichloroethane	200 (a)	2100 JD	17 / 24	**35**	3		**3**	3	J	<	3	U	**4**	3		<	3	U
1,1,2,2-Tetrachloroethane	0.3 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
1,1,2-Trichloroethane	5 (a)	26	3 / 24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
1,1-Dichloroethane	810 (c)	72 J	11 / 24	**6**	3		**3**	3		<	3	U	**8**	3		<	3	U
1,1-Dichloroethene	7 (a)	2800 JD	15 / 24	**37**	3		<	3	U	<	3	U	**9**	3		<	3	U
1,2-Dichloroethane	5 (a)	17	4 / 24	**1**	3	J	<	3	U	<	3	U	**1**	3	J	<	3	U
1,2-Dichloropropane	5 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
2-Butanone	1900 (c)	14 J	1 / 24	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
2-Hexanone	N/A	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Acetone	610 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Benzene	5 (a)	2 J	1 / 24	<	3	U	<	3	U	<	3	U	**2**	3	J	<	3	U
Bromochloromethane	90 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromodichloromethane	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromoform	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Carbon Disulfide	1000 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Carbon Tetrachloride	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chlorobenzene	110 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chlorodibromomethane	5 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloroethane	4.6 (c)	5	1 / 24	<	3	U	<	3	U	<	3	U	**5**	3		<	3	U
Chloroform	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloromethane	3 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
cis-1,2-Dichloroethene	70 (a)	46	7 / 24	**3**	3		**1**	3	J	<	3	U	**9**	3		<	3	U
cis-1,3-Dichloropropene	0.4 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Dichlorodifluoromethane	1000 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Ethylbenzene	700 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Freon 113	59000 (c)	31	3 / 24	<	3	U	<	3	U	<	5	U	<	3	U	<	3	U
Methyl Bromide	10 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methyl Isobutyl Ketone	160 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methylene Bromide	61 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methylene Chloride	5 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Styrene	100 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Tetrachloroethene	5 (a)	37	5 / 24	**1**	3	J	<	3	U	<	3	U	<	3	U	<	3	U
Toluene	1000 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
trans-1,2-Dichloroethene	100 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U

TABLE I-1
SUMMARY OF CHEMICALS IN DIRECT PUSH SAMPLES
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID DATE COLLECTED	**IAAAP Regulatory Standard**	**Maximum Detection**	**Detection Frequency**	**FTP-DP18-10 October 25, 2002**			**FTP-DP19-14 October 25, 2002**			**FTP-DP20-23 November 21, 2002**			**FTP-DP21-30 October 25, 2002**			**FTP-DP22-20 November 21, 2002**		
				Result	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Result**	**RL**	**Qual**
VOLATILE ORGANIC COMPOUNDS (µg/L)																		
trans-1,3-Dichloropropene	N/A	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Trichloroethene	5 (a)	12	6 / 24	**2**	3	J	<	3	U	<	3	U	**2**	3	J	<	3	U
Trichlorofluoromethane	1300 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Vinyl Chloride	2 (a)	29	3 / 24	<	3	U	<	3	U	<	3	U	**1**	3	J	<	3	U
Xylenes				<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
m,p-Xylene				<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
o-Xylene				<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
m,p-Xylene	10000 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
o-Xylene	10000 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
EXPLOSIVES (µg/L)																		
1,3,5-Trinitrobenzene	1100 (c)	-	0/10	<	0.27	U		NE			NE			NE			NE	
1,3-Dinitrobenzene	1 (b)	-	0/10	<	0.27	U		NE			NE			NE			NE	
2,4,6-Trinitrotoluene	2 (b)	-	0/10	<	0.27	U		NE			NE			NE			NE	
2,4-Dinitrotoluene	1 (d)	-	0/10	<	0.27	U		NE			NE			NE			NE	
2,6-Dinitrotoluene	1 (d)	-	0/10	<	0.27	U		NE			NE			NE			NE	
2-Amino-4,6-Dinitrotoluene	N/A	-	0/10	<	0.27	U		NE			NE			NE			NE	
2-Nitrotoluene	61 (c)	-	0/10	<	0.27	U		NE			NE			NE			NE	
3-Nitrotoluene	61 (c)	-	0/10	<	0.27	U		NE			NE			NE			NE	
4-Amino-2,6-Dinitrotoluene	N/A	-	0/10	<	0.27	U		NE			NE			NE			NE	
4-Nitrotoluene	61 (c)	-	0/10	<	0.27	U		NE			NE			NE			NE	
HMX	400 (b)	27	2 / 10	**0.64**	0.27			NE			NE			NE			NE	
MNX	N/A	-	0/10	<	0.27	U		NE			NE			NE			NE	
Nitrobenzene	3.4 (c)	-	0/10	<	0.27	U		NE			NE			NE			NE	
RDX	2 (b)	3.5 P	1 / 10	<	0.27	U		NE			NE			NE			NE	
Tetryl	N/A	2.8 P	1 / 10	**2.8**	0.27	P		NE			NE			NE			NE	

Notes:

< = Less Than
µg/L = Micrograms Per Liter
D = Dilution
HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
IAAAP = Iowa Army Ammunition Plant
J = Estimated
MNX = Mono-Nitroso RDX
N/A = Not Available

NE = Not Evaluated
P = Percent difference greater than 25%
Qual = Qualifier
RAA = Remedial Alternatives Analysis
RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine
RL = Reporting Limit
U = Nondetect
Z = Co-Elution

All samples collected during the Six Sites RAA Data Collection (URS 2003).
Bold Result = Concentration Detected
▨ Above IAAAP Regulatory Standard
Regulatory Standards:
(a) Maximum Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region 9 Preliminary Remediation Goal (PRG)
(d) Proposed DNT Mixture Action Level

TABLE I-1
SUMMARY OF CHEMICALS IN DIRECT PUSH SAMPLES
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP Regulatory Standard	Maximum Detection	Detection Frequency	FTP-DP23-25			FTP-DP24-07			FTP-DP25-22			FTP-DP26-23		
DATE COLLECTED				**November 21, 2002**			**November 22, 2002**			**November 22, 2002**			**November 25, 2002**		
				Result	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Result**	**RL**	**Qual**
VOLATILE ORGANIC COMPOUNDS (µg/L)															
1,1,1-Trichloroethane	200 (a)	2100 JD	17 / 24	**20**	3		**18**	3		**5**	3		<	3	U
1,1,2,2-Tetrachloroethane	0.3 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
1,1,2-Trichloroethane	5 (a)	26	3 / 24	<	3	U	<	3	U	<	3	U	<	3	U
1,1-Dichloroethane	810 (c)	72 J	11 / 24	<	3	U	**4**	3		<	3	U	<	3	U
1,1-Dichloroethene	7 (a)	2800 JD	15 / 24	**12**	3		**7**	3		<	3	U	<	3	U
1,2-Dichloroethane	5 (a)	17	4 / 24	<	3	U	<	3	U	<	3	U	<	3	U
1,2-Dichloropropane	5 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
2-Butanone	1900 (c)	14 J	1 / 24	<	10	U	<	10	U	<	10	U	<	10	U
2-Hexanone	N/A	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Acetone	610 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Benzene	5 (a)	2 J	1 / 24	<	3	U	<	3	U	<	3	U	<	3	U
Bromochloromethane	90 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Bromodichloromethane	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Bromoform	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Carbon Disulfide	1000 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Carbon Tetrachloride	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Chlorobenzene	110 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Chlorodibromomethane	5 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Chloroethane	4.6 (c)	5	1 / 24	<	3	U	<	3	U	<	3	U	<	3	U
Chloroform	80 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Chloromethane	3 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
cis-1,2-Dichloroethene	70 (a)	46	7 / 24	<	3	U	<	3	U	<	3	U	<	3	U
cis-1,3-Dichloropropene	0.4 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Dichlorodifluoromethane	1000 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Ethylbenzene	700 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Freon 113	59000 (c)	31	3 / 24	<	5	U	<	5	U	<	5	U	**31**	5	
Methyl Bromide	10 (b)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Methyl Isobutyl Ketone	160 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Methylene Bromide	61 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Methylene Chloride	5 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Styrene	100 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Tetrachloroethene	5 (a)	37	5 / 24	<	3	U	<	3	U	<	3	U	<	3	U
Toluene	1000 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
trans-1,2-Dichloroethene	100 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U

TABLE I-1
SUMMARY OF CHEMICALS IN DIRECT PUSH SAMPLES
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP			FTP-DP23-25			FTP-DP24-07			FTP-DP25-22			FTP-DP26-23		
DATE COLLECTED	Regulatory	Maximum	Detection	November 21, 2002			November 22, 2002			November 22, 2002			November 25, 2002		
	Standard	Detection	Frequency	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMPOUNDS (µg/L)															
trans-1,3-Dichloropropene	N/A	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Trichloroethene	5 (a)	12	6 / 24	<	3	U	<	3	U	<	3	U	<	3	U
Trichlorofluoromethane	1300 (c)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
Vinyl Chloride	2 (a)	29	3 / 24	<	3	U	<	3	U	<	3	U	<	3	U
Xylenes				<	3	U	<	3	U	<	3	U	<	3	U
m,p-Xylene				<	3	U	<	3	U	<	3	U	<	3	U
o-Xylene				<	3	U	<	3	U	<	3	U	<	3	U
m,p-Xylene	10000 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
o-Xylene	10000 (a)	-	0/24	<	3	U	<	3	U	<	3	U	<	3	U
EXPLOSIVES (µg/L)															
1,3,5-Trinitrobenzene	1100 (c)	-	0/10	<	0.39	U	<	0.75	U	<	0.52	U	<	0.95	U
1,3-Dinitrobenzene	1 (b)	-	0/10	<	0.39	U	<	0.75	U	<	0.52	U	<	0.95	U
2,4,6-Trinitrotoluene	2 (b)	-	0/10	<	0.39	U	<	0.75	U	<	0.52	U	<	0.95	U
2,4-Dinitrotoluene	1 (d)	-	0/10	<	0.39	U	<	0.75	U	<	0.52	U	<	0.95	U
2,6-Dinitrotoluene	1 (d)	-	0/10	<	0.39	U	<	0.75	U	<	0.52	U	<	0.95	U
2-Amino-4,6-Dinitrotoluene	N/A	-	0/10	<	0.39	U	<	0.75	U	<	0.52	U	<	0.95	U
2-Nitrotoluene	61 (c)	-	0/10	<	0.39	U	<	0.75	U	<	0.52	U	<	0.95	U
3-Nitrotoluene	61 (c)	-	0/10	<	0.39	U	<	0.75	U	<	0.52	U	<	0.95	U
4-Amino-2,6-Dinitrotoluene	N/A	-	0/10	<	0.39	U	<	0.75	U	<	0.52	U	<	0.95	U
4-Nitrotoluene	61 (c)	-	0/10	<	0.39	U	<	0.75	U	<	0.52	U	<	0.95	U
HMX	400 (b)	27	2 / 10	<	0.39	U	**27**	0.75		<	0.52	U	<	0.95	U
MNX	N/A	-	0/10	<	0.39	U	<	0.75	U	<	0.52	U	<	0.95	U
Nitrobenzene	3.4 (c)	-	0/10	<	0.39	U	<	0.75	U	<	0.52	U	<	0.95	U
RDX	2 (b)	3.5 P	1 / 10	<	0.39	U	**3.5**	0.75	P	<	0.52	U	<	0.95	U
Tetryl	N/A	2.8 P	1 / 10	<	0.39	U	<	0.75	U	<	0.52	U	<	0.95	U

Notes:

< = Less Than
µg/L = Micrograms Per Liter
D = Dilution
HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
IAAAP = Iowa Army Ammunition Plant
J = Estimated
MNX = Mono-Nitroso RDX
N/A = Not Available

NE = Not Evaluated
P = Percent difference greater than 25%
Qual = Qualifier
RAA = Remedial Alternatives Analysis
RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine
RL = Reporting Limit
U = Nondetect
Z = Co-Elution

All samples collected during the Six Sites RAA Data Collection (URS 2003).
Bold Result = Concentration Detected
▨ Above IAAAP Regulatory Standard
Regulatory Standards:
(a) Maximum Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region 9 Preliminary Remediation Goal (PRG)
(d) Proposed DNT Mixture Action Level

Monitoring Well Results

TABLE I-2
SPRING 2003 SUMMARY OF CHEMICALS IN MONITORING WELL SAMPLES
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID DATE COLLECTED	IAAAP Regulatory Standard	Maximum Detection	Detection Frequency	FTA-99-1 May 20, 2003[1]			FTA-99-2 May 20, 2003[1]			JAW-58 May 30, 2003[1]			JAW-59 May 21, 2003[1]			JAW-60 May 21, 2003[1]		
				Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMPOUNDS (µg/L)																		
1,1,1-Trichloroethane	200 (a)	270 D	9 / 19	**90**	3		<	3	U	**130**	6	D	**170**	3		**91**	3	
1,1,2,2-Tetrachloroethane	0.3 (b)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
1,1,2-Trichloroethane	5 (a)	4	4 / 19	**1**	3	J	<	3	U	<	3	U	**1**	3	J	**4**	3	
1,1-Dichloroethane	810 (c)	240 D	9 / 19	**12**	3		<	3	U	**3**	3		**6**	3		**140**	3	
1,1-Dichloroethene	7 (a)	380 D	10 / 19	**84**	3		<	3	U	**81**	3		**180**	3		**380**	15	D
1,2-Dichloroethane	5 (a)	130 J	5 / 19	**4**	3		<	3	U	<	3	U	**2**	3	J	**30**	3	
1,2-Dichloropropane	5 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
2-Butanone	1900 (a)	190 D	1 / 19	<	10	U	<	10	U	<	10	UJ	<	10	U	<	10	U
2-Hexanone	N/A	-	0 / 19	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Acetone	610 (c)	980 JD	1 / 19	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Benzene	5 (a)	110	2 / 19	<	3	U	<	3	U	<	3	U	<	3	U	**11**	3	
Bromochloromethane	90 (b)	2 J	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromodichloromethane	80 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromoform	80 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Carbon Disulfide	1000 (c)	4	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Carbon Tetrachloride	80 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chlorobenzene	110 (c)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chlorodibromomethane	5 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloroethane	4.6 (c)	3700 D	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloroform	80 (a)	5	3 / 19	**2**	3	J	<	3	U	<	3	U	<	3	U	**5**	3	
Chloromethane	3 (b)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
cis-1,2-Dichloroethene	70 (a)	400 D	6 / 19	**9**	3		<	3	U	<	3	U	**4**	3		**110**	3	
cis-1,3-Dichloropropene	0.4 (c)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Dichlorodifluoromethane	1000 (b)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Ethylbenzene	700 (a)	120	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Freon 113	59000 (c)	83	6 / 19	<	3	U	**2**	3	J	<	3	U	<	3	U	<	3	U
Methyl Bromide	10 (b)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methyl Isobutyl Ketone	160 (c)	1600 JD	1 / 19	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Methylene Bromide	61 (c)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methylene Chloride	5 (a)	510 JD	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Styrene	100 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Tetrachloroethene	5 (a)	76	3 / 19	<	3	U	<	3	U	**2**	3	J	**5**	3		<	3	U
Toluene	1000 (a)	5600 D	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U

TABLE I-2
SPRING 2003 SUMMARY OF CHEMICALS IN MONITORING WELL SAMPLES
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	**IAAAP Regulatory Standard**	**Maximum Detection**	**Detection Frequency**	**FTA-99-1**			**FTA-99-2**			**JAW-58**			**JAW-59**			**JAW-60**		
DATE COLLECTED				**May 20, 2003[1]**			**May 20, 2003[1]**			**May 30, 2003[1]**			**May 21, 2003[1]**			**May 21, 2003[1]**		
				Result	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Result**	**RL**	**Qual**
VOLATILE ORGANIC COMPOUNDS (µg/L)																		
trans-1,2-Dichloroethene	100 (a)	4	2 / 19	<	3	U	<	3	U	<	3	U	<	3	U	**1**	3	J
trans-1,3-Dichloropropene	N/A	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Trichloroethene	5 (a)	120	7 / 19	**8**	3		<	3	U	<	3	U	**2**	3	J	**74**	3	
Trichlorofluoromethane	1300 (c)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Vinyl Chloride	2 (a)	360 D	2 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
m,p-Xylene	10000 (a)	470 D	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
o-Xylene	10000 (a)	160	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
EXPLOSIVES (µg/L)																		
1,3,5-Trinitrobenzene	1100 (c)	1.9 P	1 / 19	<	0.38	U	<	0.22	U	<	0.39	U	<	0.33	U	<	0.65	U
1,3-Dinitrobenzene	1 (b)	-	0 / 19	<	0.38	U	<	0.22	U	<	0.39	U	<	0.33	U	<	0.65	U
2,4,6-Trinitrotoluene	2 (b)	-	0 / 19	<	0.38	U	<	0.22	U	<	0.39	U	<	0.33	U	<	0.65	U
2,4-Dinitrotoluene	1 (d)	-	0 / 19	<	0.38	U	<	0.22	U	<	0.39	U	<	0.33	U	<	0.65	U
2,6-Dinitrotoluene	1 (d)	2.7 P	1 / 19	<	0.38	U	<	0.22	U	<	0.39	U	<	0.33	U	<	0.65	U
2-Amino-4,6-Dinitrotoluene	N/A	-	0 / 19	<	0.38	U	<	0.22	U	<	0.39	U	<	0.33	U	<	0.65	U
2-Nitrotoluene	61 (c)	-	0 / 19	<	0.38	U	<	0.22	U	<	0.39	U	<	0.33	U	<	0.65	U
3-Nitrotoluene	61 (c)	-	0 / 19	<	0.38	U	<	0.22	U	<	0.39	U	<	0.33	U	<	0.65	U
4-Amino-2,6-Dinitrotoluene	N/A	-	0 / 19	<	0.38	U	<	0.22	U	<	0.39	U	<	0.33	U	<	0.65	U
4-Nitrotoluene	61 (c)	1.2 P	1 / 19	<	0.38	U	<	0.22	U	<	0.39	U	<	0.33	U	<	0.65	U
HMX	400 (b)	1.7	3 / 19	**1.7**	0.38		<	0.22	U	<	0.39	U	**0.28**	0.33	JP	<	0.65	U
MNX	N/A	0.31 JP	1 / 19	**0.31**	0.38	JP	<	0.22	U	<	0.39	U	<	0.33	U	<	0.65	U
Nitrobenzene	3.4 (c)	-	0 / 19	<	0.38	U	<	0.22	U	<	0.39	U	<	0.33	U	<	0.65	U
RDX	2 (b)	6.9	5 / 19	**6.9**	0.38		<	0.22	U	<	0.39	U	**1.3**	0.33		<	0.65	U
Tetryl	N/A	-	0 / 19	<	0.38	U	<	0.22	U	<	0.39	U	<	0.33	U	<	0.65	U
METALS (µg/L)																		
Arsenic	10 (a)	58	3 / 19	<	10	U	**3.4**	10	J	<	10	U	<	10	U	**3.3**	10	J
Barium	2000 (a)	353	19 / 19	**151**	200	J	**54.9**	200	J	**85.4**	200	J	**133**	200	J	**219**	200	
Cadmium	5 (a)	0.16 J	4 / 19	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U
Chromium	100 (a)	1.7 J	4 / 19	**1.7**	10	J	<	10	U	<	10	U	**1**	10	J	<	10	U
Lead	15 (a)	-	0 / 19	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Mercury	2 (b)	0.022 J	1 / 19	<	0.2	U	<	0.2	U	<	0.2	U	<	0.2	U	<	0.2	U
Selenium	50 (a)	16.2	10 / 19	<	10	U	<	10	U	**5.9**	10	J	<	10	U	<	10	U
Silver	100 (b)	-	0 / 19	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U

TABLE I-2
SPRING 2003 SUMMARY OF CHEMICALS IN MONITORING WELL SAMPLES
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID DATE COLLECTED	IAAAP Regulatory Standard	Maximum Detection	Detection Frequency	FTA-99-1 May 20, 2003[1]			FTA-99-2 May 20, 2003[1]			JAW-58 May 30, 2003[1]			JAW-59 May 21, 2003[1]			JAW-60 May 21, 2003[1]		
				Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
NA PARAMETERS (µg/L) (METALS)																		
Calcium	NE	92000	8 / 8		NE			NE			NE			NE			NE	
Magnesium	NE	35500	8 / 8		NE			NE			NE			NE			NE	
Sodium	NE	110000	8 / 8		NE			NE			NE			NE			NE	
NA PARAMETERS (mg/L)																		
Alkalinity	NE	540	19 / 19	**300**	20		**420**	20		**270**	8		**330**	20		**380**	20	
Ammonia	NE	0.33	9 / 19	<	0.02	U	<	0.02	U	**0.1**	0.02		<	0.02	U	<	0.02	U
Carbon Dioxide	NE	180	18 / 18	**45**	0.1		**45**	0.1		**29**	0.1		**107**	0.1		**89**	0.1	
Chloride	NE	40	19 / 19	**8**	1		**2**	1		**2**	1		**12**	10		**21**	10	
Nitrate, Nitrite as N	10 (a)	2	14 / 19	**1.6**	0.05		**0.13**	0.05		**0.09**	0.05		**0.18**	0.05		**0.08**	0.05	
ortho-Phosphate as P	NE	-	0 / 19	<	1	U	<	1	U	<	1	U	<	1	U	<	1	U
Sulfate	NE	240	18 / 19	**40**	10		**59**	10		**35**	10		**66**	10		**39**	10	
Sulfide	NE	-	0 / 19	<	1	U	<	1	U	<	1	U	<	1	U	<	1	U
Total Kjeldahl Nitrogen	NE	0.7	6 / 19	<	0.3	U	**0.4**	0.3		**0.4**	0.3		<	0.3	U	<	0.3	U
Total Organic Carbon	NE	130	10 / 19	<	1	U	<	1	U	**2.1**	1		**1.6**	1		**1.9**	1	

Notes:

< = Less Than
µg/L = Micrograms Per Liter
D = Dilution
HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
IAAAP = Iowa Army Ammunition Plant
J = Estimated
mg/L = Milligrams Per Liter
MNX = Mono-Nitroso RDX
N/A = Not Available
NA = Natural Attenuation
NE = Not Evaluated
P = Percent difference greater than 25%
Qual = Qualifier
RAA = Remedial Alternatives Analysis
RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine
RL = Reporting Limit
U = Nondetect
Z = Co-Elution

[1] Samples collected during Annual Groundwater Monitoring Event (HGL 2003).
All others collected during the Six Sites RAA Data Collection (URS 2003).
Bold Result = Concentration Detected
▨ Above IAAAP Regulatory Standard

Regulatory Standards:
(a) Maximum Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region 9 Preliminary Remediation Goal (PRG)
(d) Proposed DNT Mixture Action Level

TABLE I-2
SPRING 2003 SUMMARY OF CHEMICALS IN MONITORING WELL SAMPLES
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	**IAAAP**			**JAW-61**			**JAW-62**			**JAW-63**			**JAW-80**			**M-01**		
DATE COLLECTED	**Regulatory**	**Maximum**	**Detection**	**May 28, 2003[1]**			**May 28, 2003[1]**			**May 28, 2003[1]**			**May 28, 2003[1]**			**May 20, 2003[1]**		
	Standard	**Detection**	**Frequency**	**Result**	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Result**	**RL**	**Qual**
VOLATILE ORGANIC COMPOUNDS (µg/L)																		
1,1,1-Trichloroethane	200 (a)	270 D	9 / 19	**270**	15	D	<	3	U	<	3	U	**19**	3		<	3	U
1,1,2,2-Tetrachloroethane	0.3 (b)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
1,1,2-Trichloroethane	5 (a)	4	4 / 19	**1**	3	J	<	3	U	<	3	U	<	3	U	<	3	U
1,1-Dichloroethane	810 (c)	240 D	9 / 19	**48**	3		<	3	U	<	3	U	**1**	3	J	<	3	U
1,1-Dichloroethene	7 (a)	380 D	10 / 19	**190**	15	D	<	3	U	<	3	U	**17**	3		<	3	U
1,2-Dichloroethane	5 (a)	130 J	5 / 19	**4**	3		<	3	U	<	3	U	<	3	U	<	3	U
1,2-Dichloropropane	5 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
2-Butanone	1900 (a)	190 D	1 / 19	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
2-Hexanone	N/A	-	0 / 19	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Acetone	610 (c)	980 JD	1 / 19	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Benzene	5 (a)	110	2 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromochloromethane	90 (b)	2 J	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromodichloromethane	80 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromoform	80 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Carbon Disulfide	1000 (c)	4	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Carbon Tetrachloride	80 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chlorobenzene	110 (c)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chlorodibromomethane	5 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloroethane	4.6 (c)	3700 D	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloroform	80 (a)	5	3 / 19	**3**	3		<	3	U	<	3	U	<	3	U	<	3	U
Chloromethane	3 (b)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
cis-1,2-Dichloroethene	70 (a)	400 D	6 / 19	**21**	3		<	3	U	<	3	U	<	3	U	<	3	U
cis-1,3-Dichloropropene	0.4 (c)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Dichlorodifluoromethane	1000 (b)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Ethylbenzene	700 (a)	120	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Freon 113	59000 (c)	83	6 / 19	**1**	3	J	<	3	U	<	3	U	**7**	3		**2**	3	J
Methyl Bromide	10 (b)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methyl Isobutyl Ketone	160 (c)	1600 JD	1 / 19	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Methylene Bromide	61 (c)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methylene Chloride	5 (a)	510 JD	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Styrene	100 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Tetrachloroethene	5 (a)	76	3 / 19	**76**	3		<	3	U	<	3	U	<	3	U	<	3	U
Toluene	1000 (a)	5600 D	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U

TABLE I-2
SPRING 2003 SUMMARY OF CHEMICALS IN MONITORING WELL SAMPLES
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP Regulatory Standard	Maximum Detection	Detection Frequency	JAW-61			JAW-62			JAW-63			JAW-80			M-01		
DATE COLLECTED				May 28, 2003[1]			May 28, 2003[1]			May 28, 2003[1]			May 28, 2003[1]			May 20, 2003[1]		
				Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMPOUNDS (µg/L)																		
trans-1,2-Dichloroethene	100 (a)	4	2 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
trans-1,3-Dichloropropene	N/A	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Trichloroethene	5 (a)	120	7 / 19	**120**	3		<	3	U	<	3	U	**2**	3	J	<	3	U
Trichlorofluoromethane	1300 (c)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Vinyl Chloride	2 (a)	360 D	2 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
m,p-Xylene	10000 (a)	470 D	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
o-Xylene	10000 (a)	160	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
EXPLOSIVES (µg/L)																		
1,3,5-Trinitrobenzene	1100 (c)	1.9 P	1 / 19	<	0.47	U	<	0.73	U	<	0.64	U	<	1	U	<	1.2	U
1,3-Dinitrobenzene	1 (b)	-	0 / 19	<	0.47	U	<	0.73	U	<	0.64	U	<	1	U	<	1.2	U
2,4,6-Trinitrotoluene	2 (b)	-	0 / 19	<	0.47	U	<	0.73	U	<	0.64	U	<	1	U	<	1.2	U
2,4-Dinitrotoluene	1 (d)	-	0 / 19	<	0.47	U	<	0.73	U	<	0.64	U	<	1	U	<	1.2	U
2,6-Dinitrotoluene	1 (d)	2.7 P	1 / 19	<	0.47	U	<	0.73	U	<	0.64	U	<	1	U	<	1.2	U
2-Amino-4,6-Dinitrotoluene	N/A	-	0 / 19	<	0.47	U	<	0.73	U	<	0.64	U	<	1	U	<	1.2	U
2-Nitrotoluene	61 (c)	-	0 / 19	<	0.47	U	<	0.73	U	<	0.64	U	<	1	U	<	1.2	U
3-Nitrotoluene	61 (c)	-	0 / 19	<	0.47	U	<	0.73	U	<	0.64	U	<	1	U	<	1.2	U
4-Amino-2,6-Dinitrotoluene	N/A	-	0 / 19	<	0.47	U	<	0.73	U	<	0.64	U	<	1	U	<	1.2	U
4-Nitrotoluene	61 (c)	1.2 P	1 / 19	<	0.47	U	<	0.73	U	<	0.64	U	<	1	U	<	1.2	U
HMX	400 (b)	1.7	3 / 19	<	0.47	U	<	0.73	U	<	0.64	U	<	1	U	<	1.2	U
MNX	N/A	0.31 JP	1 / 19	<	0.47	U	<	0.73	U	<	0.64	U	<	1	U	<	1.2	U
Nitrobenzene	3.4 (c)	-	0 / 19	<	0.47	U	<	0.73	U	<	0.64	U	<	1	U	<	1.2	U
RDX	2 (b)	6.9	5 / 19	<	0.47	U	<	0.73	U	<	0.64	U	<	1	U	<	1.2	U
Tetryl	N/A	-	0 / 19	<	0.47	U	<	0.73	U	<	0.64	U	<	1	U	<	1.2	U
METALS (µg/L)																		
Arsenic	10 (a)	58	3 / 19	<	10	UJ	<	10	UJ	<	10	UJ	<	10	UJ	<	10	U
Barium	2000 (a)	353	19 / 19	**93.5**	200	J	**70.8**	200	J	**79.2**	200	J	**189**	200	J	**231**	200	
Cadmium	5 (a)	0.16 J	4 / 19	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U
Chromium	100 (a)	1.7 J	4 / 19	<	10	U	<	10	U	<	10	U	<	10	U	**0.75**	10	J
Lead	15 (a)	-	0 / 19	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Mercury	2 (b)	0.022 J	1 / 19	<	0.2	U	<	0.2	U	<	0.2	U	<	0.2	U	<	0.2	U
Selenium	50 (a)	16.2	10 / 19	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Silver	100 (b)	-	0 / 19	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U

TABLE I-2
SPRING 2003 SUMMARY OF CHEMICALS IN MONITORING WELL SAMPLES
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP			JAW-61			JAW-62			JAW-63			JAW-80			M-01		
DATE COLLECTED	Regulatory	Maximum	Detection	May 28, 2003[1]			May 28, 2003[1]			May 28, 2003[1]			May 28, 2003[1]			May 20, 2003[1]		
	Standard	Detection	Frequency	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
NA PARAMETERS (µg/L) (METALS)																		
Calcium	NE	92000	8 / 8		NE			NE			NE			NE			NE	
Magnesium	NE	35500	8 / 8		NE			NE			NE			NE			NE	
Sodium	NE	110000	8 / 8		NE			NE			NE			NE			NE	
NA PARAMETERS (mg/L)																		
Alkalinity	NE	540	19 / 19	**190**	20		**170**	20		**270**	20		**320**	20		**270**	20	
Ammonia	NE	0.33	9 / 19	**0.05**	0.02		**0.07**	0.02		<	0.02	U	<	0.02	U	<	0.02	U
Carbon Dioxide	NE	180	18 / 18	**65**	0.1		**34**	0.1		**45**	0.1		**38**	0.1		**36**	0.1	
Chloride	NE	40	19 / 19	**7**	1		**14**	10		**1**	1		**3**	1		**6**	1	
Nitrate, Nitrite as N	10 (a)	2	14 / 19	**0.38**	0.05		**0.31**	0.05		**0.38**	0.05		**1.9**	0.05		**0.07**	0.05	
ortho-Phosphate as P	NE	-	0 / 19	<	1	U	<	1	U	<	1	U	<	1	U	<	1	U
Sulfate	NE	240	18 / 19	**45**	10		**39**	10		**37**	10		**27**	10		**33**	10	
Sulfide	NE	-	0 / 19	<	1	U	<	1	U	<	1	U	<	1	U	<	1	U
Total Kjeldahl Nitrogen	NE	0.7	6 / 19	<	0.3	U	<	0.3	U	<	0.3	U	<	0.3	U	**0.3**	0.3	
Total Organic Carbon	NE	130	10 / 19	<	1	U	<	1	U	<	1	U	<	1	U	<	1	U

Notes:

< = Less Than
µg/L = Micrograms Per Liter
D = Dilution
HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
IAAAP = Iowa Army Ammunition Plant
J = Estimated
mg/L = Milligrams Per Liter
MNX = Mono-Nitroso RDX
N/A = Not Available
NA = Natural Attenuation
NE = Not Evaluated
P = Percent difference greater than 25%
Qual = Qualifier
RAA = Remedial Alternatives Analysis
RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine
RL = Reporting Limit
U = Nondetect
Z = Co-Elution

[1] Samples collected during Annual Groundwater Monitoring Event (HGL 2003).
All others collected during the Six Sites RAA Data Collection (URS 2003).
Bold Result = Concentration Detected
▨ Above IAAAP Regulatory Standard

Regulatory Standards:
(a) Maximum Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region 9 Preliminary Remediation Goal (PRG)
(d) Proposed DNT Mixture Action Level

TABLE I-2
SPRING 2003 SUMMARY OF CHEMICALS IN MONITORING WELL SAMPLES
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	**IAAAP**			**SA-99-1**			**FTP-MW1**			**FTP-MW2**			**FTP-MW3**			**FTP-MW4**		
DATE COLLECTED	**Regulatory**	**Maximum**	**Detection**	**May 20, 2003[1]**			**May 13, 2003**			**May 13, 2003**			**May 13, 2003**			**May 14, 2003**		
	Standard	**Detection**	**Frequency**	**Result**	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Result**	**RL**	**Qual**
VOLATILE ORGANIC COMPOUNDS (µg/L)																		
1,1,1-Trichloroethane	200 (a)	270 D	9 / 19	**68**	3		<	3	U	**17**	3		<	3	U	<	3	U
1,1,2,2-Tetrachloroethane	0.3 (b)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
1,1,2-Trichloroethane	5 (a)	4	4 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
1,1-Dichloroethane	810 (c)	240 D	9 / 19	**240**	150	D	**15**	3		**2**	3	J	<	3	U	<	3	U
1,1-Dichloroethene	7 (a)	380 D	10 / 19	**28**	3	J	**2**	3	J	**13**	3		<	3	U	<	3	U
1,2-Dichloroethane	5 (a)	130 J	5 / 19	**130**	3	J	<	3	U	<	3	U	<	3	U	<	3	U
1,2-Dichloropropane	5 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
2-Butanone	1900 (a)	190 D	1 / 19	**190**	10	J	<	10	U	<	10	U	<	10	U	<	10	U
2-Hexanone	N/A	-	0 / 19	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Acetone	610 (c)	980 JD	1 / 19	**980**	500	JD	<	10	U	<	10	U	<	10	U	<	10	U
Benzene	5 (a)	110	2 / 19	**110**	3		<	3	U	<	3	U	<	3	U	<	3	U
Bromochloromethane	90 (b)	2 J	1 / 19	**2**	3	J	<	3	U	<	3	U	<	3	U	<	3	U
Bromodichloromethane	80 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromoform	80 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Carbon Disulfide	1000 (c)	4	1 / 19	**4**	3		<	3	U	<	3	U	<	3	U	<	3	U
Carbon Tetrachloride	80 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chlorobenzene	110 (c)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chlorodibromomethane	5 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloroethane	4.6 (c)	3700 D	1 / 19	**3700**	150	D	<	3	U	<	3	U	<	3	U	<	3	U
Chloroform	80 (a)	5	3 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloromethane	3 (b)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
cis-1,2-Dichloroethene	70 (a)	400 D	6 / 19	**400**	150	D	<	3	U	**1**	3	J	<	3	U	<	3	U
cis-1,3-Dichloropropene	0.4 (c)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Dichlorodifluoromethane	1000 (b)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	UJ
Ethylbenzene	700 (a)	120	1 / 19	**120**	3		<	3	U	<	3	U	<	3	U	<	3	U
Freon 113	59000 (c)	83	6 / 19	**83**	3		<	3	U	<	3	U	<	3	U	<	3	U
Methyl Bromide	10 (b)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methyl Isobutyl Ketone	160 (c)	1600 JD	1 / 19	**1600**	500	JD	<	10	U	<	10	U	<	10	U	<	3	U
Methylene Bromide	61 (c)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methylene Chloride	5 (a)	510 JD	1 / 19	**510**	150	JD	<	3	U	<	3	U	<	3	U	<	3	U
Styrene	100 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Tetrachloroethene	5 (a)	76	3 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Toluene	1000 (a)	5600 D	1 / 19	**5600**	150	D	<	3	U	<	3	U	<	3	U	<	3	U

TABLE I-2
SPRING 2003 SUMMARY OF CHEMICALS IN MONITORING WELL SAMPLES
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	**IAAAP Regulatory Standard**	**Maximum Detection**	**Detection Frequency**	**SA-99-1**			**FTP-MW1**			**FTP-MW2**			**FTP-MW3**			**FTP-MW4**		
DATE COLLECTED				**May 20, 2003[1]**			**May 13, 2003**			**May 13, 2003**			**May 13, 2003**			**May 14, 2003**		
				Result	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Result**	**RL**	**Qual**
VOLATILE ORGANIC COMPOUNDS (µg/L)																		
trans-1,2-Dichloroethene	100 (a)	4	2 / 19	**4**	3		<	3	U	<	3	U	<	3	U	<	3	U
trans-1,3-Dichloropropene	N/A	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Trichloroethene	5 (a)	120	7 / 19	**3**	3		<	3	U	**1**	3	J	<	3	U	<	3	U
Trichlorofluoromethane	1300 (c)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Vinyl Chloride	2 (a)	360 D	2 / 19	**360**	150	D	**19**	3		<	3	U	<	3	U	<	3	U
m,p-Xylene	10000 (a)	470 D	1 / 19	**470**	150	D	<	3	U	<	3	U	<	3	U	<	3	U
o-Xylene	10000 (a)	160	1 / 19	**160**	3		<	3	U	<	3	U	<	3	U	<	3	U
EXPLOSIVES (µg/L)																		
1,3,5-Trinitrobenzene	1100 (c)	1.9 P	1 / 19	**1.9**	1.2	P	<	0.96	U	<	0.42	U	<	0.2	U	<	0.81	U
1,3-Dinitrobenzene	1 (b)	-	0 / 19	<	1.2	U	<	0.96	U	<	0.42	U	<	0.2	U	<	0.81	U
2,4,6-Trinitrotoluene	2 (b)	-	0 / 19	<	1.2	U	<	0.96	U	<	0.42	U	<	0.2	U	<	0.81	U
2,4-Dinitrotoluene	1 (d)	-	0 / 19	<	1.2	U	<	0.96	U	<	0.42	U	<	0.2	U	<	0.81	U
2,6-Dinitrotoluene	1 (d)	2.7 P	1 / 19	**2.7**	1.2	P	<	0.96	U	<	0.42	U	<	0.2	U	<	0.81	U
2-Amino-4,6-Dinitrotoluene	N/A	-	0 / 19	<	1.2	U	<	0.96	U	<	0.42	U	<	0.2	U	<	0.81	U
2-Nitrotoluene	61 (c)	-	0 / 19	<	1.2	U	<	0.96	U	<	0.42	U	<	0.2	U	<	0.81	UJ
3-Nitrotoluene	61 (c)	-	0 / 19	<	1.2	U	<	0.96	U	<	0.42	U	<	0.2	U	<	0.81	UJ
4-Amino-2,6-Dinitrotoluene	N/A	-	0 / 19	<	1.2	UJ	<	0.96	U	<	0.42	U	<	0.2	U	<	0.81	U
4-Nitrotoluene	61 (c)	1.2 P	1 / 19	<	1.2	U	**1.2**	0.96	P	<	0.42	U	<	0.2	U	<	0.81	UJ
HMX	400 (b)	1.7	3 / 19	<	1.2	U	<	0.96	U	<	0.42	U	**0.47**	0.2		<	0.81	U
MNX	N/A	0.31 JP	1 / 19	<	1.2	U	<	0.96	U	<	0.42	U	<	0.2	U	<	0.81	U
Nitrobenzene	3.4 (c)	-	0 / 19	<	1.2	U	<	0.96	U	<	0.42	U	<	0.2	U	<	0.81	UJ
RDX	2 (b)	6.9	5 / 19	**1.9**	1.2	P	<	0.96	U	**1.2**	0.42		<	0.2	U	<	0.81	U
Tetryl	N/A	-	0 / 19	<	1.2	U	<	0.96	U	<	0.42	U	<	0.2	U	<	0.81	U
METALS (µg/L)																		
Arsenic	10 (a)	58	3 / 19	**58**	10		<	10	U	<	10	U	<	10	U	<	10	U
Barium	2000 (a)	353	19 / 19	**353**	200		**142**	200	J	**88.6**	200	J	**106**	200	J	**71.6**	200	J
Cadmium	5 (a)	0.16 J	4 / 19	<	5	U	<	5	U	<	5	U	<	5	U	**0.11**	5	J
Chromium	100 (a)	1.7 J	4 / 19	**0.78**	10	J	<	10	U	<	10	U	<	10	U	<	10	U
Lead	15 (a)	-	0 / 19	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Mercury	2 (b)	0.022 J	1 / 19	<	0.2	U	<	0.2	U	<	0.2	U	<	0.2	U	<	0.2	U
Selenium	50 (a)	16.2	10 / 19	**3.7**	10	J	**0.44**	10	J	**0.16**	10	J	**16.2**	10		**1.5**	10	J
Silver	100 (b)	-	0 / 19	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U

TABLE I-2
SPRING 2003 SUMMARY OF CHEMICALS IN MONITORING WELL SAMPLES
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP			SA-99-1			FTP-MW1			FTP-MW2			FTP-MW3			FTP-MW4		
DATE COLLECTED	Regulatory	Maximum	Detection	May 20, 2003[1]			May 13, 2003			May 13, 2003			May 13, 2003			May 14, 2003		
	Standard	Detection	Frequency	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
NA PARAMETERS (µg/L) (METALS)																		
Calcium	NE	92000	8 / 8		NE		**92000**	5000		**47800**	5000		**79900**	5000		**81000**	5000	
Magnesium	NE	35500	8 / 8		NE		**29300**	5000		**9590**	5000		**34900**	5000		**35500**	5000	
Sodium	NE	110000	8 / 8		NE		**11700**	5000		**4460**	5000	J	**18200**	5000		**28100**	5000	
NA PARAMETERS (mg/L)																		
Alkalinity	NE	540	19 / 19	**540**	20		**380**	2		**180**	2		**340**	2		**420**	2	
Ammonia	NE	0.33	9 / 19	**0.15**	0.02		**0.33**	0.02		**0.02**	0.02		<	0.02	U	**0.07**	0.02	
Carbon Dioxide	NE	180	18 / 18	**180**	0.1			NE		**60**	0.25		**40**	0.25		**38**	0.25	
Chloride	NE	40	19 / 19	**40**	10		**5**	1		**3**	1		**11**	10		**6**	1	
Nitrate, Nitrite as N	10 (a)	2	14 / 19	<	0.05	U	**0.36**	0.05		**0.16**	0.05		<	0.05	U	<	0.05	U
ortho-Phosphate as P	NE	-	0 / 19	<	1	U	<	1	U	<	1	U	<	1	U	<	1	U
Sulfate	NE	240	18 / 19	<	1	U	**27**	10		**15**	1		**62**	10		**33**	10	
Sulfide	NE	-	0 / 19	<	1	U	<	1	U	<	1	U	<	1	U	<	1	U
Total Kjeldahl Nitrogen	NE	0.7	6 / 19	**0.7**	0.3		**0.7**	0.3		<	0.3	U	<	0.3	U	<	0.3	U
Total Organic Carbon	NE	130	10 / 19	**130**	10		**3.4**	1		**1.8**	1		**1.3**	1		<	1	U

Notes:

< = Less Than

µg/L = Micrograms Per Liter

D = Dilution

HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

IAAAP = Iowa Army Ammunition Plant

J = Estimated

mg/L = Milligrams Per Liter

MNX = Mono-Nitroso RDX

N/A = Not Available

NA = Natural Attenuation

NE = Not Evaluated

P = Percent difference greater than 25%

Qual = Qualifier

RAA = Remedial Alternatives Analysis

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

RL = Reporting Limit

U = Nondetect

Z = Co-Elution

[1] Samples collected during Annual Groundwater Monitoring Event (HGL 2003).

All others collected during the Six Sites RAA Data Collection (URS 2003).

Bold Result = Concentration Detected

▨ Above IAAAP Regulatory Standard

Regulatory Standards:

(a) Maximum Contaminant Level (MCL)

(b) Health Advisory Level (HAL)

(c) Region 9 Preliminary Remediation Goal (PRG)

(d) Proposed DNT Mixture Action Level

TABLE I-2
SPRING 2003 SUMMARY OF CHEMICALS IN MONITORING WELL SAMPLES
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP Regulatory Standard	Maximum Detection	Detection Frequency	FTP-MW5			FTP-MW6			FTP-MW7			FTP-MW8		
DATE COLLECTED				May 13, 2003			May 14, 2003			May 14, 2003			May 14, 2003		
				Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMPOUNDS (µg/L)															
1,1,1-Trichloroethane	200 (a)	270 D	9 / 19	**8**	3		<	3	U	<	3	U	<	3	U
1,1,2,2-Tetrachloroethane	0.3 (b)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U
1,1,2-Trichloroethane	5 (a)	4	4 / 19	<	3	U	<	3	U	<	3	U	<	3	U
1,1-Dichloroethane	810 (c)	240 D	9 / 19	<	3	U	<	3	U	<	3	U	<	3	U
1,1-Dichloroethene	7 (a)	380 D	10 / 19	**6**	3		<	3	U	<	3	U	<	3	U
1,2-Dichloroethane	5 (a)	130 J	5 / 19	<	3	U	<	3	U	<	3	U	<	3	U
1,2-Dichloropropane	5 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U
2-Butanone	1900 (a)	190 D	1 / 19	<	10	U	<	10	U	<	10	U	<	10	U
2-Hexanone	N/A	-	0 / 19	<	10	U	<	10	U	<	10	U	<	10	U
Acetone	610 (c)	980 JD	1 / 19	<	10	U	<	10	U	<	10	U	<	10	U
Benzene	5 (a)	110	2 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Bromochloromethane	90 (b)	2 J	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Bromodichloromethane	80 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Bromoform	80 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Carbon Disulfide	1000 (c)	4	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Carbon Tetrachloride	80 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Chlorobenzene	110 (c)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Chlorodibromomethane	5 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Chloroethane	4.6 (c)	3700 D	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Chloroform	80 (a)	5	3 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Chloromethane	3 (b)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U
cis-1,2-Dichloroethene	70 (a)	400 D	6 / 19	<	3	U	<	3	U	<	3	U	<	3	U
cis-1,3-Dichloropropene	0.4 (c)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Dichlorodifluoromethane	1000 (b)	-	0 / 19	<	3	UJ	<	3	UJ	<	3	UJ	<	3	UJ
Ethylbenzene	700 (a)	120	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Freon 113	59000 (c)	83	6 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Methyl Bromide	10 (b)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Methyl Isobutyl Ketone	160 (c)	1600 JD	1 / 19	<	10	U	<	10	U	<	10	U	<	10	U
Methylene Bromide	61 (c)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Methylene Chloride	5 (a)	510 JD	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Styrene	100 (a)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Tetrachloroethene	5 (a)	76	3 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Toluene	1000 (a)	5600 D	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U

TABLE I-2
SPRING 2003 SUMMARY OF CHEMICALS IN MONITORING WELL SAMPLES
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP Regulatory Standard	Maximum Detection	Detection Frequency	FTP-MW5			FTP-MW6			FTP-MW7			FTP-MW8		
DATE COLLECTED				May 13, 2003			May 14, 2003			May 14, 2003			May 14, 2003		
				Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMPOUNDS (µg/L)															
trans-1,2-Dichloroethene	100 (a)	4	2 / 19	<	3	U	<	3	U	<	3	U	<	3	U
trans-1,3-Dichloropropene	N/A	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Trichloroethene	5 (a)	120	7 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Trichlorofluoromethane	1300 (c)	-	0 / 19	<	3	U	<	3	U	<	3	U	<	3	U
Vinyl Chloride	2 (a)	360 D	2 / 19	<	3	U	<	3	U	<	3	U	<	3	U
m,p-Xylene	10000 (a)	470 D	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U
o-Xylene	10000 (a)	160	1 / 19	<	3	U	<	3	U	<	3	U	<	3	U
EXPLOSIVES (µg/L)															
1,3,5-Trinitrobenzene	1100 (c)	1.9 P	1 / 19	<	0.7	U	<	1.4	U	<	0.56	U	<	0.52	U
1,3-Dinitrobenzene	1 (b)	-	0 / 19	<	0.7	U	<	1.4	U	<	0.56	U	<	0.52	U
2,4,6-Trinitrotoluene	2 (b)	-	0 / 19	<	0.7	U	<	1.4	U	<	0.56	U	<	0.52	U
2,4-Dinitrotoluene	1 (d)	-	0 / 19	<	0.7	U	<	1.4	U	<	0.56	U	<	0.52	U
2,6-Dinitrotoluene	1 (d)	2.7 P	1 / 19	<	0.7	U	<	1.4	U	<	0.56	U	<	0.52	U
2-Amino-4,6-Dinitrotoluene	N/A	-	0 / 19	<	0.7	U	<	1.4	U	<	0.56	U	<	0.52	U
2-Nitrotoluene	61 (c)	-	0 / 19	<	0.7	U	<	1.4	UJ	<	0.56	UJ	<	0.52	UJ
3-Nitrotoluene	61 (c)	-	0 / 19	<	0.7	U	<	1.4	UJ	<	0.56	UJ	<	0.52	UJ
4-Amino-2,6-Dinitrotoluene	N/A	-	0 / 19	<	0.7	U	<	1.4	U	<	0.56	U	<	0.52	U
4-Nitrotoluene	61 (c)	1.2 P	1 / 19	<	0.7	U	<	1.4	UJ	<	0.56	UJ	<	0.52	UJ
HMX	400 (b)	1.7	3 / 19	<	0.7	U	<	1.4	U	<	0.56	U	<	0.52	U
MNX	N/A	0.31 JP	1 / 19	<	0.7	U	<	1.4	U	<	0.56	U	<	0.52	U
Nitrobenzene	3.4 (c)	-	0 / 19	<	0.7	U	<	1.4	UJ	<	0.56	UJ	<	0.52	UJ
RDX	2 (b)	6.9	5 / 19	<	0.7	U	<	1.4	U	**0.35**	0.56	J	<	0.52	U
Tetryl	N/A	-	0 / 19	<	0.7	U	<	1.4	U	<	0.56	U	<	0.52	U
METALS (µg/L)															
Arsenic	10 (a)	58	3 / 19	<	10	U	<	10	U	<	10	U	<	10	U
Barium	2000 (a)	353	19 / 19	**55.6**	200	J	**67.4**	200	J	**130**	200	J	**86.8**	200	J
Cadmium	5 (a)	0.16 J	4 / 19	**0.16**	5	J	**0.11**	5	J	**0.06**	5	J	<	5	U
Chromium	100 (a)	1.7 J	4 / 19	<	10	U	<	10	U	<	10	U	<	10	U
Lead	15 (a)	-	0 / 19	<	10	U	<	10	U	<	10	U	<	10	U
Mercury	2 (b)	0.022 J	1 / 19	<	0.2	U	<	0.2	U	<	0.2	U	**0.022**	0.2	J
Selenium	50 (a)	16.2	10 / 19	**0.26**	10	J	**6.1**	10	J	**1**	10	J	**4.1**	10	J
Silver	100 (b)	-	0 / 19	<	10	U	<	10	U	<	10	U	<	10	U

TABLE I-2
SPRING 2003 SUMMARY OF CHEMICALS IN MONITORING WELL SAMPLES
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	**IAAAP**			**FTP-MW5**			**FTP-MW6**			**FTP-MW7**			**FTP-MW8**		
DATE COLLECTED	**Regulatory**	**Maximum**	**Detection**	**May 13, 2003**			**May 14, 2003**			**May 14, 2003**			**May 14, 2003**		
	Standard	**Detection**	**Frequency**	**Result**	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Result**	**RL**	**Qual**
NA PARAMETERS (µg/L) (METALS)															
Calcium	NE	92000	8 / 8	**85200**	5000		**73900**	5000		**67400**	5000		**80900**	5000	
Magnesium	NE	35500	8 / 8	**24200**	5000		**34200**	5000		**27200**	5000		**33600**	5000	
Sodium	NE	110000	8 / 8	**23000**	5000		**110000**	5000		**11400**	5000		**46400**	5000	
NA PARAMETERS (mg/L)															
Alkalinity	NE	540	19 / 19	**280**	2		**380**	2		**270**	2		**410**	2	
Ammonia	NE	0.33	9 / 19	<	0.02	U	**0.13**	0.02		<	0.02	U	**0.13**	0.02	
Carbon Dioxide	NE	180	18 / 18	**70**	0.25		**27**	0.25		**26**	0.25		**30**	0.25	
Chloride	NE	40	19 / 19	**30**	10		**6**	10	J	**22**	10		**17**	10	J
Nitrate, Nitrite as N	10 (a)	2	14 / 19	<	0.05	U	**0.19**	0.05		**2**	0.1		<	0.05	U
ortho-Phosphate as P	NE	-	0 / 19	<	1	U	<	1	U	<	1	U	<	1	UJ
Sulfate	NE	240	18 / 19	**81**	10		**240**	50		**36**	10		**56**	10	
Sulfide	NE	-	0 / 19	<	1	U	<	1	U	<	1	U	<	1	U
Total Kjeldahl Nitrogen	NE	0.7	6 / 19	<	0.3	U	<	0.3	U	<	0.3	U	**0.4**	0.3	
Total Organic Carbon	NE	130	10 / 19	**1.7**	1		**1.1**	1		<	1	U	**1.1**	1	J

Notes:

< = Less Than
µg/L = Micrograms Per Liter
D = Dilution
HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
IAAAP = Iowa Army Ammunition Plant
J = Estimated
mg/L = Milligrams Per Liter
MNX = Mono-Nitroso RDX
N/A = Not Available
NA = Natural Attenuation
NE = Not Evaluated
P = Percent difference greater than 25%
Qual = Qualifier
RAA = Remedial Alternatives Analysis
RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine
RL = Reporting Limit
U = Nondetect
Z = Co-Elution

[1] Samples collected during Annual Groundwater Monitoring Event (HGL 2003).
All others collected during the Six Sites RAA Data Collection (URS 2003).

Bold Result = Concentration Detected

▨ Above IAAAP Regulatory Standard

Regulatory Standards:
(a) Maximum Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region 9 Preliminary Remediation Goal (PRG)
(d) Proposed DNT Mixture Action Level

Surface Water Results

TABLE I-3
SPRING 2003 SUMMARY OF CHEMICALS IN SURFACE WATER SAMPLES
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	**IAAAP**	**SC1**			**SC2**			**SC3**			**SC4**			**SC5**		
DATE COLLECTED	**Regulatory**	**May 15, 2003^1**			**May 15, 2003^1**			**May 15, 2003^1**			**May 15, 2003^1**			**May 15, 2003^1**		
	Standard	**Result**	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Result**	**RL**	**Qual**
VOLATILE ORGANIC COMPOUNDS (μg/L)																
1,1,1-Trichloroethane	200 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
1,1,2,2-Tetrachloroethane	0.3 (b)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
1,1,2-Trichloroethane	5 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
1,1-Dichloroethane	810 (c)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
1,1-Dichloroethene	7 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
1,2-Dichloroethane	5 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
1,2-Dichloropropane	5 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
2-Butanone	1900 (a)	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
2-Hexanone	N/A	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Acetone	610 (c)	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Benzene	5 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromochloromethane	90 (b)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromodichloromethane	80 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Bromoform	80 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Carbon Disulfide	1000 (c)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Carbon Tetrachloride	80 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chlorobenzene	110 (c)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chlorodibromomethane	5 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloroethane	4.6 (c)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloroform	80 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloromethane	3 (b)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
cis-1,2-Dichloroethene	70 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
cis-1,3-Dichloropropene	0.4 (c)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Dichlorodifluoromethane	1000 (b)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Ethylbenzene	700 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Freon 113	59000 (c)	<	3	U	**130**	6	D	**50**	3		**3**	3		**29**	3	
Methyl Bromide	10 (b)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methyl Isobutyl Ketone	160 (c)	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Methylene Bromide	61 (c)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Methylene Chloride	5 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Styrene	100 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Tetrachloroethene	5 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Toluene	1000 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U

TABLE I-3
SPRING 2003 SUMMARY OF CHEMICALS IN SURFACE WATER SAMPLES
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	**IAAAP Regulatory Standard**	**SC1**			**SC2**			**SC3**			**SC4**			**SC5**		
DATE COLLECTED		**May 15, 2003[1]**			**May 15, 2003[1]**			**May 15, 2003[1]**			**May 15, 2003[1]**			**May 15, 2003[1]**		
		Result	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Result**	**RL**	**Qual**
VOLATILE ORGANIC COMPOUNDS (µg/L)																
trans-1,2-Dichloroethene	100 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
trans-1,3-Dichloropropene	N/A	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Trichloroethene	5 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Trichlorofluoromethane	1300 (c)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Vinyl Chloride	2 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
m,p-Xylene	10000 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
o-Xylene	10000 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
EXPLOSIVES (µg/L)																
1,3,5-Trinitrobenzene	1100 (c)	<	0.58	U	<	0.99	U	<	0.36	U	<	0.27	U	<	0.44	U
1,3-Dinitrobenzene	1 (b)	<	0.58	U	<	0.99	U	<	0.36	U	<	0.27	U	<	0.44	U
2,4,6-Trinitrotoluene	2 (b)	<	0.58	U	<	0.99	U	<	0.36	U	<	0.27	U	<	0.44	U
2,4-Dinitrotoluene	1 (d)	<	0.58	U	<	0.99	U	<	0.36	U	<	0.27	U	<	0.44	U
2,6-Dinitrotoluene	1 (d)	<	0.58	U	<	0.99	U	<	0.36	U	<	0.27	U	<	0.44	U
2-Amino-4,6-Dinitrotoluene	N/A	<	0.58	U	<	0.99	U	<	0.36	U	<	0.27	U	<	0.44	U
2-Nitrotoluene	61 (c)	<	0.58	U	<	0.99	U	<	0.36	U	<	0.27	U	<	0.44	U
3-Nitrotoluene	61 (c)	<	0.58	U	<	0.99	U	<	0.36	U	<	0.27	U	<	0.44	U
4-Amino-2,6-Dinitrotoluene	N/A	<	0.58	U	<	0.99	U	<	0.36	U	<	0.27	U	<	0.44	U
4-Nitrotoluene	61 (c)	<	0.58	U	<	0.99	U	<	0.36	U	<	0.27	U	<	0.44	U
HMX	400 (b)	<	0.58	U	<	0.99	U	**0.33**	0.36	J	**0.18**	0.27	J	<	0.44	U
MNX	N/A	<	0.58	U	<	0.99	U	<	0.36	U	<	0.27	U	<	0.44	U
Nitrobenzene	3.4 (c)	<	0.58	U	<	0.99	U	<	0.36	U	<	0.27	U	<	0.44	U
RDX	2 (b)	<	0.58	U	**0.92**	0.99	JP	**0.58**	0.36	P	**0.3**	0.27	P	<	0.44	U
Tetryl	N/A	<	0.58	U	<	0.99	U	<	0.36	U	<	0.27	U	<	0.44	U
METALS (µg/L)																
Arsenic	10 (a)	<	10	U	<	10	U	**5.3**	10	J	<	10	U	<	10	U
Barium	2000 (a)	**137**	200	J	**146**	200	J	**135**	200	J	**172**	200	J	**125**	200	J
Cadmium	5 (a)	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U
Chromium	100 (a)	<	10	U	**0.94**	10	J	**0.83**	10	J	**3.8**	10	J	<	10	U
Lead	15 (a)	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Mercury	2 (b)	<	0.2	U	<	0.2	U	<	0.2	U	<	0.2	U	<	0.2	U
Selenium	50 (a)	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Silver	100 (b)	**0.63**	10	J	<	10	U	<	10	U	<	10	U	<	10	U

TABLE I-3
SPRING 2003 SUMMARY OF CHEMICALS IN SURFACE WATER SAMPLES
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID	IAAAP	SCT1			SCT2			SCT3		
DATE COLLECTED	Regulatory	May 15, 2003[1]			May 15, 2003[1]			May 15, 2003[1]		
	Standard	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMPOUNDS (µg/L										
1,1,1-Trichloroethane	200 (a)	<	3	U	<	3	U	<	3	U
1,1,2,2-Tetrachloroethane	0.3 (b)	<	3	U	<	3	U	<	3	U
1,1,2-Trichloroethane	5 (a)	<	3	U	<	3	U	<	3	U
1,1-Dichloroethane	810 (c)	<	3	U	<	3	U	<	3	U
1,1-Dichloroethene	7 (a)	<	3	U	<	3	U	<	3	U
1,2-Dichloroethane	5 (a)	<	3	U	<	3	U	<	3	U
1,2-Dichloropropane	5 (a)	<	3	U	<	3	U	<	3	U
2-Butanone	1900 (a)	<	10	U	<	10	U	<	10	U
2-Hexanone	N/A	<	10	U	<	10	U	<	10	U
Acetone	610 (c)	<	10	U	<	10	U	<	10	U
Benzene	5 (a)	<	3	U	<	3	U	<	3	U
Bromochloromethane	90 (b)	<	3	U	<	3	U	<	3	U
Bromodichloromethane	80 (a)	<	3	U	<	3	U	<	3	U
Bromoform	80 (a)	<	3	U	<	3	U	<	3	U
Carbon Disulfide	1000 (c)	<	3	U	<	3	U	<	3	U
Carbon Tetrachloride	80 (a)	<	3	U	<	3	U	<	3	U
Chlorobenzene	110 (c)	<	3	U	<	3	U	<	3	U
Chlorodibromomethane	5 (a)	<	3	U	<	3	U	<	3	U
Chloroethane	4.6 (c)	<	3	U	<	3	U	<	3	U
Chloroform	80 (a)	<	3	U	<	3	U	<	3	U
Chloromethane	3 (b)	<	3	U	<	3	U	<	3	U
cis-1,2-Dichloroethene	70 (a)	<	3	U	<	3	U	<	3	U
cis-1,3-Dichloropropene	0.4 (c)	<	3	U	<	3	U	<	3	U
Dichlorodifluoromethane	1000 (b)	<	3	U	<	3	U	<	3	U
Ethylbenzene	700 (a)	<	3	U	<	3	U	<	3	U
Freon 113	59000 (c)	**3**	3	J	**390**	15	D	<	3	U
Methyl Bromide	10 (b)	<	3	U	<	3	U	<	3	U
Methyl Isobutyl Ketone	160 (c)	<	10	U	<	10	U	<	10	U
Methylene Bromide	61 (c)	<	3	U	<	3	U	<	3	U
Methylene Chloride	5 (a)	<	3	U	<	3	U	<	3	U
Styrene	100 (a)	<	3	U	<	3	U	<	3	U
Tetrachloroethene	5 (a)	<	3	U	<	3	U	<	3	U
Toluene	1000 (a)	<	3	U	<	3	U	<	3	U

TABLE I-3
SPRING 2003 SUMMARY OF CHEMICALS IN SURFACE WATER SAMPLES
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

FIELD ID DATE COLLECTED	IAAAP Regulatory Standard	SCT1			SCT2			SCT3		
		May 15, 2003[1]			May 15, 2003[1]			May 15, 2003[1]		
		Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMPOUNDS (µg/L										
trans-1,2-Dichloroethene	100 (a)	<	3	U	<	3	U	<	3	U
trans-1,3-Dichloropropene	N/A	<	3	U	<	3	U	<	3	U
Trichloroethene	5 (a)	<	3	U	<	3	U	<	3	U
Trichlorofluoromethane	1300 (c)	<	3	U	<	3	U	<	3	U
Vinyl Chloride	2 (a)	<	3	U	<	3	U	<	3	U
m,p-Xylene	10000 (a)	<	3	U	<	3	U	<	3	U
o-Xylene	10000 (a)	<	3	U	<	3	U	<	3	U
EXPLOSIVES (µg/L)										
1,3,5-Trinitrobenzene	1100 (c)	<	0.78	U	<	0.46	U	<	0.35	U
1,3-Dinitrobenzene	1 (b)	<	0.78	U	<	0.46	U	<	0.35	U
2,4,6-Trinitrotoluene	2 (b)	<	0.78	U	<	0.46	U	<	0.35	U
2,4-Dinitrotoluene	1 (d)	<	0.78	U	<	0.46	U	<	0.35	U
2,6-Dinitrotoluene	1 (d)	<	0.78	U	<	0.46	U	<	0.35	U
2-Amino-4,6-Dinitrotoluene	N/A	<	0.78	U	<	0.46	U	<	0.35	U
2-Nitrotoluene	61 (c)	<	0.78	U	<	0.46	U	<	0.35	U
3-Nitrotoluene	61 (c)	<	0.78	U	<	0.46	U	<	0.35	U
4-Amino-2,6-Dinitrotoluene	N/A	<	0.78	U	<	0.46	U	<	0.35	U
4-Nitrotoluene	61 (c)	<	0.78	U	<	0.46	U	<	0.35	U
HMX	400 (b)	<	0.78	U	**4.3**	0.46	P	<	0.35	U
MNX	N/A	<	0.78	U	**0.34**	0.46	JP	<	0.35	U
Nitrobenzene	3.4 (c)	<	0.78	U	<	0.46	U	<	0.35	U
RDX	2 (b)	<	0.78	U	**16**	0.46		<	0.35	U
Tetryl	N/A	<	0.78	U	<	0.46	U	<	0.35	U
METALS (µg/L)										
Arsenic	10 (a)	<	10	U	<	10	U	<	10	U
Barium	2000 (a)	**121**	200	J	**138**	200	J	**118**	200	J
Cadmium	5 (a)	<	5	U	<	5	U	<	5	U
Chromium	100 (a)	<	10	U	<	10	U	**0.68**	10	J
Lead	15 (a)	<	10	U	<	10	U	<	10	U
Mercury	2 (b)	<	0.2	U	<	0.2	U	<	0.2	U
Selenium	50 (a)	<	10	U	<	10	U	<	10	U
Silver	100 (b)	<	10	U	<	10	U	<	10	U

Notes:

< = Less Than
µg/L = Micrograms Per Liter
D = Dilution
HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
IAAAP = Iowa Army Ammunition Plant
J = Estimated
MNX = Mono-Nitroso RDX
N/A = Not Available
P = Percent difference greater than 25%
Qual = Qualifier
RAA = Remedial Alternatives Analysis
RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine
RL = Reporting Limit
U = Nondetect
Z = Co-Elution

[1] Samples collected during Annual Groundwater Monitoring Event (HGL 2003).

Bold Result = Concentration Detected

▨ Above IAAAP Regulatory Standard

Regulatory Standards:
(a) Maximum Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region 9 Preliminary Remediation Goal (PRG)
(d) Proposed DNT Mixture Action Level

Duplicate Sample Pair Results

TABLE I-4
SUMMARY OF ANALYTICAL RESULTS FOR DUPLICATE SAMPLE PAIRS
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

SITE NAME	**East Burn Pads**			**East Burn Pads**					**Fire Training Pit**			**Fire Training Pit**				
FIELD ID	**EBP-MW5**			**EBP-MW7**					**FTP -MW1**			**FTP -MW9**				
SAMPLE TYPE	**Monitoring Well**			**Monitoring Well**					**Monitoring Well**			**Monitoring Well**				
QC TYPE	**Original**			**Duplicate**			**Duplicate Pair**		**Original**			**Duplicate**			**Duplicate Pair**	
DATE COLLECTED	**May 12, 2003**			**May 12, 2003**					**May 13, 2003**			**November 28, 2001**				
	Result	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Precision**	**Action**	**Result**	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Precision**	**Action**
VOLATILE ORGANIC COMPOUNDS (µg/L)																
1,1-Dichloroethane	<	3	U	<	3	U	--	None	15	3		15	3		0.0%	None
1,1-Dichloroethene	<	3	U	<	3	U	--	None	2	3	J	2	3	J	0.0%	None
m,p-Xylene	1	3	J	<	3	U	--	None	<	3	U	<	3	U	--	None
o-Xylene	1	3	J	<	3	U	--	None	<	3	U	<	3	U	--	None
Vinyl Chloride	<	3	U	<	3	U	--	None	19	3		19	2		0.0%	None
EXPLOSIVES (µg/L)																
4-Nitrotoluene	<	0.84	U	<	1.5	U	--	None	1.2	0.96		<	0.36	U	--	None
HMX	7.2	0.84		7.8	1.5		8.0%	None	<	0.96	U	<	0.36	U	--	None
MNX	1.2	0.84		<	1.5	U	--	None	<	0.96	U	<	0.36	U	--	None
RDX	26	0.84		31	1.5		17.5%	None	<	0.96	U	<	0.36	U	--	None
METALS (µg/L)																
Barium		NE			NE				142	200	J	146	200	J	2.8%	None
Selenium		NE			NE				0.44	10	J	0.4	10	J	9.5%	None
NA METALS (µg/L)																
Calcium	78500	5000		87100	5000		10.4%	None	92000	5000		93000	5000		1.1%	None
Magnesium	22300	5000		22400	5000		0.4%	None	29300	5000		29700	5000		1.4%	None
Sodium	9210	5000		9420	5000		2.3%	None	11700	5000		11500	5000		1.7%	None
NA PARAMETERS (mg/L)																
Alkalinity	300	2		300	2		0.0%	None	380	2		380	2		0.0%	None
Ammonia	<	0.02	U	<	0.2	U		None	0.33	0.02		0.33	0.02		0.0%	None
Chloride	3	1		3	1		0.0%	None	5	1		5	1		0.0%	None
Nitrate/Nitrite as N	0.77	0.05		0.81	0.05		5.1%	None	0.36	0.05		0.36	0.05		0.0%	None
Total Kjeldahl Nitrogen	<	0.3	U	<	0.3	U		None	0.7	0.3		0.7	0.3		0.0%	None
Sulfate	32	10		31	10		3.2%	None	27	10		27	10		0.0%	None
Total Organic Carbon	1.4	1		1.4	1		0.0%	None	3.4	1		3.4	1		0.0%	None

Notes:

< = Less Than

-- = Not Measured

µg/L = Micrograms Per Liter

HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

J = Estimated

mg/L = Milligrams Per Liter

MNX = Mono-Nitroso RDX

NA = Natural Attenuation

NE = Not Evaluated

Qual = Qualifier

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

RL = Reporting Limit

U = Nondetect

TABLE I-4
SUMMARY OF ANALYTICAL RESULTS FOR DUPLICATE SAMPLE PAIRS
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

SITE NAME	**Line 2**			**Line 2**					**Line 2**			**Line 2**				
FIELD ID	**L2-DP05-25**			**L2-DS05-25**					**L2-DP12-28**			**DUPLICATE 3**				
SAMPLE TYPE	**Direct Push**			**Direct Push**					**Direct Push**			**Direct Push**				
QC TYPE	**Original**			**Duplicate**			**Duplicate Pair**		**Original**			**Duplicate**			**Duplicate Pair**	
DATE COLLECTED	**October 28, 2002**			**October 28, 2002**					**November 6, 2002**			**November 6, 2002**				
	Result	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Precision**	**Action**	**Result**	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Precision**	**Action**
VOLATILE ORGANIC COMPOUNDS (µg/L)																
1,1-Dichloroethane		NE			NE					NE			NE			
1,1-Dichloroethene		NE			NE					NE			NE			
Freon113		NE			NE					NE			NE			
1,1,1-Trichloroethane		NE			NE					NE			NE			
Tetrachloroethene		NE			NE					NE			NE			
EXPLOSIVES (µg/L)																
2-Amino-4,6-Dinitrotoluene	<	0.79	U	<	0.82	U	--	None	<	0.99	U	<	0.82	U	--	None
4-Amino-2,6-Dinitrotoluene	<	0.79	U	<	0.82	U	--	None	<	0.99	U	<	0.82	U	--	None
HMX	<	0.79	U	<	0.82	U	--	None	<	0.99	U	<	0.82	U	--	None
MNX	<	0.79	U	<	0.82	U	--	None	<	0.99	U	<	0.82	U	--	None
RDX	<	0.79	U	<	0.82	U	--	None	<	0.99	U	<	0.82	U	--	None

Notes:

-- = Not Measured

< = Less Than

µg/L = Micrograms Per Liter

D = Dilution

HMX = Octahydro-1,3,5,7-tetranitro-
-1,3,5,7-tetrazocine

J = Estimated

MNX = Mono-Nitroso RDX

N/A = Not Available

NE = Not Evaluated

P = Difference between columns greater than 25%

Qual = Qualifier

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

RL = Reporting Limit

SD = Sample Difference

U = Nondetect

Z = Co-Elution

TABLE I-4
SUMMARY OF ANALYTICAL RESULTS FOR DUPLICATE SAMPLE PAIRS
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

SITE NAME	**Line 3**			**Line 3**					**Line 9**			**Line 9**				
FIELD ID	**L3-DP04-22**			**DUPLICATE 4**					**L9-DP01-20**			**DUPLICATE 8**				
SAMPLE TYPE	**Direct Push**			**Direct Push**					**Direct Push**			**Direct Push**				
QC TYPE	**Original**			**Duplicate**			**Duplicate Pair**		**Original**			**Duplicate**			**Duplicate Pair**	
DATE COLLECTED	**November 6, 2002**			**November 6, 2002**					**November 12, 2002**			**November 12, 2002**				
	Result	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Precision**	**Action**	**Result**	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Precision**	**Action**
VOLATILE ORGANIC COMPOUNDS (µg																
1,1-Dichloroethane		NE			NE				<	3	U	<	3	U	--	None
1,1-Dichloroethene		NE			NE				<	3	U	<	3	U	--	None
Freon113		NE			NE				37000	3000	D	35000	3000	D	5.6%	None
1,1,1-Trichloroethane		NE			NE				<	3	U	<	3	U	--	None
Tetrachloroethene		NE			NE				<	3	U	<	3	U	--	None
EXPLOSIVES (µg/L)																
2-Amino-4,6-Dinitrotoluene	<	0.6	U	<	0.29	U	--	None		NE			NE			
4-Amino-2,6-Dinitrotoluene	<	0.6	U	<	0.29	U	--	None		NE			NE			
HMX	<	0.6	U	<	0.29	U	--	None		NE			NE			
MNX	<	0.6	U	<	0.29	U	--	None		NE			NE			
RDX	<	0.6	U	<	0.82	U	--	None		NE			NE			

Notes:

-- = Not Measured

< = Less Than

µg/L = Micrograms Per Liter

D = Dilution

HMX = Octahydro-1,3,5,7-tetranitro-
-1,3,5,7-tetrazocine

J = Estimated

MNX = Mono-Nitroso RDX

N/A = Not Available

NE = Not Evaluated

P = Difference between columns greater than 25%

Qual = Qualifier

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

RL = Reporting Limit

SD = Sample Difference

U = Nondetect

Z = Co-Elution

TABLE I-4
SUMMARY OF ANALYTICAL RESULTS FOR DUPLICATE SAMPLE PAIRS
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

SITE NAME	**Line 9**			**Line 9**					**Line 9**			**Line 9**				
FIELD ID	**L9-DP07-26**			**DUPLICATE 5**					**L9-DP11-23**			**DUPLICATE 6**				
SAMPLE TYPE	**Direct Push**			**Direct Push**					**Direct Push**			**Direct Push**				
QC TYPE	**Original**			**Duplicate**			**Duplicate Pair**		**Original**			**Duplicate**			**Duplicate Pair**	
DATE COLLECTED	**November 7, 2002**			**November 7, 2002**					**November 8, 2002**			**November 8, 2002**				
	Result	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Precision**	**Action**	**Result**	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Precision**	**Action**
VOLATILE ORGANIC COMPOUNDS (µg																
1,1-Dichloroethane	<	3	U	<	3	U	--	None	<	3	U	<	3	U	--	None
1,1-Dichloroethene	<	3	U	<	3	U	--	None	<	3	U	<	3	U	--	None
Freon113	20000	750	DJ	26000	300	DJ	26.1%	**QUAL**	1100	60	D	1100	60	D	0.0%	None
1,1,1-Trichloroethane	<	3	U	<	3	U	--	None	<	3	U	<	3	U	--	None
Tetrachloroethene	<	3	U	<	3	U	--	None	<	3	U	<	3	U	--	None
EXPLOSIVES (µg/L)																
2-Amino-4,6-Dinitrotoluene		NE			NE					NE			NE			
4-Amino-2,6-Dinitrotoluene		NE			NE					NE			NE			
HMX		NE			NE					NE			NE			
MNX		NE			NE					NE			NE			
RDX		NE			NE					NE			NE			

Notes:

-- = Not Measured

< = Less Than

µg/L = Micrograms Per Liter

D = Dilution

HMX = Octahydro-1,3,5,7-tetranitro-
-1,3,5,7-tetrazocine

J = Estimated

MNX = Mono-Nitroso RDX

N/A = Not Available

NE = Not Evaluated

P = Difference between columns greater than 25%

Qual = Qualifier

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

RL = Reporting Limit

SD = Sample Difference

U = Nondetect

Z = Co-Elution

TABLE I-4
SUMMARY OF ANALYTICAL RESULTS FOR DUPLICATE SAMPLE PAIRS
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

SITE NAME	Line 9			Line 9					Fire Training Pit			Fire Training Pit				
FIELD ID	L9-DP13-20			DUPLICATE 7					FTP-DP05-23			FTP-DP05-00				
SAMPLE TYPE	Direct Push			Direct Push					Direct Push			Direct Push				
QC TYPE	Original			Duplicate			Duplicate Pair		Original			Duplicate			Duplicate Pair	
DATE COLLECTED	November 8, 2002			November 8, 2002					October 25, 2002			October 25, 2002				
	Result	RL	Qual	Result	RL	Qual	Precision	Action	Result	RL	Qual	Result	RL	Qual	Precision	Action
VOLATILE ORGANIC COMPOUNDS (µg																
1,1-Dichloroethane	<	3	U	<	3	U	--	None	3	3		3	3		0.0%	None
1,1-Dichloroethene	<	3	U	<	3	U	--	None	51	3		42	3		19.4%	None
Freon113	7800	300	D	8500	300	D	8.6%	None	<	3	U	<	3	U	--	None
1,1,1-Trichloroethane	<	3	U	<	3	U	--	None	40	3		39	3		2.5%	None
Tetrachloroethene	<	3	U	<	3	U	--	None	3	3	J	2	3	J	SD>RL	None
EXPLOSIVES (µg/L)																
2-Amino-4,6-Dinitrotoluene		NE			NE					NE			NE			
4-Amino-2,6-Dinitrotoluene		NE			NE					NE			NE			
HMX		NE			NE					NE			NE			
MNX		NE			NE					NE			NE			
RDX		NE			NE					NE			NE			

Notes:

-- = Not Measured

< = Less Than

µg/L = Micrograms Per Liter

D = Dilution

HMX = Octahydro-1,3,5,7-tetranitro-
-1,3,5,7-tetrazocine

J = Estimated

MNX = Mono-Nitroso RDX

N/A = Not Available

NE = Not Evaluated

P = Difference between columns greater than 25%

Qual = Qualifier

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

RL = Reporting Limit

SD = Sample Difference

U = Nondetect

Z = Co-Elution

TABLE I-4
SUMMARY OF ANALYTICAL RESULTS FOR DUPLICATE SAMPLE PAIRS
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

SITE NAME	**Fire Training Pit**			**Fire Training Pit**					**Fire Training Pit**			**Fire Training Pit**				
FIELD ID	**FTP-DP23-25**			**DUPLICATE 10**					**FTP-DP25-22**			**DUPLICATE 11**				
SAMPLE TYPE	**Direct Push**			**Direct Push**					**Direct Push**			**Direct Push**				
QC TYPE	**Original**			**Duplicate**			**Duplicate Pair**		**Original**			**Duplicate**			**Duplicate Pair**	
DATE COLLECTED	**November 21, 2002**			**November 21, 2003**					**November 22, 2002**			**November 22, 2002**				
	Result	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Precision**	**Action**	**Result**	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Precision**	**Action**
VOLATILE ORGANIC COMPOUNDS (µg																
1,1-Dichloroethane	<	3	U	3	3	U	--	None	<	3	U	3	3	U	--	None
1,1-Dichloroethene	12	3		12	3		0.0%	None	<	3	U	<	3	U	--	None
Freon113	<	5	U	<	5	U	--	None	<	5	U	<	5	U	--	None
1,1,1-Trichloroethane	20	3		20	3		0.0%	None	5	3		5	3		0.0%	None
Tetrachloroethene	<	3	U	2	3	J	--	None	<	3	U	2	3	J	--	None
EXPLOSIVES (µg/L)																
2-Amino-4,6-Dinitrotoluene		NE			NE					NE			NE			
4-Amino-2,6-Dinitrotoluene		NE			NE					NE			NE			
HMX		NE			NE					NE			NE			
MNX		NE			NE					NE			NE			
RDX		NE			NE					NE			NE			

Notes:

-- = Not Measured

< = Less Than

µg/L = Micrograms Per Liter

D = Dilution

HMX = Octahydro-1,3,5,7-tetranitro-
-1,3,5,7-tetrazocine

J = Estimated

MNX = Mono-Nitroso RDX

N/A = Not Available

NE = Not Evaluated

P = Difference between columns greater than 25%

Qual = Qualifier

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

RL = Reporting Limit

SD = Sample Difference

U = Nondetect

Z = Co-Elution

TABLE I-4
SUMMARY OF ANALYTICAL RESULTS FOR DUPLICATE SAMPLE PAIRS
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

SITE NAME	**East Burn Pads**			**East Burn Pads**					**West Burn Pads Area**			**West Burn Pads Area**				
FIELD ID	**EBP-DP14-25**			**EBP-DP14-00**					**WBP-DP06-22**			**DUPLICATE 13**				
SAMPLE TYPE	**Direct Push**			**Direct Push**					**Direct Push**			**Direct Push**				
QC TYPE	**Original**			**Duplicate**			**Duplicate Pair**		**Original**			**Duplicate**			**Duplicate Pair**	
DATE COLLECTED	**October 24, 2002**			**October 24, 2002**					**February 10, 2003**			**February 10, 2003**				
	Result	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Precision**	**Action**	**Result**	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Precision**	**Action**
VOLATILE ORGANIC COMPOUNDS (µg																
1,1-Dichloroethane		NE			NE					NE			NE			
1,1-Dichloroethene		NE			NE					NE			NE			
Freon113		NE			NE					NE			NE			
1,1,1-Trichloroethane		NE			NE					NE			NE			
Tetrachloroethene		NE			NE					NE			NE			
EXPLOSIVES (µg/L)																
2-Amino-4,6-Dinitrotoluene	<	0.79	U	<	0.44	U	--	None	<	0.83	U	<	1.9	U	--	None
4-Amino-2,6-Dinitrotoluene	<	0.79	U	<	0.44	U	--	None	<	0.83	U	<	1.9	U	--	None
HMX	100	7.9	D	110	4.4	D	9.5%	None	<	0.83	U	<	1.9	U	--	None
MNX	3.6	0.99		3.6	0.55		0.0%	None	<	0.83	U	<	1.9	U	--	None
RDX	70	7.9	DP	76	4.4	DP	8.2%	None	<	0.83	U	<	1.9	U	--	None

Notes:

-- = Not Measured
< = Less Than
µg/L = Micrograms Per Liter
D = Dilution
HMX = Octahydro-1,3,5,7-tetranitro-
-1,3,5,7-tetrazocine
J = Estimated
MNX = Mono-Nitroso RDX
N/A = Not Available
NE = Not Evaluated
P = Difference between columns greater than 25%
Qual = Qualifier
RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine
RL = Reporting Limit
SD = Sample Difference
U = Nondetect
Z = Co-Elution

TABLE I-4
SUMMARY OF ANALYTICAL RESULTS FOR DUPLICATE SAMPLE PAIRS
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

SITE NAME	**West Burn Pads Area**			**West Burn Pads Area**				
FIELD ID	**WBP-DP12-09**			**DUPLICATE 12**				
SAMPLE TYPE	**Direct Push**			**Direct Push**				
QC TYPE	**Original**			**Duplicate**			**Duplicate Pair**	
DATE COLLECTED	**November 23, 2002**			**November 23, 2002**				
	Result	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Precision**	**Action**
VOLATILE ORGANIC COMPOUNDS (µg								
1,1-Dichloroethane		NE			NE			
1,1-Dichloroethene		NE			NE			
Freon113		NE			NE			
1,1,1-Trichloroethane		NE			NE			
Tetrachloroethene		NE			NE			
EXPLOSIVES (µg/L)								
2-Amino-4,6-Dinitrotoluene	1.4	0.22	PZ	1.5	0.18	PZ	6.9%	None
4-Amino-2,6-Dinitrotoluene	1.6	0.22	PZ	1.8	0.18	PZ	11.8%	None
HMX	38	2.2	D	42	1.8	D	10.0%	None
MNX	2.3	0.22	P	2.4	0.18	P	4.3%	None
RDX	64	2.2	D	70	1.8	D	9.0%	None

Notes:

-- = Not Measured

< = Less Than

µg/L = Micrograms Per Liter

D = Dilution

HMX = Octahydro-1,3,5,7-tetranitro-
-1,3,5,7-tetrazocine

J = Estimated

MNX = Mono-Nitroso RDX

N/A = Not Available

NE = Not Evaluated

P = Difference between columns greater than 25%

Qual = Qualifier

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

RL = Reporting Limit

SD = Sample Difference

U = Nondetect

Z = Co-Elution

Quality Assurance Split Sample Pair Results

TABLE I-5
SUMMARY OF ANALYTICAL RESULTS FOR QUALITY ASSURANCE SPLIT SAMPLE PAIRS
FIRE TRAINING PIT GROUNDWATER FEASIBILITY STUDY

SITE NAME	East Burn Pads			East Burn Pads					Fire Training Pit			Fire Training Pit				
FIELD ID	EBP-MW5			EBP-MW5 Split					FTP -MW1			FTP-MW1 Split				
SAMPLE TYPE	Monitoring Well			Monitoring Well					Monitoring Well			Monitoring Well				
QC TYPE	Original			QA Split			QA Split Pair		Original			QA Split			QA Split Pair	
DATE COLLECTED	May 12, 2003			May 12, 2003					May 13, 2003			May 13, 2003				
	Result	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Precision**	**Action**	**Result**	**RL**	**Qual**	**Result**	**RL**	**Qual**	**Precision**	**Action**
VOLATILE ORGANIC COMPOUNDS (µg/L)																
1,1-Dichloroethane	<	3	U	<	2	U		Data Agreed	15	3		15.1	2		0.7%	Data Agreed
1,1-Dichloroethene	<	3	U	<	2	U		Data Agreed	2	3	J	2	2	J	0.0%	Data Agreed
cis-1,2-Dichloroethene	<	3	U	<	2	U		Data Agreed	<	3	U	0.6	2	J	SD<RL	Data Agreed
m,p-Xylene	1	3	J	<	2	U	SD<RL	Data Agreed	<	3	U	<	2	U		Data Agreed
o-Xylene	1	3	J	<	2	U	SD<RL	Data Agreed	<	3	U	<	2	U		Data Agreed
Vinyl Chloride	<	3	U	<	2	U		Data Agreed	19	3		30	2		44.9%	Data Agreed
SEMIVOLATILE ORGANIC COMPOUNDS (µg/L)																
Bis(2-ethylhexyl)phthalate	<	5	U	1	4.9	J	SD<RL	Data Agreed		NE			NE			
EXPLOSIVES (µg/L)																
2-Amino-4,6-Dinitrotoluene	<	0.84	U	0.35	0.21	C	SD<RL	Data Agreed	<	0.96	U	<	0.21	U		Data Agreed
4-Amino-2,6-Dinitrotoluene	<	0.84	U	0.60	0.19			Data Agreed	<	0.96	U	<	0.19	U		Data Agreed
4-Nitroltoluene	<	0.84	U	<	0.26	U		Data Agreed	1.2	0.96		<	0.26	U	SD<RL	Data Agreed
HMX	7.2	0.84		14	1.6	**C**	64.2%	Minor	<	0.96	U	<	1.6	U		Data Agreed
RDX	26	0.84		64	1.3	**C**	84.4%	Minor	<	0.96	U	<	1.3	U		Data Agreed
METALS (µg/L)																
Barium		NE		63.1	2.5	J			142	200	J	150	2.5		5.5%	Data Agreed
Silver	<	10	U	<	10	U		None	<	10	U	<	10	U		None
Total Organic Carbon	<	1	U	<	1	U		None	<	1	U	<	1	U		None
Selenium		NE		<	20	U			0.44	10	J	<	20	U	SD<RL	Data Agreed

Notes:

< = Less Than

µg/L = Micrograms Per Liter

C = Result not confirmed due to matrix interference

HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

J = Estimated

NE = Not Evaluated

Qual = Qualifier

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

RL = Reporting Limit

SD = Sample Difference

U = Nondetect

Split samples were not collected at Line 3 during the Remedial Alternatives Analysis.

APPENDIX J

Human Health Risk Assessment

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Appendix J Human Health Risk Assessment

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List of Acronyms and Abbreviations

µg	Microgram(s)
%	Percent
AT	Averaging Time
bgs	Below Ground Surface
BW	Body Weight
CF	Conversion Factor
cm	Centimeter(s)
cm^2	Square Centimeter(s)
CNS	Central Nervous System
COC	Chemical of Concern
COPC	Chemical of Potential Concern
CTE	Central Tendency Exposure
D	Qualifier indicating “diluted” data value
E	Emission Rate
ED	Exposure Duration
EF	Exposure Frequency
EPC	Exposure Point Concentration
ET	Exposure Time
ft	Foot or Feet
ft^2	Square Foot or Square Feet
FTP	Fire Training Pit
g	Gram(s)
GWM	Groundwater Monitoring Event
HEAST	Health Effects Assessment Summary Tables
HGL	HydroGeoLogic, Inc.
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
hr	Hour
IAAAP	Iowa Army Ammunition Plant
IF	Intake Factor
IR	Ingestion Rate
IRIS	Integrated Risk Information System
J	Qualifier indicating “estimated data” value
kg	Kilogram(s)
L	Liter(s)

LOAEL	Lowest Observed Adverse Effects Level
m	Meter(s)
m^3	Cubic Meter(s)
MCL	Maximum Contaminant Level
mg	Milligram(s)
mL	Milliliter(s)
NA	Not Applicable
NCEA	National Center for Environmental Assessment
ND	Nondetect or Not Detected
NOAEL	No Observed Adverse Effects Level
ORNL	Oak Ridge National Laboratory
P	Qualifier indicating percent difference greater than 25 percent
PC	Permeability Coefficient
PRG	Preliminary Remediation Goal
QA/QC	Quality Assurance/Quality Control
R	Qualifier indicating “rejected” data value
RAA	Remedial Alternatives Analysis
RAGS	Risk Assessment Guidance for Superfund
RAIS	Risk Assessment Information System
RDA	Recommended Daily Allowance
RDX	Hexahydro-1,3,5-trinitro-1,3,5-triazine; a common military explosive
RfD	Reference Dose
RL	Reporting Limit
RME	Reasonable Maximum Exposure
SA	Surface Area
SCEM	Site Conceptual Exposure Model
SDEF	Standard Default Exposure Factor
SF	Slope Factor
SVOC	Semivolatile Organic Compound
U	Qualifier indicating “nondetected” data value
UCL	Upper Confidence Limit
URS	URS Group, Inc.
USEPA	United States Environmental Protection Agency
VF	Volatilization Factor
VOC	Volatile Organic Compound

J.1 OBJECTIVES AND METHODOLOGY

A human health risk assessment (HHRA) was performed to assess potential adverse health effects or risks due to current or future exposure to chemicals of potential concern (COPCs) released from the Iowa Army Ammunition Plant (IAAAP). The results of the HHRA were used to:

- Estimate the magnitude of potential human health risk associated with site-related chemicals
- Identify the primary contributors to the risk at the site
- Help determine whether remediation is warranted at the site to protect public health

The risk assessment methodology used in this study is consistent with United States Environmental Protection Agency (USEPA) Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual (Part A) (USEPA 1989). USEPA guidance was applied because it is the most appropriate and widely accepted guidance for such an assessment. USEPA cautions that its documents are intended to provide guidance only and that considerable professional judgment must be exercised in applying the guidance to site-specific HHRAs.

The steps in the HHRA process are:

1. Selection of COPCs
2. Exposure assessment
3. Calculation of exposure point concentrations
4. Estimation of chemical intakes
5. Toxicity assessment
6. Risk characterization (including an evaluation of uncertainties in the risk assessment)
7. Human health risk-based preliminary remediation goal (PRG) concentrations, if warranted

J.1.1 Previous Risk Evaluation

A previous soil, groundwater, and surface water risk assessment was completed by ICAIR Life Systems Inc., Cleveland, Ohio and presented in the Revised Draft Final Remedial Investigation/Risk Assessment, Volume 11 (JAYCOR 1996). The current groundwater and surface water HHRA was completed to reevaluate the risk at the Fire Training Pit (FTP) using Spring 2003 site conditions. The groundwater monitoring data and surface water sampling results from the Spring 2003 groundwater monitoring event (Spring 2003 GWM) (HGL 2003) and the FTP groundwater Remedial Alternatives Analysis (RAA) field activities were used for this HHRA.

J.2 SELECTION OF COPCS

COPCs are chemicals that may have been released from process activities or waste sources at IAAAP that have been detected in groundwater and/or surface water and may be significant contributors to human health risks. Groundwater was categorized into two distinct zones during the risk assessment evaluation: shallow (3 to 30 feet below ground surface [bgs]) and bedrock (30 to 65 feet bgs). FTP COPCs were selected based on the following screening criteria:

- Chemical data evaluation: Data were considered usable for risk assessment purposes if the data were unqualified or estimated. Rejected data were not used in the HHRA. Chemicals at concentrations that can be attributed to laboratory or field contamination were not considered COPCs.
- Essential nutrients: Essential nutrients (i.e., calcium, magnesium, potassium, and sodium, as specified in USEPA Region 4 guidance [USEPA 1996a]) that did not exceed recommended daily allowances (RDAs) were not considered COPCs.
- Comparison to project human health screening values: Chemicals that were detected at concentrations below human health risk-based screening levels were not considered COPCs. Maximum detected site concentrations were compared to a variety of federal screening levels and calculated background levels. If the maximum detected concentration exceeded the screening value for a medium, the chemical was considered to be a COPC.
- Availability of USEPA toxicity criteria: COPCs that had USEPA-established toxicity factors were evaluated quantitatively in the HHRA. COPCs that did not have USEPA-established toxicity factors but that could potentially contribute to risks were evaluated qualitatively in the HHRA if a suitable surrogate could not be found.

J.2.1 Use of Data

This risk assessment included groundwater and surface water data collected during the Spring 2003 GWM (HGL 2003) and the FTP groundwater RAA field activities.

J.2.2 Chemical Data Evaluation

Data Usability

Prior to use in the HHRA, all site data collected during the FTP groundwater RAA were validated and qualified following the quality assurance/quality control (QA/QC) procedures described in the Fire Training Pit, West Burn Pads Area, and East Burn Pads Feasibility Study Data Collection Work Plan Addendum (URS 2002). The QA review was performed in compliance with USEPA laboratory data validation guidelines (USEPA 2001a, 2002a). Data of insufficient quality based on QA/QC criteria were rejected at this point and not used in the HHRA. Sample results were assigned appropriate qualifiers during the review and validation process. (e.g., **J**-estimated).

Data were considered usable for risk assessment purposes if the data were unqualified, diluted (**D** qualifier), nondetect (**U** qualifier), or estimated (**J** or **P** qualifier). Data were not used if the data were rejected (**R** qualifier). Additionally, samples collected for QA/QC purposes (e.g., matrix spike/matrix spike duplicate) were not used in the HHRA.

Results of the data review and validation are presented in **Section 5** and **Appendix I**.

J.2.3 Essential Nutrients

Chemicals that are essential nutrients (calcium, iron, magnesium, potassium, and sodium, as specified in USEPA Region 4 guidance [USEPA 1996a]) were not considered to be COPCs if daily intakes calculated from maximum concentrations did not exceed RDAs. These chemicals are generally not considered toxic at environmental levels but are required to maintain normal health in humans and biota. The screening of essential nutrients is presented in **Table J-1**.

J.2.4 Comparison to Human Health Screening Criteria

Maximum concentrations for each chemical were compared to USEPA Region 9 Tap Water PRGs (USEPA 2002b) and calculated background concentrations. The drinking water standard (USEPA 2002b) was used as a screening value if a Region 9 PRG was not available (e.g., lead). If the maximum detected concentration exceeded the screening value for a medium, the chemical was considered to be a COPC.

J.2.5 Availability of USEPA Toxicity Criteria

The sources of toxicity values used in this HHRA are 1) USEPA's Integrated Risk Information System (IRIS) (online database), 2) USEPA's National Center for Environmental Assessment (NCEA) and 3) the Health Effects Assessment Summary Tables (HEAST) (USEPA 1997a).

J.3 EXPOSURE ASSESSMENT

The objectives of the exposure assessment were to:

- Characterize the exposure setting
- Identify populations (receptors) that may be potentially exposed to site-related constituents
- Identify and evaluate the complete pathways by which exposure may occur by developing a site conceptual exposure model (SCEM) of potential exposure pathways

For this HHRA, the exposure assessment involved developing the reasonable maximum exposure (RME) and central tendency exposure (CTE) intake factors for each receptor. CTE variables are those that, applying USEPA guidance and professional judgment, represent the most likely estimates of exposure for an individual with normal activity patterns. The CTE (most likely) scenarios are conservative in that they assume that contact with a contaminated medium occurs routinely over the course of many years. The RME scenario was defined from a set of exposure variables (e.g., body weight [BW], ingestion rate [IR], body surface area [SA]) that resulted in the highest exposure that would reasonably be expected to occur at the site.

J.3.1 Characterization of Exposure Setting

Physical Setting and Land Use

A description of the general physical setting of the FTP area is provided in **Section 2**. The primary land use at the FTP was industrial. Although, the FTP is no longer active it is periodically patrolled by a security work force. While IAAAP is fenced, the FTP area itself is not fenced. The receptors who might be directly exposed to COPCs detected at the FTP are the current and future construction worker, commercial/industrial worker, and hunter/trespasser.

J.3.2 Potentially Exposed Populations

Current Exposures

Groundwater receptors are limited to the construction worker and the commercial/industrial worker. Surface water receptors are limited to the construction worker and the hunter/trespasser. However, during the COPC selection (see **Section 6** of this RAA), no COPCs were identified in surface water. Therefore, surface water is not a media of concern and no receptors were evaluated for surface water.

Future Site Exposures

The same exposure assumptions were used to evaluate the current and future construction worker and the current and future commercial/industrial worker exposures to groundwater. Groundwater contaminant fate and transport modeling results (presented in **Section 8**) indicated that contaminant concentrations are now at their highest predicted values and are expected to decline in the future. Therefore, the Spring 2003 groundwater results used in the current/future risk calculations are considered to be representative of the potential risks at the FTP.

J.3.3 Site Conceptual Exposure Model

Information concerning contaminant sources, contaminant release and transport mechanisms, and locations of potentially exposed individuals (receptors) were used to develop an SCEM that describes potential human exposure pathways. The SCEM is a schematic representation of the contaminant source area, chemical release mechanisms, environmental transport media, exposure media, potential human intake routes, and potential human receptors. The purpose of the SCEM was to provide a framework for problem definition, to identify exposure pathways that may result in human health risks, to aid in identifying data needed to evaluate those pathways, and to aid in identifying effective cleanup measures, if necessary, that would target significant contaminant sources. An SCEM includes four elements:

- A source of chemicals and a mechanism of chemical release
- An environmental transport media (e.g., groundwater, surface water)
- An exposure point
- A human intake route (e.g., inhalation, ingestion, or dermal)

Each one of these four elements must be present for an exposure pathway to be complete. If only three elements are present, the exposure cannot occur and the pathway is incomplete. Only potentially complete pathways were addressed in this HHRA. The SCEM for potential human receptor populations considered for the FTP groundwater is presented on **Figure J-1.**

Volatile organic compounds (VOCs) and explosives compounds disposed of at the FTP may be a potential source for chemical release. Volatiles and/or explosives may have inadvertently transferred into soil via spills, leaking containers, incomplete combustion or detonation, indirect product discharges and storm water runoff. Surface contamination infiltrates through the soil to groundwater. Potential exposure may occur through inhalation, ingestion, incidental ingestion or dermal contact with groundwater.

Exposure routes are the modes (e.g., ingestion, dermal contact, inhalation) by which receptors contact the contaminated media. Exposure to the FTP shallow groundwater plume via inhalation, incidental ingestion, and dermal contact represent potentially complete exposure pathways for the construction worker. Exposure to the FTP shallow groundwater plume via ingestion represents the potentially complete exposure pathway for the commercial/industrial worker.

Hypothetical construction workers could be exposed to contaminants in shallow groundwater via inhalation, incidental ingestion or dermal contact, if future excavations encounter the shallow groundwater plume. Ten feet was considered a reasonable maximum depth for a construction excavation (groundwater at the FTP was encountered at 3 to 12 feet bgs).

Although it is unlikely that on-post groundwater could be used for drinking water, USEPA Region 7 requested in the 1996 dispute resolution that the commercial/industrial workers' exposure to contaminants in groundwater via ingestion be evaluated (USEPA 1996b). Ingestion of groundwater was considered the only significant pathway.

Spring Creek runs adjacent to the FTP and was initially considered to be a potential medium of concern. However, during the COPC selection process (**Section 6**), no compounds were detected in surface water above the screening values. Therefore, surface water was no longer considered a medium of concern and the hunter/trespasser was not considered a potential receptor for this risk assessment. Potential receptors and potentially complete pathways are summarized as follows:

Current/Future Construction Workers

- Incidental ingestion of shallow groundwater (e.g., during excavation)
- Dermal contact with shallow groundwater (e.g., during excavation)
- Inhalation of volatile emissions from groundwater (e.g., during excavation)

Current/Future Commercial/Industrial Worker

- Ingestion of groundwater (e.g., drinking water)

J.4 CALCULATION OF EXPOSURE POINT CONCENTRATIONS

J.4.1 Exposure Point Concentrations in Groundwater and Surface Water

General

USEPA (1989) recommends that for each COPC, the 95-percent upper confidence limit (95% UCL) (based on assumed lognormal distribution for sample groups greater than 10) be calculated using chemical analytical results. According to USEPA guidance (USEPA 1989), the lognormal statistical approach is very sensitive to sample size and variance. The FTP data set was composed of fewer than 10 samples; therefore, a 95% UCL was not calculated. Instead, the maximum detected concentration was used as the RME value. The maximum concentration is likely to significantly overestimate the average concentration to which people would be exposed. The exposure point concentrations for the FTP shallow groundwater plume are presented in **Table J-2**.

Dermal Adjusted Concentrations

Concentrations of chemicals detected in groundwater were adjusted for dermal-aqueous permeability. Chemical-specific permeability coefficients (PCs) were obtained from USEPA's Dermal Guidance (USEPA 2001b) when possible.

J.4.2 VOC Concentrations in Construction Trenches from Groundwater

A USEPA Box Model (USEPA, 1999) was used to estimate the upper-bound exposure point concentration for workers in trenches flooded with groundwater off-gassing VOCs. The derivation is based on a mass balance equation using a well mixed, single-compartment model (i.e., "box" model). This approach is commonly used to estimate air concentrations in enclosed spaces (Andelman, 1985). In this conservative approach, the VOC concentration everywhere in the "box" (e.g., the trench air compartment) is assumed to be the same. The VOC enters the box through emission from groundwater at the base of the trench and leaves the box by wind-induced convection. At steady state, the mass balance for the system is obtained by setting the emission rate (E) of a VOC from water to air equal to the rate at which the chemical is carried away from the trench by exchange with the overlying air mass.

A generic VOC volatilization factor (VF_{VOC}) can be obtained using the conservative estimates based on the mass transfer coefficients for water and air (USEPA, 1999) assuming that for volatile chemicals, the overall mass transfer coefficient for water-to-air transfer is approximately equal to its liquid mass transfer coefficient. Multiplying the volatilization factor by groundwater concentration yields a conservative estimate of the air concentrations to which workers in trenches with groundwater off-gassing VOCs could be exposed.

Thus,

$$C_{air} = C_{H2O} \text{ x } VF_{VOC} \text{ x } CF$$

where:

C_{air} = Concentration of the chemical in the vapor phase (mg/m^3)
C_{H2O} = Concentration of the chemical in the water phase (mg/L)
CF = Conversion Factor (L/m^3)
VF_{VOC} = $1.8x10^{-5}$ (unitless)

Table J-13 shows the estimation of air concentrations of VOCs from the shallow groundwater plume at the FTP.

J.5 ESTIMATION OF CHEMICAL INTAKES

Using the exposure point concentrations of COPCs it is possible to estimate the potential human intake of those chemicals via each exposure pathway. Intakes are expressed in terms of milligrams chemical per kilogram body weight per day (mg/kg–day). Intakes were calculated following guidance in the Risk Assessment Guidance for Superfund (USEPA 1989), Exposure Factors Handbook (USEPA 1997b), other USEPA guidance documents as appropriate, and professional judgment regarding probable site-specific exposure conditions. Intakes were estimated using reasonable estimates of body size, inhalation rates, ingestion rates, dermal absorption rates, and frequency and duration of exposure.

Intakes were estimated for both the CTE and RME conditions. The CTE is the exposure that, applying USEPA guidance and professional judgment, represents the typical exposure for an individual with normal activity patterns. The CTE scenarios are conservative (i.e., protective of most receptors) in that they assume that contact with contaminated media occurs routinely over the course of many years (when in fact such assumptions may never be realized). The RME was estimated by selecting values for exposure variables so that the combination of all variables results in the reasonable maximum (high end) exposure that can be expected to occur at the site. In this risk assessment, the RME scenarios were developed using USEPA's Standard Default Exposure Factors (SDEFs) (USEPA 1991a).

The general equation for calculating the construction worker and the commercial/industrial worker intake in terms of mg/kg–day is:

$$\text{Intake Factor} = (IR \times EF \times ED \times CF)/(BW \times AT)$$

where:

IR = Ingestion Rate
EF = Exposure Frequency
ED = Exposure Duration
CF = Conversion Factor
BW = Body Weight
AT = Averaging Time

The variable "averaging time" is expressed in days to calculate average daily intake. For noncarcinogenic chemicals, intakes are calculated by averaging the total cumulative dose over the period of exposure to yield an average daily intake. For carcinogens, intakes are calculated by averaging the total cumulative dose over a 70-year lifetime, yielding “lifetime average daily dose.” Different averaging times are used for carcinogens and noncarcinogens because it is thought that their effects occur by different mechanisms. The approach for carcinogens is based on the scientific opinion that a high dose received over a short period of time is equivalent to a corresponding low dose spread over a lifetime, and that any dose, no matter how small, has a probability of causing cancer. Therefore, the intake of a carcinogen, for whatever duration, is averaged over a 70-year lifetime (USEPA 1989).

Omitting chemical concentrations from the intake equation yields a pathway-specific “intake factor” (kg soil, L water, and cubic meters [m^3] air per kg–day). Because the exposure pattern resulting in exposure to various COPCs is the same, the pathway-specific intake of a chemical can be calculated by multiplying the concentration of each chemical by the intake factor (IF). IFs were calculated separately for each receptor and exposure pathway. The intake assumptions used in the HHRA are presented in **Tables J-3** through **J-6** and are summarized in **Table J-7**. The assumptions used in deriving IFs are discussed below.

J.5.1 General Assumptions

Several exposure parameters, such as body weight and averaging times, have general application in all intake estimations, regardless of pathway.

Exposure Frequency

- The exposure frequency for the construction worker was assumed to be 45 days per year (nine work weeks, five days per week for one year) for the CTE case, which is the estimated duration for excavation activities for an average construction project (e.g., small foundation construction, pipeline installation/maintenance). The RME duration for the construction worker was assumed to be 90 days per year (18 work weeks, five days per week for one year), which is the estimated duration of excavation activities for a larger construction project (foundation for a large building).
- The exposure frequency for the commercial/industrial worker was assumed to be 250 days per year for the CTE and RME case (USEPA 1996b).

Exposure Time

- Construction workers were assumed to spend eight hours per day at the site for both the CTE and RME cases. This is equivalent to a typical workday.

Exposure Duration

- The exposure duration for the construction worker was assumed to be one year for both the CTE and RME cases. This assumes that a construction project will be completed within a one-year time span.
- The exposure duration for the commercial/industrial worker to groundwater as drinking water was assumed to be 6.6 years (CTE) and 21.9 years (RME) (USEPA 1997b).

Averaging Time

- The CTE and RME averaging time for noncarcinogenic effects was assumed to be 365 days for the construction worker.
- The CTE and RME averaging times for noncarcinogenic effects were assumed to be 2,409 days (365 days per year for 6.6 years) and 7,994 days (365 days per year for 21.9 years), respectively, for the commercial/industrial worker.
- Averaging time for carcinogens was 25,550 days (365 days per year for 70 years).

Body Weight

- The recommended average adult body weight was 70 kg (USEPA 1989). This value was used in both the CTE and RME cases for all receptors.

J.5.2 Groundwater Inhalation Assumptions

Uptake of COPCs via inhalation of VOCs from groundwater is a function of the volume of vapor inhaled per hour and the frequency and duration of exposure. The following assumptions were used to estimate exposure to COPCs through inhalation of volatile compounds from groundwater:

- The construction workers' inhalation rate was assumed to be 1.3 cubic meters per hour (m^3/hr) and 2.5 m^3/hr for the CTE and RME cases, respectively (USEPA 1997b).

J.5.3 Groundwater Ingestion Assumptions

Uptake of COPCs via ingestion of groundwater is a function of the volume of water ingested per day and the frequency and duration of exposure. The following assumptions were used to estimate exposure to COPCs through ingestion of groundwater:

- The construction worker was assumed to incidentally ingest 5 milliliters per day (mL/day) and 10 mL/day of groundwater for the CTE and RME cases, respectively (USEPA 1988). Incidentally ingested groundwater was assumed to be on the hands of the construction workers, not from actual standing water.
- The commercial/industrial worker was assumed to ingest 500 mL/day and 1,000 mL/day of groundwater for the CTE and RME cases, respectively. The RME ingestion rate for the commercial/industrial worker was recommended by USEPA Region 7 (USEPA 1996b).

Exposure frequency and exposure duration assumptions were discussed in **Section J.5.1**.

J.5.4 Dermal Absorption from Groundwater

Uptake of COPCs through dermal contact with groundwater is a function of exposed body surface area, the rate at which chemicals penetrate the skin, and exposure frequency and duration. The following assumptions were used to estimate exposure to COPCs through dermal contact with groundwater:

- Construction workers were assumed to wear clothing appropriate for weather and activity. For the construction worker, the body surface area exposed per day was 3,160 square centimeters (cm^2) for the CTE case and 5,230 cm^2 for the RME case. The CTE value is equivalent to the head, forearms, and hands; the RME value is equivalent to the head, forearms, lower legs, and hands (USEPA 2001b).
- The PC is a chemical-specific parameter. The PC for inorganic analytes (metals) was assumed to $1x10^{-3}$, which is the recommended default value (USEPA 1992a). The PCs for organic compounds are chemical-specific and were obtained from USEPA (2001b) or the Risk Assessment Information System (RAIS) (2003). This is a conservative approach for evaluating metals, because absorption through the skin does not occur readily. For organic analytes that do not have a chemical-specific PC, a recommended default factor was used (USEPA 1992a).

Exposure frequency and exposure duration assumptions were discussed in **Section J.5.1**.

J.6 TOXICITY ASSESSMENT

USEPA toxicity factors were used to assess potential health risks resulting from the estimated chemical intakes. Toxicity factors are expressed either as a reference dose (RfD) or a slope factor (SF). An RfD is the daily dose that is unlikely to result in noncancer toxic effects to humans over a lifetime of exposure. SFs and the USEPA weight-of-evidence classification are used to estimate potential carcinogenic risks. The SF is an estimate of the upper-bound probability of an individual developing cancer as a result of exposure to a potential carcinogen. The weight-of-evidence classification is an evaluation of the quality and quantity of carcinogenic potency data for a given chemical. The RfDs and SFs are presented in **Tables J-8** and **J-9**, respectively.

J.6.1 RfDs for Noncarcinogenic Effects

Substances that produce adverse noncarcinogenic effects are generally thought to have a threshold dose, below which the adverse effect is not likely to be observed over a lifetime (chronic) or a portion of lifetime (subchronic) exposure. Chemical intakes that are expected to result in no adverse effects to humans are referred to as RfDs by USEPA. USEPA defines a chronic RfD as an estimate of a daily exposure level for the human population that is unlikely to result in deleterious effects, even to sensitive subpopulations (e.g., the very young or very old), during a lifetime (70 years). A chronic RfD is used to evaluate the potential noncarcinogenic hazards associated with long-term chemical exposures (from seven years to a lifetime). Chronic RfDs were used to assess noncarcinogenic RME hazards for the commercial/industrial worker.

Subchronic RfDs have been developed to characterize potential noncarcinogenic hazards associated with shorter-term chemical exposures. USEPA defines subchronic exposure as periods ranging from two weeks to seven years (USEPA 1989). Subchronic RfDs tend to be higher (generally by an order of magnitude) than chronic RfDs, because a higher dose can be tolerated for the shorter exposure duration. Construction workers are expected to be on site for one year or less; therefore, subchronic RfDs (if available) were used to evaluate potential exposures. Subchronic RfDs should be used to evaluate the CTE exposure scenario for the construction worker (one year). According to USEPA Region 4 (USEPA 1996a), the chronic RfD should be used if a subchronic RfD is not available.

To develop the RfD, the threshold dose or “no observed adverse effect level” (NOAEL) is identified through experimentation on animals. A NOAEL is an experimentally determined highest dose at which there was no statistically or biologically significant effect of concern, often called the “critical toxic effect.” For certain substances, only a “lowest observed adverse effect level” (LOAEL) has been determined. This is the lowest dose of a substance that produces either a statistically or biologically significant indication of the critical toxic effect. The NOAEL or the LOAEL may be used to calculate the RfD of a particular chemical. USEPA bases the RfD on the most sensitive animal species tested (i.e., the species that experiences adverse effects at the lowest doses). In some cases, RfDs may be based on human epidemiologic data.

RfDs are generally calculated by dividing the NOAEL (or LOAEL) by uncertainty factors that usually range from 10 to 1,000. Uncertainty factors are intended to account for specific types of uncertainty inherent in extrapolation from one exposure route to another, extrapolation of data from laboratory animals to humans, variations in species sensitivity, variations in sensitivity among individuals within a species, limitations in exposure duration in animal experiments, and other limitations in the experimental data. Experimental animal data have historically been relied upon by regulatory agencies and other expert groups to assess the hazards of human chemical exposures. Although this reliance has been generally supported by empirical observations, there are known interspecies differences in chemical adsorption, metabolism, excretion, and toxic responses. There are also uncertainties concerning the relevance of animal studies using exposure routes that differ from the human exposure routes under consideration. Additionally, extrapolating results of short-term or subchronic animal studies to long-term exposures in humans has inherent uncertainty.

Despite the many limitations of experimental animal data, such information is essential for chemical toxicity assessment, especially in the absence of human epidemiological evidence. The uncertainty factors used in the derivation of RfDs are intended to compensate for data limitations. Synergistic effects may occur when the adverse effect of one chemical is greater in the presence of a second chemical than if the exposure were to one chemical alone. Antagonistic effects may occur when two chemicals interfere with each other’s actions or when one chemical interferes with the action of the other chemical (USEPA 1986a).

The method of deriving human RfDs from short-term studies in sensitive animals is conservative by design and introduces the potential to overestimate, but very likely not underestimate, noncarcinogenic effects. The methodology for deriving RfDs is more fully described in USEPA’s current human health risk assessment guidance (USEPA 1989). The RfD is expressed in units of milligrams of chemical per kilogram of body weight per day (mg/kg-day).

USEPA recognizes that, even with the application of uncertainty factors, RfDs are provisional estimates with uncertainty perhaps spanning an order of magnitude or more (USEPA 1997b). USEPA rates the confidence level of verified RfDs as high, medium, or low.

J.6.2 Slope Factors for Carcinogenic Effects

In estimating the potential risk posed by potential carcinogens, it is the practice of USEPA and other regulatory agencies to assume that any exposure level has a finite probability, however minute, of producing a carcinogenic response. USEPA assumes that a small number of molecular events can evoke changes in a single cell that can lead to uncontrolled cellular proliferation. This mechanism for carcinogenicity is referred to as “nonthreshold,” because there is theoretically no level of exposure for such a substance that does not pose a small probability of producing a carcinogenic response. USEPA assigns the substance a weight-of-evidence classification that describes the likelihood, based on scientific evidence, that the substance is a human carcinogen. Given sufficient data, an SF is then calculated, with a selected computer model specific for the assumed mechanism of action for carcinogenesis, that describes quantitatively the relationship between average lifetime dose and carcinogenic risk (USEPA 1986b).

The SFs are based primarily on the results of animal studies. There is uncertainty whether animal carcinogens are also carcinogenic in humans. While many chemical substances are carcinogenic in one or more animal species, only a small number of chemical substances are known to be human carcinogens. USEPA assumes that humans are as sensitive to all animal carcinogens as the most sensitive animal species. This policy decision introduces the potential to overestimate, but very likely not to underestimate, carcinogenic risk.

A number of mathematical models and procedures have been developed to extrapolate from carcinogenic responses observed at high doses in experimental animals to responses expected at low doses in humans. USEPA uses a linearized multistage model for low-dose extrapolation. This conservative mathematical model is based on the multistage theory of carcinogenesis, wherein the response is assumed to be linear at low doses. USEPA further calculates the upper 95th percent confidence limit of the slope of the resulting dose-response curve. This value, the SF, expressed in units of $(\text{mg/kg-day})^{-1}$, is used to convert the average daily intake of a chemical, normalized over a lifetime, directly to an estimate of cancer risk. The resulting risk estimate represents an estimation of an upper-bound lifetime probability that an individual will develop cancer as a result of exposure to a potential carcinogen. This model provides a conservative estimate of cancer risk at low doses, and is likely to overestimate the actual cancer risk. USEPA acknowledges that actual risk is likely to be less than the estimate calculated with the SF using the linearized multistage model (USEPA 1989), and in fact may be zero.

J.6.3 Sources and Uses of Toxicity Information

The result of toxicity assessments performed by USEPA was the development of chemical-specific toxicity factors (i.e., RfDs and SFs) for the oral, dermal, or inhalation exposure pathway. According to USEPA Region 4 (USEPA 1996a), IRIS is the primary source of toxicity data to be used in a HHRA. IRIS is a USEPA database containing health risk and regulatory information for numerous chemicals. Only toxicity factors that have been verified by USEPA science work groups are included in IRIS. If a toxicity value is available in IRIS, it was used in the HHRA. Information in IRIS supersedes all other sources. If a value is not available in IRIS, the next source to be consulted was the latest update of NCEA and then finally HEAST. HEAST typically contains interim and subchronic toxicity factors that do not appear in IRIS.

Table J-8 summarizes the subchronic and chronic RfDs, sources, uncertainty factors, confidence level, critical effect, and experiment used to derive the RfDs for each noncarcinogenic COPC identified in the HHRA. **Table J-9** summarizes the SFs, sources, weight-of-evidence classification, critical effect, and experiment used to determine the SF for each carcinogenic COPC identified in the HHRA.

J.7 RISK CHARACTERIZATION

Risk characterization combines the outputs of the exposure and toxicity assessments to develop quantitative estimates of risks associated with exposures to COPCs released from the site. The risk characterization should present the risk estimates in an unbiased manner and explain the uncertainties associated with the calculation of the risk estimates. Both the CTE and RME risks were calculated for shallow groundwater. A human health risk summary for all receptors and pathways is presented in **Table J-10**. The human health risk summaries for each receptor are presented in **Tables J-11** and **J-12**. The calculation of human health risks for each receptor and pathway is presented in **Tables J-14** through **J-17**.

J.7.1 Hazard Index for Noncarcinogenic Effects

The potential for noncarcinogenic effects is characterized by comparing estimated chemical intakes with chemical-specific RfDs. Chemical intake is calculated by multiplying the RME chemical concentration and the intake factor. The RfD is considered to be the average daily dose (in terms of mg chemical per kg body weight per day) that is not likely to result in adverse effects, even to sensitive individuals over a lifetime of exposure. Chemical intake is the chemical concentration in the exposure medium multiplied by the pathway-specific intake factor. The ratio of the estimated intake to the RfD is called a hazard quotient (HQ), which is calculated as follows:

$$\textit{Noncancer Hazard Quotient (HQ)} = \frac{\textit{Chemical Intake (mg/kg - day)}}{\textit{RfD (mg/kg - day)}}$$

It should be noted that the level of concern does not increase linearly as the RfD is approached or exceeded. This is because all RfDs have built-in safety or modifying factors and are generally specific to experimental conditions. Furthermore, the HQ does not represent a statistical probability of an effect occurring. The HQ provides a rough measure of potential toxicity, but it is conservative and dependent on the quality of the experimental evidence. Because the HQ does not define dose-response relationships, its numerical value cannot be construed as a direct estimate of the magnitude of risk (USEPA 1986a).

For each receptor (i.e., construction workers and commercial/industrial workers), HQs were summed for all COPCs and their relevant exposure pathways to yield a total hazard index (HI). A HI value equal to or less than 1 indicates that no adverse noncarcinogenic health effects are expected to occur, even to sensitive individuals over a lifetime of exposure to contaminants in the shallow groundwater. A HI value above 1 indicates a potential cause for concern and the need for further evaluation of assumptions about exposure and toxicity (e.g., effects of several different chemicals are not necessarily additive, although the HI approach assumes additivity).

The assumption of additive effects reflected in the cumulative HI is most properly applied to substances that induce the same toxic effect by the same mechanism (USEPA 1986a). Consequently, application of the equation to a mixture of substances that are not expected to induce the same type of effects could overestimate the potential for adverse health effects. When the HI exceeds 1, a qualitative assessment of the major contributors to the HI was made to determine whether different target organ systems were affected. If different target organ systems were affected, the addition of the HQs may be causing an overestimation of adverse health effects. Therefore, the major contributors to the HI were evaluated individually to assess whether a single target organ system has a HI greater than 1.

J.7.2 Carcinogenic Risk

Potential carcinogenic effects are characterized in terms of the excess probability of an individual developing cancer over a lifetime as a result of exposure to a potential carcinogen. Excess probability means the increased probability over and above the normal probability of getting cancer (i.e., background risk), which in the United States is 1 in 3 (American Cancer Society 1990).

Excess lifetime cancer risk is calculated by multiplying the average daily chemical intake by the cancer SF, which is a risk-per-unit chemical intake:

$$\textit{Risk} = \textit{Chemical Intake}(mg/kg\text{–}day) \times SF(mg/kg\text{–}day)^{-1}$$

For each receptor category at each site, cancer risks were calculated separately for each carcinogen and each exposure pathway, and the resulting risks are summed to yield a total upper-bound estimate of cancer risk due to multiple exposures. This is a conservative approach that can result in an artificially elevated estimate of cancer risk, especially if several carcinogens are present. This is because 95th percentile estimates may not be strictly additive (USEPA 1986a). RME cancer risks are likely to be overestimated significantly because they are calculated by multiplying 95th percentile estimates of cancer potency and RME of concentration and exposure. The approach also ignores potential antagonistic or synergistic effects.

The following guidance should be considered in order to interpret the significance of the cancer risk estimates. In the National Oil and Hazardous Substances Pollution Contingency Plan (USEPA 1990a), USEPA states that: “For known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper-bound lifetime cancer risk to an individual of between $1x10^{-4}$ and $1x10^{-6}$.” These values are equivalent to a 1 in 10,000 to 1 in 1,000,000 excess individual lifetime chance of developing cancer from the exposure. These risk levels are extremely low and would not be measurable or discernible (compared to the background cancer risk of 1 in 3) in individuals or even in a large population. For example, a risk level of 1 in 10,000 ($1x10^{-4}$) would increase an individual’s chance of getting cancer from the background risk of 1 in 3 to 1.0001 in 3. The Guidance on Risk Characterization for Risk

Managers and Risk Assessors (USEPA 1992c) concurs with the $1x10^{-6}$ to $1x10^{-4}$ target risk range.

J.8 UNCERTAINTIES AND LIMITATIONS

Throughout the HHRA, conservative assumptions were used that probably overestimate actual risks at the site. Although some uncertainties may exist that may underestimate risk, the overall conservative features of the HHRA process are likely to compensate for them and yield an upper-bound estimate of potential risk. The important factors that tend to over- or underestimate risk are discussed below. Site-specific uncertainties and limitations are discussed in relevant sections of the report.

J.8.1 Factors that Tend to Overestimate Risk

- For commercial/industrial workers, direct ingestion of groundwater as drinking water was assumed. It is not likely that groundwater would be used for a drinking water source; however, USEPA Region 7 requested in the 1996 dispute resolution that the commercial/industrial workers' exposure to contaminants in groundwater via ingestion be evaluated (USEPA 1996b). These assumptions overstate current and probable future exposure conditions at the FTP by one or more orders of magnitude.

- No source decay of organic compounds in groundwater was assumed to occur over a 30-year period. This assumption is likely to result in overestimation of exposure point concentrations and risks due to ingestion and dermal contact of organic compounds, perhaps by several times.

- USEPA RfDs are based on conservative estimates of the potential for adverse noncarcinogenic effects. Most RfDs are developed by reducing the dose at which no adverse effects were observed in the most sensitive animal species by uncertainty factors ranging from 10 to 10,000. This method provides a considerable level of conservatism in the RfDs used to estimate the potential for noncarcinogenic health effects and could result in an overestimate of potential hazards by one or more orders of magnitude.

- USEPA SFs are highly conservative estimates of dose-response relationships and probably result in a significant overstatement of actual cancer risk. Cancer SFs are calculated using the 95% UCL on a dose–response curve estimated by a linear mathematical model that extrapolates from short-term, high-dose animal exposures to long-term, low-dose human exposures. USEPA guidance states that the cancer SFs are upper-bound estimates of potency, and actual potency is likely to be lower.

- RME cancer risks are estimated by multiplying a series of upper 95th percentile estimates of carcinogenicity, concentration, and exposure factors. This practice can result in a significant overestimate of potential risk.

- The RME was estimated by selecting the maximum exposure for all variables. The RME scenarios were developed using USEPA SDEFs (USEPA 1991a). These factors probably significantly overestimate actual exposures at the site.

J.8.2 Factors that May Over- or Underestimate Risk

- Rates of ingestion, medium matrix effects, gut absorption, dermal adherence, and dermal absorption were selected to bracket "best estimate" (CTE) and "reasonable maximum" (RME) rates. The values may overestimate or underestimate actual rates. However, values used in the RME scenario are selected to provide an upper-bound estimate of the maximum exposure (and risk) that could reasonably be expected to occur at this site.
- The risk assessment does not consider how other individual risk factors (e.g., occupational exposure) may interact synergistically with the risks due to groundwater exposure, potentially underestimating the risk.
- Bromodichloromethane was used as a surrogate for bromochloromethane. In actuality, bromodichloromethane may have significantly different chemical and physical properties than bromochloromethane. Therefore, site risks may be overestimated or underestimated using a surrogate compound.

J.9 CALCULATION OF HUMAN HEALTH RISK-BASED PRELIMINARY REMEDIATION GOALS

Human health risk-based PRGs were calculated for all receptors and potentially complete pathways at the site. Calculated human health risk-based cleanup concentrations are presented in **Table J-18**.

Calculation of PRGs

There are two methods to calculate PRGs. The first method consists of rearranging the chemical intake equations to solve for the concentration term. The second method (shown below) is a simplified method based on site-specific exposure data and was used to calculate for COPCs of concern. A ratio between the target HQ or cancer risk and the calculated HQ or cancer risk due to a specific chemical in a specific medium is calculated. The proportion is:

$$\frac{EPC_{chemical\ i}}{Calculated\ HQ\ or\ Cancer\ Risk_{chemical\ i}} = \frac{PRG_{chemical\ i}}{Target\ HQ\ or\ Cancer\ Risk}$$

where:

EPC = exposure point concentration

PRGs for a target cancer risk of $1x10^{-6}$ to $1x10^{-4}$ or a target HQ of 1.0 were calculated by rearranging the above equation as:

$$PRG_{chemical\ i} = EPC_{chemical\ i}\ x\ \frac{Target\ HQ\ or\ Cancer\ Risk}{Calculated\ HQ\ or\ Cancer\ Risk_{chemical\ i}}$$

J.10 REFERENCES

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TABLE J-1
ESSENTIAL NUTRIENTS SCREENING
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Chemical	Number of Detects	Number of Samples	Frequency of Detection (Percentage)	Maximum Detected Concentration	Daily Intake from the Site[1] (mg/day)	Recommended Daily Allowance[2] (mg/day)	Screening Value Source[3]	Above the RDA (YES/NO)
METALS in Groundwater (mg/L)								
Calcium	8	8	100	92	92	1,200	RDA	NO
Magnesium	8	8	100	35.5	35.5	400	RDA	NO
Sodium	8	8	100	110	110	1,000	RDA	NO

Notes:

COPC = Chemical of Potential Concern

L = Liter(s)

mg = Milligram(s)

RDA = Recommended Daily Allowance

[1] If a chemical's daily intake based on the maximum concentration did not exceed the RDA, it was eliminated as a COPC.

[2] Recommended Daily Allowance of Essential Nutrients. National Research Council 1989. RDAs have not been established for sodium. These numbers are based on recommendations for a 2,000-calorie diet (a sodium restricted diet). Daily intake from site groundwater (mg/day) = maximum detected concentration (mg/L)*ingestion rate of 1000 mL/day*conversion factor of 1x10^{-3} L/mL.

[3] National Academy of Sciences (NAS)

Bold indicates chemicals retained as COPCs

TABLE J-2
SHALLOW GROUNDWATER PLUME EXPOSURE POINT CONCENTRATIONS
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Sample Identification	1,1,1-Trichloroethane			1,1,2-Trichloroethane			1,1-Dichloroethene			1,2-Dichloroethane		
	Result (mg/L)	RL (mg/L)	Qual	Result (mg/L)	RL (mg/L)	Qual	Result (mg/L)	RL (mg/L)	Qual	Result (mg/L)	RL (mg/L)	Qual
FTP-DP03-031	2100	150	JD	26	3		2800	150	JD	5	3	J
FTA -99-1	90	3		1	3	J	84	3		4	3	
JAW-58	130	6	D	1.5	6	U	81	3		1.5	3	U
JAW-59	170	3		1	3	J	180	3		2	3	J
JAW-60	91	3		4	3		380	15	D	30	3	
JAW-61	270	5	D	1	5	J	190	15	D	4	3	
JAW-80	19	3		1.5	3	U	17	3		1.5	3	U
SA-99-1	68	3		1.5	3	U	28	3	J	130	3	J
FTP-MW1	1.5	3	U	1.5	3	U	2	3	J	1.5	3	U
FTP-MW2	17	3		1.5	3	U	13	3		1.5	3	U
FTP-MW5	8	3		1.5	3	U	6	3		1.5	3	U
FTP-MW7	1.5	3	U	1.5	3	U	1.5	3	U	1.5	3	U
Number	12			12			12			12		
Minimum	8.0			1.0			2.0			2.0		
Maximum	2100			26			2800			130		
Average	247			4			315			15		
Standard Deviation	589			7			791			37		
RME	**2100**			**26**			**2800**			**130**		

Notes:

µg/L = Micrograms Per Liter
D = Dilution
J = Estimated
NE = Not Evaluated
P = Percent difference greater that 25%
Qual = Qualifier
RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine
RL = Reporting Limit (Laboratory)
RME = Reasonable Maximum Exposure
U = Nondetect

TABLE J-2
SHALLOW GROUNDWATER PLUME EXPOSURE POINT CONCENTRATIONS
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Sample Identification	Acetone			Benzene			Bromochloromethane			Chloroethane		
	Result (mg/L)	RL (mg/L)	Qual	Result (mg/L)	RL (mg/L)	Qual	Result (mg/L)	RL (mg/L)	Qual	Result (mg/L)	RL (mg/L)	Qual
FTP-DP03-031	5	10	U	1.5	3	U	1.5	3	U	1.5	3	U
FTA -99-1	5	10	U	1.5	3	U	1.5	3	U	1.5	3	U
JAW-58	5	10	U	1.5	3	U	1.5	3	U	1.5	3	U
JAW-59	5	10	U	1.5	3	U	1.5	3	U	1.5	3	U
JAW-60	5	10	U	11	3		1.5	3	U	1.5	3	U
JAW-61	5	10	U	1.5	3	U	1.5	3	U	1.5	3	U
JAW-80	5	10	U	1.5	3	U	1.5	3	U	1.5	3	U
SA-99-1	980	500	JD	110	3		2	3	J	3700	150	D
FTP-MW1	5	10	U	1.5	3	U	1.5	3	U	1.5	3	U
FTP-MW2	5	10	U	1.5	3	U	1.5	3	U	1.5	3	U
FTP-MW5	5	10	U	1.5	3	U	1.5	3	U	1.5	3	U
FTP-MW7	5	10	U	1.5	3	U	1.5	3	U	1.5	3	U
Number	12			12			12			12		
Minimum	980			11			2.0			3700		
Maximum	980			110			2.0			3700		
Average	86			11			1.5			310		
Standard Deviation	281			31			0.14			1068		
RME	**980**			**110**			**2.0**			**3700**		

Notes:

μg/L = Micrograms Per Liter

D = Dilution

J = Estimated

NE = Not Evaluated

P = Percent difference greater that 25%

Qual = Qualifier

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

RL = Reporting Limit (Laboratory)

RME = Reasonable Maximum Exposure

U = Nondetect

TABLE J-2
SHALLOW GROUNDWATER PLUME EXPOSURE POINT CONCENTRATIONS
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Sample Identification	**cis-1,2-Dichloroethene**			**Ethylbenzene**			**Methyl Isobutyl Ketone**			**Methylene Chloride**		
	Result (mg/L)	**RL (mg/L)**	**Qual**	**Result (mg/L)**	**RL (mg/L)**	**Qual**	**Result (mg/L)**	**RL (mg/L)**	**Qual**	**Result (mg/L)**	**RL (mg/L)**	**Qual**
FTP-DP03-031	1.5	3	U	1.5	3	U	5	10	U	1.5	3	U
FTA -99-1	9	3		1.5	3	U	5	10	U	1.5	3	U
JAW-58	1.5	3	U	1.5	3	U	5	10	U	1.5	3	U
JAW-59	4	3		1.5	3	U	5	10	U	1.5	3	U
JAW-60	110	3		1.5	3	U	5	10	U	1.5	3	U
JAW-61	21	3		1.5	3	U	5	10	U	1.5	3	U
JAW-80	1.5	3	U	1.5	3	U	5	10	U	1.5	3	U
SA-99-1	400	150	D	120	3		1600	500	JD	510	150	JD
FTP-MW1	1.5	3	U	1.5	3	U	5	10	U	1.5	3	U
FTP-MW2	1	3	J	1.5	3	U	5	10	U	1.5	3	U
FTP-MW5	1.5	3	U	1.5	3	U	5	10	U	1.5	3	U
FTP-MW7	1.5	3	U	1.5	3	U	5	10	U	1.5	3	U
Number	12			12			12			12		
Minimum	1.0			120			1600			510		
Maximum	400			120			1600			510		
Average	46			11			138			44		
Standard Deviation	116			34			460			147		
RME	**400**			**120**			**1600**			**510**		

Notes:

µg/L = Micrograms Per Liter

D = Dilution

J = Estimated

NE = Not Evaluated

P = Percent difference greater that 25%

Qual = Qualifier

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

RL = Reporting Limit (Laboratory)

RME = Reasonable Maximum Exposure

U = Nondetect

TABLE J-2
SHALLOW GROUNDWATER PLUME EXPOSURE POINT CONCENTRATIONS
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Sample Identification	Tetrachloroethene			Toluene			Trichloroethene			Vinyl Chloride		
	Result (mg/L)	RL (mg/L)	Qual	Result (mg/L)	RL (mg/L)	Qual	Result (mg/L)	RL (mg/L)	Qual	Result (mg/L)	RL (mg/L)	Qual
FTP-DP03-031	37	3		1.5	3	U	4	3	J	1.5	3	U
FTA -99-1	1.5	3	U	1.5	3	U	8	3		1.5	3	U
JAW-58	2	3	J	1.5	3	U	1.5	3	U	1.5	3	U
JAW-59	5	3		1.5	3	U	2	3	J	1.5	3	U
JAW-60	1.5	3	U	1.5	3	U	74	3		1.5	3	U
JAW-61	76	3		1.5	3	U	120	3		1.5	3	U
JAW-80	1.5	3	U	1.5	3	U	2	3	J	1.5	3	U
SA-99-1	1.5	3	U	5600	150	D	3	3		360	150	D
FTP-MW1	1.5	3	U	1.5	3	U	1.5	3	U	19	3	
FTP-MW2	1.5	3	U	1.5	3	U	1	3	J	1.5	3	U
FTP-MW5	1.5	3	U	1.5	3	U	1.5	3	U	1.5	3	U
FTP-MW7	1.5	3	U	1.5	3	U	1.5	3	U	1.5	3	U
Number	12			12			12			12		
Minimum	2.0			5600			1.0			19		
Maximum	76			5600			120			360		
Average	11			468			18			33		
Standard Deviation	23			1616			38			103		
RME	**76**			**5600**			**120**			**360**		

Notes:

µg/L = Micrograms Per Liter

D = Dilution

J = Estimated

NE = Not Evaluated

P = Percent difference greater that 25%

Qual = Qualifier

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

RL = Reporting Limit (Laboratory)

RME = Reasonable Maximum Exposure

U = Nondetect

TABLE J-2
SHALLOW GROUNDWATER PLUME EXPOSURE POINT CONCENTRATIONS
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Sample Identification	m, p-Xylene			2,6-Dinitrotoluene			RDX			Arsenic		
	Result (mg/L)	RL (mg/L)	Qual	Result (mg/L)	RL (mg/L)	Qual	Result (mg/L)	RL (mg/L)	Qual	Result (mg/L)	RL (mg/L)	Qual
FTP-DP03-031	1.5	3	U	NE	NE	NE	NE	NE	NE	NE	NE	NE
FTA -99-1	1.5	3	U	0.19	0.38	U	6.9	0.38		5	10	U
JAW-58	1.5	3	U	0.195	0.39	U	0.195	0.39	U	5	10	U
JAW-59	1.5	3	U	0.165	0.33	U	1.3	0.33		5	10	U
JAW-60	1.5	3	U	0.325	0.65	U	0.325	0.65	U	3.3	10	J
JAW-61	1.5	3	U	0.235	0.47	U	0.235	0.47	U	5	10	UJ
JAW-80	1.5	3	U	0.5	1	U	0.5	1	U	5	10	UJ
SA-99-1	470	150	D	2.7	1.2	P	1.9	1.2	P	58	10	
FTP-MW1	1.5	3	U	0.48	0.96	U	0.48	0.96	U	5	10	U
FTP-MW2	1.5	3	U	0.21	0.42	U	1.2	0.42		5	10	U
FTP-MW5	1.5	3	U	0.35	0.7	U	0.35	0.7	U	5	10	U
FTP-MW7	1.5	3	U	0.28	0.56	U	0.35	0.56	J	5	10	U
Number	12			11			11			11		
Minimum	470			2.7			0.35			3.3		
Maximum	470			2.7			6.9			58		
Average	41			0.51			1.2			10		
Standard Deviation	135			0.73			2.0			16		
RME	**470**			**2.7**			**6.9**			**58**		

Notes:

µg/L = Micrograms Per Liter

D = Dilution

J = Estimated

NE = Not Evaluated

P = Percent difference greater that 25%

Qual = Qualifier

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

RL = Reporting Limit (Laboratory)

RME = Reasonable Maximum Exposure

U = Nondetect

TABLE J-3
INTAKE ASSUMPTIONS FOR INHALATION OF VOCs FROM GROUNDWATER (CONSTRUCTION WORKER)
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

$$\text{Intake Factor} = \frac{\text{IR x ET x EF x ED}}{\text{BW x AT}}$$

Parameter	Central Tendency Exposure (CTE)	Reasonable Maximum Exposure (RME)
IR: Inhalation rate (m^3/hour)[1]	1.3	2.5
ET: Exposure time (hours/day)[2]	8	8
EF: Exposure frequency (days/year)[3]	45	90
ED: Exposure duration (years)[4]	1	1
BW: Body weight (kg)[5]	70	70
AT: Average time (days)[6]		
Noncarcinogenic	365	365
Carcinogenic	25,550	25,550
Intake factor (m^3/kg-day)		
Noncarcinogenic	1.8E-02	7.0E-02
Carcinogenic	2.6E-04	1.0E-03

Notes:

kg = Kilogram(s)
m^3 = Cubic Meter(s)

USEPA = United States Environmental Protection Agency

[1] IR: The recommended inhalation values for outdoor activities (USEPA 1997b). Short-term exposures: hourly rate 1.3 m^3/hr for the CTE case and heavy activities 2.5 m^3/hour for the RME case.

[2] ET: The CTE and RME values represent the standard workday.

[3] EF: Estimated duration of construction activities; 5 days/week for 9 weeks for the CTE case and 5 days/week for 18 weeks for the RME case.

[4] ED: Construction activities are assumed to be completed within one year.

[5] BW: The recommended average adult body weight (USEPA 1989).

[6] AT: ED x 365 days/year for the CTE and RME cases; 70 years x 365 days/year for carcinogens (USEPA 1989).

TABLE J-4
INTAKE ASSUMPTIONS FOR INCIDENTAL INGESTION OF GROUNDWATER (CONSTRUCTION WORKER)
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

$$\text{Intake Factor} = \frac{IR \times EF \times ED \times CF}{BW \times AT}$$

Parameter	Central Tendency Exposure (CTE)	Reasonable Maximum Exposure (RME)
IR: Ingestion rate (mL/day)[1]	5	10
EF: Exposure frequency (days/year)[2]	45	90
ED: Exposure duration (years)[3]	1	1
CF: Conversion factor (L/mL)	1E-03	1E-03
BW: Body weight (kg)[4]	70	70
AT: Average time (days)[5]		
Noncarcinogenic	365	365
Carcinogenic	25,550	25,550
Intake factor (L/kg-day)		
Noncarcinogenic	8.8E-06	3.5E-05
Carcinogenic	1.3E-07	5.0E-07

Notes:

kg = Kilogram(s)

L = Liter(s)

mL = Milliliter(s)

USEPA = United States Environmental Protection Agency

[1] IR: Estimated rates of incidental water ingested. 10 mL/day is one-fifth the incidental water ingestion rate while swimming (50 mL/swimming event, 1.0 hour/event, 1 event/day) reported in USEPA 1988.

[2] EF: Estimated duration of construction activities; 5 days/week for 9 weeks for the CTE case and 5 days/week for 18 weeks for the RME case.

[3] ED: Construction activities are assumed to be completed within one year.

[4] BW: The recommended average adult body weight (USEPA 1989).

[5] AT: ED x 365 days/year for the CTE and RME cases; 70 years x 365 days/year for carcinogens (USEPA 1989).

TABLE J-5
INTAKE ASSUMPTIONS FOR DERMAL CONTACT WITH GROUNDWATER (CONSTRUCTION WORKER)
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

$$\text{Intake Factor} = \frac{SA \times PC \times ET \times EF \times ED \times CF}{BW \times AT}$$

Parameter	Central Tendency Exposure (CTE)	Reasonable Maximum Exposure (RME)
SA: Surface area (cm^2)[1]	3,160	5,230
PC: Permeability coefficient (cm/hour)[2]	Chemical specific	Chemical specific
ET: Exposure tme (hours/day)[3]	8	8
EF: Exposure frequency (days/year)[4]	45	90
ED: Exposure duration (years)[5]	1	1
CF: Conversion factor (L/cm^3)	1E-03	1E-03
BW: Body weight (kg)[6]	70	70
AT: Average time (days)[7]		
Noncarcinogenic	365	365
Carcinogenic	25,550	25,550
Intake Factor (L/kg-day)		
Noncarcinogenic	4.5E-02	1.5E-01
Carcinogenic	6.4E-04	2.1E-03

Notes:

cm = Centimeter(s)

kg = Kilogram(s)

L = Liter(s)

USEPA = United States Environmental Protection Agency

[1] SA: The worker is assumed to wear civilian clothing appropriate for weather and type of outdoor work. The CTE surface area (3,160 cm^2) is equivalent to head, forearms and hands (assumes the worker is wearing a short-sleeve shirt, jeans, and boots); RME surface area (5,230 cm^2) is equivalent to head, forearms, hands, and lower legs (assumes the worker is wearing a short-sleeve shirt, jeans, and boots) (USEPA 1997b).

[2] PC: Chemical-specific permeability coefficients are used to adjust chemical concentrations for use in calculating risks for the dermal contact route (USEPA 1992a, 2001b, and RAIS 2003). The intake factors shown here are calculated using PC = 1.0.

[3] ET: The CTE and RME values represent the standard workday.

[4] EF: Estimated duration of construction activities; 5 days/week for 9 weeks for the CTE case and 5 days/week for 18 weeks for the RME case.

[5] ED: Construction activities are assumed to be completed within one year.

[6] BW: The recommended average adult body weight (USEPA 1989).

[7] AT: ED x 365 days/year for the CTE and RME cases; 70 years x 365 days/year for carcinogens (USEPA 1989).

TABLE J-6
INTAKE ASSUMPTIONS FOR INGESTION OF GROUNDWATER (COMMERCIAL/INDUSTRIAL WORKER)
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

$$\text{Intake Factor} = \frac{\text{IR x EF x ED x CF}}{\text{BW x AT}}$$

Parameter	Central Tendency Exposure (CTE)	Reasonable Maximum Exposure (RME)
IR: Ingestion rate (mL/day)[1]	500	1,000
EF: Exposure frequency (days/year)[2]	250	250
ED: Exposure duration (years)[3]	6.6	21.9
CF: Conversion factor (L/mL)	1E-03	1E-03
BW: Body weight (kg)[4]	70	70
AT: Average time (days)[5]		
Noncarcinogenic	2,409	7,994
Carcinogenic	25,550	25,550
Intake factor (L/kg-day)		
Noncarcinogenic	4.9E-03	9.8E-03
Carcinogenic	4.6E-04	3.1E-03

Notes:

cm = Centimeter(s)
kg = Kilogram(s)
L = Liter(s)
mL = Milliliter(s)
USEPA = United States Environmental Protection Agency

[1] IR: Commercial/industrial worker estimated daily water consumption rate is 500 mL for the CTE case and 1,000 mL for the RME case (USEPA Resolution of Dispute Letter, March 6, 1996).

[2] EF: Estimated frequency of exposure is 250 days/year for both the CTE and RME cases (USEPA Resolution of Dispute Letter, March 6, 1996b).

[3] ED: Estimated duration of exposure is 6.6 years for the CTE case and 21.9 years for the RME case (USEPA 1997b).

[4] BW: The recommended average adult body weight (USEPA 1997b).

[5] AT: ED x 365 days/year for noncarcinogens; 70 years x 365 days/year for carcinogens (USEPA 1989).

TABLE J-7
SUMMARY OF INTAKE FACTORS FOR ALL RECEPTORS
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Receptor/Pathway	Central Tendency Exposure		Reasonable Maximum Exposure	
	Noncarcinogenic	Cancer Risk	Noncarcinogenic	Cancer Risk
Construction Worker				
Inhalation of Groundwater	1.8E-02	2.6E-04	7.0E-02	1.0E-03
Incidental Ingestion of Groundwater	8.8E-06	1.3E-07	3.5E-05	5.0E-07
Dermal Contact with Groundwater	4.5E-02	6.4E-04	1.5E-01	2.1E-03
Commercial/Industrial Worker				
Ingestion of Groundwater	4.9E-03	4.6E-04	9.8E-03	3.1E-03

Notes:

Exposure assumptions and intake factors are shown in **Tables J-3** through **J-6**. Intake factors are multiplied by exposure point concentrations of chemicals of potential concern to estimate daily chemical intake.

TABLE J-8
REFERENCE DOSES FOR NONCARCINOGENIC CHEMICALS OF POTENTIAL CONCERN
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Chemical	**Noncarcinogenic RfD (mg/kg-day)**				**Uncertainty Factor**		**Confidence Level**	**Critical Effect**	**Species/Experiment Length/Target Organ**
	Inhalation	**Source**	**Oral**	**Source**	**Inhalation**	**Oral**			
1,1,1-Trichloroethane									
Subchronic	6.3E-01	2	2.8E-01	2	N/A	N/A	N/A	N/A	N/A
Chronic	6.3E-01	3	2.8E-01	3	N/A	N/A			
1,1,2-Trichloroethane									
Subchronic	N/A	N/A	4.0E-02	4	N/A	100	Medium	Clinical serum chemistry	Mouse/subchronic/Serum
Chronic	N/A	N/A	4.0E-03	1	N/A	1000			
1,1-Dichloroethene									
Subchronic	5.7E-02	2	9.0E-03	4	N/A	1000	Medium	Liver toxicity	Rat/chronic or drinking water study/liver
Chronic	5.7E-02	1	5.0E-02	1	N/A	100			
1,2-Dichloroethane									
Subchronic	1.4E-03	2	3.0E-02	2	N/A	N/A	N/A	Hepatotoxicity, renal toxicity, CNS effects, gastric effects	Human and animal studies, both oral and inhalation/multiple systems.
Chronic	1.4E-03	3	3.0E-02	3	N/A	N/A			
cis-1,2-Dichloroethene									
Subchronic	N/A	N/A	1.0E-01	4	N/A	300	N/A	Decreased hematocrit and hemoglobin	Rats/90 days, gavage/blood
Chronic	N/A	N/A	1.0E-02	4	N/A	3000			
Acetone									
Subchronic	N/A	N/A	1.0E+00	4	N/A	100	Medium	Nephropathy	Rats/subchronic or drinking water study/kidney
Chronic	N/A	N/A	9.0E-01	1	N/A	1000			
Benzene									
Subchronic	8.6E-03	2	4.0E-03	2	N/A	N/A	Medium	Decreased lymphocyte count	Human/occupational inhalation/blood
Chronic	8.6E-03	1	4.0E-03	1	300	300			
Bromochloromethane[1]									
Subchronic	N/A	N/A	2.0E-02	4	N/A	1000	Medium	Renal cytomegaly	Mouse/chronic drinking water study, gavage/kidney
Chronic	N/A	N/A	2.0E-02	1	N/A	1000			
Chloroethane									
Subchronic	2.9E+00	2	4.0E-01	2	N/A	N/A	Medium	Delayed fetal ossification	Mouse/developmental inhalation study
Chronic	2.9E+00	1	4.0E-01	3	300	N/A			
Ethylbenzene									
Subchronic	2.9E-01	2	1.0E-01	2	N/A	N/A	Low	Liver/kidney toxicity	Rats/subchronic to chronic/liver, kidney
Chronic	2.9E-01	1	1.0E-01	1	300	1000			
Methyl Isobutyl Ketone									
Subchronic	8.6E-01	2	8.0E-01	4	N/A	300	Low	Lethargy, increased organ weight	Rats/13 weeks, gavage/whole body, liver, kidney
Chronic	8.6E-01	1	8.0E-02	4	300	3000			

TABLE J-8
REFERENCE DOSES FOR NONCARCINOGENIC CHEMICALS OF POTENTIAL CONCERN
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Chemical	Noncarcinogenic RfD (mg/kg-day)				Uncertainty Factor		Confidence Level	Critical Effect	Species/Experiment Length/Target Organ
	Inhalation	Source	Oral	Source	Inhalation	Oral			
Methylene Chloride									
Subchronic	8.6E-01	2	6.0E-02	4	N/A	100	Medium	Gastrointestinal, hematologic, hepatic, renal, endocrine, and metabolic effects.	Mouse/studies, oral/multiple systems
Chronic	8.6E-01	4	6.0E-02	1	N/A	100			
Tetrachloroethene									
Subchronic	1.7E-01	2	1.0E-01	4	N/A	100	Medium	Hepatotoxicity	Mouse/6 weeks, gavage/liver
Chronic	1.7E-01	3	1.0E-02	1	N/A	1000			
Toluene									
Subchronic	1.1E-01	2	2.0E+00	4	N/A	100	Medium	Changes in liver/kidney weight	Rats/13-week study, gavage/liver, kidney
Chronic	1.1E-01	1	2.0E-01	1	300	1000			
Trichloroethene									
Subchronic	1.0E-02	2	3.0E-04	2	N/A	N/A	N/A	Liver/kidney damage, CNS and hepatic effects	Rat and mice studies
Chronic	1.0E-02	3	3.0E-04	3	N/A	N/A			
Vinyl Chloride									
Subchronic	2.9E-02	2	3.0E-03	2	N/A	N/A	Medium	Liver cell polymorphism	Rats/chronic feeding study/liver
Chronic	2.9E-02	1	3.0E-03	1	30	30			
m,p-Xylene									
Subchronic	2.9E-02	2	2.0E-01	2	N/A	N/A	Medium	Decreased body weight	Rats/oral exposure/whole body;
Chronic	2.9E-02	1	2.0E-01	1	300	1000		Impaired motor coordination	Rats/subchronic inhalation/CNS
RDX									
Subchronic	N/A	N/A	3.0E-03	4	N/A	100	High	CNS, renal failure	Rats/oral gavage, 90 days
Chronic	N/A	N/A	3.0E-03	1	N/A	100			
2,6-Dinitrotoluene									
Subchronic	N/A	N/A	1.0E-02	4	N/A	300	N/A	CNS, methemoglobinemia, histopathology	Dog/13 weeks/CNS, blood, kidney
Chronic	N/A	N/A	1.0E-03	4	N/A	3000			
Arsenic									
Subchronic	N/A	N/A	3.0E-04	4	N/A	3	Medium	Hyperpigmentation, keratosis, vascular complications	Human/chronic oral exposure/skin
Chronic	N/A	N/A	3.0E-04	1	N/A	3			

Notes:

1 = Verifiable in IRIS
2 = Chronic RfD adopted as subchronic RfD.
3 = National Center for Environmental Assessment
4 = Health Effects Assessment Summary Tables (1997d)
CNS = Central Nervous System
kg = Kilogram(s)

mg = Milligram(s)
N/A = Not Applicable/Not Available
RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine
RfD = Reference Dose

EPA Class A = Human carcinogen
EPA Class B = Probable human carcinogen
EPA Class B2 = Sufficient evidence of carcinogenicity in animals with inadequate data or lack of evidence in humans.
EPA Class C = Possible human carcinogen
EPA Class D = Not classsified as to human carcinogenicity

[1] Bromodichloromethane was used as a surrogate for this compound.

TABLE J-9
SLOPE FACTORS FOR CARCINOGENIC CHEMICALS OF POTENTIAL CONCERN
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Chemical	Slope Factor (mg/kg-day)$^{-1}$						
	Inhalation	Source	Oral	Source	EPA Class	Critical Effect	Species/Experiment Length/Target Organ
1,1,2-Trichloroethane	5.6E-02	1	5.7E-02	1	C	Hepatocellular carcinoma	Mice/oral gavage/liver
1,2-Dichloroethane	9.1E-02	1	9.1E-02	1	B2	Hemangiosarcomas	Rat/oral gavage/liver
Benzene	2.9E-02	1	5.5E-02	1	A	Leukemia	Human/occupational inhalation/blood
Bromochloromethane[1]	NA	N/A	6.2E-02	1	D	Tubular cell adenomas, adenocarcinomas	Mice/oral gavage/kidney
Chloroethane	NA	N/A	2.9E-03	2	C	Brain, skin, and uterine tumors	Rats/subchronic, inhalation
Ethylbenzene	3.9E-03	2	N/A	N/A	C	Renal tubule adenomas, testicular adenomas	Rat and mice studies
Methylene Chloride	1.6E-03	1	7.5E-03	1	C	Liver cancer	Mice and rats/both oral and inhalation studies/liver
Tetrachloroethene	1.0E-02	2	5.2E-02	2	C	Bladder cancer, kidney cancer, cervical cancer, leukemia	Human studies/chronic, both oral and inhalation
Trichloroethene	4.0E-01	2	4.0E-01	2	B	Liver, kidney, and cervical cancer	Rat and mice studies
Vinyl Chloride	1.6E-02	1	7.2E-01	1	A	Liver cancer	Rats/oral, diet and inhalation/liver
RDX	1.1E-01	1	1.1E-01	1	C	Hepatocellular carcinoma	Liver, CNS
Arsenic	N/A	1	1.5E+00	1	A	Skin cancer, Lung cancer	Human/oral, drinking water/skin Human/inhalation, occupational/lungs

Notes:

1 = Verifiable in IRIS
2 = National Center for Environmental Assessment
CNS = Central Nervous System
mg/kg-d = Milligram(s) Per Kilogram Per Day
N/A = Not Applicable
RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

EPA Class A = Human carcinogen
EPA Class B = Probable human carcinogen
EPA Class B2 = Sufficient evidence of carcinogenicity in animals with inadequate data or lack of evidence in humans.
EPA Class C = Possible human carcinogen
EPA Class D = Not classsified as to human carcinogenicity

[1] Bromodichloromethane was used as a surrogate for this compound.

TABLE J-10
SUMMARY OF HEALTH RISKS FOR ALL RECEPTORS AND PATHWAYS
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Medium/Receptor	Central Tendency Exposure		Reasonable Maximum Exposure	
	HI	Cancer Risk	HI	Cancer Risk
Shallow Groundwater				
Construction Worker	0.3	1.6E-06	1.2	5.7E-06
Commercial/Industrial Worker	3.5	1.8E-04	7.1	1.2E-03

Notes:

HI = Hazard Index

Hazard quotients and cancer risks are from **Tables J-14** through **J-17**.

TABLE J-11
SUMMARY OF HEALTH RISKS FOR THE CONSTRUCTION WORKER
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Receptor/Pathway	Central Tendency Exposure		Reasonable Maximum Exposure	
	HI	**Cancer Risk**	**HI**	**Cancer Risk**
Construction Worker				
Inhalation of Groundwater	0.08	3.8E-07	0.31	1.5E-06
Incidental Ingestion of Groundwater	0.01	4.9E-08	0.03	1.9E-07
Dermal Contact with Groundwater	0.3	1.2E-06	0.9	4.0E-06
	0.35	**1.6E-06**	**1.2**	**5.7E-06**

Notes:

HI = Hazard Index

Hazard quotients and cancer risks are from **Tables J-14** through **J-16**.

TABLE J-12
SUMMARY OF HEALTH RISK FOR THE COMMERCIAL/INDUSTRIAL WORKER FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Receptor/Pathway	Central Tendency Exposure		Reasonable Maximum Exposure	
	HI	**Cancer Risk**	**HI**	**Cancer Risk**
Commercial/Industrial Worker				
Ingestion of Groundwater	3.5	1.8E-04	7.1	1.2E-03
	3.5	**1.8E-04**	**7.1**	**1.2E-03**

Notes:

HI = Hazard Index

Hazard quotients and cancer risks are from **Table J-17**.

TABLE J-13
AIR CONCENTRATIONS OF VOLATILE CHEMICALS OF POTENTIAL CONCERN FROM GROUNDWATER
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Equation 1: $VF_{voc} = k_{LG}/(kNH)$

where:
VF_{voc} = volatilization factor of volatile organic compound (unitless)
k_{LG} = Aqueous mass transfer coefficient from the liquid phase to gas phase for VOC of interest (m/sec)
k = Mixing factor to account for incomplete air exchange in trench (unitless)
N = Number of air exchanges per unit time in the trench (sec^{-1})
H =Height of the trench (m)

assuming: $k_{LG} = 3 \times 10^{-6}$ m/sec (conservative estimate of mass transfer coefficient for VOCs from groundwater to air, USEPA, 1999)

Equation 2: $N = u/L$

where:
u = wind speed (m/sec)
L = length of trench (m)

Equation 3: $C_{air} = C_{H2O} * VF_{voc} * CF$

where:
C_{air} = Concentration of the chemical in the vapor phase (mg/m^3)
C_{H2O} = Concentration of the chemical in the water phase (mg/L)
CF = Conversion Factor (L/m^3)

Chemical	**C_{H2O} (mg/L)**	**K_{LG} (m/sec)**	**k (unitless)**	**H (m)**	**L (m)**	**u (m/sec)**	**N (sec^{-1})**	**VF_{voc} (unitless)**	**CF (L/m^3)**	**C_{air} (mg/m^3)**
1,1,1-Trichloroethane	2.1E+00	3.0E-06	5.0E-01	5.0E+00	1.5E+01	1.0E+00	6.7E-02	1.8E-05	1.0E+03	3.8E-02
1,1,2-Trichloroethane	2.6E-02	3.0E-06	5.0E-01	5.0E+00	1.5E+01	1.0E+00	6.7E-02	1.8E-05	1.0E+03	4.7E-04
1,1-Dichloroethene	2.8E+00	3.0E-06	5.0E-01	5.0E+00	1.5E+01	1.0E+00	6.7E-02	1.8E-05	1.0E+03	5.0E-02
1,2-Dichloroethane	1.3E-01	3.0E-06	5.0E-01	5.0E+00	1.5E+01	1.0E+00	6.7E-02	1.8E-05	1.0E+03	2.3E-03
Acetone	9.8E-01	3.0E-06	5.0E-01	5.0E+00	1.5E+01	1.0E+00	6.7E-02	1.8E-05	1.0E+03	1.8E-02
Benzene	1.1E-01	3.0E-06	5.0E-01	5.0E+00	1.5E+01	1.0E+00	6.7E-02	1.8E-05	1.0E+03	2.0E-03
Bromochloromethane	2.0E-03	3.0E-06	5.0E-01	5.0E+00	1.5E+01	1.0E+00	6.7E-02	1.8E-05	1.0E+03	3.6E-05
Chloroethane	3.7E+00	3.0E-06	5.0E-01	5.0E+00	1.5E+01	1.0E+00	6.7E-02	1.8E-05	1.0E+03	6.7E-02
cis-1,2-Dichloroethene	4.0E-01	3.0E-06	5.0E-01	5.0E+00	1.5E+01	1.0E+00	6.7E-02	1.8E-05	1.0E+03	7.2E-03
Ethylbenzene	1.2E-01	3.0E-06	5.0E-01	5.0E+00	1.5E+01	1.0E+00	6.7E-02	1.8E-05	1.0E+03	2.2E-03
Methyl Isobutyl Ketone	1.6E+00	3.0E-06	5.0E-01	5.0E+00	1.5E+01	1.0E+00	6.7E-02	1.8E-05	1.0E+03	2.9E-02
Methylene chloride	5.1E-01	3.0E-06	5.0E-01	5.0E+00	1.5E+01	1.0E+00	6.7E-02	1.8E-05	1.0E+03	9.2E-03
Tetrachloroethene	7.6E-02	3.0E-06	5.0E-01	5.0E+00	1.5E+01	1.0E+00	6.7E-02	1.8E-05	1.0E+03	1.4E-03
Toluene	5.6E+00	3.0E-06	5.0E-01	5.0E+00	1.5E+01	1.0E+00	6.7E-02	1.8E-05	1.0E+03	1.0E-01
Trichloroethene	1.2E-01	3.0E-06	5.0E-01	5.0E+00	1.5E+01	1.0E+00	6.7E-02	1.8E-05	1.0E+03	2.2E-03
Vinyl Chloride	3.6E-01	3.0E-06	5.0E-01	5.0E+00	1.5E+01	1.0E+00	6.7E-02	1.8E-05	1.0E+03	6.5E-03
m,p-Xylene	4.7E-01	3.0E-06	5.0E-01	5.0E+00	1.5E+01	1.0E+00	6.7E-02	1.8E-05	1.0E+03	8.5E-03

Notes:

L = Liter(s)
m = Meter(s)
m^3 = Cubic Meter(s)
mg = Milligram(s)
sec = Second

TABLE J-14
CONSTRUCTION WORKER HEALTH RISK (INHALATION OF VOCs FROM GROUNDWATER)
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

	Air	**Noncarcinogenic IF**		**Carcinogenic IF**		**Subchronic**	**Subchronic**	**Hazard Quotient**[1]		**Cancer Risk**[2]	
	RME (mg/m^3)	**CTE (m^3/kg-day)**	**RME (m^3/kg-day)**	**CTE (m^3/kg-day)**	**RME (m^3/kg-day)**	**RfD (mg/kg-day)**	**Slope Factor $(mg/kg\text{-}day)^{-1}$**	**CTE**	**RME**	**CTE**	**RME**
Volatile Organic Compounds											
1,1,1-Trichloroethane	3.8E-02	1.8E-02	7.0E-02	2.6E-04	1.0E-03	6.3E-01	NTF	1.1E-03	4.2E-03	NTF	NTF
1,1,2-Trichloroethane	4.7E-04	1.8E-02	7.0E-02	2.6E-04	1.0E-03	NTF	5.6E-02	NTF	NTF	6.9E-09	2.6E-08
1,1-Dichloroethene	5.0E-02	1.8E-02	7.0E-02	2.6E-04	1.0E-03	5.7E-02	NTF	1.6E-02	6.2E-02	NTF	NTF
1,2-Dichloroethane	2.3E-03	1.8E-02	7.0E-02	2.6E-04	1.0E-03	1.4E-03	9.1E-02	3.1E-02	1.2E-01	5.6E-08	2.1E-07
Acetone	1.8E-02	1.8E-02	7.0E-02	2.6E-04	1.0E-03	NTF	NTF	NTF	NTF	NTF	NTF
Benzene	2.0E-03	1.8E-02	7.0E-02	2.6E-04	1.0E-03	8.6E-03	2.9E-02	4.2E-03	1.6E-02	1.5E-08	5.8E-08
Bromochloromethane	3.6E-05	1.8E-02	7.0E-02	2.6E-04	1.0E-03	NTF	NTF	NTF	NTF	NTF	NTF
Chloroethane	6.7E-02	1.8E-02	7.0E-02	2.6E-04	1.0E-03	2.9E+00	NTF	4.3E-04	1.6E-03	NTF	NTF
cis-1,2-Dichloroethene	7.2E-03	1.8E-02	7.0E-02	2.6E-04	1.0E-03	NTF	NTF	NTF	NTF	NTF	NTF
Ethylbenzene	2.2E-03	1.8E-02	7.0E-02	2.6E-04	1.0E-03	2.9E-01	3.9E-03	1.4E-04	5.2E-04	2.2E-09	8.4E-09
Methyl Isobutyl Ketone	2.9E-02	1.8E-02	7.0E-02	2.6E-04	1.0E-03	8.6E-01	NTF	6.1E-04	2.4E-03	NTF	NTF
Methylene chloride	9.2E-03	1.8E-02	7.0E-02	2.6E-04	1.0E-03	8.6E-01	1.6E-03	2.0E-04	7.5E-04	3.8E-09	1.5E-08
Tetrachloroethene	1.4E-03	1.8E-02	7.0E-02	2.6E-04	1.0E-03	1.7E-01	1.0E-02	1.5E-04	5.7E-04	3.6E-09	1.4E-08
Toluene	1.0E-01	1.8E-02	7.0E-02	2.6E-04	1.0E-03	1.1E-01	1.0E-02	1.7E-02	6.5E-02	2.6E-07	1.0E-06
Trichloroethene	2.2E-03	1.8E-02	7.0E-02	2.6E-04	1.0E-03	NTF	6.0E-03	NTF	NTF	3.4E-09	1.3E-08
Vinyl Chloride	6.5E-03	1.8E-02	7.0E-02	2.6E-04	1.0E-03	2.9E-02	1.6E-02	4.2E-03	1.6E-02	2.7E-08	1.0E-07
m,p-Xylene	8.5E-03	1.8E-02	7.0E-02	2.6E-04	1.0E-03	2.9E-02	NTF	5.3E-03	2.1E-02	NTF	NTF
Totals								**0.08**	**0.31**	**3.8E-07**	**1.5E-06**

Notes:

CTE = Central Tendency Exposure

IF = Intake Factor

kg = Kilogram(s)

m^3 = Cubic Meter(s)

mg = Milligram(s)

NTF = No established USEPA toxicity factor

RME = Reasonable Maximum Exposure

RfD = Reference Dose

[1] Air RME x Noncarcinogenic IF/RfD

[2] Air RME x Carcinogenic IF x Slope Factor

Air concentration from **Table J-13**.

TABLE J-15
CONSTRUCTION WORKER HEALTH RISK (INCIDENTAL INGESTION OF GROUNDWATER)
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

	Groundwater Concentration	Noncarcinogenic IF		Carcinogenic IF		Subchronic	Subchronic	Hazard Quotient[1]		Cancer Risk[2]	
	RME (mg/L)	CTE (L/kg-day)	RME (L/kg-day)	CTE (L/kg-day)	RME (L/kg-day)	RfD (mg/kg-day)	Slope Factor $(mg/kg-day)^{-1}$	CTE	RME	CTE	RME
Volatile Oganic Compounds											
1,1,1-Trichloroethane	2.1E+00	8.8E-06	3.5E-05	1.3E-07	5.0E-07	2.8E-01	NTF	6.6E-05	2.6E-04	NTF	NTF
1,1,2-Trichloroethane	2.6E-02	8.8E-06	3.5E-05	1.3E-07	5.0E-07	4.0E-02	5.7E-02	5.7E-06	2.3E-05	1.9E-10	7.5E-10
1,1-Dichloroethene	2.8E+00	8.8E-06	3.5E-05	1.3E-07	5.0E-07	9.0E-03	NTF	2.7E-03	1.1E-02	NTF	NTF
1,2-Dichloroethane	1.3E-01	8.8E-06	3.5E-05	1.3E-07	5.0E-07	3.0E-02	9.1E-02	3.8E-05	1.5E-04	1.5E-09	6.0E-09
Acetone	9.8E-01	8.8E-06	3.5E-05	1.3E-07	5.0E-07	1.0E+00	NTF	8.6E-06	3.5E-05	NTF	NTF
Benzene	1.1E-01	8.8E-06	3.5E-05	1.3E-07	5.0E-07	4.0E-03	5.5E-02	2.4E-04	9.7E-04	7.6E-10	3.0E-09
Bromochloromethane	2.0E-03	8.8E-06	3.5E-05	1.3E-07	5.0E-07	2.0E-02	6.2E-02	8.8E-07	3.5E-06	1.6E-11	6.2E-11
Chloroethane	3.7E+00	8.8E-06	3.5E-05	1.3E-07	5.0E-07	4.0E-01	2.9E-03	8.1E-05	3.3E-04	1.3E-09	5.4E-09
cis-1,2-Dichloroethene	4.0E-01	8.8E-06	3.5E-05	1.3E-07	5.0E-07	1.0E-01	NTF	3.5E-05	1.4E-04	NTF	NTF
Ethylbenzene	1.2E-01	8.8E-06	3.5E-05	1.3E-07	5.0E-07	1.0E-01	NTF	1.1E-05	4.2E-05	NTF	NTF
Methyl Isobutyl Ketone	1.6E+00	8.8E-06	3.5E-05	1.3E-07	5.0E-07	8.0E-01	NTF	1.8E-05	7.0E-05	NTF	NTF
Methylene Chloride	5.1E-01	8.8E-06	3.5E-05	1.3E-07	5.0E-07	6.0E-02	7.5E-03	7.5E-05	3.0E-04	4.8E-10	1.9E-09
Tetrachloroethene	7.6E-02	8.8E-06	3.5E-05	1.3E-07	5.0E-07	1.0E-01	5.2E-02	6.7E-06	2.7E-05	5.0E-10	2.0E-09
Toluene	5.6E+00	8.8E-06	3.5E-05	1.3E-07	5.0E-07	2.0E+00	NTF	2.5E-05	9.9E-05	NTF	NTF
Trichloroethene	1.2E-01	8.8E-06	3.5E-05	1.3E-07	5.0E-07	6.0E-03	1.1E-02	1.8E-04	7.0E-04	1.7E-10	6.6E-10
Vinyl Chloride	3.6E-01	8.8E-06	3.5E-05	1.3E-07	5.0E-07	3.0E-03	7.2E-01	1.1E-03	4.2E-03	3.3E-08	1.3E-07
m,p-Xylene	4.7E-01	8.8E-06	3.5E-05	1.3E-07	5.0E-07	2.0E-01	NTF	2.1E-05	8.3E-05	NTF	NTF
Explosives											
2,6-DNT	2.7E-03	8.8E-06	3.5E-05	1.3E-07	5.0E-07	1.0E-02	NTF	2.4E-06	9.5E-06	NTF	NTF
RDX	6.9E-03	8.8E-06	3.5E-05	1.3E-07	5.0E-07	3.0E-03	1.1E-01	2.0E-05	8.1E-05	9.5E-11	3.8E-10
Metals											
Arsenic	5.8E-02	8.8E-06	3.5E-05	1.3E-07	5.0E-07	3.0E-04	1.5E+00	1.7E-03	6.8E-03	1.1E-08	4.4E-08
Totals								**0.01**	**0.03**	**4.9E-08**	**1.9E-07**

Notes:

CTE = Central Tendency Exposure

2,6-DNT = 2,6-Dinitrotoluene

IF = Intake Factor

kg = Kilogram(s)

L = Liter(s)

mg = Milligram(s)

NTF = No established USEPA toxicity factor

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

RfD = Reference Dose

RME = Reasonable Maximum Exposure

[1] Groundwater Concentration x Noncarcinogenic IF/RfD

[2] Groundwater Concentration x Carcinogenic IF x Slope Factor

TABLE J-16
CONSTRUCTION WORKER HEALTH RISK (DERMAL CONTACT WITH GROUNDWATER)
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

	Groundwater Concentration	**Dermal**	**Dermal Adjusted**	**Noncarcinogenic IF**		**Carcinogenic IF**		**Subchronic**	**Subchronic**	**Hazard Quotient**[1]		**Cancer Risk**[2]	
	RME (mg/L)	**PC (cm/hour)**	**RME (mg/L)**	**CTE (L/kg-day)**	**RME (L/kg-day)**	**CTE (L/kg-day)**	**RME (L/kg-day)**	**RfD (mg/kg-day)**	**Slope Factor (mg/kg-day)$^{-1}$**	**CTE**	**RME**	**CTE**	**RME**
Volatile Oganic Compounds													
1,1,1-Trichloroethane	2.1E+00	1.7E-02	3.6E-02	4.5E-02	1.5E-01	6.4E-04	2.1E-03	2.8E-01	NTF	5.7E-03	1.9E-02	NTF	NTF
1,1,2-Trichloroethane	2.6E-02	6.4E-03	1.7E-04	4.5E-02	1.5E-01	6.4E-04	2.1E-03	4.0E-02	5.7E-02	1.9E-04	6.1E-04	6.0E-09	2.0E-08
1,1-Dichloroethene	2.8E+00	1.2E-02	3.4E-02	4.5E-02	1.5E-01	6.4E-04	2.1E-03	9.0E-03	NTF	1.7E-01	5.5E-01	NTF	NTF
1,2-Dichloroethane	1.3E-01	4.2E-03	5.5E-04	4.5E-02	1.5E-01	6.4E-04	2.1E-03	3.0E-02	9.1E-02	8.1E-04	2.7E-03	3.2E-08	1.0E-07
Acetone	9.8E-01	5.7E-04	5.6E-04	4.5E-02	1.5E-01	6.4E-04	2.1E-03	1.0E+00	NTF	2.5E-05	8.2E-05	NTF	NTF
Benzene	1.1E-01	1.5E-02	1.7E-03	4.5E-02	1.5E-01	6.4E-04	2.1E-03	4.0E-03	5.5E-02	1.8E-02	6.1E-02	5.8E-08	1.9E-07
Bromochloromethane	2.0E-03	4.6E-03	9.2E-06	4.5E-02	1.5E-01	6.4E-04	2.1E-03	2.0E-02	6.2E-02	2.0E-05	6.8E-05	3.6E-10	1.2E-09
Chloroethane	3.7E+00	6.1E-03	2.3E-02	4.5E-02	1.5E-01	6.4E-04	2.1E-03	4.0E-01	2.9E-03	2.5E-03	8.3E-03	4.2E-08	1.4E-07
cis-1,2-Dichloroethene	4.0E-01	7.7E-03	3.1E-03	4.5E-02	1.5E-01	6.4E-04	2.1E-03	1.0E-01	NTF	1.4E-03	4.5E-03	NTF	NTF
Ethylbenzene	1.2E-01	4.9E-02	5.9E-03	4.5E-02	1.5E-01	6.4E-04	2.1E-03	1.0E-01	NTF	2.6E-03	8.7E-03	NTF	NTF
Methyl Isobutyl Ketone	1.6E+00	4.0E-03	6.4E-03	4.5E-02	1.5E-01	6.4E-04	2.1E-03	8.0E-01	NTF	3.5E-04	1.2E-03	NTF	NTF
Methylene Chloride	5.1E-01	3.5E-03	1.8E-03	4.5E-02	1.5E-01	6.4E-04	2.1E-03	6.0E-02	7.5E-03	1.3E-03	4.4E-03	8.5E-09	2.8E-08
Tetrachloroethene	7.6E-02	3.3E-02	2.5E-03	4.5E-02	1.5E-01	6.4E-04	2.1E-03	1.0E-01	5.2E-02	1.1E-03	3.7E-03	8.3E-08	2.7E-07
Toluene	5.6E+00	3.1E-02	1.7E-01	4.5E-02	1.5E-01	6.4E-04	2.1E-03	2.0E+00	NTF	3.9E-03	1.3E-02	NTF	NTF
Trichloroethene	1.2E-01	1.2E-02	1.4E-03	4.5E-02	1.5E-01	6.4E-04	2.1E-03	6.0E-03	1.1E-02	1.1E-02	3.5E-02	1.0E-08	3.3E-08
Vinyl Chloride	3.6E-01	5.6E-03	2.0E-03	4.5E-02	1.5E-01	6.4E-04	2.1E-03	3.0E-03	7.2E-01	3.0E-02	9.9E-02	9.2E-07	3.1E-06
m,p-Xylene	4.7E-01	5.3E-02	2.5E-02	4.5E-02	1.5E-01	6.4E-04	2.1E-03	2.0E-01	NTF	5.5E-03	1.8E-02	NTF	NTF
Explosives													
2,6-DNT	2.7E-03	2.1E-03	5.7E-06	4.5E-02	1.5E-01	6.4E-04	2.1E-03	1.0E-02	NTF	2.5E-05	8.4E-05	NTF	NTF
RDX	6.9E-03	3.5E-04	2.4E-06	4.5E-02	1.5E-01	6.4E-04	2.1E-03	3.0E-03	1.1E-01	3.6E-05	1.2E-04	1.7E-10	5.6E-10
Metals													
Arsenic	5.8E-02	1.0E-03	5.8E-05	4.5E-02	1.5E-01	6.4E-04	2.1E-03	3.0E-04	1.5E+00	8.6E-03	2.8E-02	5.5E-08	1.8E-07
Totals										**0.3**	**0.9**	**1.2E-06**	**4.0E-06**

Notes:

cm = Centimeter(s)
CTE = Central Tendency Exposure
2,6-DNT = 2,6-Dinitrotoluene
IF = Intake Factor
kg = Kilogram(s)
L = Liter(s)
mg = Milligram(s)
NTF = No established USEPA toxicity factor

PC = Permeability Coefficient (cm/hour) (USEPA 1992a, 2001b, RAIS 2003)
RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine
RfD = Reference Dose
RME = Reasonable Maximum Exposure

[1] Dermal Adjusted RME x Noncarcinogenic IF/RfD

[2] Dermal Adjusted RME Concentration x Carcinogenic IF x Slope Factor

TABLE J-17
COMMERCIAL/INDUSTRIAL WORKER HEALTH RISK (INGESTION OF GROUNDWATER)
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

	Groundwater Concentration	Noncarcinogenic IF		Carcinogenic IF		Chronic	Chronic	Hazard Quotient[1]		Cancer Risk[2]	
	RME (mg/L)	CTE (L/kg-day)	RME (L/kg-day)	CTE (L/kg-day)	RME (L/kg-day)	RfD (mg/kg-day)	Slope Factor $(mg/kg-day)^{-1}$	CTE	RME	CTE	RME
Volatile Oganic Compounds											
1,1,1-Trichloroethane	2.1E+00	4.9E-03	9.8E-03	4.6E-04	3.1E-03	2.8E-01	NTF	NTF	7.3E-02	NTF	NTF
1,1,2-Trichloroethane	2.6E-02	4.9E-03	9.8E-03	4.6E-04	3.1E-03	4.0E-02	5.7E-02	3.2E-03	6.4E-03	6.8E-07	4.5E-06
1,1-Dichloroethene	2.8E+00	4.9E-03	9.8E-03	4.6E-04	3.1E-03	9.0E-03	NTF	1.5E+00	3.0E+00	NTF	NTF
1,2-Dichloroethane	1.3E-01	4.9E-03	9.8E-03	4.6E-04	3.1E-03	3.0E-02	9.1E-02	2.1E-02	4.2E-02	5.5E-06	3.6E-05
Acetone	9.8E-01	4.9E-03	9.8E-03	4.6E-04	3.1E-03	1.0E+00	NTF	4.8E-03	9.6E-03	NTF	NTF
Benzene	1.1E-01	4.9E-03	9.8E-03	4.6E-04	3.1E-03	4.0E-03	5.5E-02	1.3E-01	2.7E-01	2.8E-06	1.9E-05
Bromochloromethane	2.0E-03	4.9E-03	9.8E-03	4.6E-04	3.1E-03	2.0E-02	6.2E-02	4.9E-04	9.8E-04	5.7E-08	3.8E-07
Chloroethane	3.7E+00	4.9E-03	9.8E-03	4.6E-04	3.1E-03	4.0E-01	2.9E-03	4.5E-02	9.1E-02	4.9E-06	3.3E-05
cis-1,2-Dichloroethene	4.0E-01	4.9E-03	9.8E-03	4.6E-04	3.1E-03	1.0E-01	NTF	2.0E-02	3.9E-02	NTF	NTF
Ethylbenzene	1.2E-01	4.9E-03	9.8E-03	4.6E-04	3.1E-03	1.0E-01	NTF	5.9E-03	1.2E-02	NTF	NTF
Methyl Isobutyl Ketone	1.6E+00	4.9E-03	9.8E-03	4.6E-04	3.1E-03	8.0E-01	NTF	9.8E-03	2.0E-02	NTF	NTF
Methylene Chloride	5.1E-01	4.9E-03	9.8E-03	4.6E-04	3.1E-03	6.0E-02	7.5E-03	4.2E-02	8.3E-02	1.8E-06	1.2E-05
Tetrachloroethene	7.6E-02	4.9E-03	9.8E-03	4.6E-04	3.1E-03	1.0E-01	5.2E-02	3.7E-03	7.4E-03	1.8E-06	1.2E-05
Toluene	5.6E+00	4.9E-03	9.8E-03	4.6E-04	3.1E-03	2.0E+00	NTF	1.4E-02	2.7E-02	NTF	NTF
Trichloroethene	1.2E-01	4.9E-03	9.8E-03	4.6E-04	3.1E-03	6.0E-03	1.1E-02	9.8E-02	2.0E-01	6.1E-07	4.0E-06
Vinyl Chloride	3.6E-01	4.9E-03	9.8E-03	4.6E-04	3.1E-03	3.0E-03	7.2E-01	5.9E-01	1.2E+00	1.2E-04	7.9E-04
m,p-Xylene	4.7E-01	4.9E-03	9.8E-03	4.6E-04	3.1E-03	2.0E-01	NTF	1.1E-02	2.3E-02	NTF	NTF
Explosives											
2,6-DNT	2.7E-03	4.9E-03	9.8E-03	4.6E-04	3.1E-03	1.0E-03	NTF	1.3E-02	2.6E-02	NTF	NTF
RDX	6.9E-03	4.9E-03	9.8E-03	4.6E-04	3.1E-03	3.0E-03	1.1E-01	1.1E-02	2.3E-02	3.5E-07	2.3E-06
Metals											
Arsenic	5.8E-02	4.9E-03	9.8E-03	4.6E-04	3.1E-03	3.0E-04	1.5E+00	9.5E-01	1.9E+00	4.0E-05	2.7E-04
Totals								**3.5**	**7.1**	**1.8E-04**	**1.2E-03**

Notes:

CTE = Central Tendency Exposure
2,6-DNT = 2,6-Dinitrotoluene
IF = Intake Factor
kg = Kilogram(s)
L = Liter(s)
mg = Milligram(s)
NTF = No established USEPA toxicity factor

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine
RfD = Reference Dose
RME = Reasonable Maximum Exposure

[1] Hazard Quotient = Groundwater Concentration x Noncarcinogenic IF/RfD

[2] Groundwater Concentration x Carcinogenic IF x Slope Factor

TABLE J-18
HUMAN HEALTH RISK-BASED PRELIMINARY REMEDIATION GOALS
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Medium/Receptor	Chemical	RME Concentration (mg/L)	Noncarcinogenic Effects (mg/L)[1]	Carcinogenic Effects (mg/L)[2]
Shallow Groundwater				
Commercial/Industrial Worker - Ingestion	1,1,1-Trichloroethane	2,100	29,000	NTF
	1,1,2-Trichloroethane	26	4,100	6
	1,1-Dichloroethene	2,800	920	NTF
	1,2-Dichloroethane	130	3,100	4
	Acetone	980	100,000	NTF
	Benzene	110	410	6
	Bromochloromethane	2.0	2,000	5
	Chloroethane	3,700	41,000	110
	cis-1,2-Dichloroethene	400	10,000	NTF
	Ethylbenzene	120	10,000	NTF
	Methyl Isobutyl Ketone	1,600	82,000	NTF
	Methylene Chloride	510	6,100	44
	Tetrachloroethene	76	10,000	6
	Toluene	5,600	200,000	NTF
	Trichloroethene	120	610	30
	Vinyl Chloride	360	310	0.5
	m,p-Xylene	470	20,000	NTF
	2,6-Dinitrotoluene	2.7	100	NTF
	RDX	6.9	310	3
	Arsenic	58	30	0.2
Construction Worker - Inhalation	1,1,1-Trichloroethane	2,100	500,000	NTF
	1,1,2-Trichloroethane	26	NTF	990
	1,1-Dichloroethene	2,800	45,000	NTF
	1,2-Dichloroethane	130	1,100	610
	Acetone	980	NTF	NTF
	Benzene	110	6,800	1,900
	Bromochloromethane	2	NTF	NTF
	Chloroethane	3,700	NTF	NTF
	cis-1,2-Dichloroethene	400	NTF	NTF
	Ethylbenzene	120	230,000	14,000
	Methyl Isobutyl Ketone	1,600	680,000	NTF
	Methylene Chloride	510	680,000	35,000
	Tetrachloroethene	76	130,000	5,500
	Toluene	5,600	87,000	5,500
	Trichloroethene	120	NTF	9,200
	Vinyl Chloride	360	23,000	3,500
	m,p-Xylene	470	23,000	NTF
Construction Worker - Incidental Ingestion	1,1,1-Trichloroethane	2,100	7,900,000	NTF
	1,1,2-Trichloroethane	26	1,100,000	35,000
	1,1-Dichloroethene	2,800	260,000	NTF
	1,2-Dichloroethane	130	850,000	22,000
	Acetone	980	28,000,000	NTF
	Benzene	110	110,000	36,000
	Bromochloromethane	2.0	570,000	32,000

TABLE J-18
HUMAN HEALTH RISK-BASED PRELIMINARY REMEDIATION GOALS
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Medium/Receptor	Chemical	RME Concentration (mg/L)	Noncarcinogenic Effects (mg/L)[1]	Carcinogenic Effects (mg/L)[2]
Shallow Groundwater				
Construction Worker	Chloroethane	3,700	11,000,000	690,000
- Incidental Ingestion (Continued)	cis-1,2-Dichloroethene	400	2,800,000	NTF
	Ethylbenzene	120	2,800,000	NTF
	Methyl Isobutyl Ketone	1,600	23,000,000	NTF
	Methylene Chloride	510	1,700,000	265,000
	Tetrachloroethene	76	2,800,000	38,000
	Toluene	5,600	57,000,000	NTF
	Trichloroethene	120	170,300	180,700
	Vinyl Chloride	360	85,000	2,800
	m,p-Xylene	470	5,700,000	NTF
	2,6-Dinitrotoluene	2.7	280,000	NTF
	RDX	6.9	85,000	18,000
	Arsenic	58	8,500	1,300
Construction Worker	1,1,1-Trichloroethane	2,100	110,000	NTF
- Dermal	1,1,2-Trichloroethane	26	42,000	1,300
	1,1-Dichloroethene	2,800	5,100	NTF
	1,2-Dichloroethane	130	48,000	1,200
	Acetone	980	12,000,000	NTF
	Benzene	110	1,800	580
	Bromochloromethane	2	30,000	1,700
	Chloroethane	3,700	440,000	27,000
	cis-1,2-Dichloroethene	400	88,000	NTF
	Ethylbenzene	120	14,000	NTF
	Methyl Isobutyl Ketone	1,600	1,400,000	NTF
	Methylene Chloride	510	120,000	18,000
	Tetrachloroethene	76	21,000	280
	Toluene	5,600	440,000	NTF
	Trichloroethene	120	3,400	3,600
	Vinyl Chloride	360	3,600	120
	m,p-Xylene	470	26,000	NTF
	2,6-Dinitrotoluene	2.7	32,000	NTF
	RDX	6.9	58,000	12,000
	Arsenic	58	2,000	320

Notes:

µg/L = Micrograms Per Liter

HQ = Hazard Quotient

NTF = No established USEPA toxicity factor

PRG = Preliminary Remediation Goal

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

RME = Reasonable Maximum Exposure

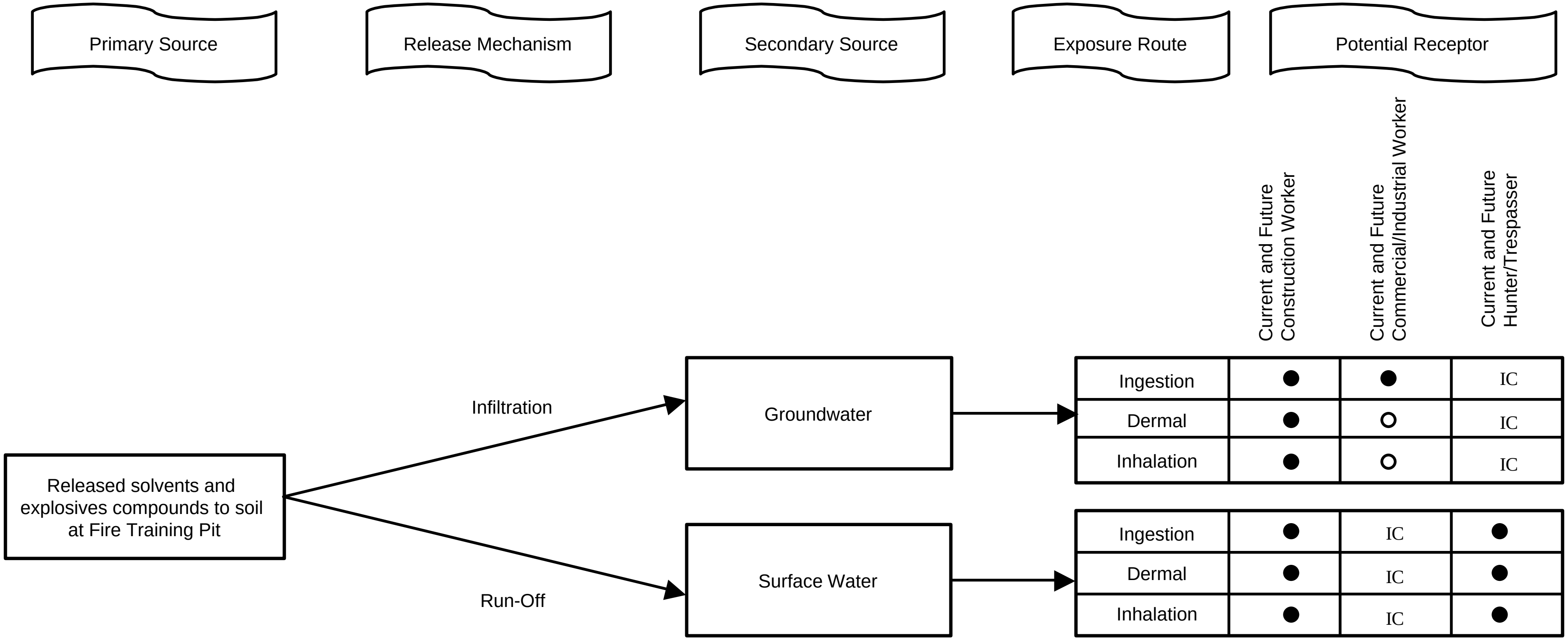
UTL = Upper Tolerance Limit

[1] Risk-based PRGs (noncarcinogenic) = (RME concentration/HQ) x 1.0.

[2] Risk-based PRGs (carcinogenic) = (RME concentration/cancer risk) x 10^{-6}.

▨ Shading indicates the lowest calculated risk-based PRG for each chemical.

* Note the arsenic PRG of 0.22 µg/L is less than the background UTL of 40.3 µg/L (see **Appendix M**).



		Current and Future Construction Worker	Current and Future Commercial/Industrial Worker	Current and Future Hunter/Trespasser
Groundwater	Ingestion	●	●	IC
	Dermal	●	○	IC
	Inhalation	●	○	IC
Surface Water	Ingestion	●	IC	●
	Dermal	●	IC	●
	Inhalation	●	IC	●

NA	Not Applicable
– – –	Incomplete pathway or minor pathway
——	Potentially complete pathway
○	Minor exposure route
●	Potentially complete exposure route
IC	Incomplete exposure route

URS

SITE CONCEPTUAL EXPOSURE MODEL
FIRE TRAINING PIT GROUNDWATER
REMEDIAL ALTERNATIVES ANALYSIS

DRN. BY: **DLC**	DATE: **10/27/03**	PROJECT NO. **16169421**	FIG. NO. **J-1**
CHK'D. BY: **TLT**	DATE: **03/09/04**		

DRAFT
TECHNICAL MEMORANDUM

FIRE TRAINING PIT GROUNDWATER FLOW AND CONTAMINANT FATE AND TRANSPORT MODELING

IOWA ARMY AMMUNITION PLANT
MIDDLETOWN, IOWA

Prepared for
U.S. Army Corps of Engineers
Omaha District

May 2004

12120 Shamrock Plaza, Suite 300
Omaha, Nebraska 68154

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Appendix K Groundwater Flow and Contaminant Fate and Transport Modeling Technical Memorandum

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List of Acronyms and Abbreviations

%	Percent
µg	Microgram(s)
1,1-DCE	1,1-Dichloroethene
GCG	Generalized Conjugate Gradient
D_l	Longitudinal Dispersivity
D_l	Longitudinal Dispersivity
D_t	Transverse Dispersivity
D_v	Vertical Dispersivity
EBP	East Burn Pads
EDA	Explosives Disposal Area
FS	Feasibility Study
ft	Foot or Feet
ft^2	Square Foot or Square Feet
FTP	Fire Training Pit
g	Gram(s)
gpm	Gallons Per Minute
HAL	Health Advisory Level
IAAAP	Iowa Army Ammunition Plant
IGS	Iowa Geological Survey
in	Inch(es)
ISCO	In-Situ Chemical Oxidation
k	Decay Constant
K_d	Soil/water partition coefficient
K_{oc}	Organic carbon/water partition coefficient
K_{ow}	Octanol/water partition coefficient
K_x	Longitudinal Hydraulic Conductivity
K_y	Transverse Hydraulic Conductivity
K_z	Vertical Hydraulic Conductivity
L	Liter(s)
mL	Milliliter(s)
MNA	Monitored Attenuation

msl	Mean Sea Level
η	Total Porosity
NAVD88	North American Vertical Datum 1988
η_e	Effective Porosity
pcf	Pounds Per Cubic Foot
RAA	Remedial Alternatives Analysis
RDX	Hexahydro-1,3,5-trinitro-1,3,5-triazine
RMS	Root Mean Squared
TOC	Total Organic Carbon
URS	URS Group, Inc.
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
WHI	Waterloo Hydrogeologic Inc.
SIP	Strongly Implicit Procedure
SSOR	Slice–Successive Overrelaxation
TCE	Trichloroethene
TVD	Total Variation Diminishing
VOC	Volatile Organic Compound
WBPA	West Burn Pads Area

K.1 INTRODUCTION

K.1.1 Purpose and Authority for the Project

The United States Army Corps of Engineers (USACE) contracted URS Group, Inc. (URS) to complete a groundwater model in conjunction with the Groundwater Remedial Alternatives Analysis (RAA) for the Fire Training Pit (FTP) at the Iowa Army Ammunition Plant (IAAAP) located near Middletown, Iowa. Work for this assignment is being performed under Contract Number DACA45-96-D-0017, Delivery Order 0063. The purpose of this technical memorandum is to provide the technical documentation for the groundwater flow and contaminant fate and transport modeling completed by URS in support of the RAA for the FTP.

K.1.2 Groundwater Modeling Objectives and Scope of Work

The objectives for the groundwater flow and contaminant fate and transport modeling effort were:

- Design and construct a baseline MODFLOW groundwater flow model and baseline MT3DMS contaminant fate and transport model for the FTP.
- Calibrate the flow model based on water level data collected during the Spring 2003 FTP Feasibility Study (FS) data collection investigation (presented in **Section 4**).
- Evaluate the effectiveness of various remedial alternatives for the RAA.

The overall modeling scope of work completed by URS is subsequently presented.

K.1.2.1 Groundwater Flow Modeling Scope of Work

The groundwater flow modeling scope of work included:

- Construction of a three-dimensional, numerical, finite-difference groundwater flow model in MODFLOW (Harbaugh, et al. 2000). The MODFLOW model was constructed using the Visual MODFLOW (WHI 2003) modeling software. The flow model simulated baseline steady-state groundwater flow conditions for the saturated materials (unconsolidated and bedrock) underlying the FTP.
- Calibration of the flow model to Spring 2003 water levels.
- Simulation of advective particle transport using MODPATH (Pollock 1994). Model-predicted transport was compared to the Spring 2003 volatile organic compound (VOC) plume to verify flow directions and maximum extent of groundwater movement.
- Evaluation of the remedial alternatives presented in the RAA using MODPATH (Pollock 1994) to determine capture zones and/or hydrogeologic effects of the alternatives on the baseline groundwater flow conditions.

K.1.2.2 Contaminant Fate and Transport Modeling Scope of Work

The contaminant fate and transport modeling scope of work included:

- Construction of a three-dimensional, numerical solute transport model using MT3DMS (Zheng and Wang 1998). The transport model was used in conjunction with the calibrated MODFLOW flow model. The transport model used the flow terms (e.g., head, velocity, and gradient) from the MODFLOW simulations to calculate transport of VOCs over time. The existing grid and model setup was used as a basis for the fate and transport model. Concentrations of VOCs were input into the model using the Spring 2003 groundwater sampling results.
- Using the baseline contaminant fate and transport model to predict current and future exposure point concentrations of VOCs in support of a human health risk assessment completed for FTP groundwater.
- Using the baseline contaminant fate and transport model to predict natural attenuation trends (e.g., dilution, dispersion, retardation, and degradation) for VOCs in groundwater at the FTP.
- Using the contaminant fate and transport model for evaluation of the effectiveness of various groundwater remedial alternatives to support the RAA.

K.2 GROUNDWATER FLOW MODELING

K.2.1 Groundwater Flow Modeling Approach, Methodology, and Assumptions

The approach, methods, and assumptions used to simulate groundwater flow conditions for the FTP are discussed in the following sections.

K.2.1.1 Groundwater Flow Modeling Approach and Methodology

Groundwater flow conditions at the site were simulated using the United States Geological Survey (USGS) Modular Three-Dimensional Finite-Difference Groundwater Flow Model (MODFLOW) (Harbaugh, et al. 2000). The MODFLOW model was constructed using Visual MODFLOW 3.1 (WHI 2003). Visual MODFLOW 3.1 is a pre- and post-processing program and does not affect the results generated by running MODFLOW.

K.2.1.2 Project Uses of the Groundwater Flow Model

After the groundwater flow model was constructed and calibrated for the baseline condition (i.e., Spring 2003), the remedial alternative components (e.g., vertical wells) were applied to the baseline MODFLOW model to simulate the aquifer response to the alternatives. MODPATH, the USGS advective particle-tracking model, was used in the baseline flow model to compute and plot advective particle flow paths in the area of the existing VOC plumes. MODPATH was also used to compute and plot capture zones for the active remedial alternatives. MODFLOW and MODPATH model descriptions, assumptions, and flow equations are included in

Attachment K-2. The remedial alternative groundwater flow models were then used for the contaminant fate and transport modeling. Contaminant fate and transport model assumptions, input, and results are presented in **Section K.3**.

K.2.1.3 Groundwater Flow Modeling Assumptions

The assumptions for the groundwater flow modeling effort included the following:

- General MODFLOW model code assumptions, which include single, calculated head values within each individual cell, completely efficient sinks and sources, and uniformly porous aquifer materials.
- Only steady-state groundwater flow conditions were modeled.
- Influences of surface water and drainages (e.g., Spring Creek and surface drainages around the FTP) were effectively simulated using drain node boundary conditions applied to the cells in the surface water/drainage locations.
- General head boundary conditions, used to simulate the influence of regional flow, did not significantly influence model results in the local areas of interest (e.g., the area around the plumes).
- Only non-reactive, advective particle transport was simulated by MODPATH.

K.2.2 Groundwater Flow Model Setup and Input Parameters

To facilitate a cohesive idea of the groundwater flow at the Explosives Disposal Area (EDA) (which includes FTP, West Burn Pads Area [WBPA], and East Burn Pads [EBP]), all three areas were included within a single flow model grid. The potentiometric surface map (**Figure 4-2**) shows that FTP is adjacent to the WBPA and indicates groundwater at FTP and WBPA are connected. The eastern boundary of these two sites (Spring Creek) is also the western boundary of the EBP. Based on these interrelationships among the three sites, a single, multi-layer flow model was used to simulate groundwater flow in the saturated unconsolidated soils and bedrock underlying the EDA. This technical memorandum primarily presents the flow results for the EDA, as well as the fate and transport results for FTP (**Section K.3**).

The finite-difference grid, model boundary conditions, and hydrogeologic input parameters for the EDA flow model are described below and are presented on **Figure K-1**.

K.2.2.1 Finite-Difference Grid

The finite-difference grid for the baseline flow model consisted of 244 rows, 354 columns, and 7 layers (for a total of 604,632 cells). The model grid covered an area approximately 4,000 feet in the *x* (east–west) direction and 2,800 feet in the *y* (north–south) direction. The grid was oriented north to south.

The model area was discretized into grid cells varying from 10 feet by 10 feet to 40 feet by 40 feet, with the highest resolution in the areas of greatest interest (e.g., near the FTP VOC plume).

The largest grid cells were placed around the edges of the model area to expand the model domain to reduce potential adverse effects in the areas of greatest interest from boundary conditions.

Seven layers were constructed in the flow model to simulate groundwater flow in the unconsolidated soils and bedrock. The topographic surface of the model was based on the Baker surveyed topographic map (Baker 1998), direct push elevations, and monitoring well ground surface elevations. The vertical boundaries of the model layers were determined from geologic boring logs and model calibration. The base of the model was set to twenty feet below the deepest boring (EBP-MW2). Model-generated cross-sections in the FTP area, with model layers outlined, are shown on **Figures K-2** and **K-3**. Model-generated cross-sections A-A' and B-B' can be compared to the interpreted FTP geologic cross-sections A-A' and B-B' on **Figures 4-3** and **4-4**.

In the model setup, the flow condition for Layer 1 was unconfined (MODFLOW type 1). Layers 2 through 7 were variable confined/unconfined (MODFLOW type 3) and allowed to vary between the two conditions.

Layer thicknesses were input to the model as follows:

- Layer 1 thickness varied from 5 to 65 feet.
- Layer 2 thickness was 10 feet.
- Layer 3 thickness was 10 feet.
- Layer 4 thickness was 20 feet.
- Layer 5 thickness was 20 feet.
- Layer 6 thickness was 20 feet.
- Layer 7 thickness was 20 feet.

K.2.2.2 Model Boundary Conditions

Boundary conditions in MODFLOW determine how water enters (sources) and leaves (sinks) the model. The model boundary conditions discussed below include drain nodes, general heads, and no-flow boundary conditions.

Drain Nodes

Drain nodes, simulating removal of water from the model, were used to simulate the influence of Spring Creek and surface drainages around the EDA. The locations of drain nodes were based on existing surface features (e.g., Spring Creek and major surface drainages around the EDA) that exhibited significant impacts on the water table surface. The elevations of the drain nodes were set to simulate the observed groundwater elevations in the wells, with conductance values that ranged from 100 square feet per day (ft^2/day) to 1600 ft^2/day (about 1 ft^2/day per square foot of cell size) to represent transfer of water from the aquifer to surface water drains. The conductance values were generally set high enough to not inhibit the flux of water flowing out of the model into the drains.

General Head Boundary Conditions

General head boundary conditions, representing the regional groundwater flow regime's influence on local conditions, were input along the northern, eastern, southern, and western sides of the model in model Layers 1, 2, and 4 through 7, as shown on **Figures K-1, K-2,** and **K-3**. The model dimensions were sufficiently large to minimize adverse effects of general head boundaries on model results in local areas of interest (i.e., the VOC plumes). General head boundary elevations were also used to simulate interpreted effects of the topography on the groundwater flow regime.

General head boundary elevations were estimated using Spring 2003 flow conditions. The model grid extends past the area with observed and interpreted groundwater elevations. In these areas, general heads were input to the model using projected groundwater elevations. The general head boundaries in each layer were independent of the general head boundaries in other layers.

General head boundary conditions are required to have a conductance value input to the model that represents the resistance to flow between the boundary head and the model domain. General head conductance values assigned in the calibrated flow model ranged from 25 ft^2/day to 200 ft^2/day, depending on the length of the boundary cells. A constant value of 5 feet per day (ft/day) per linear foot of boundary was used (e.g., a 5-foot-long cell would have a conductance of 25 ft^2/day). These values were based upon model calibration and water balance considerations. The model was not sensitive to the range of general head boundary conductance values.

No-Flow Boundary Conditions

No-flow boundary conditions were used in areas where groundwater flow into and out of the model was relatively insignificant. By default, the bottom of the model is a no-flow condition in MODFLOW. The area of interest for the model is well above the bottom of the model and the no-flow boundary does not have a significant effect on the modeling results. No-Flow boundary conditions were also used along all four sides of the model in Layer 3. This model layer simulated a hydrogeologic unit that had significantly lower hydraulic conductivities than Layers 1 and 2. Based on the difference in elevations of the shallow groundwater and the bedrock groundwater, Layer 3 generally acted as an aquitard between the shallow groundwater units and the bedrock wells. The groundwater flux into and out of the model through this layer was considered relatively insignificant. Therefore, no-flow boundaries were used.

K.2.2.3 Hydrogeologic Input Parameters

MODFLOW requires the user to construct and define the model with a number of site-specific parameters, including aquifer-specific parameters. Modeling of physical and chemical systems requires the use of simplifying assumptions based on existing site information. The model input parameters were based on the hydrogeologic data collected during the FTP, EBP, and WBPA FS data collections, Spring 2003 groundwater analytical results, and recent literature values. Aquifer-specific input parameters for the EDA are listed in **Table K-1**. The development of input values for the EDA flow model is summarized below:

Top and Bottom of Unit (feet above msl). Seven model layers were established in the EDA flow model. The thickness of each layer was determined from geologic boring logs and model calibration. The seven model layers were used to facilitate evaluation of horizontal and vertical groundwater flow and contaminant transport using the model. The model layers included the following hydrogeologic units:

- Layer 1 – Shallow till, fill, and weathered bedrock
- Layer 2 – Upper bedrock/intermediate till
- Layers 3, 4, 5, and 6 – Bedrock/deep till
- Layer 7 – Bedrock

The bottom of the model was set in the bedrock unit.

Hydraulic Conductivity (K). Hydraulic conductivity model input values for the FTP portion were selected based on aquifer testing results (**Appendix F**), geologic boring logs, and model calibration and sensitivity analysis. These values are summarized in **Table 8-2**. The measured horizontal hydraulic conductivity values ranged from:

- Approximately 0.020 to 0.47 ft/day for shallow till wells and approximately 0.046 to 2.2 ft/day for till/bedrock contact wells
- Approximately 0.38 to 8.6 ft/day for deep till/bedrock contact wells
- Approximately 0.0013 to 2.4 ft/day for upper bedrock wells
- Approximately 0.00015 to 0.0076 ft/day for bedrock wells

Ranges of hydraulic conductivity values were assigned to all layers in the numerical model based on the aquifer slug test data and model calibration. The hydraulic conductivity values used in the model generally ranged from:

- 0.02 to 2 ft/day in Layer 1 for shallow till and till/bedrock contact (1 ft/day for the sump monitoring well (SA-99-1) area
- 0.001 to 0.2 ft/day in Layer 2 for upper bedrock
- 0.01 ft/day in Layer 2 for intermediate till (EBP only)
- $1x10^{-6}$ to 0.002 ft/day in Layers 3 to 7 for bedrock
- $1x10^{-5}$ to 0.006 ft/day in Layer 3 to 6 for deep till (EBP only)
- 0.4 ft/day for in Layer 1 for alluvium underlying Spring Creek and its tributaries

Longitudinal (K_x) and transverse (K_y) hydraulic conductivity values were set equal. Vertical hydraulic conductivity (K_z) values were set at a 1:10 ratio of vertical to horizontal values for all layers.

Porosity (η). Geotechnical analysis of the soils from the EDA indicated a range of total porosity values from 23.0 to 38.0 percent (0.23 to 0.38) with an overall average of about 32 percent (**Table 4-1**). In most unconsolidated sediments, the total porosity (η) is equal to the effective porosity (η_e) (Fetter 1988). A uniform effective porosity value of 32 percent was assigned to the model for the unconsolidated units at the FTP. Porosity values for the upper bedrock and bedrock were not available. Effective porosity values of 22 and 20 percent were assigned to the model for the upper bedrock and bedrock, respectively.

Horizontal Hydraulic Gradient (i). Average hydraulic gradients were simulated for each model layer by varying hydrogeologic parameters and constant head boundary conditions. Hydraulic heads and the resulting horizontal and vertical gradients were calibrated to Spring 2003 FTP values (**Table 4-3**). The FTP water table map generated from Spring 2003 water level data is shown on **Figure 4-5**. A comparison of the Spring 2003 water table map and the model-predicted water table surface is shown on **Figure K-6**.

Recharge. Recharge was based on average annual precipitation, evaporation, soil types, other ground cover, land use, and model calibration. Precipitation was considered uniform across the model area. Therefore, variations in ground cover and land use primarily accounted for spatial variations in recharge across the model. **Figure K-4** presents the distribution of recharge values across the EDA model domain. Recharge was applied to the highest active layer in the model (i.e., Layer 1). In general, recharge values input to the model ranged from 0 to 0.7 inches per year. Based on observed groundwater mounds near JAW-25 (WBPA), SA-99-1 (FTP), EDA-01 (EBP), and JAW-04(B) (EBP), localized zones of higher recharge (1 to 20 inches per year) were assigned in these areas.

Storage Coefficient (S). Storage coefficients were not used in the model simulations because the model was run as a steady-state simulation. Even under confining conditions, the contribution to hydraulic flow from release of water from storage was less than the mass balance uncertainty of the model.

Leakance (L). Vertical leakance values for all layers were automatically calculated by the model using the vertical hydraulic conductivity of each layer, the volume of the model grid cell specified by the layer top and bottom elevations, and the cell size.

Time (t). The groundwater flow model was not time dependent (i.e., steady-state conditions were modeled).

K.2.3 Baseline Groundwater Flow Model Calibration, Sensitivity, Uncertainties, and Limitations

Groundwater flow model calibration and sensitivity analysis were completed prior to the contaminant fate and transport modeling. Calibration of the groundwater flow model, comparison of model-generated potentiometric head data to actual site data, groundwater flow model sensitivity analysis, and uncertainties and limitations of the groundwater flow model are presented in the following sections.

K.2.3.1 Groundwater Flow Model Calibration

The flow model was calibrated using Spring 2003 water levels (**Table 4-2**) by varying the model input values discussed in **Section K.2.2**. Calibration model executions included varying the hydraulic conductivity values, varying the hydraulic conductivity fields, varying the recharge field and values, varying the conductance of the drain nodes, and varying the elevations of constant head boundaries and drains. These values were varied, within the boundaries of the available data, until the model-predicted groundwater flow regime reasonably simulated the observed conditions.

Calibrated Groundwater Flow Configuration

The Spring 2003 and the model-predicted shallow and intermediate groundwater potentiometric surfaces are shown on **Figures K-5** and **K-6**, respectively. In general, model-predicted groundwater flow directions, hydraulic gradients, and hydraulic head values closely matched the interpreted field data.

Potential sources of calibration error in the model are related to the areas of undefined geology and hydrogeology west of FTP, north of WBPA, and south of EBP. However, this area is a relatively small portion of the model and does not significantly impact the overall model results. The final aquifer parameter values were set in these areas such that the model results would closely match the Spring 2003 water levels.

Calibration Statistics

The calculated differences between the baseline model-estimated water levels and observed water levels are presented in **Table K-2**. A summary of the calibration statistics calculated for each layer is shown in **Table K-3**. The mean absolute differences between observed hydraulic heads and simulated hydraulic heads in each layer are as follows:

- Layer 1: 0.74 feet
- Layer 2 1.23 feet
- Layer 4: 0.98 feet
- Layer 6: 0.5 feet

- Overall Model: 0.86 feet

The slope of the zero-intercept, linear regression comparison line for all model calibration points was 0.99. A perfect linear relationship (included as the perfect calibration line on **Table K-3**) yields a slope of 1.0. This indicated a very strong linear relationship between model-predicted hydraulic heads and actual site conditions. More importantly, the simulated hydraulic gradients appeared to closely match actual hydraulic gradients and groundwater flow directions (**Figures K-5** and **K-6**).

Mean absolute model calibration residuals within 5 percent of total head variations generally are considered acceptable. The calibrated mean absolute head residual values for the EDA model averaged about 1.64 percent of the total head change, indicating statistically excellent model calibration.

The root mean squared (RMS) value of the model is defined as the square root of the sum of the squared head residual values, divided by the number of observations. The RMS for the EDA flow model was 1.14 feet. The normalized RMS is the RMS divided by the head difference across the model. The calibrated normalized RMS value for the EDA model was 2.19 percent, indicating excellent model calibration.

Calibrated Volumetric Water Budget

In addition to calibration statistics, a volumetric water budget calculation was used to estimate the accuracy of the numerical groundwater flow model. The volumetric water budget calculates the amount of water that flows in and out of model through the sinks and sources. The volumetric water budget indicates the overall acceptability of the groundwater flow model by providing the percent difference in the inflow and outflow of the modeled sinks and sources (Harbaugh, et al. 2000). The volumetric water budget for the baseline flow model had a relatively insignificant 0.01 percent discrepancy in mass balance, indicating that the model was acceptable for the project uses. **Attachment K-1** includes the MODFLOW-generated volumetric water budget for the baseline calibrated groundwater flow model.

Advective Particle Tracking Calibration

After model calibration and sensitivity analysis indicated the model reasonably predicted the baseline groundwater elevations, the baseline groundwater flow model was used to simulate the historical movement of the groundwater at the EDA. Advective particles were input to the baseline flow model in interpreted source areas (e.g., around SA-99-1) and were forward tracked throughout the model area for a period of 70 years.

The final baseline advective particle tracking results are shown on **Figures K-7** and **K-8**. The particle tracking results indicated that the model-simulated flow paths were similar to those interpreted for the Spring 2003 plumes. Advective water particles input to the model near the sump monitoring well (SA-99-1) area generally traveled south, southeast, and east toward the Spring Creek tributary (assigned as drain nodes). However, no significant VOC concentrations are expected to be transported in the surface drainages and any VOCs daylighting at the surface are expected to volatilize rapidly.

Advective particle tracking results typically predict downgradient movement of advective particles significantly greater than the actual plumes because only non-reactive, advective transport can be simulated by MODPATH. MODPATH does not simulate the effects of naturally occurring processes of dispersion, retardation, and degradation of the plume concentrations. These processes will spread contaminants laterally, slow contaminant movement, and reduce contaminant concentrations with time and distance from the source. However, the widespread downgradient extent of groundwater VOC contamination at the FTP is interpreted to be related to surface transport in surface drainage features (discussed in **Section 7.1.1**). Therefore, the particles inserted near the FTP sump monitoring well area were not expected to be transported across the entire VOC plume.

K.2.3.2 Groundwater Flow Model Sensitivity Analysis

Sensitivity of the MODFLOW groundwater flow model was evaluated qualitatively and quantitatively to describe possible variability in the subsequent aquifer response analyses. The model was sensitive to most aquifer parameters, including (in order of highest sensitivity) boundary conditions, hydraulic conductivity, and recharge. Fluctuating these parameters within reasonable estimated ranges created noticeable differences in predicted flow conditions.

Qualitative Sensitivity Analysis

The sensitivity of model-predicted heads to recharge and general head values were qualitatively evaluated during the calibration process. Measured water level data does not extend to all model boundaries. Therefore, the groundwater elevations outside of the existing water level data were extrapolated from the nearest measured water levels until model residuals (i.e., departure from observed conditions) were reasonably minimized. Systematic changes in the recharge areas and general head boundaries created similar systematic changes in the model-predicted heads. For example, increasing the amount of recharge or general head boundary elevations increased the model-predicted water table elevation. This procedure was repeated during the calibration process until a groundwater flow regime similar to the interpreted water levels was achieved.

Similar to the response of the recharge areas and general head elevations, increasing drain elevations directly impacted (i.e., raised) potentiometric surface elevations in the modeled areas around the surface water drainages. The drain conductance values were varied to more accurately simulate aquifer responses near the surface water drainage areas.

Quantitative Sensitivity Analysis

The sensitivity of the model to hydraulic conductivity and recharge was quantitatively evaluated following the final calibration of the groundwater flow model. Model runs were completed using a range of values for each parameter. During the sensitivity analysis, all other parameters not being evaluated were held constant to the values used in the final calibrated groundwater flow model. Calibration statistics, specifically the normalized root mean squared (RMS) values between observed and simulated hydraulic heads, were compared and used to determine the statistically best fit for each model run. The quantitative sensitivity analysis results are presented in **Table K-4**.

Hydraulic Conductivity Sensitivity Analysis

The highest hydraulic conductivity for Layer 1 was varied from 1 ft/day to 4 ft/day, with the calibrated groundwater flow model using a value of 2 ft/day. The resulting RMS values for the entire model ranged from 2.19% to 2.28%, with the calibrated model configuration producing an RMS of 2.19%. The model was slightly sensitive to this parameter.

The lowest hydraulic conductivity for Layer 1 was varied from 0.015 ft/day to 0.06 ft/day, with the calibrated groundwater flow model using a value of 0.03 ft/day. The resulting RMS values for the entire model ranged from 2.19% to 6.36%, with the calibrated model configuration producing an RMS of 2.19%. The model was very sensitive to this parameter.

Recharge Sensitivity Analysis

The highest recharge area at WBPA (near JAW-25) was varied from 10 inches/year to 40 inches/year, with the calibrated groundwater flow model using a value of 20 inches/year. The resulting RMS values ranged from 2.19% to 2.3%, with the calibrated groundwater flow model configuration producing the lowest RMS at 2.19%. The model was slightly sensitive to this parameter.

The highest recharge area at FTP (near SA-99-1) was varied from 2.5 inches/year to 10 inches/year, with the calibrated groundwater flow model using a value of 5 inches/year. The resulting RMS values ranged from 2.19% to 4.39%, with the calibrated groundwater flow model configuration producing the lowest RMS at 2.19%. The model was slightly sensitive to this parameter.

The highest recharge area at EDA (near EDA-01) was varied from 2.5 inches/year to 10 inches/year, with the calibrated groundwater flow model using a value of 5 inches/year. The resulting RMS values ranged from 2.19% to 3.16%, with the calibrated groundwater flow model configuration producing the lowest RMS at 2.19%. The model was slightly sensitive to this parameter. These areas (i.e., WBPA, FTP, EDA) are shown on **Figure K-4**.

K.2.3.3 Groundwater Flow Model Uncertainties

Uncertainties in the groundwater flow model included:

- Limited available hydrogeologic data for subsurface characterization of Layers 3, 5, 6, and 7.
- Actual conductance values are not available for drain nodes. This was accounted for by calibration to the observed conditions.

- Groundwater elevations at the extents of the model cannot be measured and were extrapolated from observed water level information.
- Actual recharge values are not available. Values were based on topography, vegetation, land use, and model calibration.

K.2.3.4 Groundwater Flow Model Limitations

Limitations of the flow model:

- The groundwater flow model was constructed using steady-state conditions from the Spring 2003 groundwater elevations (**Table 4-2)**. These measurements were completed in late spring (following spring precipitation and storm events) and are anticipated to be slightly higher than the average groundwater elevations at EDA during fall and winter.

K.2.3.5 Baseline Groundwater Flow Modeling Results Summary

The groundwater flow modeling results are summarized as follows:

- The overall baseline groundwater flow model calibration was statistically excellent with model-predicted heads calibrated to within 2.19 percent normalized root mean squared error and 1.64 percent absolute residual mean error.
- The mass balance of the model had a 0.01 percent discrepancy.
- The calibrated baseline groundwater flow model adequately simulated the hydraulic gradients and flow directions interpreted from the Spring 2003 potentiometric surface maps.
- Advective particle tracking results indicated that water particles originating from the sump monitoring well area would be transported toward the south, southeast, and east, similar to the interpreted plume movement at the FTP.

K.2.4 Groundwater Flow Modeling Remedial Alternatives Evaluation and Capture Zone Predictions

After model calibration and sensitivity analysis indicated that the model reasonably predicted the baseline groundwater elevations, the proposed groundwater remediation alternatives were evaluated. This evaluation was completed using a MODFLOW (Harbaugh, et al. 2000) baseline groundwater flow model and revising the model to simulate each of the remedial alternatives (e.g., adding extraction wells, etc.). Capture zone analysis for each alternative was completed using the reverse particle tracking option in MODPATH (Pollock 1994). Particle tracks were generally calculated for 70 years. A 70-year period was considered sufficient to adequately simulate the capture zones. The model-predicted capture zones and flow rates assumed 100-percent well efficiency. However, subsurface conditions usually create actual efficiencies that are significantly lower (Driscoll 1986). Therefore, the remedial alternatives were typically designed in a conservative manner to compensate for potential inefficiencies.

Five groundwater remediation alternatives were evaluated with the particle-tracking options in the groundwater flow model. The five remedial alternatives included:

- **Alternative 1: No Action** – The baseline flow model was used to simulate the No Action remedial alternative.
- **Alternative 2: Monitored Natural Attenuation (MNA)** – The baseline flow model was also used to simulate the MNA alternative.
- **Alternative 3: Focused Extraction/MNA** – The baseline flow model was modified to include extracting groundwater from the sump monitoring well.
- **Alternative 4: In-Situ Chemical Oxidation (ISCO)/MNA** – The baseline flow model was modified to include extracting groundwater from sump monitoring well and four injection wells around the perimeter of the sump excavation to inject a solution of hydrogen peroxide and water.
- **Alternative 5: Enhanced Degradation/MNA** – This alternative used the same flow model as Alternative 4.

The objective of each modeling evaluation was to determine the optimum locations and extraction rates that would facilitate cleanup of VOCs. For the remedial alternative evaluations, it was conservatively assumed that the remedial alternatives would address all FTP plume groundwater with VOC concentrations greater than the FTP risk-based PRG for each contaminant.

K.2.4.1 Alternative 1: No Action

The calibrated baseline groundwater flow model was used for the No Action and MNA alternatives evaluations. Construction of this model did not differ from construction of the previously described baseline flow model. The No Action flow model advective particle tracking results (**Figure K-9**) indicated that groundwater originating near the sump monitoring well would travel to the south, southeast, and east.

K.2.4.2 Alternative 2: Monitored Natural Attenuation

The MNA alternative groundwater flow model was the same as the No Action model.

K.2.4.3 Alternative 3: Focused Extraction/MNA

The Focused Extraction Alternative groundwater flow model consisted of extracting groundwater from the sump monitoring well at a rate of 0.25 gpm. Advective particle tracking results indicated the extraction well effectively captured the high concentration VOC plume near SA-99-1. Particle tracking results are presented on **Figure K-10**.

K.2.4.4 Alternative 4: ISCO/MNA

Alternative 4 consisted of extracting groundwater from the sump monitoring well at a rate of 2 gpm and injecting a solution of hydrogen peroxide and water through four injection wells at a rate if 0.5 gpm each. **Figure K-11** presents the extraction well location and model-predicted capture zones created the modeled flow rates. The extraction and injection wells were placed in model Layer 1 with 10-foot well screens. Advective particle tracking results for the ISCO alternative indicated effective capture of the VOC plume around the sump monitoring well.

K.2.4.5 Alternative 5: Enhanced Degradation/MNA

The flow model for Alternative 5 was identical to Alternative 4. **Figure K-12** presents the extraction well location and model-predicted capture zones created by the modeled flow rates. Advective particle tracking results for the Enhanced Degradation Alternative indicated effective capture of the VOC plume around the sump monitoring well.

K.2.4.6 Groundwater Flow Modeling Remedial Alternative Evaluation Conclusions

The groundwater flow modeling evaluation results for the five alternatives indicated:

- Advective particle tracking results for the No Action and MNA Alternatives indicated that water particles originating from the sump monitoring well area would be transported to the south, southeast, and east.
- Advective particle tracking results for the Focused Extraction Alternative indicated the extraction well effectively addressed the shallow groundwater near the sump monitoring well.
- Advective particle tracking results for the ISCO and Enhanced Degradation Alternatives indicated the extraction and injection wells effectively addressed the shallow groundwater near the sump monitoring well.
- Advective particle tracking results for all of the alternatives also indicated particles traveling in the FTP shallow groundwater plume area would not be transported into the bedrock groundwater.

The groundwater flow model accuracy was considered adequate to use in the subsequent contaminant fate and transport modeling evaluation (presented in **Section K.3**).

K.3 CONTAMINANT FATE AND TRANSPORT MODELING

The objectives of the contaminant fate and transport modeling effort were to:

- Simulate baseline contaminant transport for the FTP VOC plumes (using Spring 2003 concentrations).

- Assess whether VOC concentrations currently detected above the IAAAP regulatory standards will be transported further downgradient at the FTP to other potential receptors.
- Assess the ability of the soil and groundwater system to naturally attenuate VOCs at the FTP.
- Evaluate remedial alternatives for the RAA.

K.3.1 Contaminant Fate and Transport Modeling Approach, Methodology, and Assumptions

The approach, methods, and assumptions used to simulate groundwater contaminant fate and transport at the FTP are discussed in the following sections.

K.3.1.1 Contaminant Fate and Transport Modeling Approach and Methodology

Groundwater flow conditions at the site were simulated using MODFLOW. The MODFLOW modeling approach and methodology was discussed in **Section K.2**. Contaminant fate and transport of VOCs was simulated using MT3DMS (Zheng and Wang 1998), a three-dimensional, block-centered, finite-difference, numerical transport model. MT3DMS retrieves the hydraulic heads, flow terms, and source-sink terms from the MODFLOW groundwater flow model results and calculates chemical concentrations over time. The MT3DMS models were constructed using Visual MODFLOW (WHI 2003). Visual MODFLOW is a pre- and post-processor and does not affect results generated by running MT3DMS.

The same model dimensions, groundwater configurations, and flow parameters used in the groundwater flow model were used in the contaminant fate and transport model.

Chemicals Selected for MT3DMS Model

A contaminant fate and transport model was constructed to model benzene, chloroethane, trichloroethene (TCE), 1,1-dichloroethene (1,1-DCE), and vinyl chloride concentrations at the FTP. Benzene, chloroethane, TCE, 1,1-DCE, and vinyl chloride were selected as the main contaminants above IAAAP regulatory standards in groundwater at the FTP because they were reported at concentrations (110, 3700, 120, 2800, and 360 micrograms per liter [µg/L], respectively) significantly higher than the IAAAP regulatory standards (5, 4.6, 5, 7, and 2 µg/L, respectively) and are mobile in groundwater. It was not considered necessary to model other VOCs because the VOCs selected provided results representative of the various suites of contaminants present at FTP. Explosives were not modeled because they were reported at concentrations only slightly higher than the IAAAP regulatory standards, did not have significant areal distribution, and were not anticipated to be transported any significant distance at concentrations above the IAAAP regulatory standards.

K.3.1.2 Project Uses for the Contaminant Fate and Transport Model

The baseline groundwater flow model was used in conjunction with MT3DMS (Zheng and Wang 1998) to simulate baseline contaminant fate and transport. The remedial alternative flow models were then used in conjunction with MT3DMS to predict the effectiveness of the remedial alternatives on contaminant fate and transport. Some of the final flow model design parameters (e.g., placement of wells, etc.) were based upon the contaminant fate and transport modeling results.

K.3.1.3 Contaminant Fate and Transport Modeling Assumptions

MT3DMS uses chemical and site-specific characteristic input values to calculate contaminant dispersion and degradation (i.e., fate) and MODFLOW output to calculate advection (i.e., transport). MT3DMS accounts for the effects of adsorption/desorption, dispersion, and natural degradation (biotic and abiotic) or other chemical reactions that can be simulated with a first-order decay rate term for the removal of a chemical from the modeled system. MT3DMS cannot simulate more complicated chemical reaction systems, such as precipitation/re-solution based on changing local conditions, the rate of exhaustion of bio-nutrients based on variable uptake by indigenous microorganisms, or the transformation of a chemical into a degradation by-product.

In addition to the general MT3DMS modeling assumptions listed in **Attachment K-3**, key assumptions for this modeling effort included the following:

- The steady-state MODFLOW model assumptions, setup, and results were appropriate for the contaminant fate and transport model.
- Dissolved VOC concentrations measured from the Spring 2003 sampling event (**Table 5-2**) were used to interpret the isoconcentration maps (**Figures 7-1a, 7-1b, 7-2a, 7-2b, 11-2,** and **11-3**). These isoconcentrations were used to input initial concentration values (**Attachment K-4**). Adsorption was also considered to be at equilibrium at the time of the Spring 2003 sampling event.
- VOCs are subject to adsorption, dispersion, and degradation (approximated with a first-order decay rate, **Attachment K-4**) as it is transported through the saturated zones of the aquifer.

K.3.2 Contaminant Fate and Transport Model Setup and Input Parameters

The FTP contaminant fate and transport model was constructed using the same overall model setup as the MODFLOW groundwater flow model. The fate and transport model setup included use of the baseline flow model finite-difference grid, hydrostratigraphic layers (i.e., model Layers 1 through 7), and groundwater flow boundary conditions, with the added input of chemical-specific parameters. The groundwater flow components were previously described in **Section K.2**. The chemical-specific input parameters are documented in this section.

K.3.2.1 Initial Target Compound Concentrations

Chemical data from the Spring 2003 sampling event were the basis for the interpreted initial VOC isoconcentration maps and the subsequent conservative initial concentration values input to the baseline contaminant fate and transport model. Initial concentration values were extrapolated from the isoconcentration maps.

Current VOC concentration data were discretized and input into the model at values ranging from 2 µg/L to 2,800 µg/L. These values were used for initial concentration input. The contaminant data were discretized into fields of VOC concentrations to match Spring 2003 conditions. VOC values were input in model Layer 1 for the FTP shallow groundwater plume. A conservative approach (i.e., likely overestimating VOC mass) was used when discretizing VOC input into the model.

Initial concentration plots were constructed from MT3DMS results at a time period of 1-day. These initial concentration plots (i.e., initial concentration input) are included in **Attachment K-4**. Considering the modeling objectives (e.g., long-term simulations), these plots were considered appropriate and conservative representations of the nature and extent of contamination in Spring 2003.

K.3.2.2 Contaminant Fate and Transport Model Input Parameters

MT3DMS requires the definition of a number of site-specific and chemical-specific input parameters for each contaminant model (e.g., benzene, chloroethane, TCE, 1,1-DCE, and VC) and to make some simplifying assumptions based on existing site information. Contaminant fate and transport model input parameter values are summarized in **Table K-5**. The model input parameter values were based on the hydrogeologic characteristics of the model layers, site chemical analyses, and estimates of chemical characteristics from recent literature values.

The input parameters for the FTP contaminant fate and transport model were established as follows:

Source Concentrations: Current benzene, chloroethane, TCE, 1,1-DCE, and vinyl chloride concentration data were discretized and input in the model in values ranging from 2 µg/L to 2,800 µg/L to match Spring 2003 FTP contaminant concentration data (**Figures 7-1a** and **7-1b**).

Source Mass Decay: The Spring 2003 concentrations in groundwater of benzene, chloroethane, TCE, 1,1-DCE, and vinyl chloride were input as initial concentrations (i.e., a one-time, non-constant source).

Time (t). MT3DMS used the steady-state, time independent, flow field generated by MODFLOW to simulate contaminant fate and transport over time. The fate and transport model was simulated for a time period of 70 years. This was considered to be a sufficient amount of time to predict contaminant transport results to support a 70-year risk evaluation period (maximum lifetime exposure) and for the contaminant plume to reach equilibrium.

Bulk Density (ρb). The bulk density of the EDA soils was based on geotechnical analysis completed during the FTP, EBP, and WBPA FS data collections. Bulk density values ranged from 1.6 to 1.9 grams per cubic centimeter (g/cc). An average bulk density value of 1.8 g/cc was input for unconsolidated sediments in the model. Site-specific bulk density values for the upper bedrock and bedrock were not available. Bulk density values of 2.1 g/cc and 2.2 g/cc were assigned to the model for the upper bedrock and bedrock, respectively.

Dispersivity (D_l, D_t, D_v). Chemical dispersivity input values were assumed based on varying distances chemicals have been transported from the assumed source areas at FTP. Longitudinal dispersivity (D_l) values were assumed to be 10 percent of the downgradient transport distance. Longitudinal dispersivities were conservatively estimated at approximately 10 to 80 feet, and vertical dispersivities (D_v) and transverse dispersivities (D_t) were estimated as a fraction of the longitudinal values. Longitudinal dispersivity values are typically reported to be much larger than transverse values, which are much larger than vertical values (Gelhar 1992; Anderson 1979). The ratios of longitudinal-to-transverse-to-vertical dispersivity (e.g., D_l, $D_{t,:}D_v$) were input at 100:20:1. These ratios were established during model calibration based on the geometry of the existing plumes.

Degradation Half-life ($t_{1/2}$). Reported benzene, chloroethane, TCE, 1,1-DCE, and vinyl chloride degradation (abiotic and biotic) half-life literature values ranged from 0.15 to 7.88 years. Site-specific half-lives were calculated from historical data in the FTP shallow groundwater for benzene, chloroethane, PCE, TCE, 1,1-DCE, and vinyl chloride. Half-life calculations are included in **Attachment K-4**. Site-specific half-life calculations for other chemicals were not completed due to a lack of a historical decline in concentrations. The half-life values selected the modeling of benzene, chloroethane, TCE, 1,1-DCE, and vinyl chloride were 2.1, 8.9, 3.9, 2.1, and 8.7 years, respectively.

Half-life values were input to the model as first-order decay constants (k) using $k = \ln(2)/t_{1/2}$. The values selected were considered to be representative of natural decay processes occurring at the site, based on the site-specific half-life and literature values.

The MT3DMS code also requires an adsorbed-phase half-life value to simulate degradation of the contaminant in the adsorbed phase. It has been reported that certain biological reactions only occur in the dissolved phase (Zheng and Wang 1988), therefore, sorbed-phase half-life values are typically longer than dissolved-phase half-lives. The sorbed-phase half-life for all contaminants was assumed at a conservative value of 100 years.

Organic Carbon/Water Partition Coefficient (K_{oc}). The K_{oc} values used in the model for benzene, chloroethane, TCE, 1,1-DCE, and vinyl chloride are based on reported literature values (USEPA 1989) (**Table 8-1**). The following K_{oc} values were used in the model:

- Benzene: 165.5 milliliters per gram (mL/g)
- Chloroethane: 23.7 mL/g
- TCE: 67.7 mL/g
- 1,1-DCE : 35 mL/g
- Vinyl Chloride: 23.7 mL/g

Model calibration indicated that these values yielded results that were considered reasonable.

Total Organic Carbon (TOC). The TOC content of the EDA soils was based on laboratory analysis of soils collected during the FTP, EBP, and WBPA FS data collections and are shown on

Table 4-1. TOC values for the EDA shallow glacial till ranged from 0.05 percent to 1.6 percent with an average value of 0.1 percent. The average TOC value of 0.1 percent was assigned to the model in the shallow, intermediate, and deep tills. Site-specific TOC values for the upper bedrock and bedrock were not available. TOC values 0.05 percent and 0.03 percent were assigned to the model for the upper bedrock and bedrock, respectively.

Sorption Distribution Coefficient (K_d). Soil/water partition coefficients (K_d) were estimated for each chemical from the product of the K_{oc} and TOC values listed above. The following K_d values were used in the model:

- Benzene: 0.05 mL/g to 0.17 mL/g
- Chloroethane: 0.007 mL/g to 0.023 mL/g
- TCE: 0.02 mL/g to 0.07 mL/g
- 1,1-DCE: 0.011 mL/g to 0.035 mL/g
- Vinyl Chloride: 0.007 mL/g to 0.023 mL/g

Retardation Factor (R). The model uses the bulk density, the sorption coefficient, and effective aquifer porosity to calculate a retardation factor using the following equation:

$$R = 1 + \frac{K_d \cdot \rho b}{\eta_e}$$

Where,

ρb = Bulk density
K_d = Soil/water partition coefficient
η_e = Porosity

Using the above values, retardation factors were calculated by the model for benzene, chloroethane, TCE, 1,1-DCE, and vinyl chloride. The values for each chemical ranged from:

- Benzene: 1.55 to 1.88
- Chloroethane: 1.08 to 1.13
- TCE: 1.22 to 1.36
- 1,1-DCE: 1.12 to 1.19
- Vinyl Chloride: 1.08 to 1.13

K.3.3 Baseline Contaminant Fate and Transport Model Calibration, Sensitivity, and Limitations

The contaminant fate and transport model was calibrated to accurately simulate the extent of the Spring 2003 benzene, chloroethane, TCE, 1,1-DCE, and vinyl chloride plumes and predict future behavior of the plumes. This calibration effort included qualitative model calibration, parameter sensitivity analysis, and understanding the limitations of the model predictions.

K.3.3.1 Contaminant Fate and Transport Model Calibration

Contaminant fate and transport model setup and calibration were completed to reproduce the Spring 2003 benzene, chloroethane, TCE, 1,1-DCE, and vinyl chloride concentrations at the site as closely as possible. An iterative calibration process was used to refine MT3DMS input based on model-predicted results. Historical source release information (e.g., mass release and dates of multiple releases) cannot be accurately estimated because of the nature of the multiple source releases over time. Therefore, calibration of the contaminant fate and transport model relied on Spring 2003 groundwater analytical data, and the method of inputting sources at an assumed mass and time of release was not implemented. The model input assumed that the subsurface was at equilibrium adsorption. The calibration procedures completed included:

- Discretizing Spring 2003 VOC concentrations into model Layer 1 for the FTP shallow groundwater plume.
- Inputting dispersivity values based on distance the contaminant has traveled from the assumed origination area.
  - Longitudinal Dispersivity (D_l) = 1/10 downgradient transport distance
  - Transverse Dispersivity (D_t) = 1/5 longitudinal dispersivity
  - Vertical Dispersivity (D_v) was estimated at 1/100 of the longitudinal dispersivity.
  - Ratio of longitudinal to transverse to vertical dispersivity (e.g., D_l:D_t:D_v) was determined from the geometry of historic and Spring 2003 VOC plumes.

These parameters were systematically varied until the model-predicted behavior of the VOC plumes most accurately simulated the existing plumes.

K.3.3.2 Contaminant Fate and Transport Model Sensitivity

Sensitivity of the contaminant fate and transport model was evaluated qualitatively to describe possible variability in the subsequent model-predicted results. Contaminant fate and transport modeling results were sensitive to both contaminant-specific and groundwater flow input parameters. **Section K.2.3.2** summarized the groundwater flow model sensitivity to groundwater flow input parameters. It was assumed that if the flow model was sensitive to a parameter, the contaminant fate and transport model was also sensitive to the same parameter since the advective transport portion of the contaminant fate and transport model is determined by the output from the groundwater flow model.

Additionally, the contaminant fate and transport modeling results were sensitive to most contaminant fate and transport model input parameters. These parameters included: initial concentrations, degradation half-life, retardation factor, and dispersivity. Fluctuating these parameters within reasonable estimated ranges created noticeable differences in model-predicted results.

The degree of contaminant fate and transport model sensitivity to contaminant specific input parameters was variable. Qualitative sensitivity analysis results are summarized in the following table.

Summary of Contaminant Fate and Transport Model Sensitivity

Input Parameter	Sensitivity	Summary
Initial Concentration	High	⇩ Mass - ⇩ Future Transport
Degradation Half-life	High	⇧ Decay rate - ⇩ Future Transport
Retardation Factor	Moderate	⇧ Retardation factor - ⇩ Transport distance
Dispersivity	Low	⇩ Dispersivity - ⇩ Transport distance

K.3.3.3 Contaminant Fate and Transport Model Limitations

Limitations of the contaminant fate and transport model were directly related to the model assumptions listed in **Section K.3.1.3** and **Attachment K-3**. These limitations included a single concentration value within each cell, equilibrium-controlled adsorption/desorption, and irreversible linear decay rates. The most significant limitations for the FTP fate and transport model included:

- The dissolved VOC decay rates used for model input were calculated from historical site-specific analytical data and not model-calculated over time as the natural attenuation capacity of the aquifer (e.g., assimilative capacity) may change.
- The dissolved VOC decay rates calculated from chemicals within the sump monitoring well SA-99-1 appeared to be significantly impacted by anaerobic conditions in the sump monitoring well.
- Target VOC plume calibration was limited to the Spring 2003 interpreted plume concentrations and extent.

These limitations were compensated for by using very conservative initial VOC concentration inputs (i.e., likely overestimating initial mass).

K.3.3.4 Baseline Contaminant Fate and Transport Modeling Results Summary

After model calibration and sensitivity analysis indicated the model reasonably predicted contaminant fate and transport, the model was used to predict baseline contaminant fate and transport conditions for the Spring 2003 VOC plumes. This evaluation included estimating future VOC concentrations at potential exposure points in groundwater over a 70-year human health risk evaluation period. Model-predicted VOC concentrations in general areas of interest over time are detailed in **Table K-6**. **Figure K-13** presents the baseline VOC fate and transport modeling results over time at the FTP. The figures present model-predicted VOC concentrations in model Layer 1 (shallow groundwater) for Spring 2003 conditions, 10 years, 20 years, and 50 years in the future. Layer 1 results were presented because they correspond to the hydrostratigraphic layer in which the FTP shallow groundwater monitoring wells are screened. The model-predicted change in contaminant mass over time is presented in **Table K-7**. Full graphical documentation of the contaminant fate and transport results is presented in **Attachment K-5**.

The FTP baseline contaminant fate and transport modeling results are shown on **Figure K-13** and **Table K-6**. Key results are summarized as follows:

- The baseline contaminant fate and transport modeling results indicated that the benzene, chloroethane, TCE, 1,1-DCE, and vinyl chloride plume concentrations are at their highest predicted concentrations. Most of the VOC plume concentrations will decline below the IAAAP regulatory standards in about 15 to 25 years due to the naturally occurring processes of dispersion and degradation. The benzene plume will decline below the IAAAP regulatory standard (5 µg/L) in about 15 to 20 years, while TCE and 1,1-DCE will take about 20 to 25 years to decline below the standard (7 µg/L). vinyl chloride will take about 50 to 55 years to decline below the regulatory standard (2 µg/L). Chloroethane will be reduced to below the IAAAP regulatory standard (4.6 µg/L) in greater than 70 years.
- The modeling results indicated that the VOC plumes in the high concentration areas would not be transported downgradient any significant distance away from the sources (i.e., the sump monitoring well area).
- The modeling results indicated that the low concentrations of 1,1-DCE and vinyl chloride at the distal edges of the FTP VOC plume will attenuate to below IAAAP regulatory standards in less than 20 years.

K.3.4 Contaminant Fate and Transport Modeling Remedial Alternatives Evaluation

After model calibration and sensitivity analysis indicated the model reasonably predicted contaminant fate and transport, the baseline model was used to help evaluate the effectiveness of the groundwater remediation alternatives previously analyzed using the groundwater flow model. Five different groundwater remediation alternative scenarios were evaluated with MT3DMS (Zheng and Wang 1998). The five alternatives included:

- Alternative 1: No Action
- Alternative 2: Monitored Natural Attenuation
- Alternative 3: Focused Extraction/MNA
- Alternative 4: ISCO/MNA
- Alternative 5: Enhanced Degradation/MNA

The objective of the fate and transport modeling remedial alternative evaluations was to estimate general time frames required to reduce groundwater concentrations of VOCs below their site-specific, risk-based PRGs (see **Section 9** and **Table 9-7**). For comparative purposes, model-predicted results for VOCs are presented on **Figures K-14** through **K-17**. Changes in mass over time for each of the five VOCs modeled for each alternative are presented in **Table K-7**, and times required for reduction of VOCs to below various concentrations are presented on **Table K-8**.

The contaminant fate and transport evaluations used the baseline steady-state groundwater flow model (calibrated to Spring 2003 conditions) for Alternatives 1 and 2. The Focused Extraction flow model (discussed in **Section K.2.4.3**) was used for the contaminant fate and transport evaluation of Alternative 3. The ISCO flow model was used for Alternatives 4 and 5.

K.3.4.1 Alternative 1: No Action

The No Action contaminant fate and transport model was constructed using the VOC concentrations and extents interpreted from the Spring 2003 groundwater sampling results. Modeling results indicated VOC concentrations less than the site-specific, risk based PRGs for the five chemicals modeled can be achieved in 50 to 55 years due to natural attenuation processes (**Figure K-14**). Modeling results for the individual chemicals are presented on **Table K-8**.

The modeling results indicated about 53 percent of the total VOC mass would be removed in the first five years. At 10 years, 73 percent of the total VOC mass would be removed (**Table K-7**).

K.3.4.2 Alternative 2: Monitored Natural Attenuation

The contaminant fate and transport model and results for Alternative 2 was the same as Alternative 1.

K.3.4.3 Alternative 3: Focused Extraction/MNA

The focused extraction alternative was evaluated to simulate the extraction of groundwater through SA-99-1 at a flow rate of 0.25 gpm.

Modeling results indicated VOC concentrations less than the site-specific, risk based PRG of the five chemicals modeled can be achieved in 15 to 20 years due to extraction through SA-99-1 and MNA (**Figure K-15**). Modeling results for the individual chemicals are presented on **Table K-8**.

The modeling results indicated about 90 percent of the total VOC mass would be removed in the first five years. At 10 years, 97 percent of the total VOC mass would be removed (**Table K-7**).

K.3.4.4 Alternative 4: ISCO/MNA

The ISCO alternative was evaluated to simulate the performance of four vertical injection wells and one vertical extraction well located inside the excavated sump area (near SA-99-1).

Modeling results indicated that VOC concentrations less than the site-specific, risk-based PRGs of the five chemicals modeled can be achieved in 15 to 20 years due to ISCO, sump extraction, and MNA (**Figure K-15**). Modeling results for the individual chemicals are presented on **Table K-8**.

The modeling results indicated about 85 percent of the total VOC mass would be removed in the first five years. At 10 years, 95 percent of the total VOC mass would be removed (**Table K-7**).

K.3.4.5 Alternative 5: Enhanced Degradation/MNA

The enhanced degradation alternative was evaluated to simulate the injection of a substrate to stimulate the degradation (e.g., biotic or abiotic) of VOC. This was simulated in the contaminant fate and transport model by doubling the VOC degradation rates (e.g., decreasing the dissolved-phase half-life by half) in the treated area.

Modeling results indicated VOC concentrations less than the site-specific, risk based PRG of the five chemicals modeled can be achieved in 15 to 20 years due to enhanced degradation, ISCO, sump extraction, and MNA (**Figure K-15**). Modeling results for the individual chemicals are presented on **Table K-8**.

The modeling results indicated about 91 percent of the VOC mass would be removed in the first five years. At 10 years, 97 percent of the VOC mass would be removed (**Table K-7**).

K.3.4.6 Contaminant Fate and Transport Modeling Remedial Alternatives Evaluation Conclusions

The groundwater contaminant fate and transport modeling evaluation of the various remedial alternatives is summarized below:

- The VOC plume concentrations will be reduced to less than the risk-based PRGs in 50 to 55 years for the No Action and MNA remedial alternatives.
- The VOC plume concentrations will be reduced to less than the risk-based PRGs in 15 to 20 years for the Focused Extraction, ISCO, and Enhanced Degradation remedial alternatives.

K.4 SUMMARY

Setup and calibration of the FTP groundwater model consisted of incorporating as much of the field investigation data as possible. The initial parameter estimation included all values that were measured or calculated (e.g., hydraulic conductivity, hydraulic gradient, TOC, source chemicals, and initial discretized plume concentrations). These parameters, and others, were estimated to create a conservative model. This model was then used to give a conservative prediction of future contaminant transport.

The groundwater flow modeling and the contaminant fate and transport modeling results are summarized below.

K.4.1 Groundwater Flow Modeling Summary

The groundwater flow model results indicated:

- The overall baseline groundwater flow model calibration was statistically excellent, with model-predicted heads calibrated to within 2.19 percent normalized root mean squared error and 1.64 percent absolute residual mean error.
- The mass balance of the model had a 0.01 percent discrepancy.
- The calibrated baseline groundwater flow model predicted flow directions and hydraulic gradients similar to the flow directions interpreted from the Spring 2003 potentiometric surface maps.
- Advective particle tracking results for the No Action and MNA Alternatives indicated that water particles originating from the sump monitoring well area would be transported to the south, southeast, and east.
- Advective particle tracking results for the Focused Extraction Alternative indicated the extraction well effectively addressed the shallow groundwater near the sump monitoring well.
- Advective particle tracking results for the ISCO and Enhanced Degradation Alternatives indicated the extraction and injection wells effectively addressed the shallow groundwater near the sump monitoring well.
- Advective particle tracking results for all of the alternatives also indicated particles traveling in the FTP shallow groundwater plume area would not be transported into the bedrock groundwater.

K.4.2 Contaminant Fate and Transport Modeling Summary

The groundwater contaminant fate and transport baseline modeling and evaluation of the various remedial alternatives are summarized below:

- The baseline contaminant fate and transport modeling results indicated that the benzene, chloroethane, TCE, 1,1-DCE, and vinyl chloride plume concentrations are at their highest predicted concentrations. Most of the VOC plume concentrations will decline below the IAAAP regulatory standards in about 15 to 25 years due to the naturally occurring processes of dispersion and degradation. The benzene plume will decline below the IAAAP regulatory standard (5 µg/L) in about 15 to 20 years, while TCE and 1,1-DCE will take about 20 to 25 years to decline below the standard (7 µg/L). Vinyl chloride will take about 50 to 55 years to decline below the regulatory standard (2 µg/L). Chloroethane will be reduced to below the IAAAP regulatory standard (4.6 µg/L) in greater than 70 years.
- The modeling results indicated that the VOC plumes in the high concentration areas would not be transported downgradient any significant distance away from the sources (i.e., the sump monitoring well area).

- The modeling results indicated that the low concentrations at the distal edges of the FTP VOC plume will attenuate to below IAAAP regulatory standards in less than 20 years.
- The VOC plume concentrations will be reduced to less than the risk-based PRGs in 50 to 55 years for the No Action and MNA remedial alternatives.
- The VOC plume concentrations will be reduced to less than the risk-based PRGs in 15 to 20 years for the Focused Extraction, ISCO, and Enhanced Degradation remedial alternatives.

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TABLE K-1
GROUNDWATER FLOW MODEL INPUT PARAMETERS
FIRE TRAINING PIT GROUNDWATER MODELING

Model Layer	Geologic Profile	Base of Unit (ft msl)	Layer Thickness (ft)	Horizontal Hydraulic Conductivity K_x, K_y (ft/day)[1]	Vertical Hydraulic Conductivity K_z (ft/day)	K_x,K_y:K_z Ratio	Effective Porosity (%)	Recharge (in/yr)
Layer 1	Shallow Till/Fill	615-655	5-65	0.02-2	0.002-0.2	10:1	0.32	0 to 0.7[2]
	Spring Creek Alluvium			0.4	0.04	10:1	0.32	0
Layer 2	Upper Bedrock	605-645	10	0.001-0.15	0.0001-0.015	10:1	0.22	NA
	Spring Creek Upper Bedrock			0.2	0.02	10:1	0.22	NA
	Intermediate Till			0.01	0.001	10:1	0.32	NA
Layer 3	Bedrock	595-635	10	1x10^{-6}-0.001	1x10^{-7}-0.0001	10:1	0.20	NA
	Deep Till			1x10^{-5}	1x10^{-6}	10:1	0.32	NA
Layer 4	Bedrock	575-615	20	0.001-0.002	0.0001-0.0002	10:1	0.20	NA
	Deep Till			0.001	0.0001	10:1	0.32	NA
Layer 5	Bedrock	555-595	20	0.0001-0.0005	0.00001-0.00005	10:1	0.20	NA
	Deep Till			0.001	0.0001	10:1	0.32	NA
Layer 6	Bedrock	535-575	20	0.0005	0.00005	10:1	0.20	NA
	Deep Till			0.006	0.0006	10:1	0.32	NA
Layer 7	Bedrock	515-555	20	0.0005	0.00005	10:1	0.20	NA

Notes:

% = Percent

ft = Foot or Feet

in = Inch(es)

K_x = hydraulic conductivity in the x direction

K_y = hydraulic conductivity in the y direction

K_z = hydraulic conductivity in the z direction

msl = Mean Sea Level

yr = Year

[1] Hydraulic conductivity values for Layers 1, 2, and 4 were based on calculated values from field measurements and model calibration. Field measurements were not available for Layers 3, 5, 6, and 7; therefore, hydraulic conductivity values were based on literature values, other values at IAAAP, and model calibration.

[2] Recharge values ranged from 0 to 0.7 inches per year in most areas of the model. Localized groundwater mounds were simulated with 1 to 20 inches per year based on model calibration.

TABLE K-2
COMPARISON OF MEASURED GROUNDWATER ELEVATIONS AND MODEL-PREDICTED GROUNDWATER ELEVATIONS
FIRE TRAINING PIT GROUNDWATER MODELING

Observation Well Name	Model Location			Groundwater Elevation May 2003 (ft msl)	Model-Predicted Baseline Groundwater Elevation (ft msl)	Model-Predicted Head Difference (ft)
	Layer	Row	Column			
EBP-MW3	1	54	239	685.32	685.25	-0.07
EDA-01	1	20	256	688.57	688.51	-0.06
EDA-02(B)	1	98	212	656.39	656.48	0.09
EDA-04	1	40	309	678.87	678.01	-0.86
FTA-99-1	1	198	72	659.93	660.45	0.52
FTP-MW1	1	212	69	654.42	655.09	0.67
FTP-MW2	1	200	91	652.40	652.00	-0.40
FTP-MW5	1	163	86	663.36	663.44	0.08
FTP-MW7	1	216	19	669.36	669.86	0.50
G-29	1	93	275	679.94	680.67	0.73
JAW-04(B)	1	113	192	648.91	647.93	-0.98
JAW-05	1	80	297	682.42	681.15	-1.27
JAW-06	1	37	319	672.34	672.13	-0.21
JAW-07	1	62	316	679.69	678.86	-0.83
JAW-23	1	100	87	649.10	648.54	-0.56
JAW-24	1	106	136	636.60	635.84	-0.76
JAW-25	1	130	76	684.15	682.97	-1.18
JAW-58	1	164	55	683.16	681.72	-1.44
JAW-59	1	185	39	673.78	673.65	-0.13
JAW-60	1	176	58	671.44	673.68	2.24
JAW-61	1	180	30	679.61	677.46	-2.15
JAW-62	1	170	28	681.66	682.33	0.67
JAW-63	1	156	32	684.27	683.47	-0.80
JAW-64	1	13	294	680.48	680.24	-0.24
JAW-68	1	140	95	675.57	675.70	0.13
JAW-80	1	205	46	668.27	666.56	-1.71
M-01	1	236	53	661.16	660.77	-0.39
SA-99-1(SUMP)	1	166	40	683.45	683.82	0.37
WBP-99-1	1	135	59	666.34	667.24	0.90
WBP-99-2	1	109	56	658.70	657.96	-0.74
WBP-99-3(B)	1	138	143	644.89	643.61	-1.28
EBP-MW4(B)	2	82	183	645.04	646.45	1.41
EBP-MW5(B)	2	148	189	636.73	637.00	0.27
FTP-MW3(B)	2	179	108	642.25	644.69	2.44
G-30(B)	2	162	114	644.43	645.04	0.61
JAW-614(B)	2	121	236	654.96	653.96	-1.00
WBP-99-4(B)	2	97	58	655.48	656.03	0.55
WBP-99-5(B)	2	100	110	640.49	642.83	2.34
EBP-MW1(B)	4	171	242	636.39	636.98	0.59
EBP-MW6(B)	4	147	188	640.96	639.42	-1.54
FTA-99-2(B)	4	198	71	650.09	650.44	0.35
FTP-MW4(B)	4	186	40	665.73	665.67	-0.06
FTP-MW6(B)	4	163	87	647.47	647.15	-0.32
FTP-MW8(B)	4	216	20	666.67	666.23	-0.44
WBP-99-6(B)	4	100	87	639.24	641.70	2.46

TABLE K-2
COMPARISON OF MEASURED GROUNDWATER ELEVATIONS AND MODEL-PREDICTED GROUNDWATER ELEVATIONS
FIRE TRAINING PIT GROUNDWATER MODELING

Observation Well Name	Model Location			Groundwater Elevation May 2003 (ft msl)	Model-Predicted Baseline Groundwater Elevation (ft msl)	Model-Predicted Head Difference (ft)
	Layer	Row	Column			
WBP-99-7(B)	4	141	142	641.58	641.46	-0.12
WBP-MW1(B)	4	100	111	640.32	640.86	0.54
WBP-MW2(B)	4	105	137	643.80	640.40	-3.40
EBP-MW2	6	110	300	637.95	638.45	0.50
					Absolute Residual Mean	0.86

Notes:

ft = Foot or Feet

msl = Mean Sea Level

TABLE K-3
SUMMARY OF BASELINE GROUNDWATER FLOW MODEL CALIBRATION STATISTICS
FIRE TRAINING PIT GROUNDWATER MODELING

Observation Location	Number of Calibration Data Points	Absolute Residual Mean (feet)	Root Mean Squared (RMS) (feet)	Total Head Change Within Flow Region (feet)	Absolute Residual Mean as a Percentage of Total Head Change (%)	Normalized RMS (%)
Layer 1	31	0.74	0.94	51.97	1.43%	1.80%
Layer 2	7	1.23	1.47	18.88	6.53%	7.81%
Layer 4	10	0.98	1.45	30.07	3.27%	4.83%
Layer 6	1	0.50	0.50	NA	NA	NA
Total Model	49	0.86	1.14	52.18	1.64%	2.19%

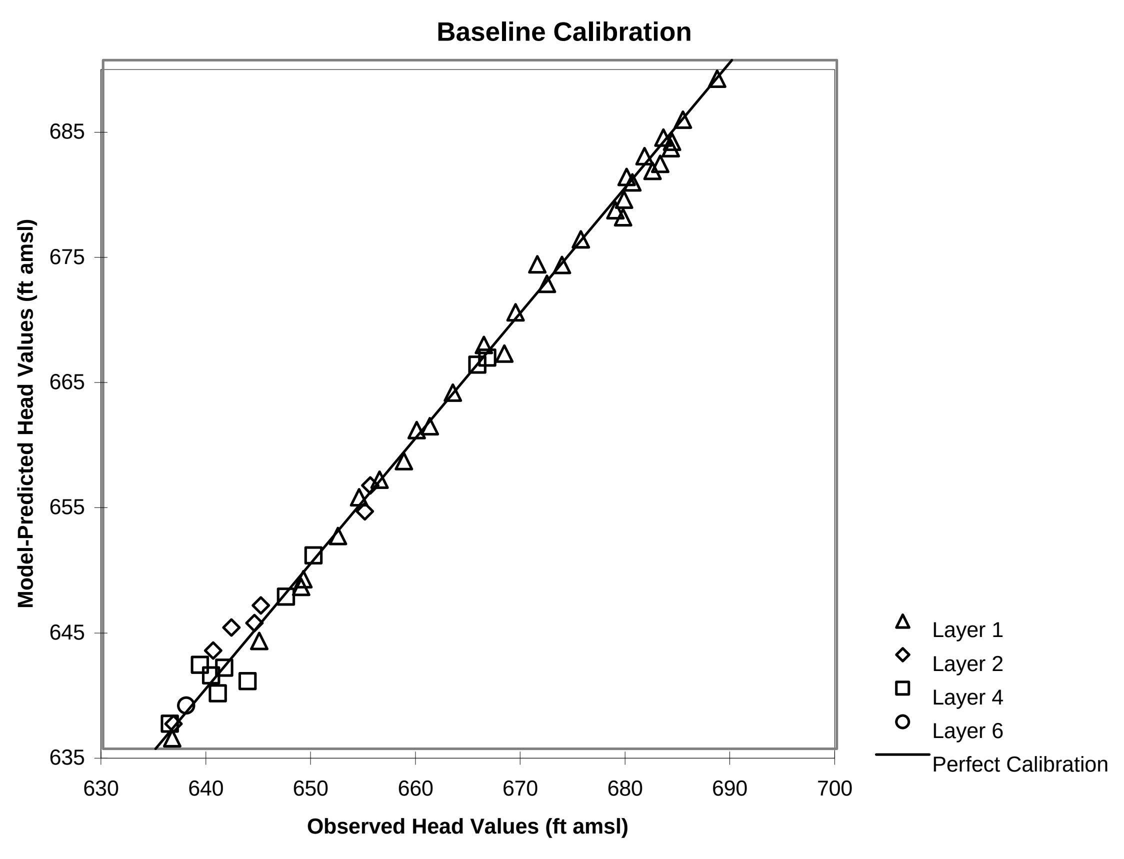


TABLE K-4
GROUNDWATER FLOW MODEL SENSITIVITY ANALYSIS
FIRE TRAINING PIT GROUNDWATER MODELING

Area of Interest	Hydraulic Conductivity (ft/day)[1]	Normalized RMS (All model layers)
Layer 1		
High Hydraulic Conductivity	1	2.28%
	2	**2.19%**
	4	2.27%
Low Hydraulic Conductivity	0.015	6.36%
	0.03	**2.19%**
	0.06	5.43%
Layer 4		
Hydraulic Conductivity	0.001	2.31%
	0.002	**2.19%**
	0.004	2.26%
Area of Interest	**Recharge Value (in/yr)[2]**	**Normalized RMS (All model layers)**
Area near JAW-25	10	2.3%
	20	**2.19%**
	40	2.26%
Area near the sump (SA-99-1)	2.5	3.43%
	5	**2.19%**
	10	4.39%
Area near EDA-01	2.5	2.62%
	5	**2.19%**
	10	3.16%

Notes:

ft/day = Foot or Feet Per Day
in/yr = Inch(es) Per Year
RMS = Root Mean Squared

[1] **Bold** indicates values used in final calibrated groundwater flow model.

[2] See **Figure K-4** for aerial distribution of recharge zones.

TABLE K-5
CONTAMINANT FATE AND TRANSPORT MODEL INPUT PARAMETERS
FIRE TRAINING PIT GROUNDWATER MODELING

Geologic Profile	Chemical	Sorbed Degradation Half-Life ($t_{1/2}$ - years)[1]	Dissolved Degradation Half-Life ($t_{1/2}$ - years)[1]	Dissolved First Order Rate Constant (k - 1/day)[2]	Total Organic Carbon (TOC) (% by weight)	Sorption Coefficient (K_d - mL/g)[3]	Bulk Density (g/cc)	Retardation Factor (R)[4]	Dispersivity (D_l - feet)[5]	Dispersivity Ratio (D_l:D_t:D_v)[6]
Shallow Till	Benzene	100	2.2	8.6E-04	0.10%	0.17	1.7	1.88	10-80	100:20:1
	Chloroethane	100	8.9	2.1E-04	0.10%	0.02	1.7	1.13	10-80	100:20:1
	TCE	100	3.9	4.9E-04	0.10%	0.07	1.7	1.36	10-80	100:20:1
	1,1-DCE	100	2.1	9.0E-04	0.10%	0.04	1.7	1.19	10-80	100:20:1
	Vinyl Chloride	100	8.7	2.2E-04	0.10%	0.02	1.7	1.13	10-80	100:20:1
Intermediate Till	Benzene	100	2.2	8.6E-04	0.10%	0.17	1.7	1.88	10	100:20:1
	Chloroethane	100	8.9	2.1E-04	0.10%	0.02	1.7	1.13	10	100:20:1
	TCE	100	4.5	4.2E-04	0.10%	0.07	1.7	1.36	10	100:20:1
	1,1-DCE	100	2.1	9.0E-04	0.10%	0.04	1.7	1.19	10	100:20:1
	Vinyl Chloride	100	8.7	2.2E-04	0.10%	0.02	1.7	1.13	10	100:20:1
Deep Till	Benzene	100	2.2	8.6E-04	0.10%	0.17	1.7	1.88	10	100:20:1
	Chloroethane	100	8.9	2.1E-04	0.10%	0.02	1.7	1.13	10	100:20:1
	TCE	100	4.5	4.2E-04	0.10%	0.07	1.7	1.36	10	100:20:1
	1,1-DCE	100	2.1	9.0E-04	0.10%	0.04	1.7	1.19	10	100:20:1
	Vinyl Chloride	100	8.7	2.2E-04	0.10%	0.02	1.7	1.13	10	100:20:1
Upper Bedrock	Benzene	100	2.2	8.6E-04	0.05%	0.08	2.1	1.79	10	100:20:1
	Chloroethane	100	8.9	2.1E-04	0.05%	0.01	2.1	1.11	10	100:20:1
	TCE	100	4.5	4.2E-04	0.05%	0.03	2.1	1.32	10	100:20:1
	1,1-DCE	100	2.1	9.0E-04	0.05%	0.02	2.1	1.17	10	100:20:1
	Vinyl Chloride	100	8.7	2.2E-04	0.05%	0.01	2.1	1.11	10	100:20:1
Bedrock	Benzene	100	2.2	8.6E-04	0.03%	0.05	2.2	1.55	10	100:20:1
	Chloroethane	100	8.9	2.1E-04	0.03%	0.01	2.2	1.08	10	100:20:1
	TCE	100	4.5	4.2E-04	0.03%	0.02	2.2	1.22	10	100:20:1
	1,1-DCE	100	2.1	9.0E-04	0.03%	0.01	2.2	1.12	10	100:20:1
	Vinyl Chloride	100	8.7	2.2E-04	0.03%	0.01	2.2	1.08	10	100:20:1

Notes:

% = Percent
1,1-DCE = 1,1-Dichloroethene
g/cc = Grams Per Cubic Centimeter
mL/g = Milliliters Per Gram
TCE = Trichloroethene

[1] Site-specific half-life values were calculated from historical data and can be found in **Appendix K**.
[2] $k = \ln(2)/t_{1/2}$
[3] $K_d = K_{oc}$*TOC; See **Table 8-1**
[4] $R = 1+(\rho b * K_d)/\eta$
[5] Assumed D_l value based on 1/10 transport distance (Gelhar 1992, Anderson 1979)
[6] D_t and D_v based on existing and calibrated model-predicted plume geometries.

TABLE K-6
BASELINE CONTAMINANT FATE AND TRANSPORT MODELING RESULTS
FIRE TRAINING PIT GROUNDWATER MODELING

			IAAAP Regulatory	Model-Predicted Concentrations (in µg/L)			
Groundwater Plume	**Location**	**Chemical**	**Standard (in µg/L)**	**@0-years[1]**	**@10-years**	**@20-years**	**@70-years**
FTP VOC Plumes	- groundwater near SA-99-1 (Sump Area)	Benzene	5	110	18	3	<1
		Chloroethane	4.6	3700	1470	582	<1
		TCE	5	3	1	<1	<1
		1,1-DCE	7	28	6	<1	<1
		Vinyl Chloride	2	360	135	43	<1
	- groundwater near JAW-60 and JAW-61	Benzene	5	11	5	1	<1
		Chloroethane	4.6	<3	8	27	7
		TCE	5	74/120	27	4	<1
		1,1-DCE	7	380/190	22	1	<1
		Vinyl Chloride	2	<3	3	7	<1
	- groundwater near JAW-58	1,1-DCE	7	81/2800	120	5	<1
	- groundwater near FTP-MW1	Vinyl Chloride	2	19	2	<2	<2

Notes:

µg/L = Micrograms Per Liter

1,1-DCE = 1,1-Dichloroethene

FTP = Fire Training Pit

TCE = Trichloroethene

VOC = Volatile Organic Compound

[1] Concentration values at 0 years were based upon Spring 2003 groundwater monitoring results (URS 2003, HGL 2003b). This information can be found in **Table 5-2**.

TABLE K-7
MODEL-PREDICTED CHANGE IN TOTAL VOC MASS OVER TIME FOR REMEDIAL ALTERNATIVES
FIRE TRAINING PIT GROUNDWATER MODELING

Baseline and Alternatives 1 & 2
No Action/MNA

Time Elapsed (years)	Mass Remaining[1]	
	lb	% of Initial Mass
0[2]	53.0	100.0%
1	44.7	84.4%
5	25.0	47.1%
10	14.4	27.1%
15	9.3	17.5%
20	6.3	11.9%
25	4.4	8.3%
30	3.1	5.8%
35	2.2	4.1%
40	1.6	2.9%
45	1.1	2.1%
50	0.8	1.5%
55	0.6	1.0%
60	0.4	0.7%
65	0.3	0.5%
70	0.2	0.4%

Remedial Alternative 3
Focused Extraction/MNA

Time Elapsed (years)	Mass Remaining[1]	
	lb	% of Initial Mass
0[2]	53.0	100.0%
1	17.3	32.6%
5	5.6	10.5%
10	1.6	3.0%
15	0.5	1.0%
20	0.2	0.4%
25	0.1	0.2%
30	0.0	0.1%
35	0.0	0.0%
40	0.0	0.0%
45	0.0	0.0%
50	0.0	0.0%
55	0.0	0.0%
60	0.0	0.0%
65	0.0	0.0%
70	0.0	0.0%

Remedial Alternative 4
ISCO/MNA

Time Elapsed (years)	Mass Remaining[1]	
	lb	% of Initial Mass
0[2]	53.0	100.0%
1	24.4	46.1%
5	8.2	15.5%
10	2.6	4.9%
15	1.0	1.9%
20	0.5	0.9%
25	0.2	0.5%
30	0.2	0.3%
35	0.1	0.2%
40	0.1	0.1%
45	0.0	0.1%
50	0.0	0.1%
55	0.0	0.0%
60	0.0	0.0%
65	0.0	0.0%
70	0.0	0.0%

Remedial Alternative 5
Enhanced Degradation/MNA

Time Elapsed (years)	Mass Remaining[1]	
	lb	% of Initial Mass
0[2]	53.0	100.0%
1	21.4	40.4%
5	4.9	9.3%
10	1.3	2.5%
15	0.5	1.0%
20	0.2	0.4%
25	0.1	0.2%
30	0.1	0.1%
35	0.0	0.1%
40	0.0	0.1%
45	0.0	0.0%
50	0.0	0.0%
55	0.0	0.0%
60	0.0	0.0%
65	0.0	0.0%
70	0.0	0.0%

Notes:

% = Percent
1,1-DCE = 1,1-Dichloroethene
ISCO = In-Situ Chemical Oxidation
lb = Pound(s)
MNA = Monitored Natural Attenuation
TCE = Trichloroethene

[1] Percent of initial mass was calculated using the model-predicted mass at the respective time period, divided by the mass in the initial (0 year) time period. The initial mass used was the total benzene, chloroethane, TCE, 1,1-DCE, and vinyl chloride mass in the model at 1 day.

[2] Mass at 0 years was based on Spring 2003 groundwater monitoring results (URS 2003, HGL 2003b).

TABLE K-8
SUMMARY OF CONTAMINANT FATE AND TRANSPORT MODELING RESULTS OF REMEDIAL ALTERNATIVES
FIRE TRAINING PIT GROUNDWATER MODELING

Alternative	Amount of time for plume concentration to be reduced below:[1]				
	Benzene <6 μg/L	Chloroethane <110 μg/L	TCE <30 μg/L	1,1-DCE <920 μg/L	Vinyl Chloride <2 μg/L
Alternatives 1 and 2 - No Action and MNA	15-20	35-40	5-10	<5	50-55
Alternative 3 - Focused Extraction/MNA	10-15	5-10	5-10	<5	15-20
Alternative 4 - ISCO/MNA	10-15	5-10	5-10	<5	15-20
Alternative 5 - Enhanced Degradation/MNA	10-15	5-10	5-10	<5	15-20

Notes:

< = Less than

μg/L = Micrograms per liter

DCE = Dichloroethene

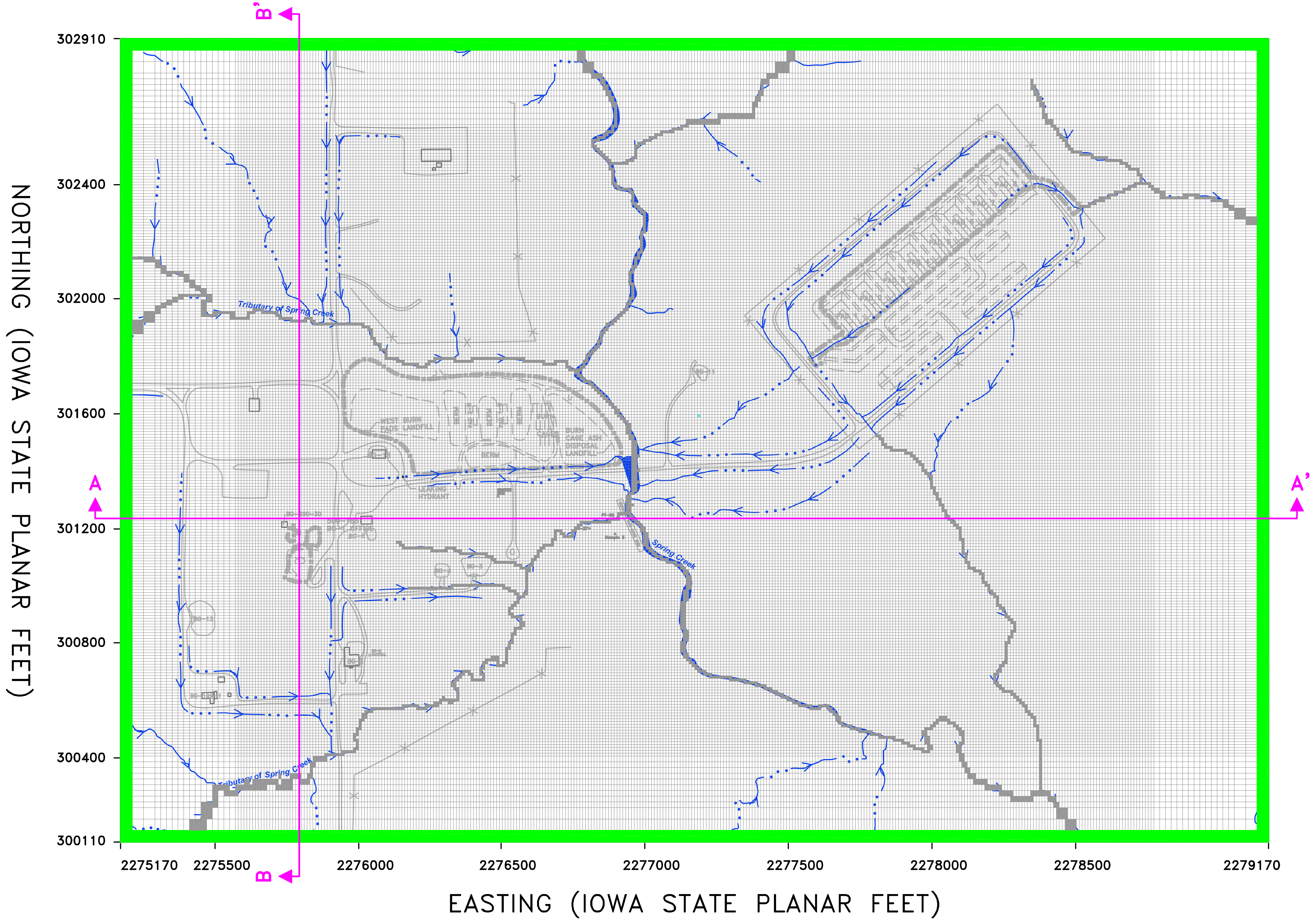
ISCO = In-Situ Chemical Oxidation

MNA = Monitored Natural Attenuation

TCE = Trichloroethene

VC = Vinyl Chloride

See **Figures K-13** to **K-17** for the model-predicted extent of chemicals in groundwater for each alternative.



LEGEND:

→—	TRIBUTARY
→· · ·	INTERMITTENT TRIBUTARY/DRAINAGE
—×—	FENCE LINE
A A'	CROSS-SECTION LOCATION
▦	GRIDLINES
🟩	GENERAL HEAD BOUNDARY
▬	DRAIN NODE

NOTES:

1. CROSS-SECTIONS A-A' AND B-B' ARE ALONG ROW 152 AND COLUMN 40, RESPECTIVELY.
2. SEE FIGURES K-2 AND K-3 FOR CROSS-SECTIONS A-A' AND B-B', RESPECTIVELY.

N

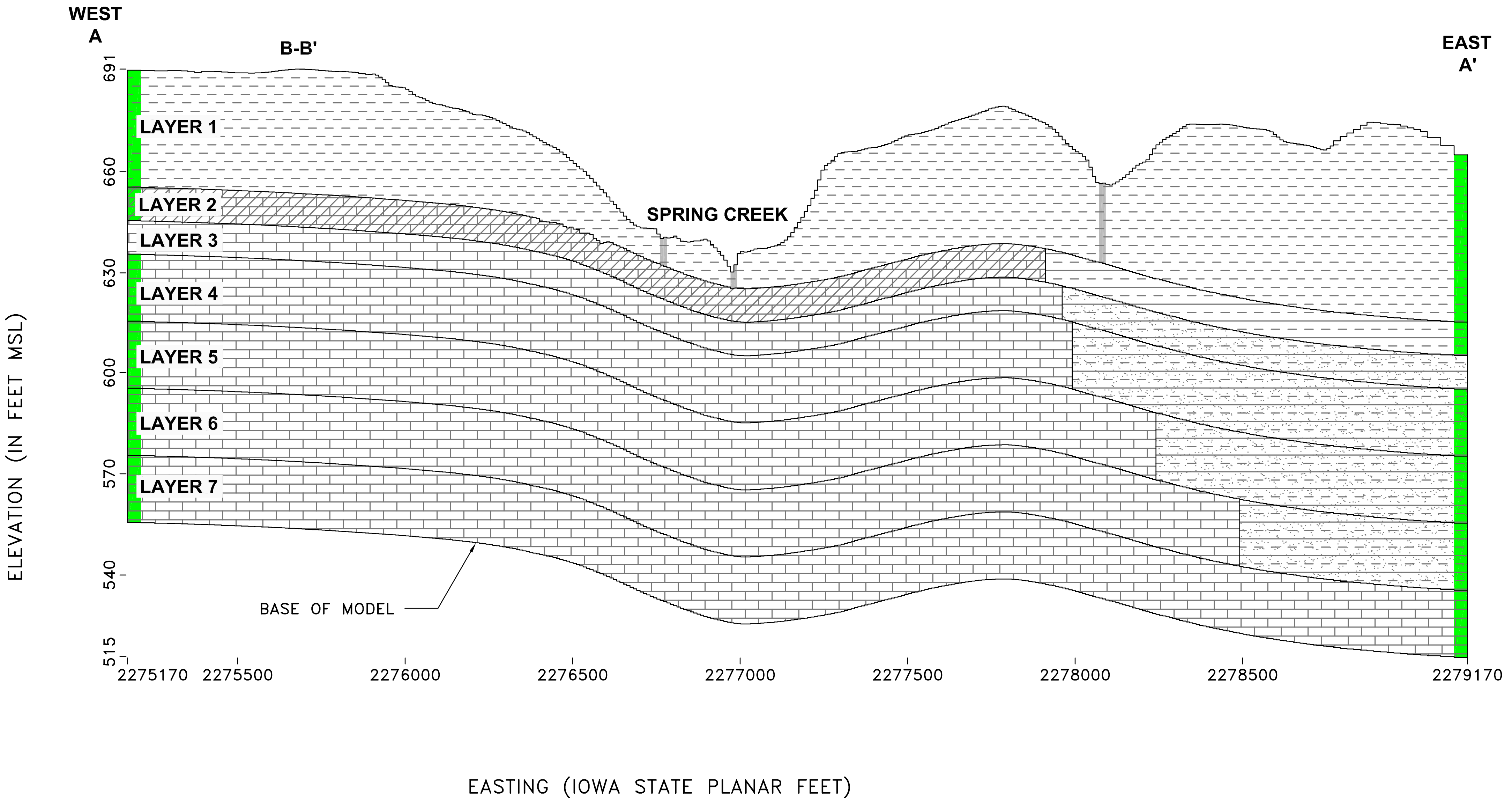
400 200 0 400
SCALE IN FEET

URS

GROUNDWATER FLOW MODEL GRID, BASEMAP, AND BOUNDARY CONDITIONS
FIRE TRAINING PIT GROUNDWATER MODELING

DRN. BY: JJS	DATE: 04/20/04	PROJECT NO. 16169421	FIG. NO. K-1
CHK'D. BY: TLT	DATE: 04/20/04		

March 12, 2004 2:21:36 p.m.
Drawing: T:\IAAAP\16169556\EDA\FTP\K-1.dwg



LEGEND:

▤ **LAYER 1 - SHALLOW TILL, FILL, AND WEATHERED BEDROCK (CL-CH)**

▤ **LAYER 2 - INTERMEDIATE TILL (CL-CH)**

▨ **LAYER 2 - UPPER BEDROCK**

▒ **LAYERS 3, 4, 5, AND 6 - DEEP TILL (CL)**

▦ **LAYERS 3, 4, 5, 6, AND 7 - BEDROCK**

■ **DRAIN NODE**

🟩 **GENERAL HEAD BOUNDARY**

NOTES:

1. **VERTICAL EXAGGERATION IS 10:1**
2. **CROSS-SECTION A-A' IS ALONG ROW 152.**
3. **SEE FIGURE K-1 FOR CROSS-SECTION LOCATION.**

40 20 0 40
VERTICAL SCALE IN FEET

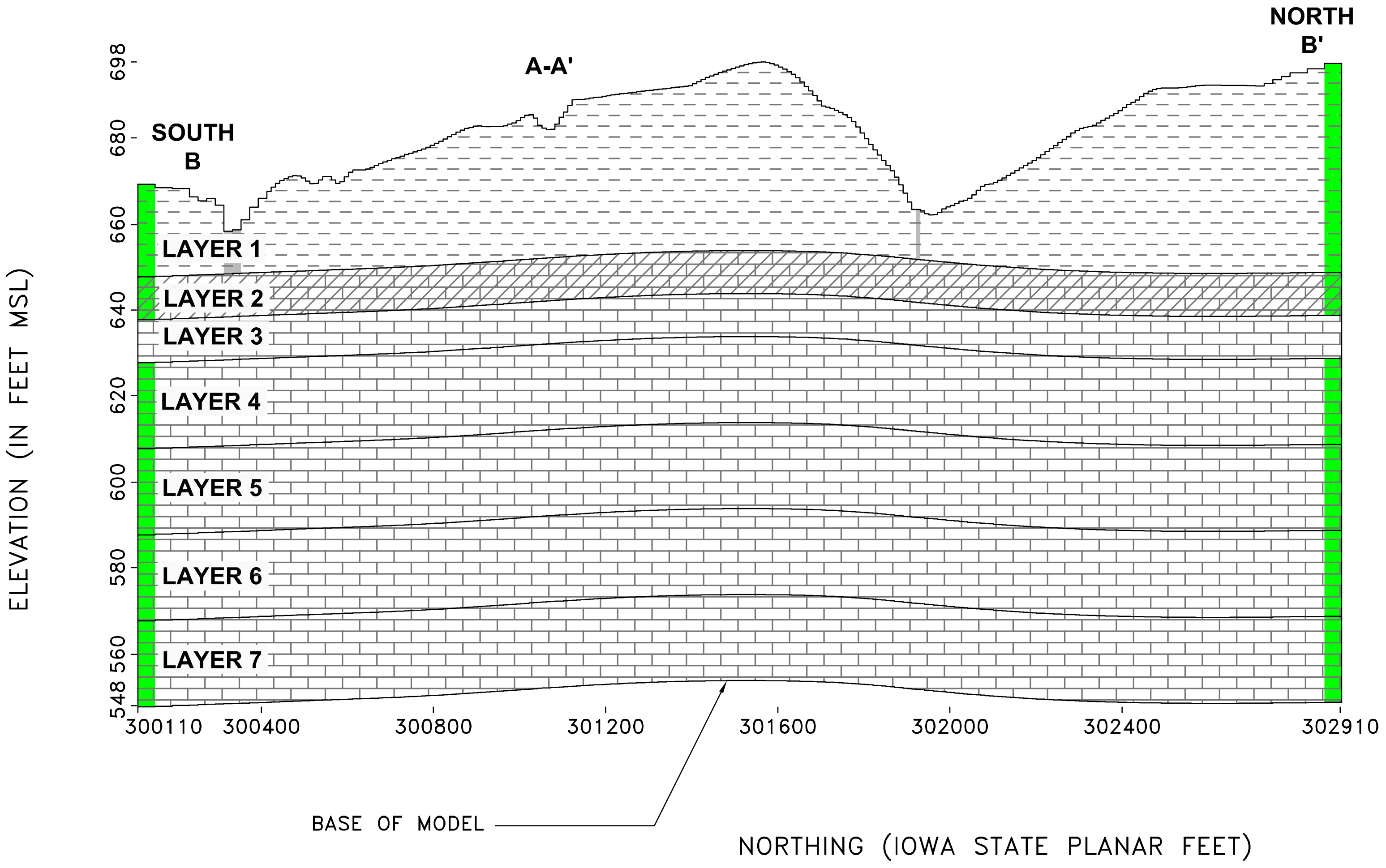
400 200 0 400
HORIZONTAL SCALE IN FEET

March 15, 2004 10:49:43 a.m.
Drawing: T:\IAAAP\16169556\EDA\FTP\FTPmodxsect.dwg

URS

MODEL–GENERATED CROSS–SECTION A–A'
FIRE TRAINING PIT GROUNDWATER MODELING

DRN. BY: DAC	DATE: 12/17/03	PROJECT NO. 16169421	FIG. NO. K–2
CHK'D. BY: TLT	DATE: 05/05/04		



LEGEND:

▤ **LAYER 1 - SHALLOW TILL, FILL, AND WEATHERED BEDROCK (CL-CH)**

▨ **LAYER 2 - UPPER BEDROCK**

▦ **LAYERS 3, 4, 5, 6, AND 7 - BEDROCK**

⬜ **DRAIN NODE**

🟩 **GENERAL HEAD BOUNDARY**

NOTES:

1. **VERTICAL EXAGGERATION IS 10:1**
2. **CROSS-SECTION B-B' IS ALONG COLUMN 40.**
3. **SEE FIGURE K-1 FOR CROSS-SECTION LOCATION.**

40 20 0 40
VERTICAL SCALE IN FEET

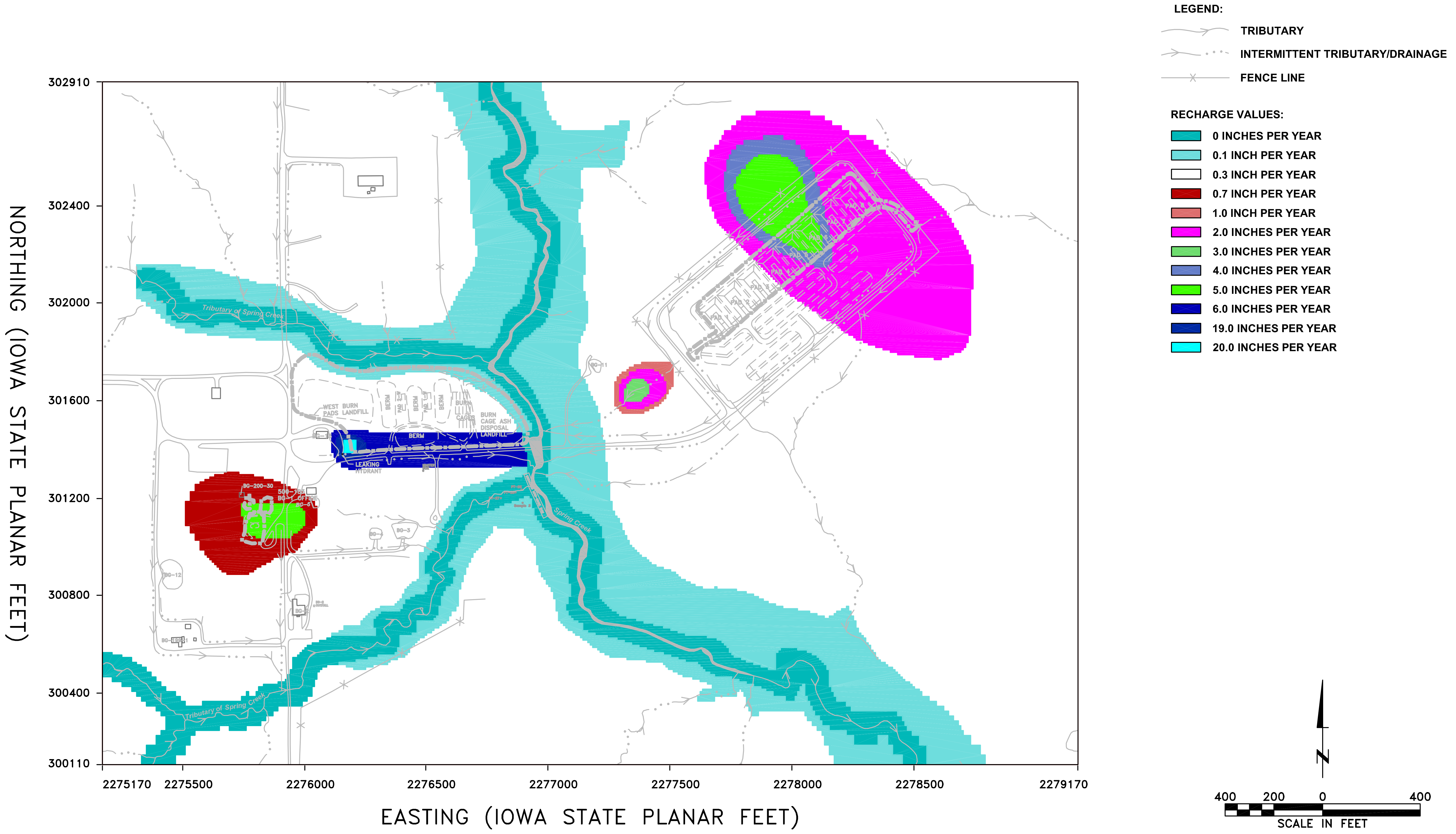
400 200 0 400
HORIZONTAL SCALE IN FEET

March 15, 2004 10:49:43 a.m.
Drawing: T:\IAAAP\16169556\EDA\FTP\FTPmodxsect.dwg

URS

MODEL–GENERATED CROSS–SECTION B–B'
FIRE TRAINING PIT GROUNDWATER MODELING

DRN. BY: DAC	DATE: 12/17/03	PROJECT NO. 16169421	FIG. NO. K–3
CHK'D. BY: TLT	DATE: 05/05/04		

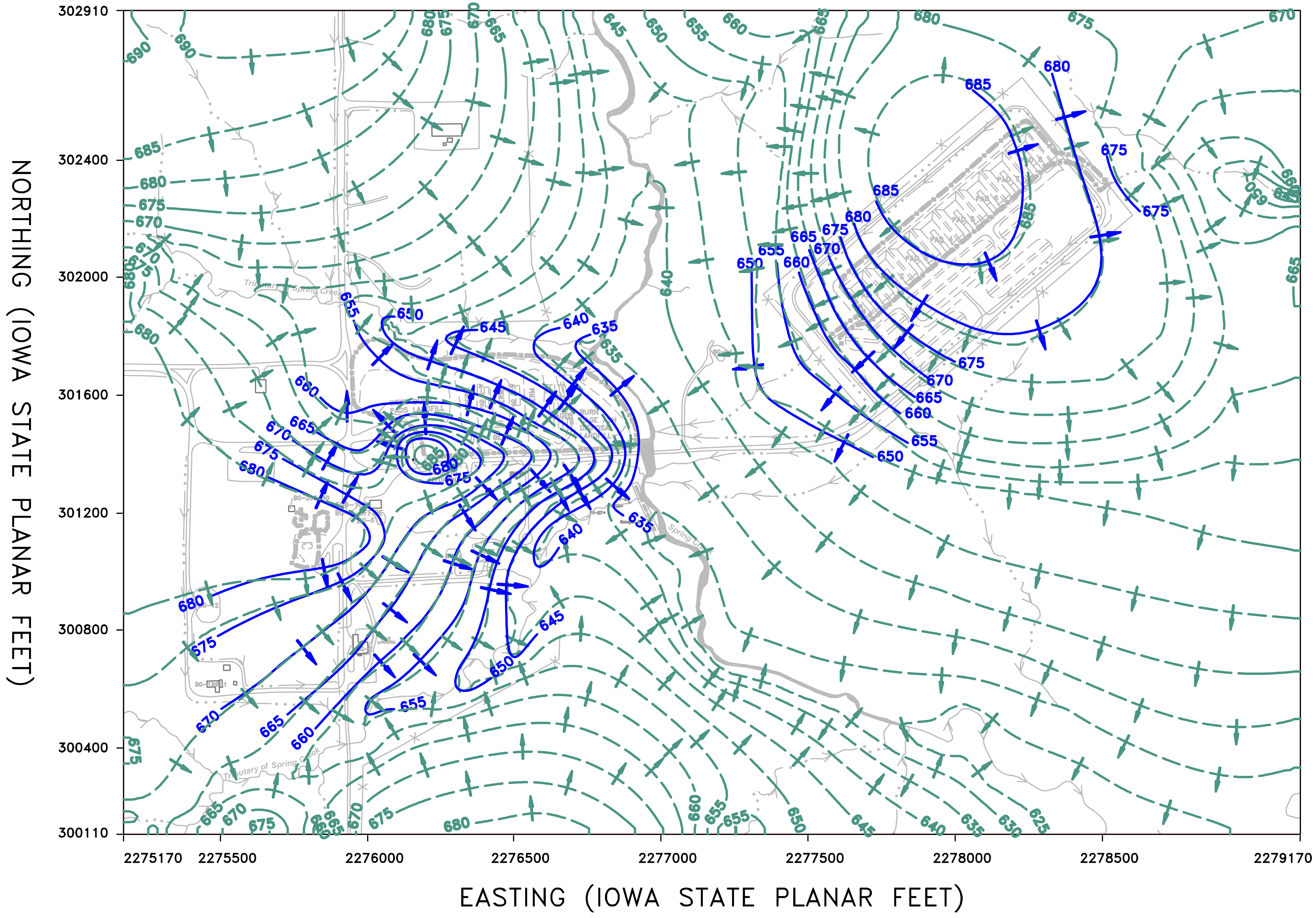


March 12, 2004 2:16:06 p.m.
Drawing: T:\IAAAP\16169556\EDA\FTP\K-4.dwg

URS

RECHARGE VALUES – LAYER 1
FIRE TRAINING PIT GROUNDWATER MODELING

DRN. BY: JJS	DATE: 04/20/04	PROJECT NO. 16169421	FIG. NO. K-4
CHK'D. BY: TLT	DATE: 04/20/04		



LEGEND:

	TRIBUTARY
	INTERMITTENT TRIBUTARY/DRAINAGE
	FENCE LINE
	GROUNDWATER FLOW DIRECTION
683	INTERPRETED SHALLOW GROUNDWATER POTENTIOMETRIC SURFACE - JUNE 2003
680	MODEL-PREDICTED SHALLOW GROUNDWATER POTENTIOMETRIC SURFACE

NOTES:

1. POTENTIOMETRIC SURFACE ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL (MSL).
2. THE CONTOUR INTERVAL FOR THE POTENTIOMETRIC SURFACES IS 5 FEET.

N

400 200 0 400

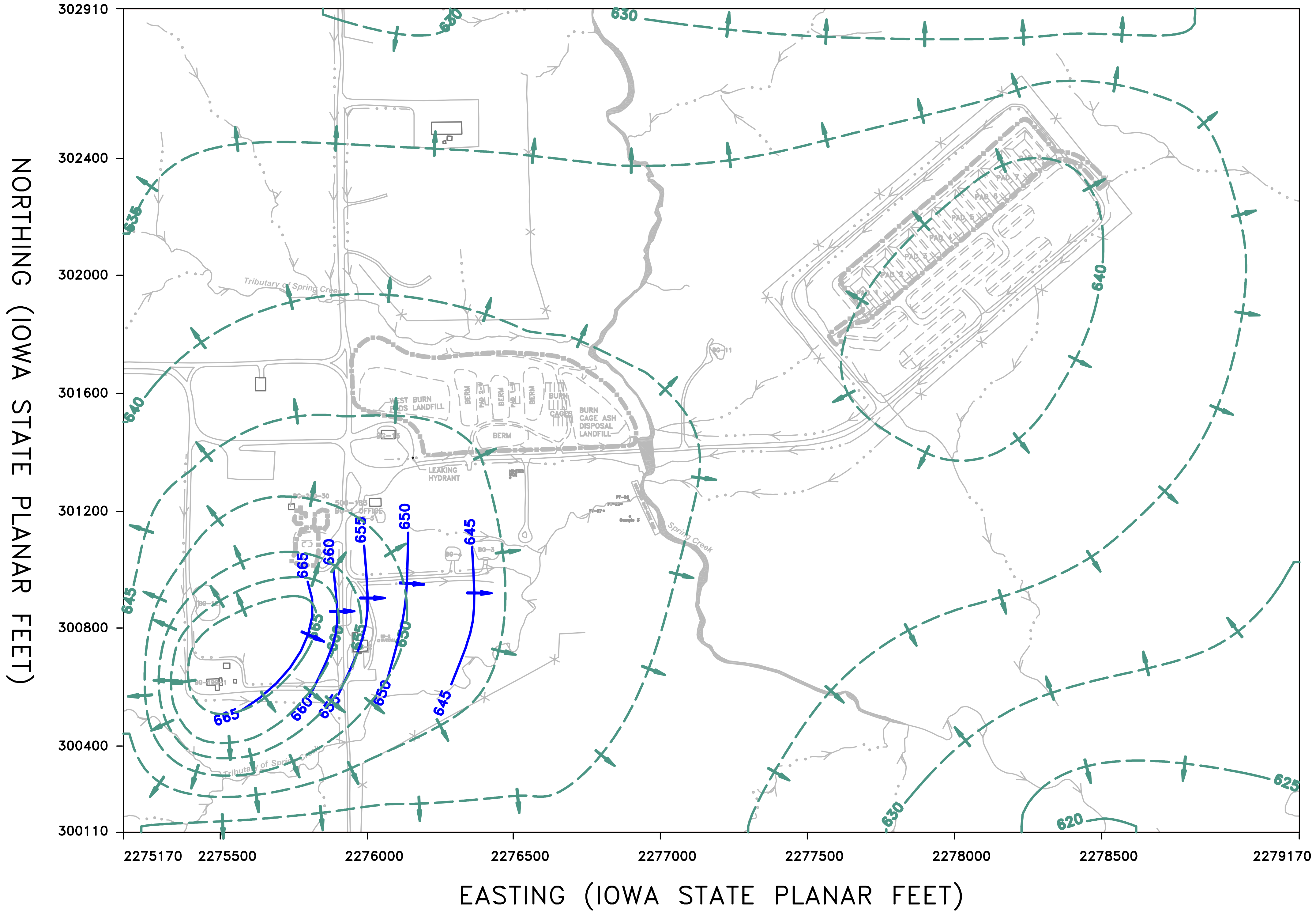
SCALE IN FEET

URS

MODEL–PREDICTED AND INTERPRETED SHALLOW
GROUNDWATER POTENTIOMETRIC SURFACES
FIRE TRAINING PIT GROUNDWATER MODELING

DRN. BY: JJS	DATE: 04/20/04	PROJECT NO. 16169421	FIG. NO. K–5
CHK'D. BY: TLT	DATE: 04/20/04		

March 15, 2004 10:53:38 a.m.
Drawing: T:\IAAAP\16169556\EDA\FTP\FTPmodbase2.dwg

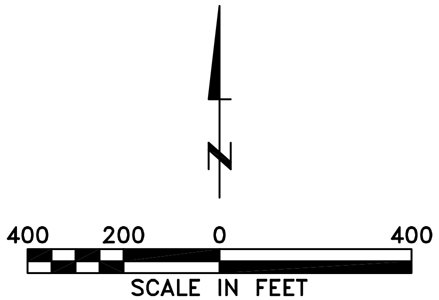


LEGEND:

⟶	TRIBUTARY
⟶ · · ·	INTERMITTENT TRIBUTARY/DRAINAGE
—x—	FENCE LINE
➚ ➚	GROUNDWATER FLOW DIRECTION
683 ——	INTERPRETED BEDROCK GROUNDWATER POTENTIOMETRIC SURFACE-JUNE 2003
680 - - -	MODEL-PREDICTED BEDROCK GROUNDWATER POTENTIOMETRIC SURFACE

NOTES:

1. POTENTIOMETRIC SURFACE ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL (MSL).
2. THE CONTOUR INTERVAL FOR THE POTENTIOMETRIC SURFACES IS 5 FEET.



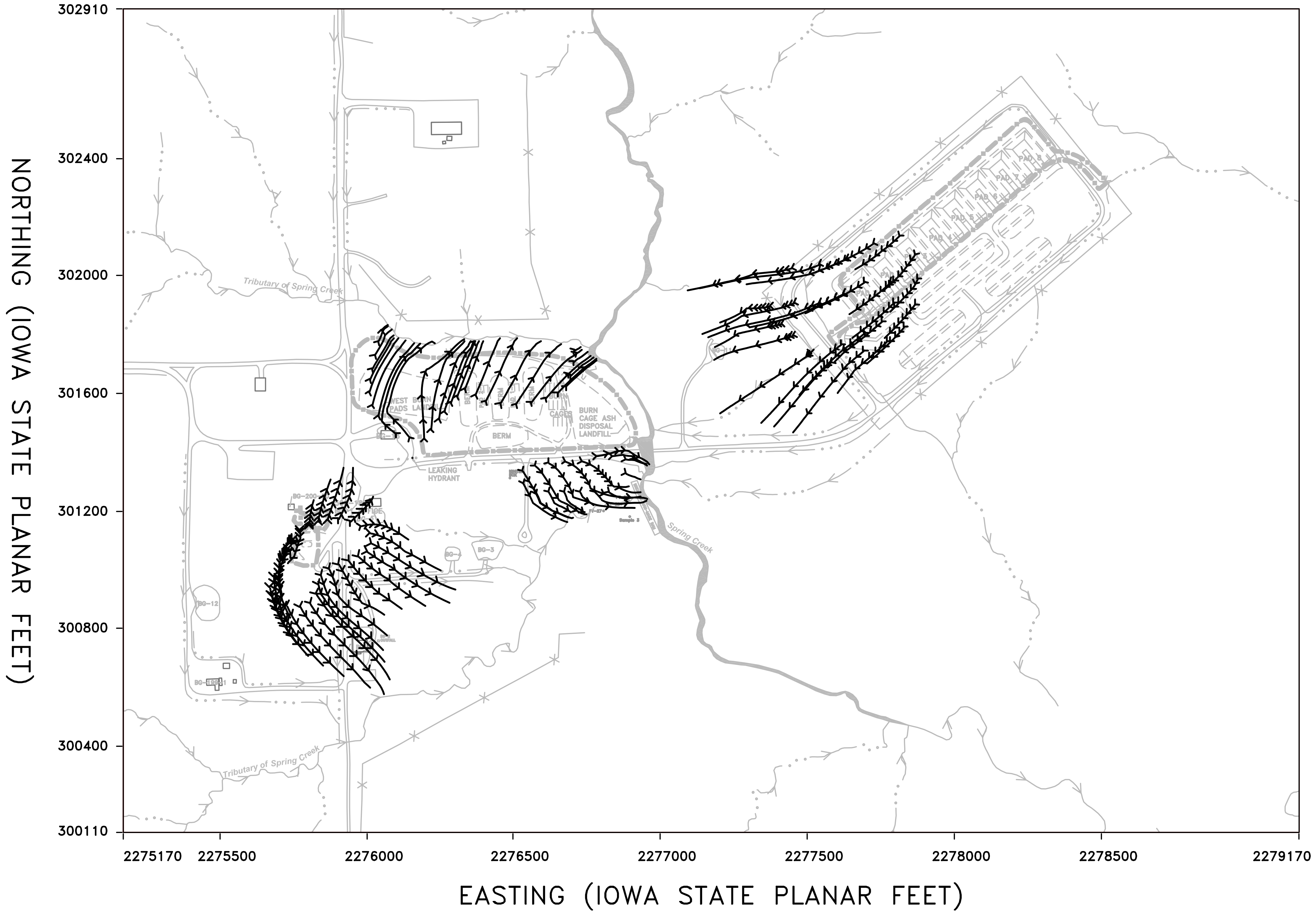
SCALE IN FEET

URS

MODEL–PREDICTED AND INTERPRETED BEDROCK
GROUNDWATER POTENTIOMETRIC SURFACES
FIRE TRAINING PIT GROUNDWATER MODELING

DRN. BY: JJS	DATE: 04/20/04	PROJECT NO. 16169421	FIG. NO. K–6
CHK'D. BY: TLT	DATE: 04/20/04		

March 15, 2004 10:53:38 a.m.
Drawing: T:\IAAAP\16169556\EDA\FTP\FTPmodbase2.dwg



LEGEND:

→	TRIBUTARY
→ · · ·	INTERMITTENT TRIBUTARY/DRAINAGE
—×—	FENCE LINE
	ADVECTIVE PARTICLE PATHS (10-YEAR TICK MARKS)

NOTES:

1. ADVECTIVE PARTICLES WERE STARTED IN LAYER 1 AROUND THE INTERPRETED SOURCE LOCATIONS AND MODELED FOR 70 YEARS.
2. TICK MARKS REPRESENT MODEL-PREDICTED 10-YEAR ADVECTIVE PARTICLE TRANSPORT DISTANCES ALONG EACH FLOW PATH.
3. CROSS-SECTIONAL VIEW OF PARTICLE FLOW PATHS CAN BE FOUND ON FIGURE K-8.

N

400 200 0 400

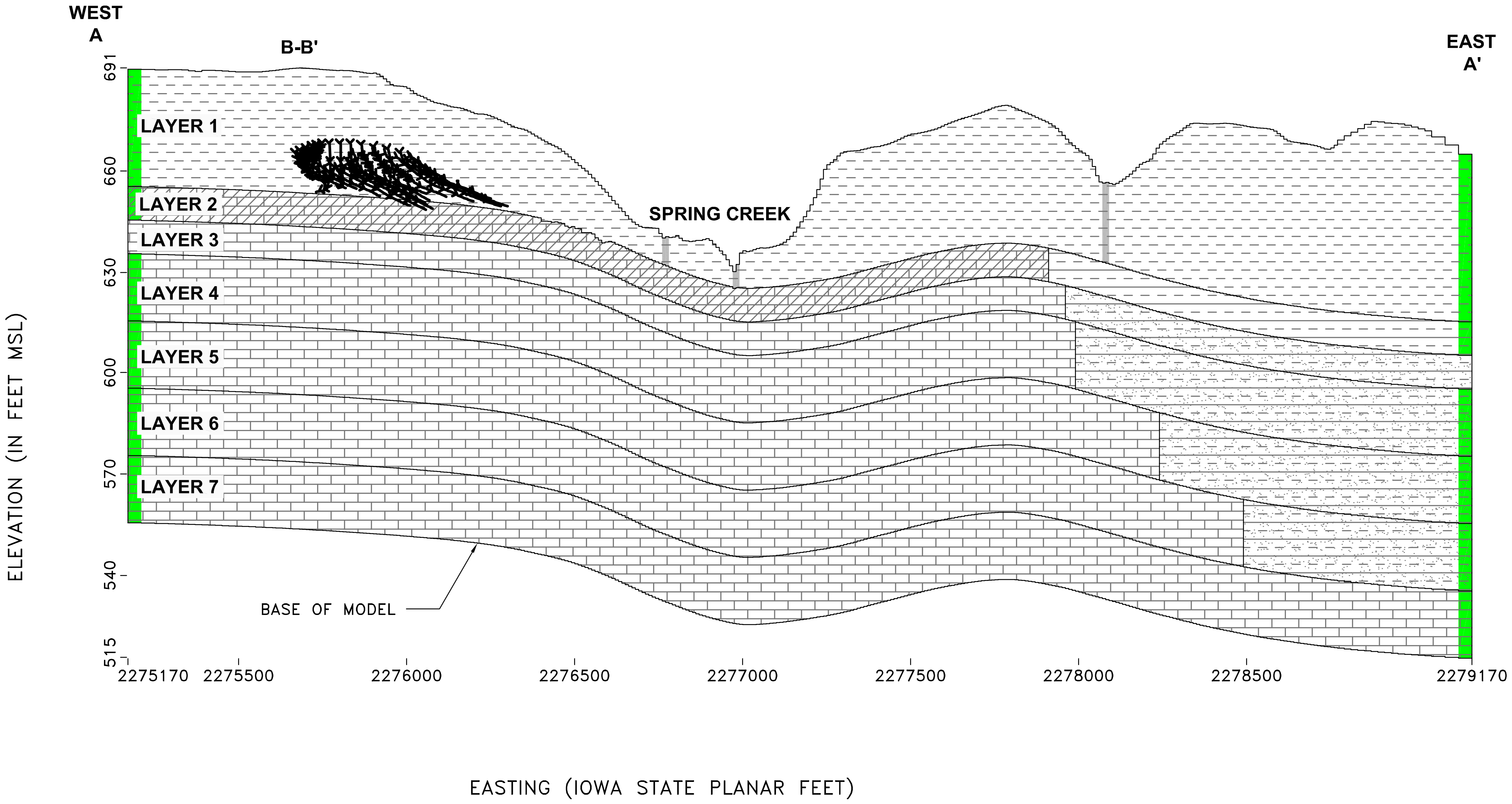
SCALE IN FEET

URS

MODEL–PREDICTED ADVECTIVE PARTICLE
TRANSPORT–BASELINE FLOW MODEL
FIRE TRAINING PIT GROUNDWATER MODELING

DRN. BY: JJS	DATE: 04/20/04	PROJECT NO.	FIG. NO.
CHK'D. BY: TLT	DATE: 05/14/04	16169421	K–7

May 14, 2004 10:53:38 a.m.
Drawing: T:\IAAAP\16169421\Site 1 – FTP\FTPmodbase2.dwg

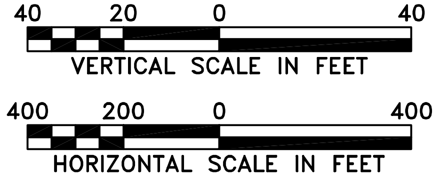


LEGEND:

▤	**LAYER 1 - SHALLOW TILL, FILL, AND WEATHERED BEDROCK (CL-CH)**
▤	**LAYER 2 - INTERMEDIATE TILL (CL-CH)**
▨	**LAYER 2 - UPPER BEDROCK**
▒	**LAYERS 3, 4, 5, AND 6 - DEEP TILL (CL)**
▦	**LAYERS 3, 4, 5, 6, AND 7 - BEDROCK**
■	**DRAIN NODE**
🟩	**GENERAL HEAD BOUNDARY**
⤫	**ADVECTIVE PARTICLE PATHS** **(10-YEAR TICK MARKS)**

NOTES:

1. **VERTICAL EXAGGERATION IS 10:1**
2. **CROSS-SECTION A-A' IS ALONG ROW 152. SEE FIGURE K-1 FOR CROSS-SECTION LOCATION.**
4. **ADVECTIVE PARTICLES WERE STARTED NEAR THE EXISTING PLUME SOURCES AND MODELED FOR 70 YEARS.**
5. **TICK MARKS REPRESENT MODEL-PREDICTED 10-YEAR ADVECTIVE PARTICLE TRANSPORT DISTANCES ALONG EACH PATH.**
6. **PARTICLE PATHS SHOWN ARE ALL PATHS THROUGHOUT THE MODEL (NOT JUST THOSE IN ROW 152).**
7. **HORIZONTAL VIEW OF PARTICLE PATHS CAN BE FOUND ON FIGURE K-6.**

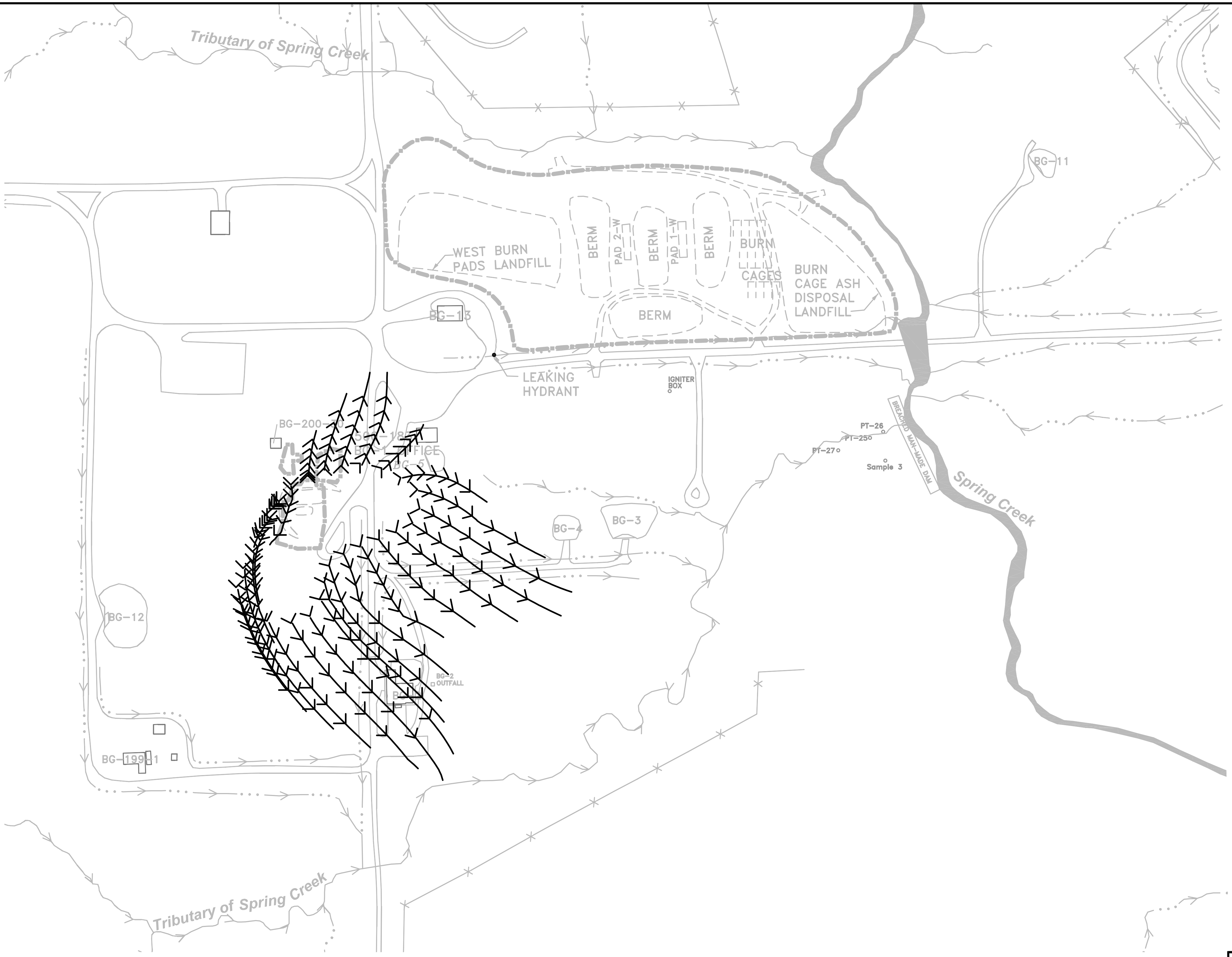


URS

MODEL–PREDICTED ADVECTIVE PARTICLE TRANSPORT IN
CROSS–SECTION/BASELINE FLOW MODEL
FIRE TRAINING PIT GROUNDWATER MODELING

DRN. BY: DAC	DATE: 04/20/04	PROJECT NO. 16169421	FIG. NO. K-8
CHK'D. BY: TLT	DATE: 04/20/04		

March 15, 2004 10:49:43 a.m.
Drawing: T:\IAAAP\16169556\EDA\FTP\FTPmodxsect.dwg



LEGEND:

⟶	TRIBUTARY
⟶ · · ·	INTERMITTENT TRIBUTARY/DRAINAGE
—×—	FENCE LINE
⤳	ADVECTIVE PARTICLE PATHS (10-YEAR TICK MARKS)

NOTES:

1. ADVECTIVE PARTICLES WERE STARTED IN LAYER 1 AROUND THE INTERPRETED SOURCE LOCATIONS AND MODELED FOR 70 YEARS.
2. TICK MARKS REPRESENT MODEL-PREDICTED 10-YEAR ADVECTIVE PARTICLE TRANSPORT DISTANCES ALONG EACH FLOW PATH.

N

200 100 0 200

SCALE IN FEET

URS

MODEL–PREDICTED ADVECTIVE PARTICLE
TRANSPORT–ALTERNATIVES 1 AND 2
FIRE TRAINING PIT GROUNDWATER MODELING

DRN. BY: JJS	DATE: 04/20/04	PROJECT NO.	FIG. NO.
CHK'D. BY: TLT	DATE: 04/20/04	16169421	K-9

March 15, 2004 10:53:38 a.m.
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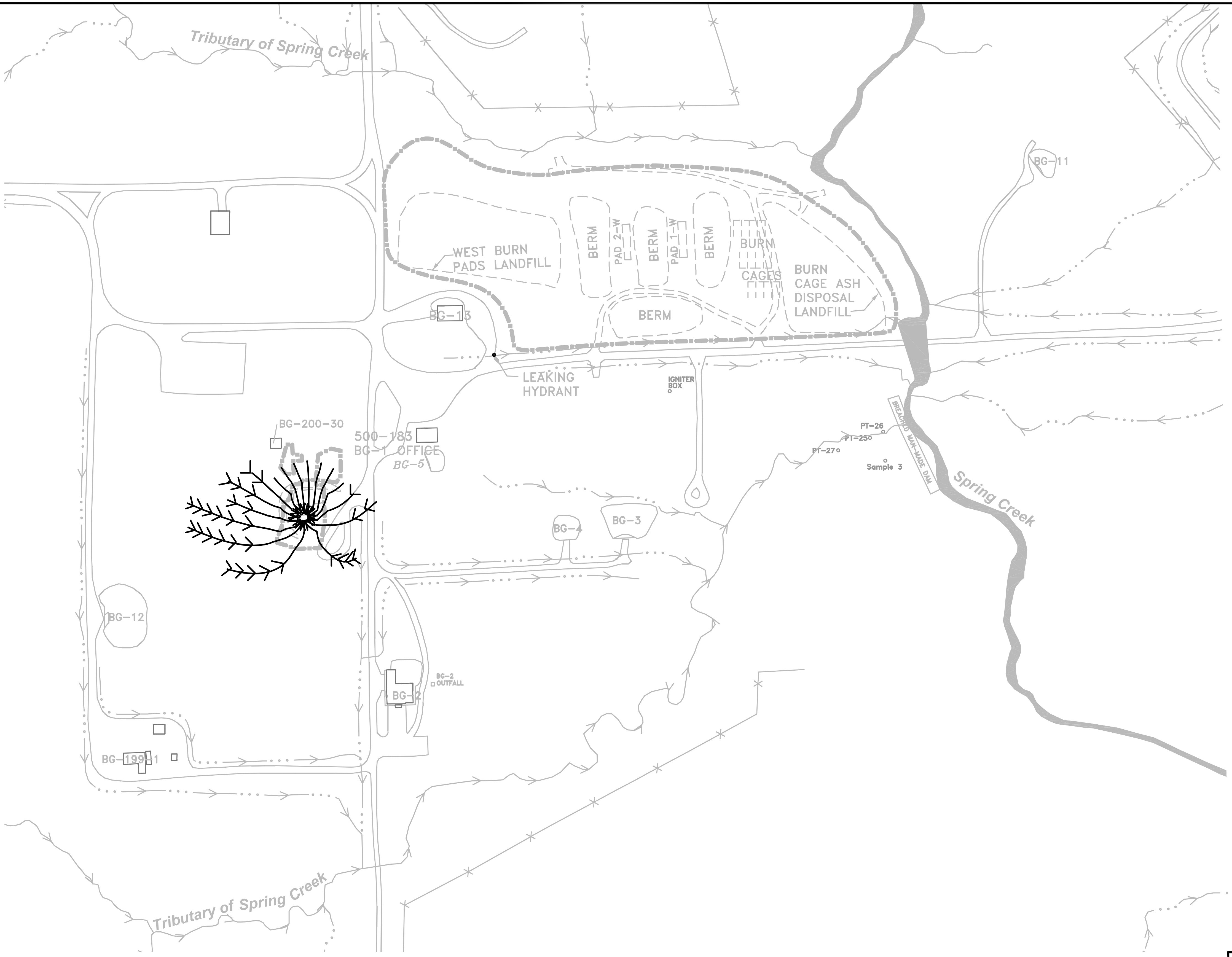


LEGEND:

	TRIBUTARY
	INTERMITTENT TRIBUTARY/DRAINAGE
	FENCE LINE
	ADVECTIVE PARTICLE PATHS (10-YEAR TICK MARKS)

NOTES:

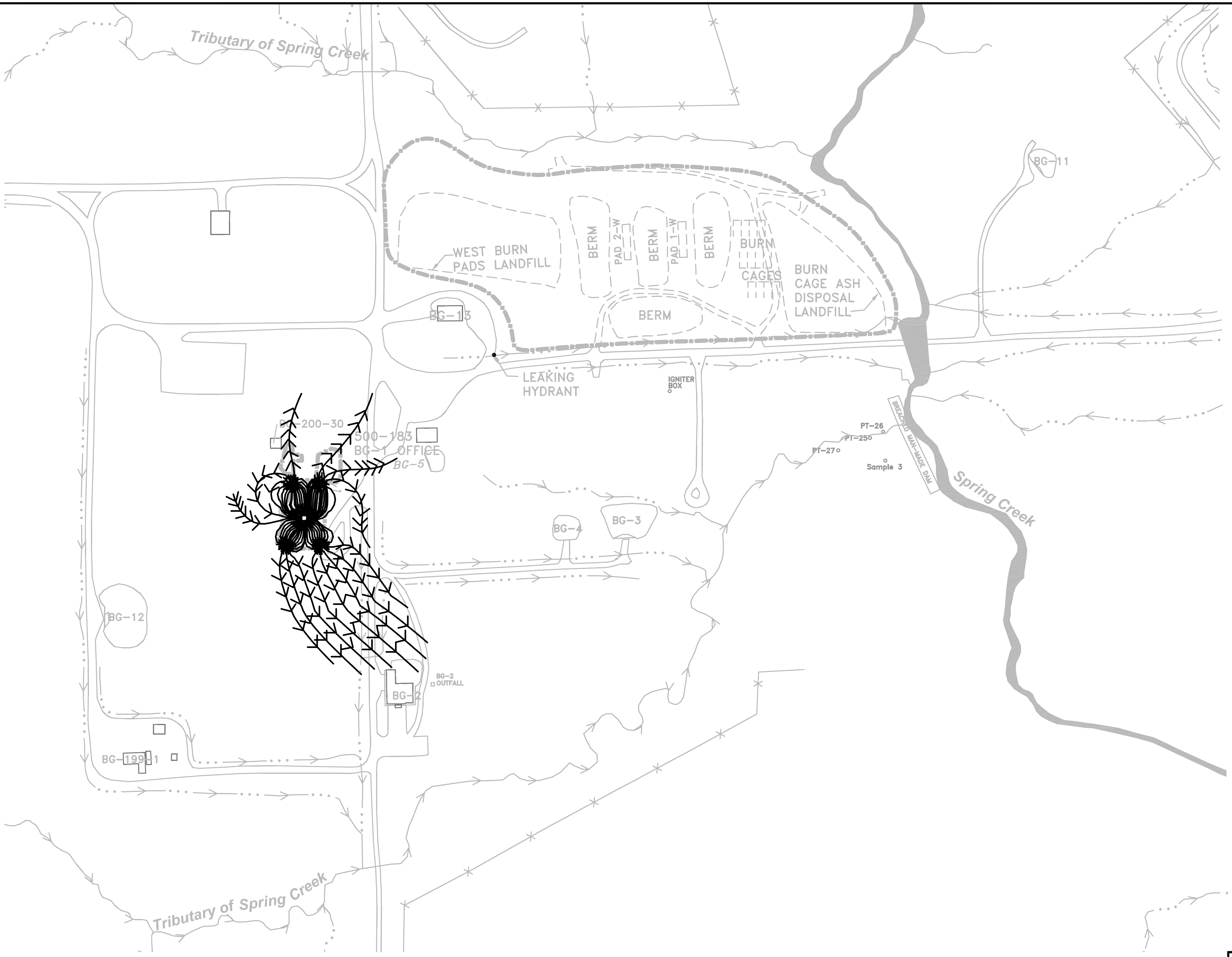
1. ADVECTIVE PARTICLES WERE STARTED AROUND THE EXTRACTION WELL LOCATIONS AND MODELED FOR 70 YEARS.
2. TICK MARKS REPRESENT MODEL-PREDICTED 10-YEAR ADVECTIVE PARTICLE TRANSPORT DISTANCES ALONG EACH FLOW PATH.

URS

MODEL-PREDICTED ADVECTIVE PARTICLE
TRANSPORT-ALTERNATIVE 3
FIRE TRAINING PIT GROUNDWATER MODELING

DRN. BY: JJS	DATE: 04/20/04	PROJECT NO.	FIG. NO.
CHK'D. BY: TLT	DATE: 04/20/04	16169421	K-10

March 15, 2004 10:53:38 a.m.
Drawing: T:\IAAAP\16169556\EDA\FTP\FTPmodbase2.dwg



LEGEND:

⟶	TRIBUTARY
⟶ · · ·	INTERMITTENT TRIBUTARY/DRAINAGE
—x—	FENCE LINE
≻⟵	ADVECTIVE PARTICLE PATHS (10-YEAR TICK MARKS)

NOTES:

1. ADVECTIVE PARTICLES WERE STARTED AROUND THE EXTRACTION AND INJECTION WELL LOCATIONS AND MODELED FOR 70 YEARS.
2. TICK MARKS REPRESENT MODEL-PREDICTED 10-YEAR ADVECTIVE PARTICLE TRANSPORT DISTANCES ALONG EACH FLOW PATH.

N

200 100 0 200

SCALE IN FEET

URS

MODEL–PREDICTED ADVECTIVE PARTICLE TRANSPORT–ALTERNATIVE 4
FIRE TRAINING PIT GROUNDWATER MODELING

DRN. BY: JJS	DATE: 04/20/04	PROJECT NO.	FIG. NO.
CHK'D. BY: TLT	DATE: 04/20/04	16169421	K-11

March 15, 2004 10:53:38 a.m.
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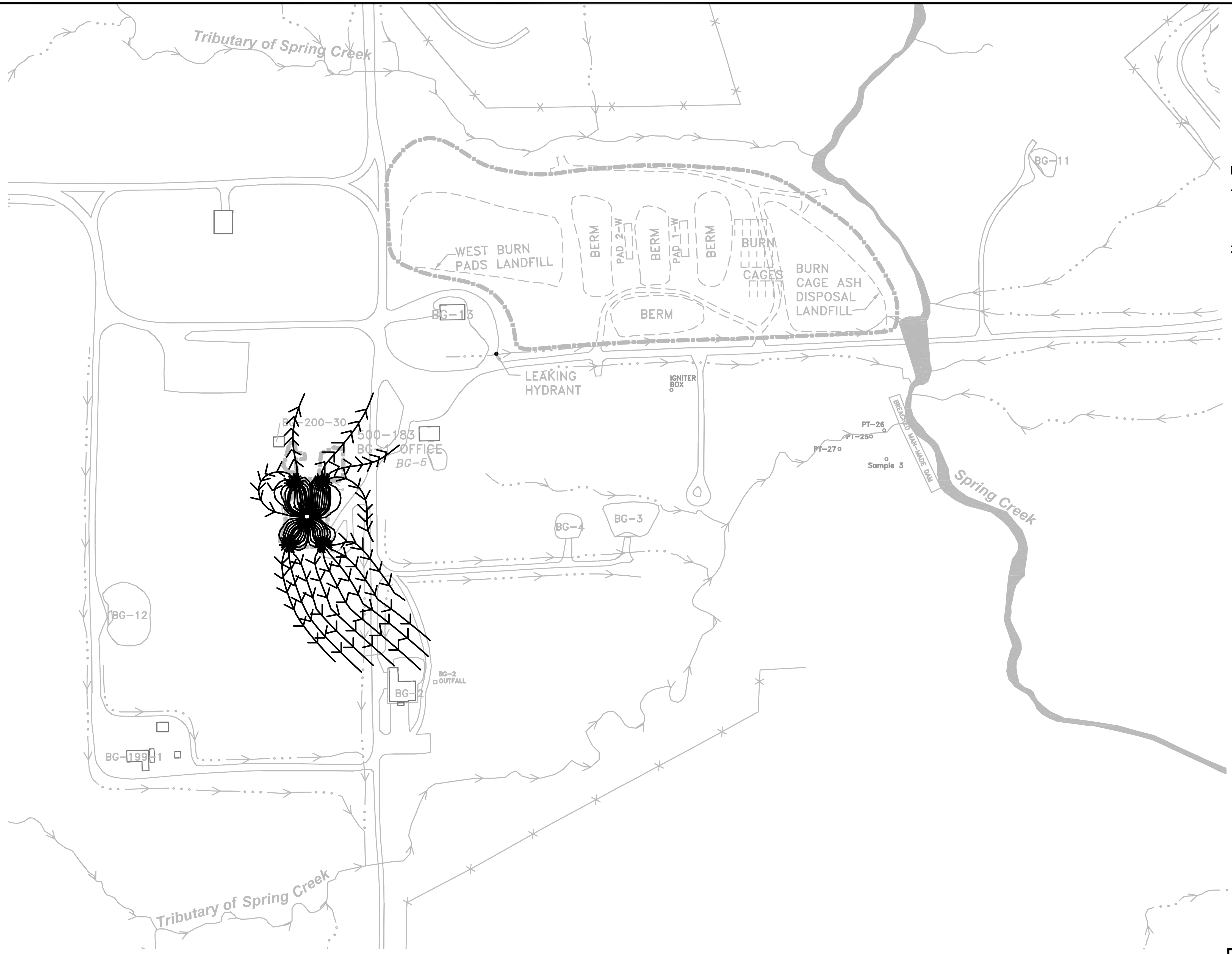


LEGEND:

TRIBUTARY

INTERMITTENT TRIBUTARY/DRAINAGE

FENCE LINE

ADVECTIVE PARTICLE PATHS
(10-YEAR TICK MARKS)

NOTES:

1. ADVECTIVE PARTICLES WERE STARTED AROUND THE EXTRACTION AND INJECTION WELL LOCATIONS AND MODELED FOR 70 YEARS.

2. TICK MARKS REPRESENT MODEL-PREDICTED 10-YEAR ADVECTIVE PARTICLE TRANSPORT DISTANCES ALONG EACH FLOW PATH.

N

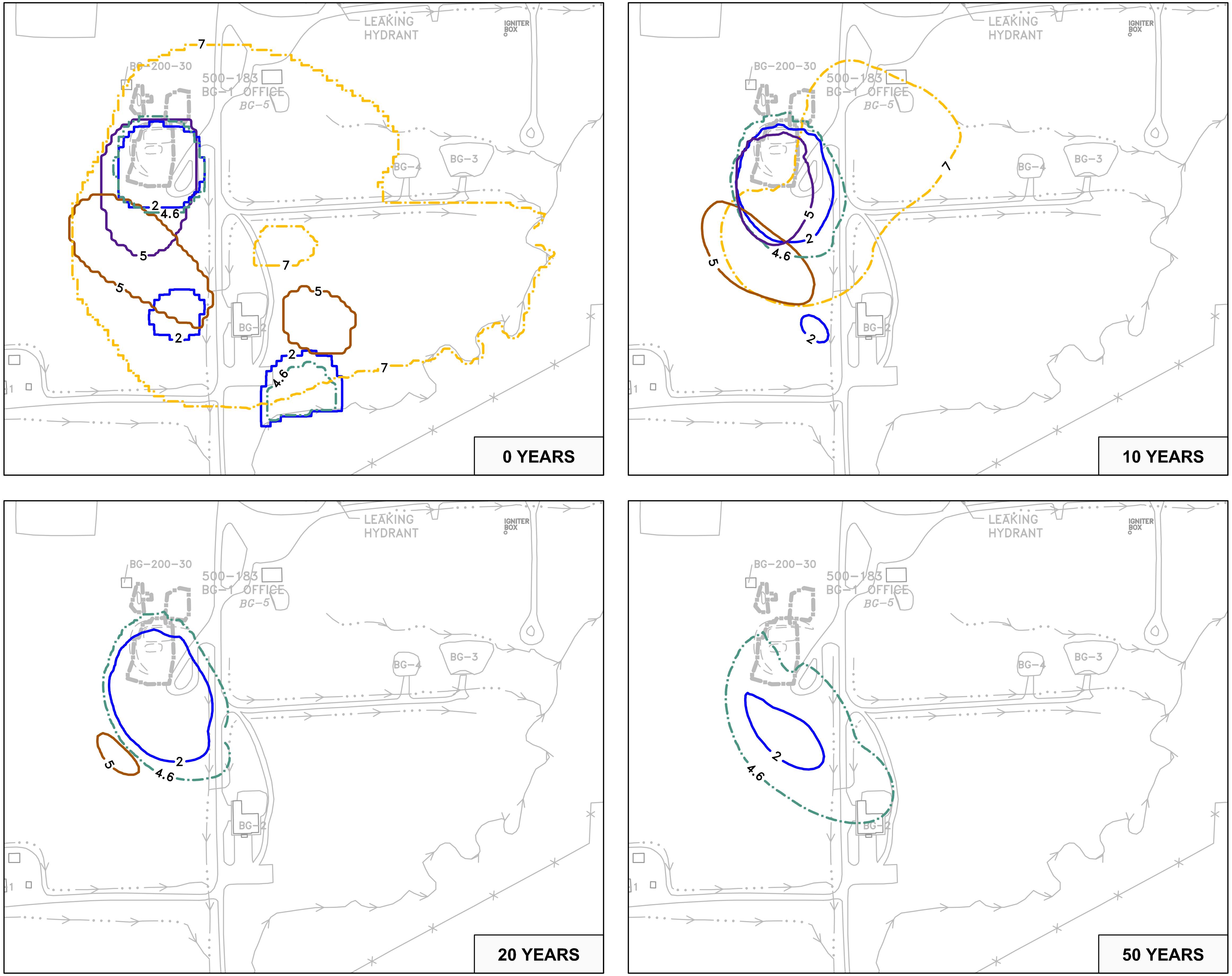
200 100 0 200
SCALE IN FEET

URS

MODEL-PREDICTED ADVECTIVE PARTICLE
TRANSPORT-ALTERNATIVE 5
FIRE TRAINING PIT GROUNDWATER MODELING

DRN. BY: JJS	DATE: 04/20/04	PROJECT NO.	FIG. NO.
CHK'D. BY: TLT	DATE: 04/20/04	16169421	K-12

March 15, 2004 10:53:38 a.m.
Drawing: T:\IAAAP\16169556\EDA\FTP\FTPmodbase2.dwg



LEGEND:

APPROXIMATE BOUNDARY OF SOILS REMOVAL ACTIONS - 1998/2003

TRIBUTARY

INTERMITTENT TRIBUTARY/DRAINAGE

FENCE LINE

HORIZONTAL EXTENT OF CONTAMINANTS (μg/L)

4.6 CHLOROETHANE

5 BENZENE

5 TCE

7 1,1-DCE

2 VINYL CHLORIDE

NOTES:

0 YEARS = SPRING 2003 INPUT

200 100 0 200

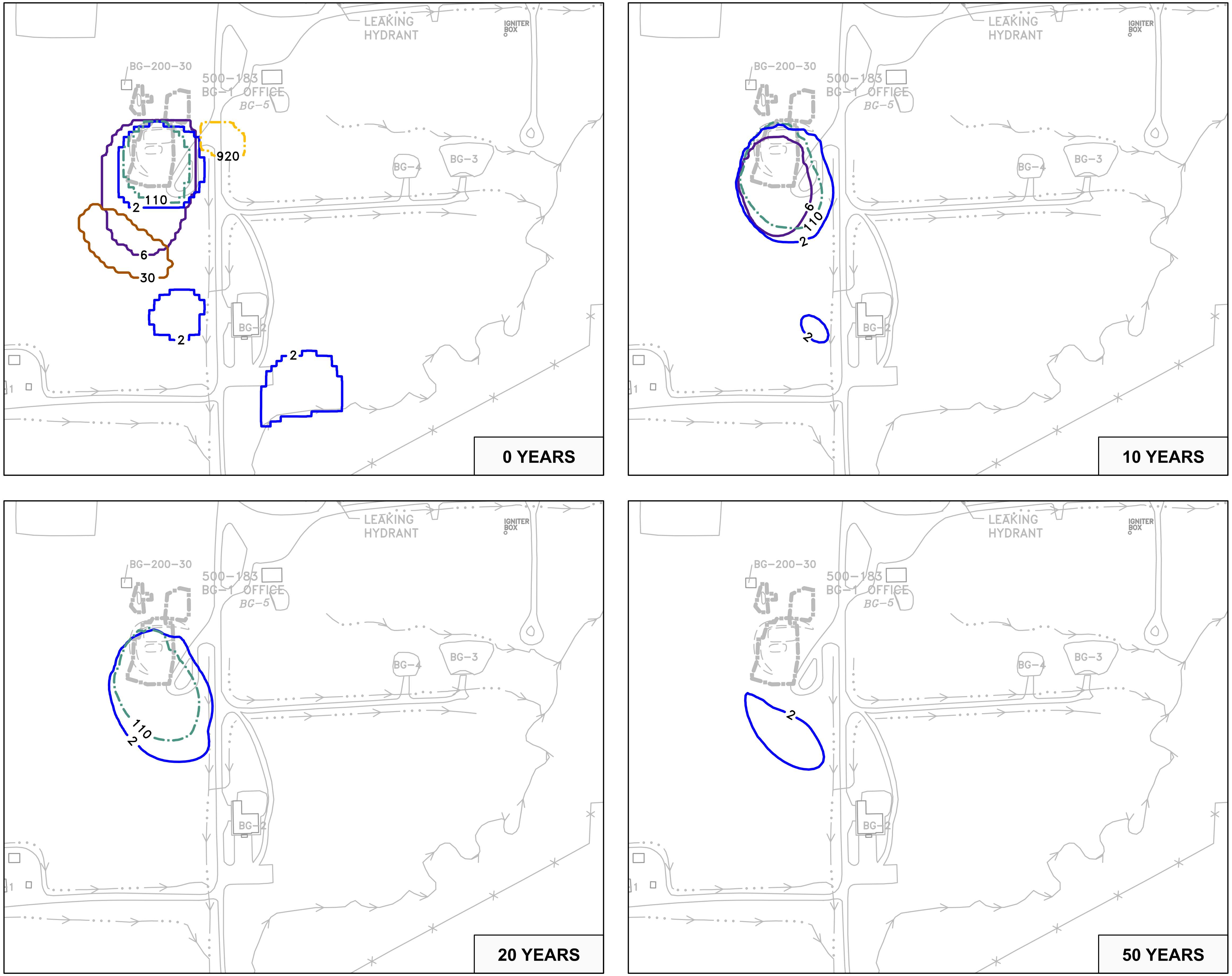
SCALE IN FEET

URS

MODEL–PREDICTED BASELINE VOC CONCENTRATIONS
FIRE TRAINING PIT GROUNDWATER MODELING

DRN. BY: JJS	DATE: 04/20/04	PROJECT NO. 16169421	FIG. NO. K–13
CHK'D. BY: .	DATE: 05/05/04		

March 12, 2004 2:33:13 p.m.
Drawing: T:\IAAAP\16169556\EDA\FTP\8-1.dwg



LEGEND:

- APPROXIMATE BOUNDARY OF SOILS REMOVAL ACTIONS - 1998/2003
- TRIBUTARY
- INTERMITTENT TRIBUTARY/DRAINAGE
- FENCE LINE

HORIZONTAL EXTENT OF CONTAMINANTS (μg/L)

110	CHLOROETHANE
6	BENZENE
30	TCE
920	1,1-DCE
2	VINYL CHLORIDE

NOTES:

0 YEARS = SPRING 2003 INPUT

200 100 0 200

SCALE IN FEET

URS

ALTERNATIVES 1 AND 2
MODEL-PREDICTED VOC CONCENTRATIONS
FIRE TRAINING PIT GROUNDWATER MODELING

DRN. BY: JJS	DATE: 04/20/04	PROJECT NO.	FIG. NO.
CHK'D. BY: TLT	DATE: 04/20/04	16169421	K-14

March 11, 2004 12:57:50 p.m.
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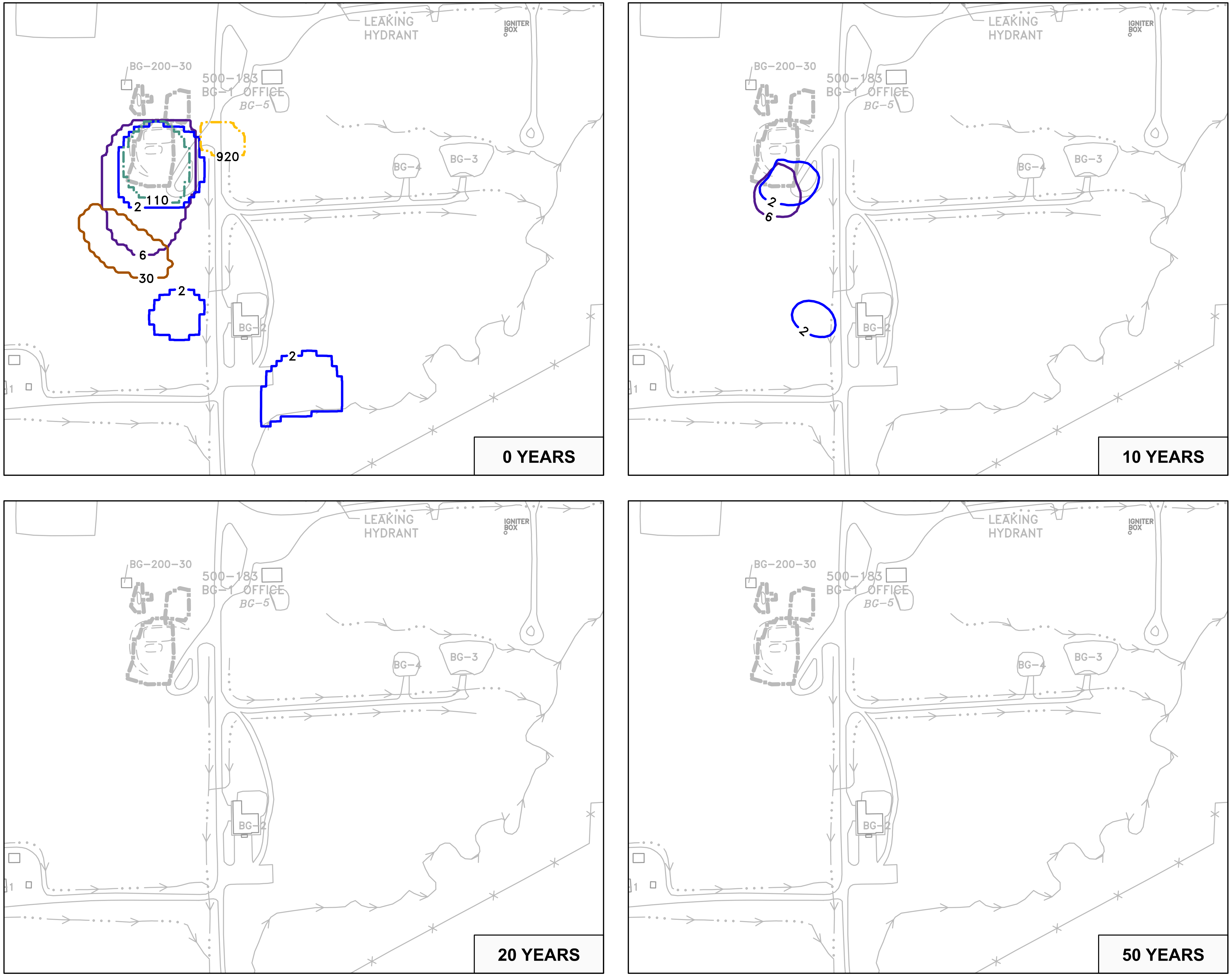


LEGEND:

APPROXIMATE BOUNDARY OF SOILS REMOVAL ACTIONS - 1998/2003

TRIBUTARY

INTERMITTENT TRIBUTARY/DRAINAGE

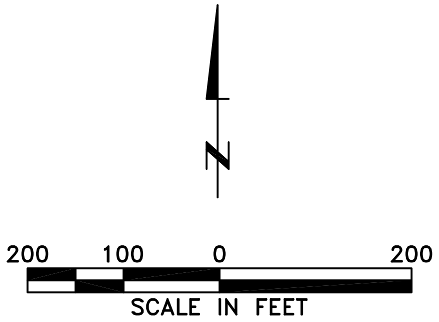
FENCE LINE

HORIZONTAL EXTENT OF CONTAMINANTS (μg/L)

110	CHLOROETHANE
6	BENZENE
30	TCE
920	1,1-DCE
2	VINYL CHLORIDE

NOTES:

0 YEARS = SPRING 2003 INPUT

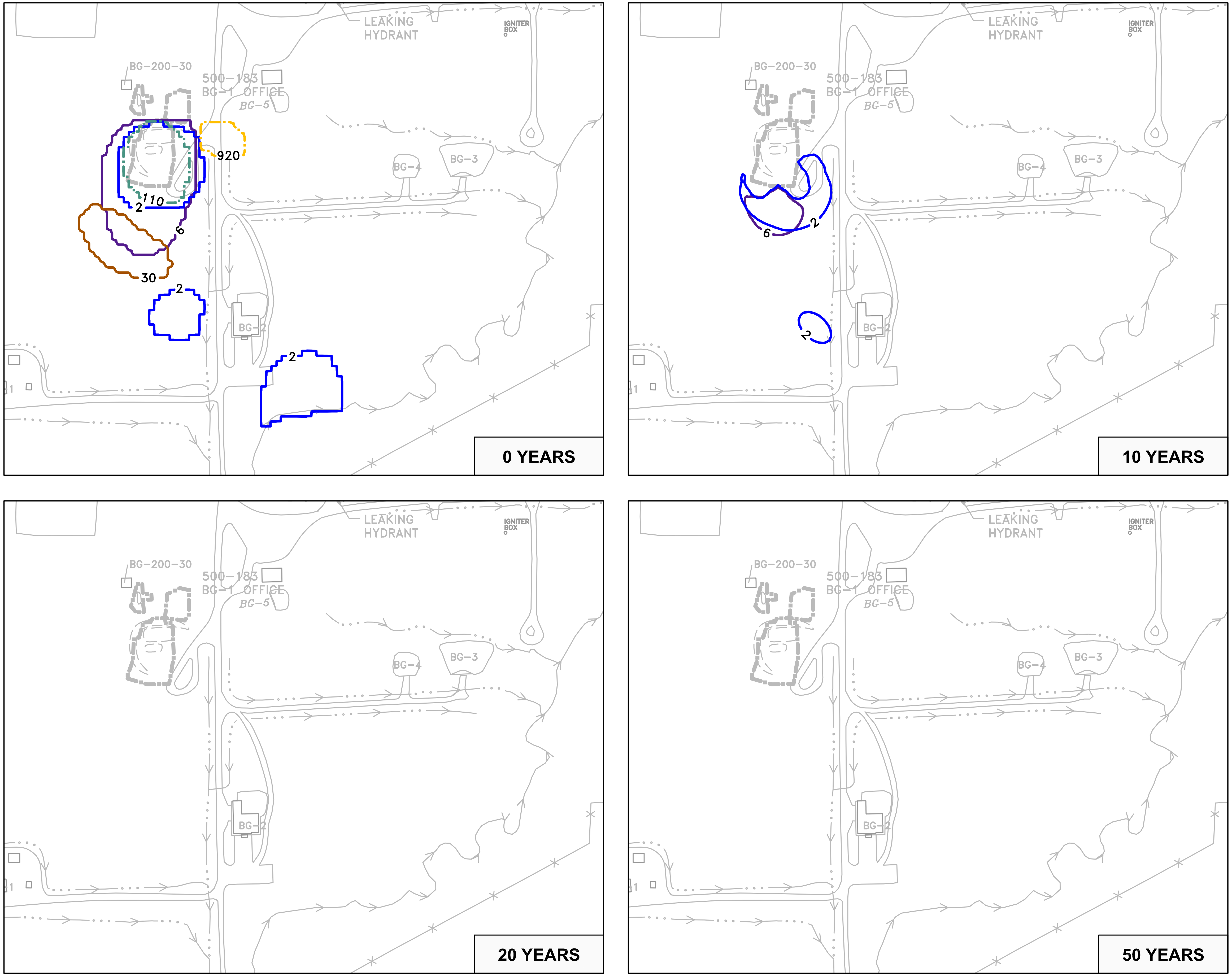


URS

ALTERNATIVE 3
MODEL-PREDICTED VOC CONCENTRATIONS
FIRE TRAINING PIT GROUNDWATER MODELING

DRN. BY: JJS	DATE: 04/20/04	PROJECT NO. 16169421	FIG. NO. K-15
CHK'D. BY: TLT	DATE: 04/20/04		

March 11, 2004 12:49:08 p.m.
Drawing: T:\IAAAP\16169556\EDA\FTP\13-2.dwg



LEGEND:

APPROXIMATE BOUNDARY OF SOILS REMOVAL ACTIONS - 1998/2003

TRIBUTARY

INTERMITTENT TRIBUTARY/DRAINAGE

FENCE LINE

HORIZONTAL EXTENT OF CONTAMINANTS (μg/L)

110 CHLOROETHANE

6 BENZENE

30 TCE

920 1,1-DCE

2 VINYL CHLORIDE

NOTES:

0 YEARS = SPRING 2003 INPUT

N

200 100 0 200

SCALE IN FEET

URS

ALTERNATIVE 4
MODEL-PREDICTED VOC CONCENTRATIONS
FIRE TRAINING PIT GROUNDWATER MODELING

DRN. BY: JJS	DATE: 04/20/04	PROJECT NO. 16169421	FIG. NO. K-16
CHK'D. BY: TLT	DATE: 04/20/04		

March 11, 2004 12:47:28 p.m.
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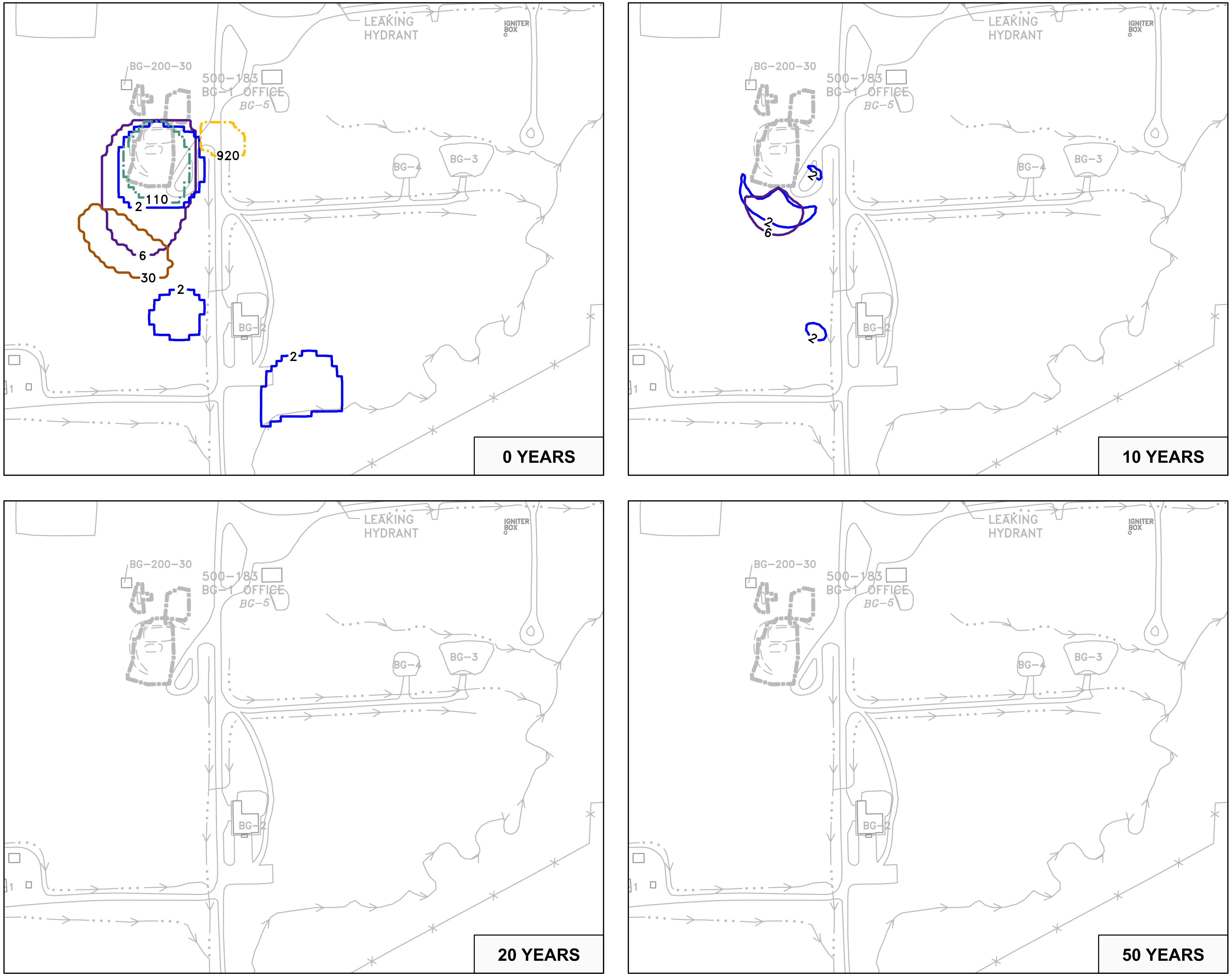


LEGEND:

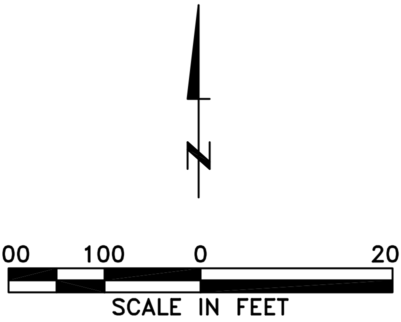
▬ · ▬	APPROXIMATE BOUNDARY OF SOILS REMOVAL ACTIONS - 1998/2003
⟶	TRIBUTARY
⟶ · · ·	INTERMITTENT TRIBUTARY/DRAINAGE
—×—	FENCE LINE

HORIZONTAL EXTENT OF CONTAMINANTS (μg/L)

-·-110-·-	CHLOROETHANE
—6—	BENZENE
—30—	TCE
-·-920-·-	1,1-DCE
—2—	VINYL CHLORIDE

NOTES:

0 YEARS = SPRING 2003 INPUT



URS

ALTERNATIVE 5
MODEL–PREDICTED VOC CONCENTRATIONS
FIRE TRAINING PIT GROUNDWATER MODELING

DRN. BY: JJS	DATE: 3/8/04	PROJECT NO.	FIG. NO.
CHK'D. BY: TLT	DATE: 05/05/04	16169421	K–17

ATTACHMENT K-1

Groundwater Flow Model – Related Calculations and Input

Calibrated Baseline Flow Model Volumetric Water Budget

ATACHMENT K-1
CALIBRATED BASELINE FLOW MODEL VOLUMETRIC WATER BUDGET
FIRE TRAINING PIT GROUNDWATER MODELING

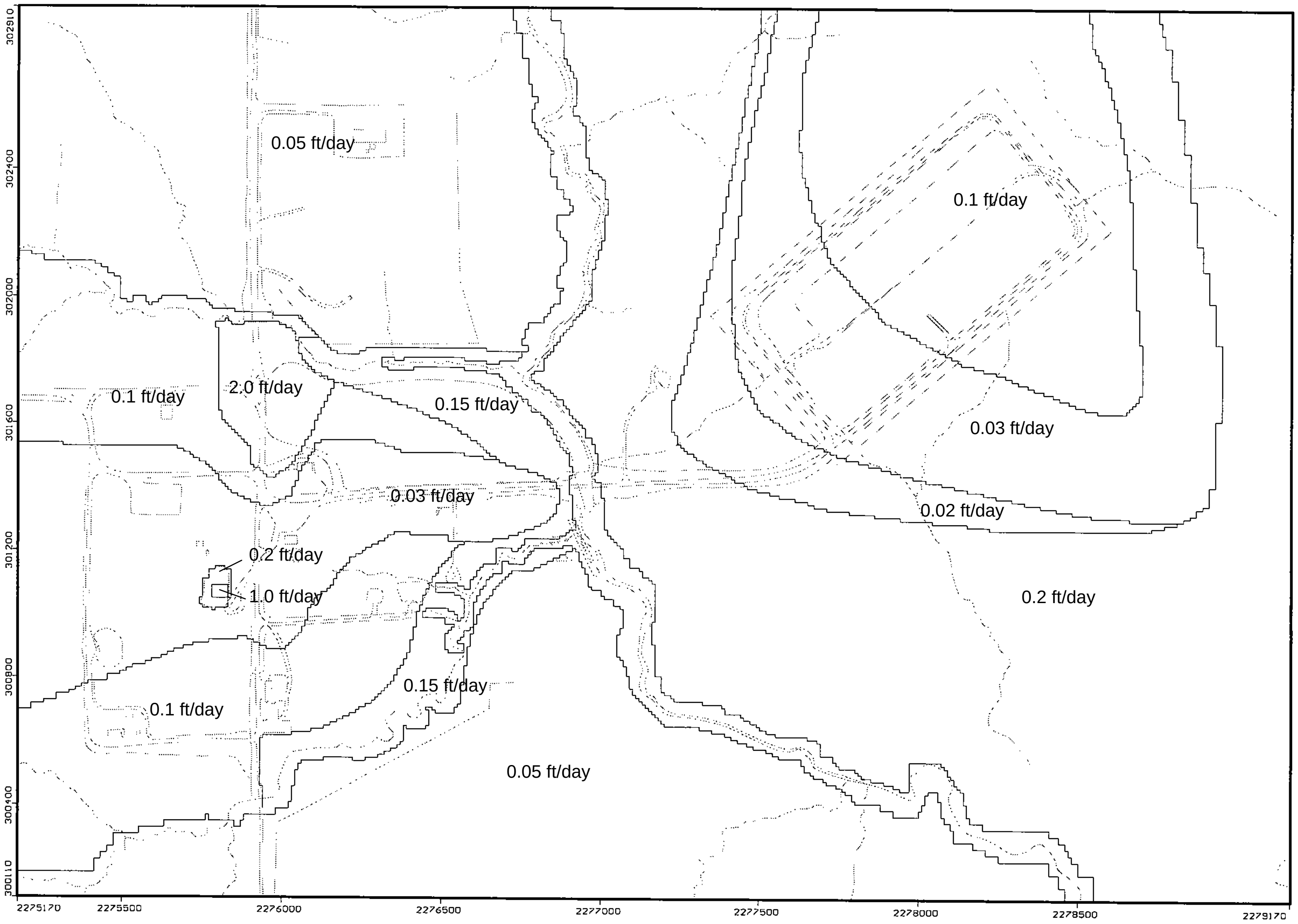
	CUMULATIVE VOLUMES (ft^3)	
	Inflow	**Outflow**
Drains	0.0	1844.0
Recharge	1257.3	0.0
General Head	1670.6	1084.2
Total	**2927.88**	**2928.19**

In - Out = **-0.31**
% Discrepancy = **0.01%**

ATTACHMENT K-1

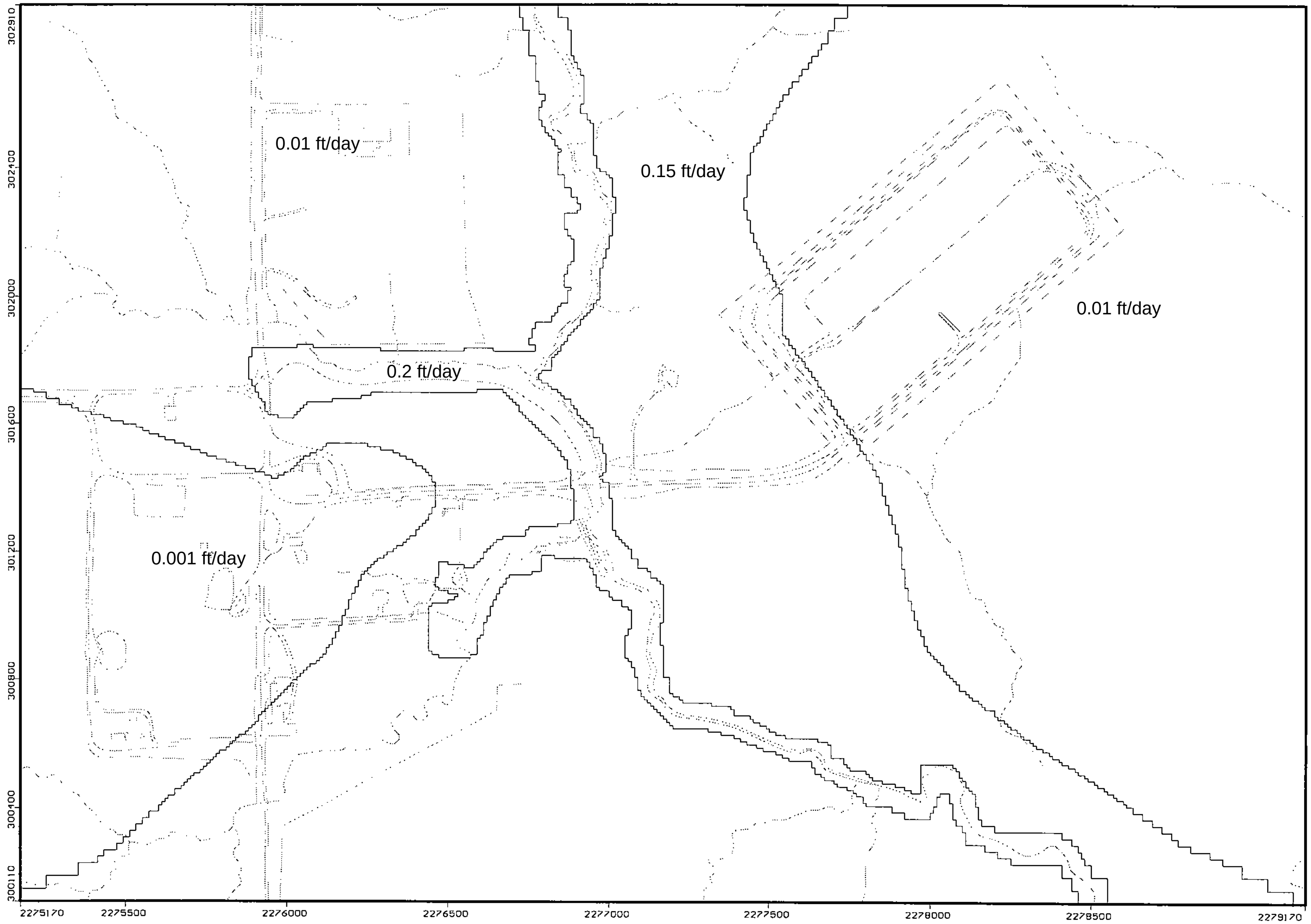
Groundwater Flow Model – Related Calculations and Input

Hydraulic Conductivity Fields



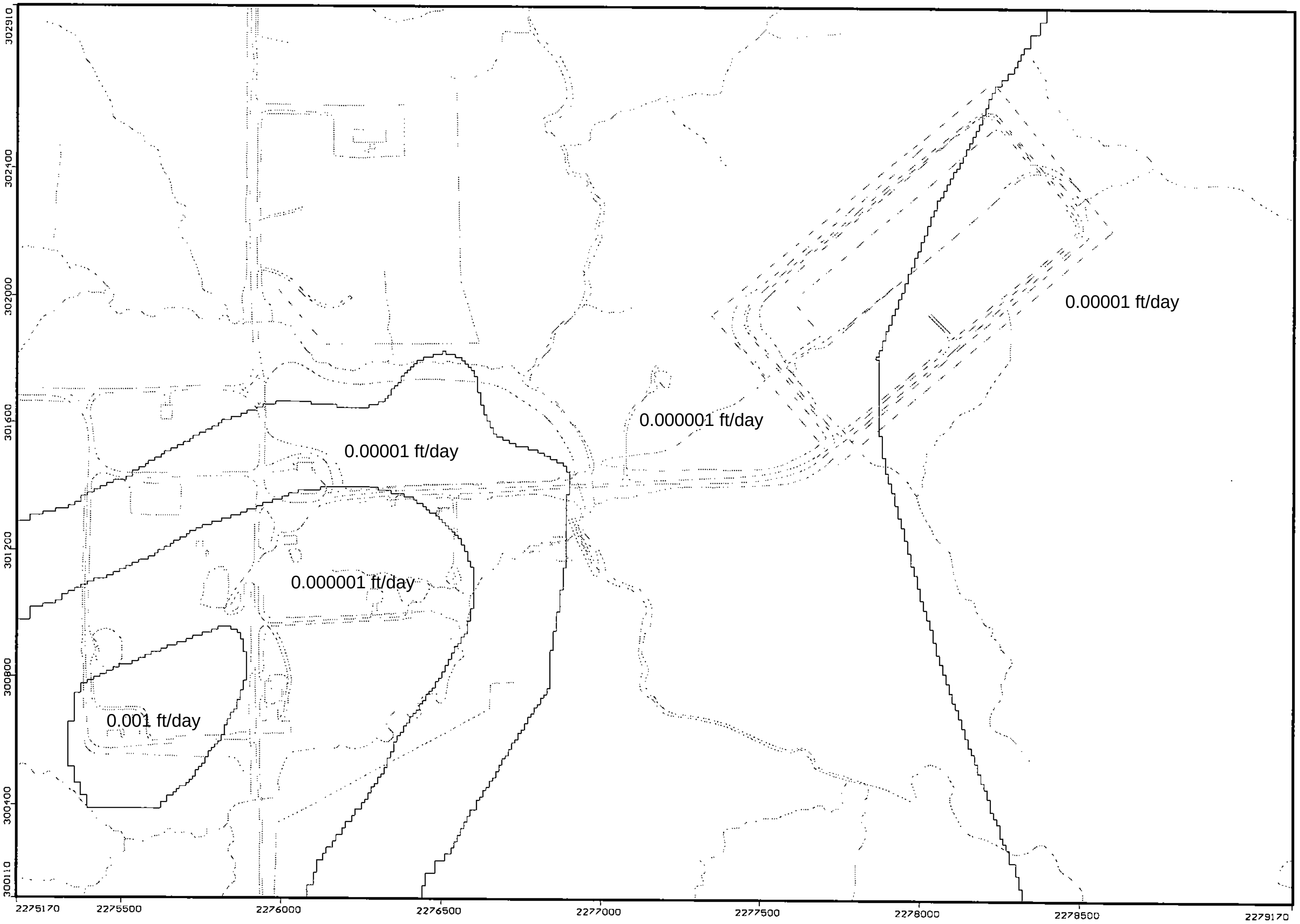
URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline – Conductivity
Modeller: JJS/ANB
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline – Conductivity
Modeller: JJS/ANB
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 2



URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline – Conductivity
Modeller: JJS/ANB
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
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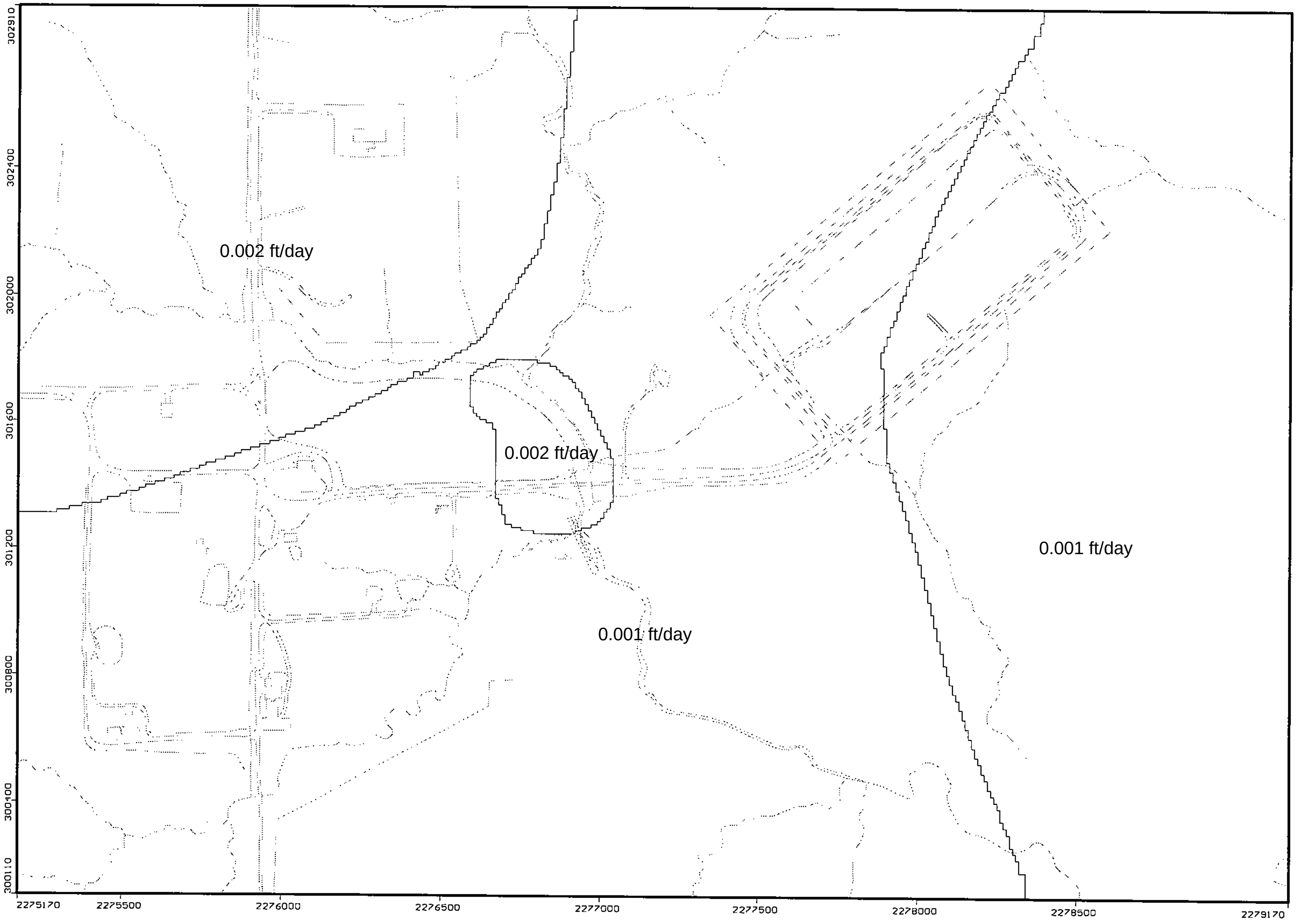

URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline – Conductivity
Modeller: JJS/ANB
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
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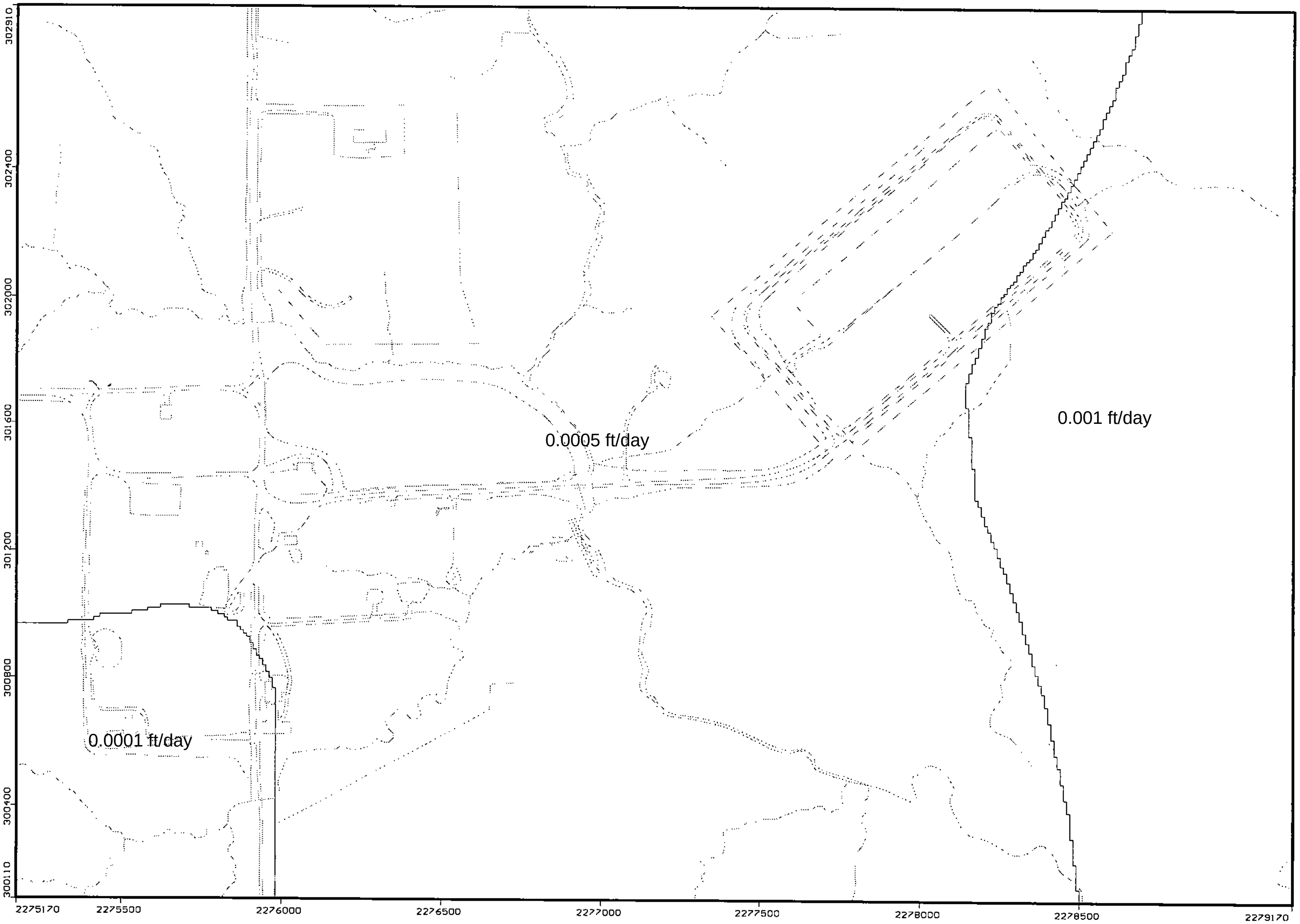

URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline – Conductivity
Modeller: JJS/ANB
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
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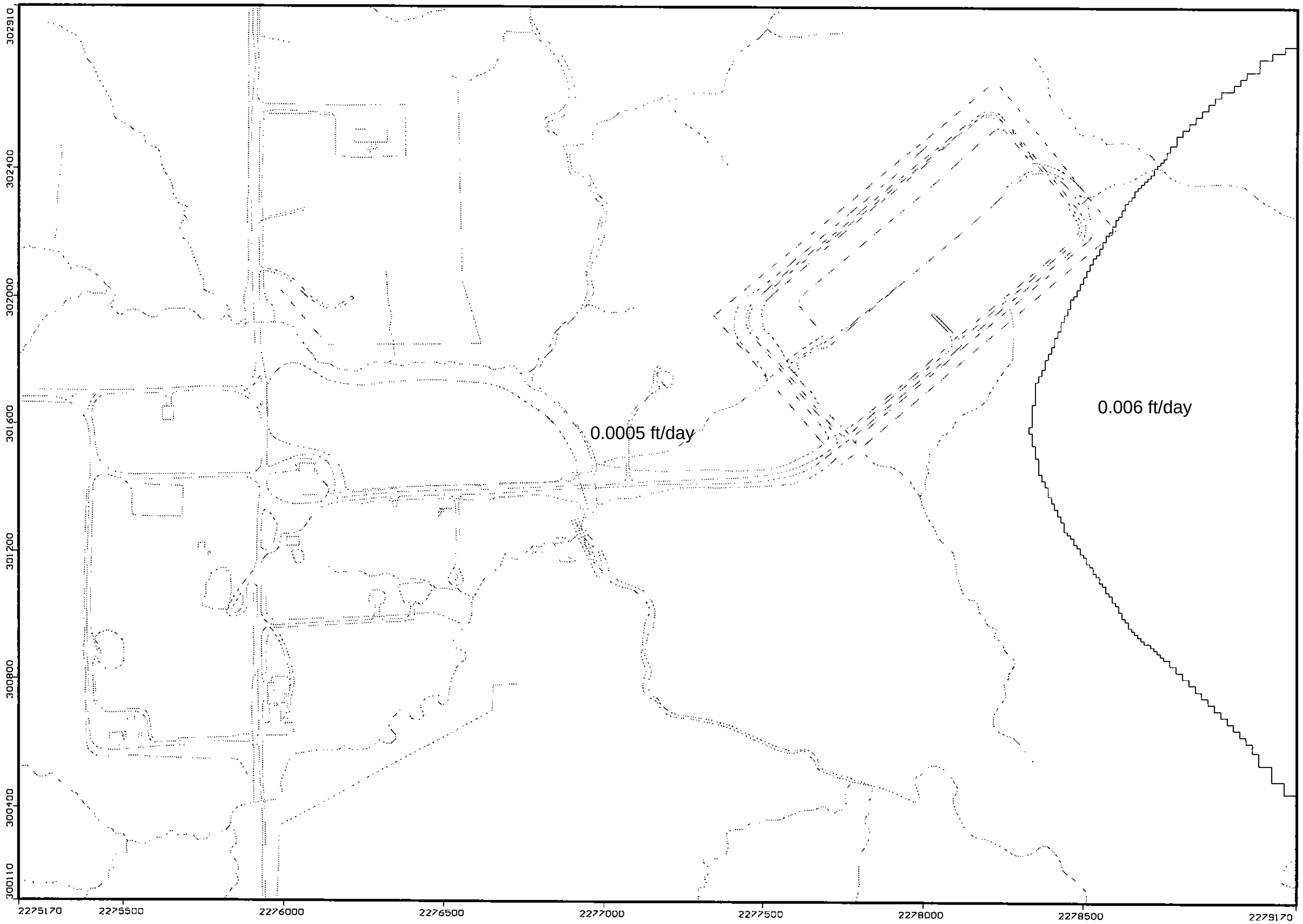

URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline – Conductivity
Modeller: JJS/ANB
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
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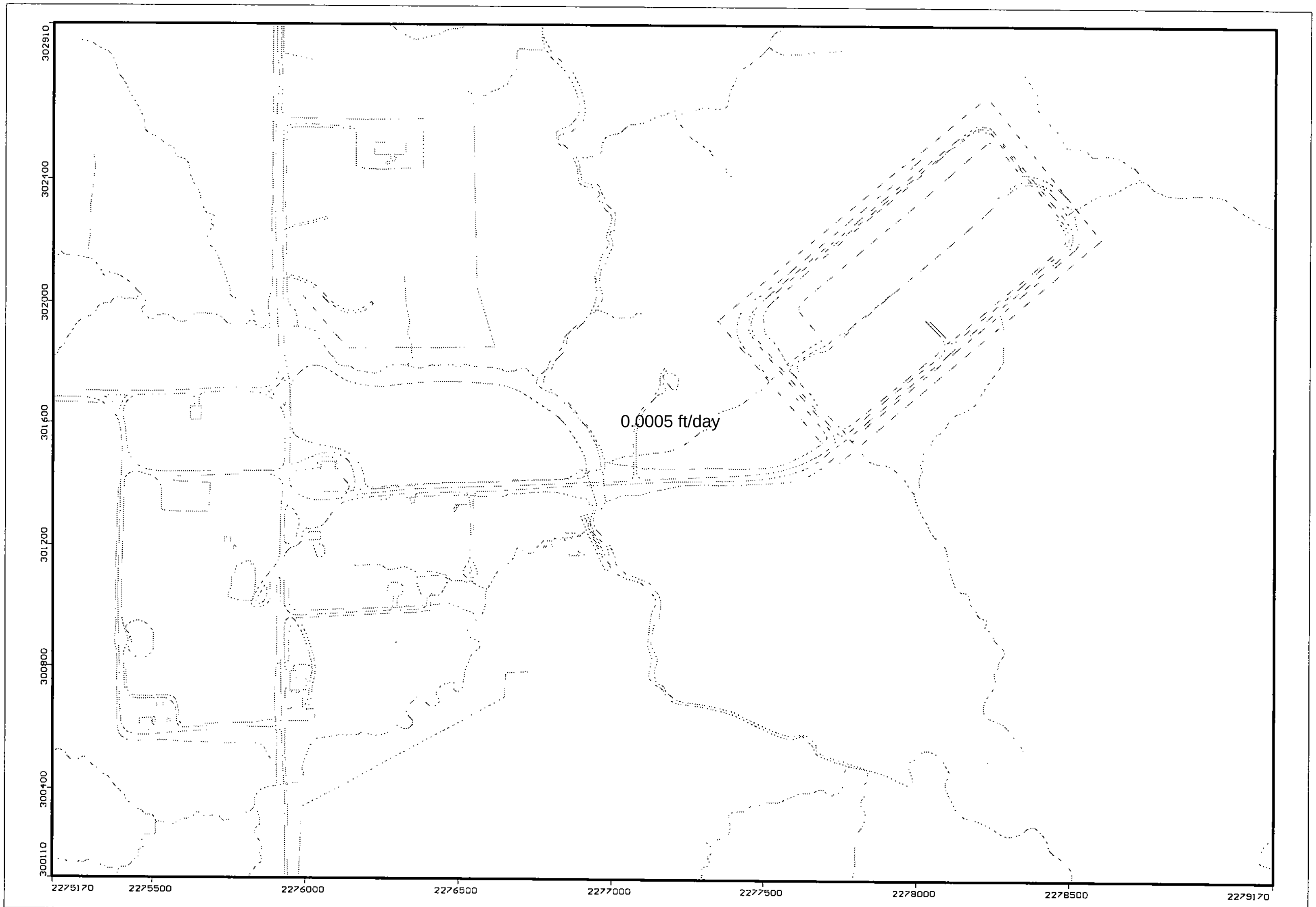


URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline – Conductivity
Modeller: JJS/ANB
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 7

ATTACHMENT K-2

MODFLOW and MODPATH Documentation

MODFLOW (Harbaugh, et al. 2000) and MODPATH (Pollock 1989) were used to evaluate groundwater flow patterns for the baseline groundwater flow model.

K-2.1 MODFLOW GROUNDWATER FLOW MODEL DOCUMENTATION

K-2.1.1 MODFLOW Model Description and Assumptions

MODFLOW is a modular three-dimensional, finite difference flow code developed by the United States Geological Survey (USGS) to solve the governing equation of groundwater flow. MODFLOW has been used extensively for groundwater flow modeling and has been available since 1983. MODFLOW can simulate the effects of wells, rivers, drains, evapotranspiration, and recharge of three-dimensional groundwater systems with heterogeneous, anisotropic aquifer properties and complex boundary conditions. Aquifers may be simulated as confined, unconfined, or a combination of both. The code permits the user to select a series of packages (or modules) to simulate hydrologic processes for wells, drains, rivers, evapotranspiration from the water table, surface recharge, and general head boundaries.

Model development typically requires calibration of input parameters, and a common calibration criterion is the comparison of simulated and observed heads. MODFLOW provides simulated head values at user specified intervals for every cell in the model. This calibration test gives an excellent indication of how well a model is simulating head changes at a particular location.

General assumptions related to MODFLOW model applications include:

- All hydraulic properties are uniform across the length, width, and depth of each individual cell. Solution nodes are only calculated at the center of each cell.
- Aquifer materials are uniformly porous (i.e., no fracture flow is considered).
- Wells/sinks/sources are completely efficient and fully penetrate the individual cells in which they are placed.
- Assumed constant head boundaries remain constant through time.
- Recharge is only applied to the uppermost active cell in the model.

K-2.1.2 MODFLOW Model Equations and Implementation

The governing equation of groundwater flow of constant density through porous earth material may be described by the partial-differential equation:

$$\frac{\partial}{\partial x}\left(K_x \frac{\partial h}{\partial x}\right) + \frac{\partial}{\partial y}\left(K_y \frac{\partial h}{\partial y}\right) = W + S_s \frac{\partial h}{\partial t}$$

where:

K_x	denotes hydraulic conductivity along the *x* axis (ft/day)
K_y	denotes hydraulic conductivity along the *y* axis which is assumed to be parallel to the major axis of hydraulic conductivity (ft/day)
K_z	denotes hydraulic conductivity along the *z* axis (ft/day)
h	is the hydraulic head (feet)
W	is a volumetric flux per unit volume and represents sources or sinks of water (per day)
S_s	is the specific storage of the porous material (per foot)
t	is time (days)

The governing equation is approximated by a set of algebraic equations which are solved by an iteration or matrix solution technique. The solution algorithms to the partial differential equation of flow include two iteration techniques, the Strongly Implicit Procedure (SIP) and the Slice-Successive Overrelaxation method (SSOR). SIP utilizes certain general concepts of matrix algebra and numerical analysis to solve large systems of simultaneous equations by iteration.

MODFLOW uses a block-centered finite-difference grid for numerical formulation. In the block-centered formulation, the blocks formed by the sets of parallel lines are the cells; the solution nodes are at the center of the cells. The model equations are based on the assumption that hydraulic properties are uniform within individual cells. In confined layers, transmissivity (the product of hydraulic conductivity and layer thickness) is specified; and the storage coefficient (the product of specific storage and layer thickness) is also used. For an unconfined layer, aquifer bottom elevation and hydraulic conductivity are input for each cell. Saturated thickness is calculated as the difference between head and bottom elevation, and transmissivity is then calculated as the product of the hydraulic conductivity and saturated thickness. Thus, transmissivity can vary from cell to cell depending on bottom elevation and head.

The cells in the model can be defined as constant head, variable head, or inactive (no-flow) cells. Constant head cells are those for which the head is specified in advance and is held at this specified value through all time steps of the simulation. Inactive or no-flow cells are those for which no flow into or out of the cell is permitted, in any time step of the simulation. Variable-head cells are characterized by heads that are unspecified and free to vary with time. Constant-head and no-flow cells are used in the model to represent conditions along various hydrologic boundaries. Other boundary conditions, such as areas of constant inflow or areas where inflow varies with head, can be simulated using external source terms or through a combination or no-flow cells and external source terms.

The model simulates groundwater flow using both spatial and temporal discretization. Spatial discretization is handled in the horizontal direction by reading the number of rows, the number of columns and the width of each row and column (that is, the width of the cells in the direction transverse to the row or column). Discretization of space in the vertical direction is handled in the model by specifying the number of layers to be used and by specifying hydraulic parameters which contain or embody the layer thickness. Vertical discretization can be used to represent individual aquifers or less permeable zones by individual layers of the model.

The program handles temporal discretization by dividing the simulation time into stress periods, time intervals during which all external stresses are constant, which can be subdivided into time steps. Within each stress period, the time steps form a linear or geometric progression. The user specifies the length of the stress period; the number of time steps into which it is to be divided; and the time step multiplier or ratio of the length of each time step to that of the preceding time step. Using these terms, the program calculates the length of each time step in the stress period.

K-2.2 MODPATH PARTICLE TRACKING MODEL DOCUMENTATION

K-2.2.1 MODPATH Model Description and Assumptions

MODPATH is an advective particle tracking post-processing package developed by the USGS to compute three-dimensional path lines using steady-state simulation output from the USGS MODFLOW numerical groundwater flow model. MODPATH uses a semi-analytical particle tracking scheme to simulate three-dimensional path lines and particle positions at specified points in time in groundwater. MODPATH also can compute particle discharge point coordinates and total travel time.

General assumptions related to MODPATH model applications include:

- Head potential flow terms are from a block-centered, finite-difference, groundwater flow model (e.g., USGS MODFLOW). All standard assumptions related to the flow model are applicable (i.e., discretization effects, uniform properties within cells, completely efficient sinks/sources/wells, etc.).
- All simulations use steady-state flow conditions only (i.e., no transient conditions).
- Particle tracking simulates nonreactive, advective transport only. Dispersion, retardation, and decay cannot be accounted for.

K-2.2.2 MODPATH Model Equation and Implementation

Once the USGS MODFLOW flow model solves the governing equation for groundwater flow for heads and intercell flow rates, MODPATH computes values for principal components of the velocity vector at all points in the flow field using the MODFLOW-derived intercell flow rates.

MODPATH uses simple linear interpolation to compute the velocity components at points within a cell. Linear interpolation produces a continuous velocity vector field within each individual cell that identically satisfies the differential conservation of mass equation everywhere within the cell. Linear interpolation of the six-cell face velocity components results in a velocity vector field within the cell that automatically satisfies the conservation of mass equation at every point inside the cell, if it is assumed that internal sources or sinks are considered to be uniformly distributed within the cell.

The change in a particle's velocity with time as it moves through a three-dimensional, finite-difference cell is given by:

$$\left(\frac{\partial v_x}{\partial t}\right)+\left(\frac{\partial v_y}{\partial t}\right)+\left(\frac{\partial v_z}{\partial t}\right)=\left(\frac{\partial v_x}{\partial x}\right)\left(\frac{\partial x}{\partial t}\right)+\left(\frac{\partial v_x}{\partial x}\right)\left(\frac{\partial y}{\partial t}\right)+\left(\frac{\partial v_z}{\partial z}\right)\left(\frac{\partial z}{\partial t}\right)$$

where:

v_x = x-component of velocity

v_y = y-component of velocity

v_z = z-component of velocity

x = x-location of a particle

y = y-location of a particle

z = z-location of a particle

t = time

MODPATH calculates the coordinates of a particle (p) at any time (t) within a cell using the following solutions:

$$x_p(t_1) = x_o + (1/A_x)[v_x(t_o)\exp(A_x Dt) - v_{xo} \qquad 1$$

$$y_p(t_1) = y_o + (1/A_y)[v_y(t_o)\exp(A_y Dt) - v_{yo} \qquad 2$$

$$z_p(t_1) = z_o + (1/A_z)[v_z(t_o)\exp(A_z Dt) - v_{zo} \qquad 3$$

where:

$x_p(t_1)$ = x-location of particle p at time t_1

$y_p(t_1)$ = y-location of particle p at time t_1

$z_p(t_1)$ = z-location of particle p at time t_1

$v_x(t_o)$ = x-component of the particle's velocity at time t_o

$v_y(t_o)$ = y-component of the particle's velocity at time t_o

$v_z(t_o)$ = z-component of the particle's velocity at time t_o

A_x = velocity gradient in the x-direction or $\partial v_x/\partial x$

A_y = velocity gradient in the y-direction or $\partial v_y/\partial y$

A_z = velocity gradient in the z-direction or $\partial v_z/\partial z$

t_o = time (original)

t_1 = time (future)

MODPATH calculates the time required for a particle to travel from any point within a cell to a boundary face of the cell. The calculations are repeated, cell-by-cell, until the future time (t_1) of analysis.

ATTACHMENT K-3

MT3DMS Model Documentation

MT3DMS (Zheng and Wang 1998) is a modular three-dimensional multi-species transport model for simulation of advection, dispersion, and chemical reactions of dissolved constituents in groundwater systems. The model program uses a modular structure similar to that implemented in MODFLOW (Harbaugh, et al. 2000). This modular structure makes it possible to simulate advection, dispersion, sink/source mixing, and chemical reactions independently without reserving computer memory space for unused options.

The MT3DMS transport model is intended to be used in conjunction with any block-centered finite difference flow model, such as MODFLOW (Harbaugh, et al. 2000), and is based on the assumption that changes in the concentration field will not affect the flow field measurably. This allows the user to construct and calibrate a flow model independently. MT3DMS retrieves the hydraulic heads and the various flow and sink/source terms saved by the flow model, automatically incorporating the specified hydrologic boundary conditions. Currently, MT3DMS accommodates the following spatial discretization capabilities and transport boundary conditions: (1) confined, unconfined or variably confined/unconfined aquifer layers; (2) inclined model layers and variable cell thickness within the same layer; (3) specified concentration or mass flux boundaries; and (4) the solute transport effects of external sources and sinks such as wells, drains, rivers, aerial recharge and evapotranspiration.

General assumptions related to MT3DMS model applications include the following:

- Constituent concentrations are uniform across the length, width, and depth of each individual cell in each layer. Solution nodes are only calculated at the center of each cell.
- Constituents are dissolved in groundwater and adsorbed onto aquifer materials (i.e., no modeling of nonaqueous-phase liquids).
- Equilibrium-controlled or rate-limited sorption and first-order irreversible or reversible kinetic reactions (e.g., biodegradation) are occurring.
- General concentration boundary conditions must be specified around a boundary (Dirichlet Condition) or across a boundary (Neumann Condition), and must remain unchanged throughout the simulation.

MT3DMS Model Equations and Implementation

The governing equation for contaminant transport is described by the partial-differential equation:

$$R\frac{\partial C}{\partial t} = \frac{\partial}{\partial x_i}\left(D_{ij}\frac{\partial C}{\partial x_j}\right) - \frac{\partial}{\partial x_i}\left(v_i C\right) + \frac{q_s}{\theta}C_s - \lambda\left(C + \frac{\rho_b}{\theta}\overline{C}\right)$$

Where *R* is called the retardation factor, defined as:

$$R = 1 + \frac{\rho_b}{\theta}\frac{\partial \overline{C}}{\partial C}$$

Where:

C is the concentration of contaminants dissolved in groundwater, (pounds per cubic foot [pcf])

$\overline{C}$ is the concentration of contaminants adsorbed on the porous medium (pounds per pound)

t is time (days)

x_i is the distance along the respective Cartesian coordinate axis (feet)

D_{ij} is the hydrodynamic dispersion coefficient (ft^2/day)

v_i is the seepage or linear pore water velocity (ft/day)

θ is the effective porosity of the porous medium (unitless)

q_s is the volumetric flux of water per unit volume of aquifer representing sources (positive) and sinks (negative) (per day)

C_s is the concentration of the sources or sinks (pcf)

ρ_b is the bulk density of the porous medium (pcf)

λ is the rate constant of the first-order decay rate reactions (per day)

The transport equation is linked to the flow equation through the relationship:

$$v_i = -\frac{K_{ii}}{\theta}\frac{\partial h}{\partial x_i}$$

Where:

K_{ii} is a principal component of the hydraulic conductivity tensor (ft/day)

h is hydraulic head (feet)

The hydraulic head is obtained from the solution of the three-dimensional groundwater flow equation:

$$\frac{\partial}{\partial x_i}\left(K_{ii}\frac{\partial h}{\partial x_j}\right) + q_s = S_s\frac{\partial h}{\partial t}$$

Where S_s is the specific storage of the porous material (per foot).

MT3DMS includes three major classes of transport solution techniques: the standard finite difference method, the particle-tracking-based Eulerian-Lagrangian methods, and the higher-order finite-volume total-variation-diminishing (TVD) method. Since no single numerical technique has been shown to be effective for all transport conditions, the combination of these solution techniques, each having its own strengths and limitations, is believed to offer the best approach for solving the most wide-ranging transport problems with desired efficiency and accuracy.

In addition to the explicit formulation of the original MT3D code, MT3DMS includes an implicit formulation that is solved with an efficient and versatile solver. The iterative solver is based on generalized conjugate gradient (GCG) methods with three preconditioning options and the Lanczos/ORTHOMIN acceleration scheme for non-symmetrical matrices. If the GCG solver is selected, dispersion, sink/source, and reaction terms are solved implicitly without any stability constraints. For the advection term, the user has the option to select any of the solution schemes available, including the standard finite-difference method, the particle tracking based Eulerian-Langrangian methods, and the third-order TVD method. The finite-difference method can be fully implicit without any stability constraint to limit transport step-size. The particle tracking based Eulerian-Langrangian methods and the third- order TVD method still have time step constraints associated with the particle tracking and TVD methodology. If the GCG solver is not selected, the explicit formulation is automatically used in MTDMS with the usual stability constraints. The explicit formulation is efficient for solving advection-dominated problems in which the transport step-sizes are restricted by accuracy considerations. It is also useful when the implicit solver requires a large number of iterations to converge or when the computer system does not have enough memory to use the implicit solver.

ATTACHMENT K-4

Contaminant Fate and Transport Model Input Justification

Contaminant Half-Life Estimations and Model Input

This section discusses the calculation of the site-specific half-lives for contaminants of potential concern at FTP.

DEFINITIONS:

The following terms are used in the calculations below.

C_t	Contaminant concentration at time (t) (µg/L)
C_0	Contaminant concentration at time (0) (µg/L)
k	Estimated first order decay constant (1 per day)
t	Time between samples (days)
$t_{0.5}$	Target compound half-life (days)
L	Distance between wells (feet)
V_{gw}	Average linear groundwater flow velocity (ft/day)
V_c	Velocity of target compound in groundwater (ft/day)
K	Hydraulic conductivity based on aquifer tests (ft/day)
i	Hydraulic gradient calculated water level data (feet per foot)
η	Effective porosity of aquifer based on geotechnical analysis
R	Target compound retardation factor in groundwater
K_{oc}	Water-organic carbon partition coefficient of target compound in groundwater (mL/g)
TOC	Total organic carbon content of aquifer
ρb	Dry bulk density of the aquifer from geotechnical analysis

DEGRADATION HALF-LIVES:

From Graves (1995), target compound half-lives can be estimated using measured concentrations over time. Half-lives can be estimated using data from one monitoring well over time, or multiple wells (along the groundwater flow path in a single event), using the following equations.

$$C_t = C_0 \cdot e^{-k \cdot t}$$

Solving for k gives:

$$k = \frac{-\ln\left(\frac{C_t}{C_0}\right)}{t}$$

Use k to calculate the degradation half-life:

$$t_{0.5} = \frac{\ln(2)}{k}$$

For single wells:

at t = 0 (C_0) and t = t (C_t)

t = time between sample events

For multiple wells:

$$t = \frac{L}{(V_c)}$$

$$V_c = \frac{\frac{K \cdot i}{\eta}}{R}$$

$$R = 1 + \frac{K_d \cdot \rho b}{\eta_e}$$

At the FTP, wells JAW-58, JAW-59, JAW-60, JAW-80, FTA-99-1, SA-99-1 were used for this analysis. Selection of these wells were based on:

- These wells were the only wells at FTP that were installed before the FTP, EBP, and WBPA FS data collections with contaminants currently (Spring 2003) detected above the IAAAP regulatory standards.
- There have been a sufficient number of sampling events to demonstrate an overall decline in contaminant concentrations over time.

Additionally, the wells used have not demonstrated a large transport distance, therefore the single well over-time method was used. The multiple well method was not used because of the limited transport of the plumes.

Supporting target compound concentration data and concentration versus time plots are included on the attached table.

REFERENCES:

Graves, D. 1995. Test Protocols for Evaluating Natural Attenuation in Groundwater. Biotechnologies Applications Center. Knoxville, Tennessee. August.

ATTACHMENT K-4
HALF-LIFE ESTIMATES OVER TIME
SINGLE WELL METHOD (GRAVES 1995)
FIRE TRAINING PIT GROUNDWATER MODELING

Well	Initial Concentration C_0 (mg/L)	Initial Concentration Sampling Event	Ending Concentration C_t (mg/L)	Ending Concentration Sampling Event	Elapsed Time t (years)	Rate Constant k (1/year)	Half-life $t_{1/2}$ (years)
Benzene							
JAW 60	32	Fall 2000	11	Spring 2003	2.5	0.43	1.6
SA-99-1	250	Fall 2000	110	Spring 2003	2.5	0.33	2.1
						Average	1.9
Chloroethane							
SA-99-1	4,500	Fall 2000	3,700	Spring 2003	2.5	0.08	8.9
PCE							
JAW-59	11	Fall 2000	5	Spring 2003	2.5	0.32	2.20
SA-99-1	14	Spring 2001	3	Spring 2003	2	0.77	0.90
						Average	1.55
TCE							
JAW-60	94	Spring 2001	74	Spring 2003	2	0.12	5.8
JAW-80	9	Spring 2001	2	Spring 2003	2	0.75	0.9
FTA-99-1	9	Spring 2000	7	Spring 2003	3	0.08	8.3
SA-99-1	96	Fall 2000	3	Spring 2003	2.5	1.39	0.5
						Average	3.9
1,1-DCE							
JAW 58	860	Spring 1996	81	Spring 2003	7	0.34	2.1
JAW 80	150	Spring 2001	17	Spring 2003	2	1.09	0.6
SA-99-1	930	Fall 2000	28	Spring 2003	2.5	1.40	0.5
						Average	1.1
VC							
JAW-60	3	Spring 2002	1.5	Spring 2003	1	0.69	1.00
SA-99-1	10	Fall 2000	390	Spring 2002	1.5	-2.44	-0.28
SA-99-1	390	Spring 2002	360	Spring 2003	1	0.08	8.66
						Average	3.13
RDX							
FTA-99-1	9	Spring 2002	6.9	Spring 2003	1	0.27	2.6

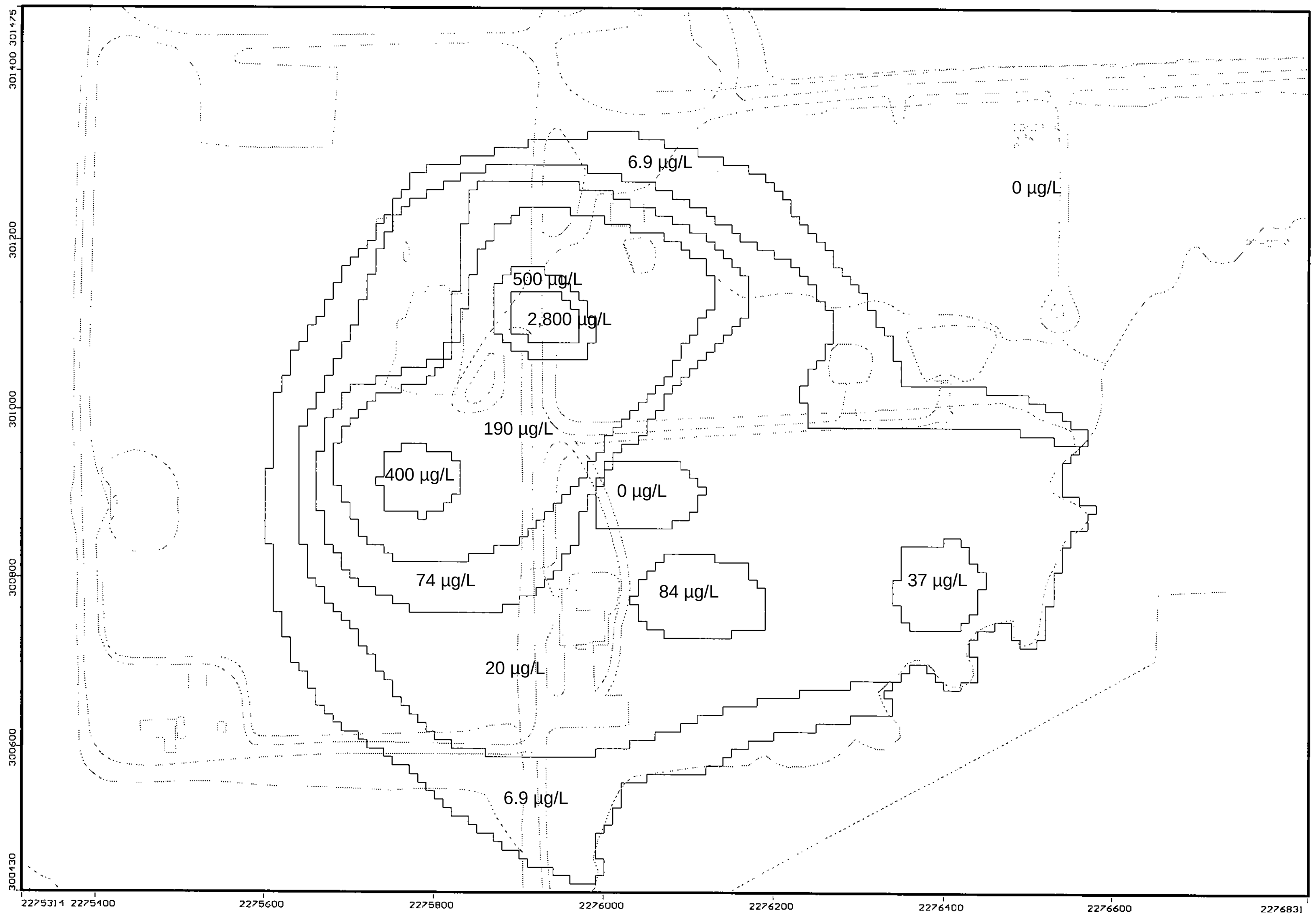
Notes: $k=-\ln(C_0/C_t)/t$

$t_{1/2}=\ln(2)/k$

ATTACHMENT K-4

Contaminant Fate and Transport Model Input Justification

Initial Target Compound Concentrations Input



URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline – 1,1–DCE
Modeller: JJS/ANB   Initial Conc.
11 Mar 04

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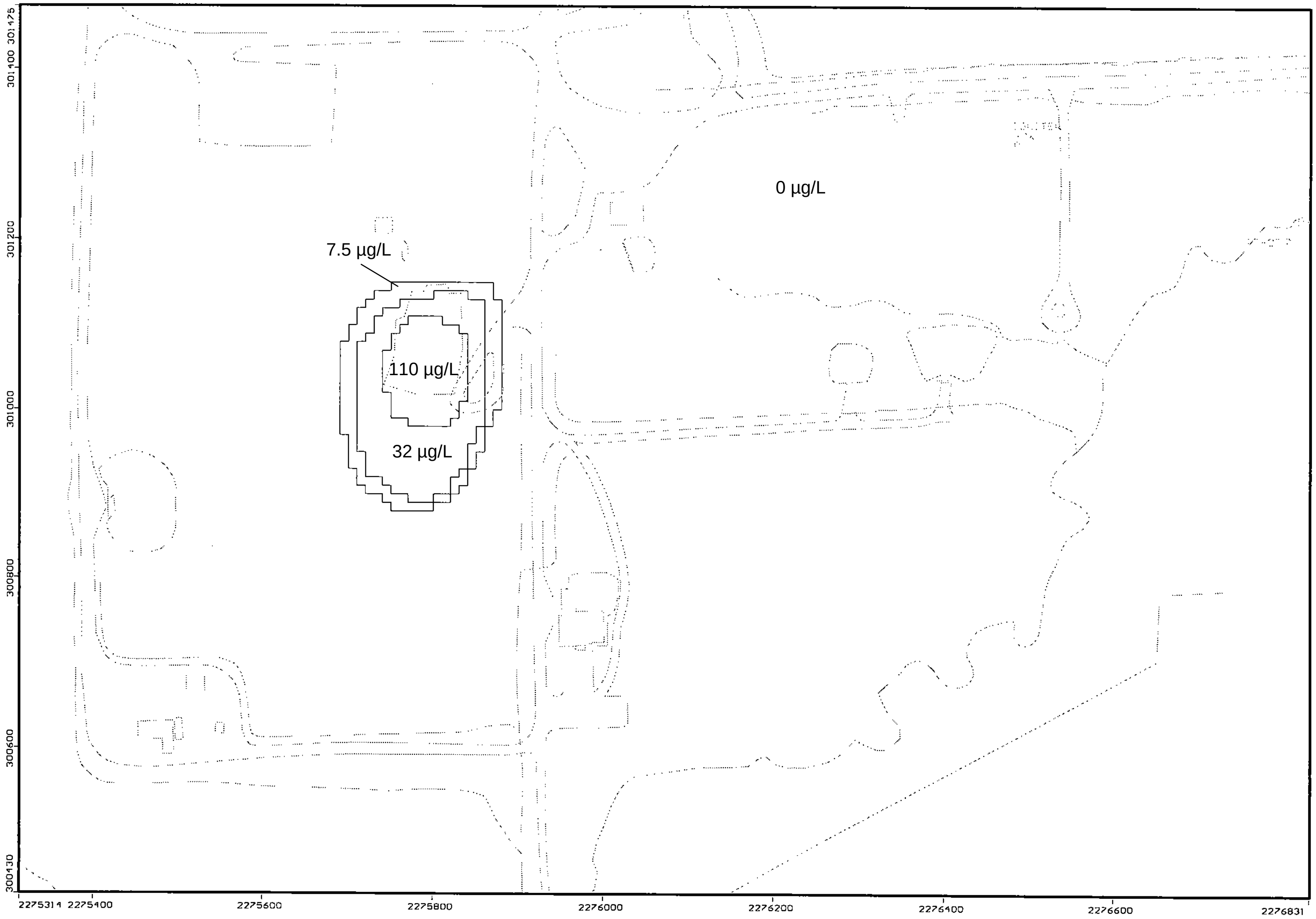
NC: 354   NR: 244   NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline – Benzene
Modeller: JJS/ANB Initial Conc.
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
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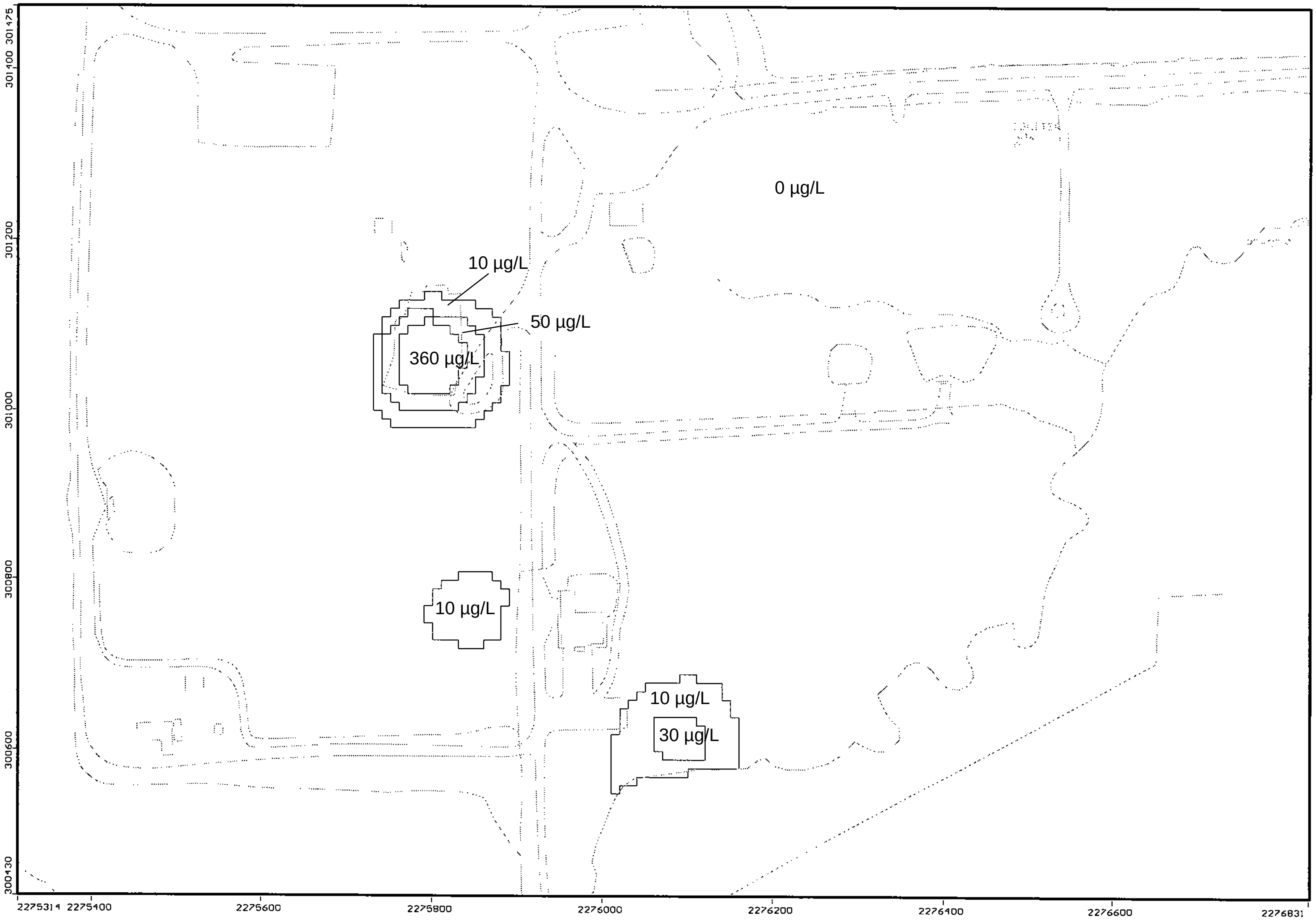

URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline – Vinyl Chloride
Modeller: JJS/ANB Initial Conc.
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
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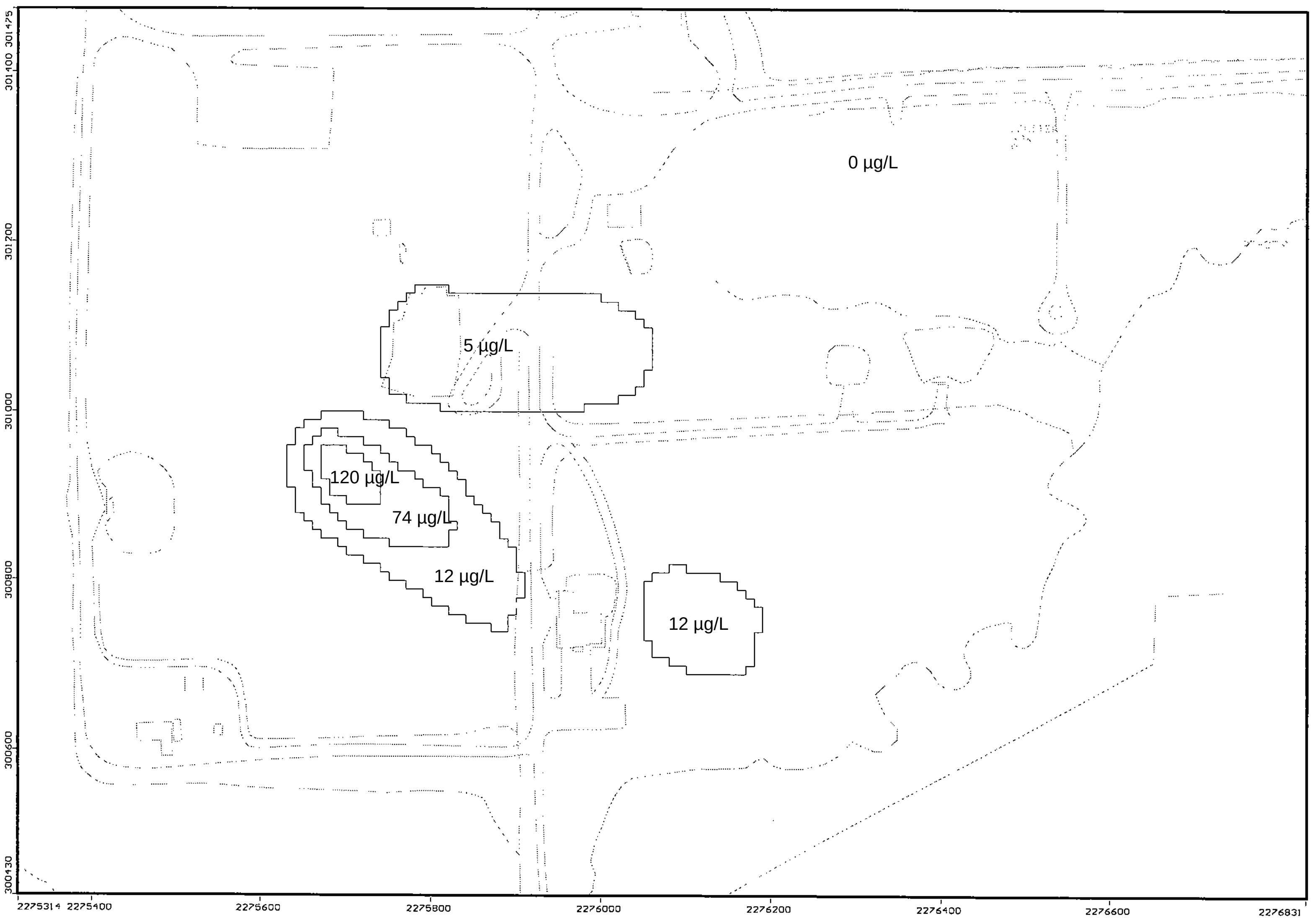

URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline – TCE
Modeller: JJS/ANB Initial Conc.
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
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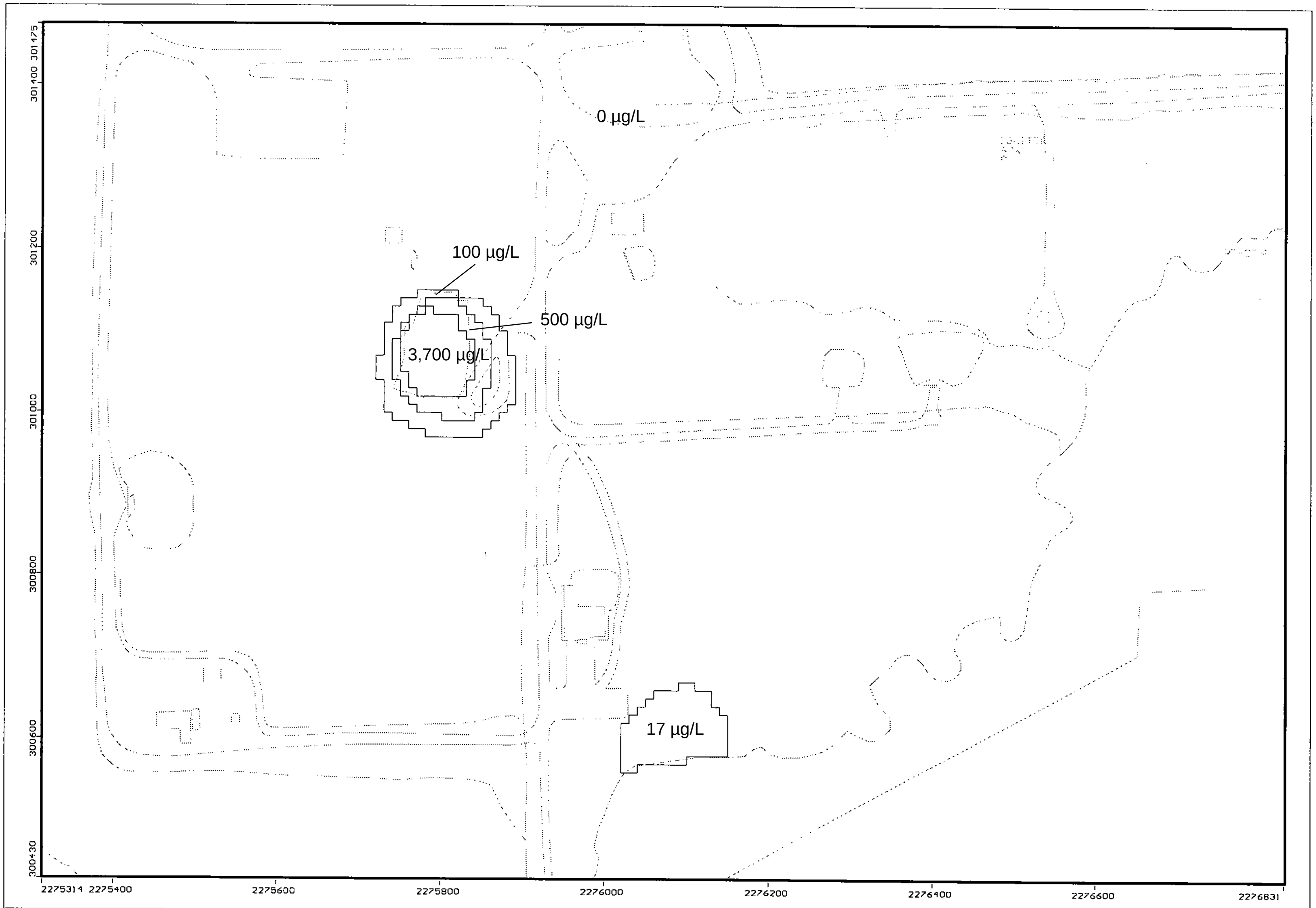


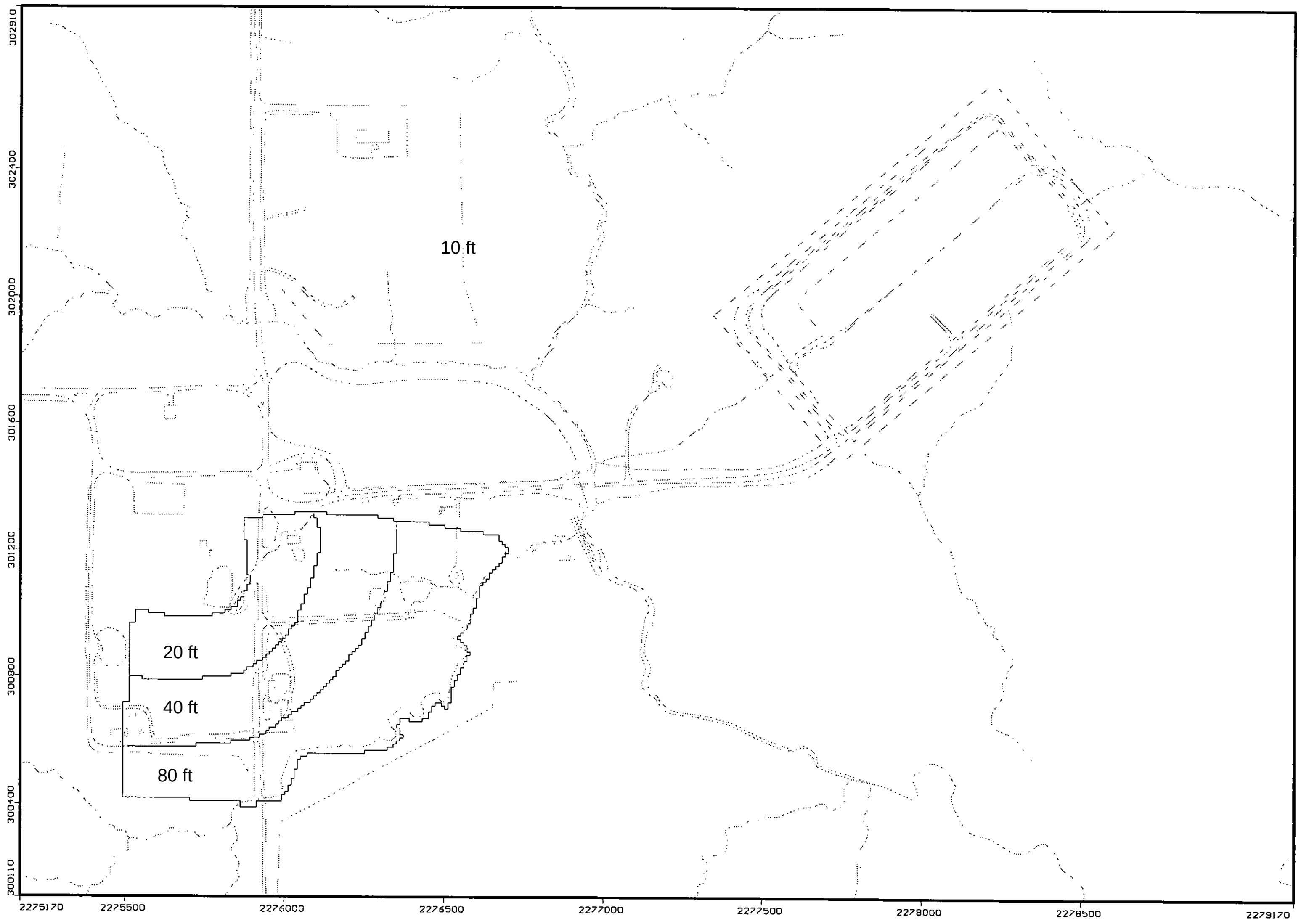
URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline – Chloroethane
Modeller: JJS/ANB Initial Conc.
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

ATTACHMENT K-4

Contaminant Fate and Transport Model Input Justification

Dispersivity Input



URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline – Dispersivity
Modeller: JJS/ANB
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
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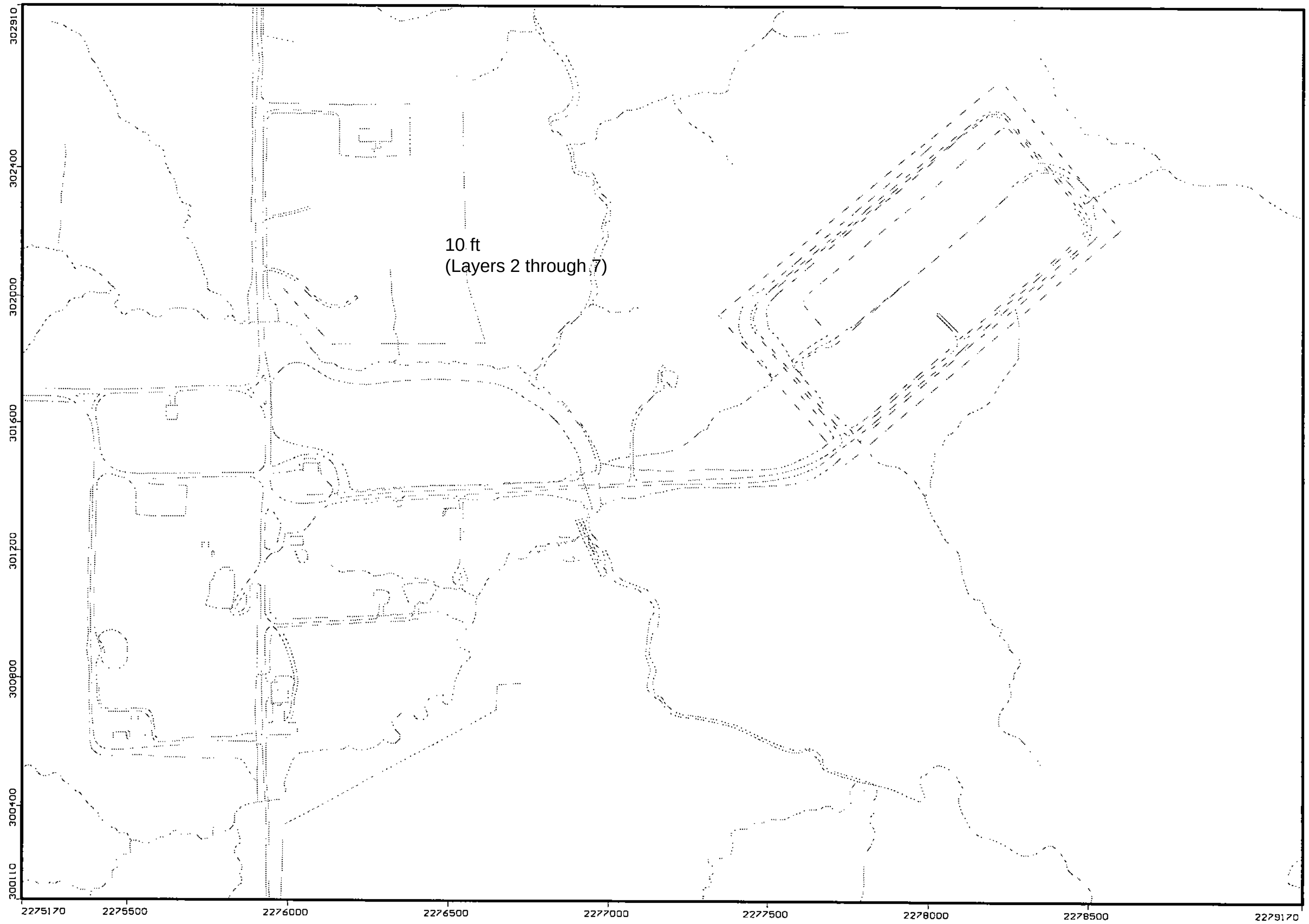


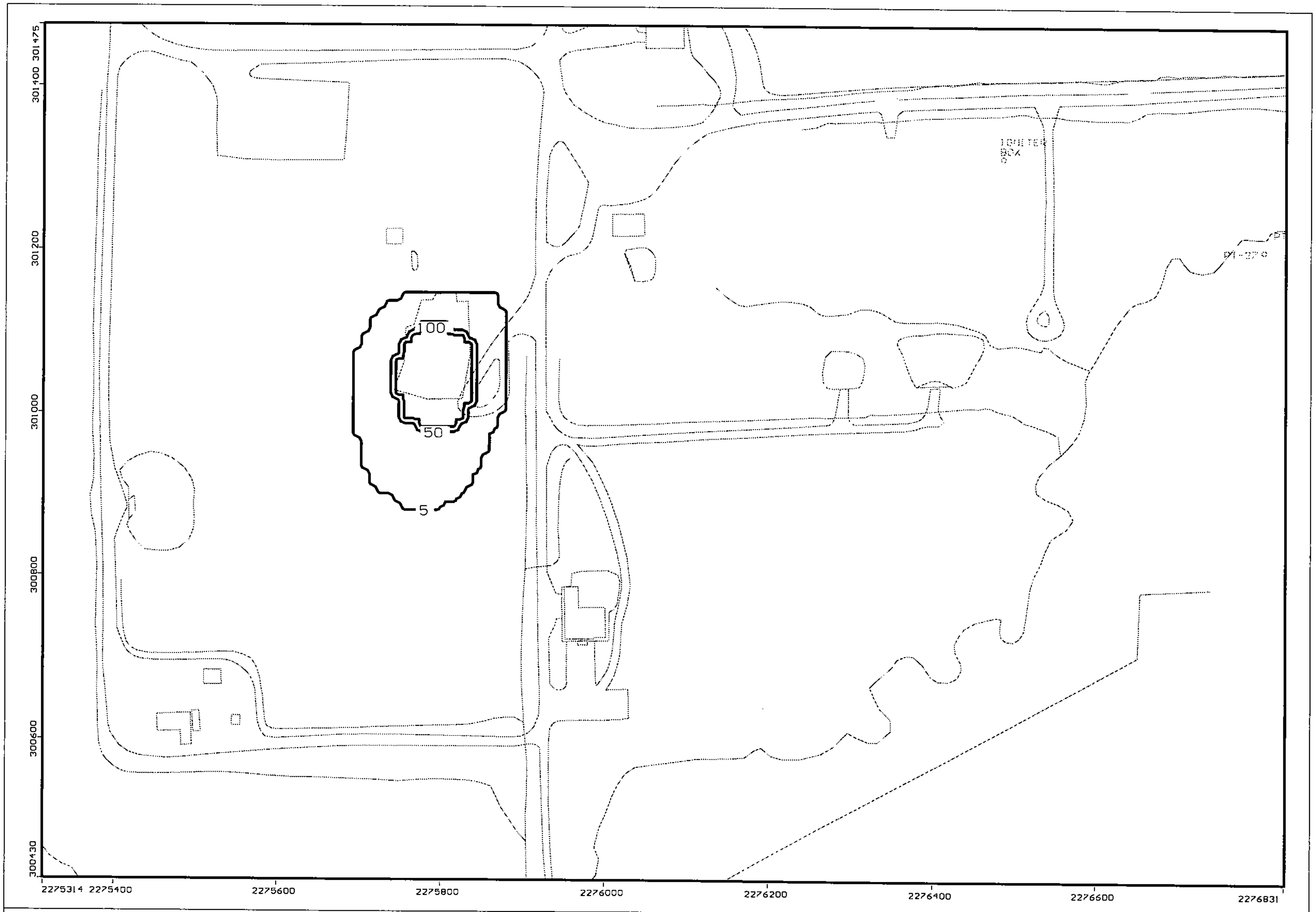
URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline – Dispersivity
Modeller: JJS/ANB Layers 2 thru' 7
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 2

ATTACHMENT K-5

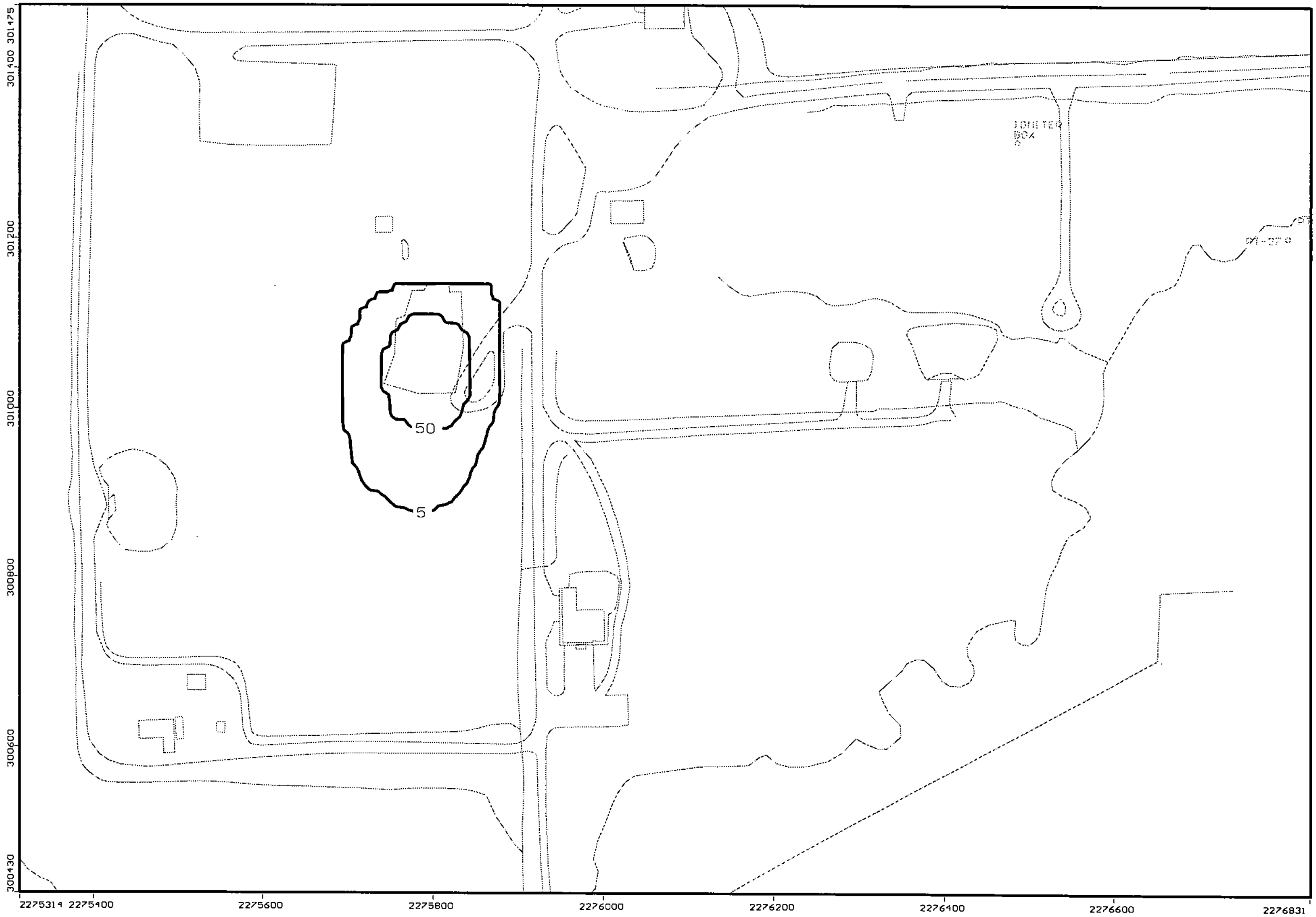
Contaminant Fate and Transport Modeling Results

Baseline Fate and Transport Model



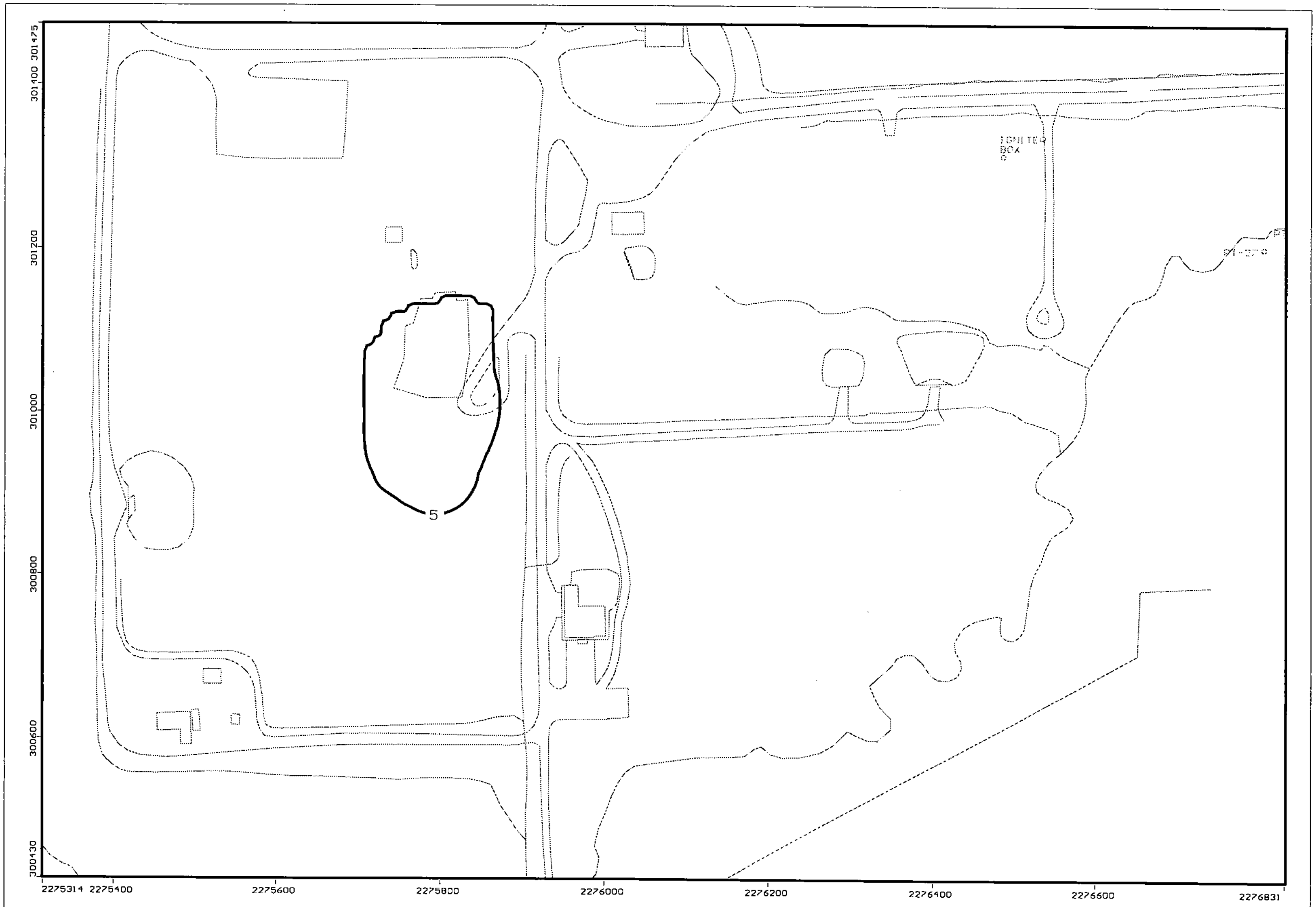
URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline-Benzene
Modeller: JJS/ANB 1 d
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995-2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



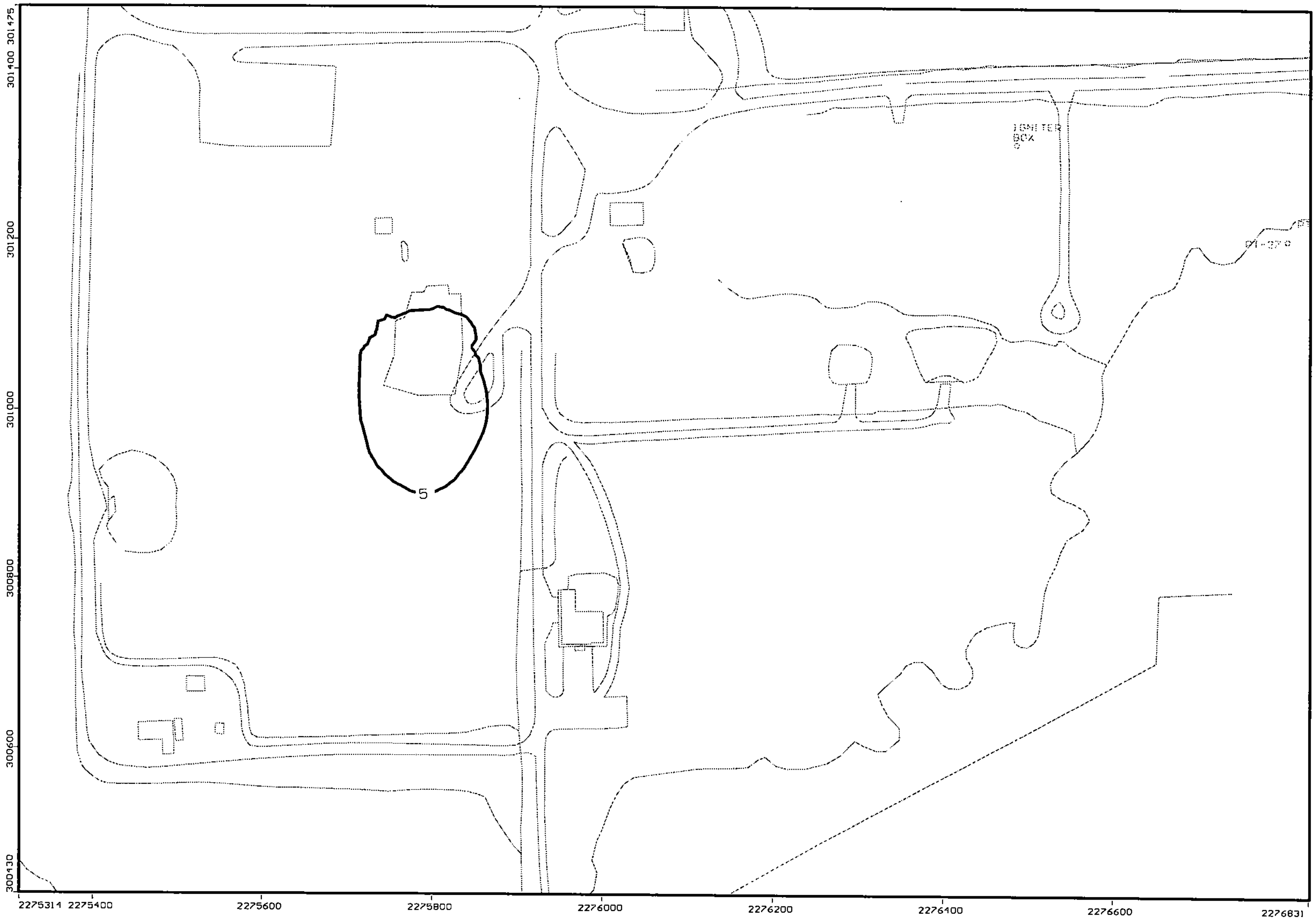
URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline–Benzene
Modeller: JJS/ANB 1 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



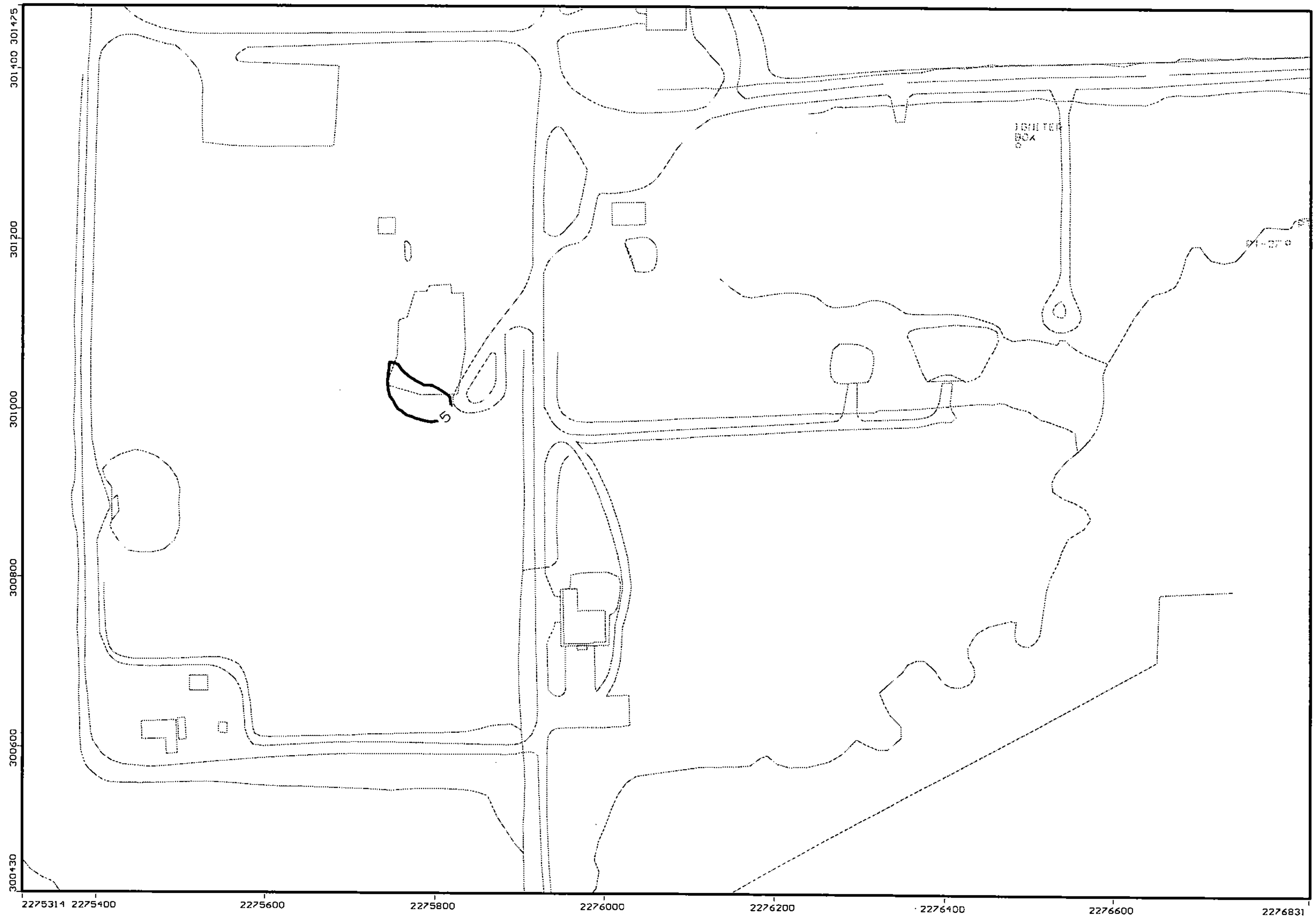
URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline–Benzene
Modeller: JJS/ANB 5 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline–Benzene
Modeller: JJS/ANB 10 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

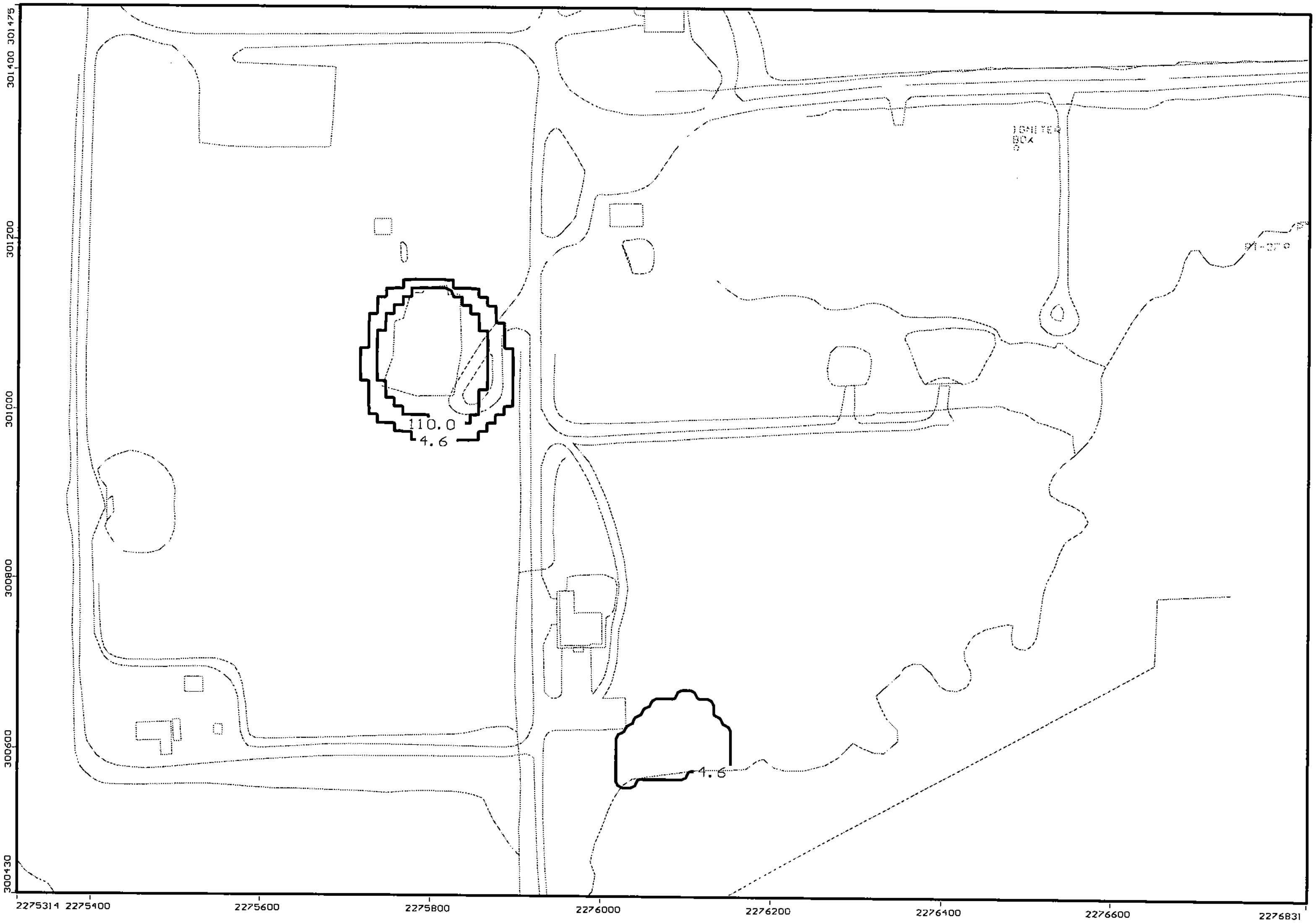


URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline–Benzene
Modeller: JJS/ANB 17 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

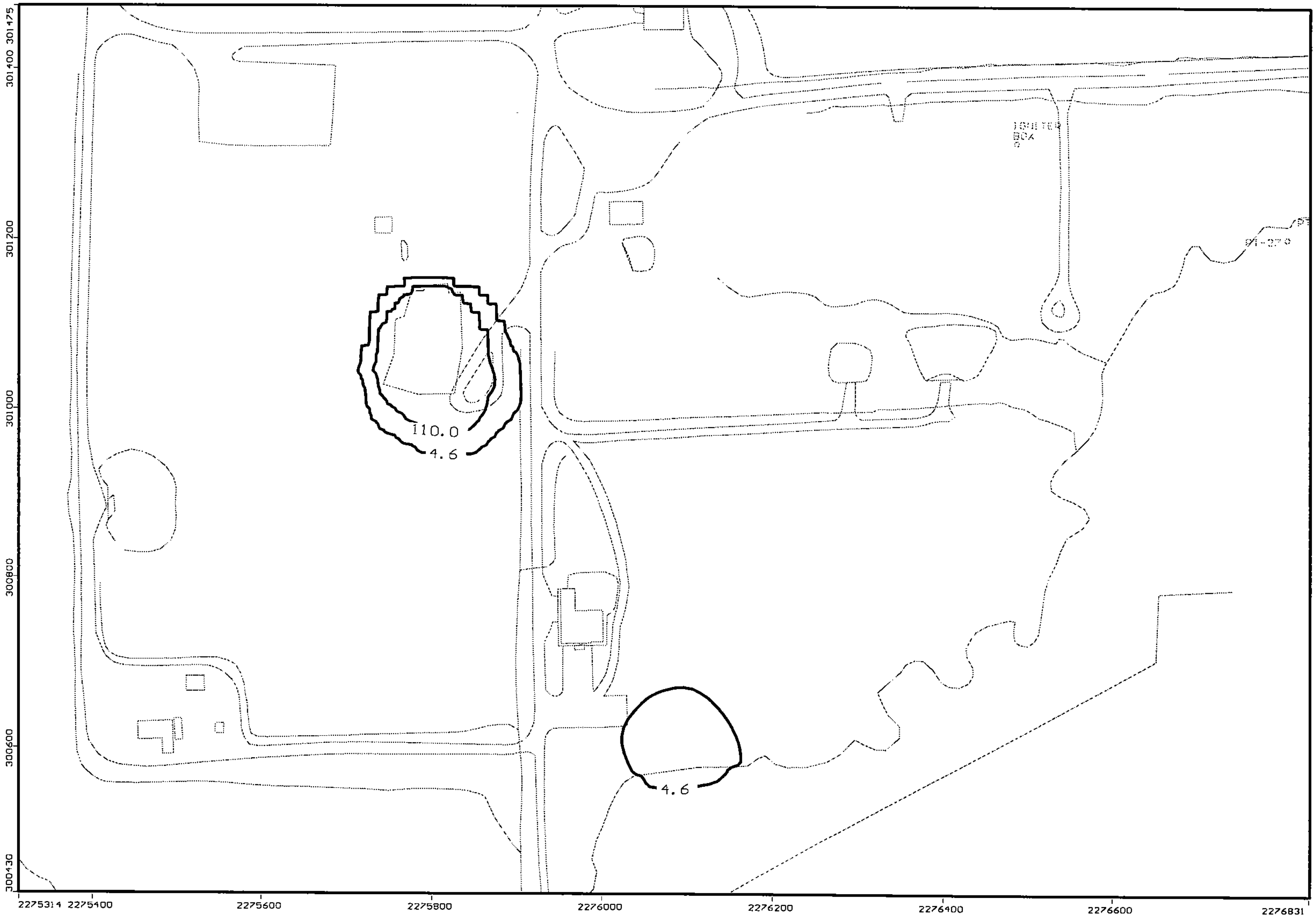
URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline–Benzene
Modeller: JJS/ANB 18 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



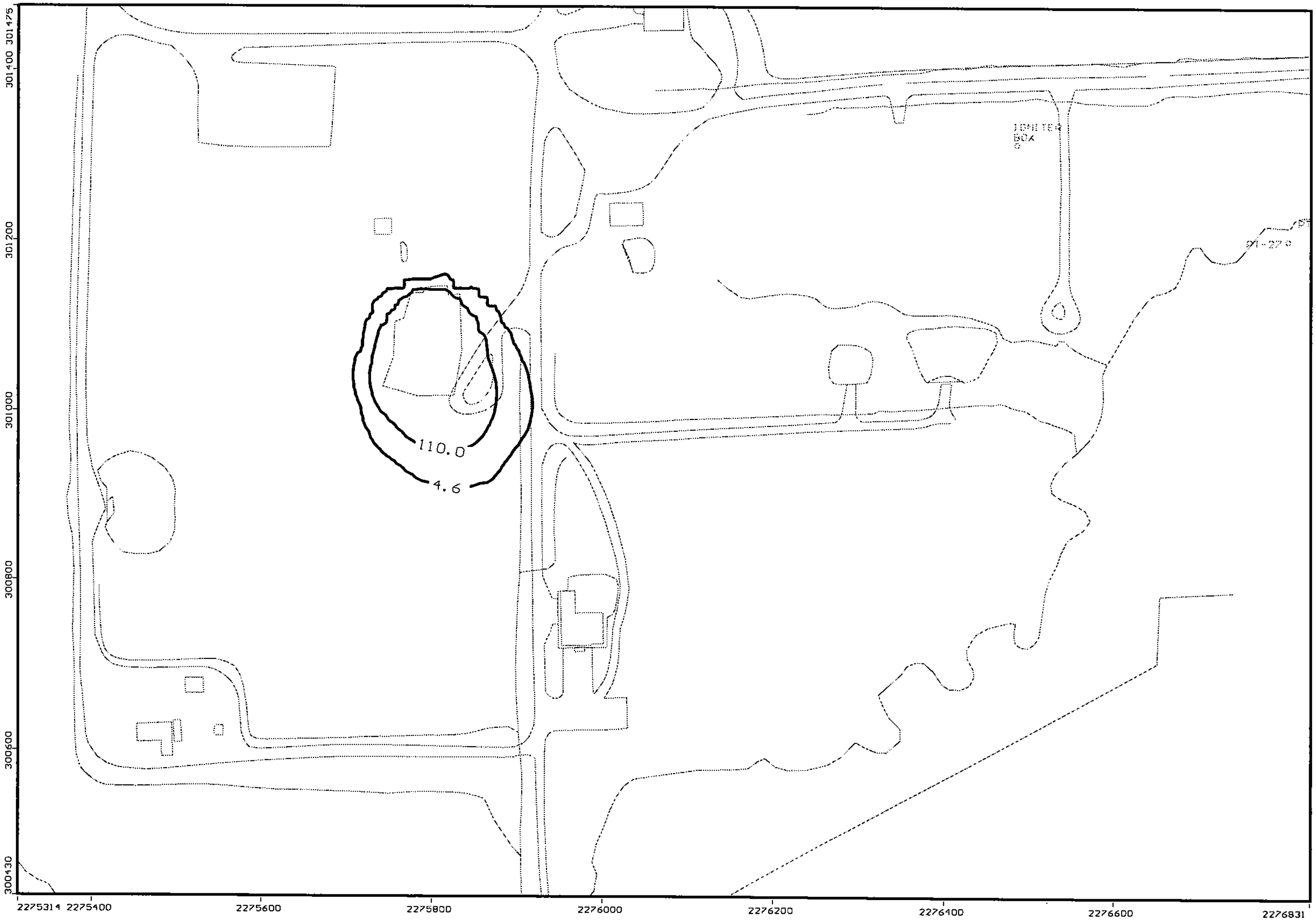
URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline–Chloroethane
Modeller: JJS/ANB 1 d
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline—Chloroethane
Modeller: JJS/ANB 1 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline–Chloroethane
Modeller: JJS/ANB 5 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
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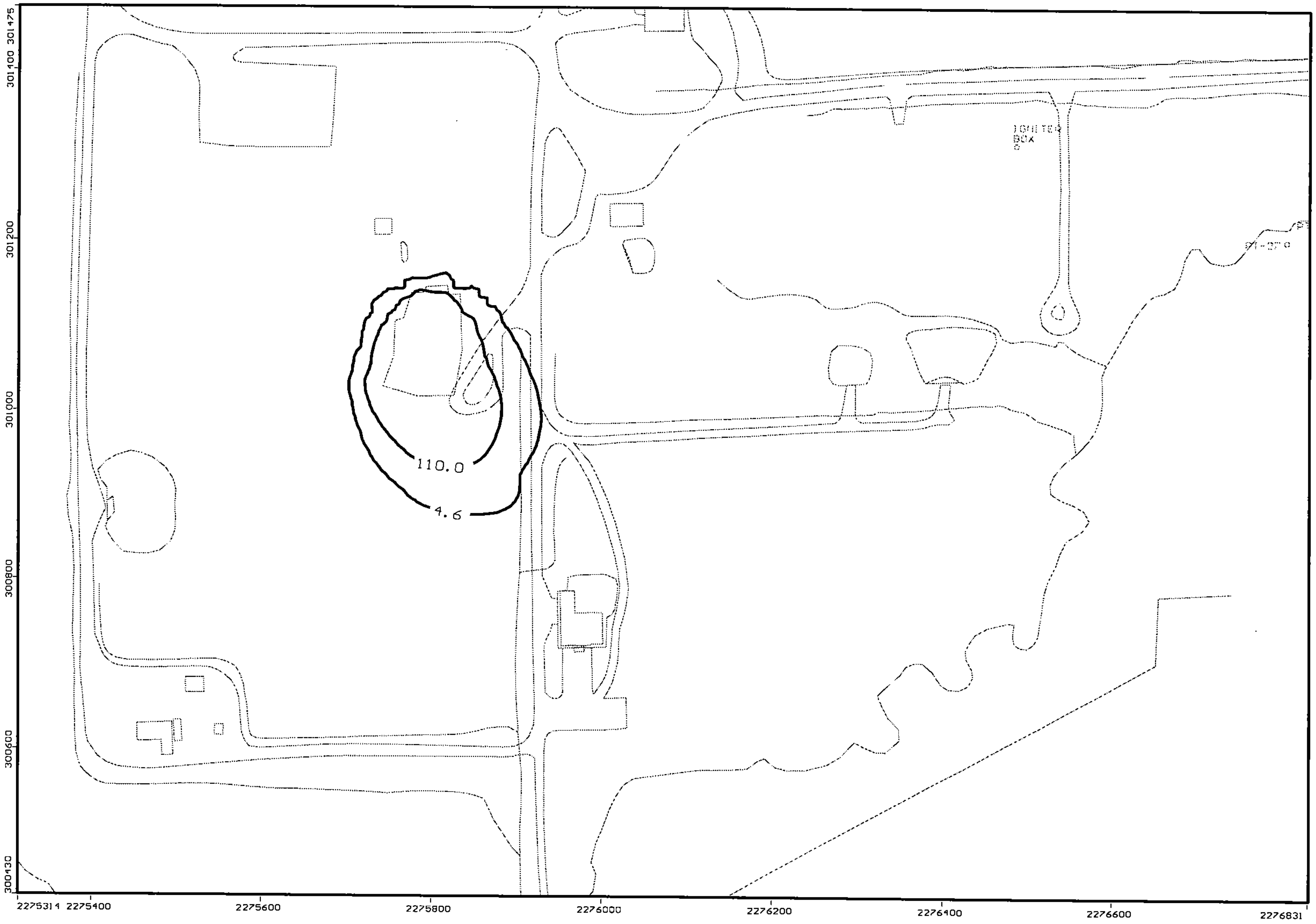

URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline–Chloroethane
Modeller: JJS/ANB 10 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
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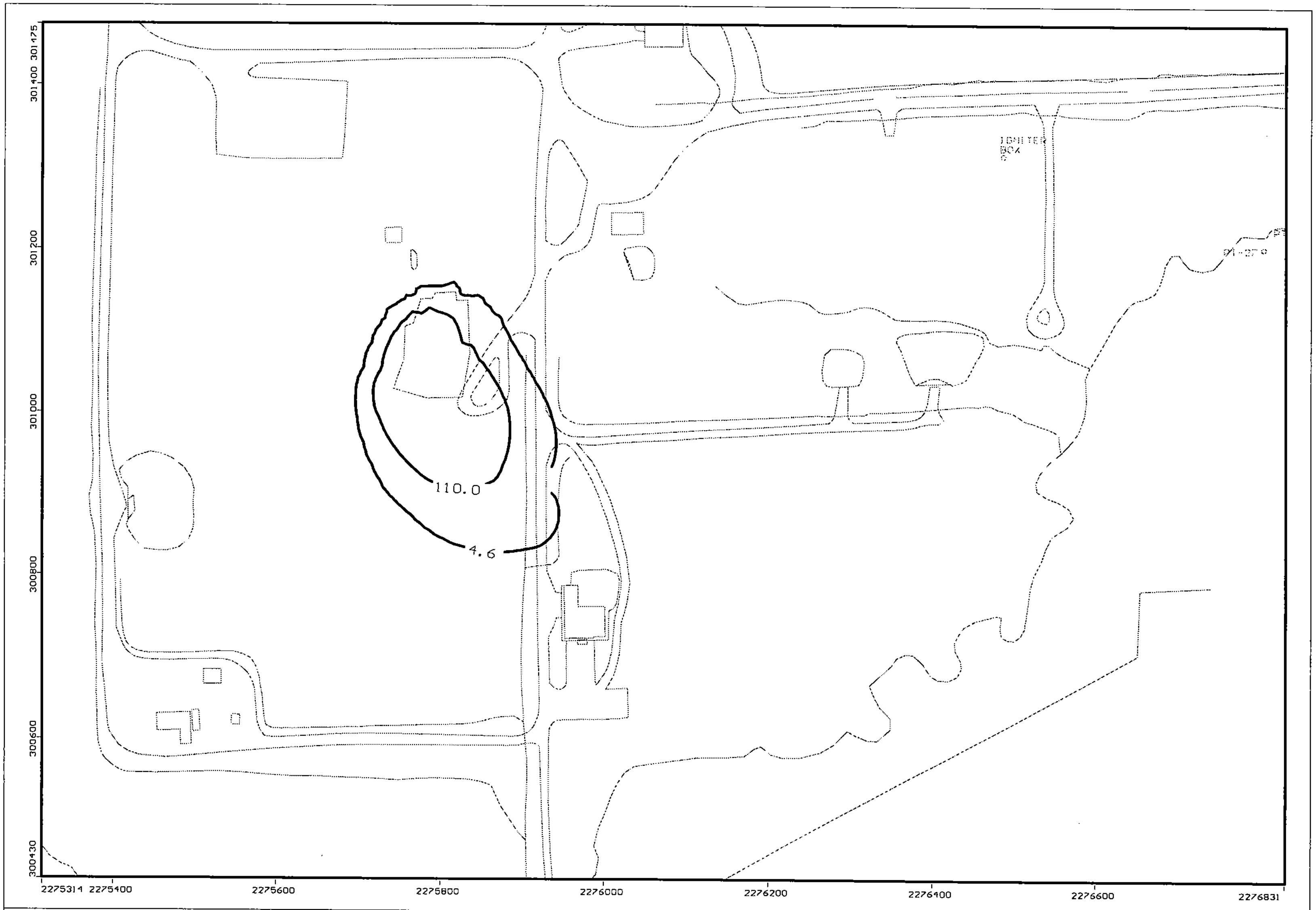
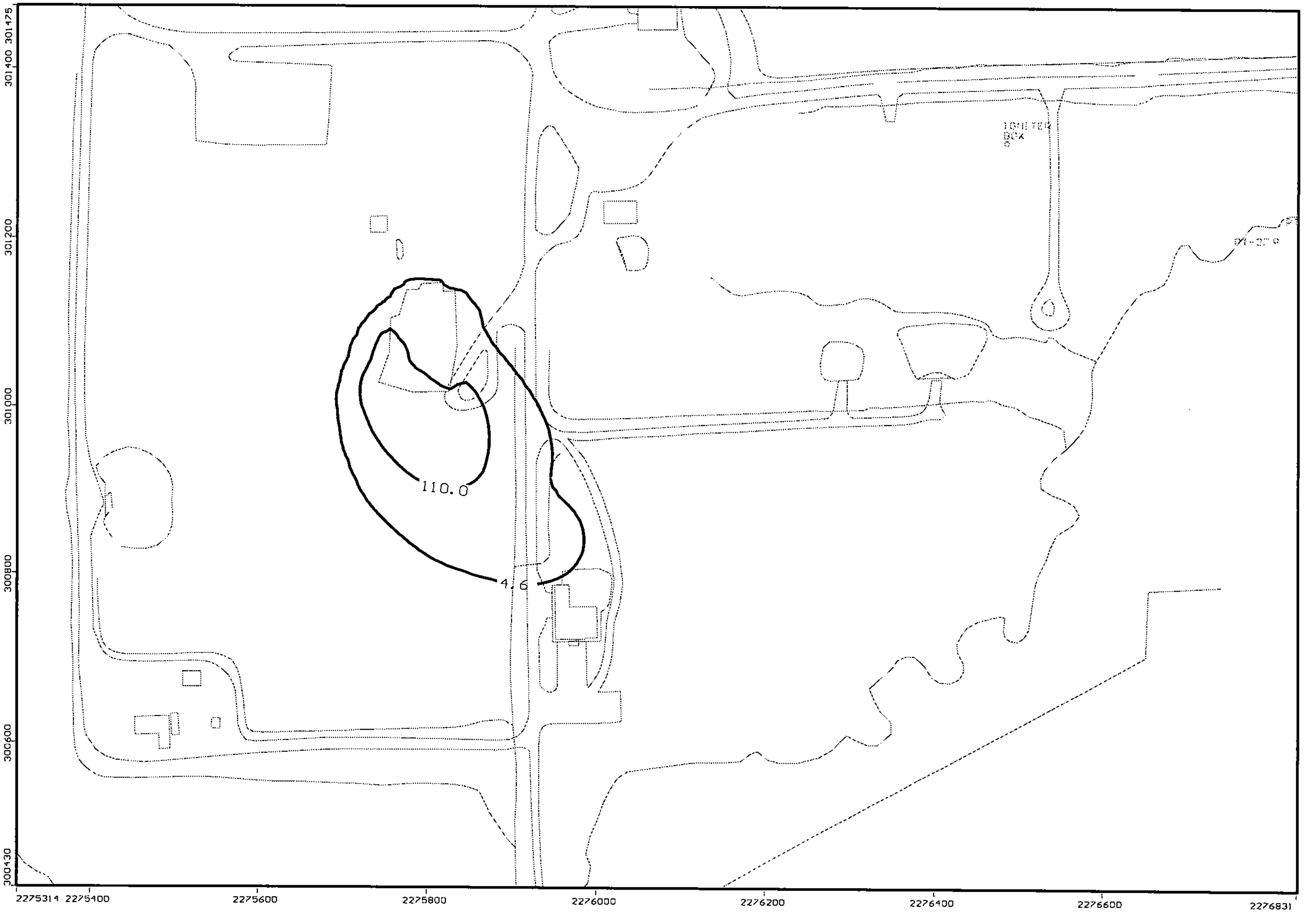


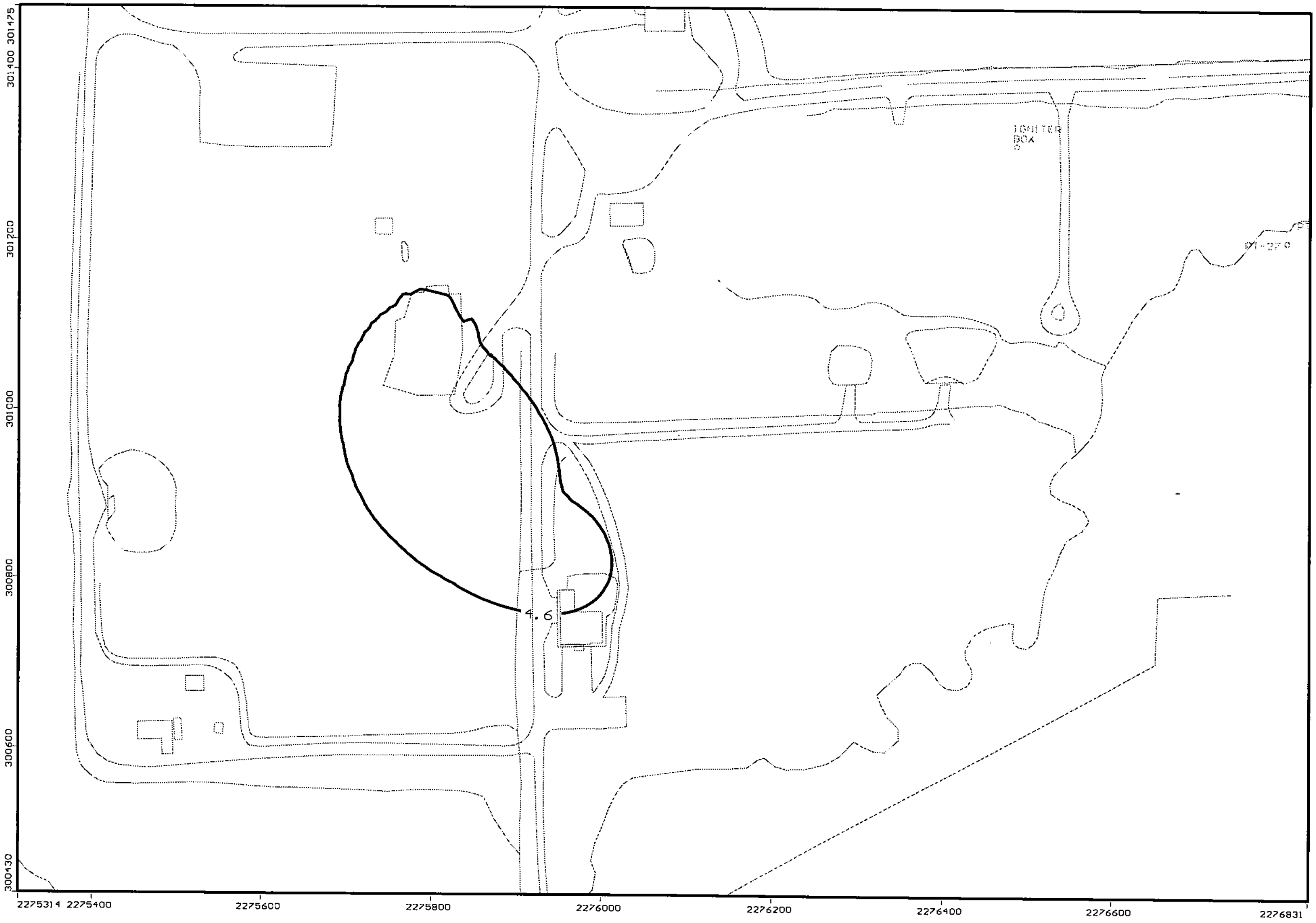
URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline–Chloroethane
Modeller: JJS/ANB 20 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



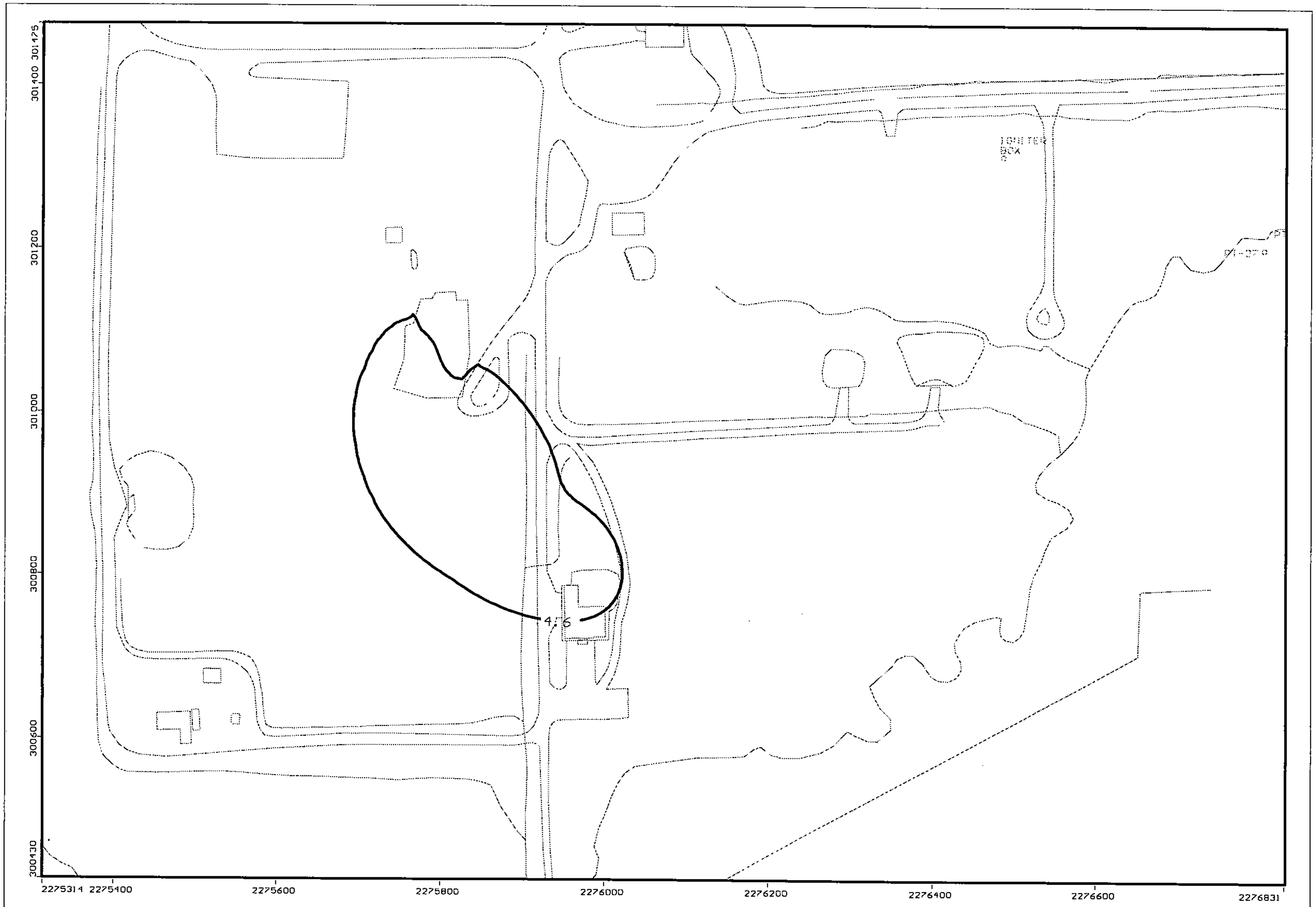
URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline—Chloroethane
Modeller: JJS/ANB 30 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



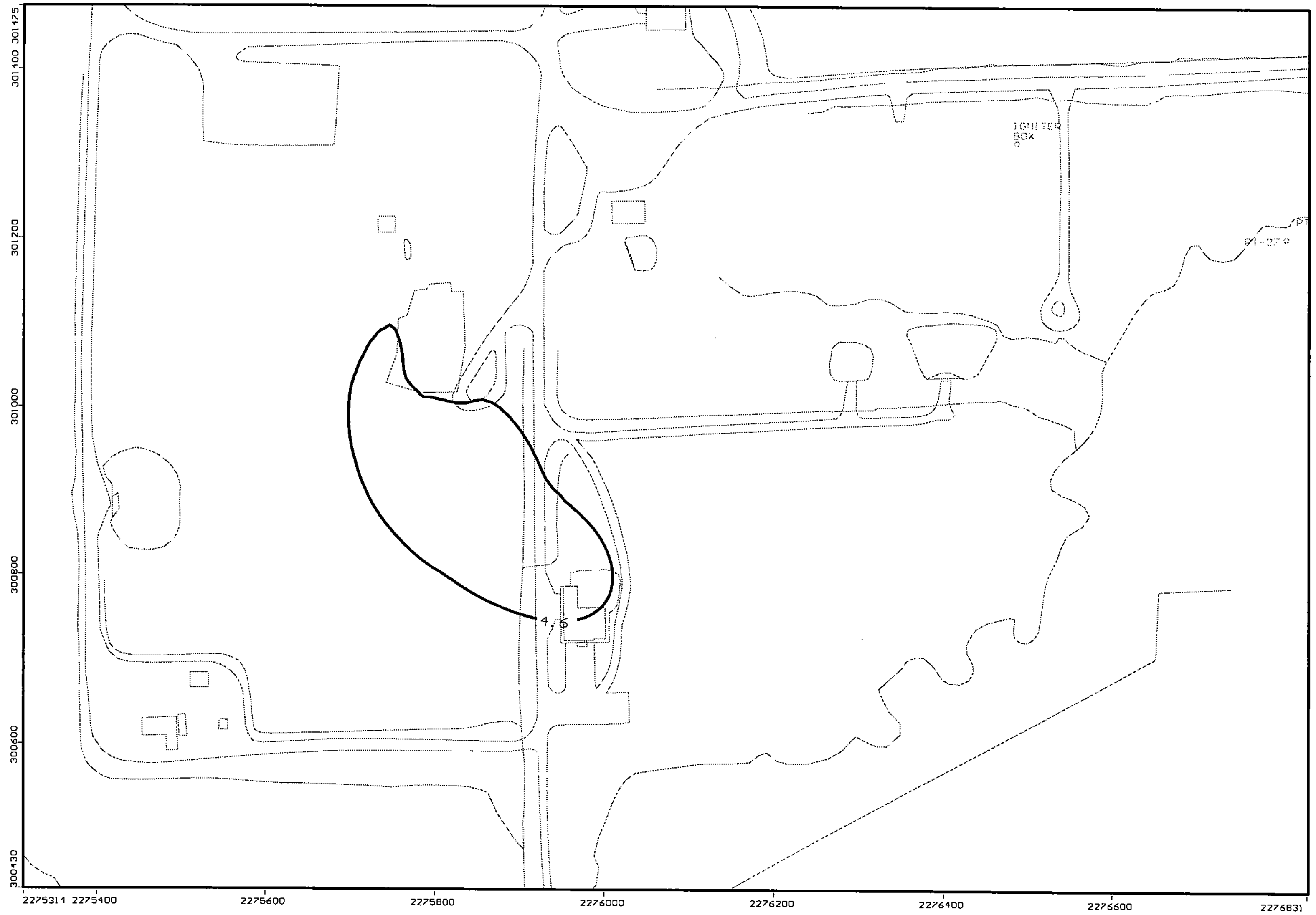
URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline–Chloroethane
Modeller: JJS/ANB 40 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



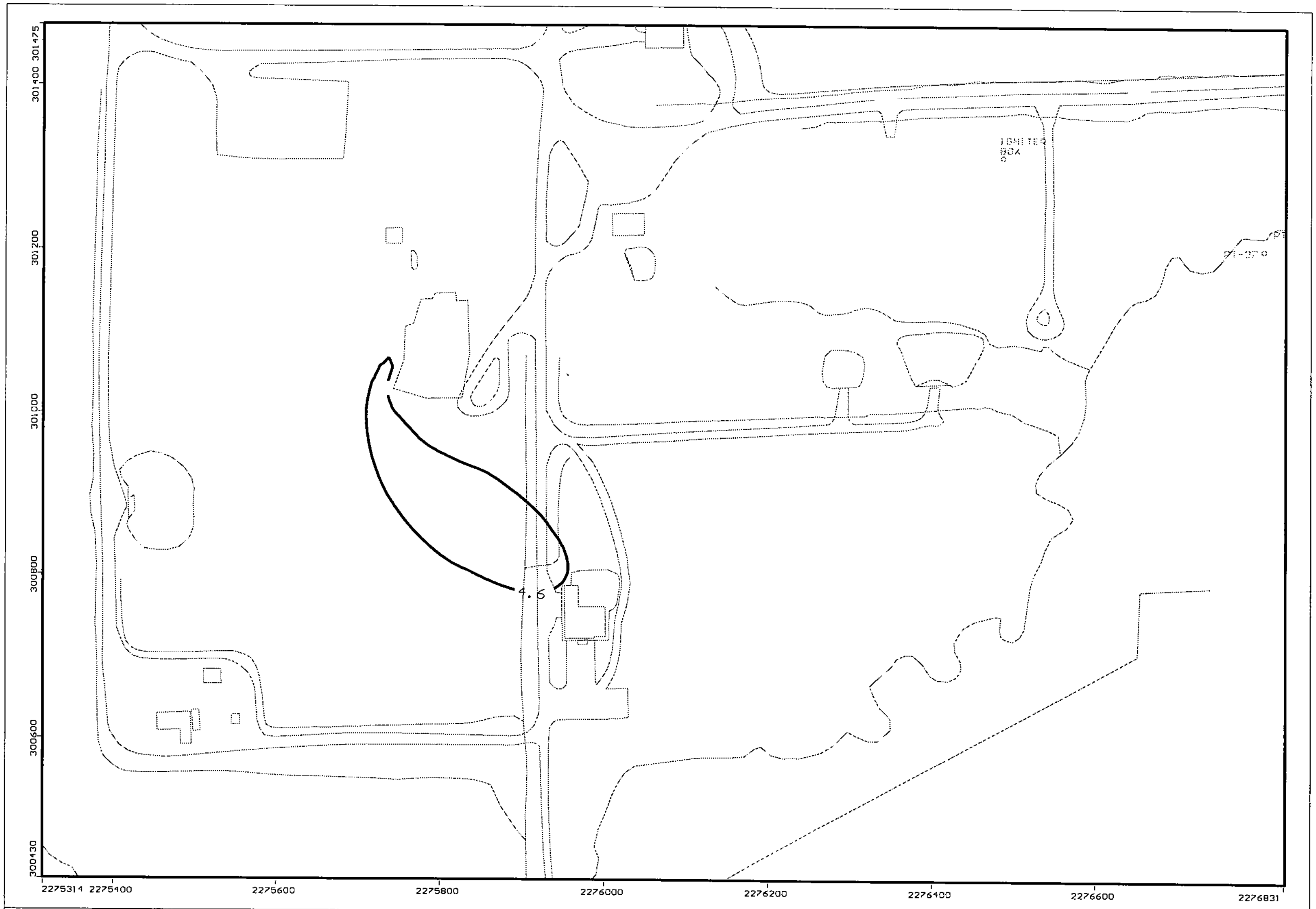
URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline–Chloroethane
Modeller: JJS/ANB 50 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



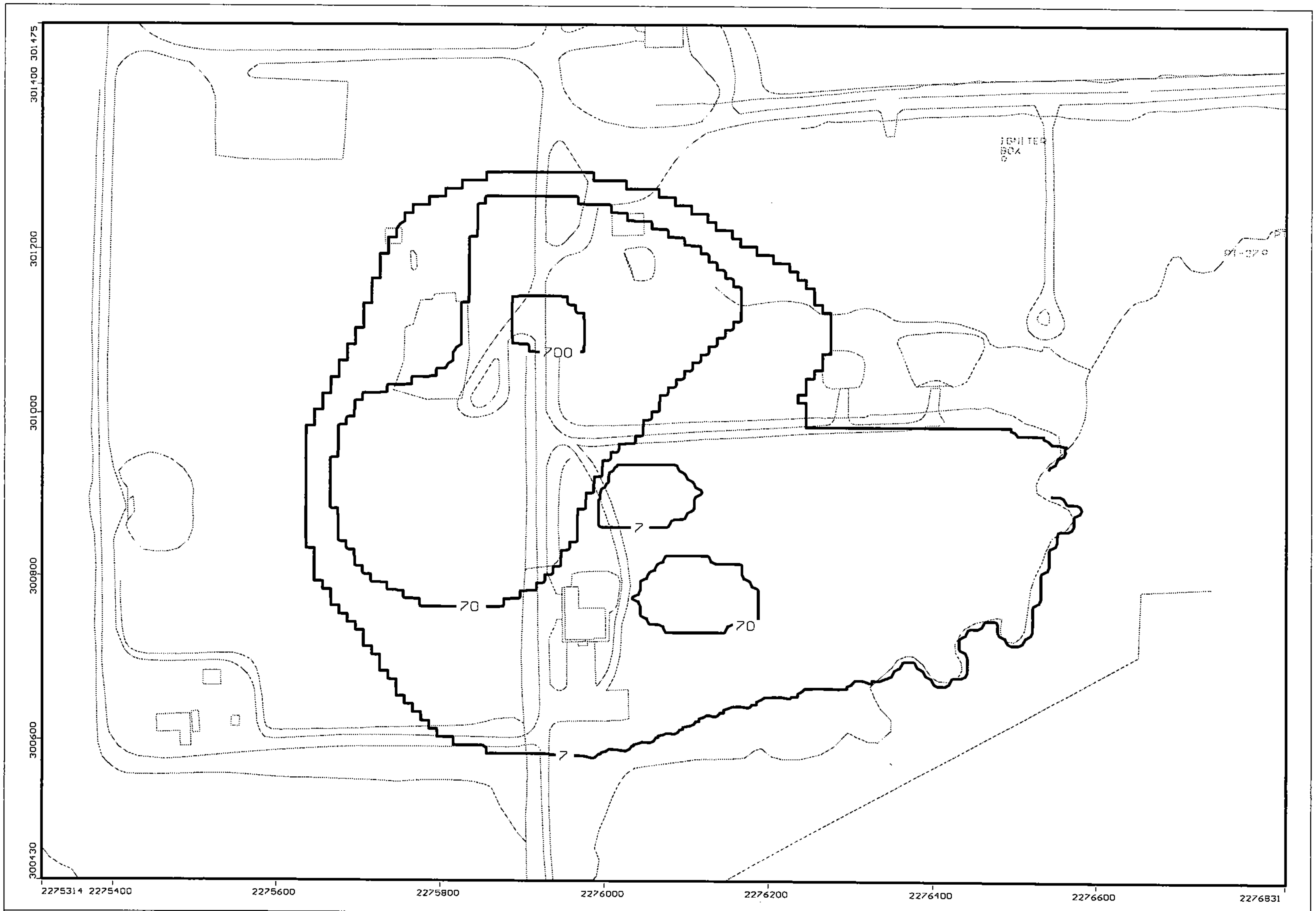
URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline–Chloroethane
Modeller: JJS/ANB 60 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline–Chloroethane
Modeller: JJS/ANB 70 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline-1,1 DCE
Modeller: JJS/ANB 1 d
10 Mar 04

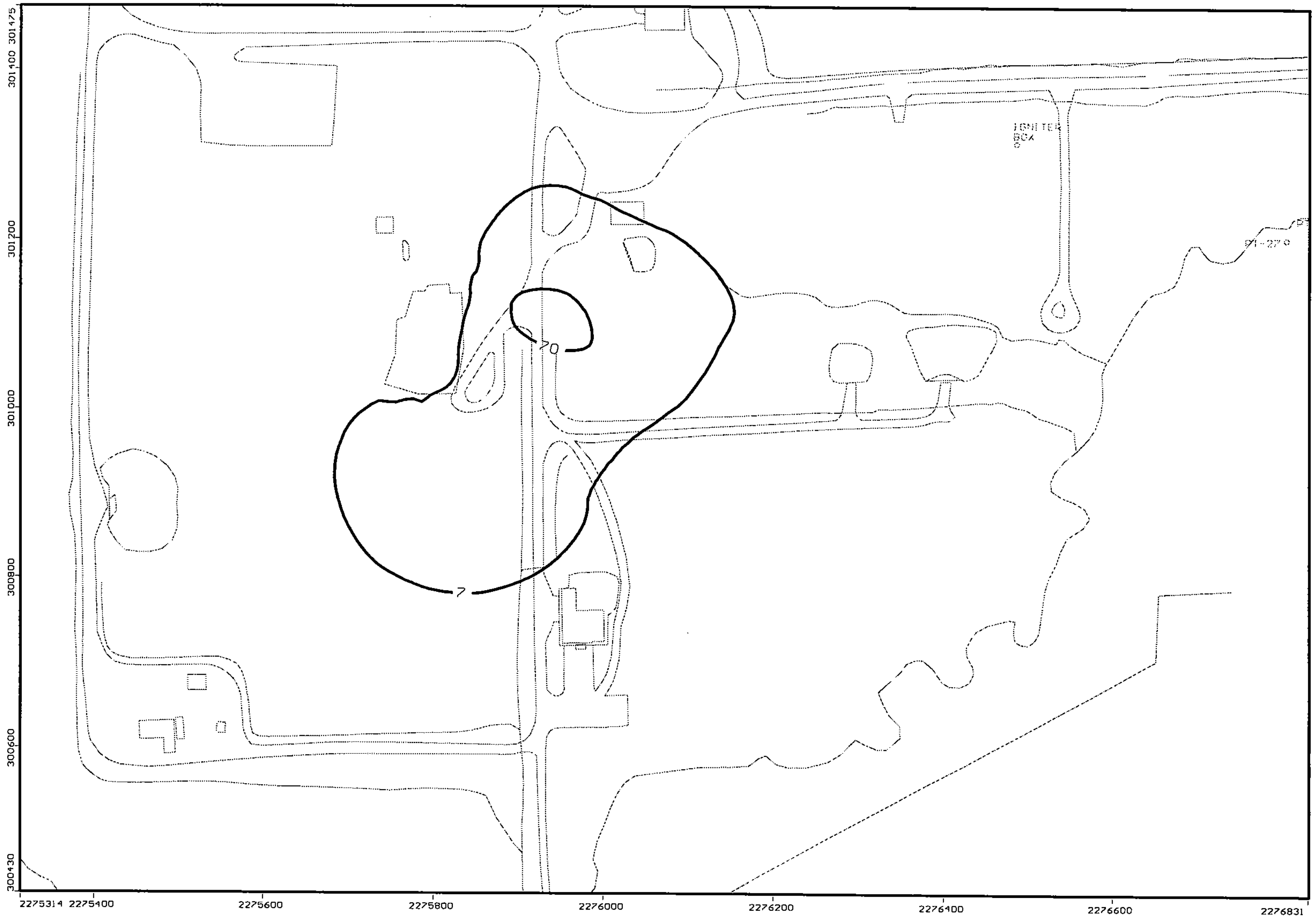
Visual MODFLOW v.3.1.0, (C) 1995-2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline–1,1 DCE
Modeller: JJS/ANB 1 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline-1,1 DCE
Modeller: JJS/ANB 5 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995-2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

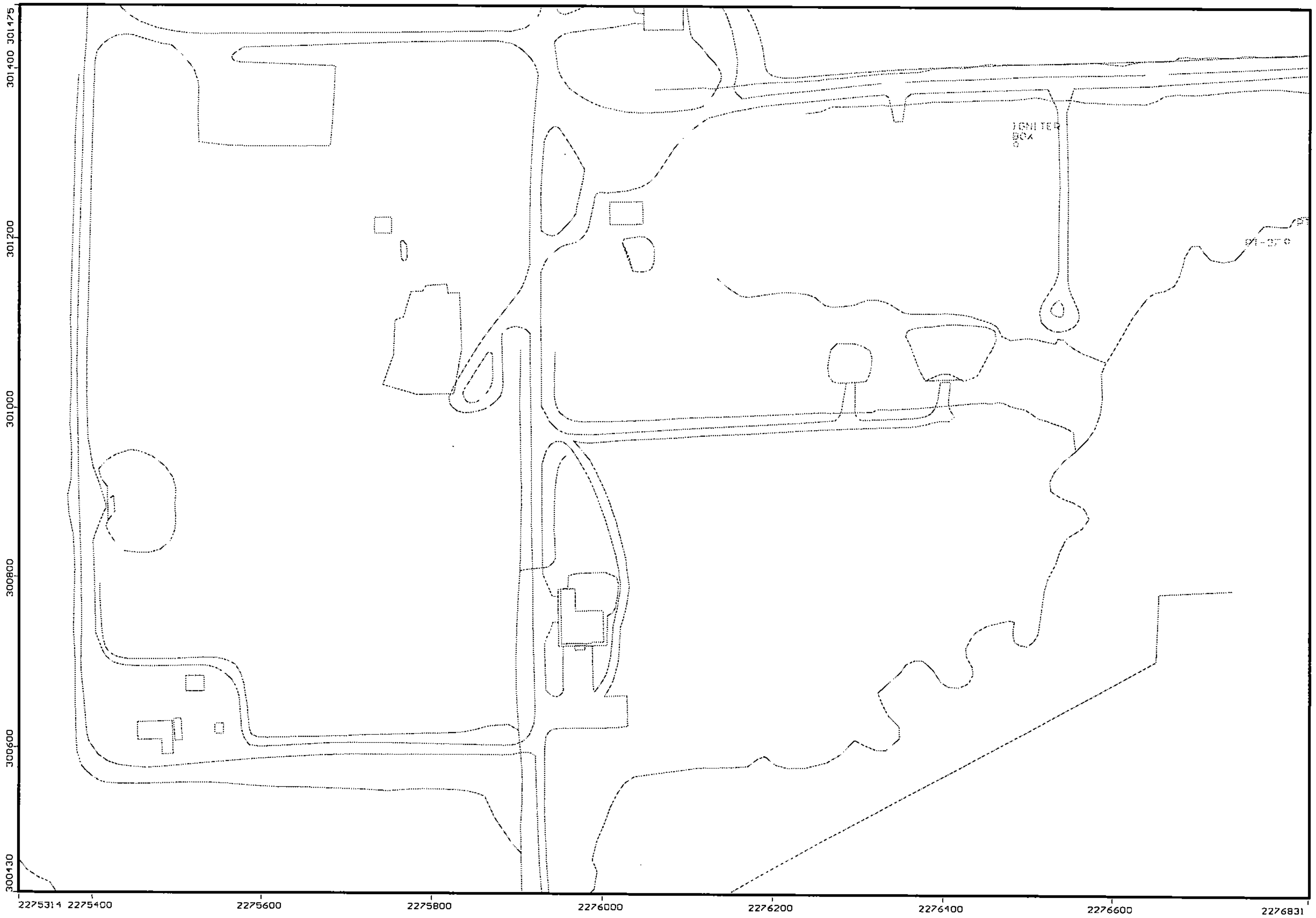


URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline–1,1 DCE
Modeller: JJS/ANB 10 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

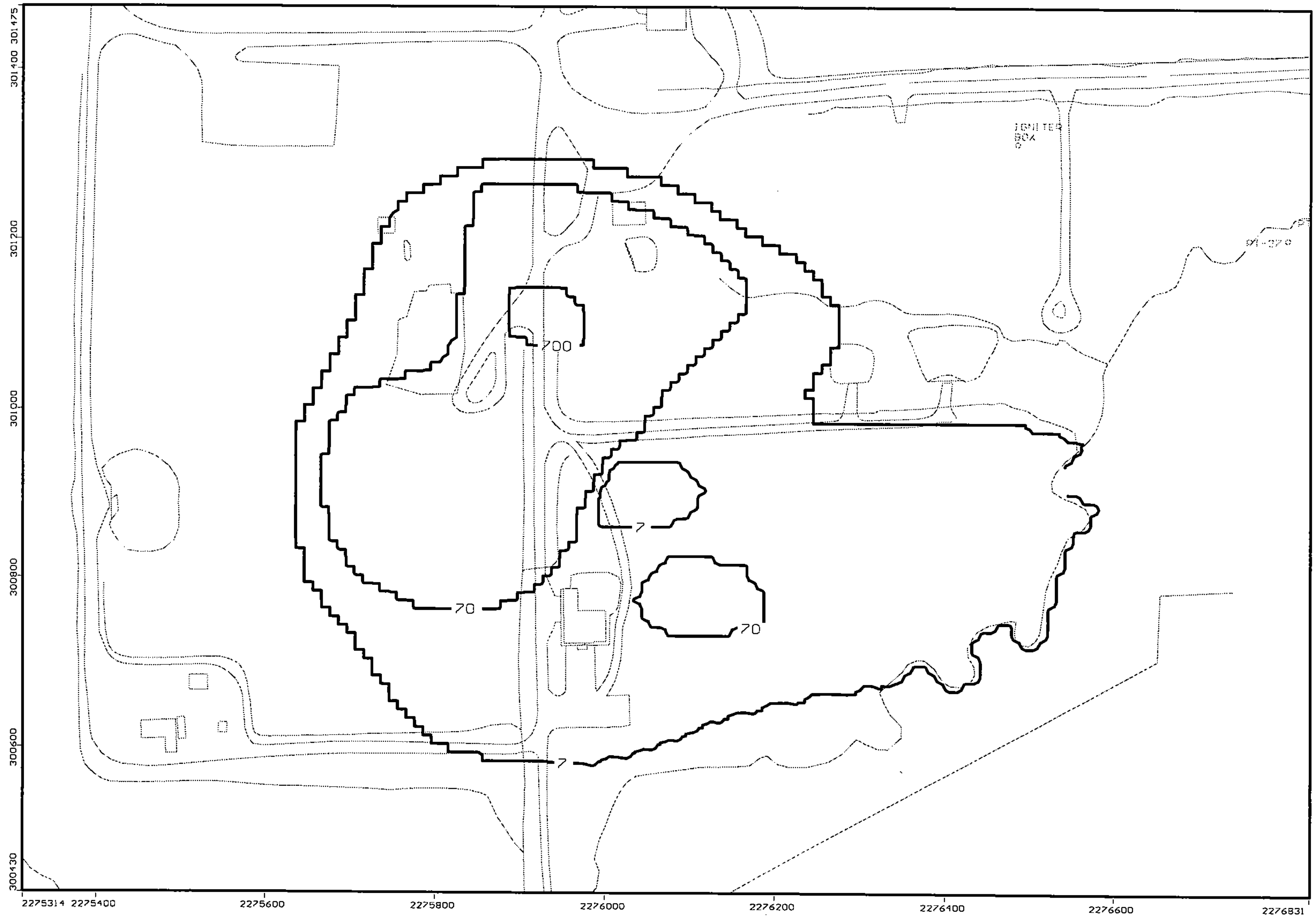
URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline—1,1 DCE
Modeller: JJS/ANB 19 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995—2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline–1,1 DCE
Modeller: JJS/ANB 20 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline—1,1 DCE
Modeller: JJS/ANB 1 d
10 Mar 04

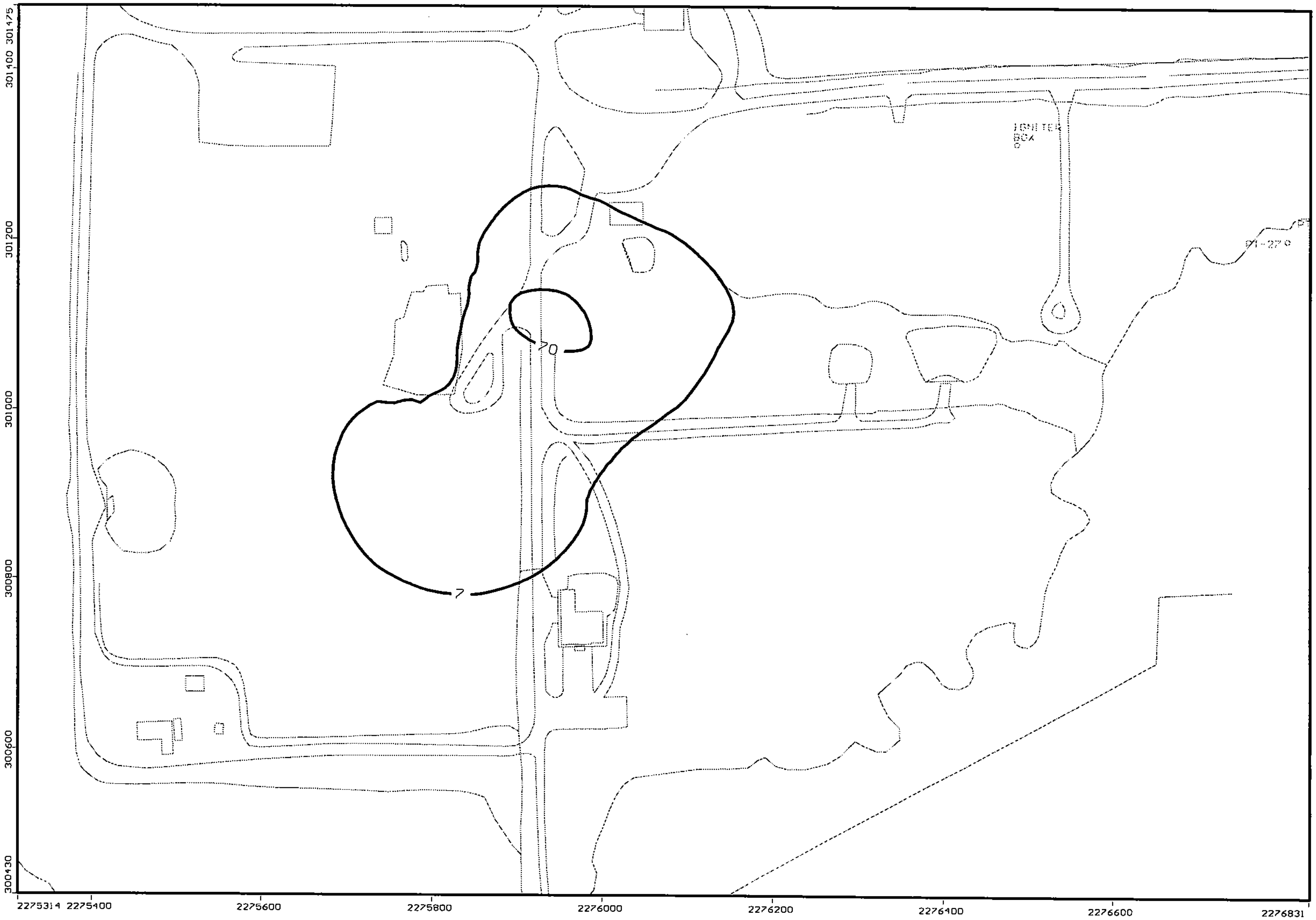
Visual MODFLOW v.3.1.0, (C) 1995—2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline–1,1 DCE
Modeller: JJS/ANB 1 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

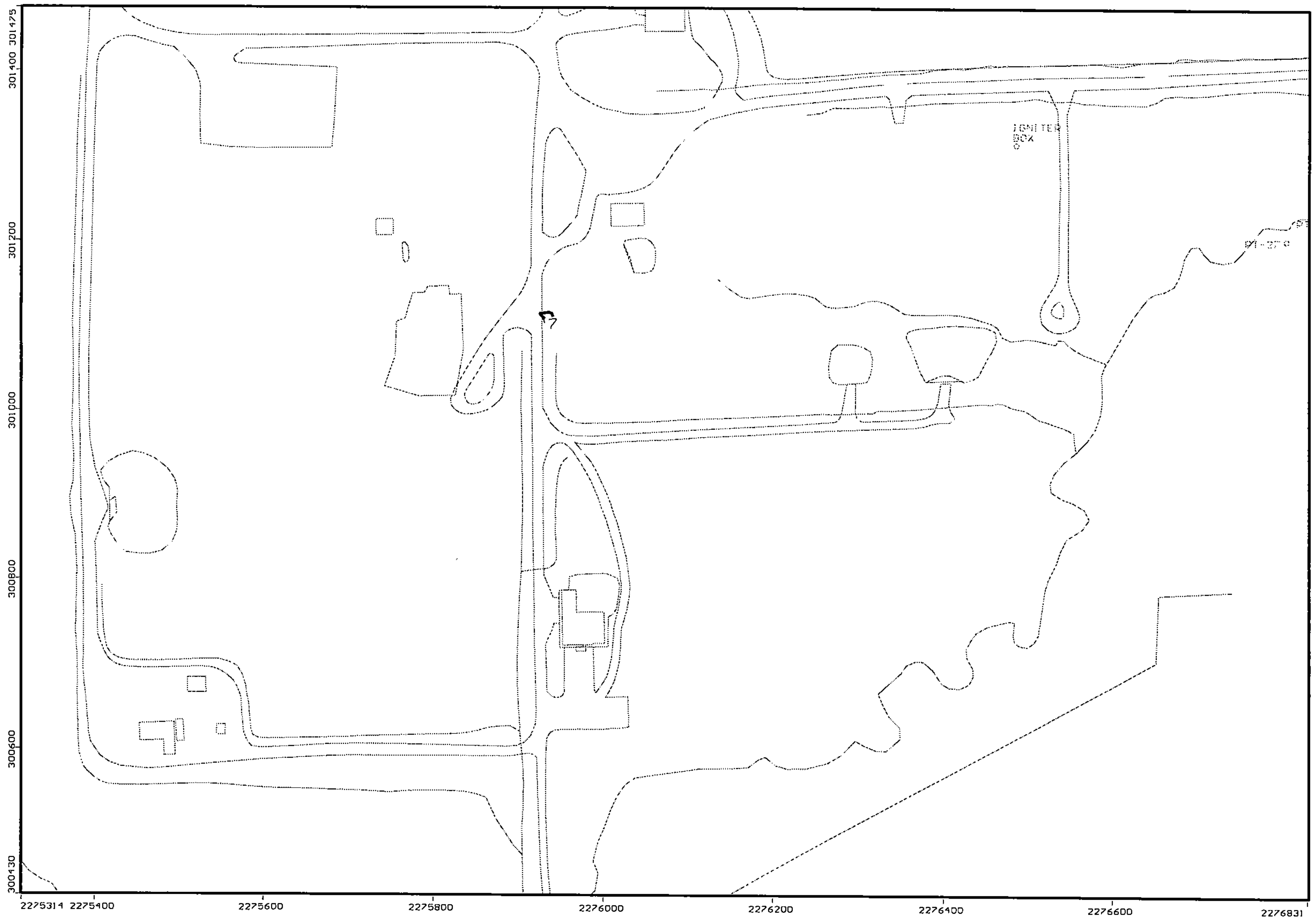
URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline-1,1 DCE
Modeller: JJS/ANB 5 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995-2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline–1,1 DCE
Modeller: JJS/ANB 10 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline–1,1 DCE
Modeller: JJS/ANB 19 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline–1,1 DCE
Modeller: JJS/ANB 20 yr
10 Mar 04

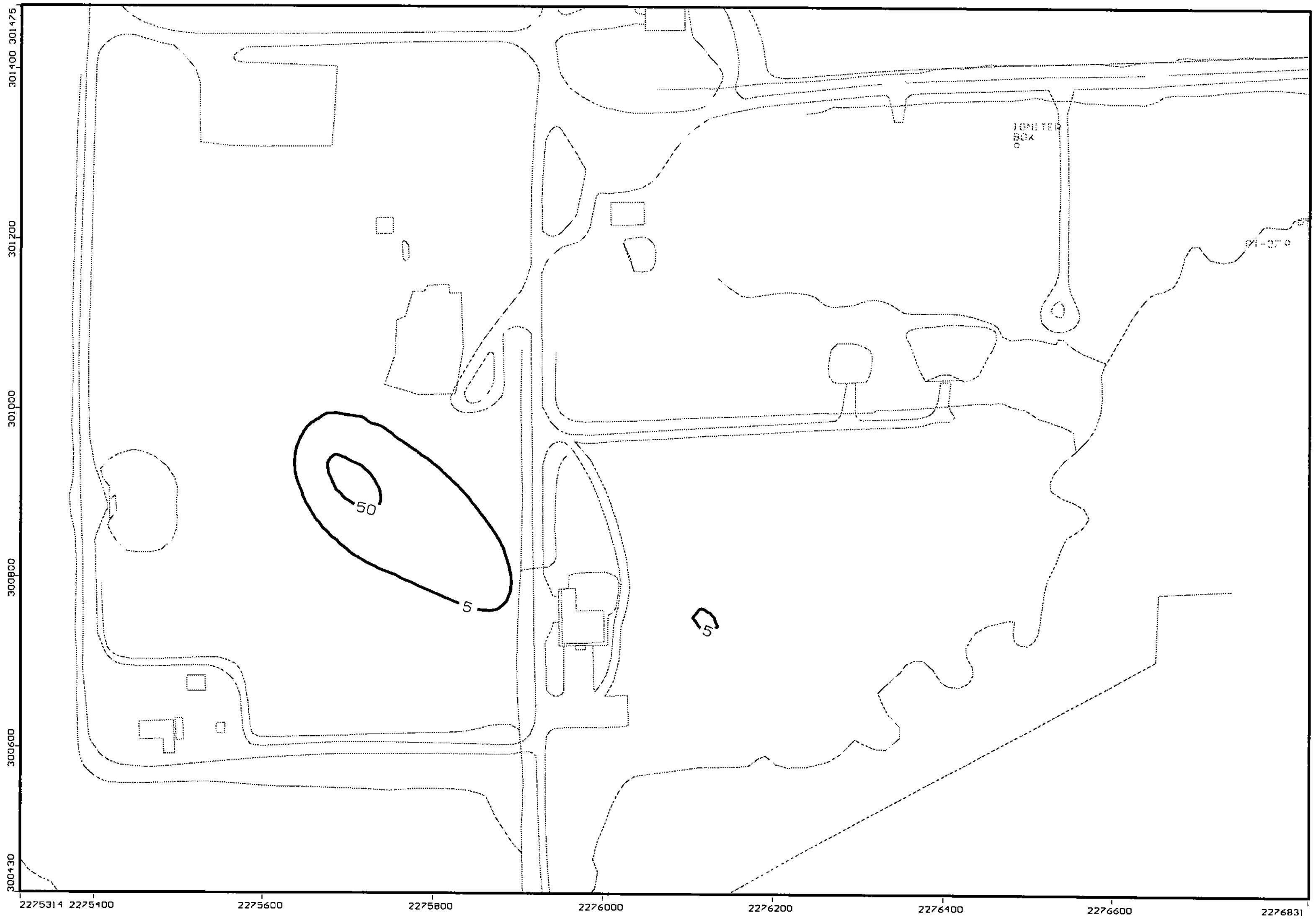
Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline–TCE
Modeller: JJS/ANB 1 d
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

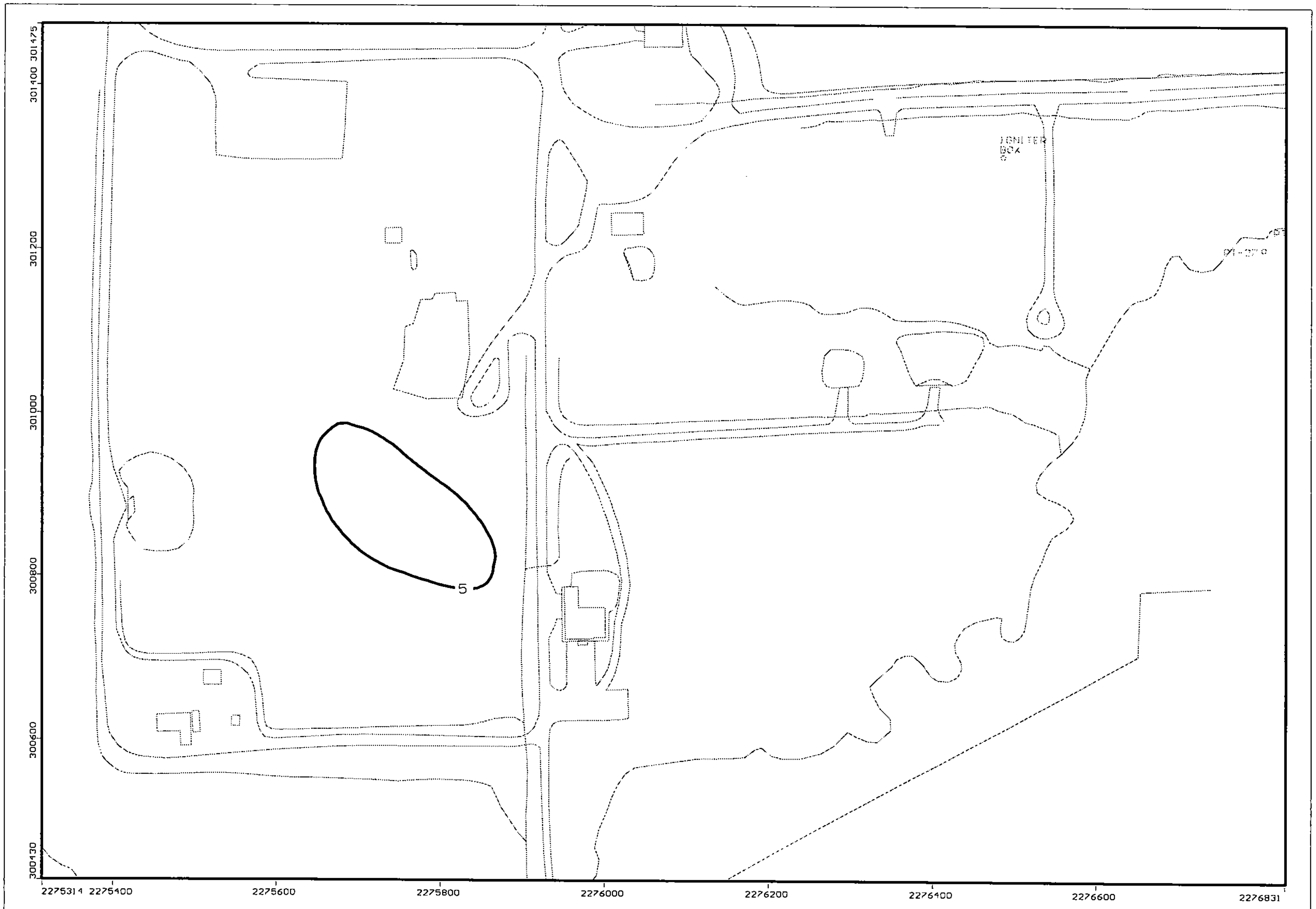
URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline—TCE
Modeller: JJS/ANB 1 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995—2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



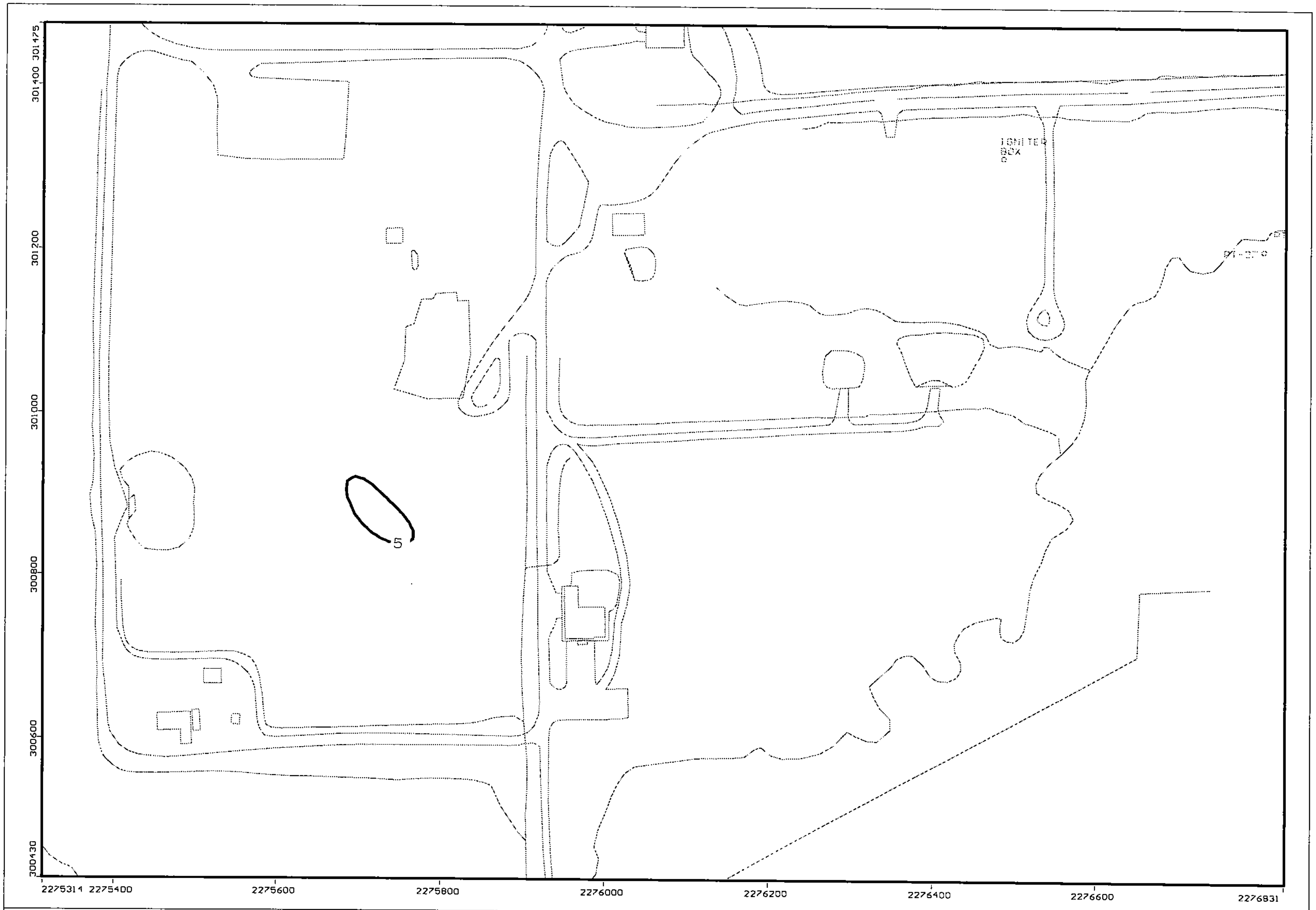
URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline–TCE
Modeller: JJS/ANB 5 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline–TCE
Modeller: JJS/ANB 10 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline—TCE
Modeller: JJS/ANB 20 yr
10 Mar 04

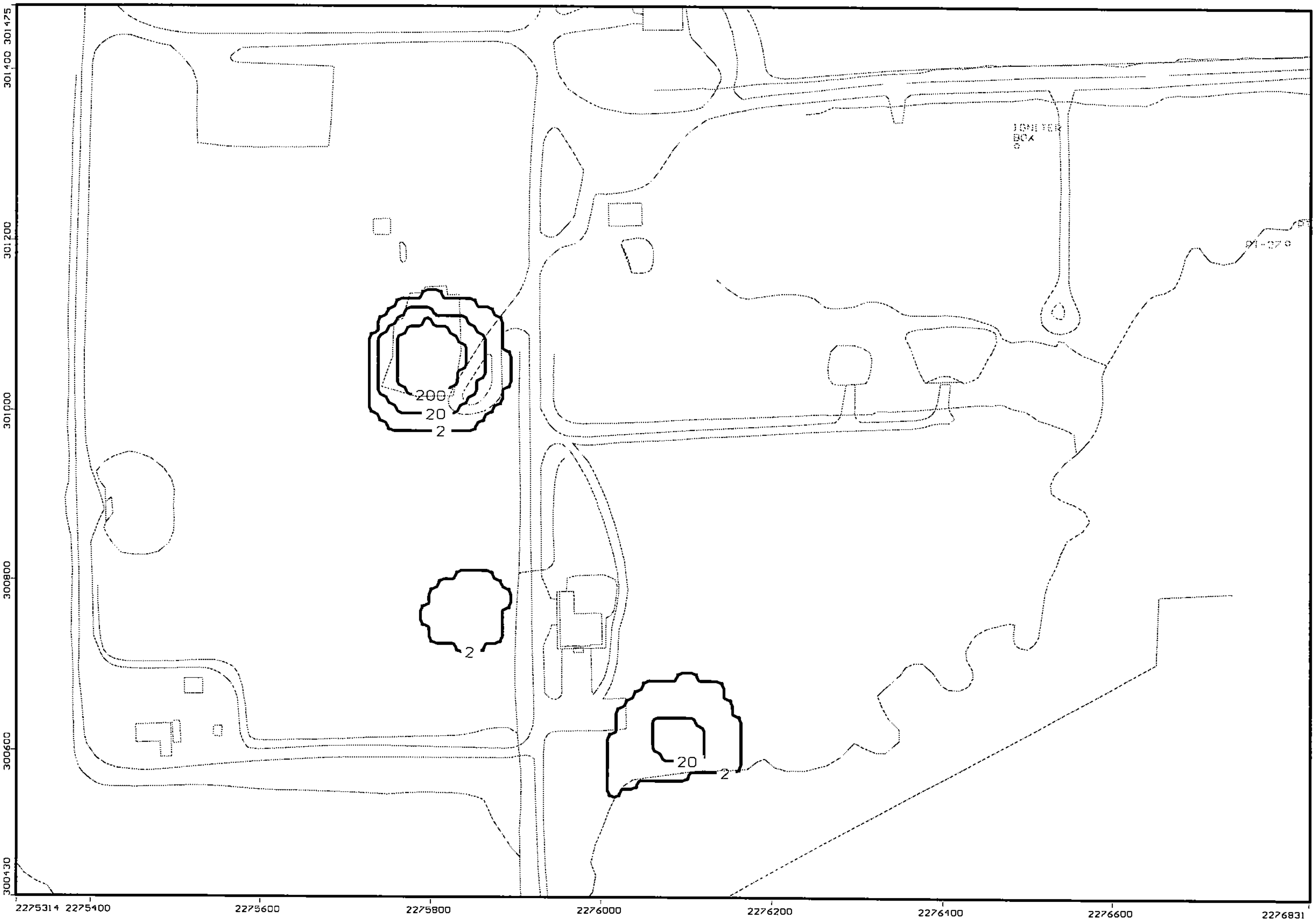
Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline–TCE
Modeller: JJS/ANB 21 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

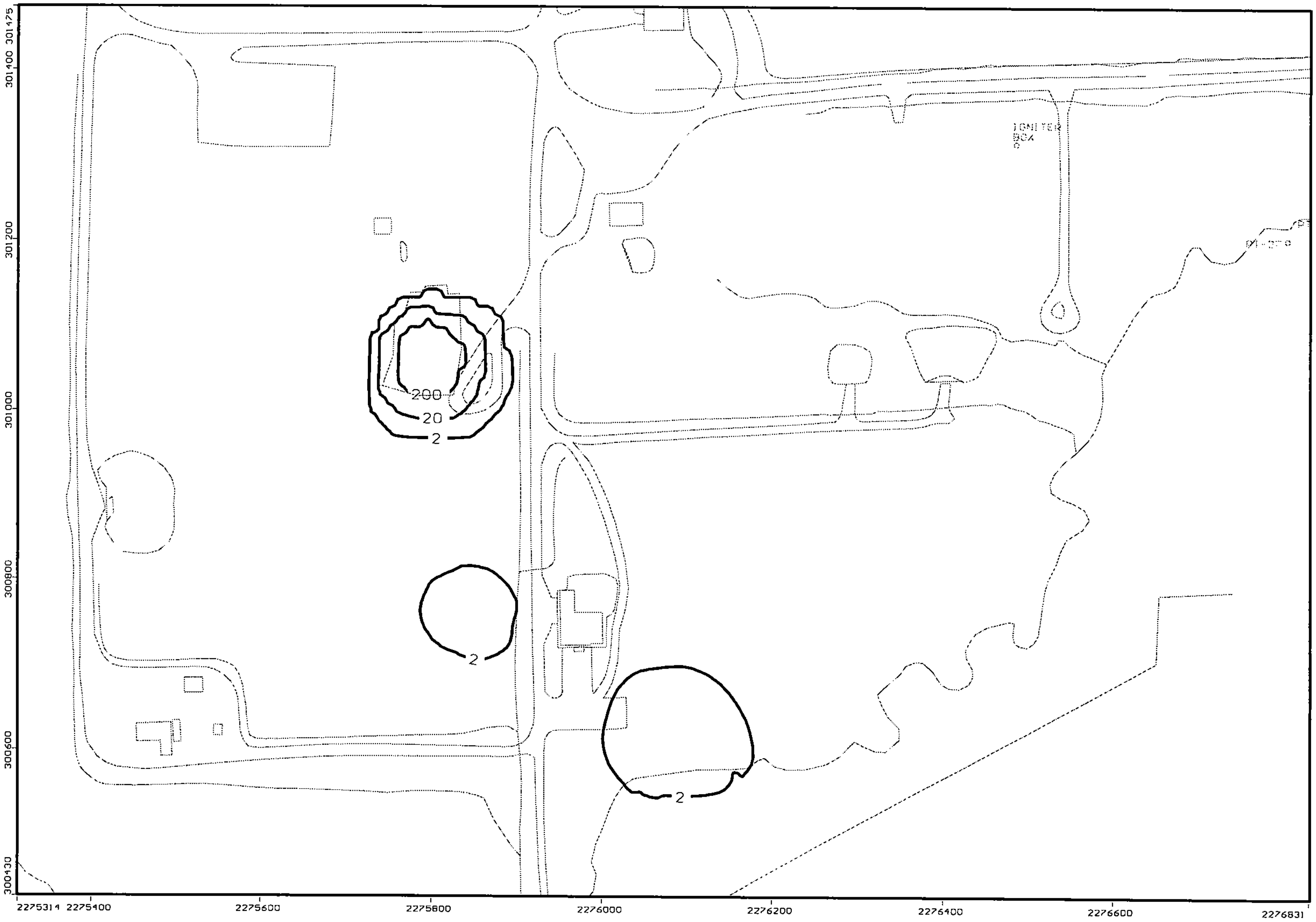
URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline—TCE
Modeller: JJS/ANB 22 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995—2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline–Vinyl Chloride
Modeller: JJS/ANB 1 d
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

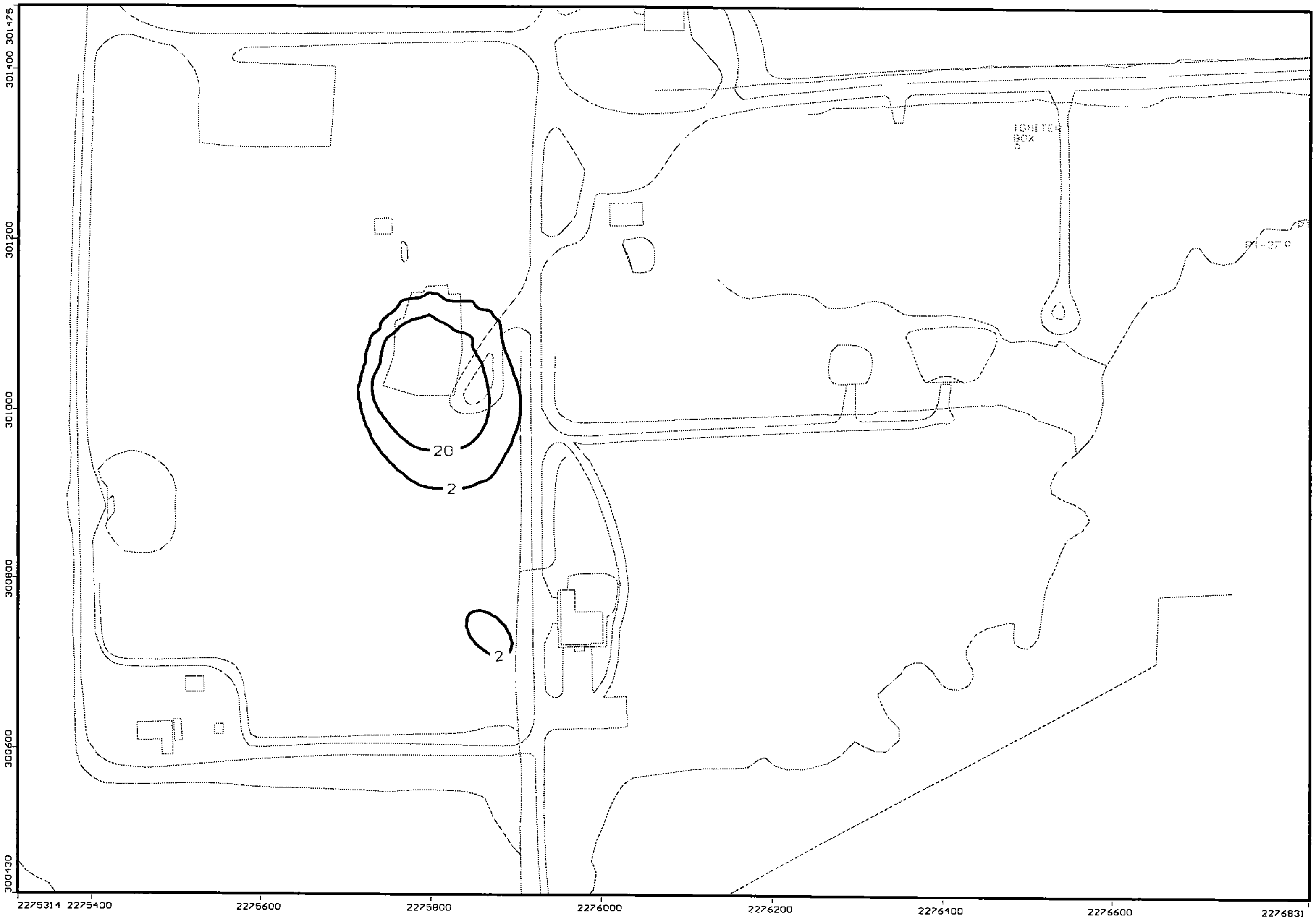


URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline—Vinyl Chloride
Modeller: JJS/ANB 1 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

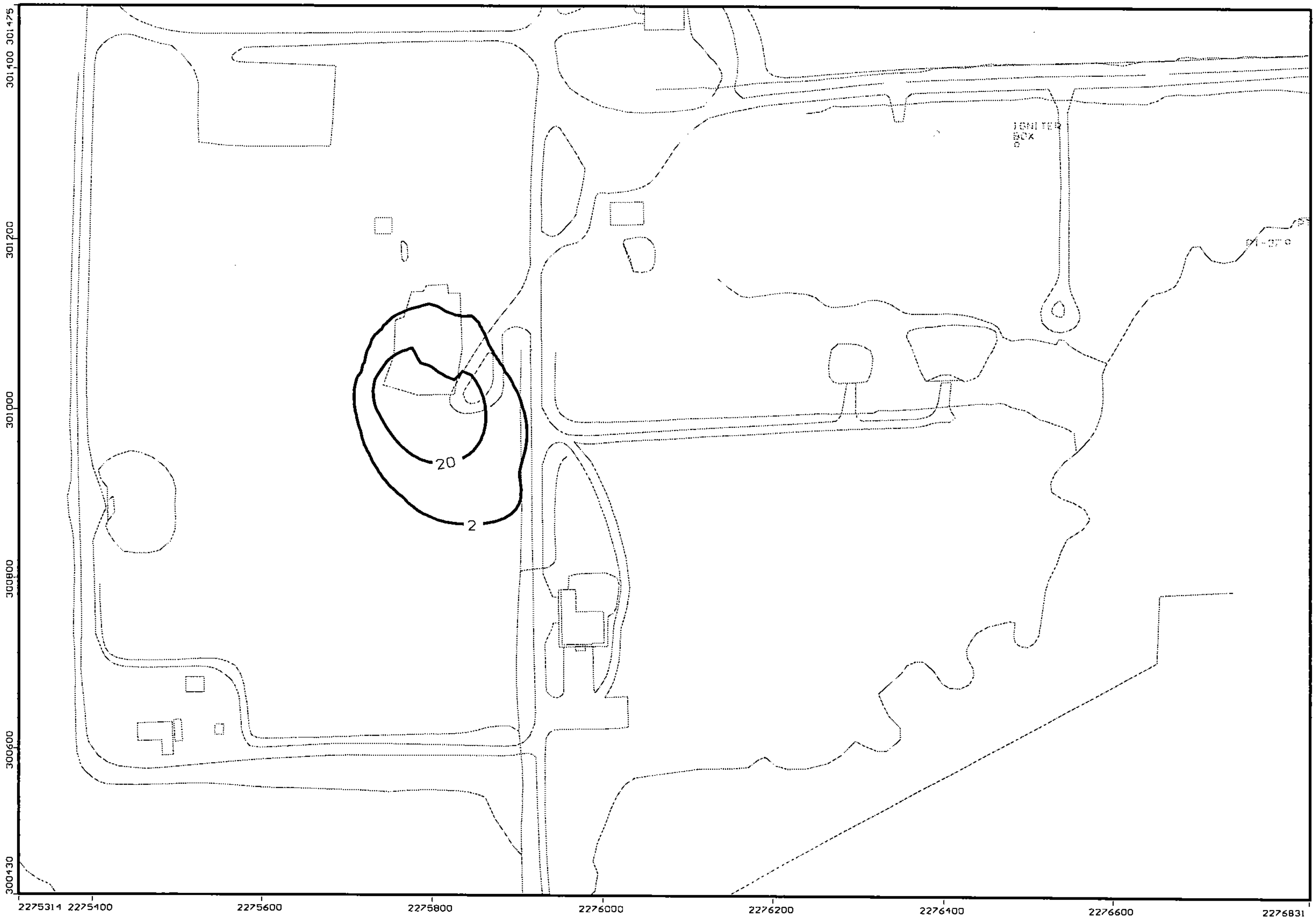
URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline–Vinyl Chloride
Modeller: JJS/ANB 5 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline–Vinyl Chloride
Modeller: JJS/ANB 10 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline–Vinyl Chloride
Modeller: JJS/ANB 20 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
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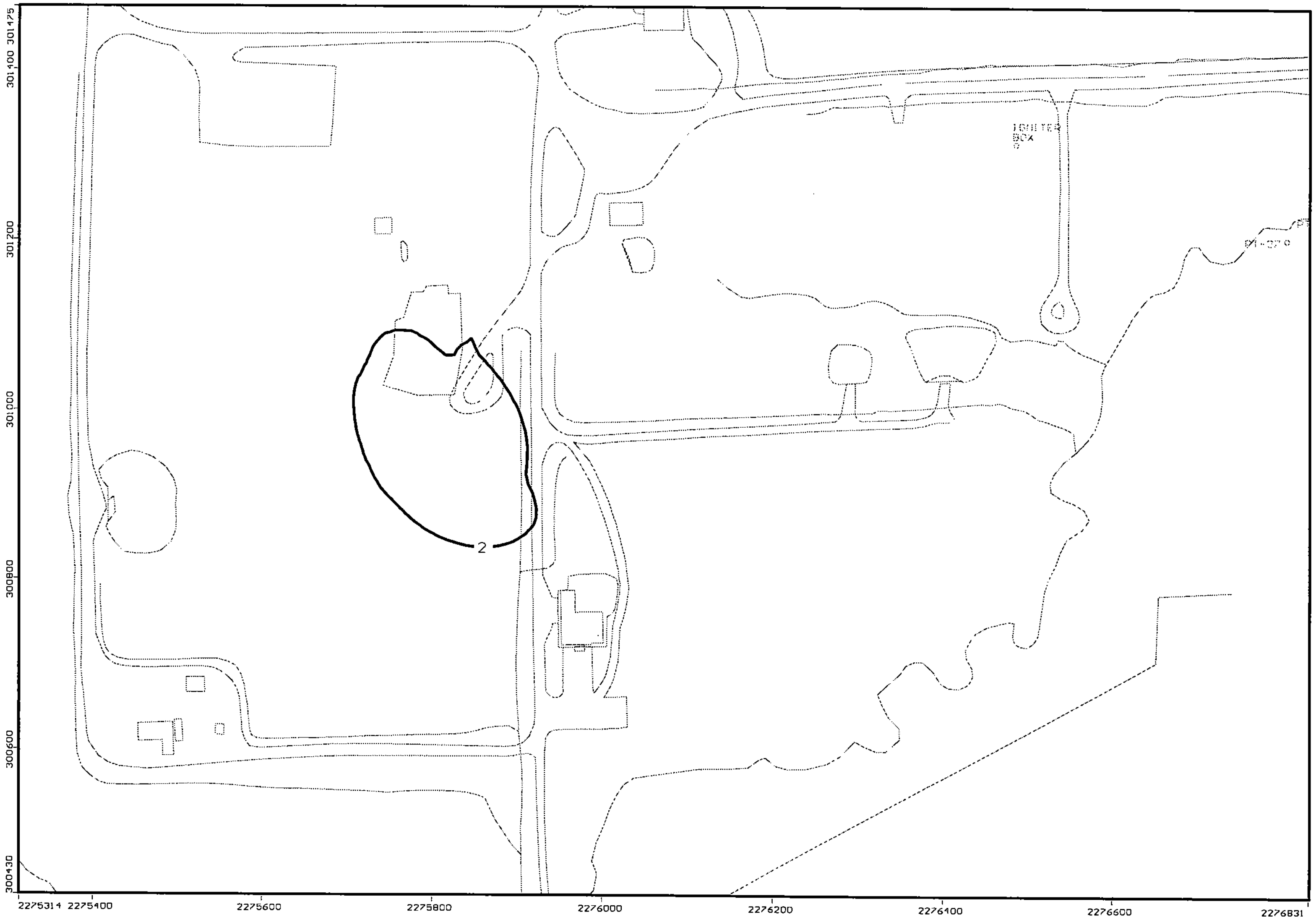
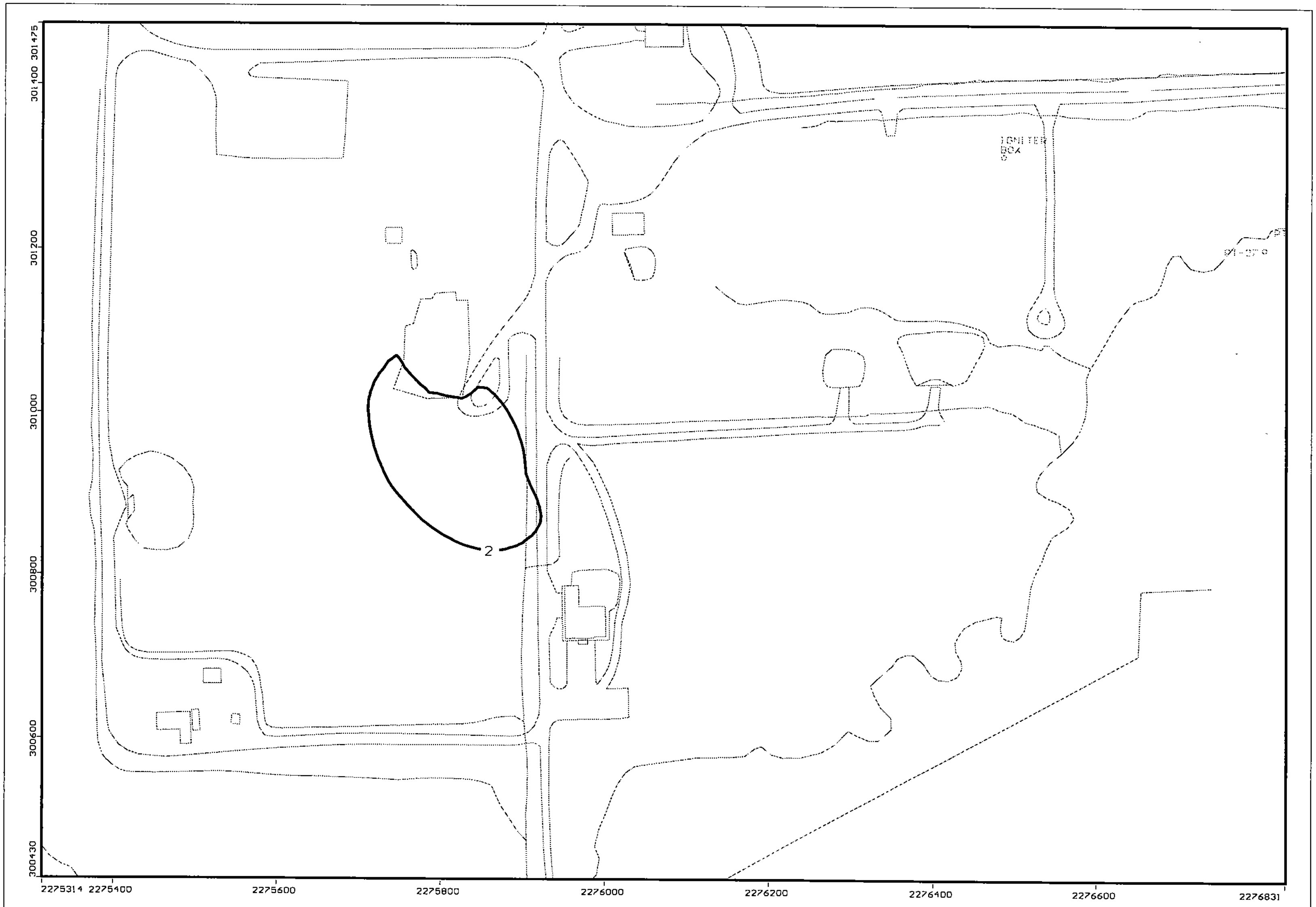


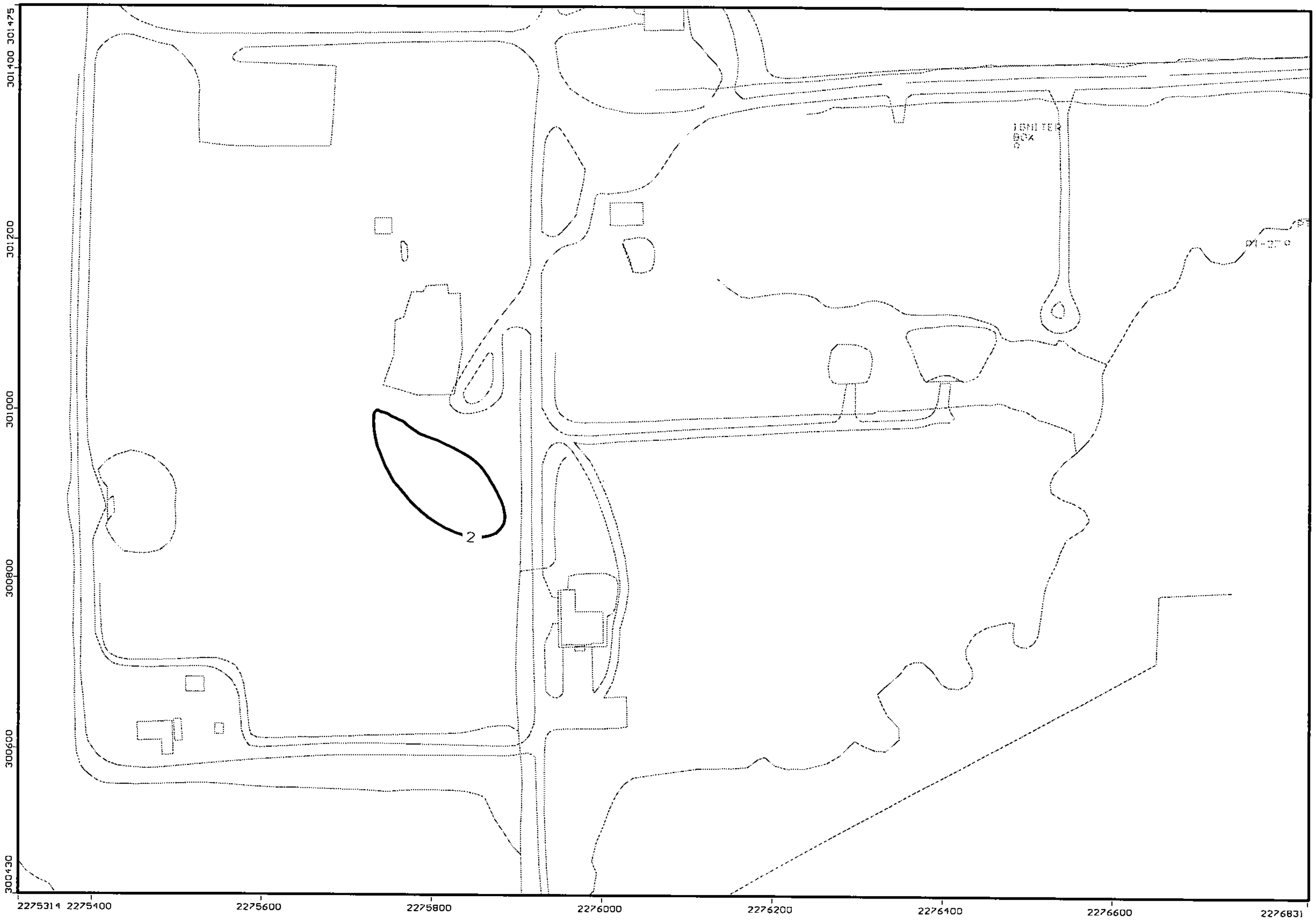
URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline–Vinyl Chloride
Modeller: JJS/ANB 30 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



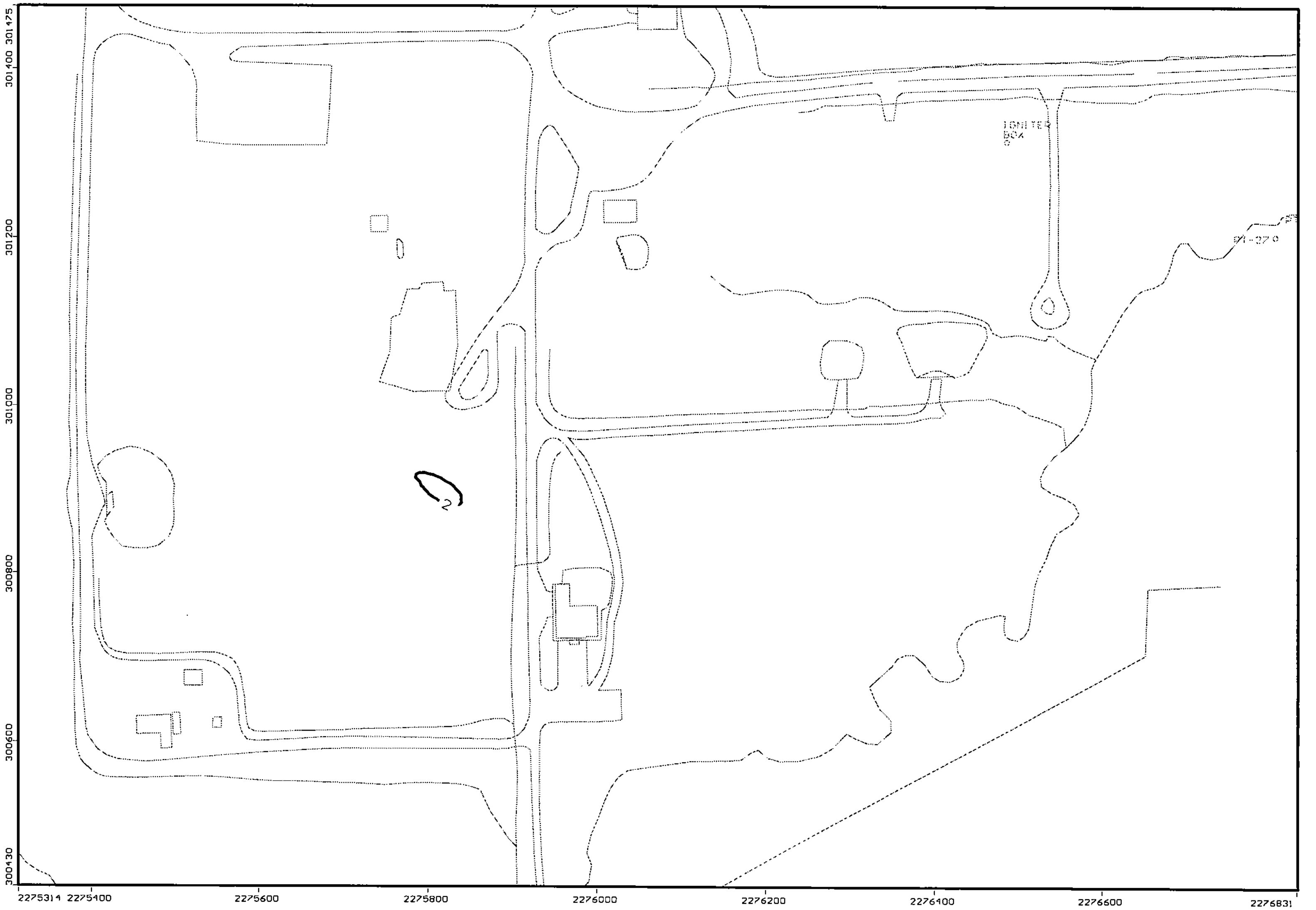
URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline–Vinyl Chloride
Modeller: JJS/ANB 40 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



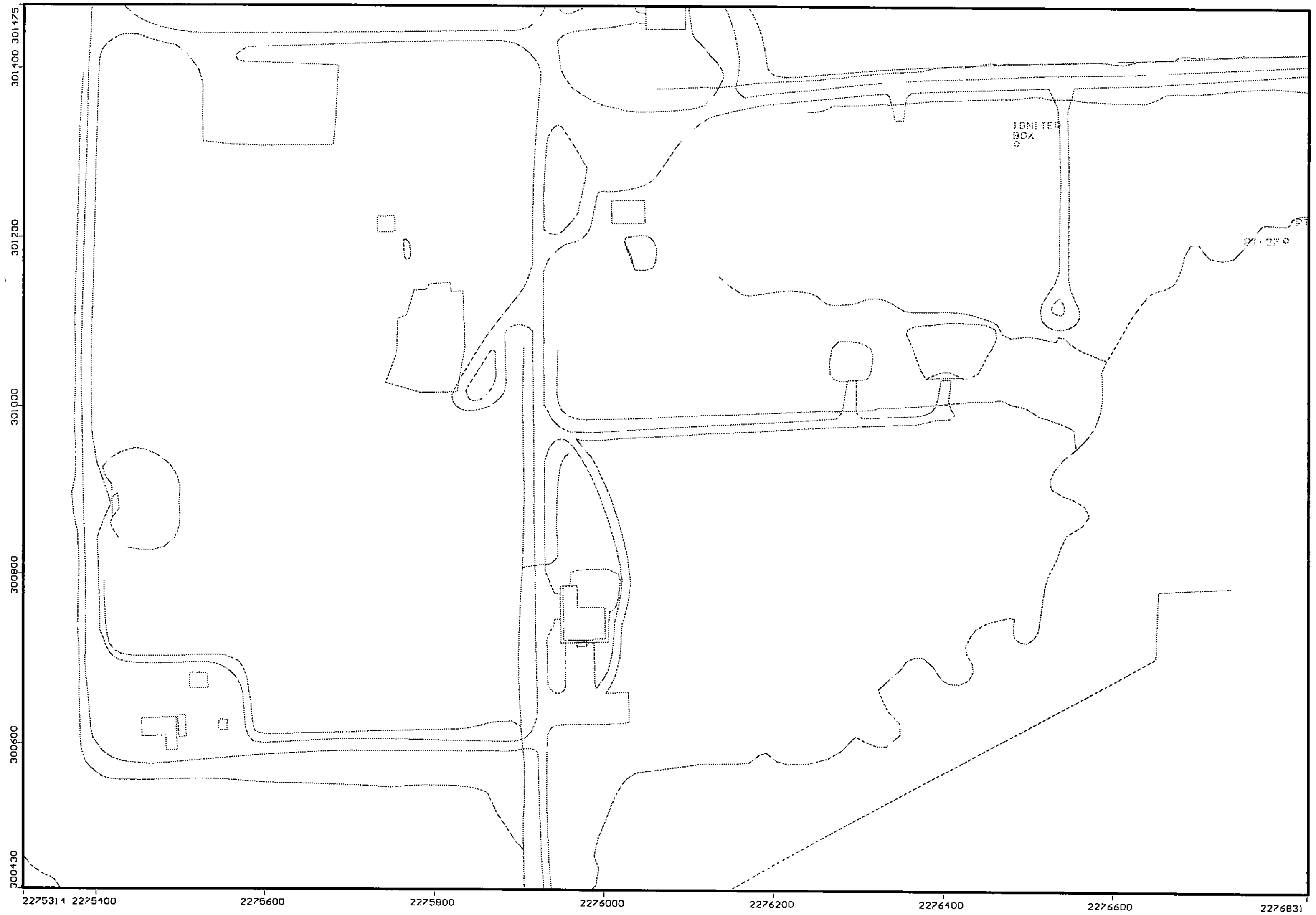
URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline–Vinyl Chloride
Modeller: JJS/ANB 50 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline—Vinyl Chloride
Modeller: JJS/ANB 53 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



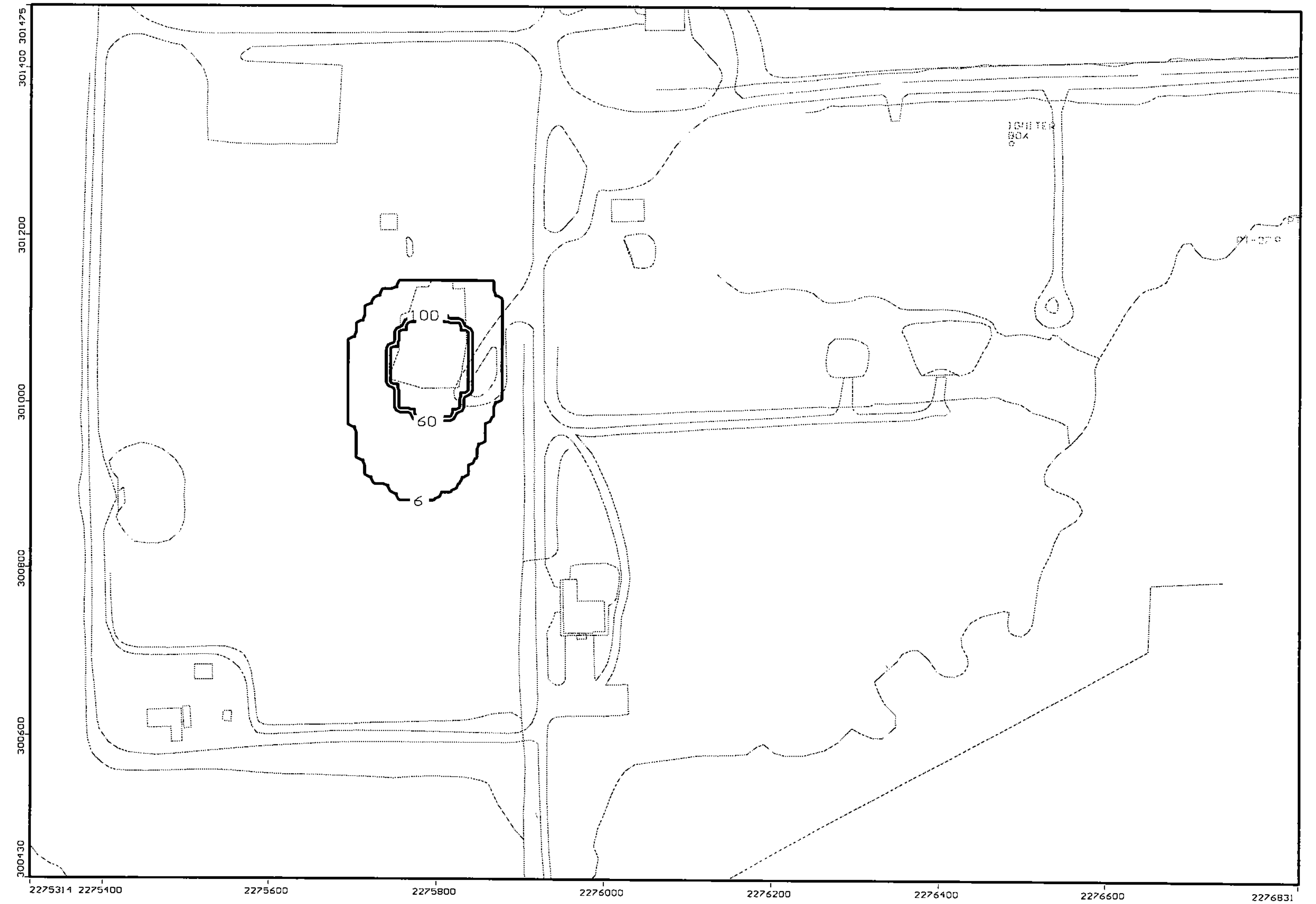
URS Corporation
Project: IAAAP EDA Modeling
Description: Baseline–Vinyl Chloride
Modeller: JJS/ANB 54 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

ATTACHMENT K-5

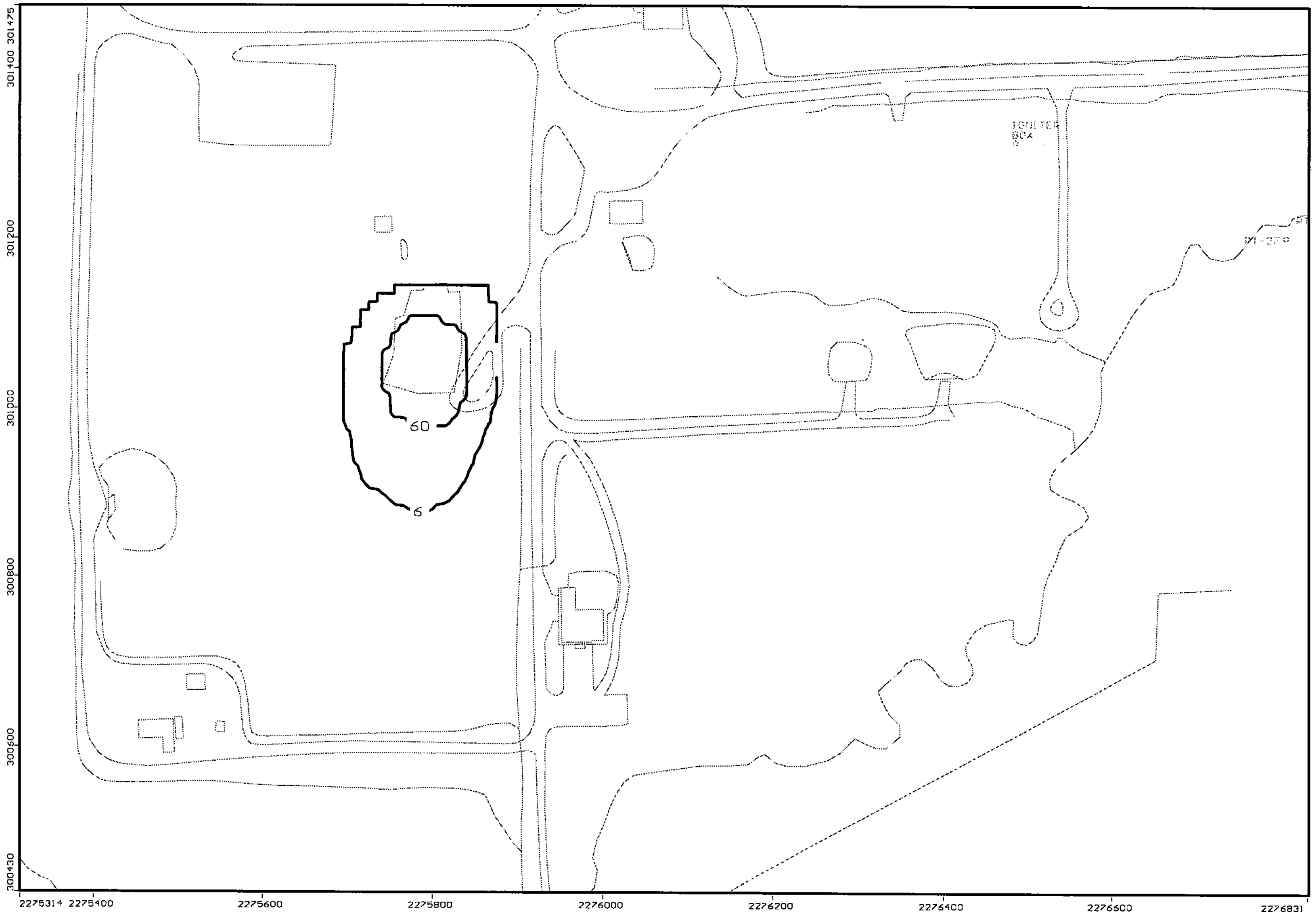
Contaminant Fate and Transport Modeling Results

Alternatives 1 and 2 – No Action/MNA



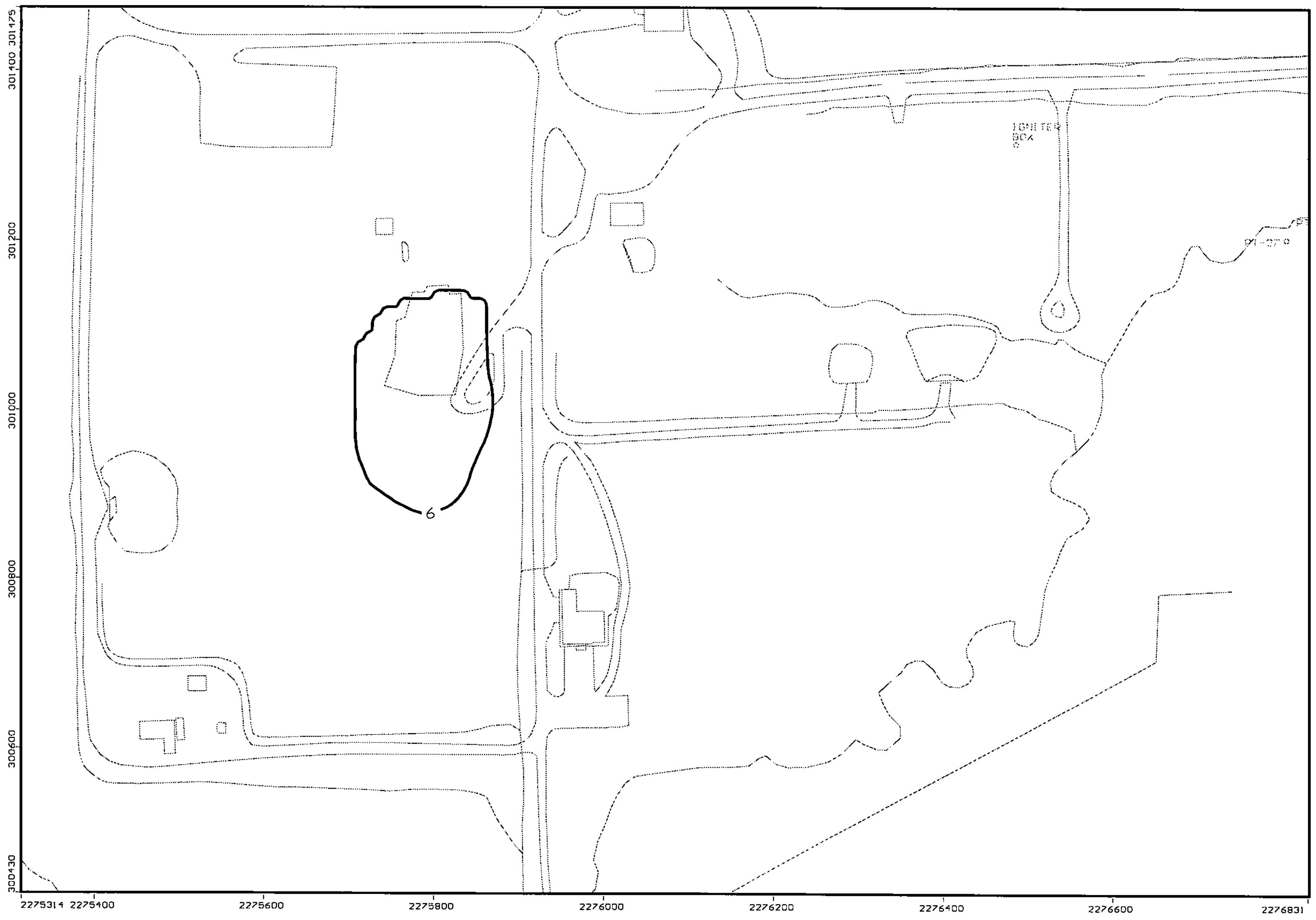
URS Corporation
Project: IAAAP EDA Modeling
Description: Alternative 1&2 – Benzene
Modeller: JJS/ANB 1 d
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



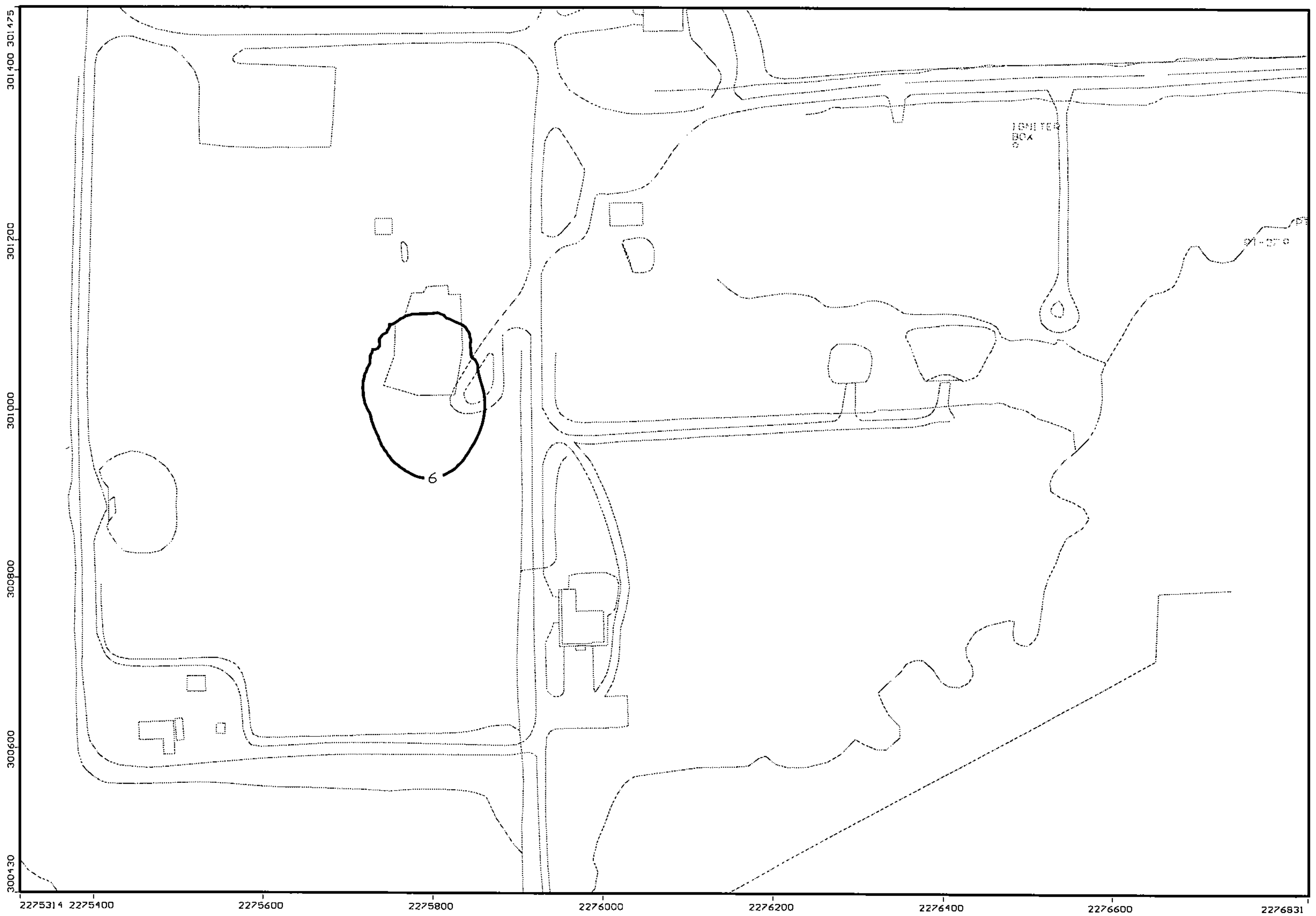
URS Corporation
Project: IAAAP EDA Modeling
Description: Alternative 1&2 – Benzene
Modeller: JJS/ANB 1 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



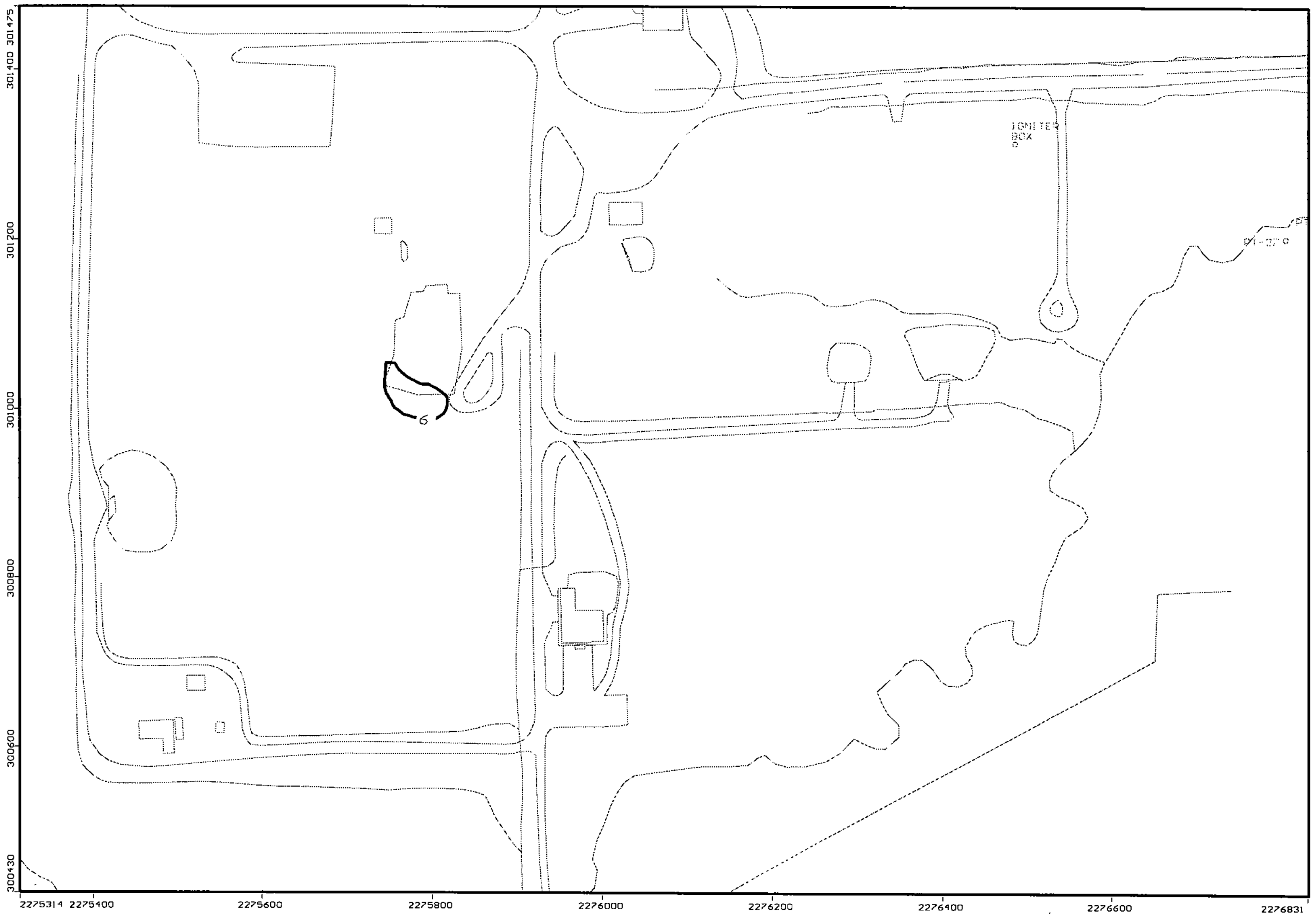
URS Corporation
Project: IAAAP EDA Modeling
Description: Alternative 1&2 – Benzene
Modeller: JJS/ANB 5 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP EDA Modeling
Description: Alternative 1&2 – Benzene
Modeller: JJS/ANB 10 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

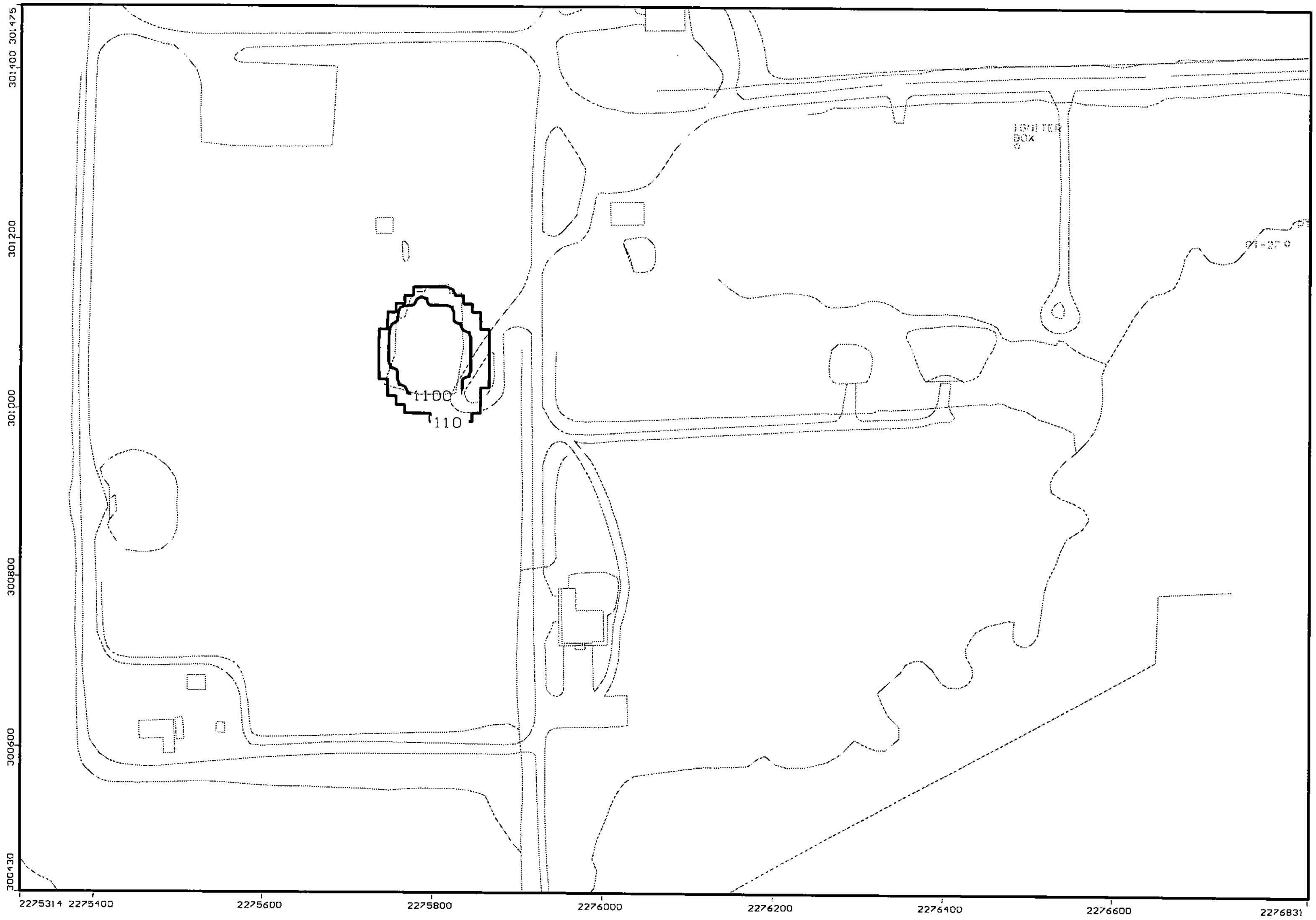


URS Corporation
Project: IAAAP EDA Modeling
Description: Alternative 1&2 – Benzene
Modeller: JJS/ANB 16 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

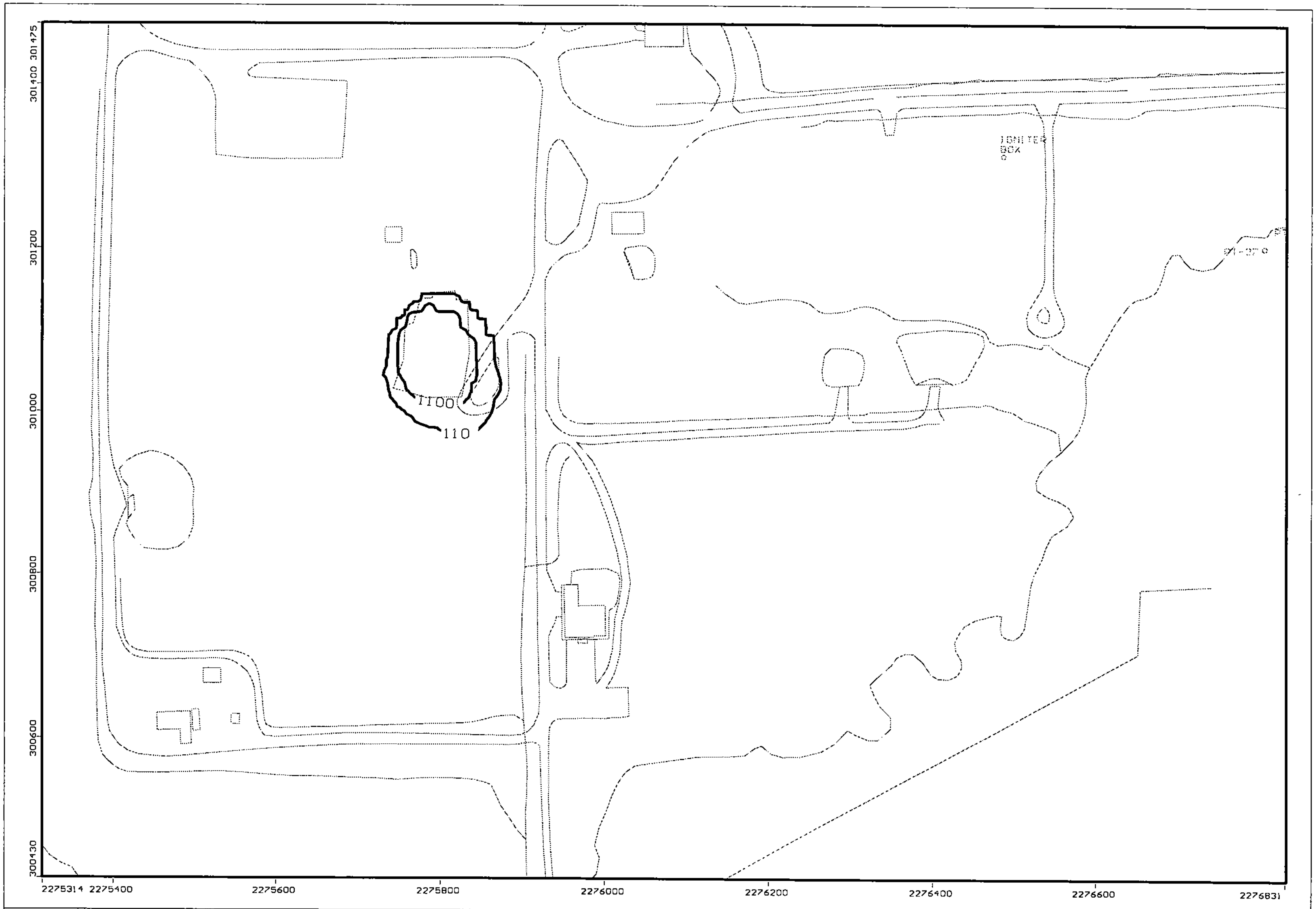
URS Corporation
Project: IAAAP EDA Modeling
Description: Alternative 1&2 – Benzene
Modeller: JJS/ANB 17 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



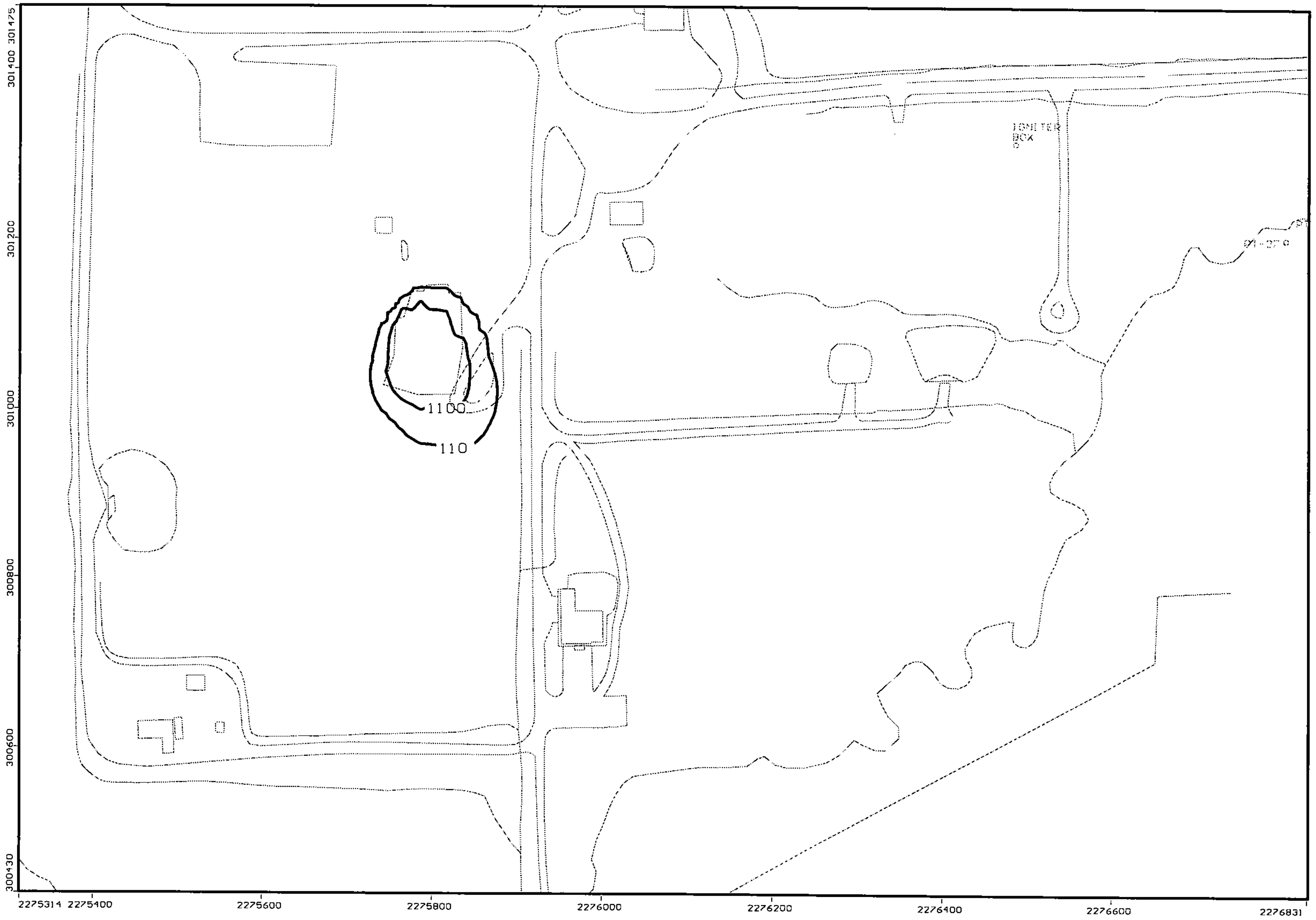
URS Corporation
Project: IAAAP EDA Modeling
Description: Alt 1&2 – Chloroethane
Modeller: JJS/ANB 1 d
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



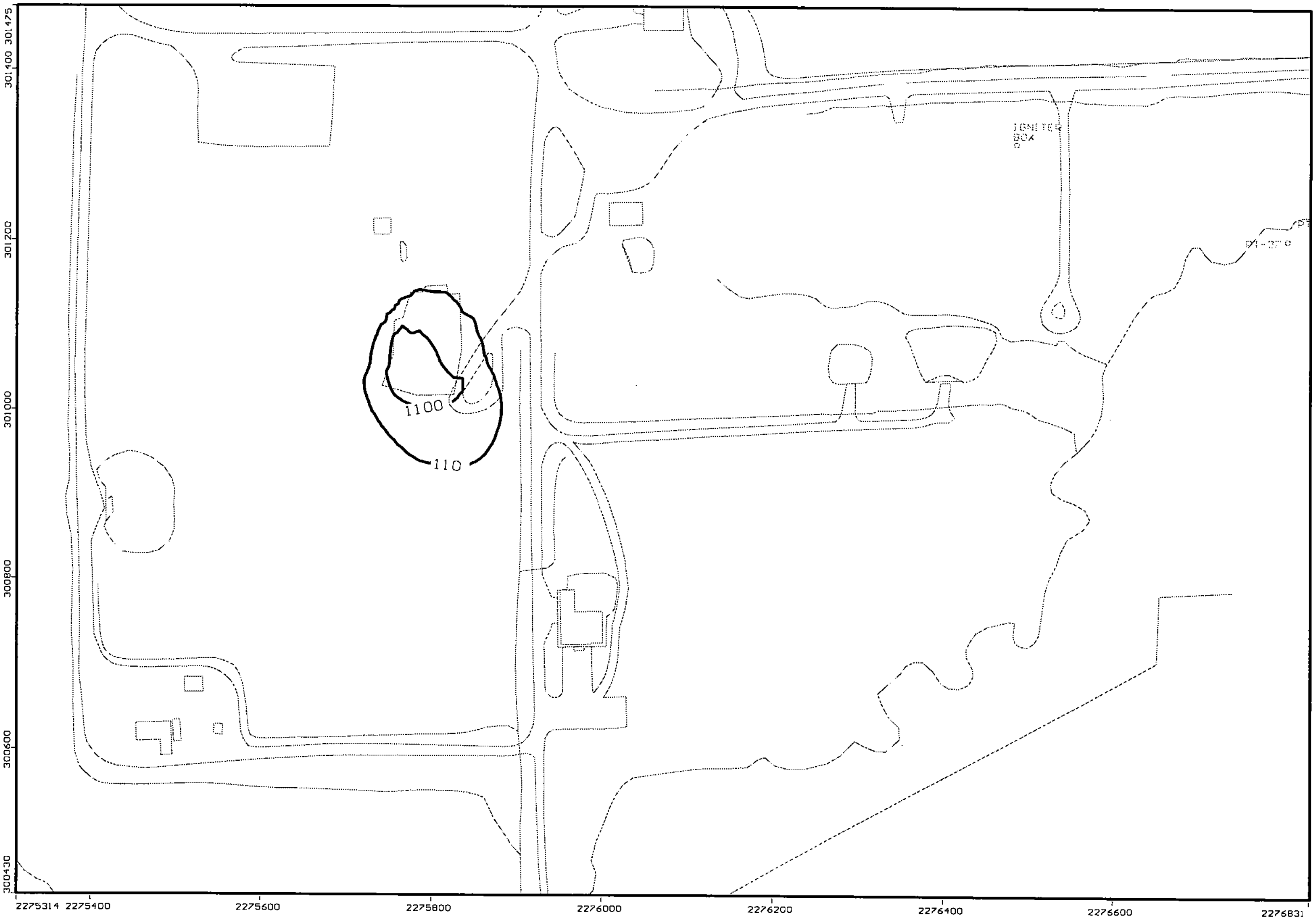
URS Corporation
Project: IAAAP EDA Modeling
Description: Alt 1&2 – Chloroethane
Modeller: JJS/ANB 1 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



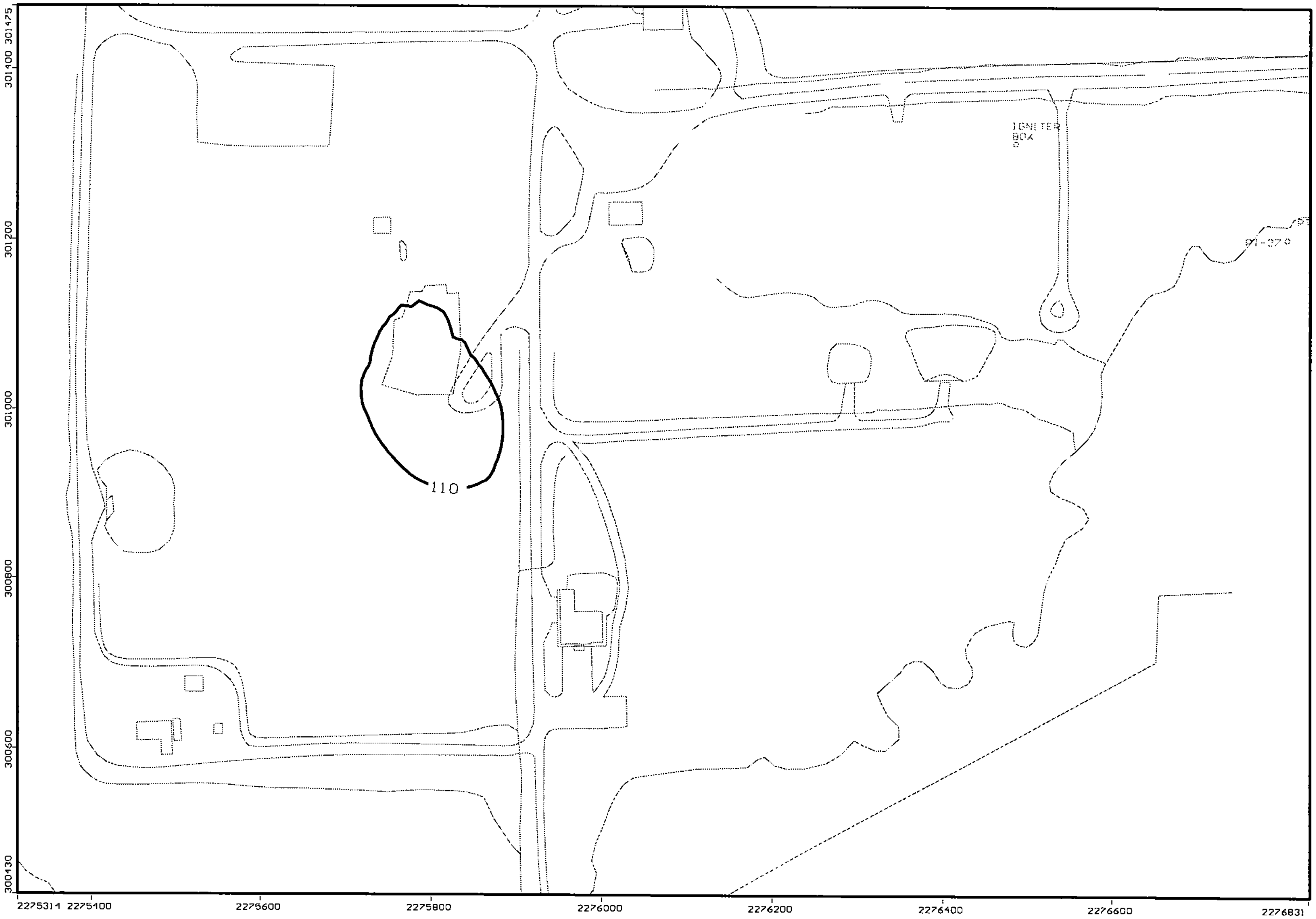
URS Corporation
Project: IAAAP EDA Modeling
Description: Alt 1&2 – Chloroethane
Modeller: JJS/ANB 5 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



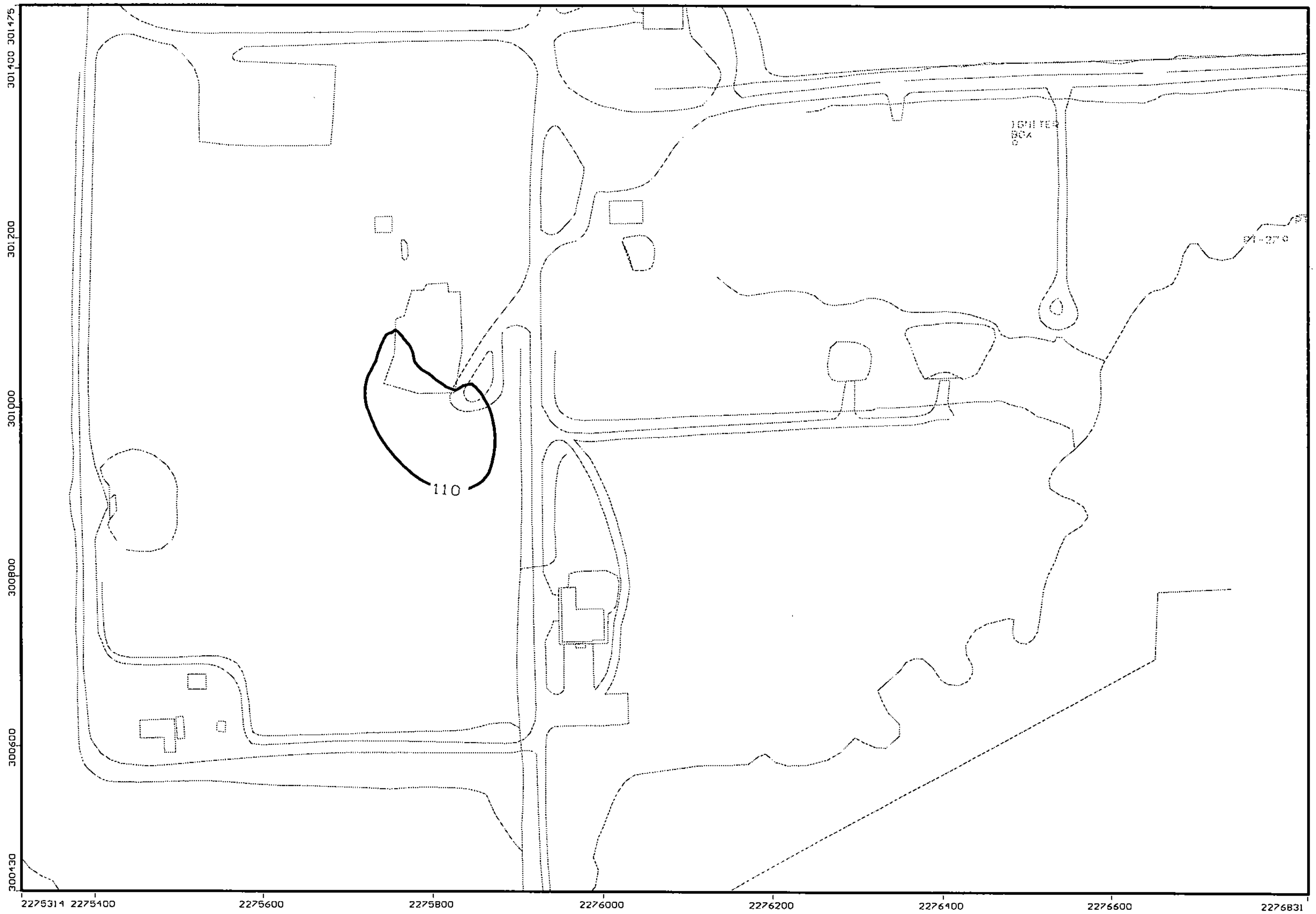
URS Corporation
Project: IAAAP EDA Modeling
Description: Alt 1&2 – Chloroethane
Modeller: JJS/ANB 10 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP EDA Modeling
Description: Alt 1&2 – Chloroethane
Modeller: JJS/ANB 20 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

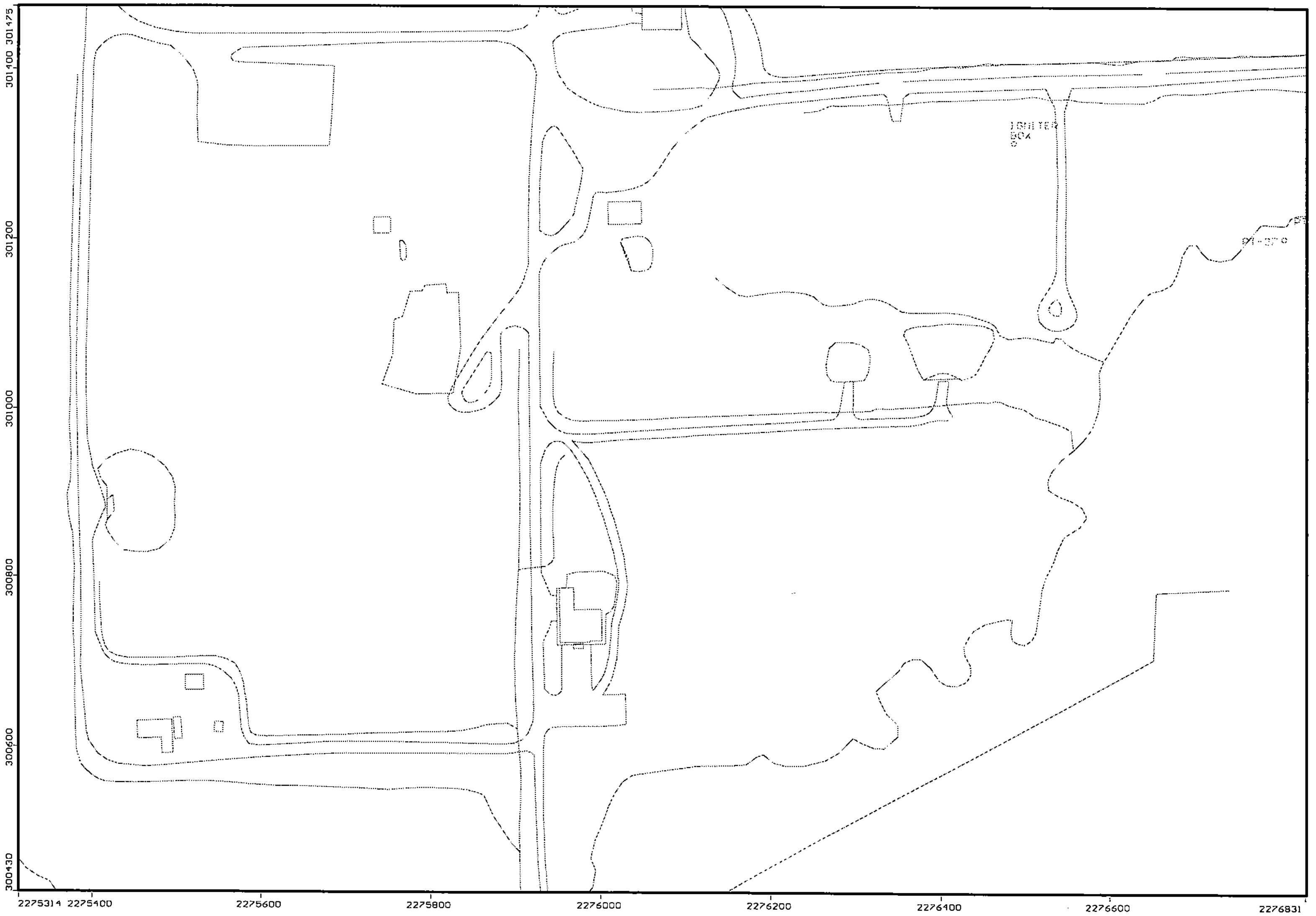


URS Corporation
Project: IAAAP EDA Modeling
Description: Alt 1&2 – Chloroethane
Modeller: JJS/ANB 30 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

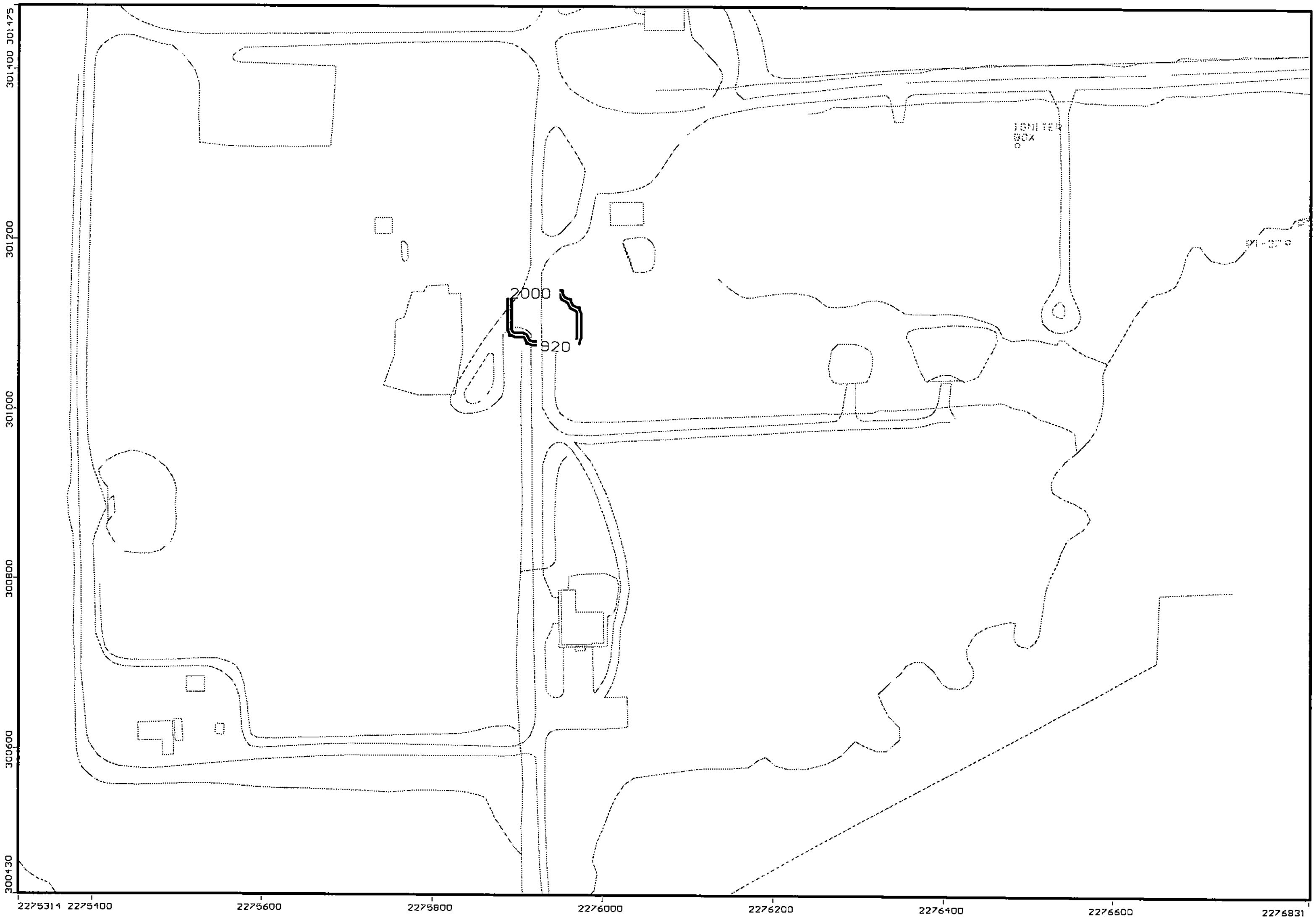
URS Corporation
Project: IAAAP EDA Modeling
Description: Alt 1&2 – Chloroethane
Modeller: JJS/ANB 38 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



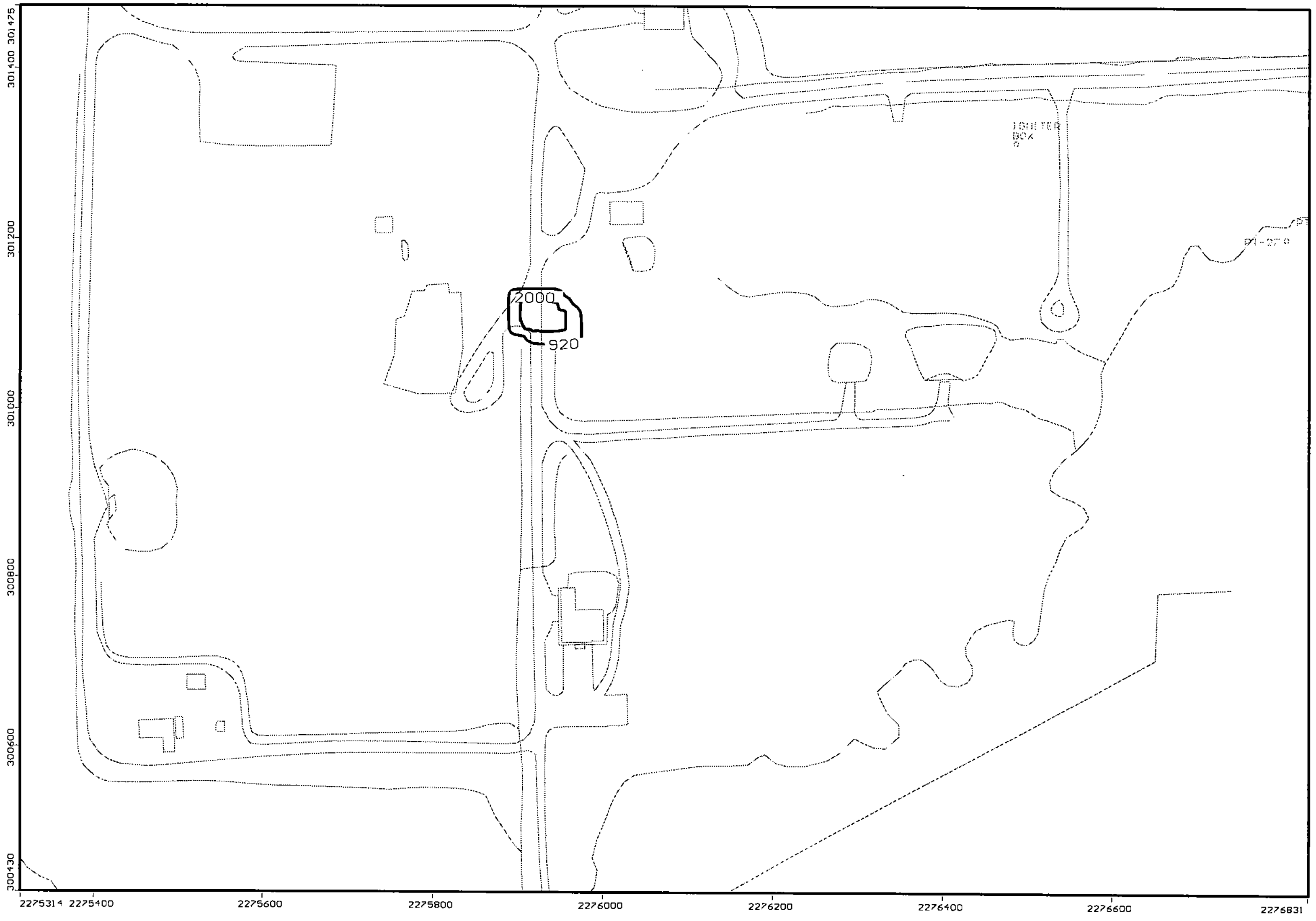
URS Corporation
Project: IAAAP EDA Modeling
Description: Alt 1&2 – Chloroethane
Modeller: JJS/ANB 39 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP EDA Modeling
Description: Alternative 1&2 – 1,1 DCE
Modeller: JJS/ANB 1 d
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP EDA Modeling
Description: Alternative 1&2 – 1,1 DCE
Modeller: JJS/ANB 1 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
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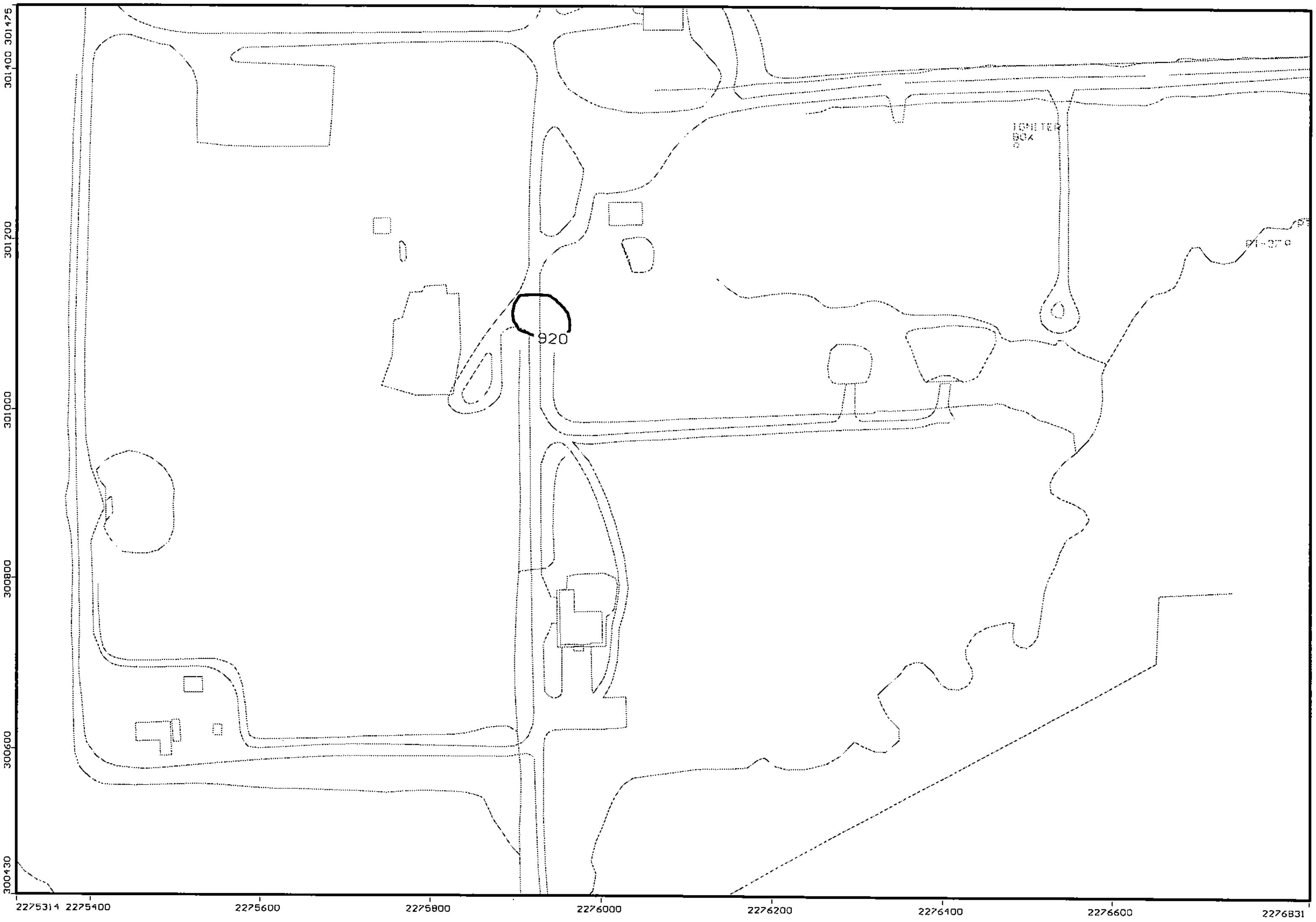
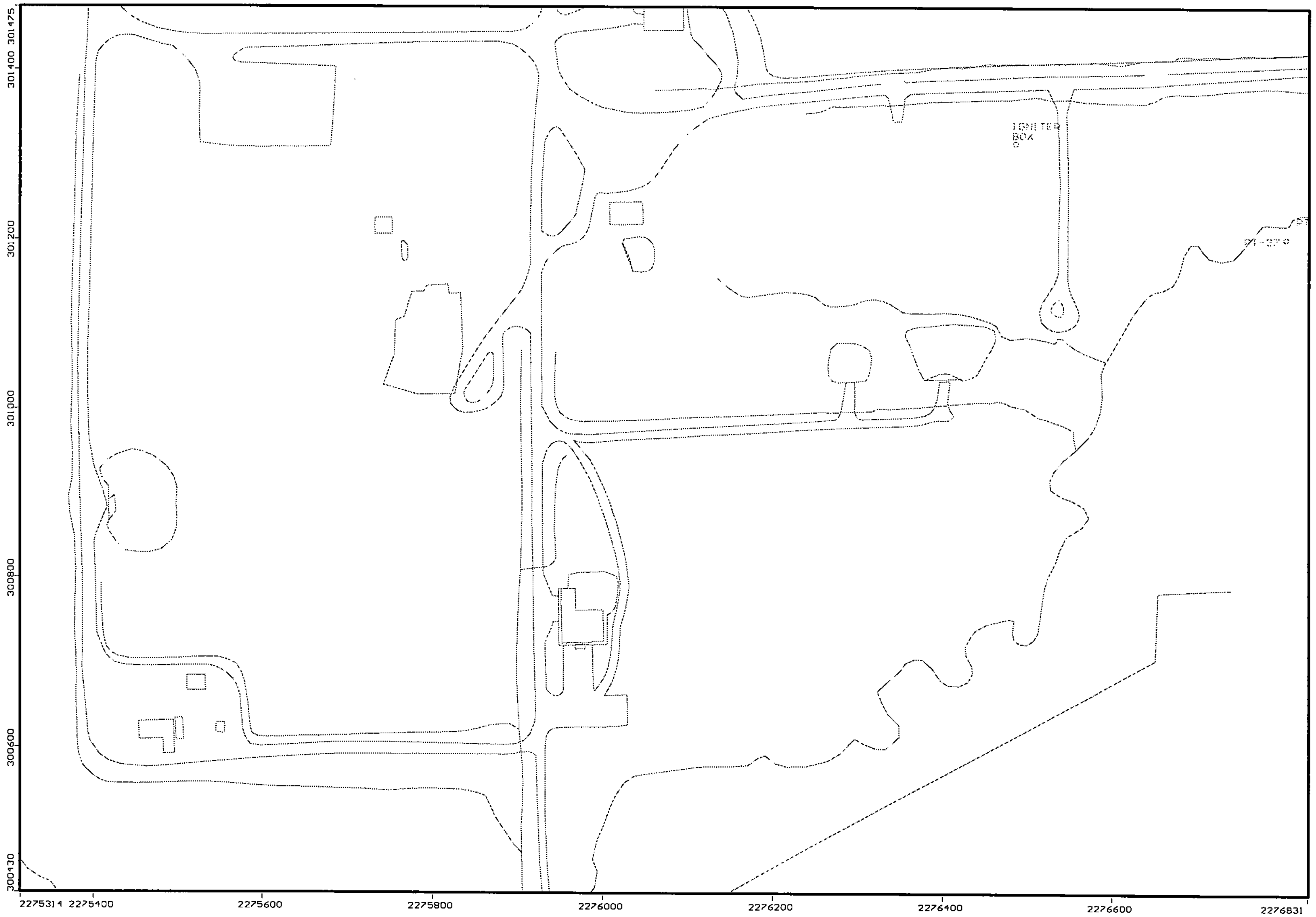


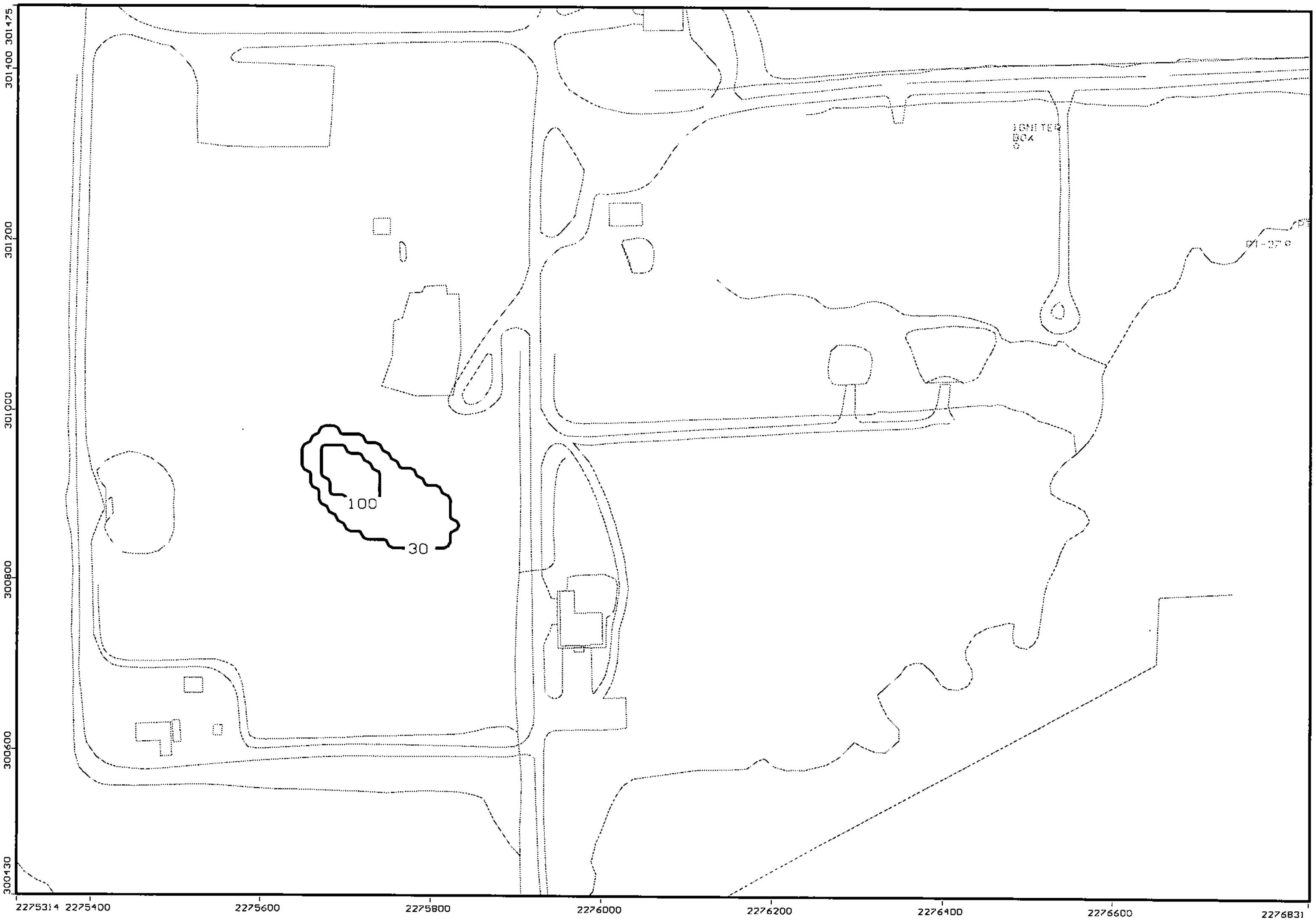
URS Corporation
Project: IAAAP EDA Modeling
Description: Alternative 1&2 – 1,1 DCE
Modeller: JJS/ANB 3 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



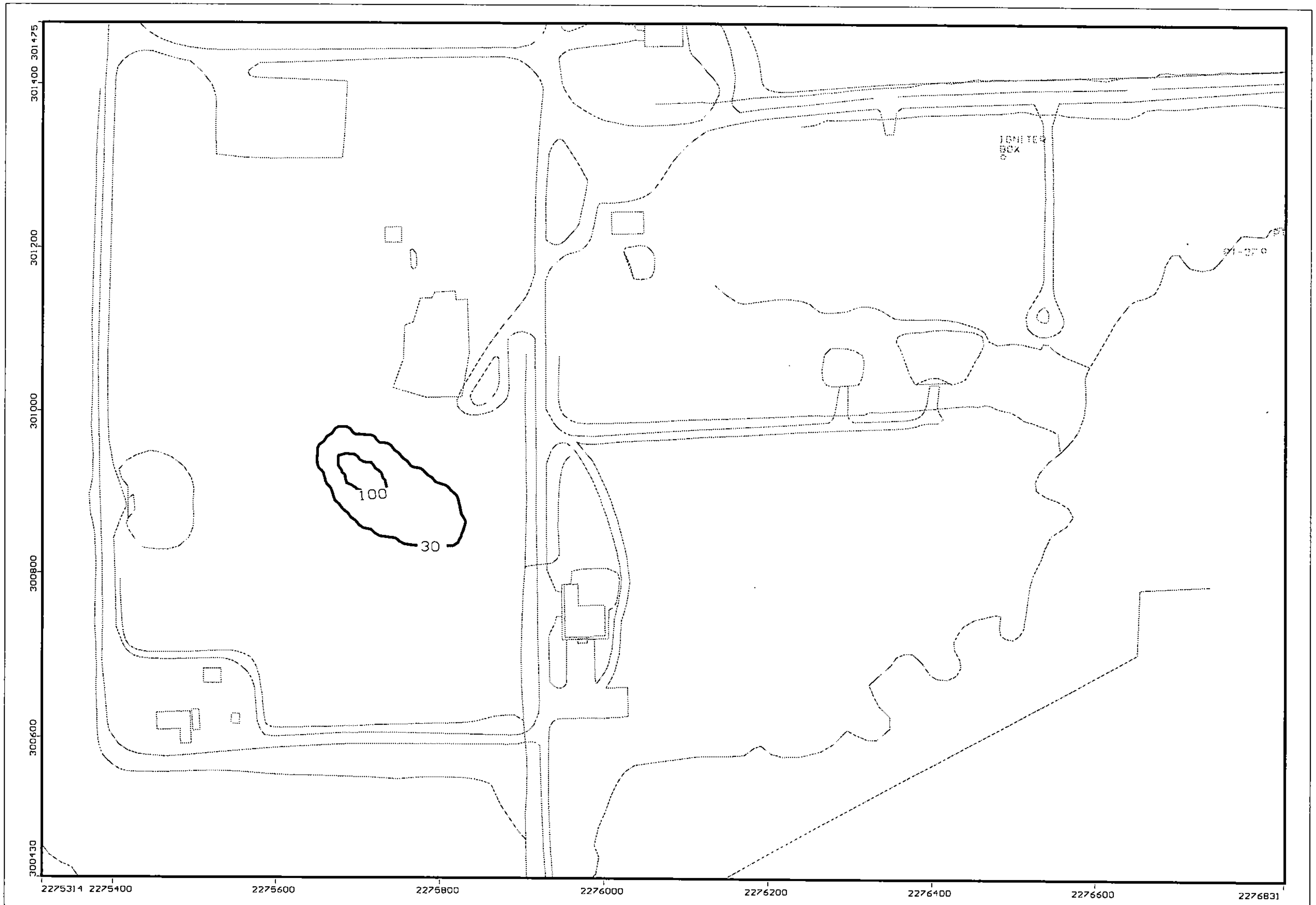
URS Corporation
Project: IAAAP EDA Modeling
Description: Alternative 1&2 – 1,1 DCE
Modeller: JJS/ANB 4 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



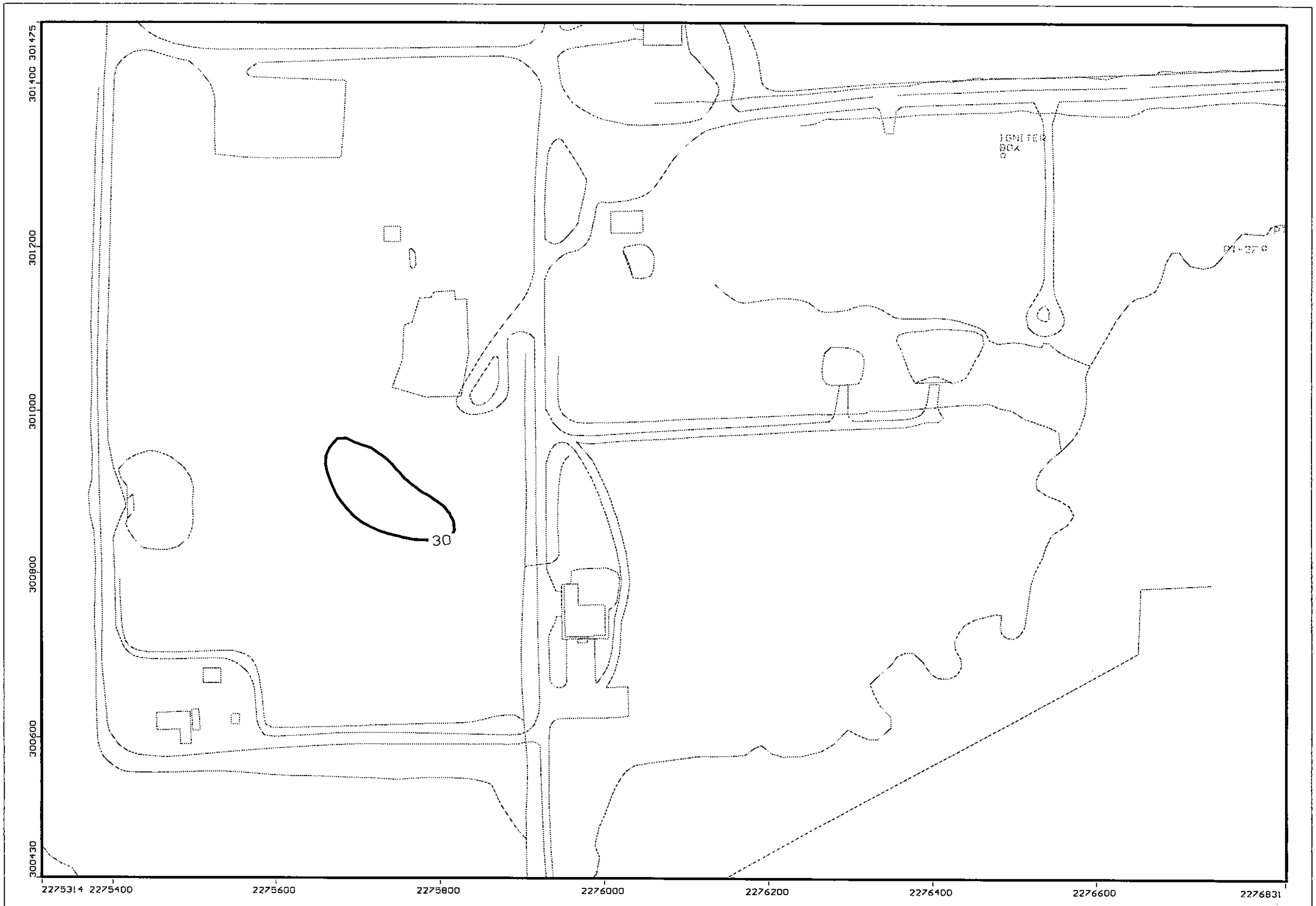
URS Corporation
Project: IAAAP EDA Modeling
Description: Alternative 1&2 – TCE
Modeller: JJS/ANB 1 d
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP EDA Modeling
Description: Alternative 1&2 – TCE
Modeller: JJS/ANB 1 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP EDA Modeling
Description: Alternative 1&2 – TCE
Modeller: JJS/ANB 5 yr
11 Mar 04

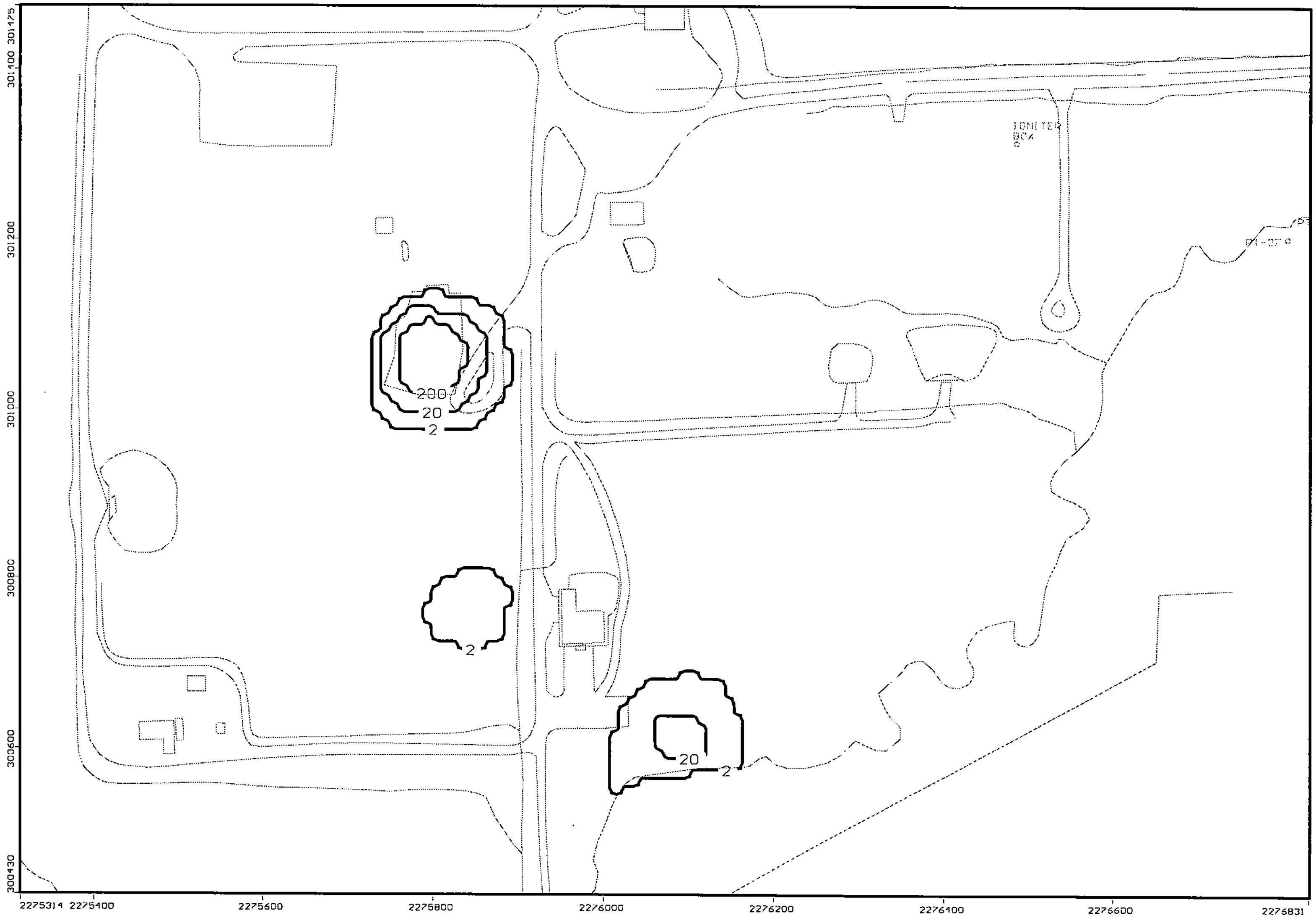
Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

URS Corporation
Project: IAAAP EDA Modeling
Description: Alternative 1&2 – TCE
Modeller: JJS/ANB 9 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

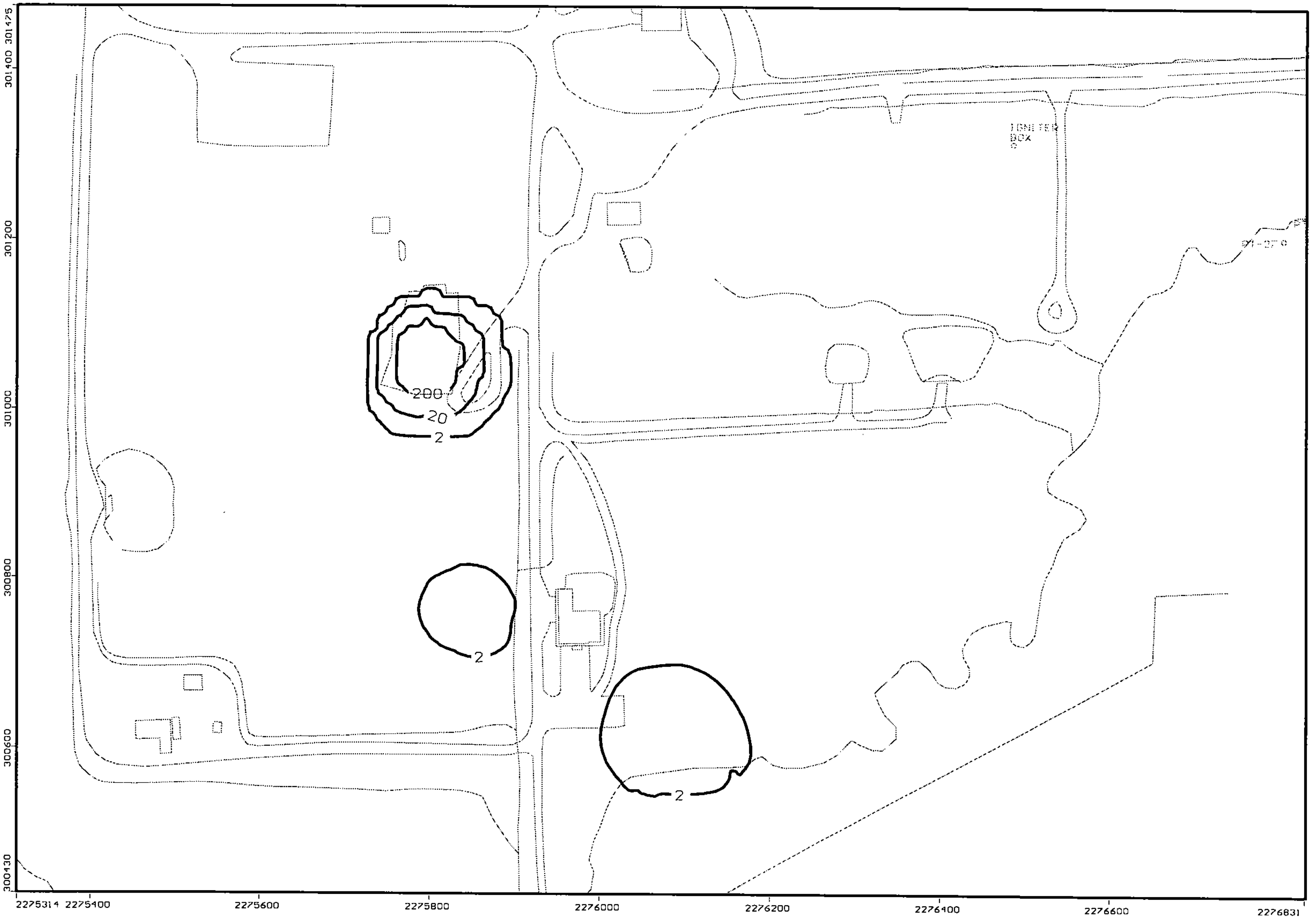
URS Corporation
Project: IAAAP EDA Modeling
Description: Alternative 1&2 – TCE
Modeller: JJS/ANB 10 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP EDA Modeling
Description: Alternative 1&2 – VC
Modeller: JJS/ANB 1 d
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

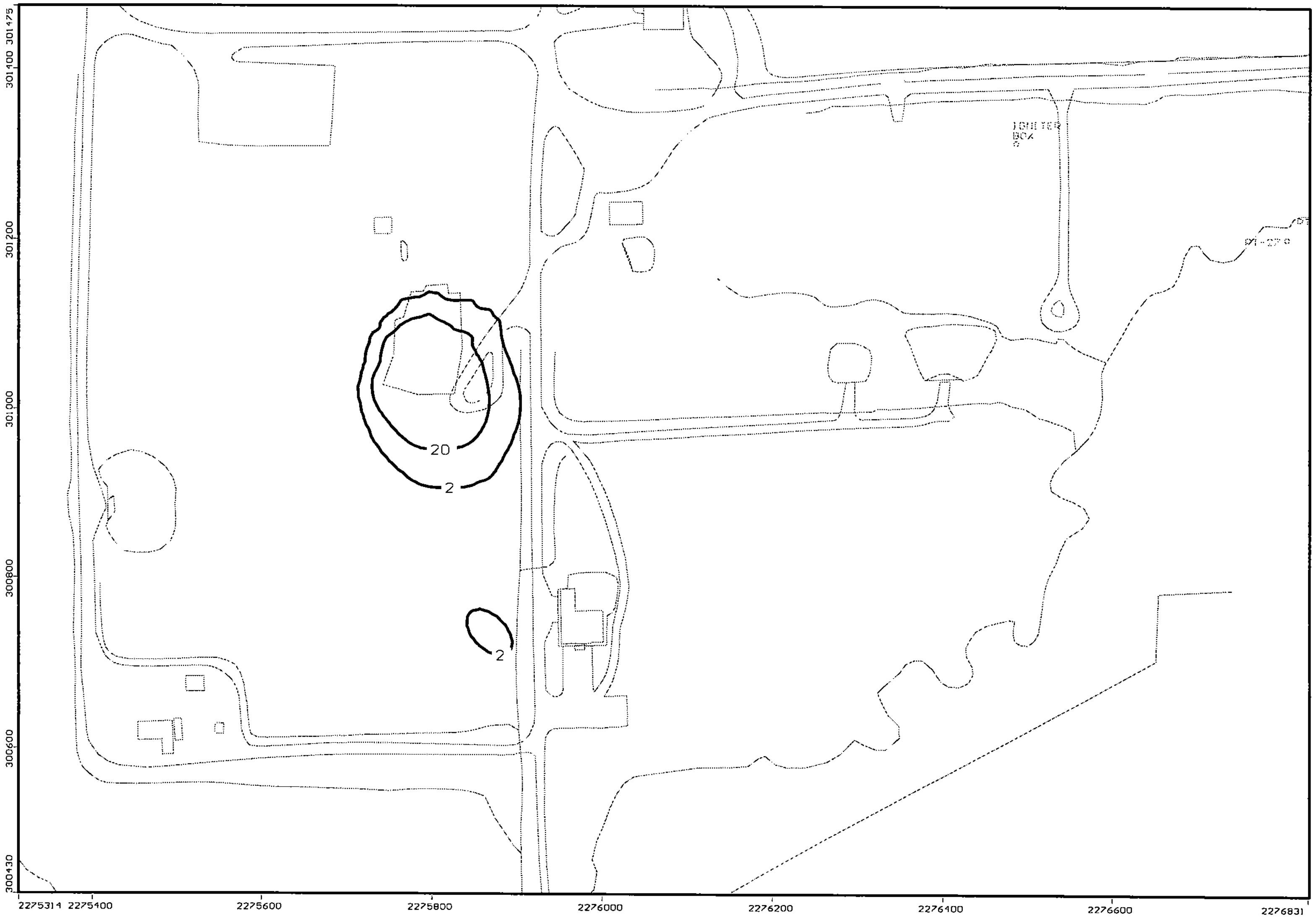


URS Corporation
Project: IAAAP EDA Modeling
Description: Alternative 1&2 — VC
Modeller: JJS/ANB 1 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

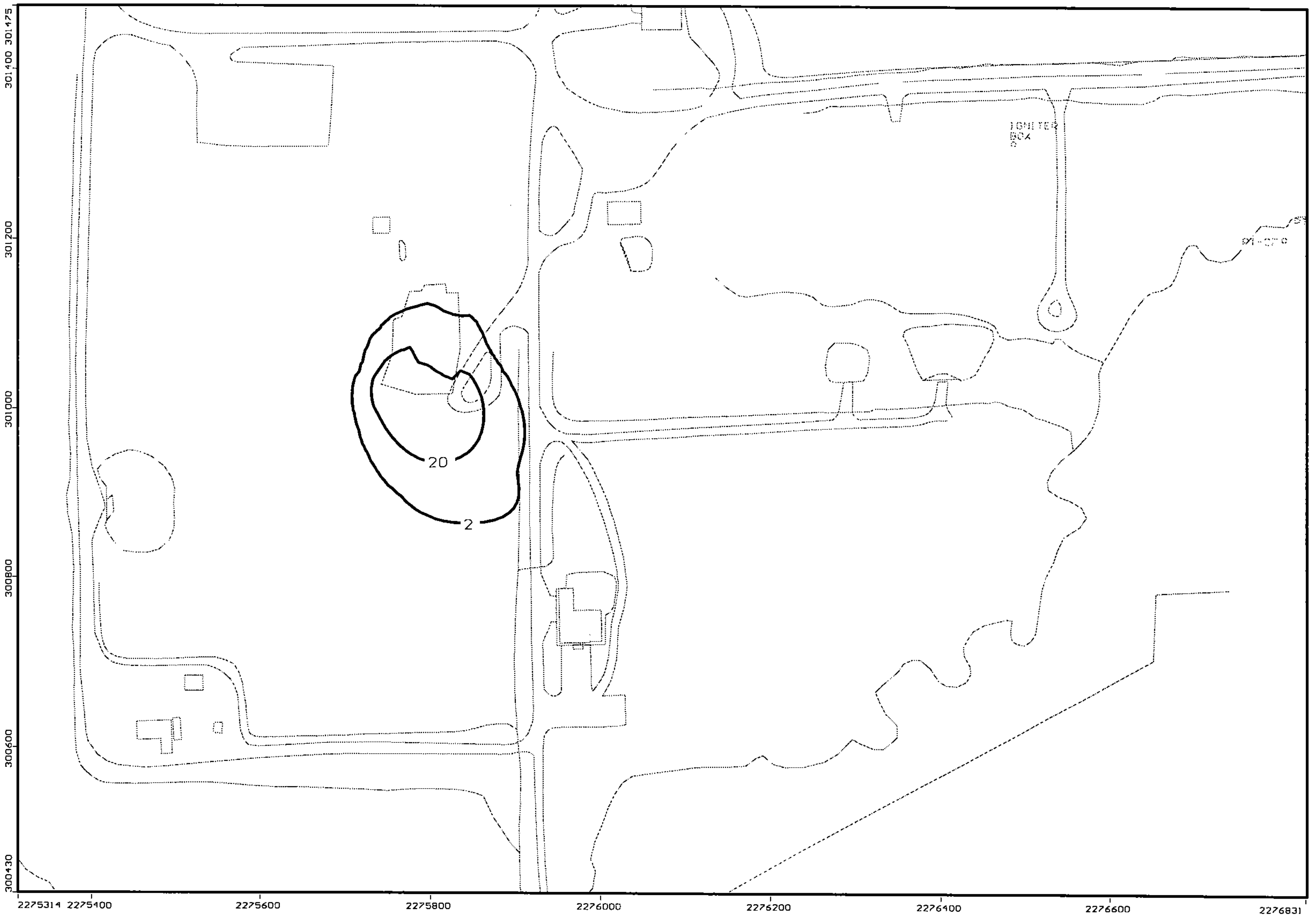
URS Corporation
Project: IAAAP EDA Modeling
Description: Alternative 1&2 – VC
Modeller: JJS/ANB 5 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



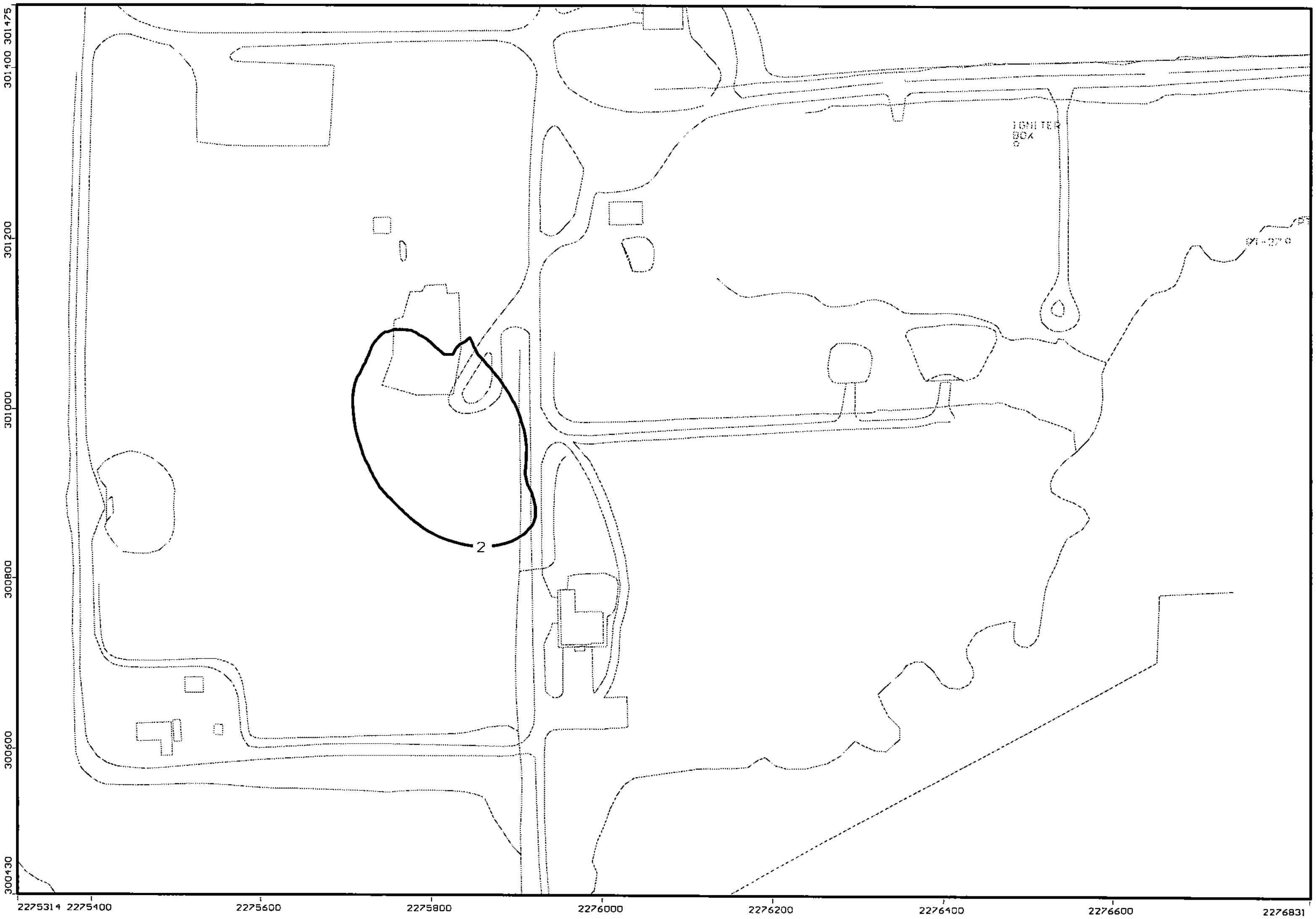
URS Corporation
Project: IAAAP EDA Modeling
Description: Alternative 1&2 – VC
Modeller: JJS/ANB 10 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



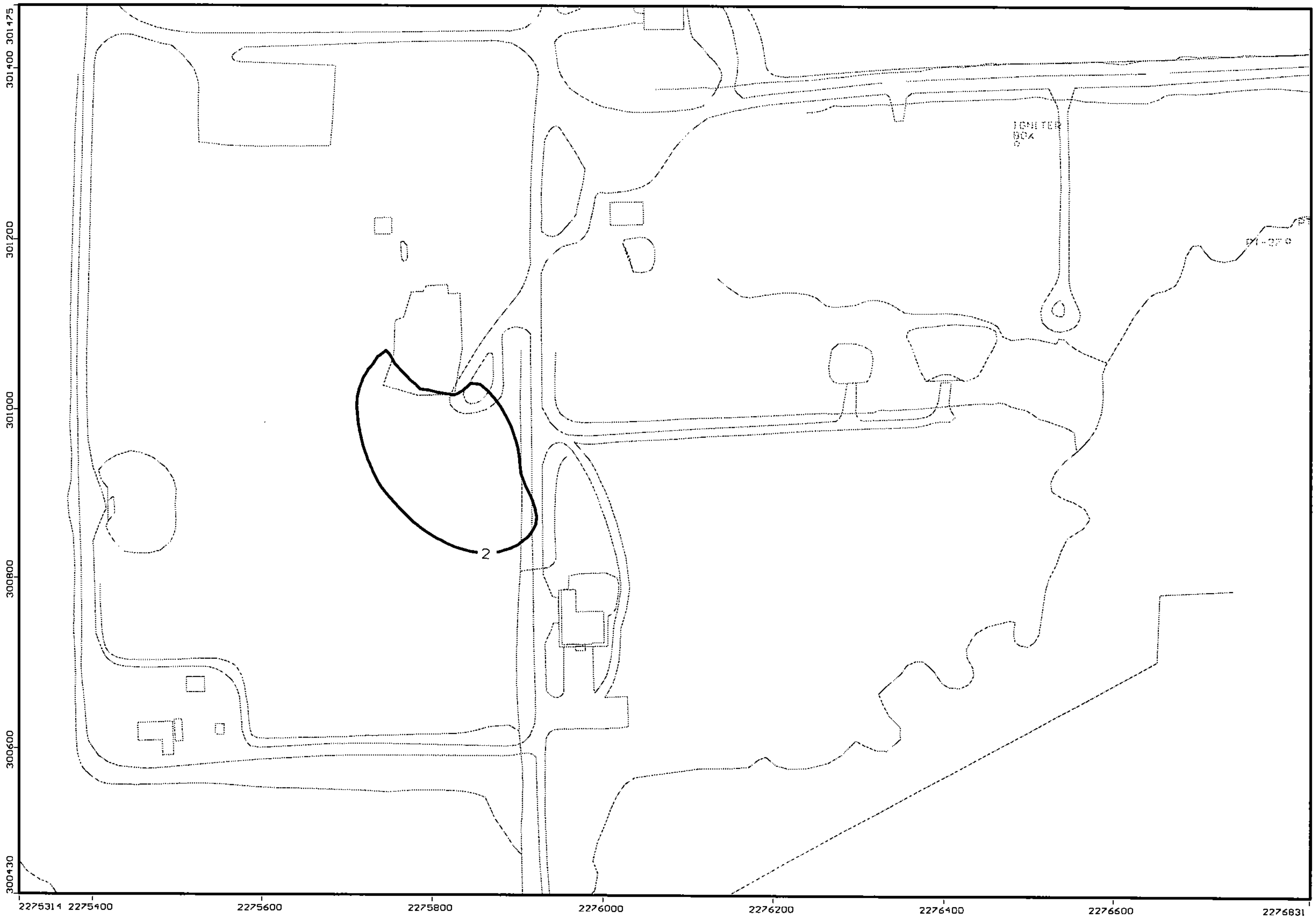
URS Corporation
Project: IAAAP EDA Modeling
Description: Alternative 1&2 – VC
Modeller: JJS/ANB 20 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



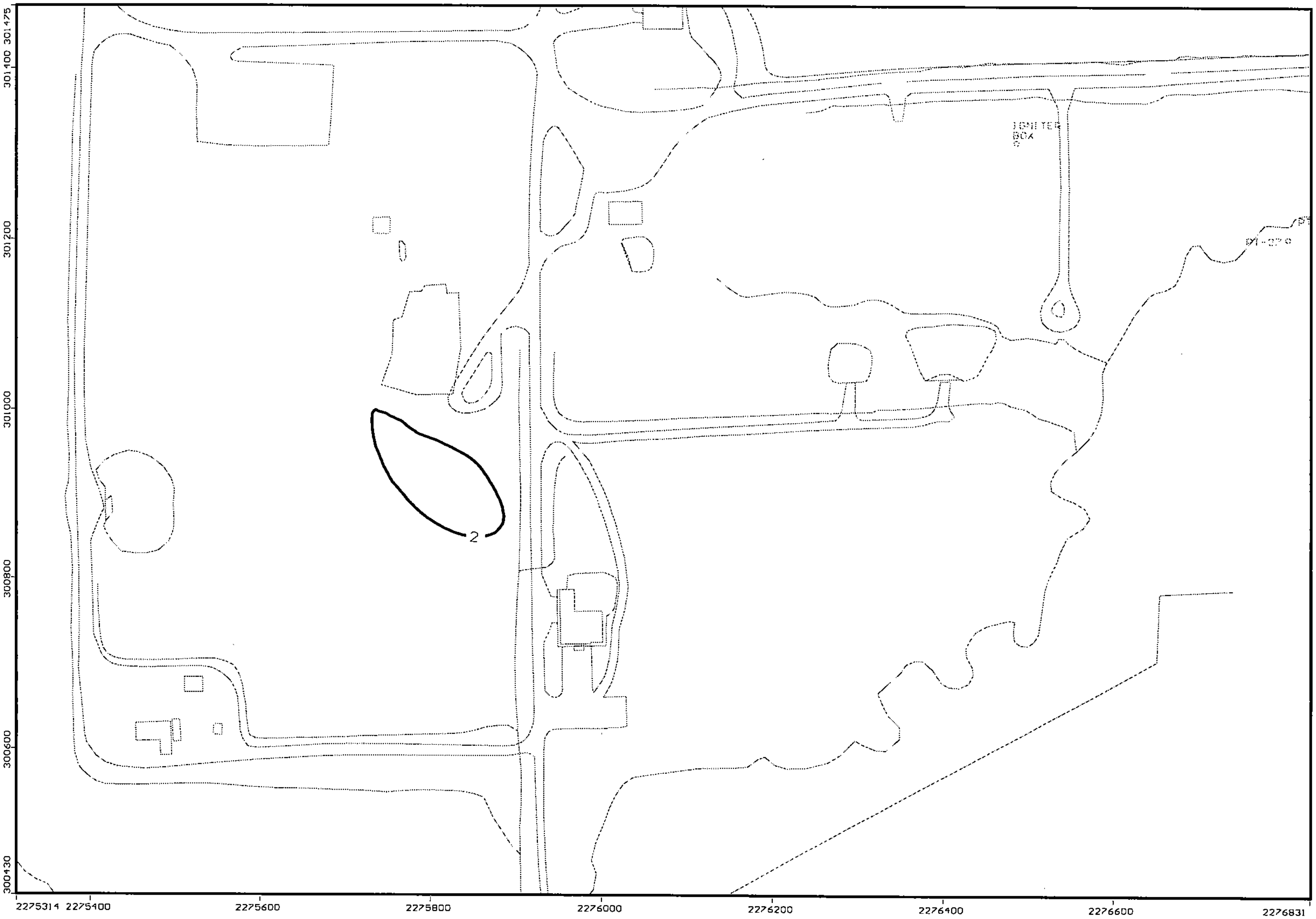
URS Corporation
Project: IAAAP EDA Modeling
Description: Alternative 1&2 – VC
Modeller: JJS/ANB 30 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



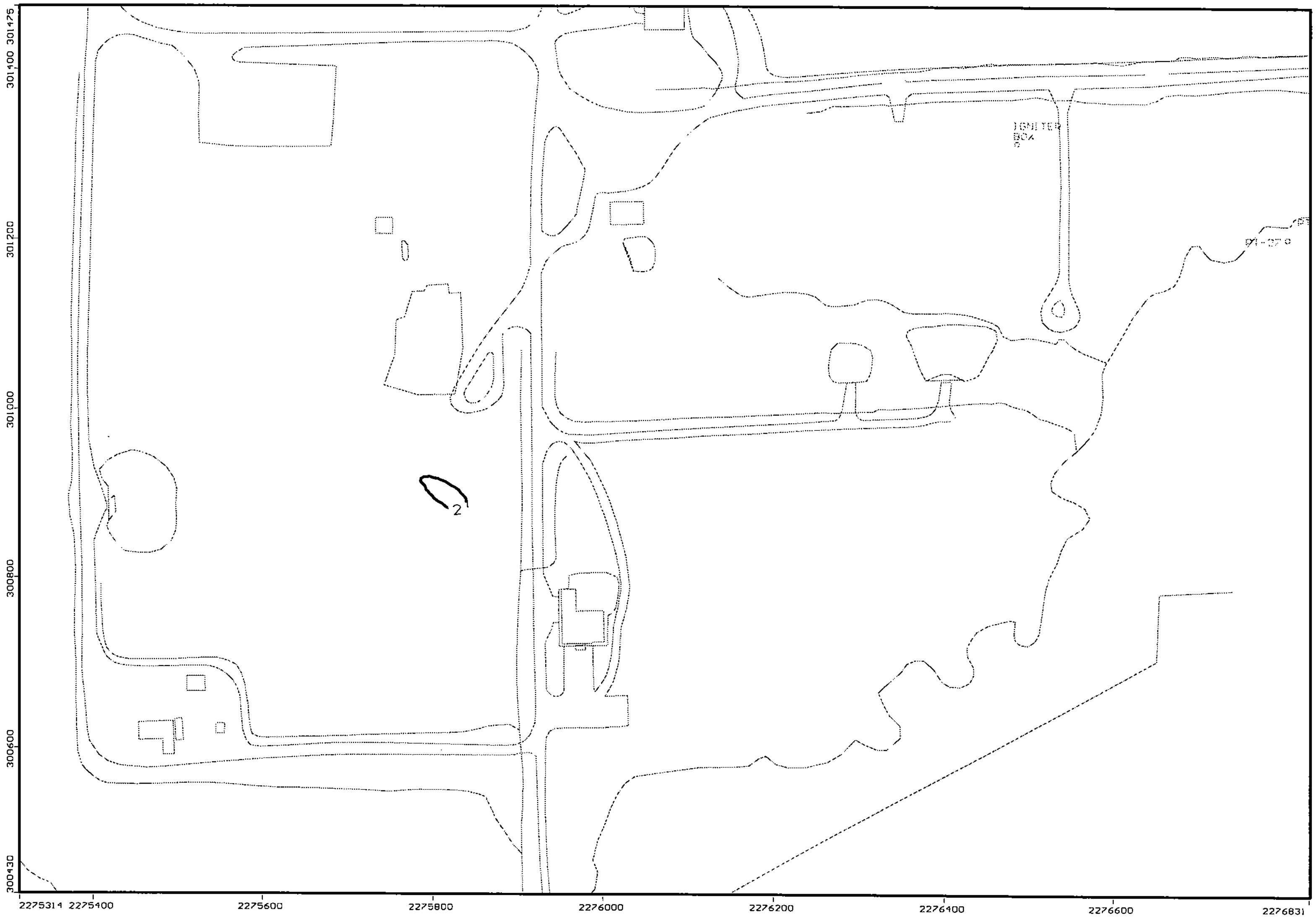
URS Corporation
Project: IAAAP EDA Modeling
Description: Alternative 1&2 – VC
Modeller: JJS/ANB 40 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP EDA Modeling
Description: Alternative 1&2 – VC
Modeller: JJS/ANB 50 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP EDA Modeling
Description: Alternative 1&2 – VC
Modeller: JJS/ANB 53 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

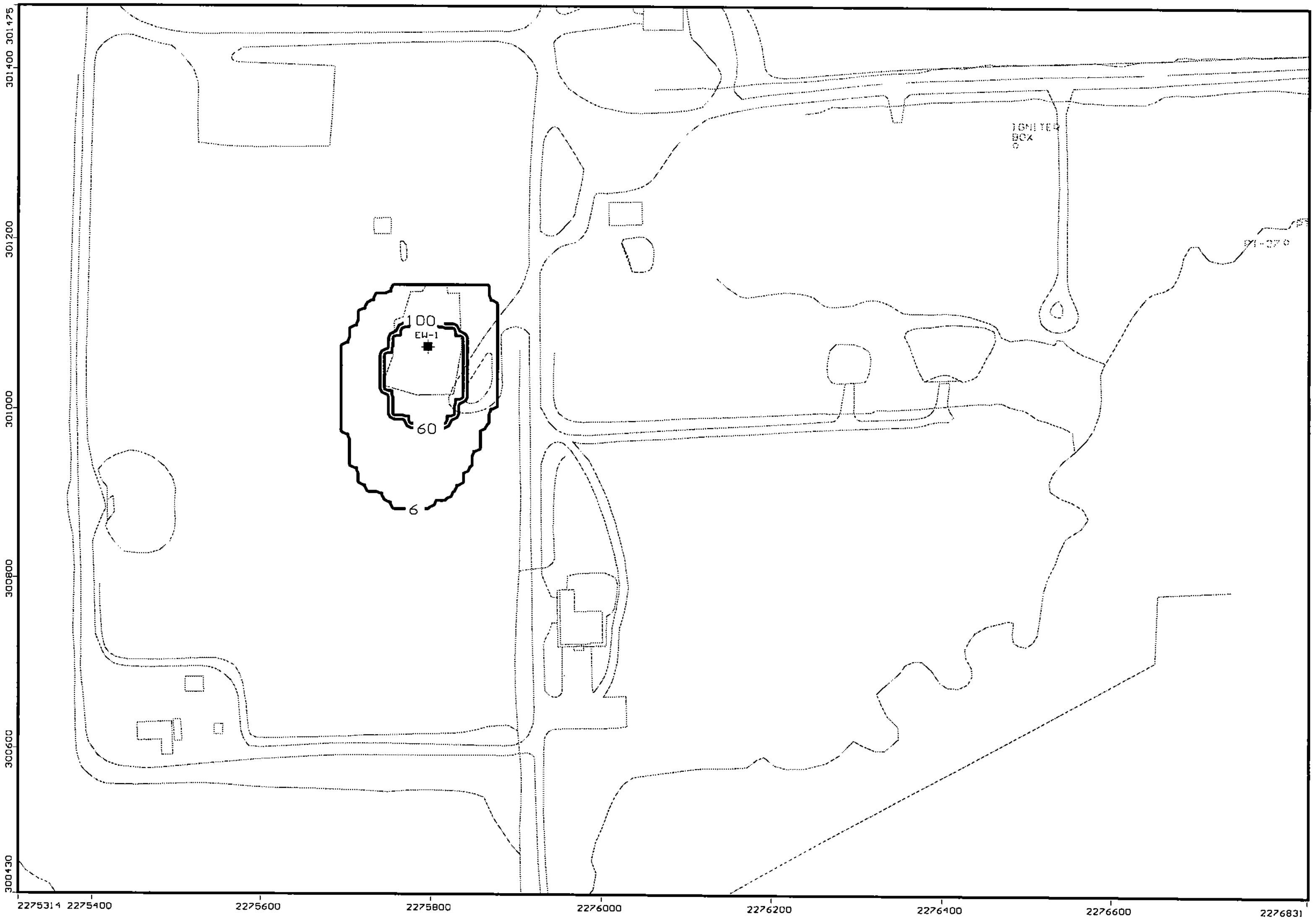
URS Corporation
Project: IAAAP EDA Modeling
Description: Alternative 1&2 – VC
Modeller: JJS/ANB 54 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

ATTACHMENT K-5

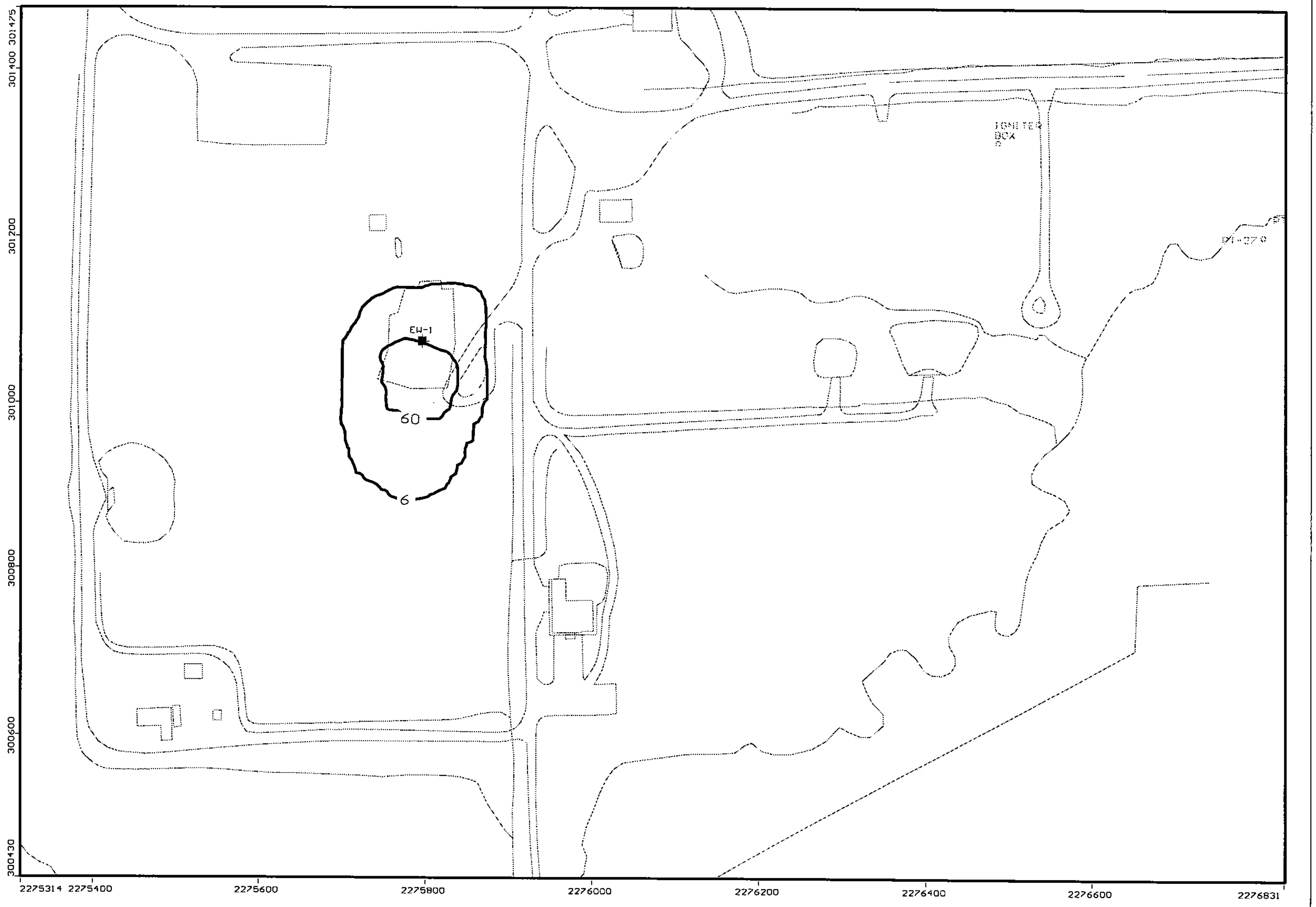
Contaminant Fate and Transport Modeling Results

Alternative 3 – Focused Extraction/MNA



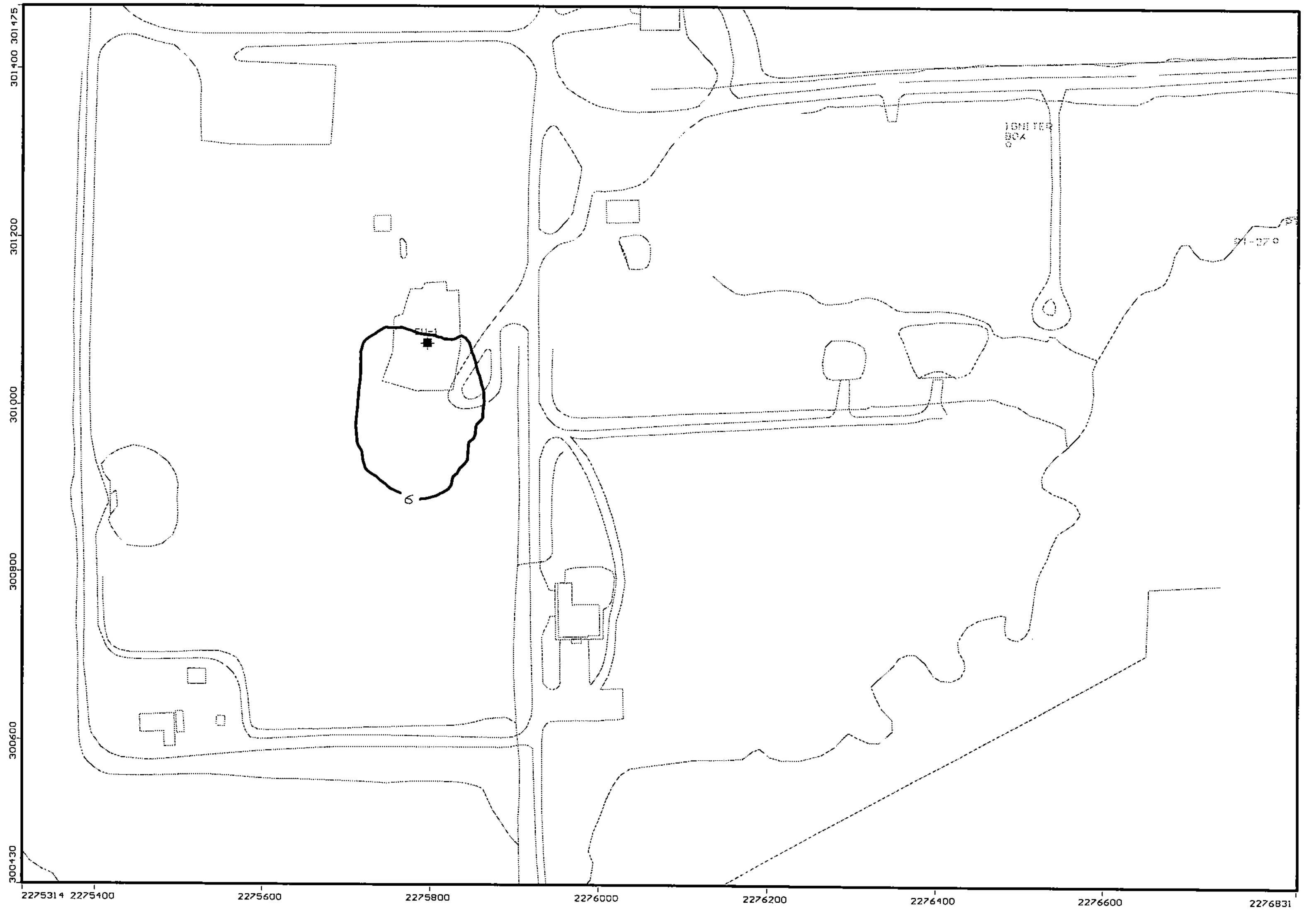
URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 3 – Benzene
Modeller: JJS/ANB 1 d
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



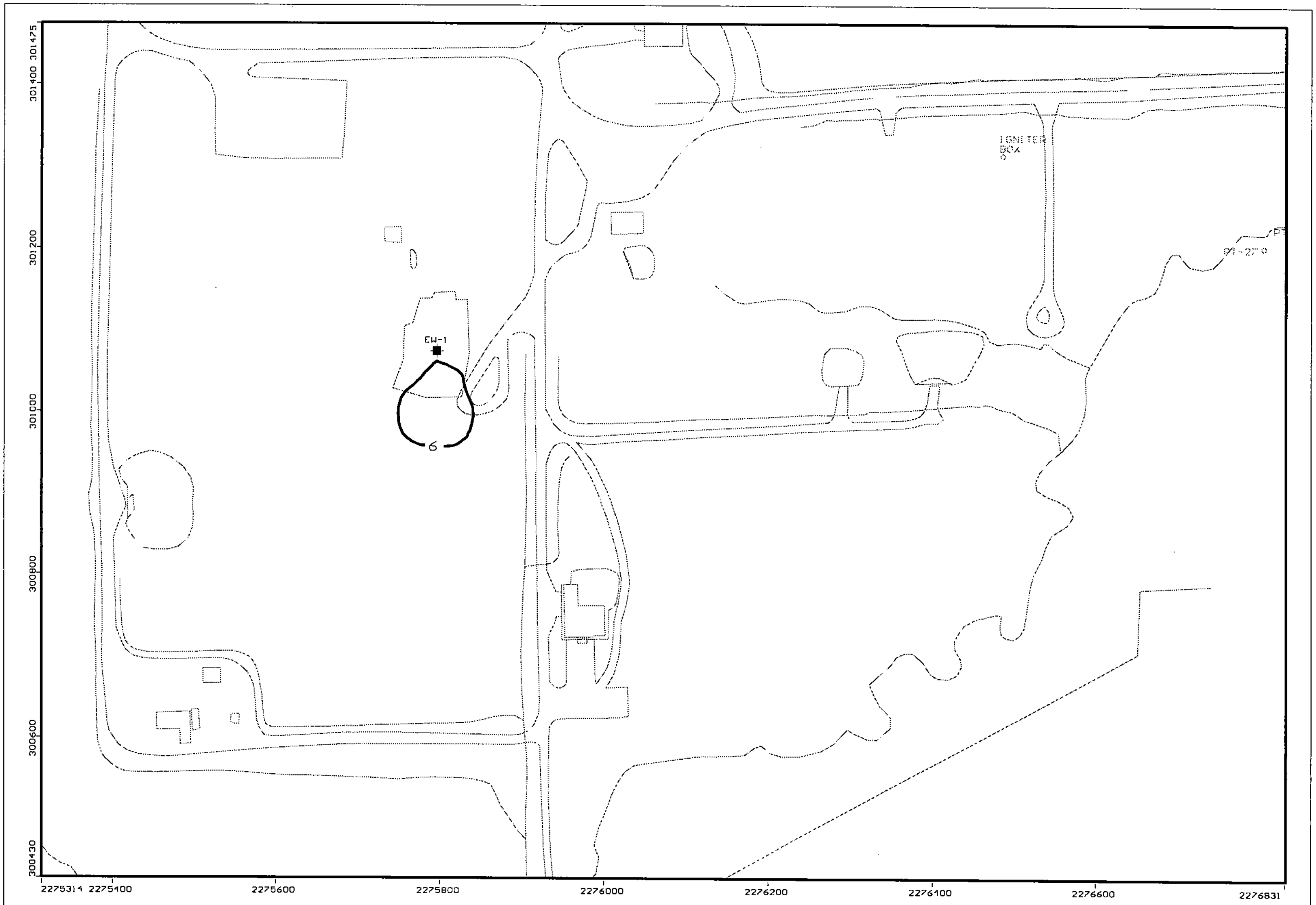
URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 3 – Benzene
Modeller: JJS/ANB 1 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



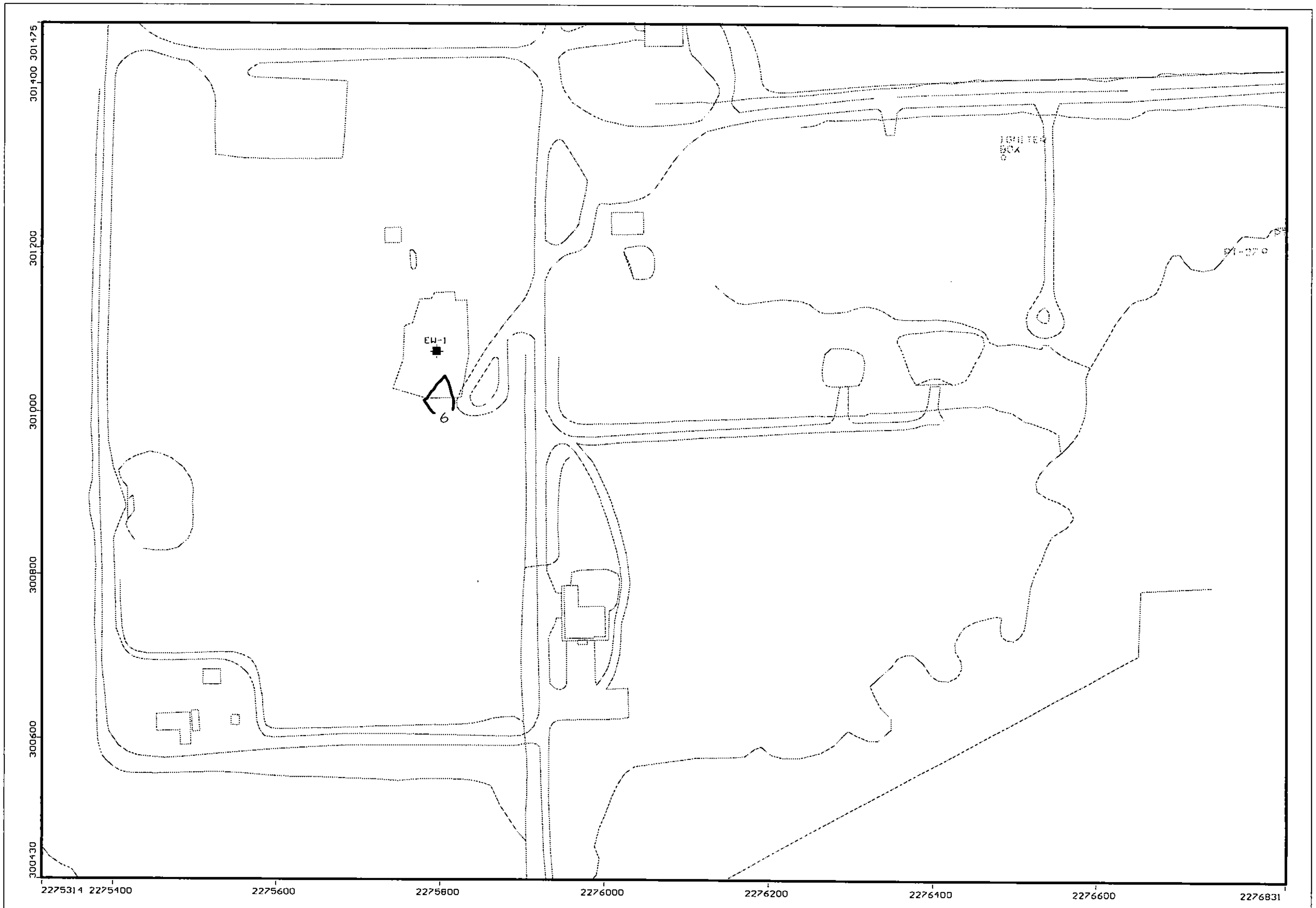
URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 3 – Benzene
Modeller: JJS/ANB 5 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



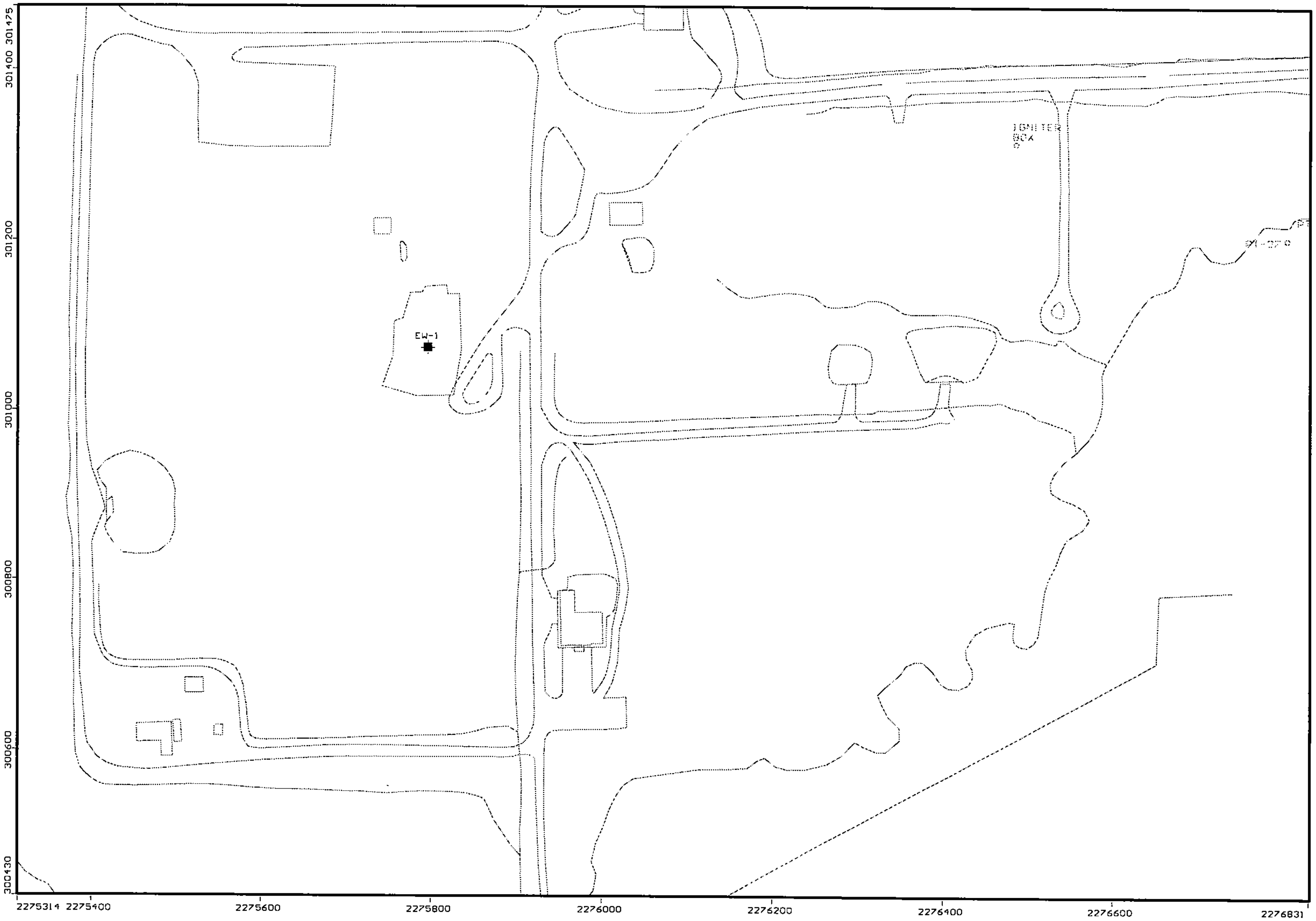
URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 3 – Benzene
Modeller: JJS/ANB 10 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



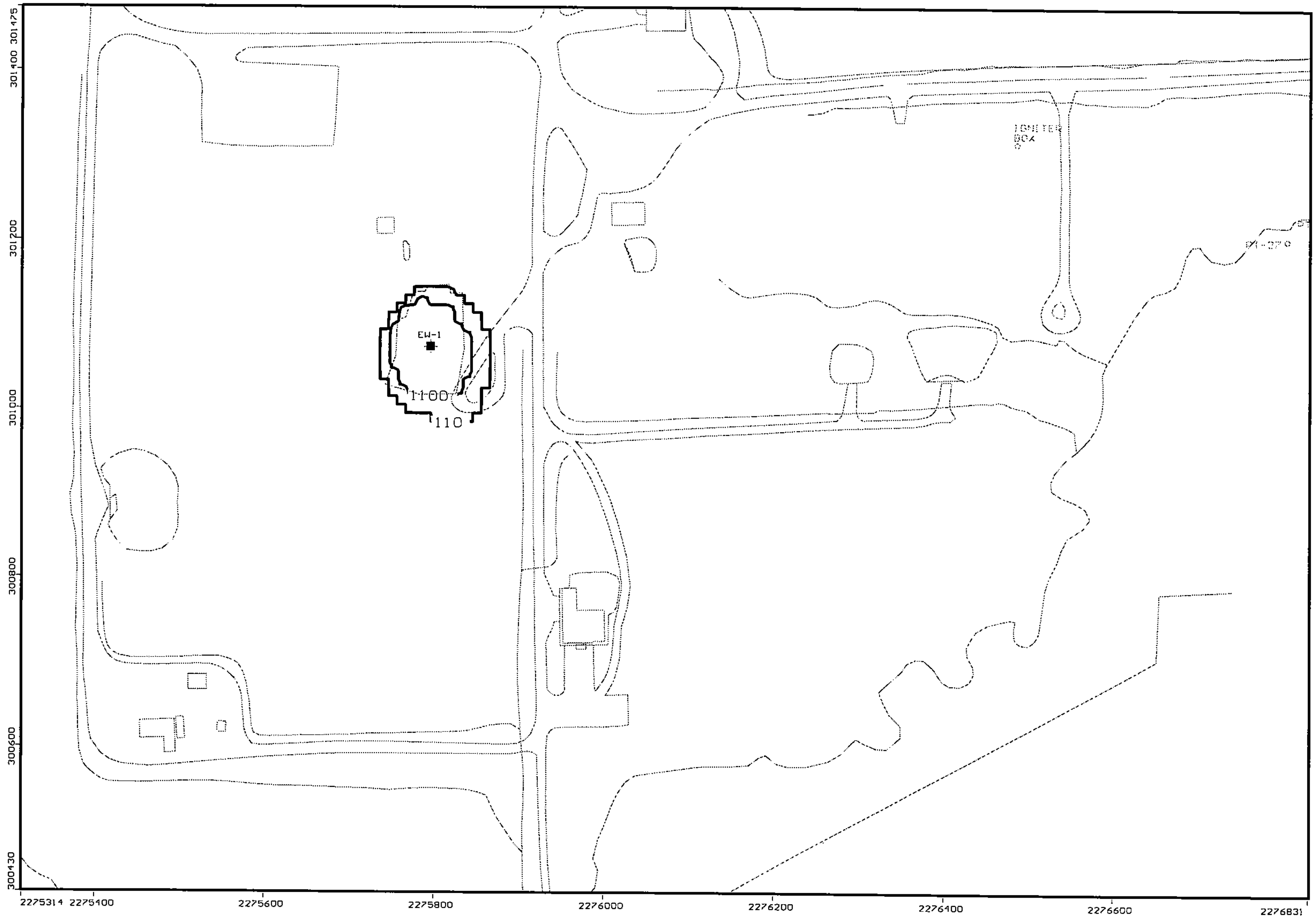
URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 3 – Benzene
Modeller: JJS/ANB 13 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



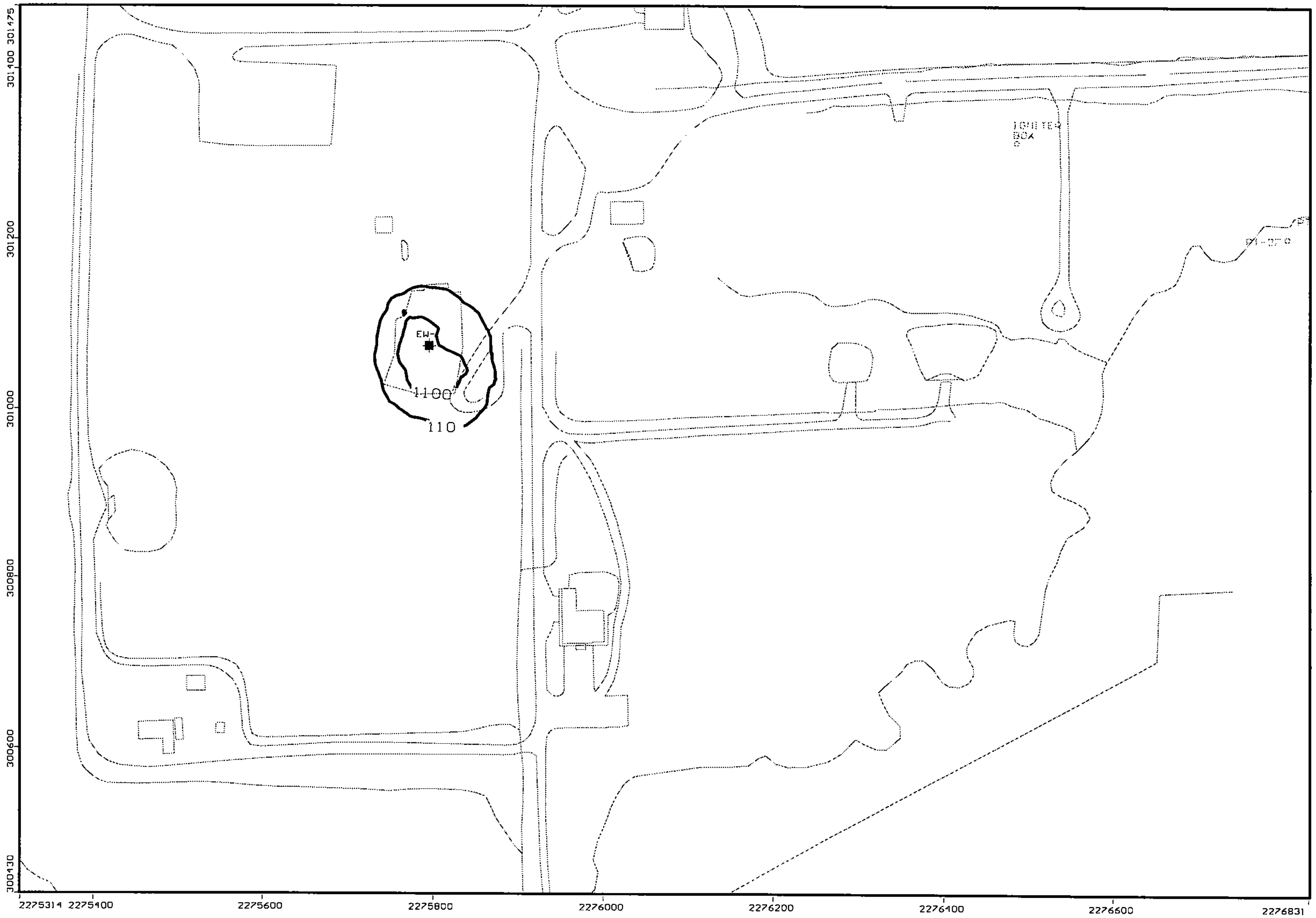
URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 3 – Benzene
Modeller: JJS/ANB 14 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



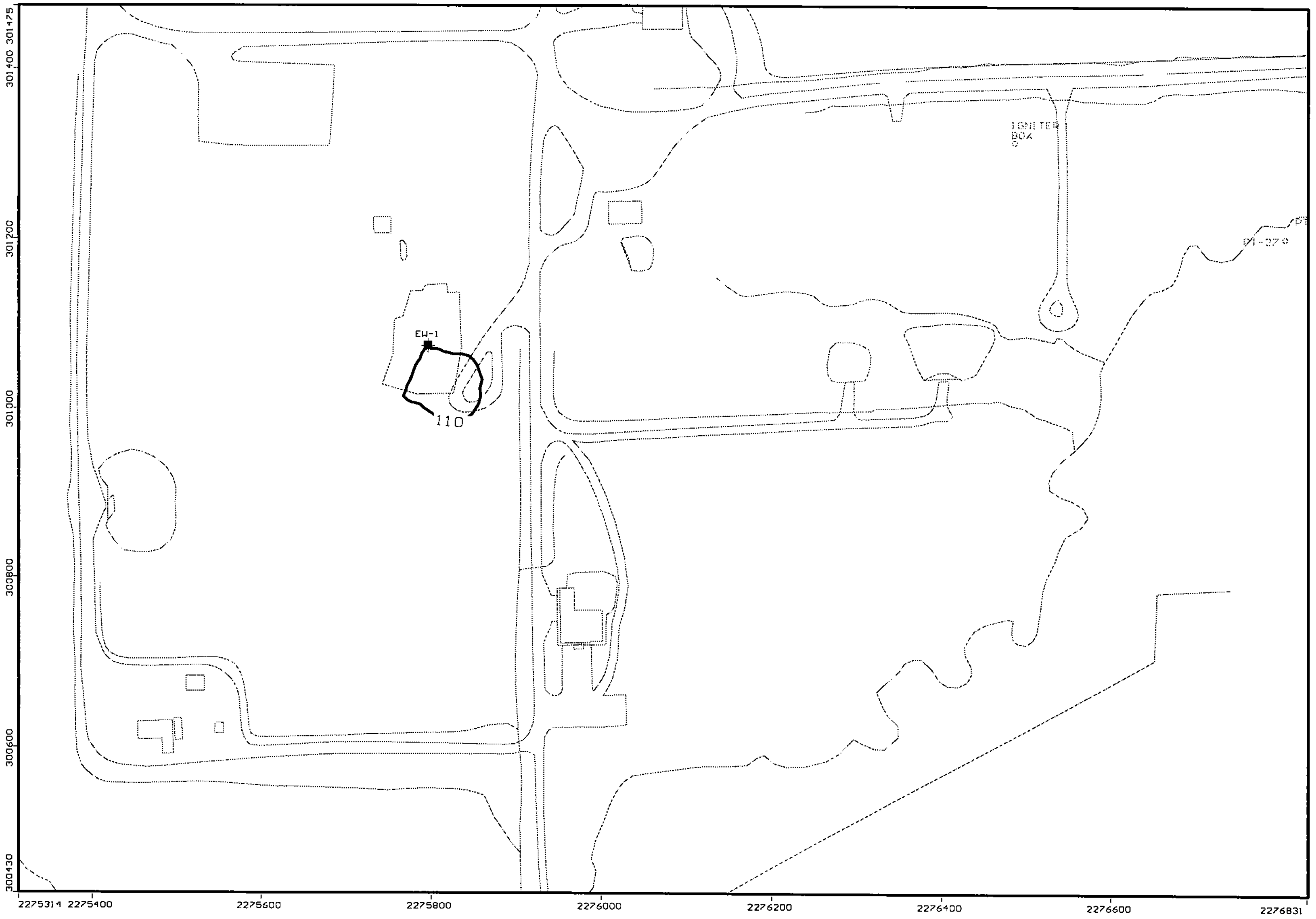
URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative3–Chloroethane
Modeller: JJS/ANB 1 d
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative3–Chloroethane
Modeller: JJS/ANB 1 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative3—Chloroethane
Modeller: JJS/ANB 5 yr
10 Mar 04

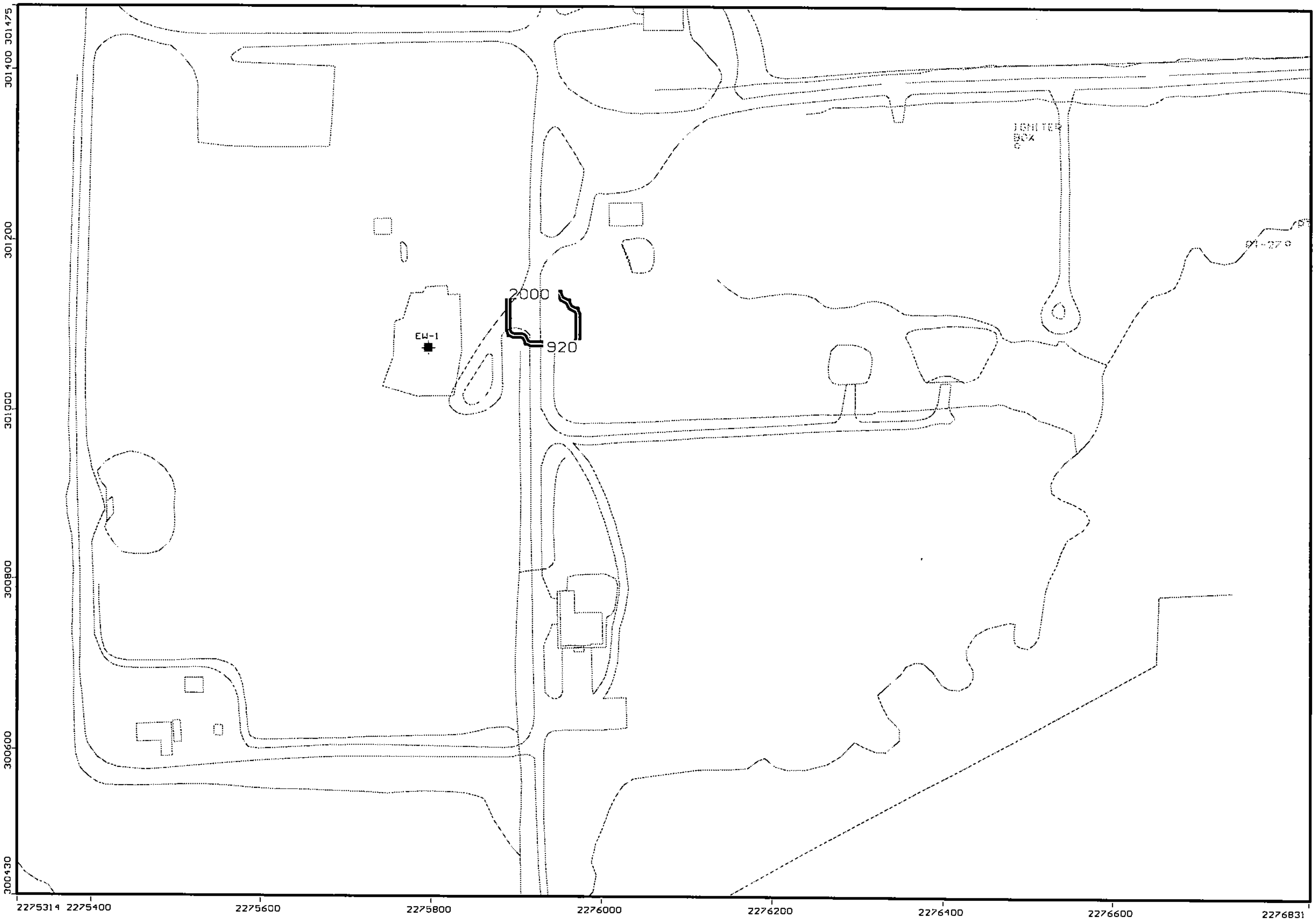
Visual MODFLOW v.3.1.0, (C) 1995—2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative3–Chloroethane
Modeller: JJS/ANB 9 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

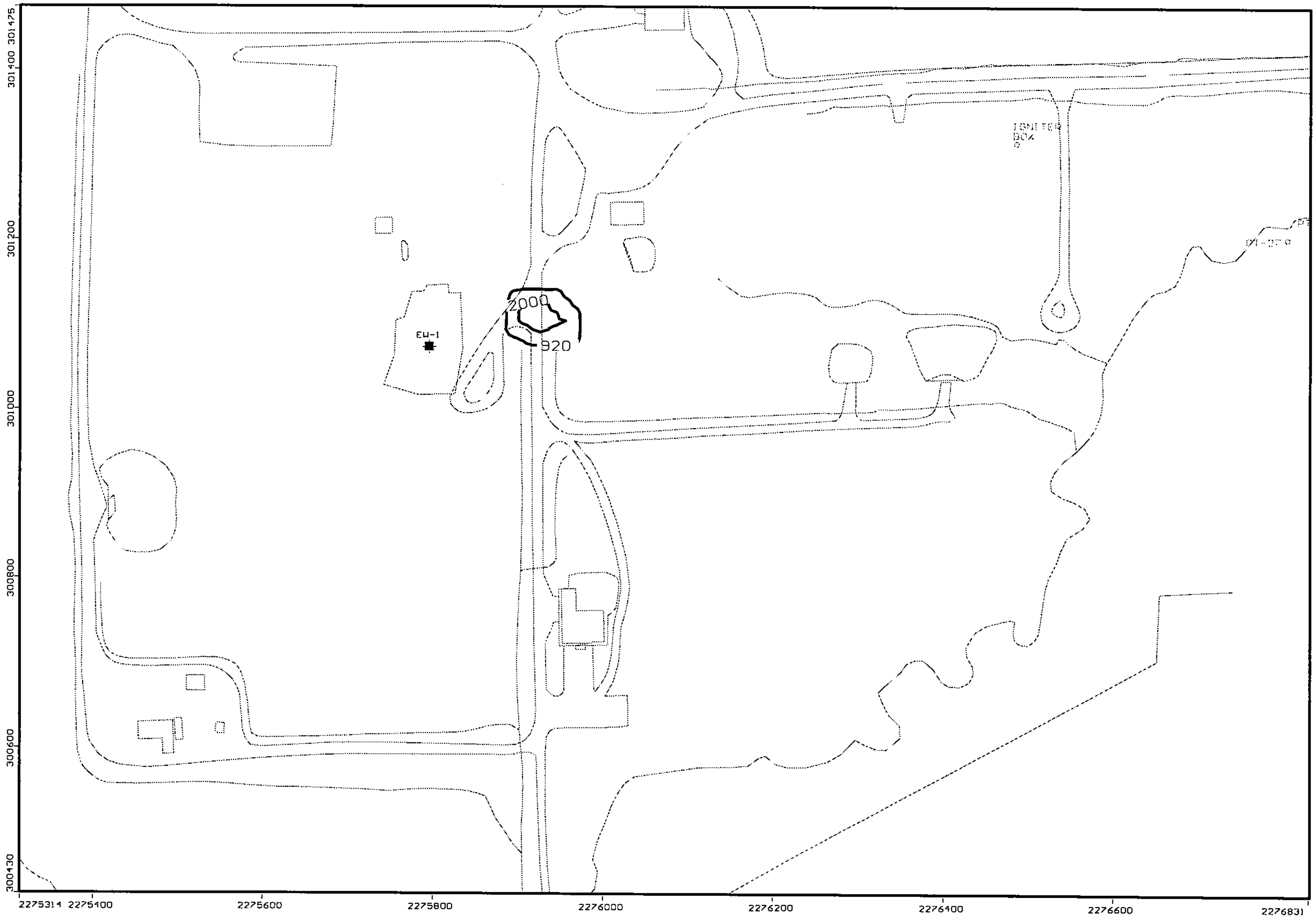
URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative3–Chloroethane
Modeller: JJS/ANB 10 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



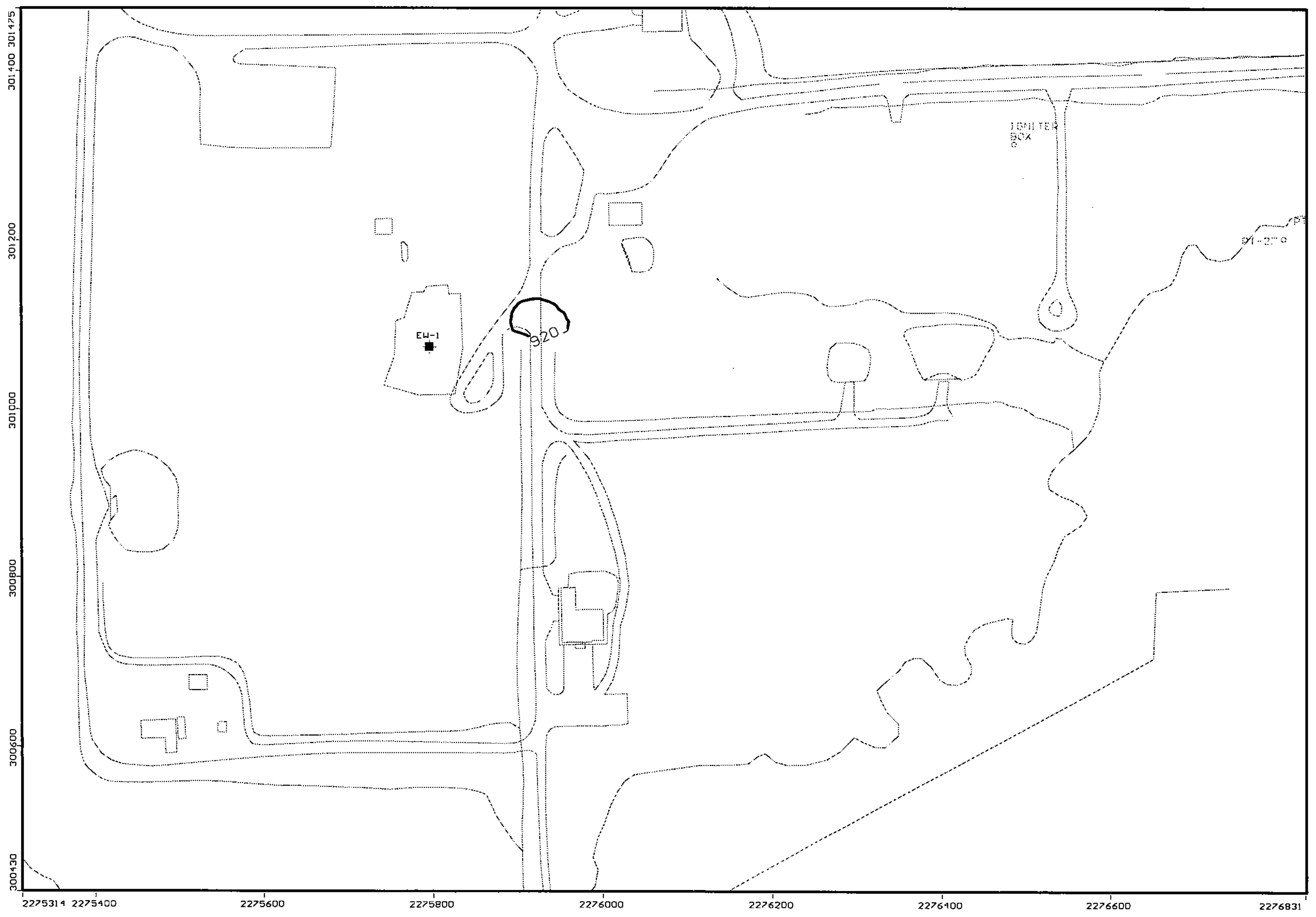
URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 3 – 1,1 DCE
Modeller: JJS/ANB 1 d
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



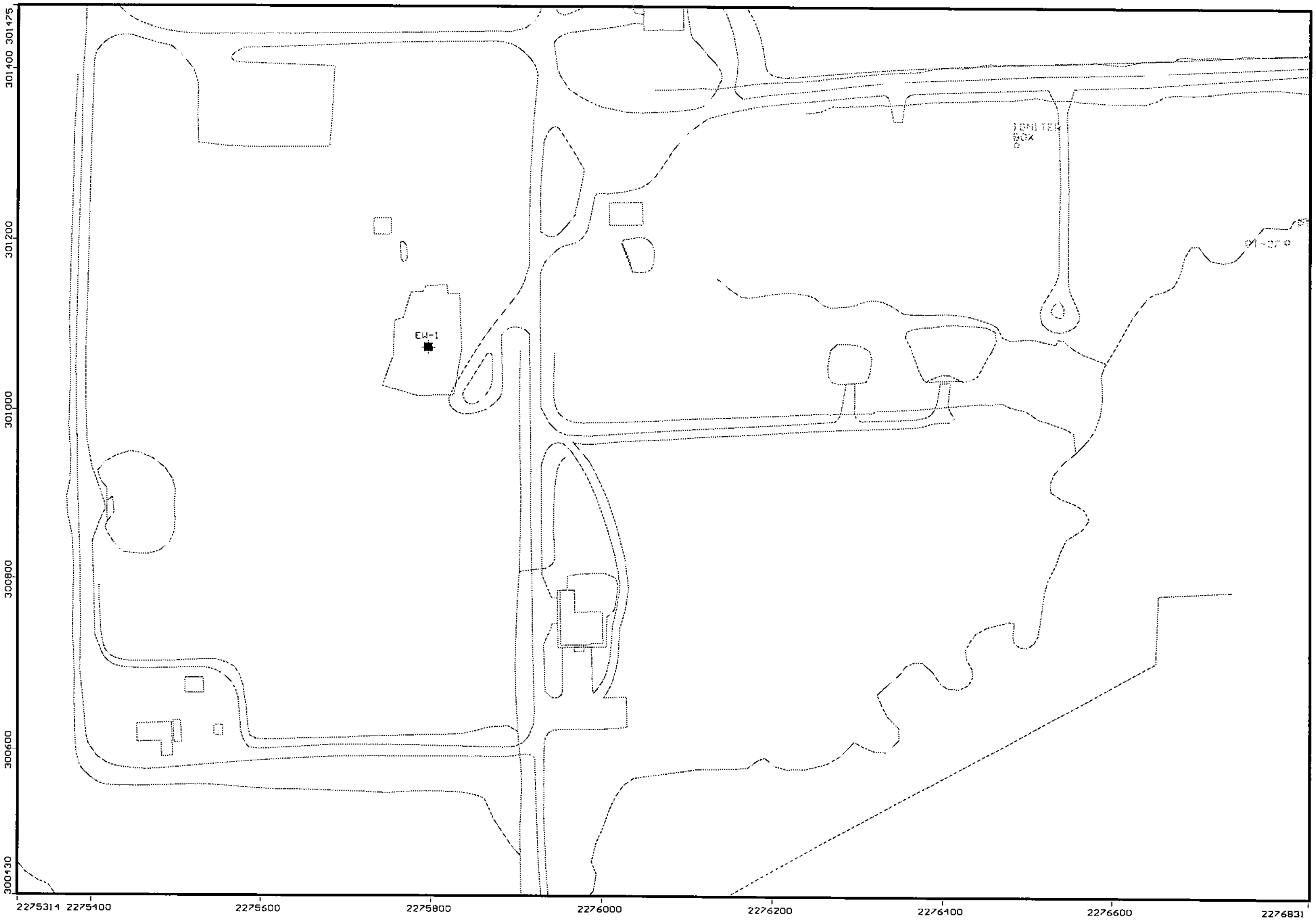
URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 3 – 1,1 DCE
Modeller: JJS/ANB 1 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 3 – 1,1 DCE
Modeller: JJS/ANB 3 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 3 – 1,1 DCE
Modeller: JJS/ANB 4 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
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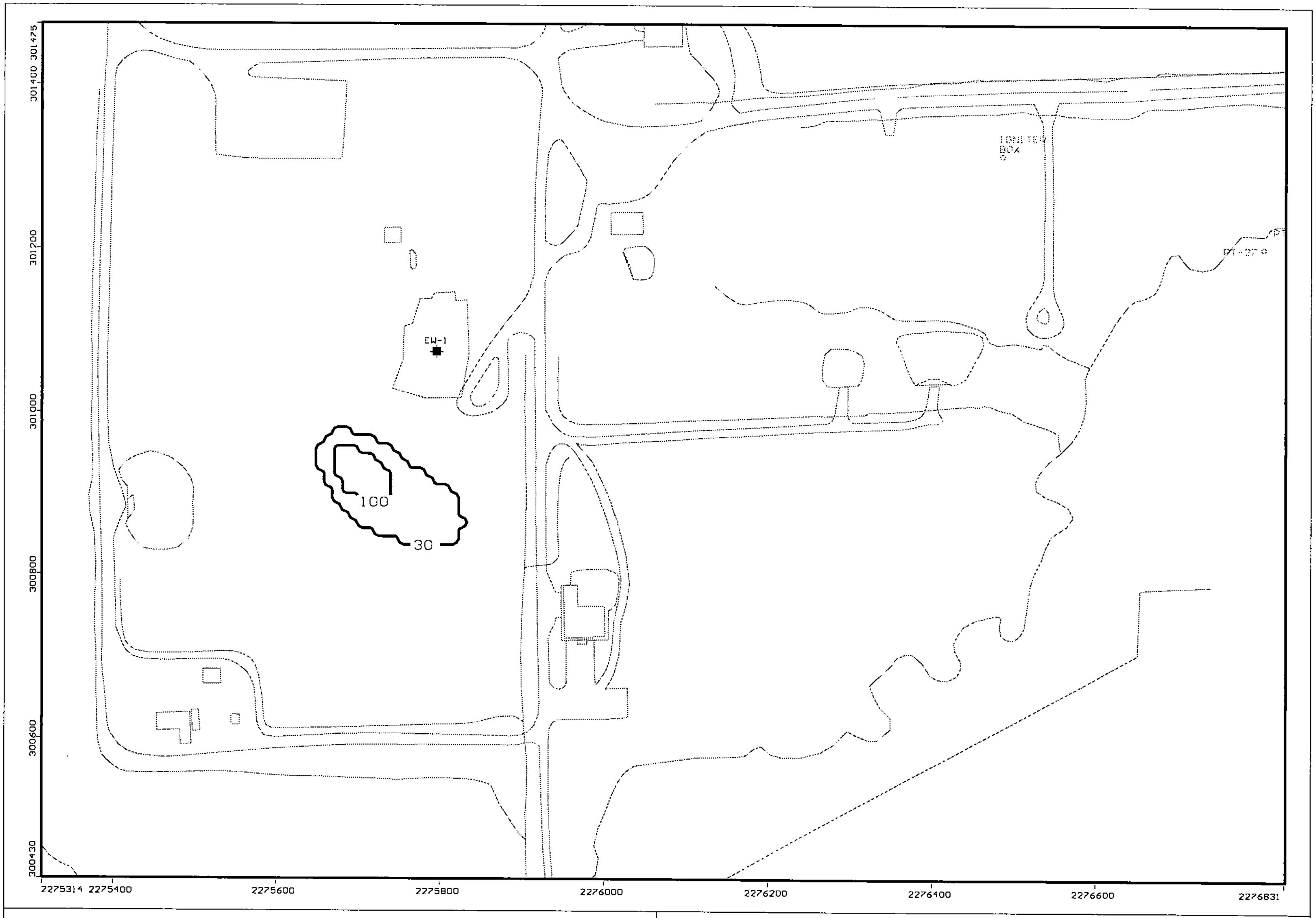
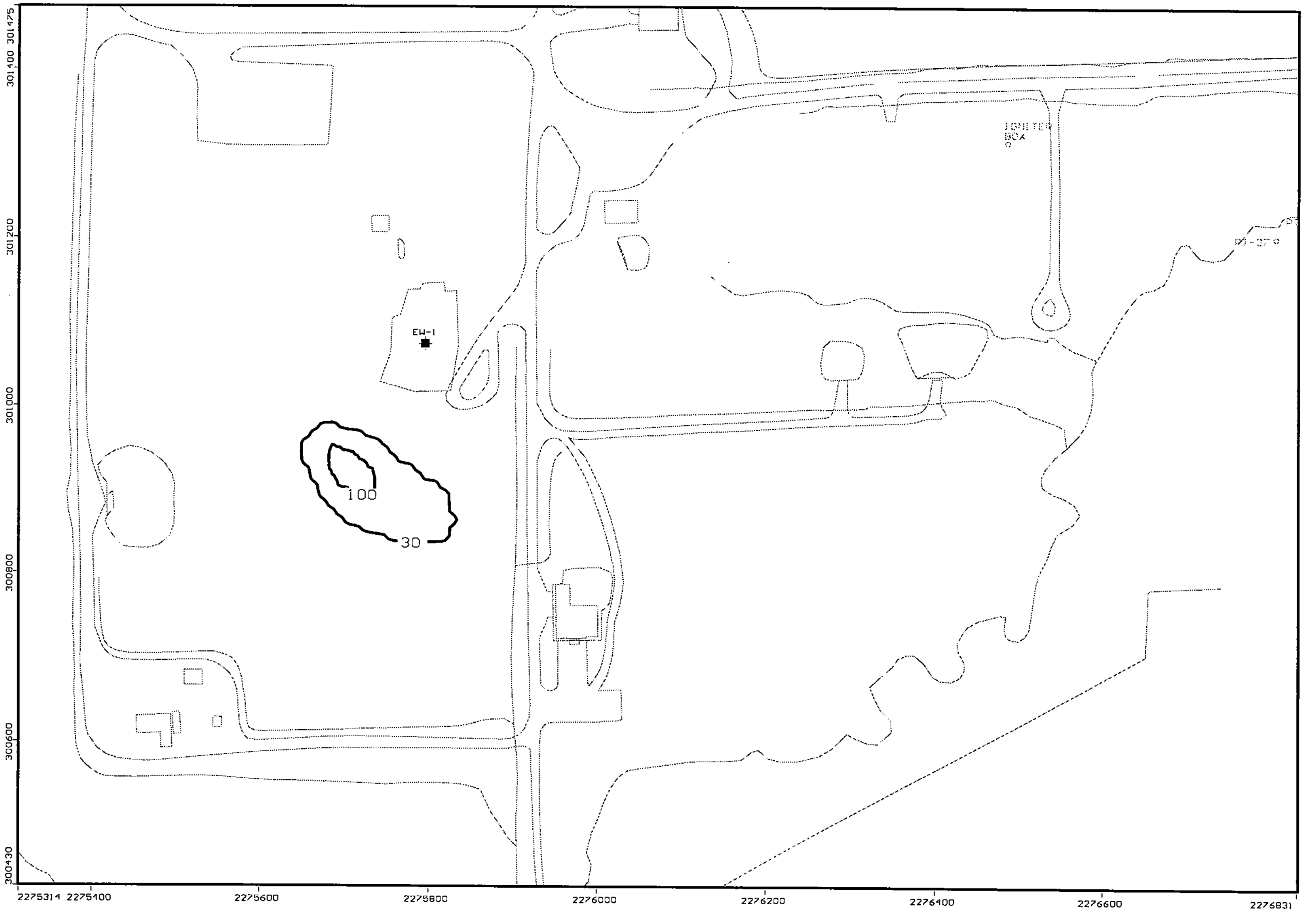


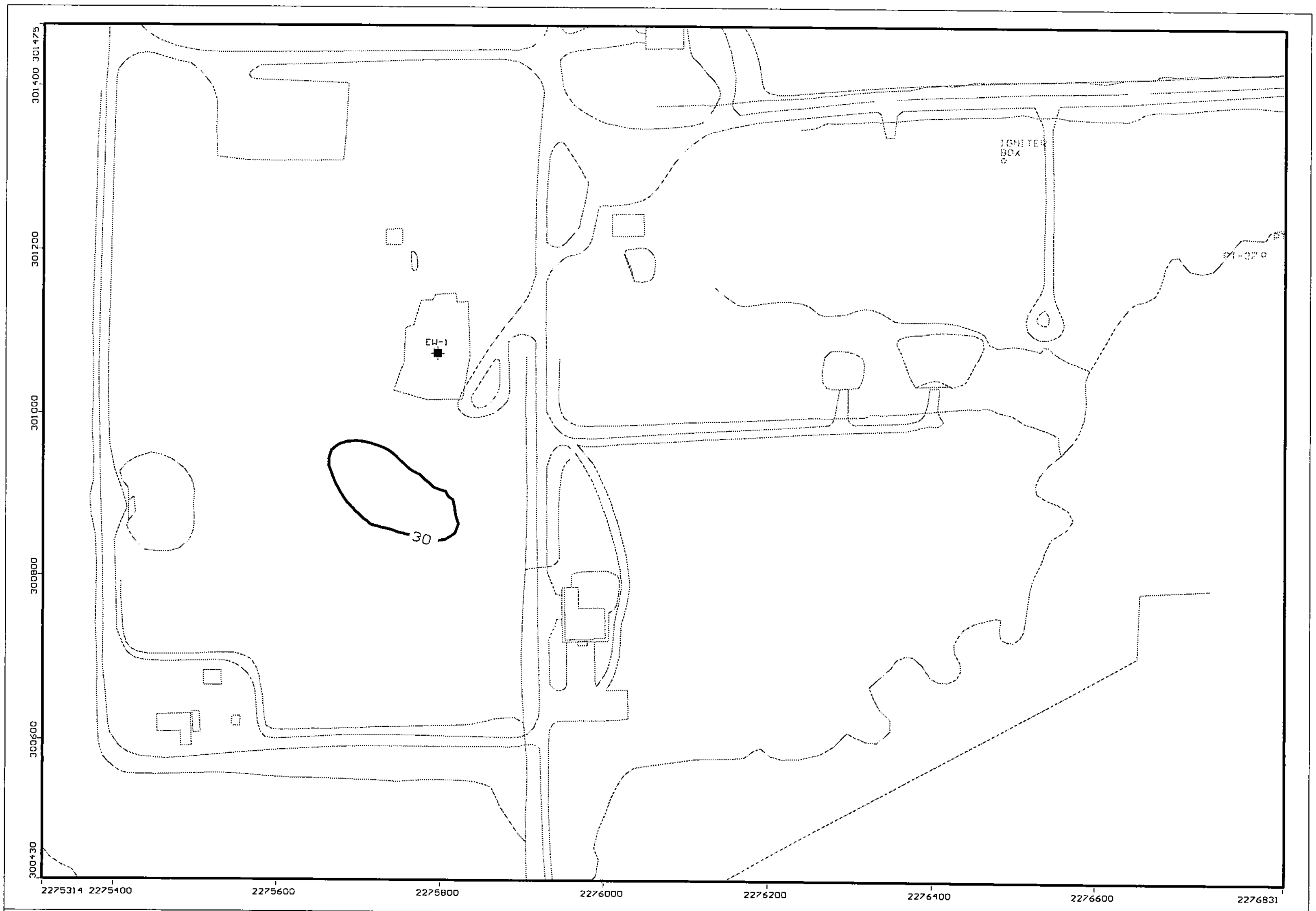
URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 3 – TCE
Modeller: JJS/ANB 1 d
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 3 – TCE
Modeller: JJS/ANB 1 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 3 – TCE
Modeller: JJS/ANB 5 yr
10 Mar 04

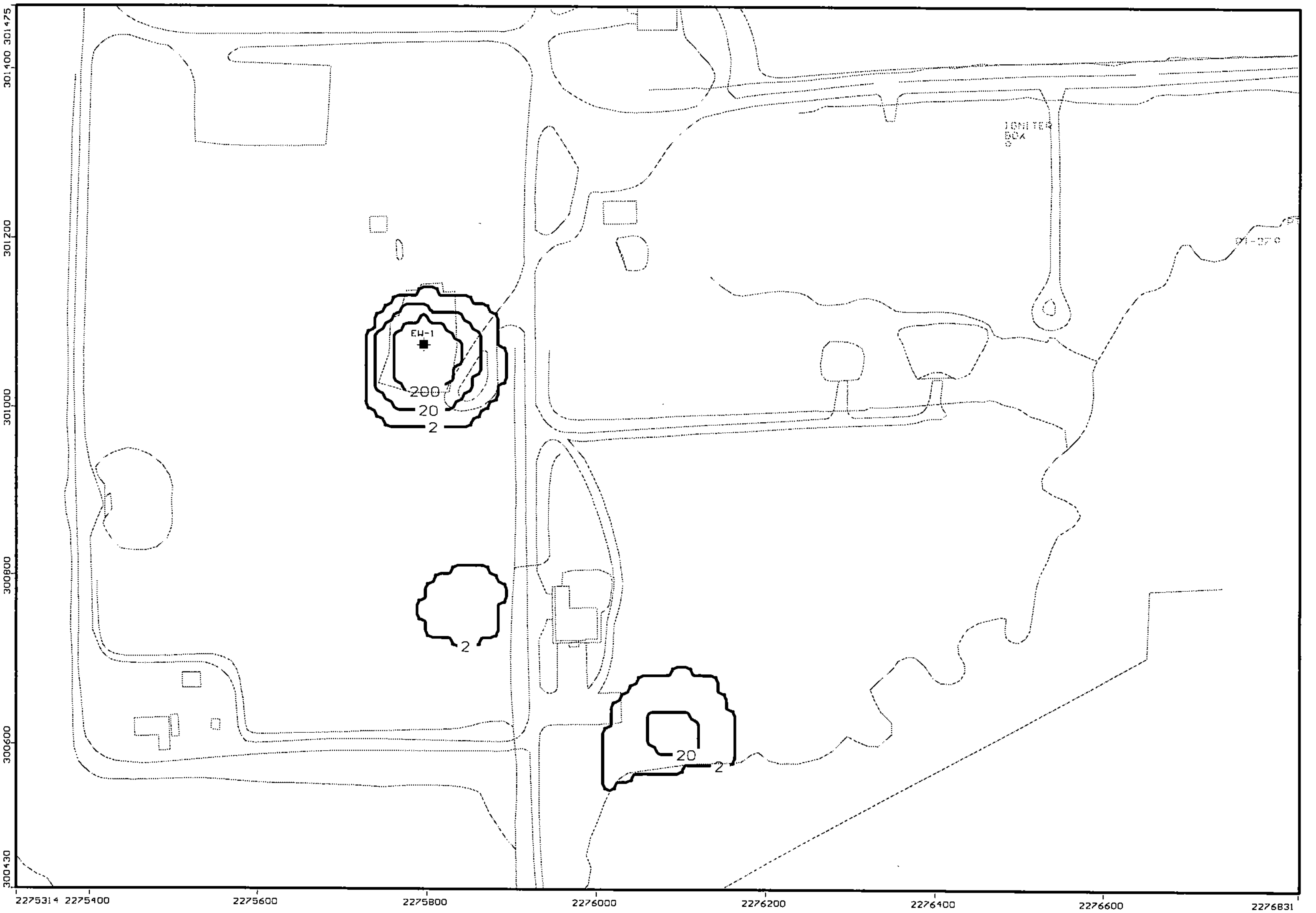
Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 3 – TCE
Modeller: JJS/ANB 9 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

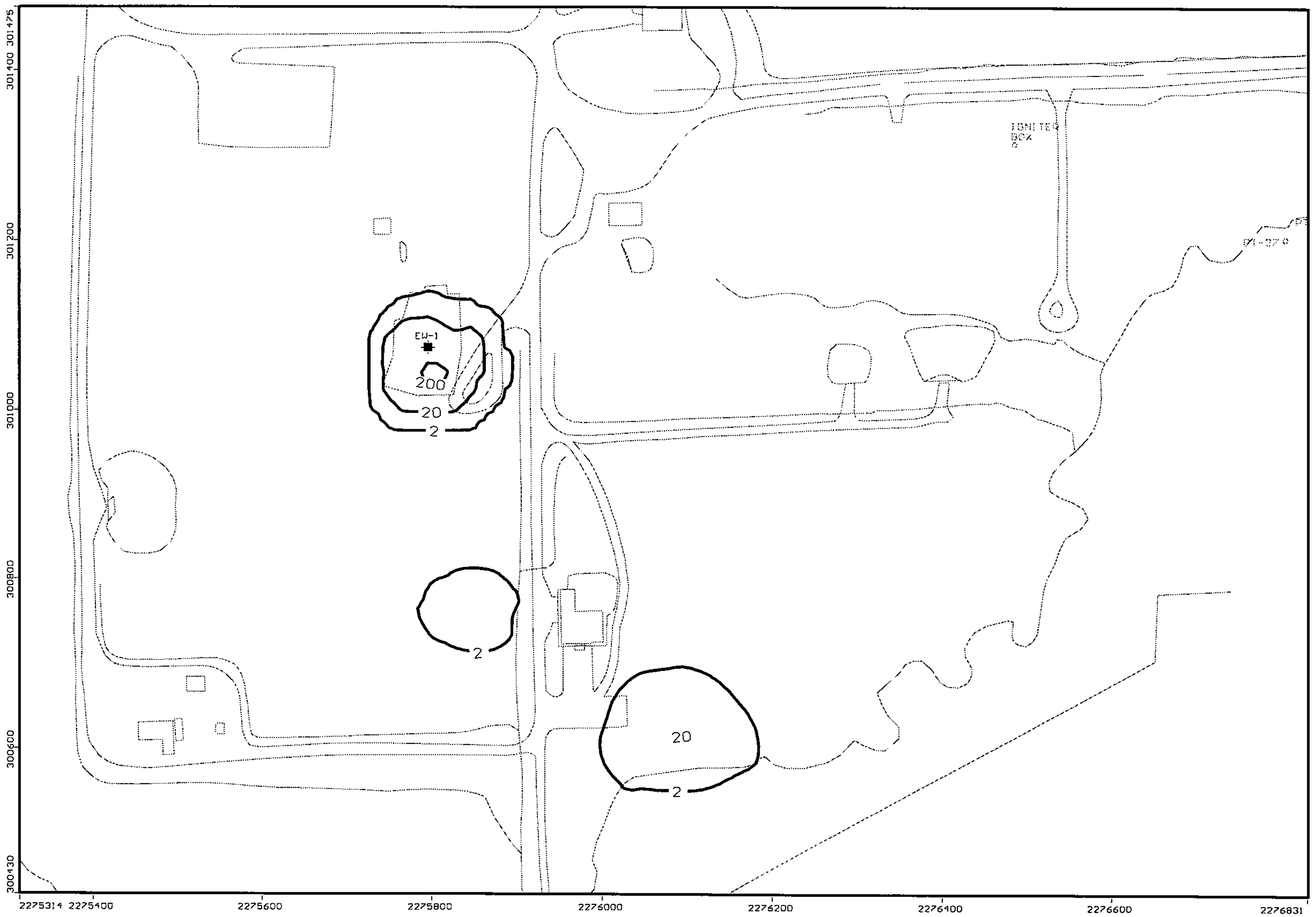
URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 3 – TCE
Modeller: JJS/ANB 10 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 3 – VC
Modeller: JJS/ANB 1 d
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 3 – VC
Modeller: JJS/ANB 1 yr
10 Mar 04

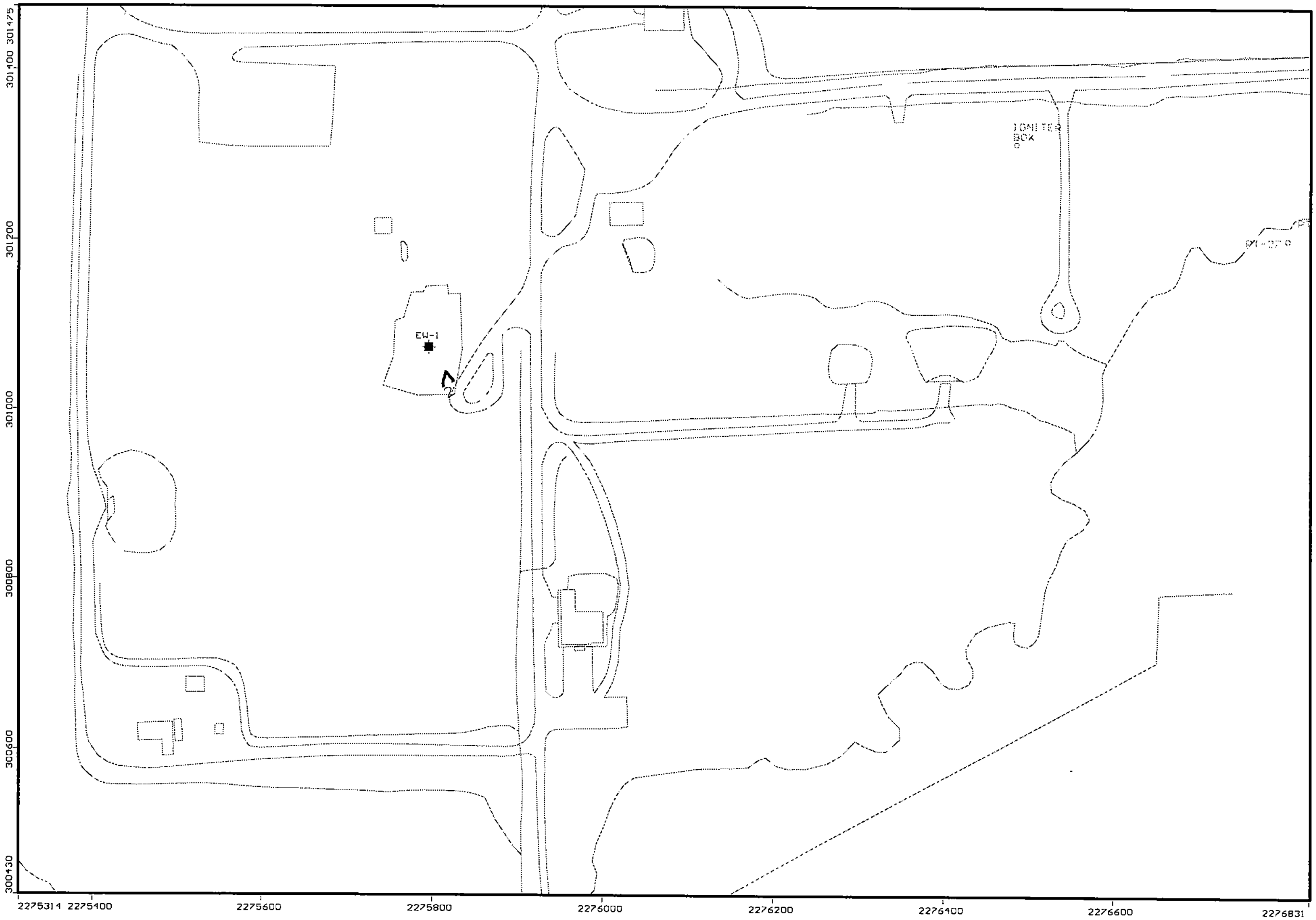
Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 3 – VC
Modeller: JJS/ANB 5 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 3 – VC
Modeller: JJS/ANB 10 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 3 – VC
Modeller: JJS/ANB 15 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

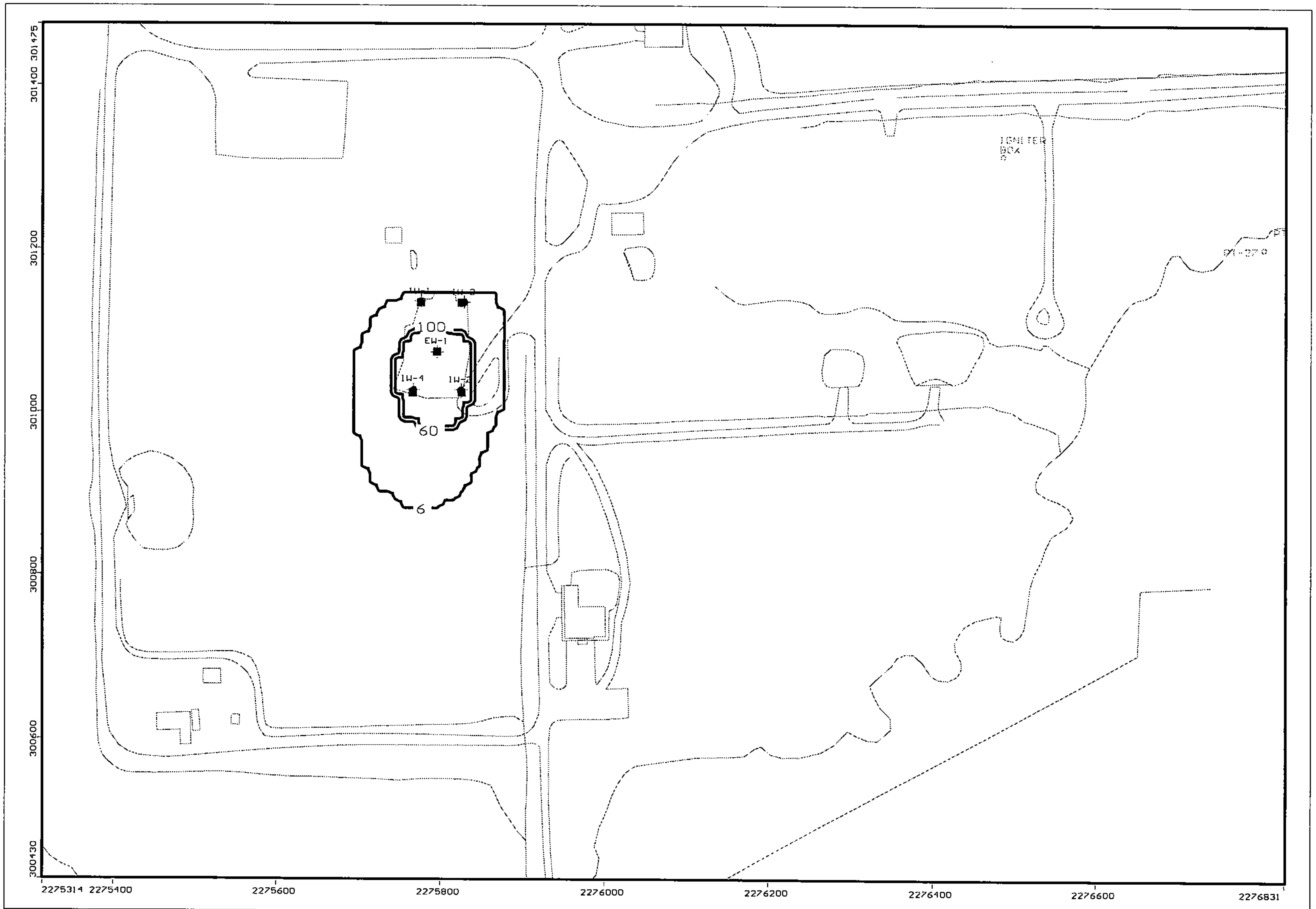
URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 3 – VC
Modeller: JJS/ANB 16 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

ATTACHMENT K-5

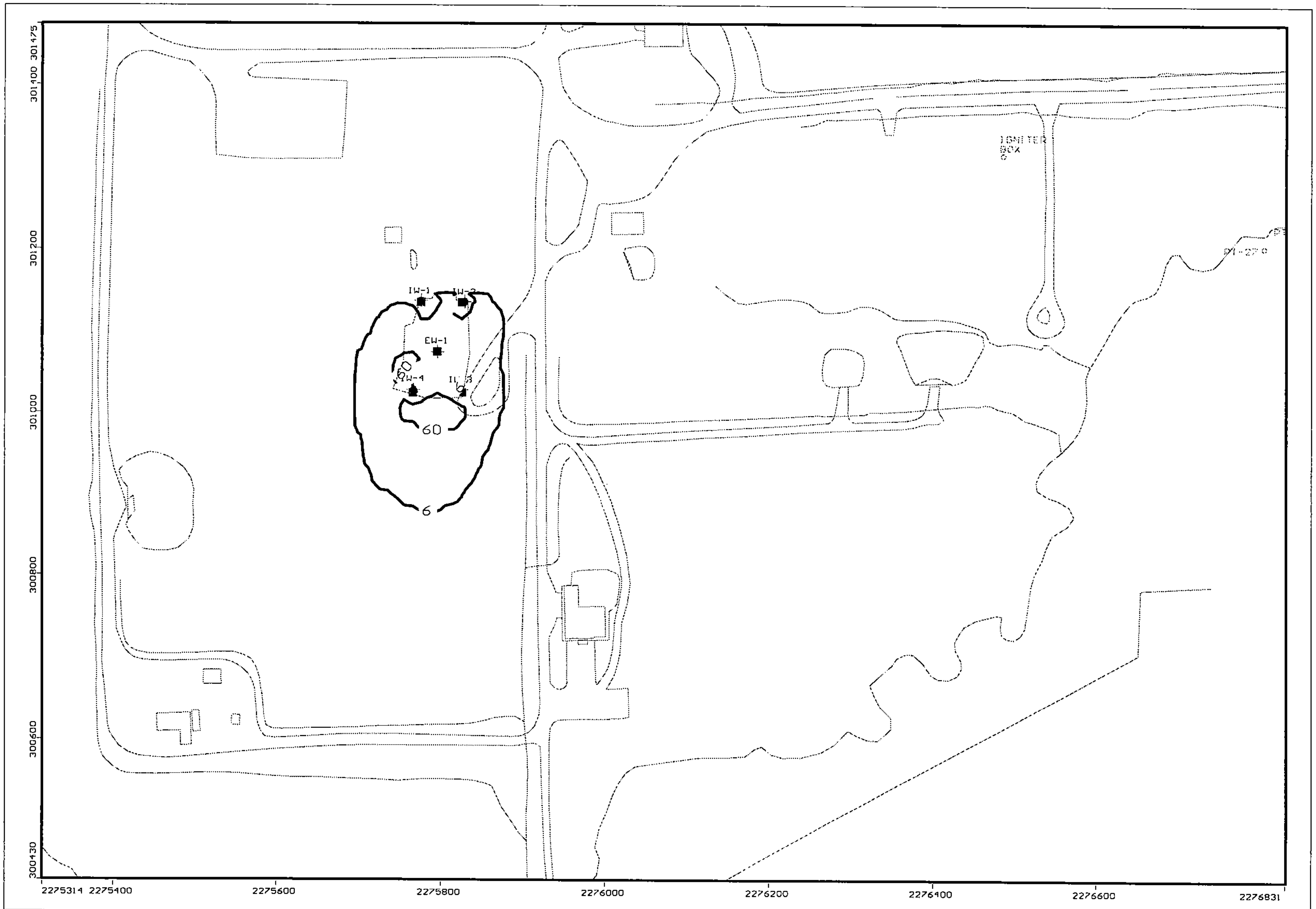
Contaminant Fate and Transport Modeling Results

Alternative 4 – ISCO/MNA



URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 4 – Benzene
Modeller: JJS/ANB 1 d
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 4 – Benzene
Modeller: JJS/ANB 1 yr
10 Mar 04

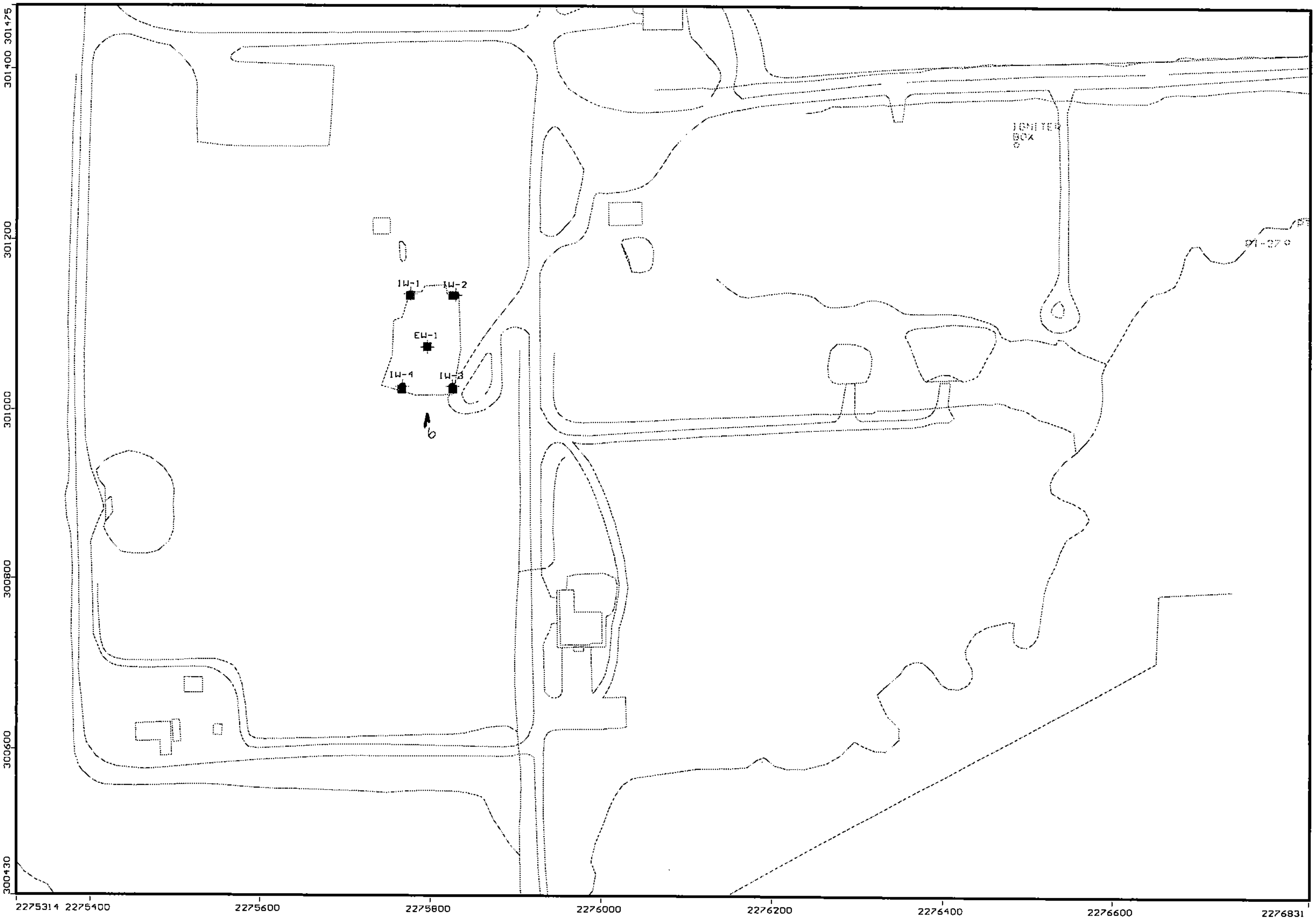
Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 4 – Benzene
Modeller: JJS/ANB 5 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

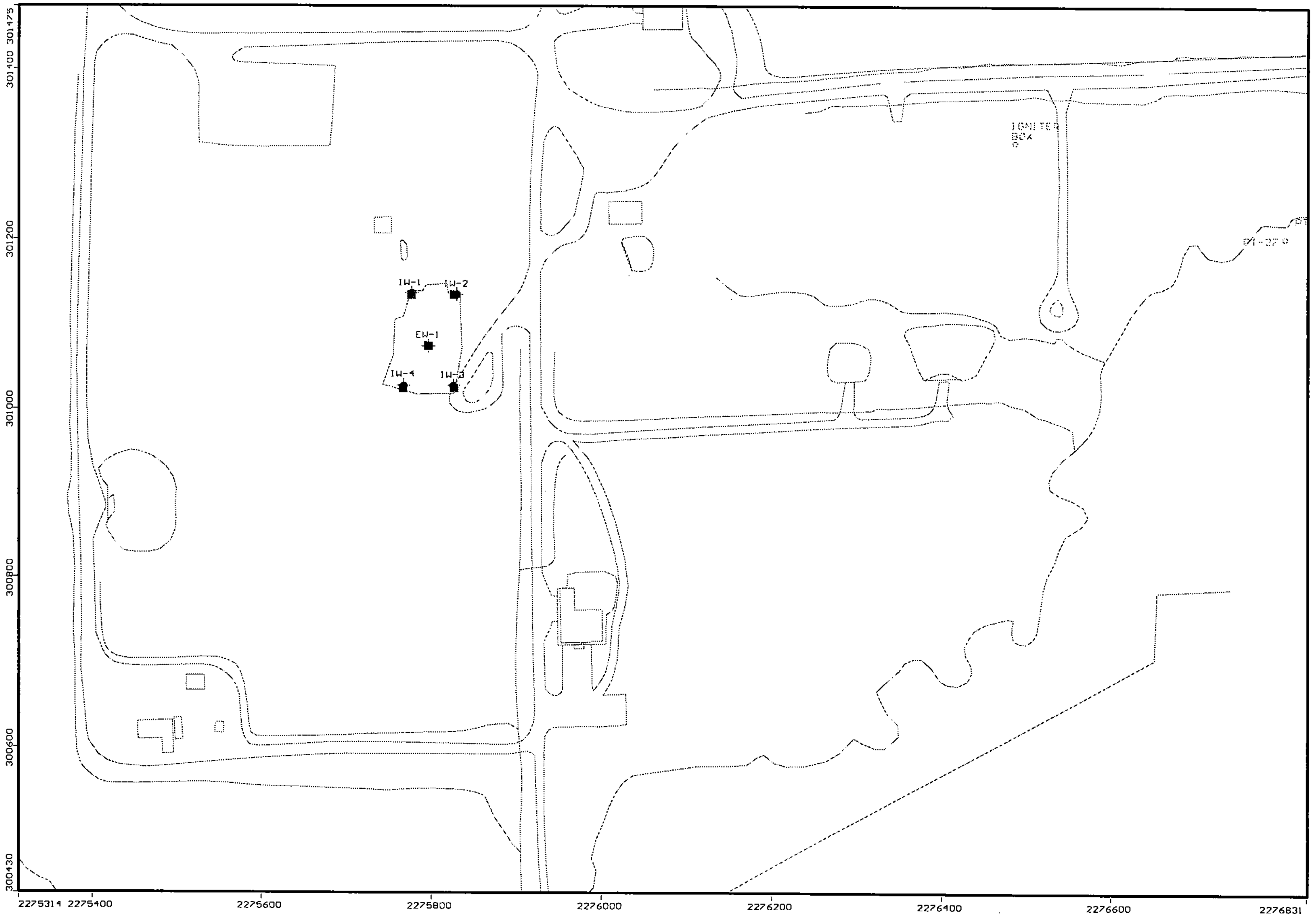
URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 4 – Benzene
Modeller: JJS/ANB 10 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



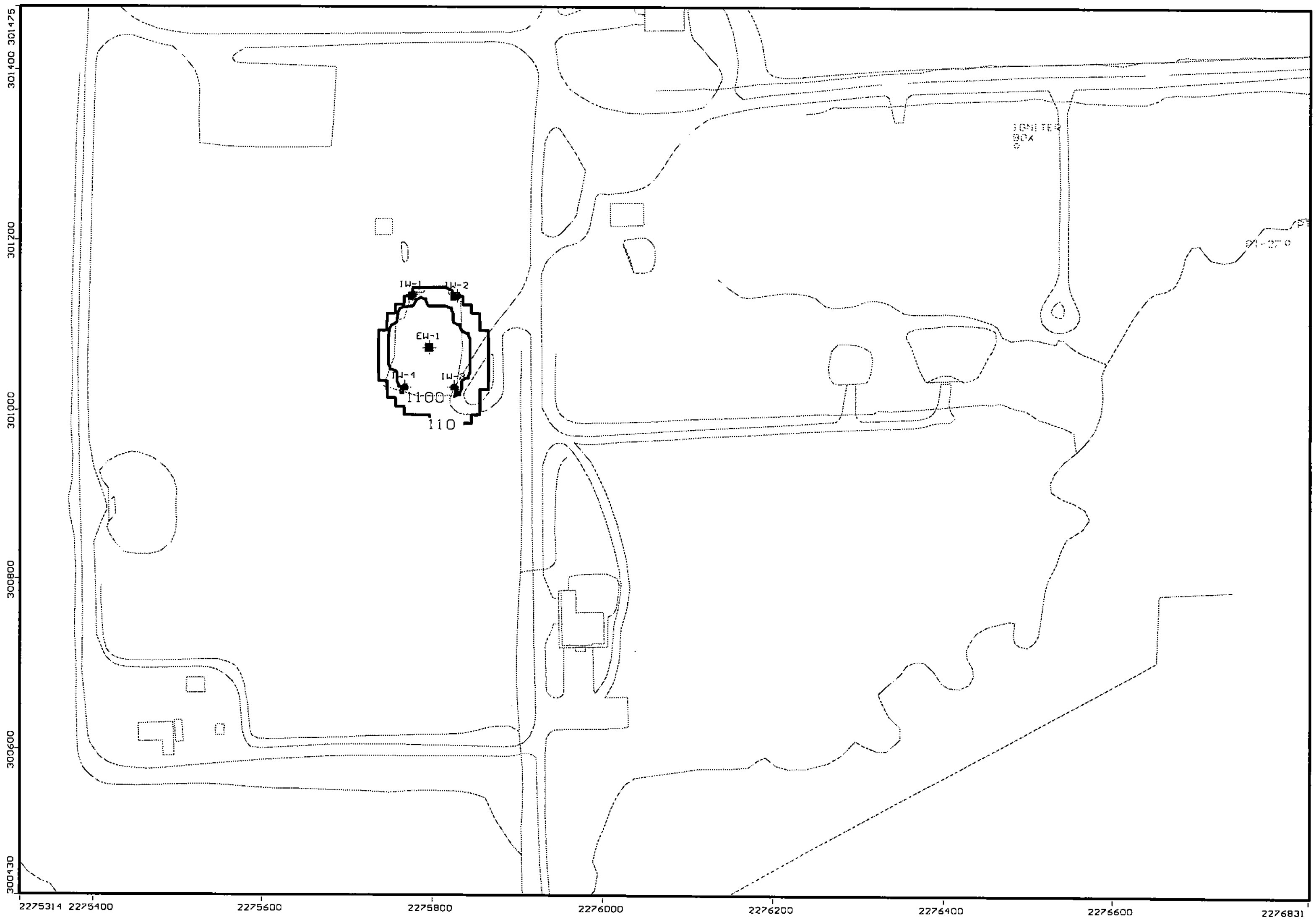
URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 4 – Benzene
Modeller: JJS/ANB 14 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



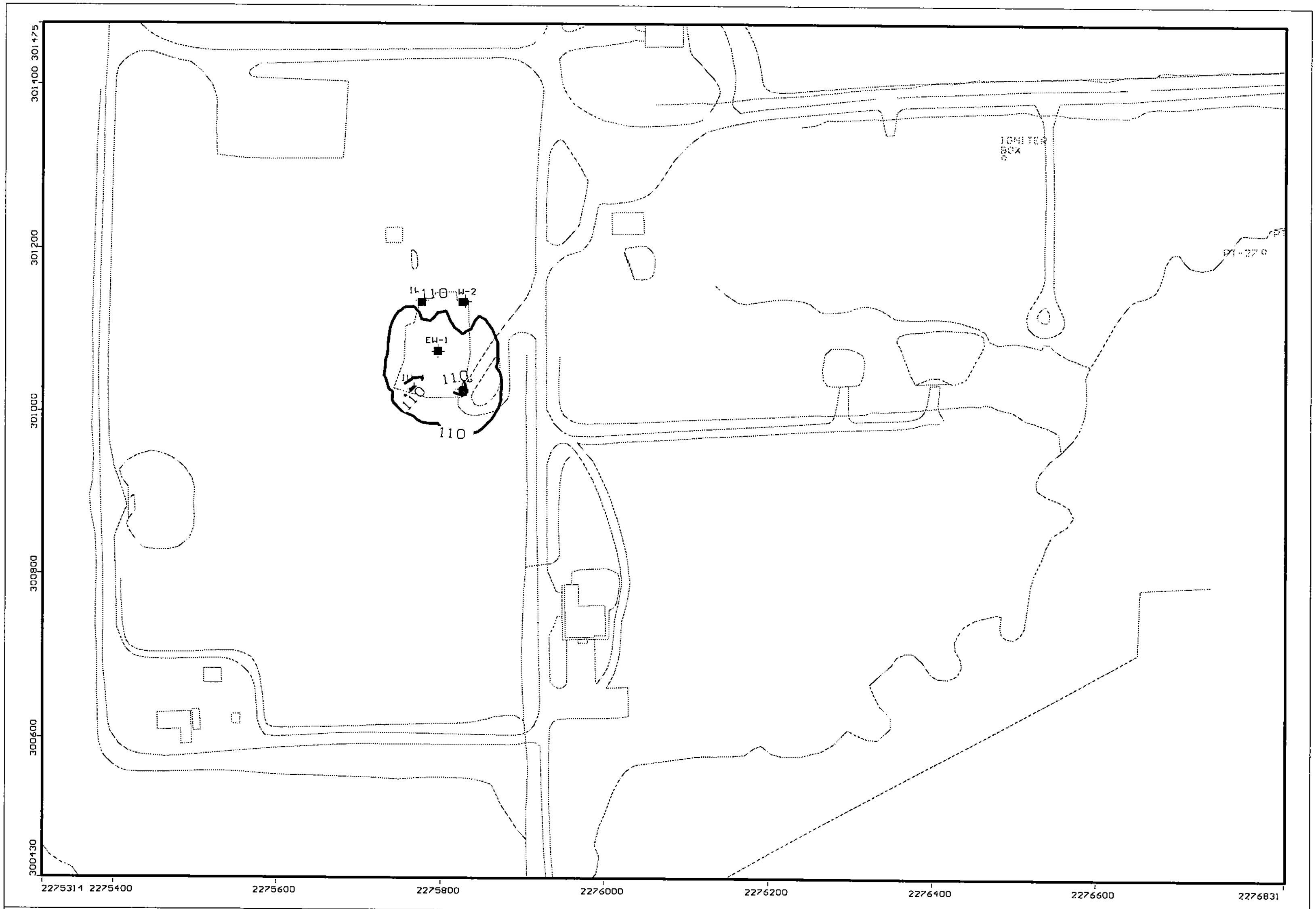
URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 4 – Benzene
Modeller: JJS/ANB 15 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



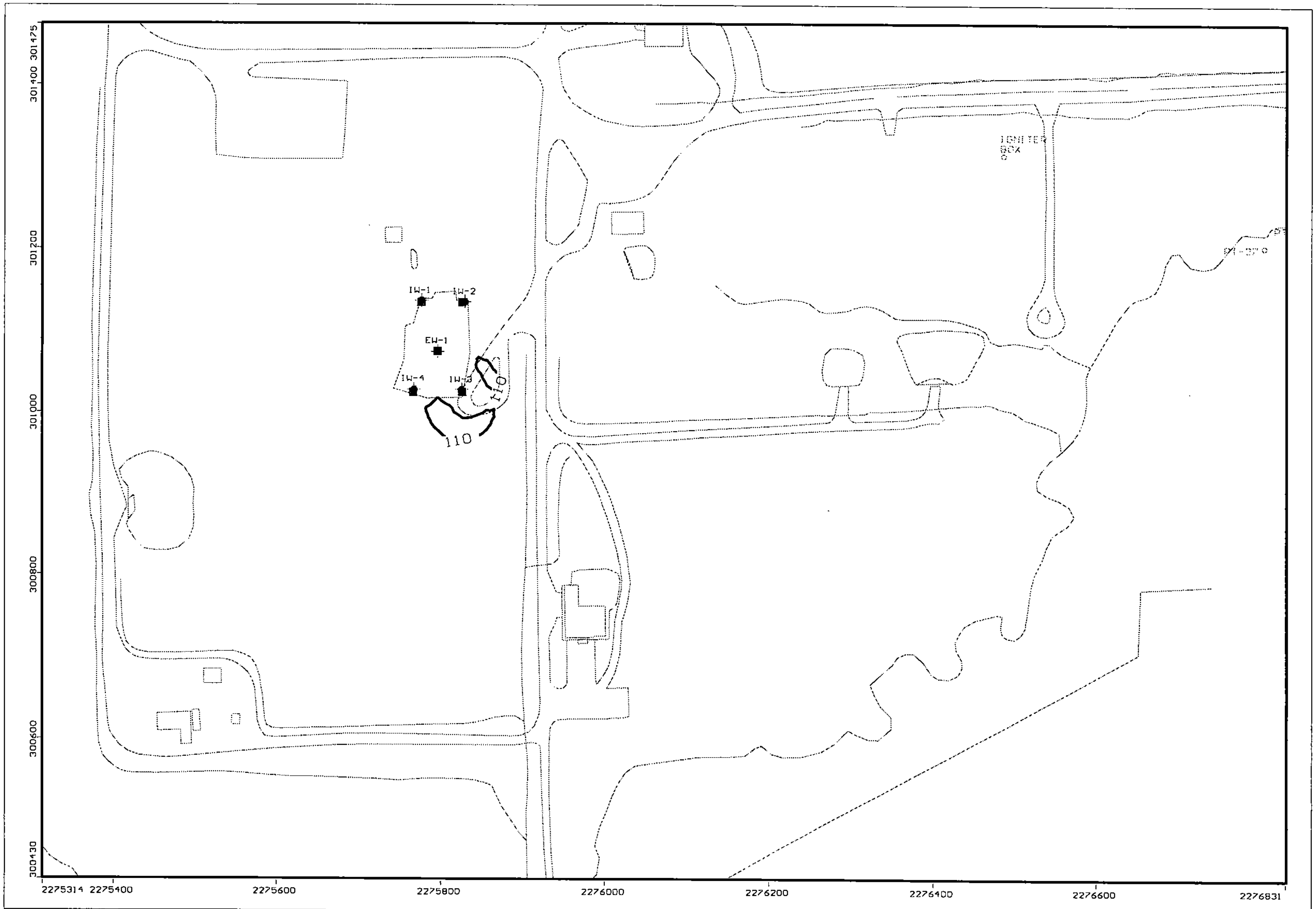
URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative4–Chloroethane
Modeller: JJS/ANB 1 d
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative4–Chloroethane
Modeller: JJS/ANB 1 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

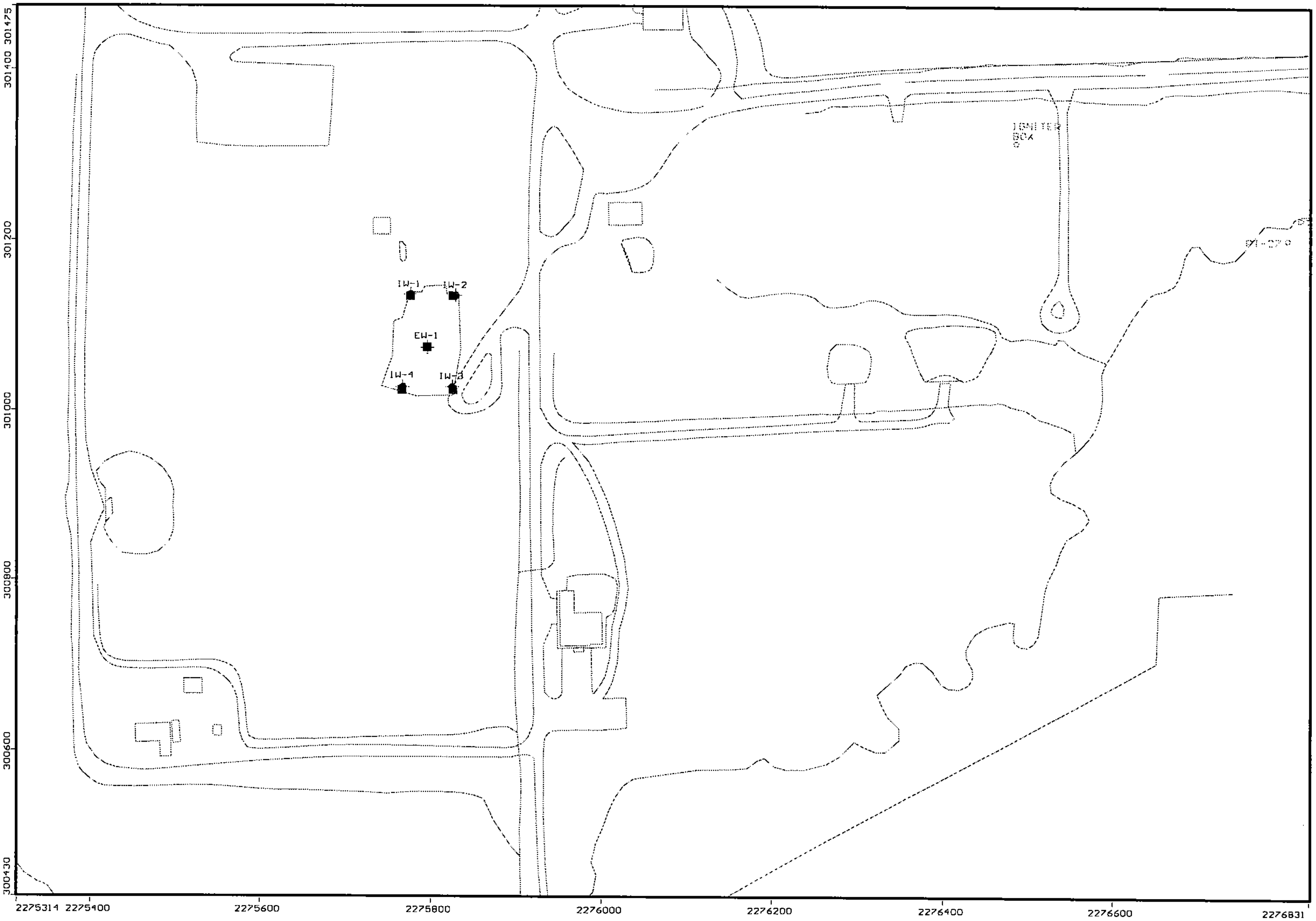


URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative4—Chloroethane
Modeller: JJS/ANB 5 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

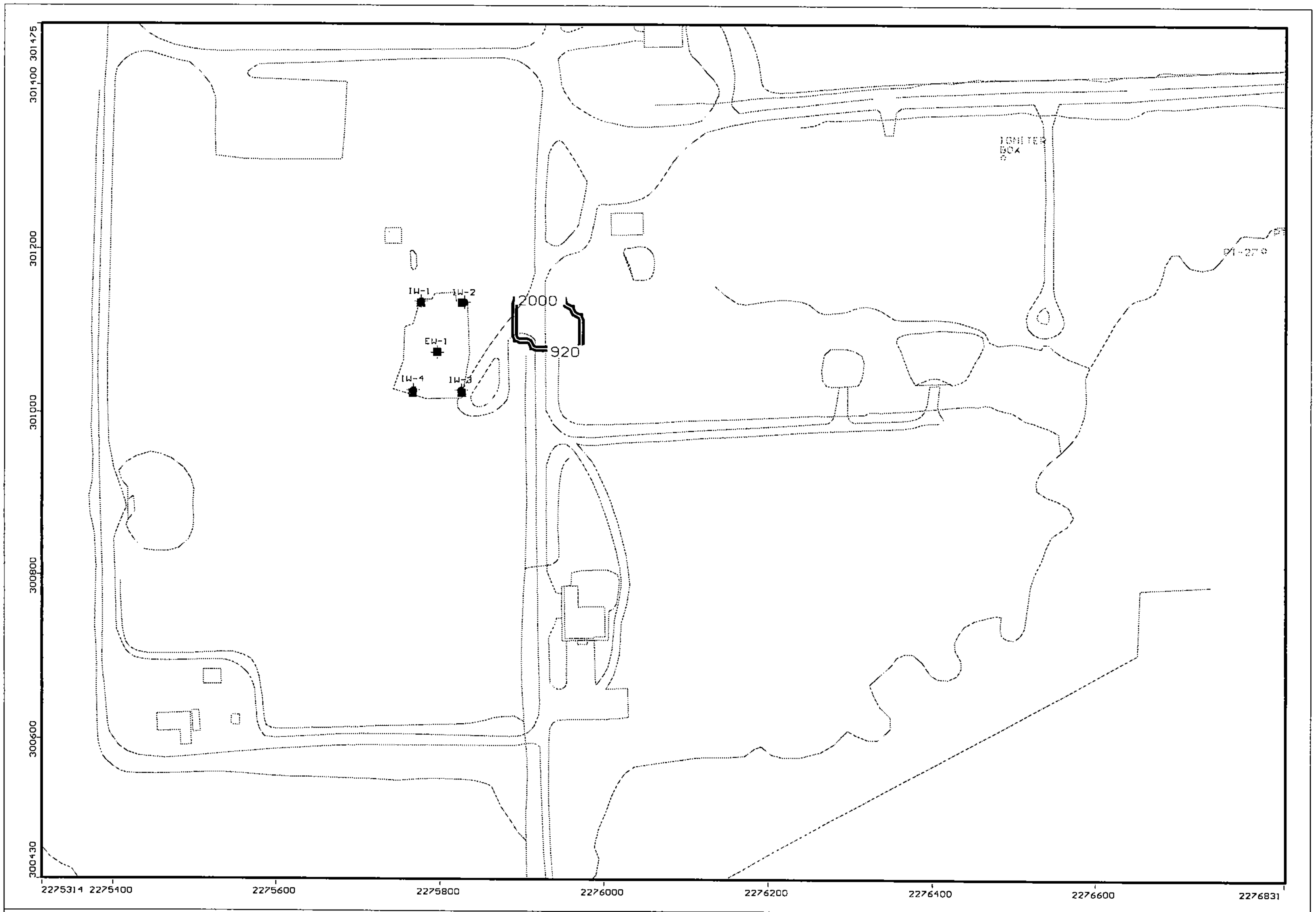
URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative4—Chloroethane
Modeller: JJS/ANB 8 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



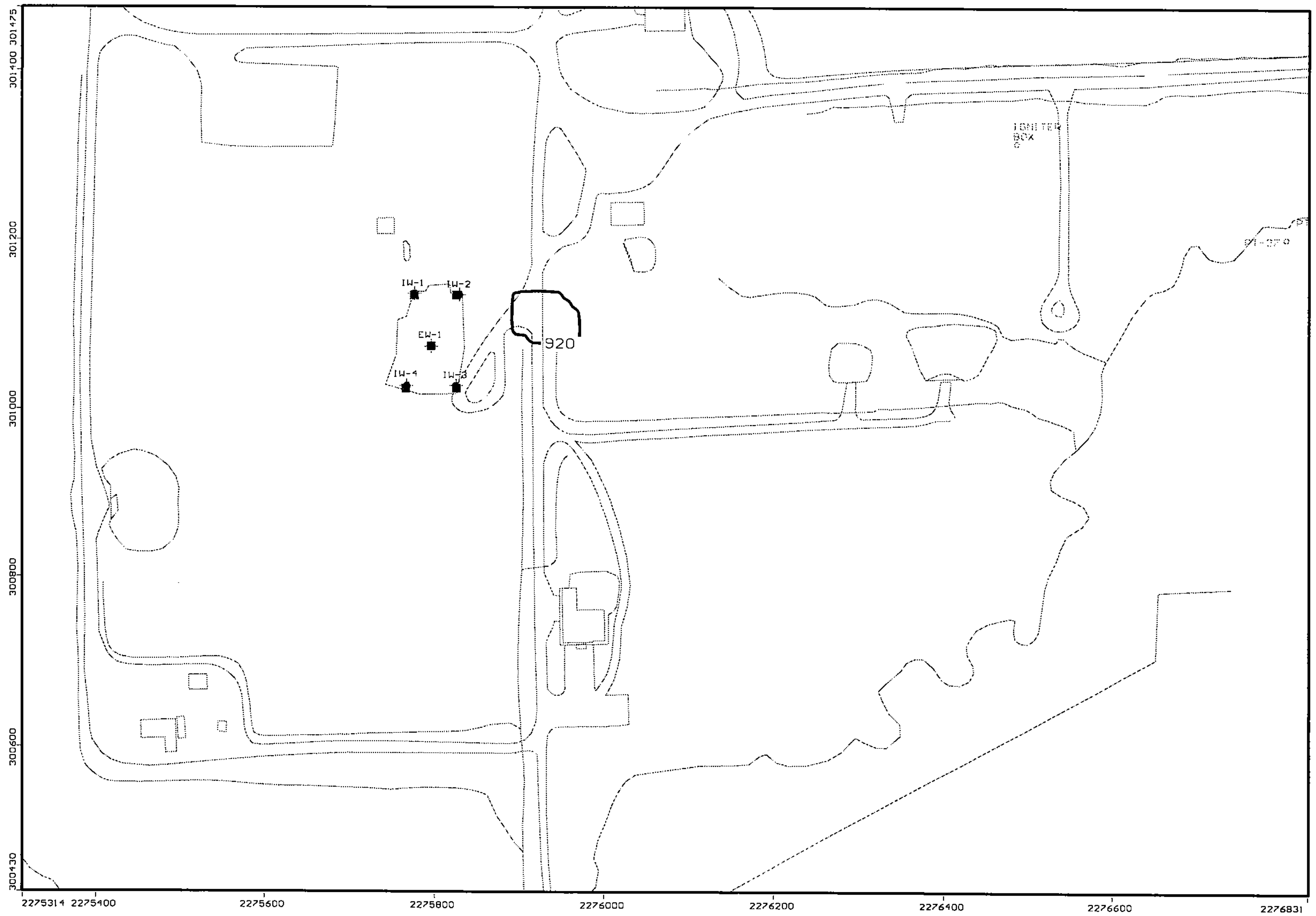
URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative4–Chloroethane
Modeller: JJS/ANB 9 yr
10 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



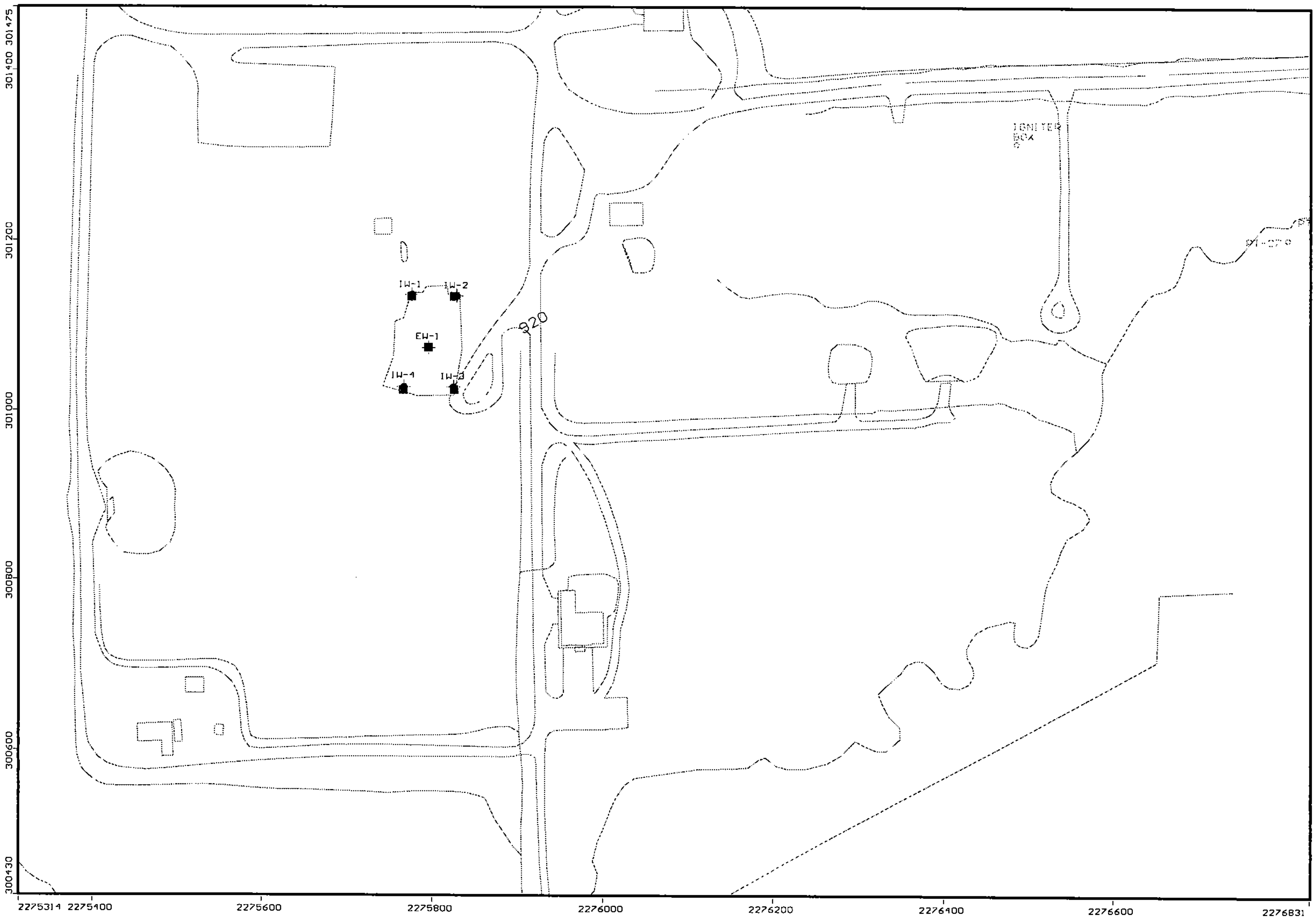
URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 5 – 1,1 DCE
Modeller: JJS/ANB 1 d
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



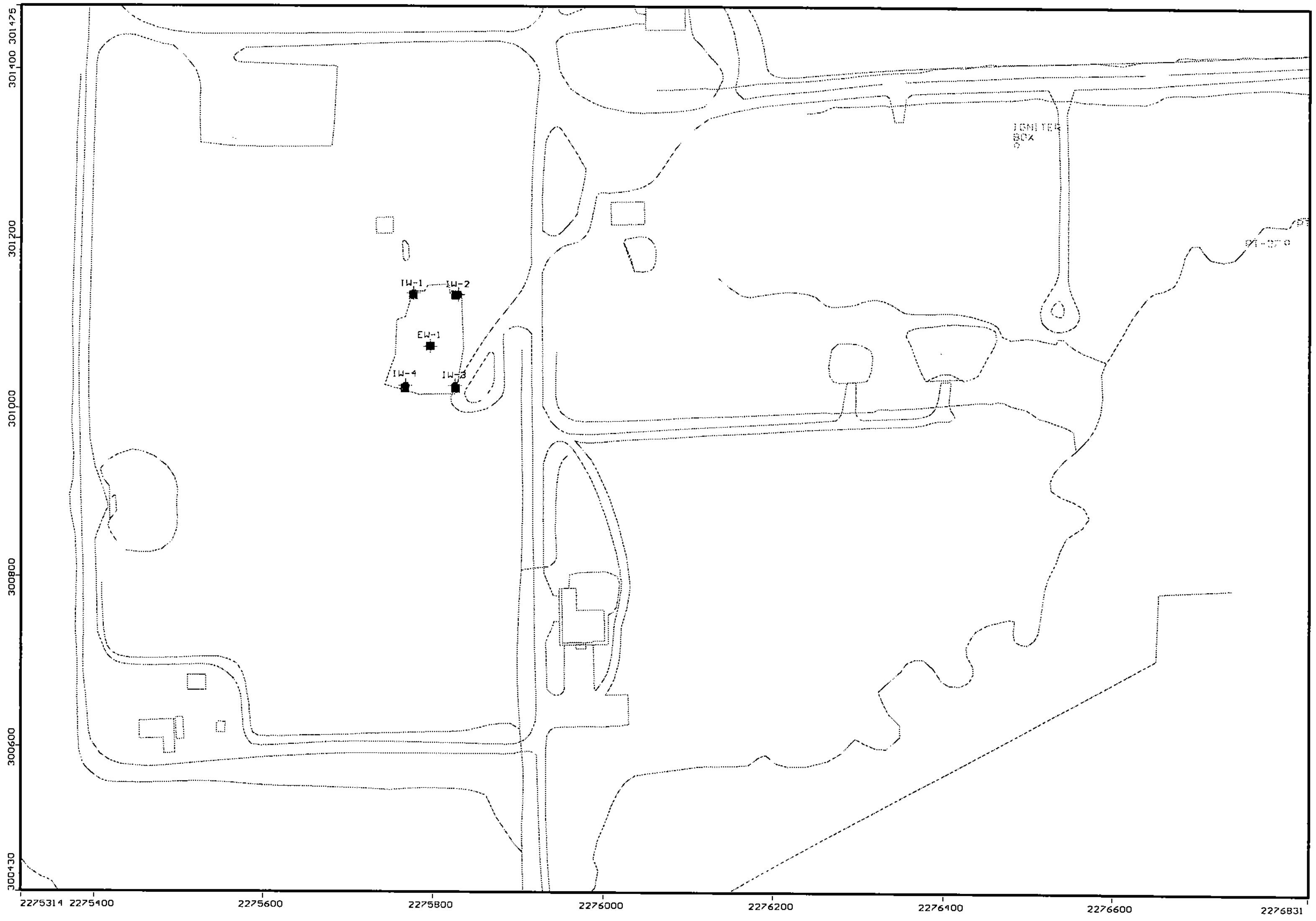
URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 5 – 1,1 DCE
Modeller: JJS/ANB 1 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



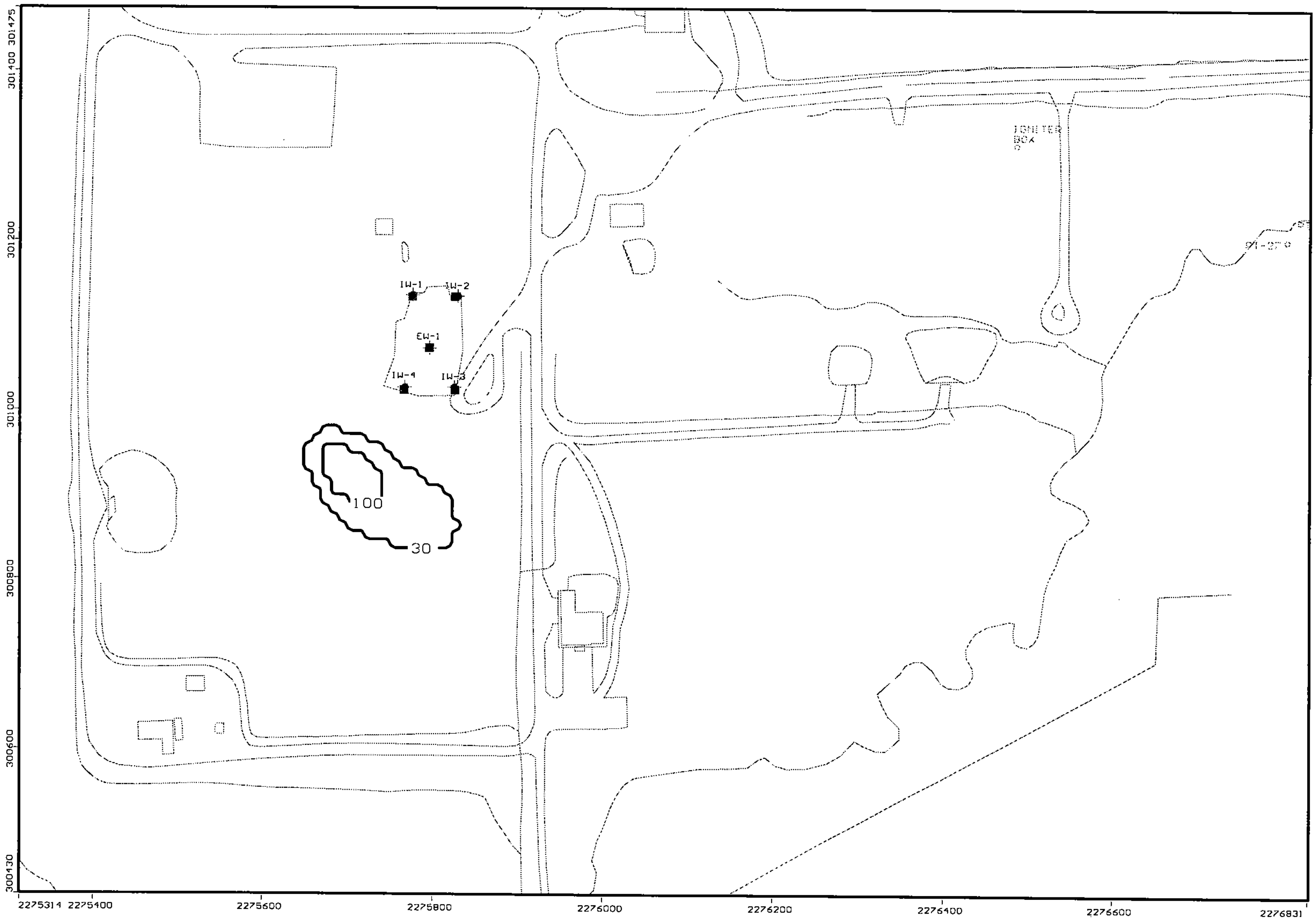
URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 5 – 1,1 DCE
Modeller: JJS/ANB 2 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



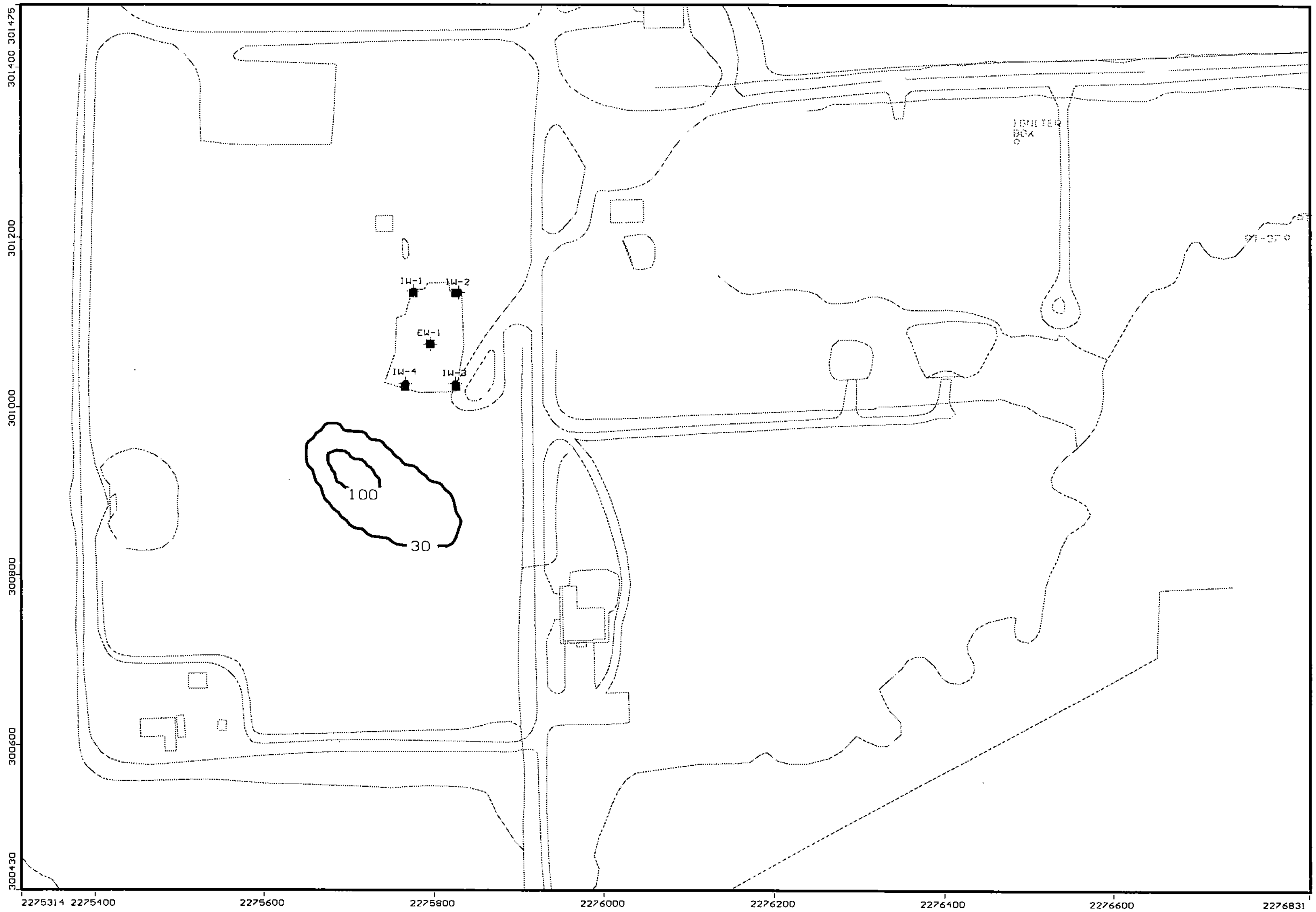
URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 5 – 1,1 DCE
Modeller: JJS/ANB 3 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



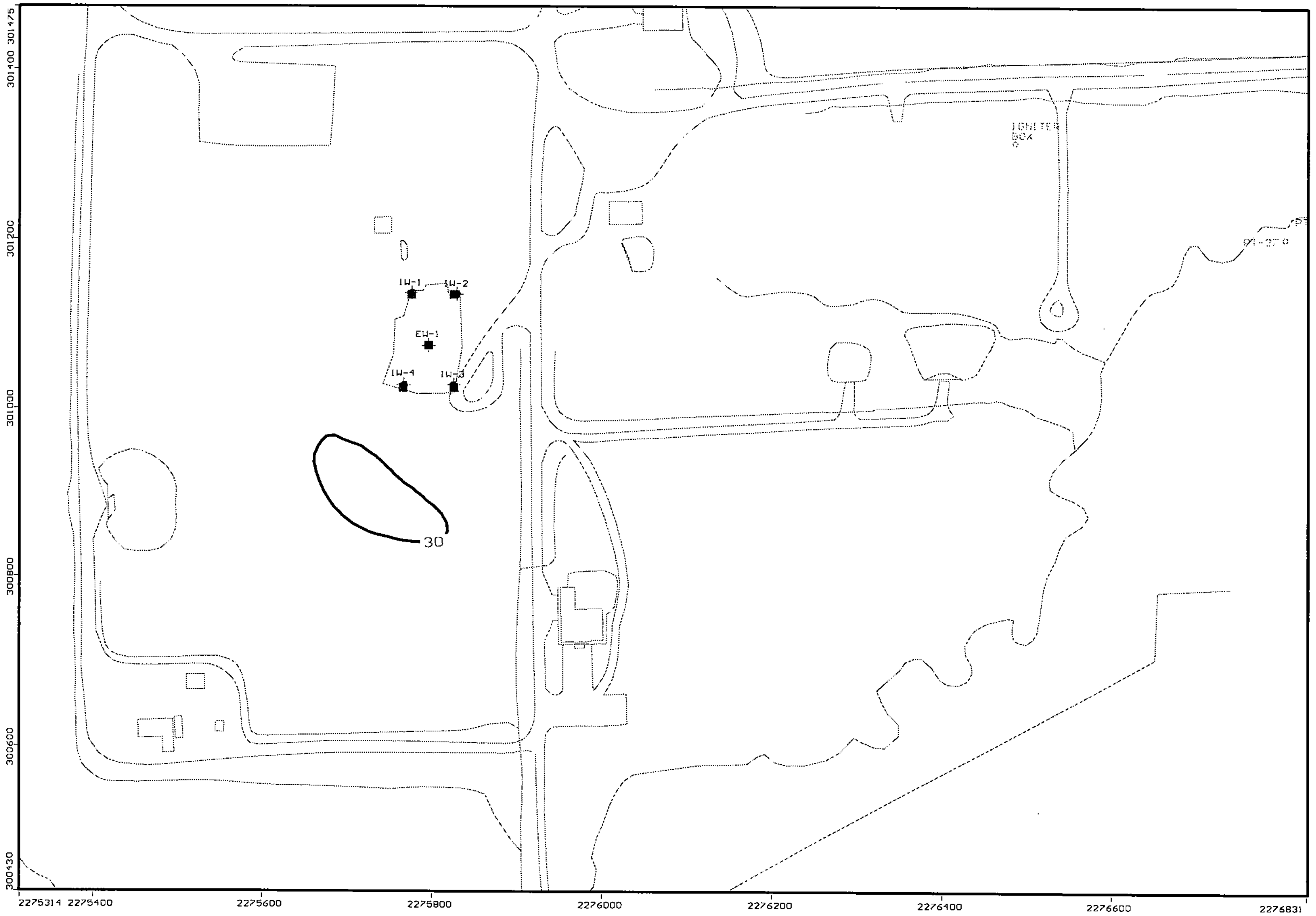
URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 4 – TCE
Modeller: JJS/ANB 1 d
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



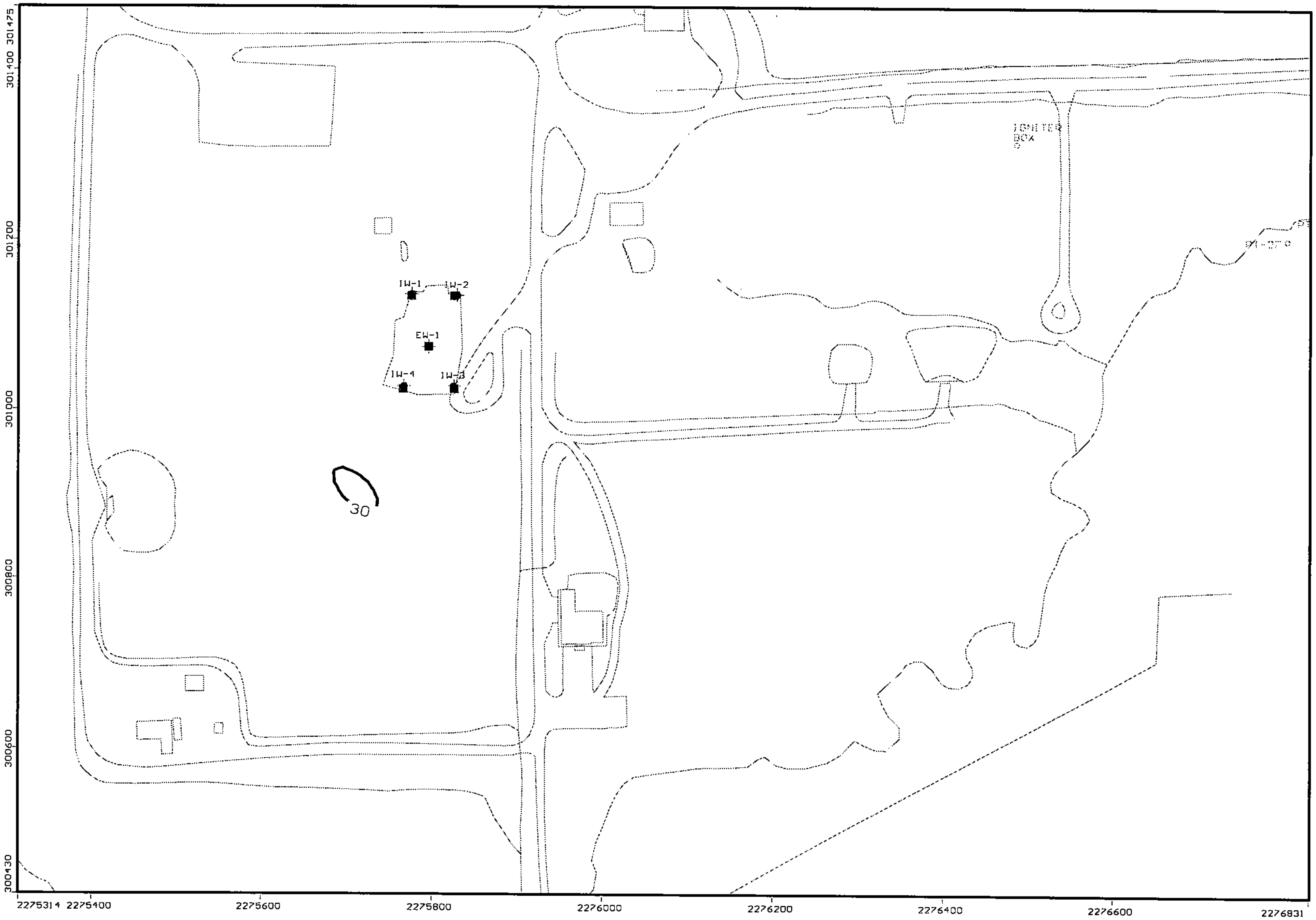
URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 4 – TCE
Modeller: JJS/ANB 1 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



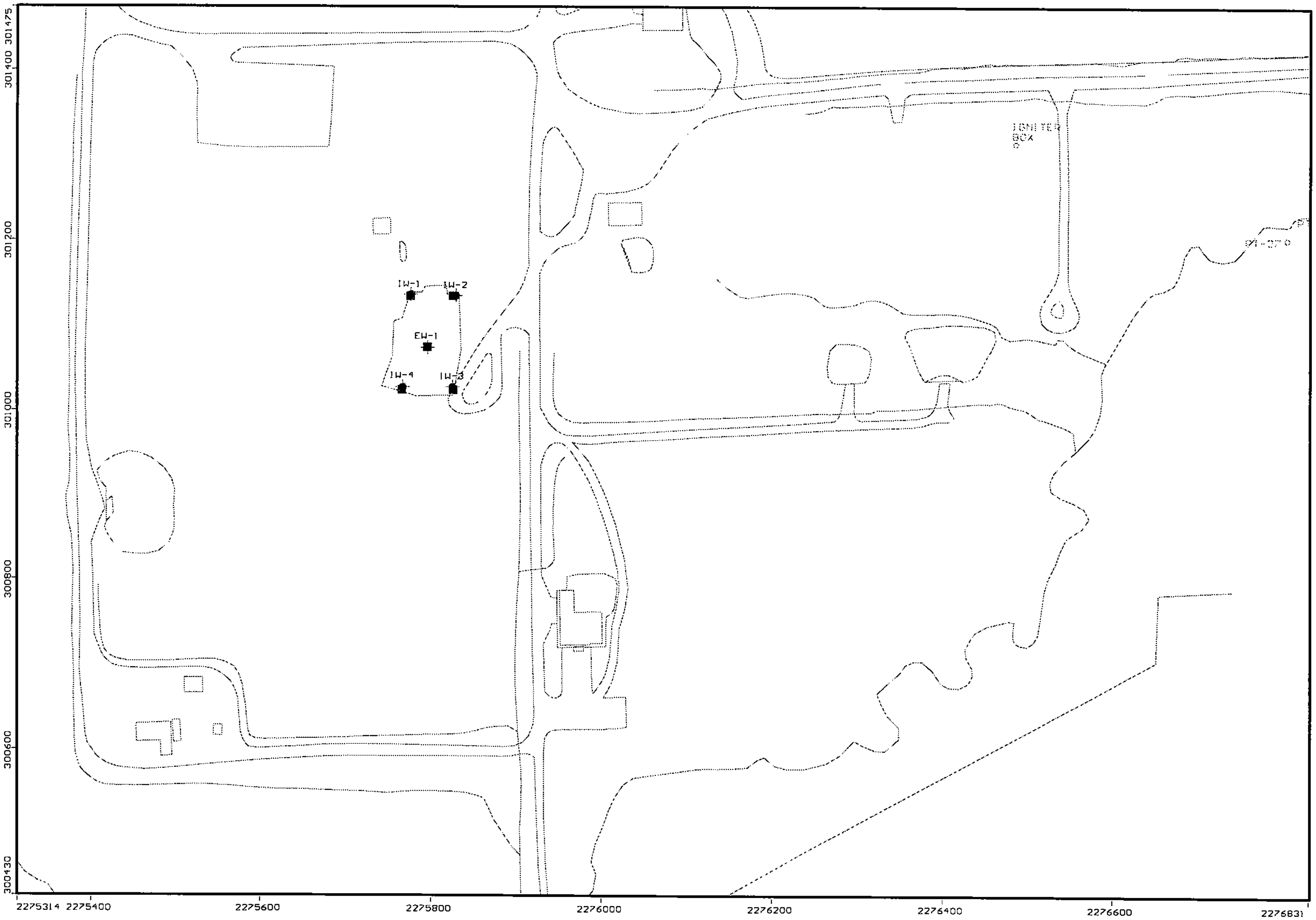
URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 4 – TCE
Modeller: JJS/ANB 5 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



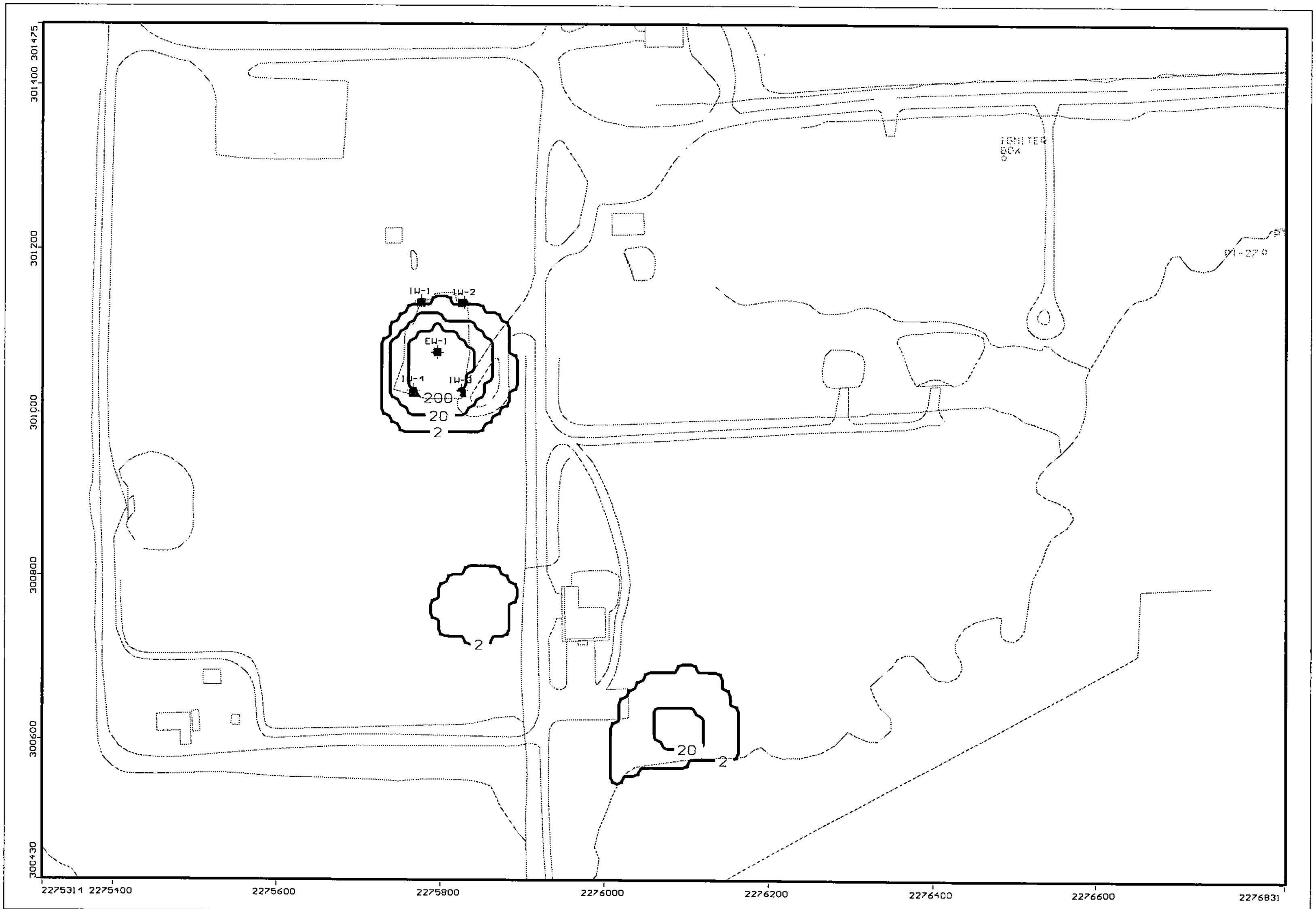
URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 4 – TCE
Modeller: JJS/ANB 9 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



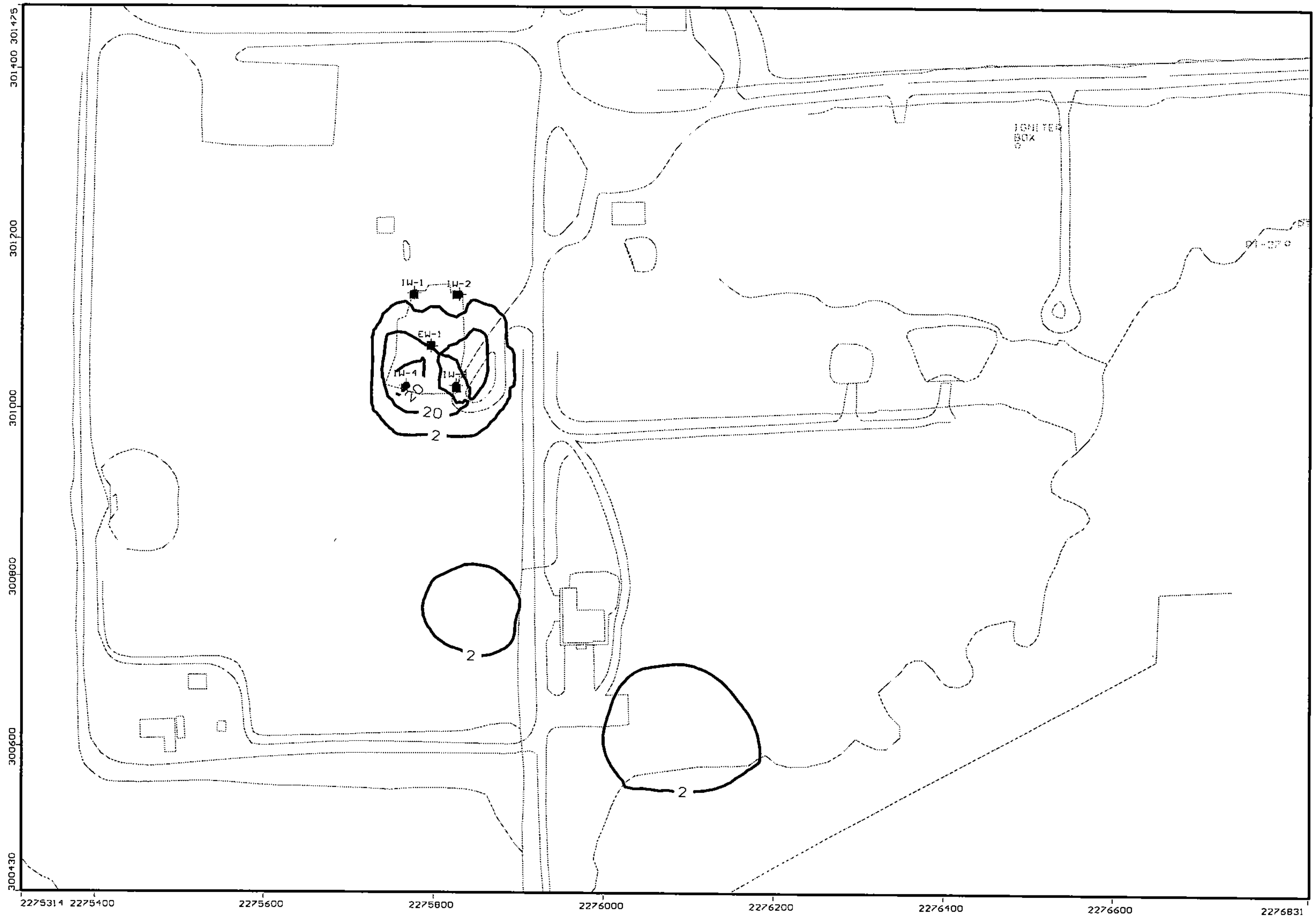
URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 4 – TCE
Modeller: JJS/ANB 10 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 4 – VC
Modeller: JJS/ANB 1 d
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 4 – VC
Modeller: JJS/ANB 1 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 4 – VC
Modeller: JJS/ANB 5 yr
11 Mar 04

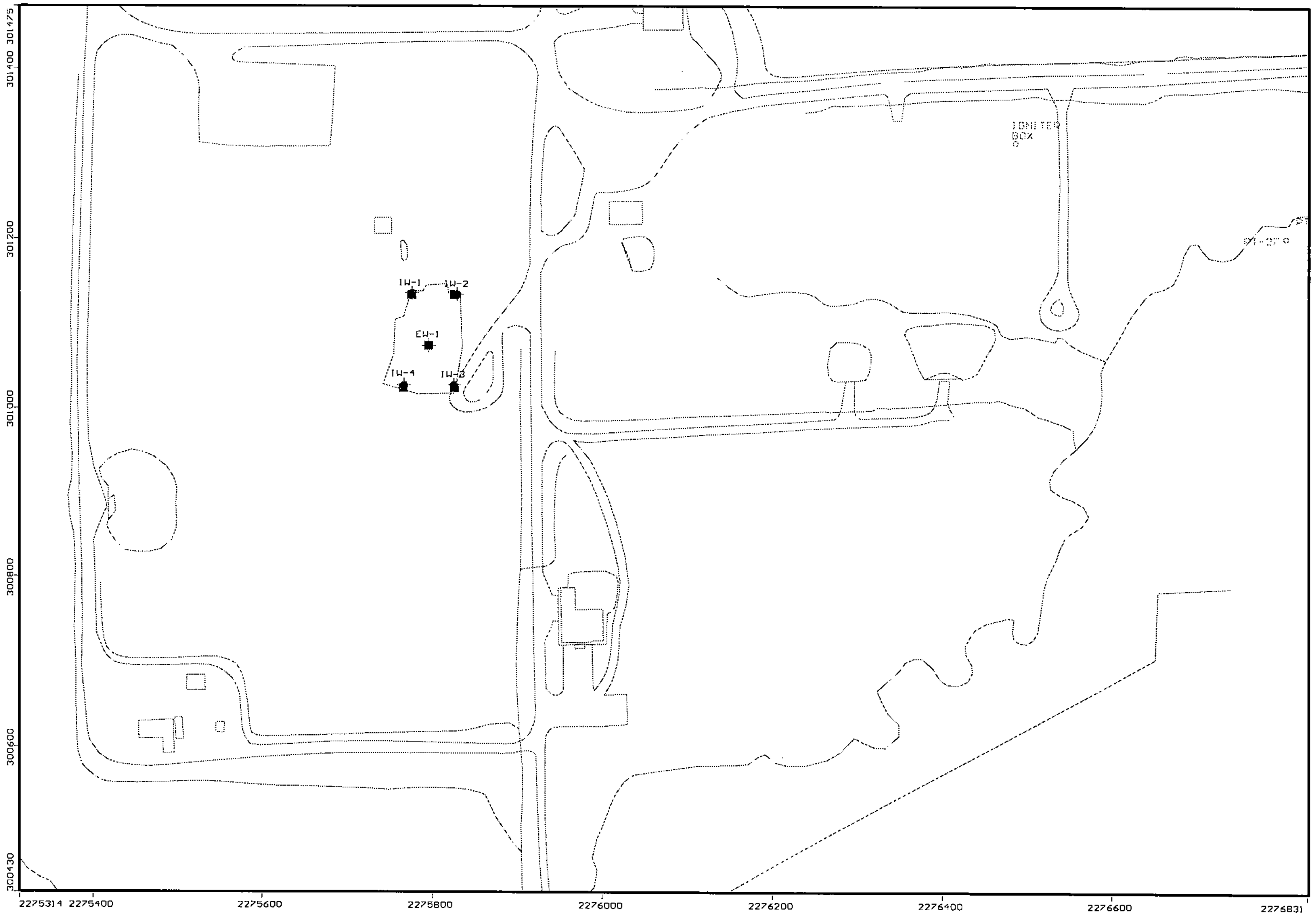
Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 4 – VC
Modeller: JJS/ANB 10 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 4 – VC
Modeller: JJS/ANB 18 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



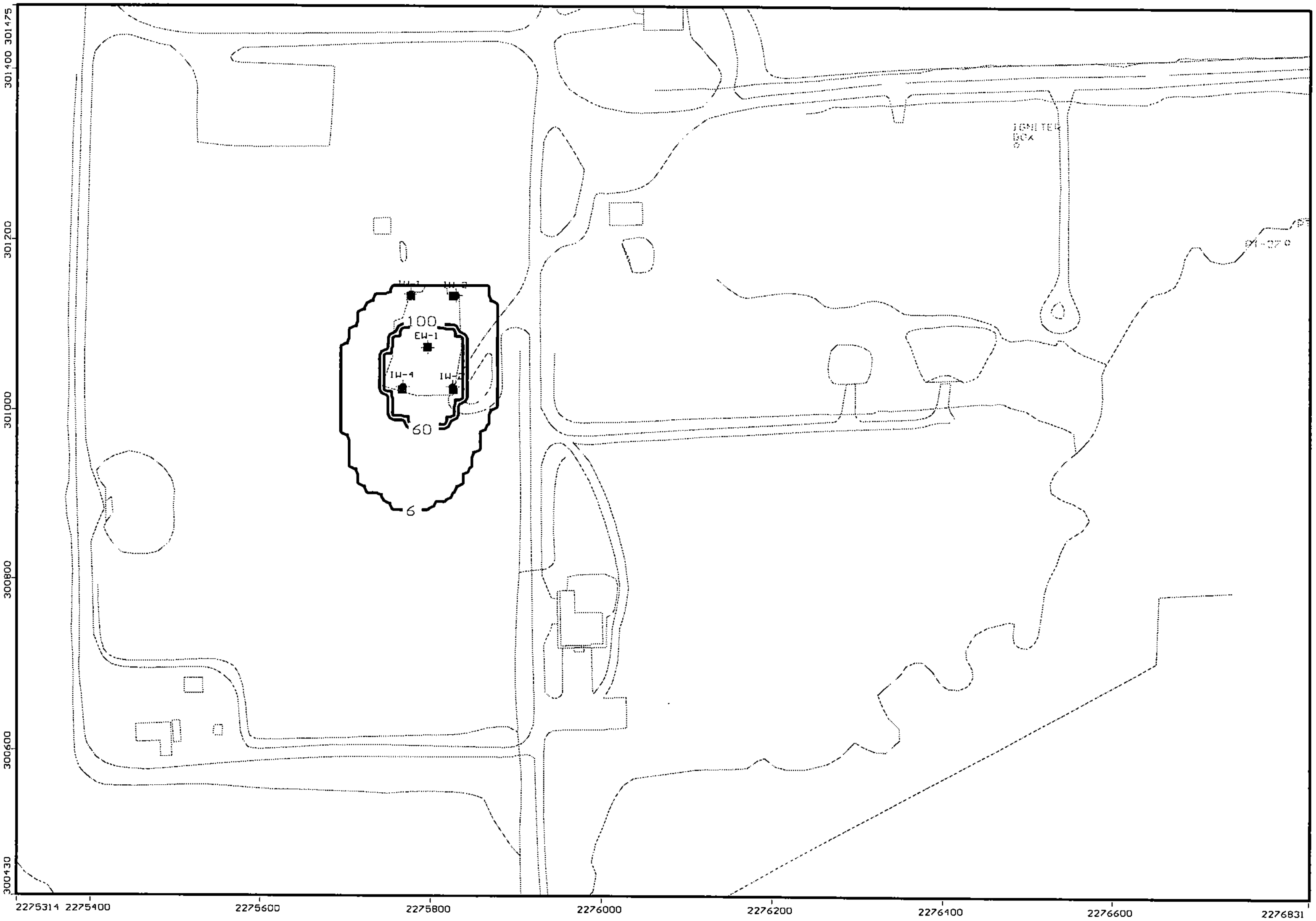
URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 4 — VC
Modeller: JJS/ANB 19 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

ATTACHMENT K-5

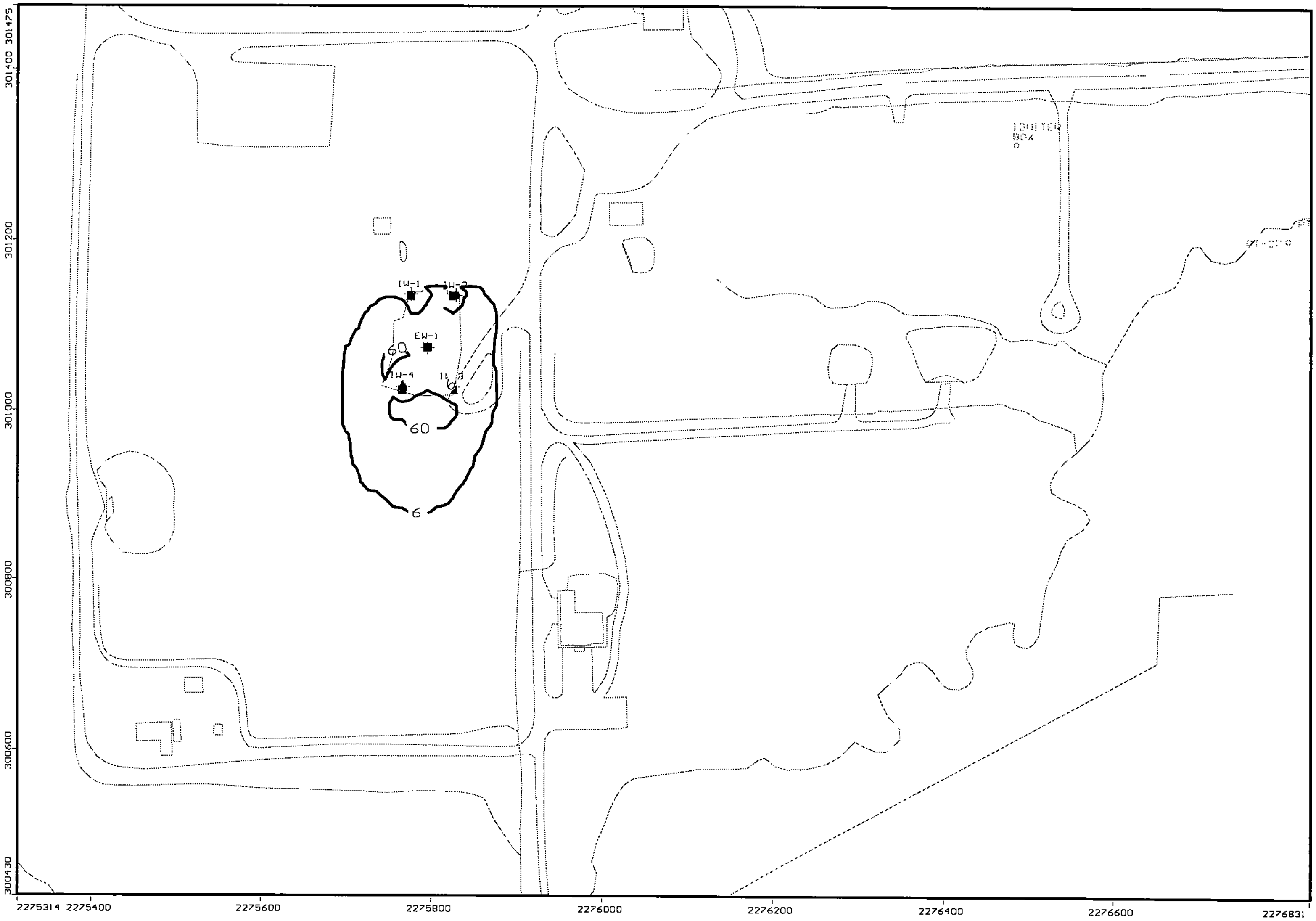
Contaminant Fate and Transport Modeling Results

Alternative 5 – Enhanced Degradation/MNA



URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 5 – Benzene
Modeller: JJS/ANB 1 d
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

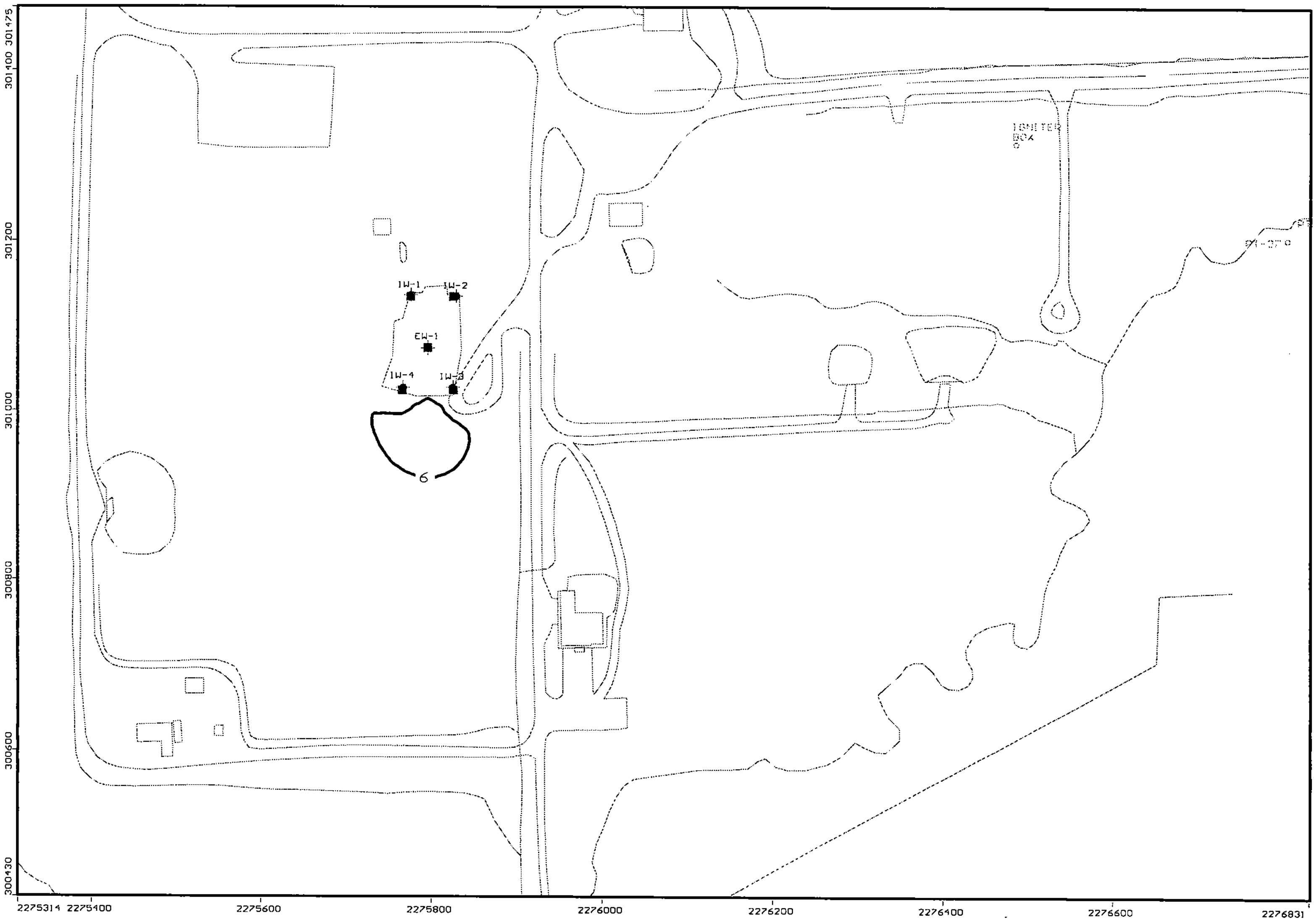


URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 5 – Benzene
Modeller: JJS/ANB 1 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

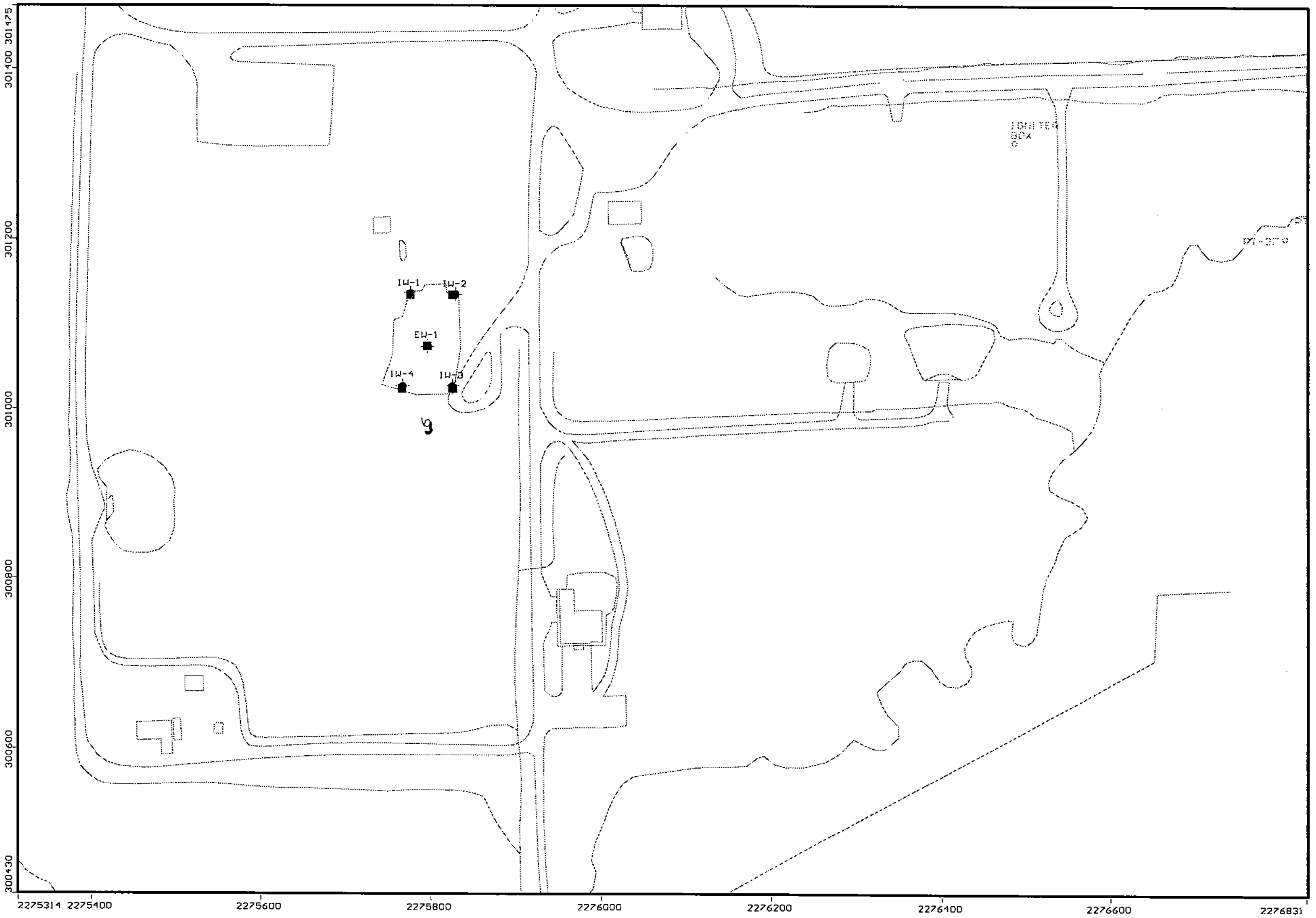
URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 5 – Benzene
Modeller: JJS/ANB 5 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



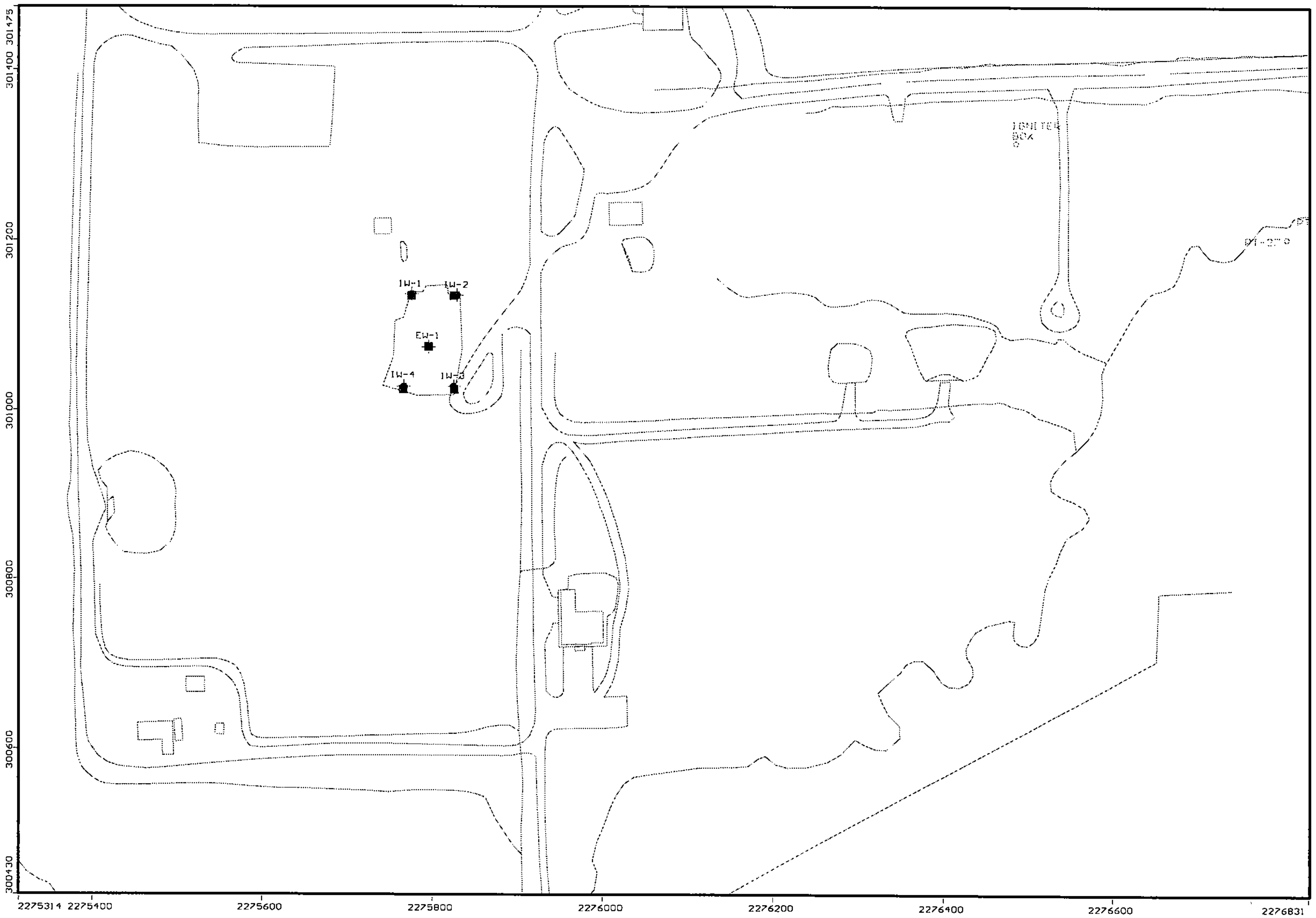
URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 5 — Benzene
Modeller: JJS/ANB 10 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



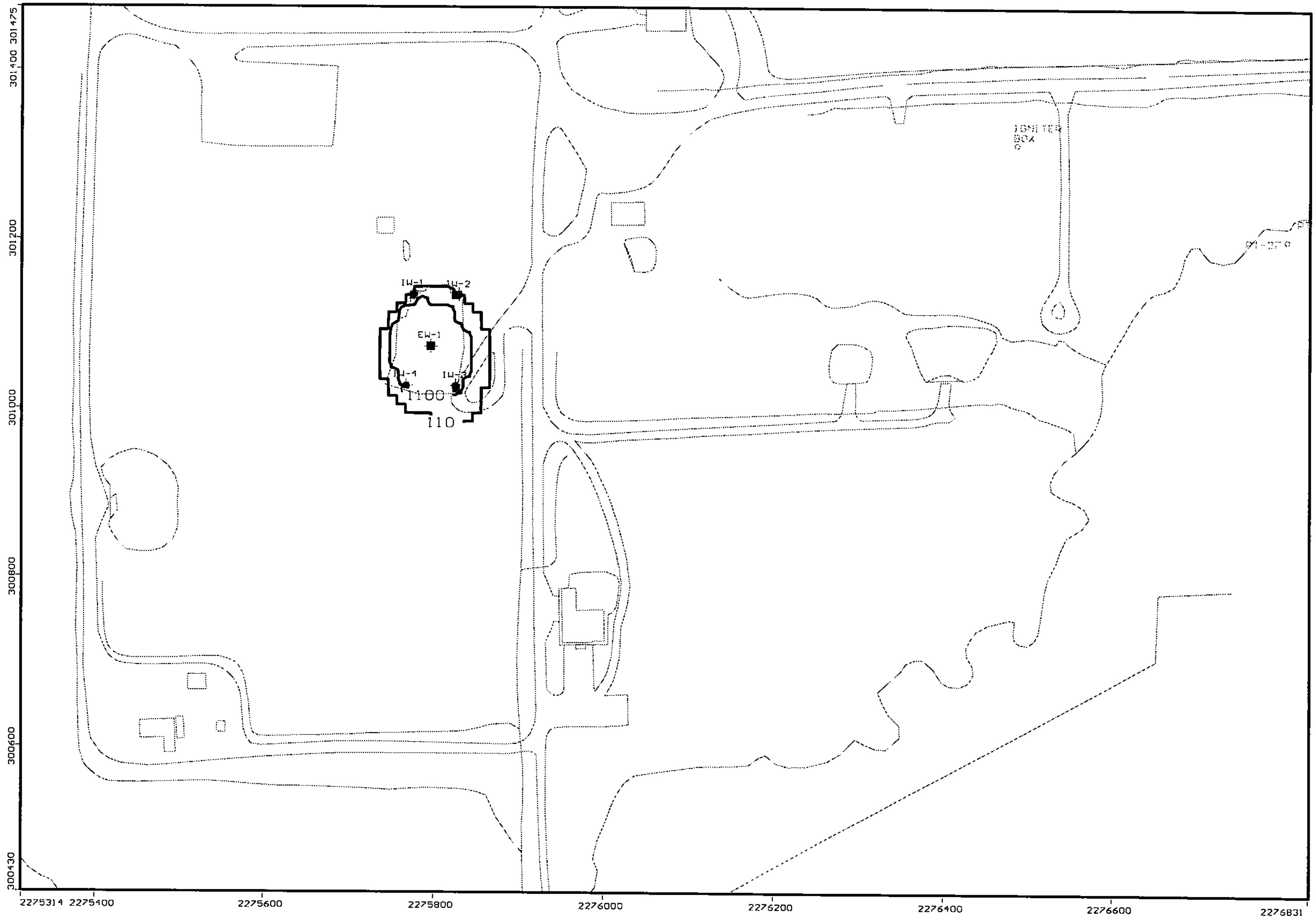
URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 5 — Benzene
Modeller: JJS/ANB 14 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



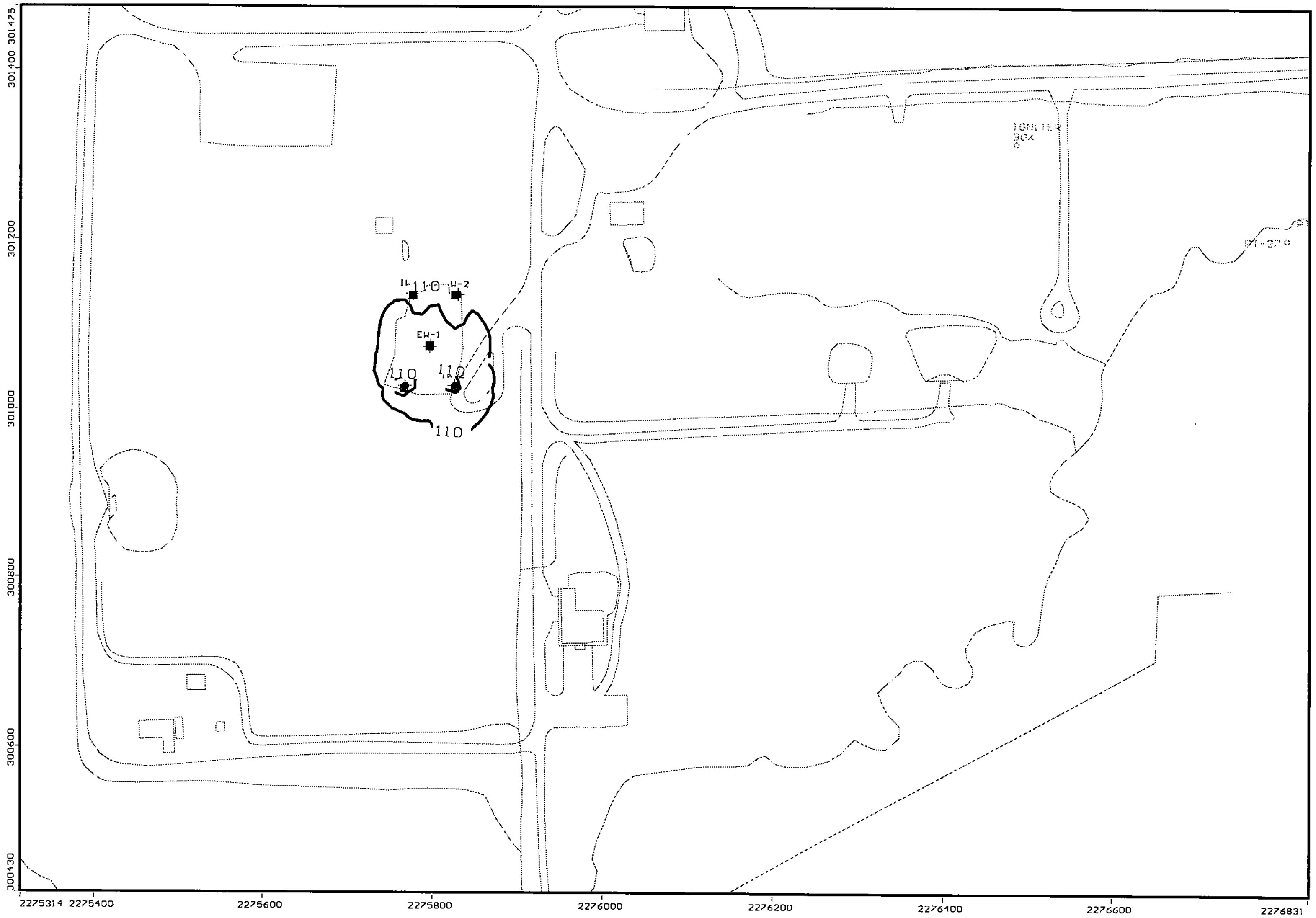
URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 5 – Benzene
Modeller: JJS/ANB 15 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



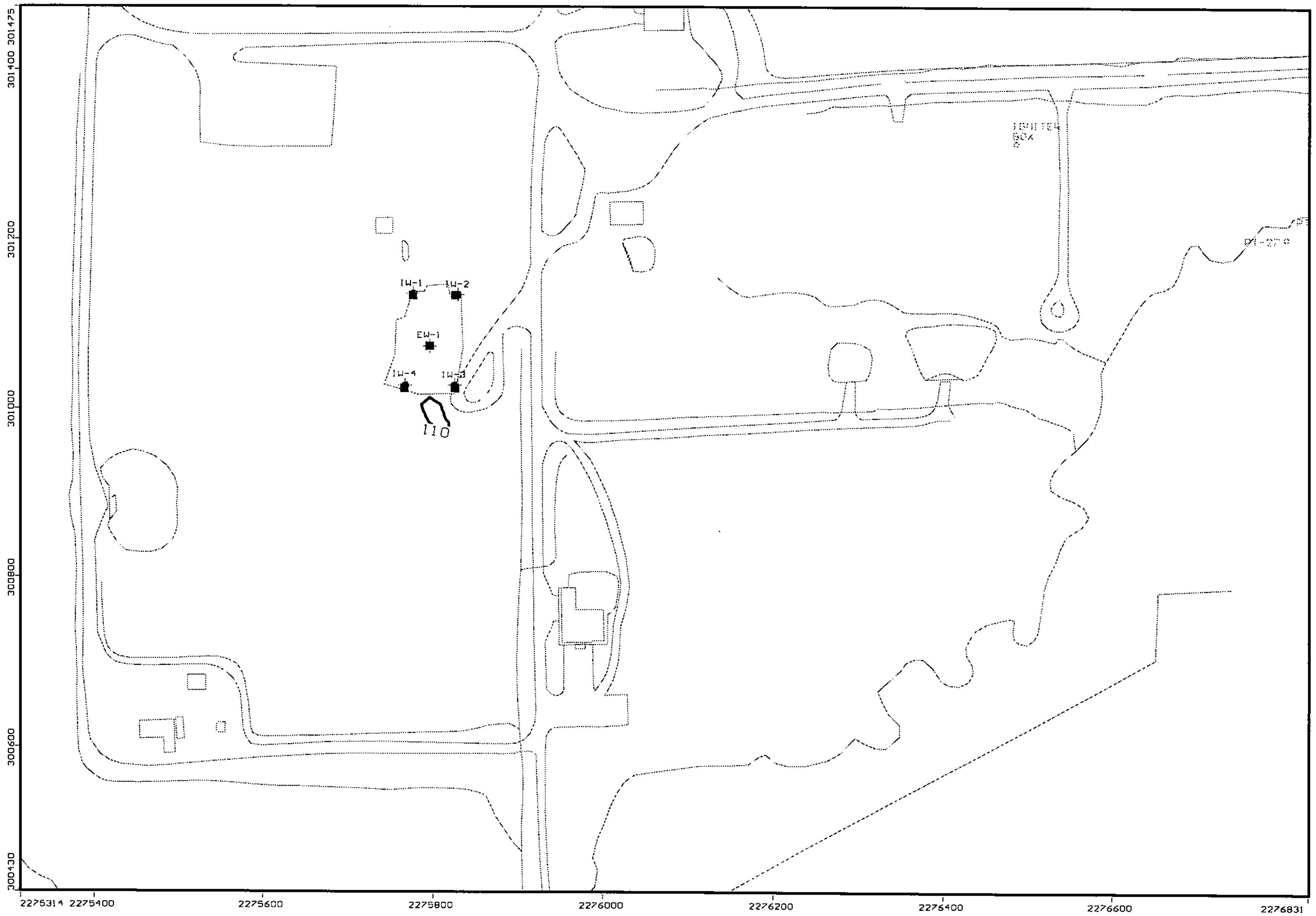
URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative5–Chloroethane
Modeller: JJS/ANB 1 d
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



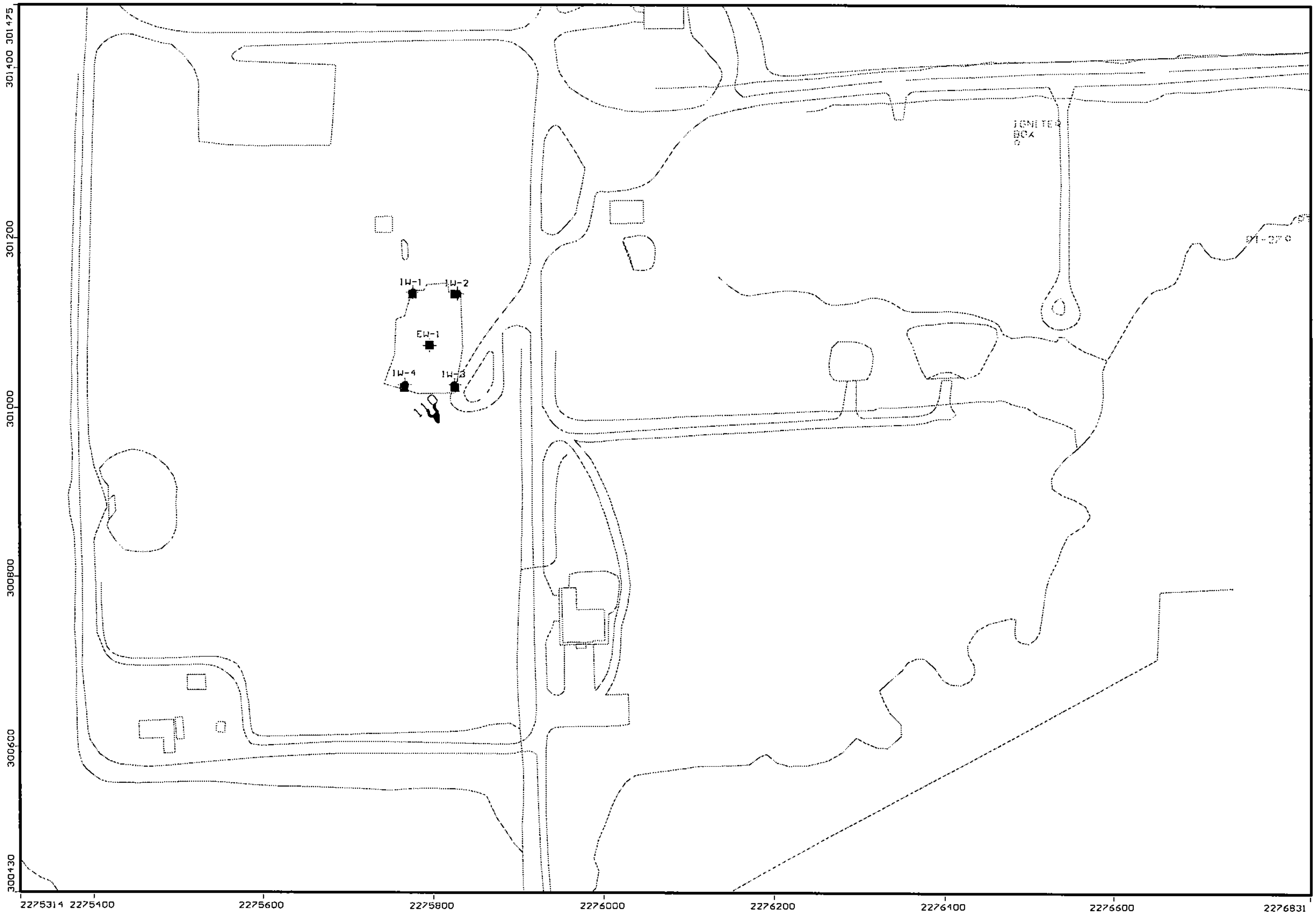
URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative5–Chloroethane
Modeller: JJS/ANB 1 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



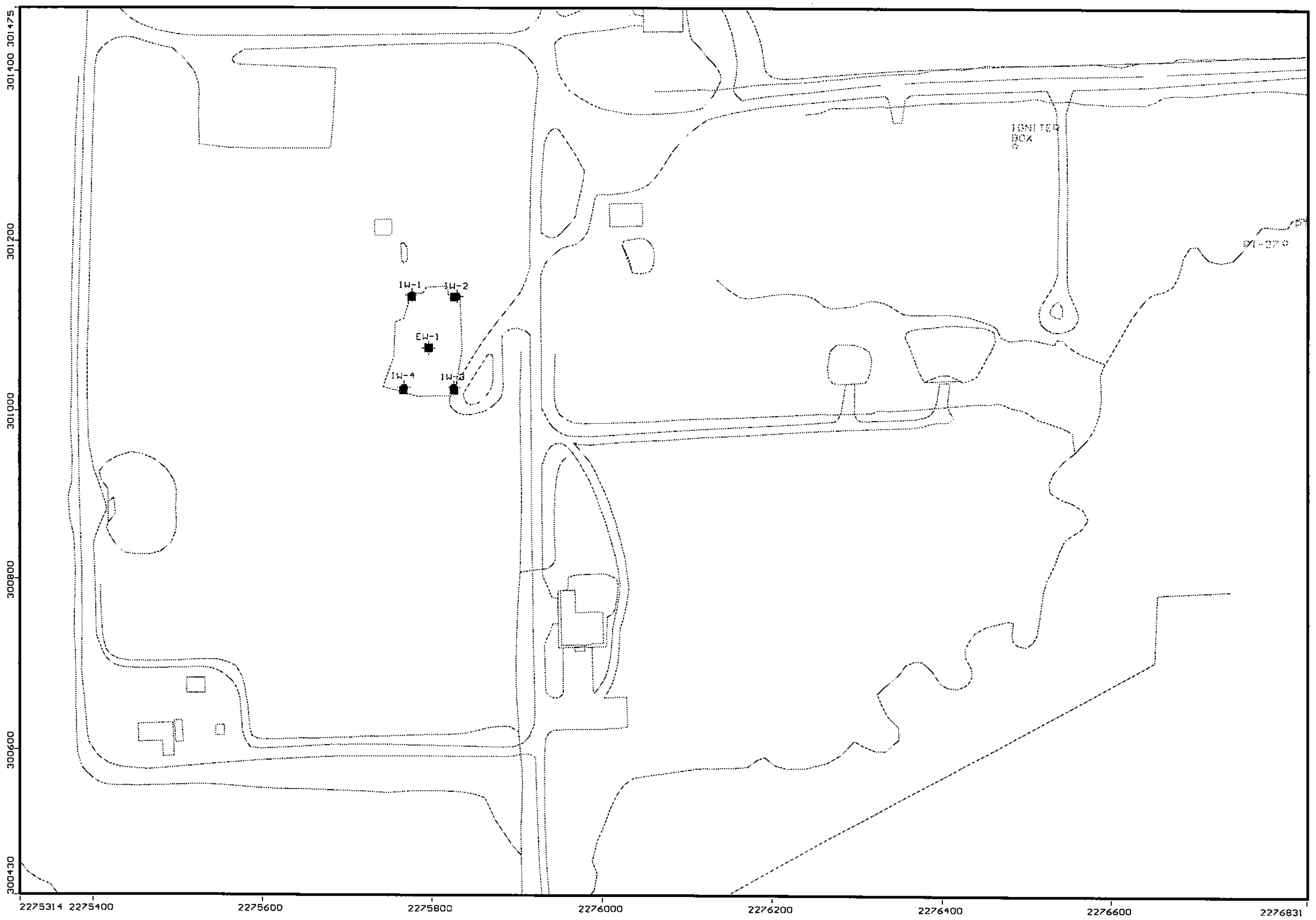
URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative5–Chloroethane
Modeller: JJS/ANB 5 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



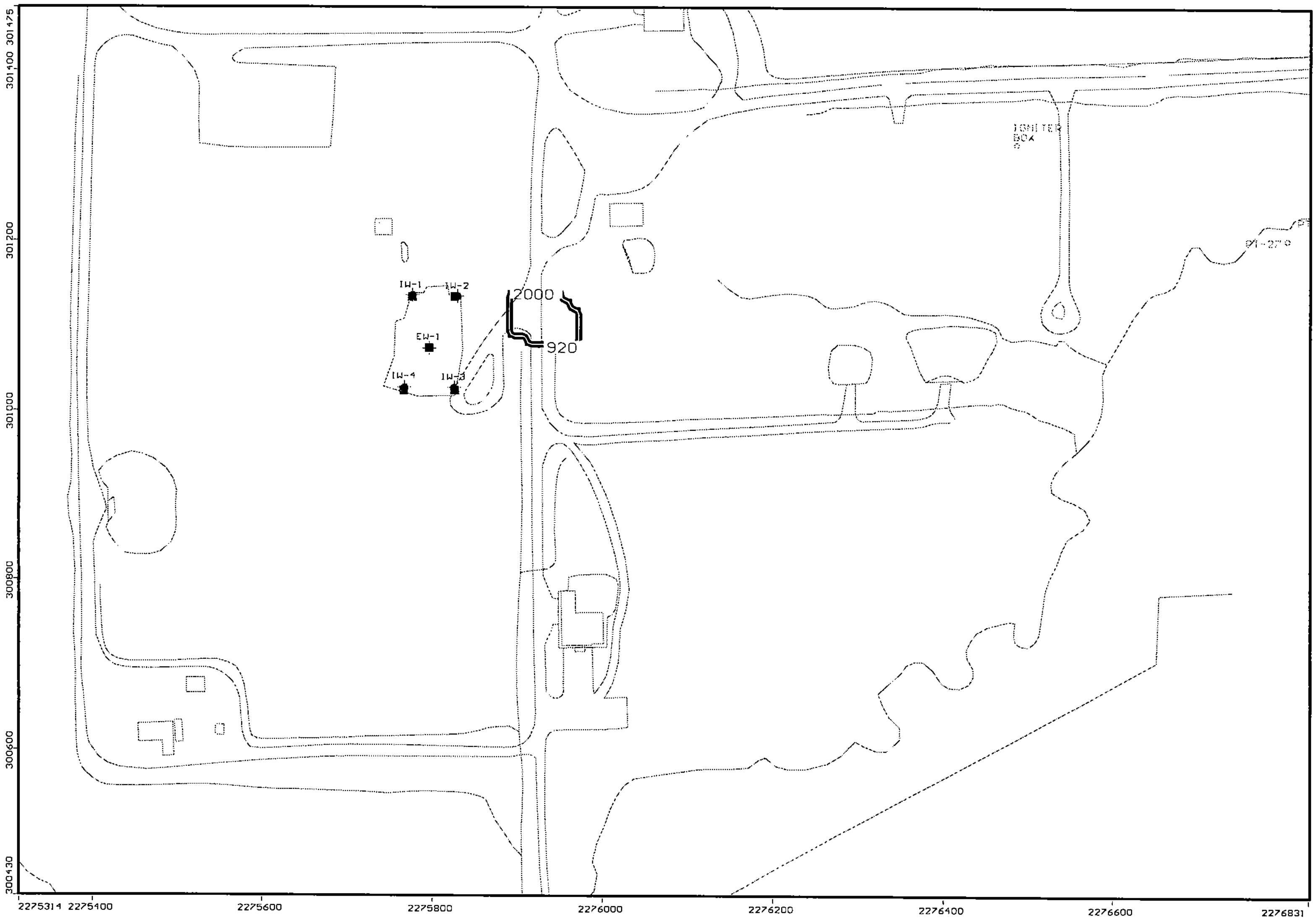
URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative5–Chloroethane
Modeller: JJS/ANB 6 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative5–Chloroethane
Modeller: JJS/ANB 7 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 5 – 1,1 DCE
Modeller: JJS/ANB 1 d
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
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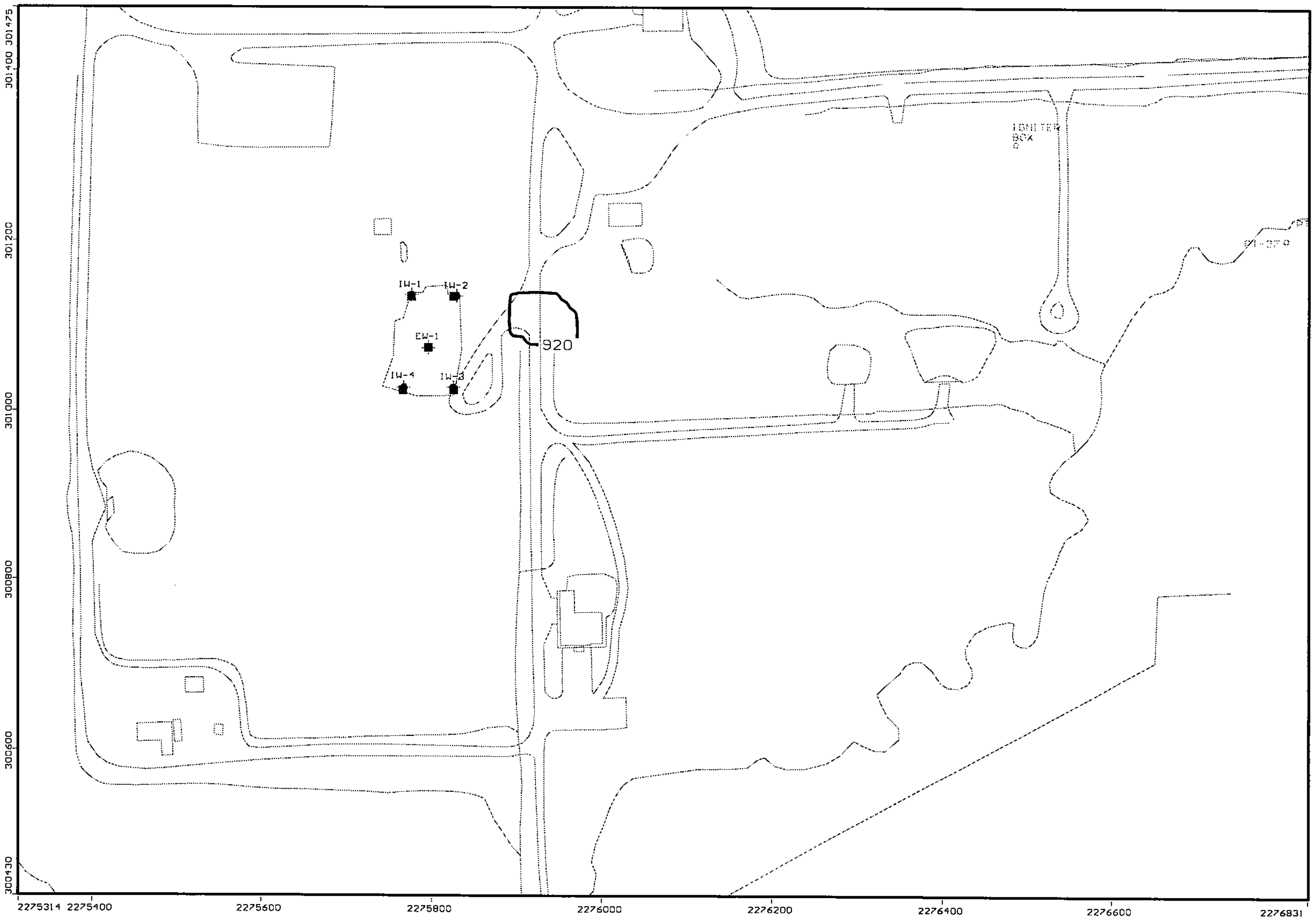

URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 5 – 1,1 DCE
Modeller: JJS/ANB 1 yr
11 Mar 04

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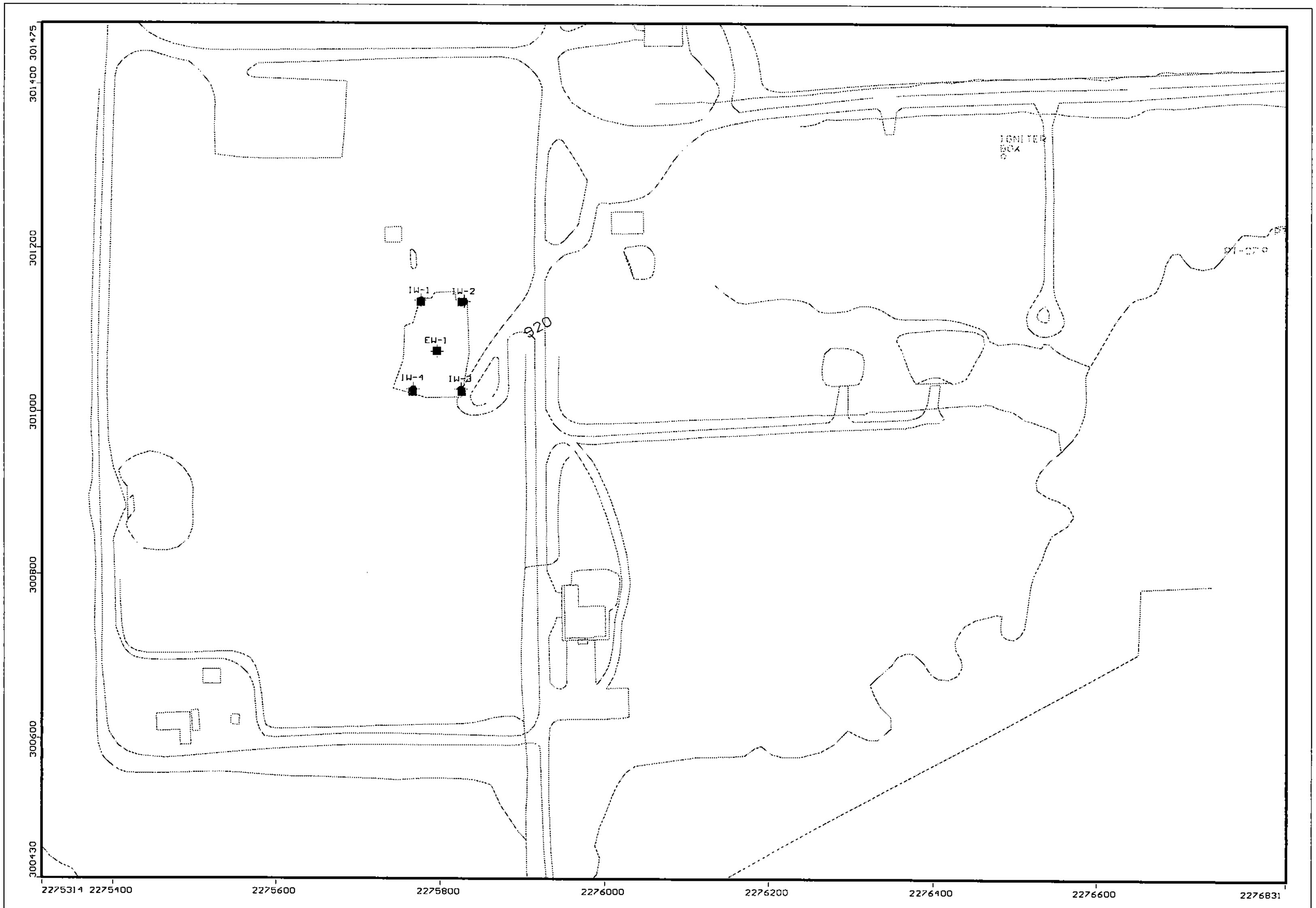

URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 5 – 1,1 DCE
Modeller: JJS/ANB 2 yr
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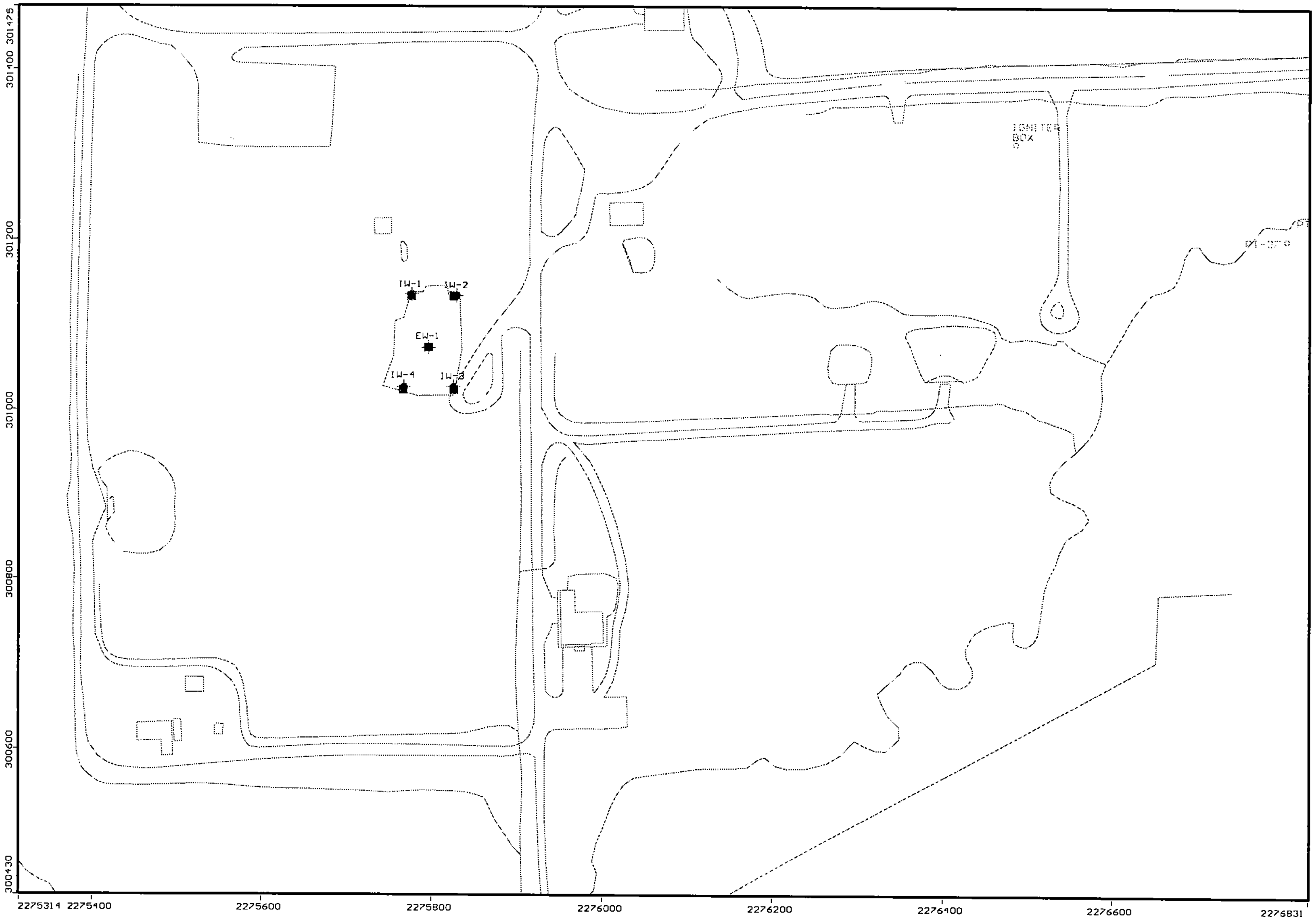

URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 5 – 1,1 DCE
Modeller: JJS/ANB 3 yr
11 Mar 04

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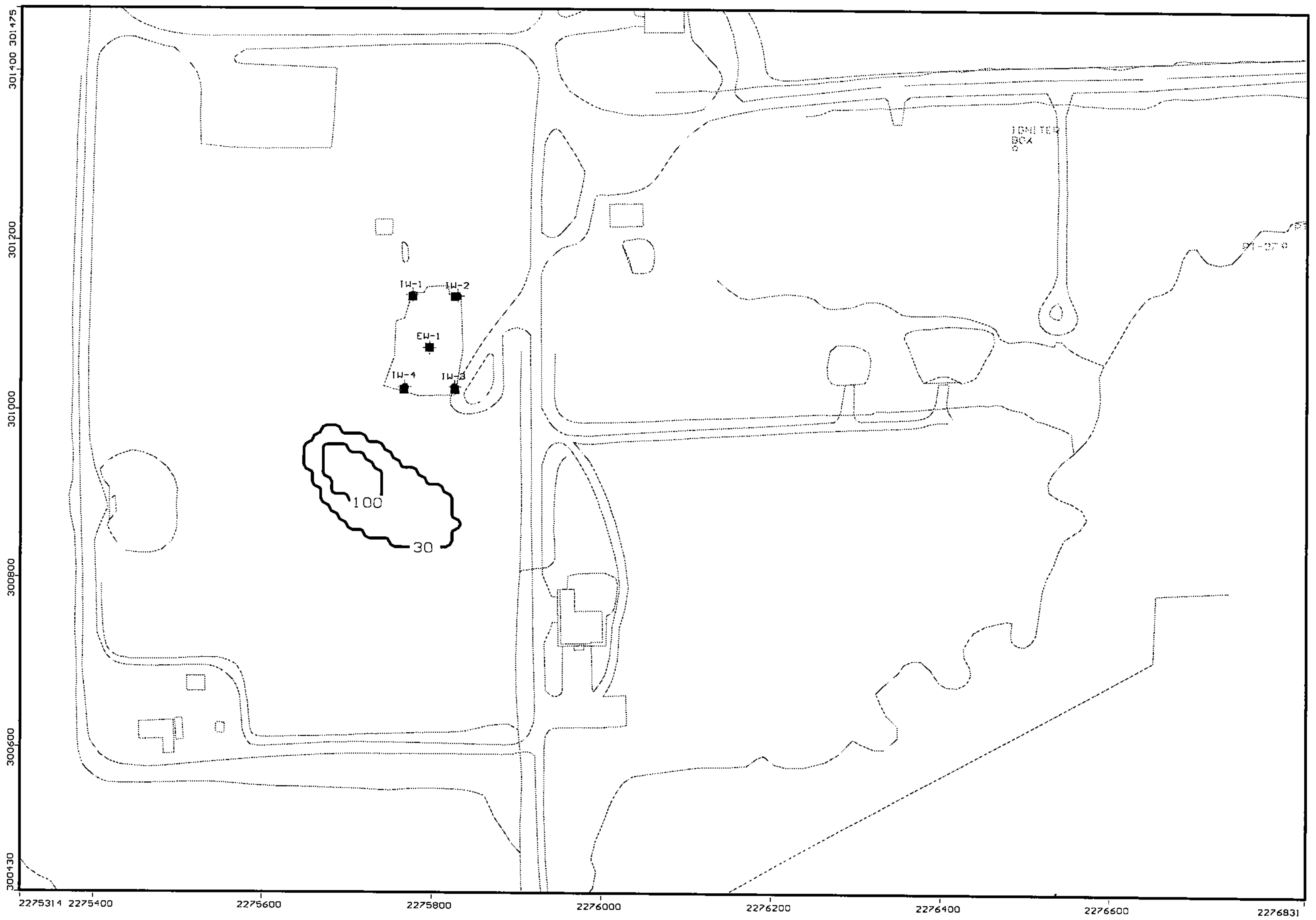

URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 5 – TCE
Modeller: JJS/ANB 1 d
11 Mar 04

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Waterloo Hydrogeologic, Inc.
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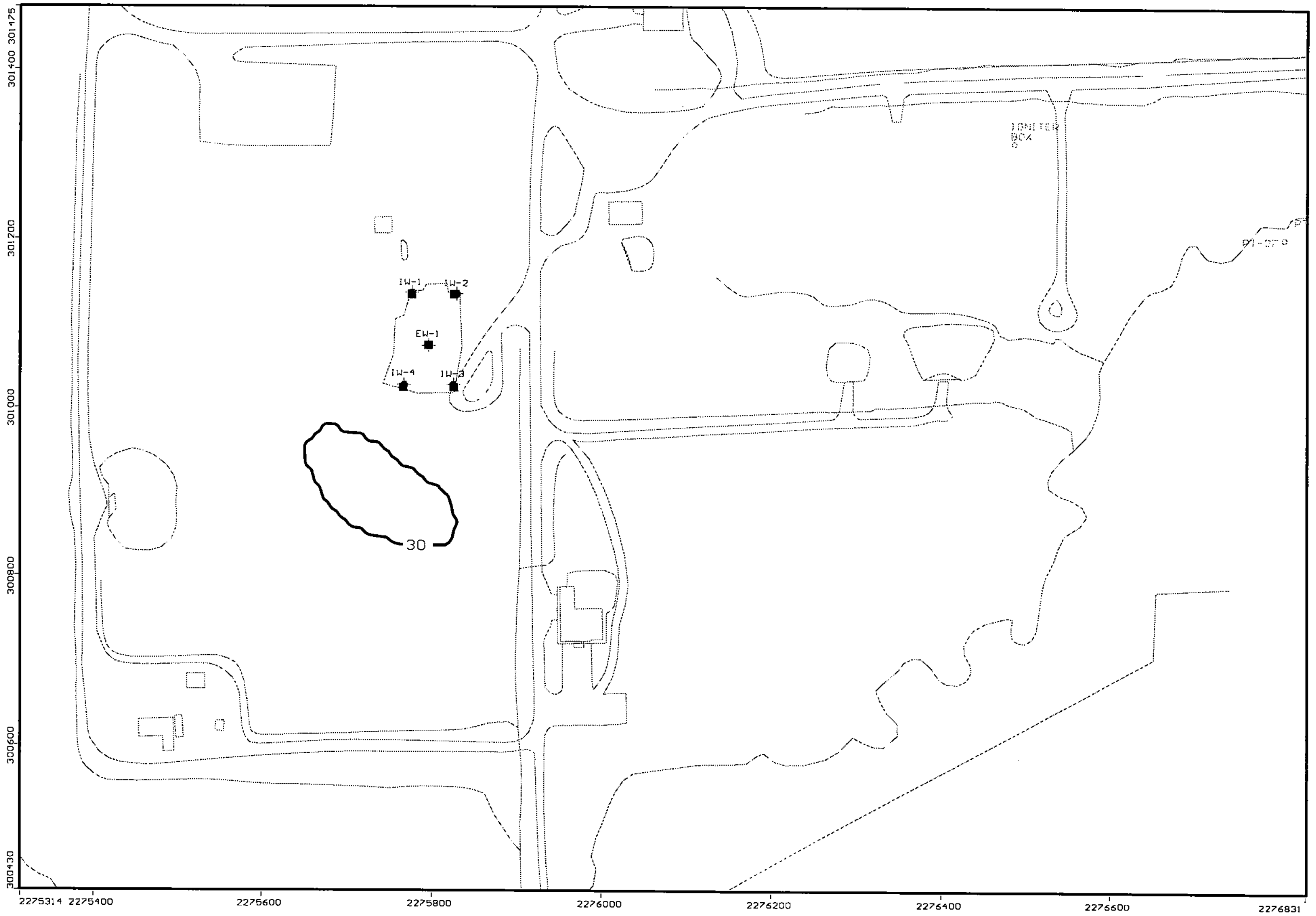

URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 5 – TCE
Modeller: JJS/ANB 1 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
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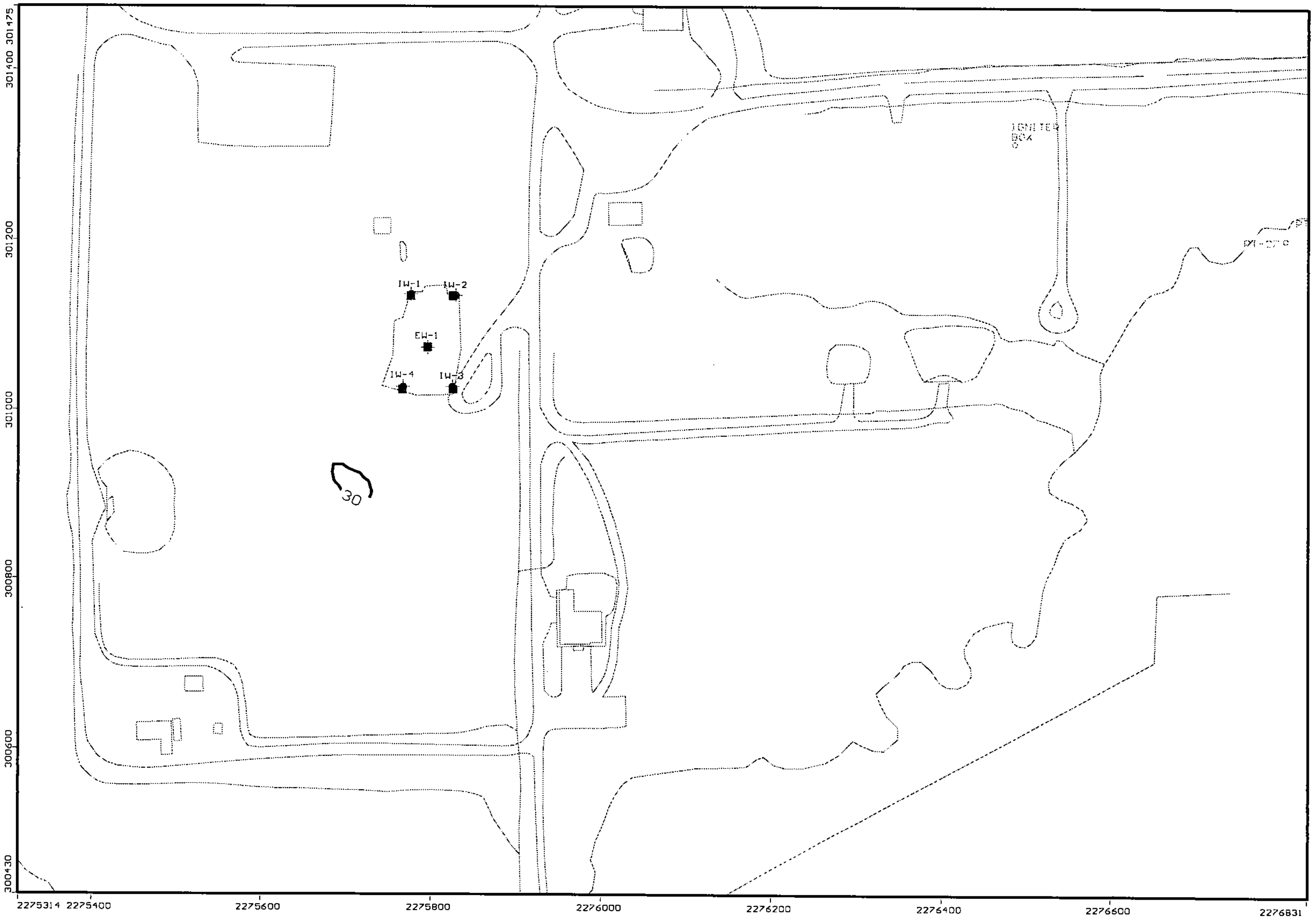

URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 5 – TCE
Modeller: JJS/ANB 5 yr
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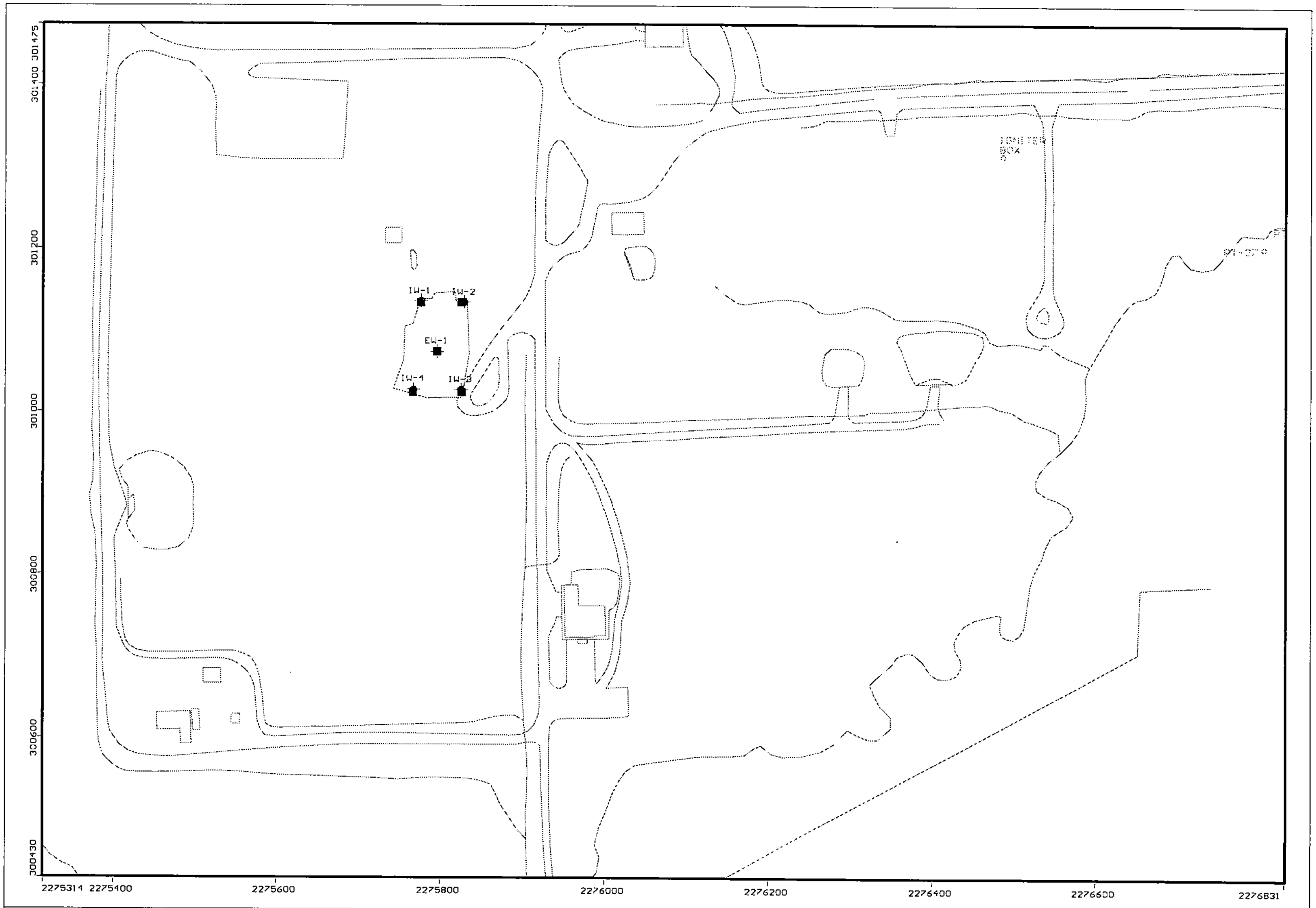

URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 5 – TCE
Modeller: JJS/ANB 6 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
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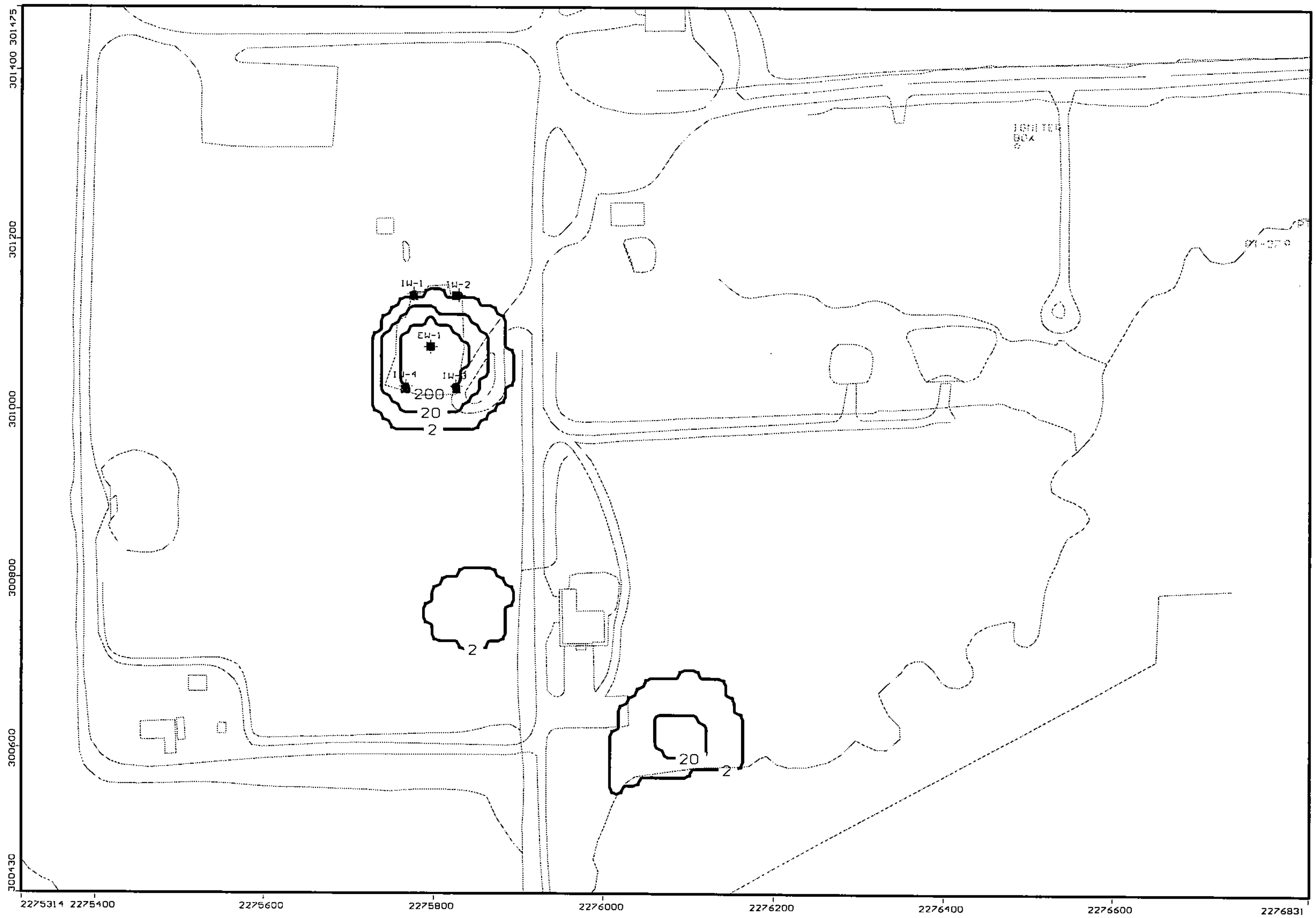

URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 5 – VC
Modeller: JJS/ANB 1 d
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
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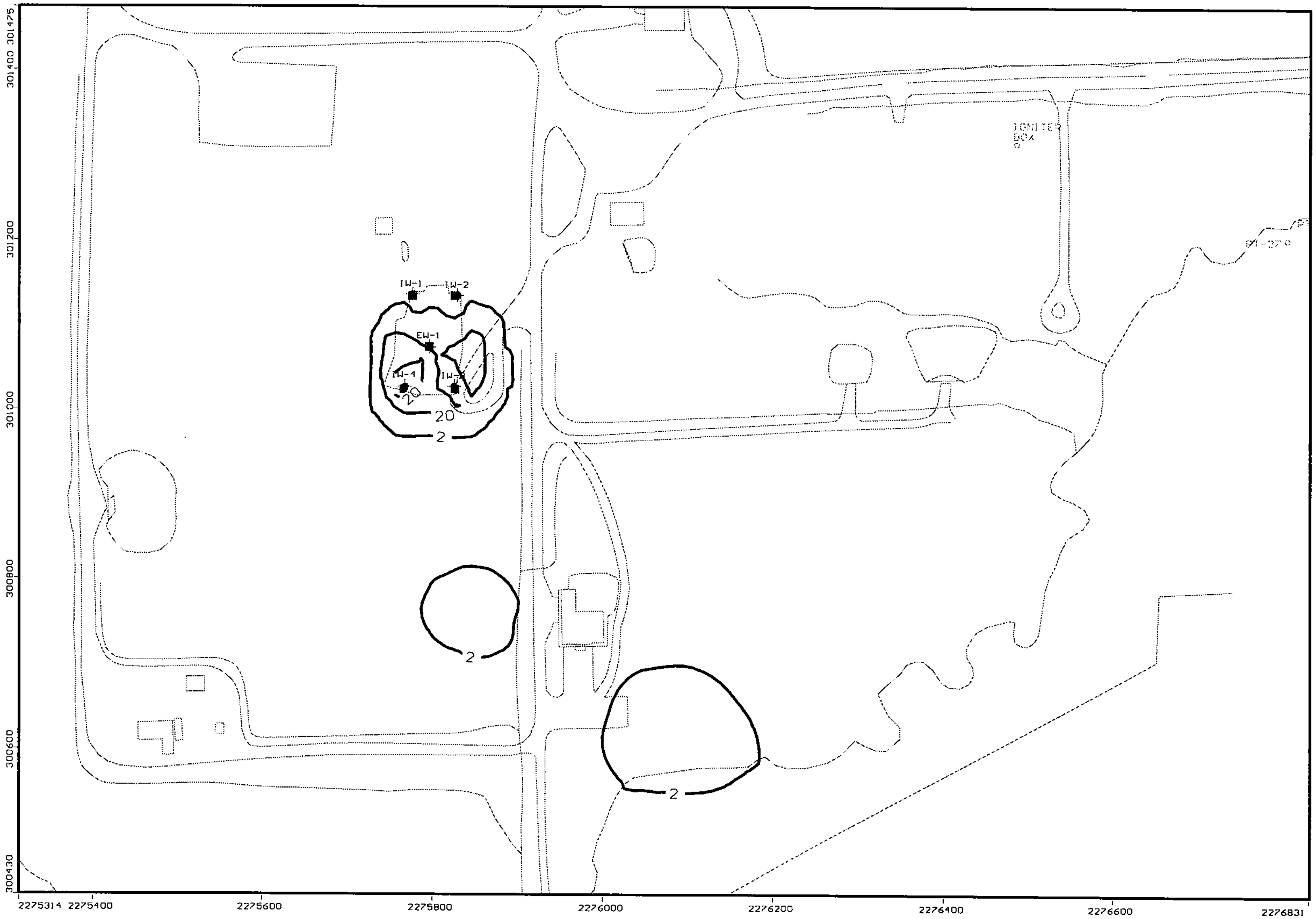


URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 5 – VC
Modeller: JJS/ANB 1 yr
11 Mar 04

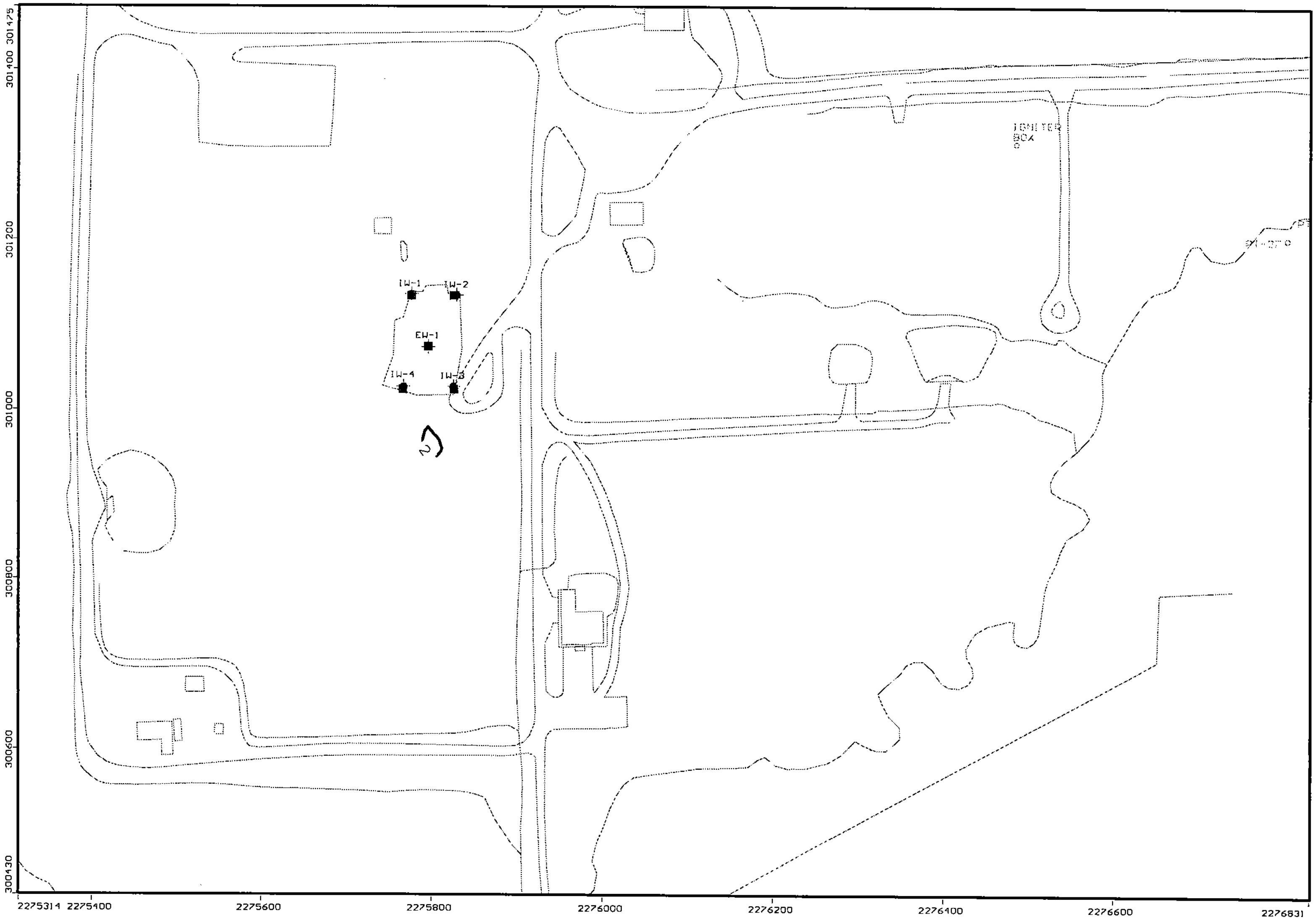
Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 5 – VC
Modeller: JJS/ANB 5 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

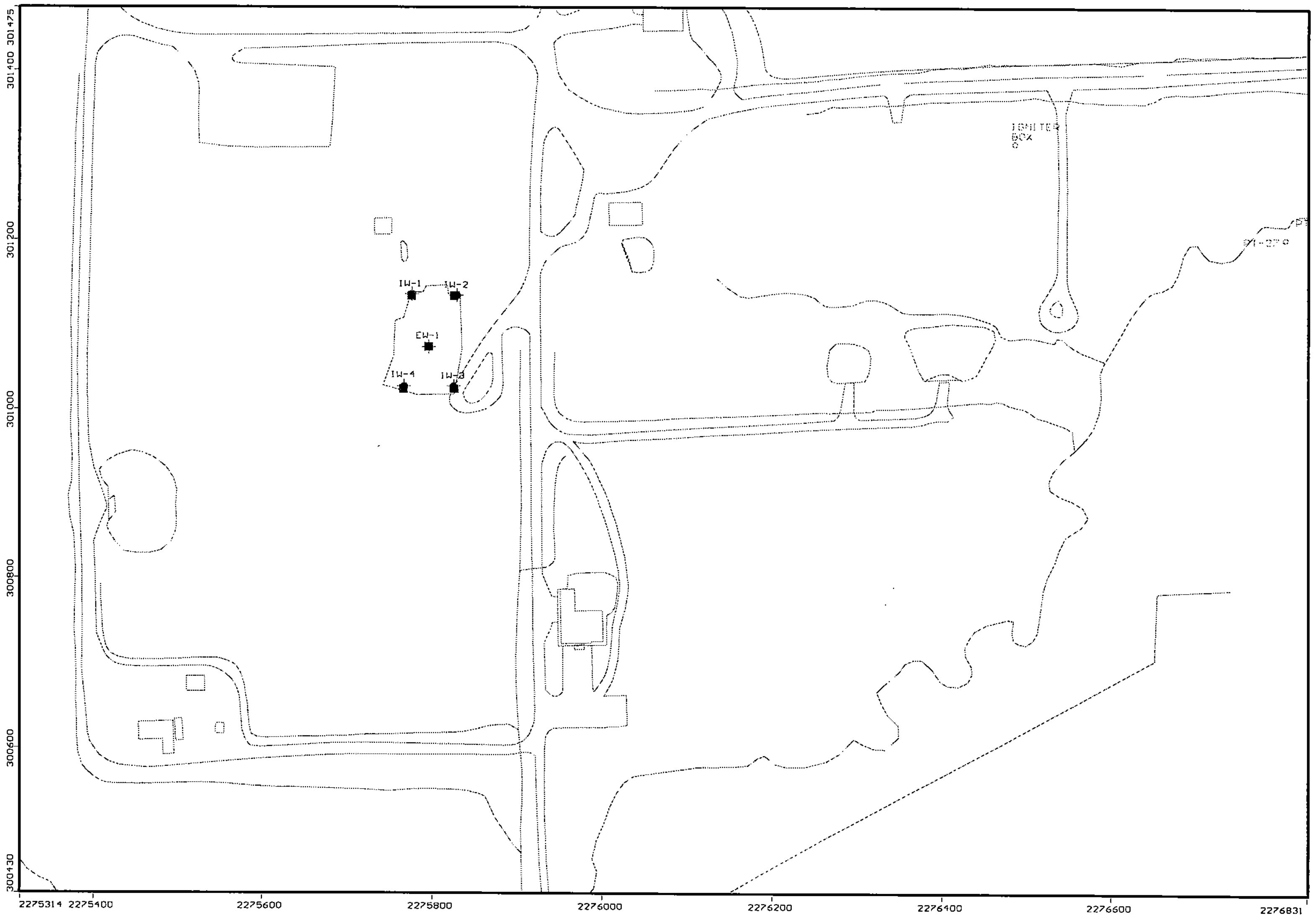
URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 5 – VC
Modeller: JJS/ANB 10 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 5 — VC
Modeller: JJS/ANB 15 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1



URS Corporation
Project: IAAAP FTP Modeling
Description: Alternative 5 – VC
Modeller: JJS/ANB 16 yr
11 Mar 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

APPENDIX L

Vegetation/Land Use Survey

This site visit report presents the results of a vegetation/land use survey at the IAAAP FTP. A general vegetation survey was conducted from October 11 through October 12, 2002. Existing vegetation reflects past and present land use within the area surveyed. Species identification and an orthometric photograph from 1998 were used to classify the FTP vegetation types/land uses. Due to the size of the area, vegetation identification efforts focused on areas potentially impacted by remedial action alternatives. The community types/land uses identified and described below include cropland, idle grassland, and woodland. The FTP is indicated on **Figure 4-1** by the line labeled "Approximate Boundary of Previous Soil Removal Action" in the map legend. Photographs from each community/land use type are shown in **Figures L-1** and **L-2**.

Present land use patterns are very different from the time of pre-European settlement. Horton, et al. (1996) stated that by 1937 (when the first aerial photographs of the area were taken), all natural vegetation within the IAAAP had been disturbed, primarily by grazing and farming. While only scattered trees were present in 1937, tree cover has expanded dramatically since that time. With cessation of grazing after the IAAAP area was acquired by the DoD in 1940 and fire suppression since the early 1900s (Horton, et al. 1996), stands of unevenly aged trees (presumably ranging from seedling to around 100 years) now dominate the areas along the creeks and upland unfarmed areas.

The native tall-grass prairies that would have dominated the area in pre-European settlement era are now rare (most were destroyed by farming practices), and no prairie remnant areas were encountered in the 2002 vegetation/land use survey. In addition, a comprehensive survey of the IAAAP was conducted in 1994 and 1995 that included vascular plants, bryophytes, vertebrates, and invertebrates (Horton, et al. 1996). The report stated that approximately 19 percent of the vascular plants at the IAAAP were introduced in the United States from other regions of the world, and approximately one percent were species that had been introduced from elsewhere in the United States. The 2002 site visit confirmed the presence of many non-native vascular plants, especially in the more disturbed areas.

L.1 VEGETATION TYPES/LAND USE

L.1.1 Cropland

Tilled cropland was identified to the west and southeast of the previous soil removal action. In 2002, all of the tilled cropland was planted with soybeans. Because the majority of the farmland in this area is on a corn–soybean rotation and varies from year to year, the type of crop is not specified on **Figure 4-1**.

L.1.2 Grassland – Reseeded Non-Native Species

The area directly surrounding the previous soil removal action boundary was classified as a non-native grassland community. This unmowed grassland community had significant past disturbance. Brome grasses (planted sometime in the past) and goldenrod species dominated the area's vegetation, but many non-native and immature trees (sun-loving, invading species) were also encountered. West of Spring Creek, the reseeded non-native grassland community contained a stand of poplar trees that appeared to have been planted within the last five years.

L.1.3 Woodland

Woodland areas were located south and east of the previous soil removal action at the FTP.

A number of different woodland communities may occur in southeast Iowa. Lammers (1983) identified three forest communities in Des Moines County (where the IAAAP is located): floodplain, maple-basswood, and oak-hickory. Horton, et al. (1996) identified three forest communities at the IAAAP: lowland/floodplain, upland (oak-hickory), and disturbed.

To a certain degree, all woodland areas at the IAAAP have been previously disturbed (Horton, et al. 1996). Species encountered in the forested areas around the FTP included several non-native (native to the United States but not to Iowa) trees such as Osage-orange and black locust, both of which were a significant component of the vegetation. Horton, et al. (1996) stated that black locust, honey locust, eastern red cedar, Osage-orange, and shingle oak are tree species characteristic of sites with considerable human disturbance. Another indication that the woodland areas had been previously disturbed was the presence of a dense shrub layer (Horton, et al. 1996).

In 2002, the forest communities around the FTP contained a mixture of vegetation common to disturbed, lowland, and upland communities. For this reason, the “Woodland” category was used rather than attempting to differentiate community types. Trees encountered that are common to lowland areas included cottonwood, American elm, and slippery elm. One area of more “upland” forest vegetation was southeast of the previous soil removal action, adjacent to Spring Creek. More oaks and hickories were present in this area, including shagbark hickory, bitternut hickory, and white oak. However, this area was not differentiated on **Figure 4-1** as an upland forest community because no obvious boundary existed between community types, and trees common to disturbed lowland forests (e.g., Osage-orange, black locust, honey locust) were also frequently encountered. Other tree species commonly encountered in the woodland areas included black cherry, dogwood species, and American hackberry. Generally, a dense shrub layer was present in the forested areas, with multiflora rose, Missouri gooseberry, common blackberry, and black raspberry being the most common. Common vines and herbaceous species encountered in the woodland communities included poison ivy, Virginia Creeper, stinging nettles, white avens, and black snakeroot. A summary of the dominant species identified in this area is presented in **Table L-1**.

L.2 THREATENED AND ENDANGERED SPECIES

None of the state or federal listed T&E vascular plants were identified during the 2002 vegetation/land use survey, and no surveys of bryophytes, vertebrates, or invertebrates were conducted. However, a natural habitat and biota assessment of the IAAAP conducted in 1994 and 1995 did identify the orangethroat darter (a state threatened species) in the Spring Creek tributary southwest of the FTP at plant road P (Horton, et al. 1996). This comprehensive survey included plants, bryophytes, vertebrates and invertebrates.

The forested areas adjacent to Spring Creek and its tributaries provide potential roosting and foraging habitat for the federally endangered Indiana bat (*Myotis sodalis*). Indiana bats use distinctly different habitats during summer and winter. In winter, bats congregate in a few large caves and mines for hibernation. Nearly 85 percent of the known population winters in only seven caves and mines in Missouri, Indiana, and Kentucky, and approximately one-half of the population uses only two of these hibernacula (IDNR 2001).

In spring, females migrate north from their hibernacula and form maternity colonies in predominantly agricultural areas of Missouri, Iowa, Illinois, Indiana, and Michigan. These colonies, consisting of 50 to 150 adults and their young, normally roost under the loose bark of dead, large-diameter trees (including but not limited to shagbark hickory, bitternut hickory, and white oak) throughout summer. Living shagbark hickories and tree cavities are also used occasionally (Humphrey 1977). Females tend to forage around water, over floodplain trees, and in and around wooded areas. Males forage more frequently among trees. The Indiana bat is an insectivore, eating mostly moths, caddisflies, leafhoppers, planthoppers, and beetle larvae (IDNR 2001).

Considering the Indiana bat's ecology, Spring Creek and its tributaries provide potential foraging habitat for female bats. The woodland area southeast of the previous soil removal action contains some hickory and oak tree species that may provide potential roosting habitat.

L.3 REFERENCES

Horton, D., et al. 1996. An assessment of the natural habitats and biota of the Iowa Army Ammunition Plant, Middletown, Iowa. Unpublished report. 93 pp.

Humphrey, S.R., A.R. Richter, and J.B. Cope. 1977. Summer habitat and ecology of the endangered Indiana bat, *Myotis sodalis*. Journal of Mammalogy, 58:334-346.

Iowa Department of Natural Resources (IDNR). 2001. Biodiversity of Iowa: Aquatic Habitats CD-ROM.

Lammers, T.G. 1983. The vascular flora of Des Moines County, Iowa. Proceedings of the Iowa Academy of Science, 90:55-71.

TABLE L-1
SUMMARY OF VEGETATION/LAND USE SURVEY
OCTOBER 11-12, 2002, FIRE TRAINING PIT AND ADJACENT AREA
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Vegetation/Land Use Type	Species Identified in Area Common Name (Scientific Name)	Comments
Cropland	cropland	Corn or soybeans.
Grassland - Reseeded Non-Native Species	brome species (*Bromus* spp.) goldenrod species (*Solidago* spp.) pasture thistle (*Cirsium discolor*) queen annes lace (*Daucus carota*) daisy fleabane (*Erigeron annuus*) crown vetch (*Coronilla varia*) sumac (*Rhus* sp.) honey locust (*Gleditsia triacanthos*) eastern red cedar (*Juniperus virginiana*)	Vegetation dominated by planted brome grasses and invading immature tree species.
Woodland	black cherry (*Prunus serotina*) American elm *(Ulmus americana)* slippery elm *(Ulmus rubra)* cottonwood *(Populus deltoides)* black locust *(Robina pseudo-acacia)* honey locust *(Gleditsia triacanthos)* American hackberry *(Celtis occidentalis)* shingle oak *(Quercus imbricaria)* dogwood *species (Cornus* spp.) Osage-orange *(Maclura pomifera)* American basswood (*Tilia americana*) mulberry *(Morus* spp.) eastern red cedar (*Juniperus virginiana*) multiflora rose *(Rosa multiflora)* black raspberry *(Rubus occidentalis)* common blackberry *(Rubus allegheniensis)* Missouri Gooseberry *(Ribes missouriense)* Virginia creeper (*Parthenocissus quinquefolia*) white snakeroot (*Eupatorium rugosum*) white avens *(Geum canadense)* sweet cicely *(Osmorhiza claytoni)* brome species (*Bromus* spp.) bedstraw (*Galium* sp.) shagbark hickory (*Carya ovata*) shingle oak (*Quercus imbricaria*) white oak (*Quercus alba*) bitternut hickory (*Carya cordiformis*) black walnut (*Juglans nigra*) hornbeam (*Ostrya virginiana*) corallberry (*Symphoricarpos orbiculatus*) poison ivy (*Toxicodendron radicans*) stinging nettles (*Urtica dioia*) clearweed (*Pilea pumila*)	Generally lowland forest vegetation with scattered oaks and hickories.

CROPLAND – SOYBEANS

GRASSLAND – RESEEDED NON–NATIVE SPECIES

URS

VEGETATION/LAND USE PHOTO LOG
FIRE TRAINING PIT GROUNDWATER
REMEDIAL ALTERNATIVES ANALYSIS

DRN. BY: DAC	DATE: 01/31/03	PROJECT NO. 16169421	FIG. NO. L–1
CHK'D. BY: TLT	DATE: 01/02/04		

March 02, 2004 2:25:14 p.m.
Drawing: T:\IAAAP\16169421\00301\site 1 – FTP\FTP_veg–landuse.dwg


10/11/2002

WOODLAND


10/13/2002

WOODLAND

URS

VEGETATION/LAND USE PHOTO LOG
FIRE TRAINING PIT GROUNDWATER
REMEDIAL ALTERNATIVES ANALYSIS

DRN. BY: DAC	DATE: 01/31/03	PROJECT NO. 16169421	FIG. NO. L-2
CHK'D. BY: TLT	DATE: 01/02/04		

March 02, 2004 2:25:14 p.m.
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APPENDIX M Background Metals and Nitrate Concentrations in Groundwater

APPENDIX M Background Metals and Nitrate Concentrations in Groundwater

During the Spring 2003 field activities, groundwater samples were collected from 47 monitoring wells across the EDA for characterization of metals and NO_3 concentrations in ground water. The statistical analysis of these data is presented in this appendix.

M.1 STATISTICAL ANALYSIS APPROACH

The analytical data for the eight RCRA metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) and NO_3 (**Table 5-2**) were separated into two data groups: clean monitoring wells (i.e., nondetect for explosives and less than 5 µg/L VOCs) and contaminated monitoring wells (i.e., explosives detected or greater than 5 µg/L VOCs).

Barium was detected in all monitoring wells sampled at the EDA. Because the barium analytical data were normally distributed (skewness greater than 1), the 95% UTL was calculated using the equation for establishing tolerance limits given in the USEPA Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Addendum to Interim Final Guidance (USEPA 1992b). The barium values and method of calculation are presented in **Table M-1**.

The remaining data sets contained a significant number of nondetects (greater than 15 percent). Due to the large number of nondetects in these data sets, the data could not be assumed or proven to be normally or lognormally distributed. Therefore, based on USEPA guidance (USEPA 1992b), the nonparametric method of establishing the UTL was used. That is, the 95% UTL for these compounds within each data set was assigned the maximum detected concentration. It should also be noted that, for the purpose of analysis, concentrations flagged with a **J** qualifier (estimated concentration, as indicated on **Table 5-2**) were treated in the same manner as nonqualified data. Sample concentrations reported as nondetect (below the laboratory reporting limit) were given a value of one-fifth the reporting limit for that analyte. The means and standard deviations were calculated with and without nondetect values for each data set that contained a significant number of nondetects. These values are presented in **Tables M-1** through **M-8**.

Analytical data from the contaminated monitoring wells were compared to the 95% UTL for the background concentration established for each of the clean monitoring well data sets. The results of these comparisons are presented and discussed in **Section M.2**.

M.2 RESULTS OF THE STATISTICAL ANALYSIS

M.2.1 Barium

Barium was detected in all monitoring wells sampled at the EDA. The background 95% UTL calculated for barium in groundwater was 382 µg/L. Three monitoring wells (JAW-23, JAW-24, and WBP-99-5) from the contaminated well data set exceeded the background 95% UTL for barium with concentrations of 2,460 µg/L, 1,510 µg/L and 1,140 µg/L, respectively. Also, one well (EBP-MW2) from the clean monitoring well data set exceeded the 95% UTL with a value of 612 µg/L. The data are presented in **Table M-1**.

M.2.2 Arsenic, Cadmium, Chromium, Lead, Mercury, and Selenium

Arsenic, cadmium, chromium, lead, mercury, and selenium were all represented by a statistically significant number of nondetects (greater than 15 percent). Therefore, in accordance with USEPA (1992b), the 95% UTLs were assigned the maximum detected concentration for each analyte. The 95% UTLs taken from the clean monitoring well data set were:

Constituents	**95% UTL (µg/L)**
Arsenic	40.3
Cadmium	0.9
Chromium	68.6
Lead	35.5
Mercury	0.077
Selenium	9.5

Notes:

µg/L = Micrograms Per Liter
UTL = Upper Tolerance Limit

Two monitoring wells (SA-99-1 and JAW-24) in the contaminated well data set exceeded the background 95% UTL for arsenic with concentrations of 58 µg/L and 99.8 µg/L. respectively. One monitoring well (JAW-23) in the contaminated well data set exceeded the background 95% UTL for cadmium, with a concentration of 5.1 µg/L. No monitoring wells in the contaminated well data set exceeded the background 95% UTL for chromium. No monitoring wells in the contaminated well data set exceeded the background 95% UTL for lead (35.5 µg/L). One monitoring well (JAW-614) in the contaminated well data set exceeded the background 95% UTL for mercury, with a concentration of 0.2 µg/L. One monitoring well (FTP-MW3) in the contaminated well data set exceeded the background 95% UTL for selenium, with a concentration of 16.2 µg/L. The data are presented in Table **M-2** through **M-7**.

M.2.3 Silver

All clean well sample results for silver were nondetect. Therefore, these data were not analyzed statistically, and "nondetect" was assumed to be the background level for these constituents. No monitoring wells from the contaminated well data sets exceeded nondetect for silver.

M.2.4 Nitrate

NO_3 was detected in 35 of the 52 wells sampled for NO_3. NO_3 was represented by a statistically significant number of nondetects (greater than 15 percent). Therefore, in accordance with USEPA (1992), the 95% UTL was assigned the maximum detected concentration. The background 95% UTL assigned to NO_3 was 500 µg/L. Fifteen monitoring wells from the contaminated well data set exceeded the background 95% UTL for NO_3, with concentrations ranging from 690 µg/L to 13,000 µg/L. The data are presented in **Table M-8**.

M.3 STATISTICAL ANALYSIS SUMMARY

Two monitoring wells (SA-99-1 and JAW-24) in the contaminated well data set exceeded the background 95% UTL for arsenic, with concentrations of 58 µg/L and 99.8 µg/L, respectively.

Three monitoring wells (JAW-23, JAW-24, and WBP-99-5) exceeded the background 95% UTL for barium, with concentrations of 2,460 µg/L, 1,510 µg/L, and 1,140 µg/L, respectively. Cadmium was detected in one monitoring well (JAW-23) in the contaminated well data set at a concentration (5.1 µg/L) exceeding the background 95% UTL. No monitoring wells in the contaminated well data set exceeded the background 95% UTLs for chromium (68.6 µg/L) and lead (35.5 µg/L). One monitoring well (JAW-614) in the contaminated well data set exceeded the background 95% UTL for mercury with a concentration of 0.2 µg/L. One monitoring well (FTP-MW3) in the contaminated well data set exceeded the background 95% UTL for selenium with a concentration of 16.2 µg/L. Fifteen monitoring wells from the contaminated well data set exceeded the background 95% UTL for NO_3 with concentrations ranging from 690 µg/L to 13,000 µg/L. No other monitoring wells from the contaminated well data set exceeded the background 95% UTLs. The 95% UTLs (i.e., background levels) and the IAAAP regulatory standards for the RCRA metals and NO_3 are presented the table below.

Analyte	95% UTL (µg/L)	IAAAP Regulatory Standard (µg/L)
Arsenic	40.3	10 (a)
Barium	382	2000 (a)
Cadmium	0.9	5 (a)
Chromium	68.6	100 (a)
Lead	35.5	15 (a)
Mercury	0.077	2 (a,b)
Selenium	9.5	50 (a)
Silver	ND	100 (b)
NO_3	500	10000 (a,c)

Notes:

µg/L = Micrograms Per Liter
95% UTL = 95 Percent Upper Tolerance Limit
ND = Nondetect

(a) Maximum Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region 9 Preliminary Remediation Goal (PRG)

A comparison of the background UTLs and IAAAP regulatory standards indicated that arsenic and lead background UTLs at the EDA exceeded the IAAAP regulatory standards. The arsenic and lead background UTLs were considered in the COPC screening process presented in **Section 6**.

TABLE M-1
BACKGROUND 95% UPPER TOLERANCE LIMIT CALCULATIONS AND COMPARISON FOR BARIUM
EXPLOSIVES DISPOSAL AREA GROUNDWATER
REMEDIAL ALTERNATIVES ANALYSIS

FIELD ID	Clean MW	Contaminated MW
	Barium (mg/L)	
FTA-99-1		**151**
FTA-99-2	**54.9**	
JAW-58		**85.4**
JAW-59		**133**
JAW-60		**219**
JAW-61		**93.5**
JAW-62	**70.8**	
JAW-63	**79.2**	
JAW-80		**189**
M-01	**231**	
SA-99-1		**353**
FTP-MW1		**142**
FTP-MW2		**88.6**
FTP-MW3		**106**
FTP-MW4	**71.6**	
FTP-MW5		**55.6**
FTP-MW6	**67.4**	
FTP-MW7		**130**
FTP-MW8	**86.8**	
EBP-MW2	**612**	
EBP-MW3		**44.9**
EDA-01	**66.9**	
EDA-02		**111**
EDA-03		**96.5**
EDA-04		**59.5**
G-29	**55.5**	
JAW-04	**123**	
JAW-05	**74.5**	
JAW-06		**167**
JAW-07	**75.7**	
JAW-64	**150**	
JAW-614		**127**
G-30		**53.8**
JAW-23		**2460**
JAW-24		**1510**
JAW-25		**17.8**
JAW-68		**64.6**
WBP-99-1		**84.8**
WBP-99-2		**53.6**
WBP-99-3		**258**
WBP-99-4		**73.4**
WBP-99-5		**1140**
WBP-99-6		**62.2**
WBP-99-7	**251**	
WBP-MW1	**48.7**	
WBP-MW2	**38.4**	
WBP-MW3	**257**	

Sample Size (n)	18
Skewness[1]	2.74
Average (x)	134.13
Standard Deviation (s)	138.25
$t17_{,0.05}$[2]	1.74
k [3]	1.79
UTL [4]	382

[1] Skewness >1 indicates normality of the data set

[2] From Johnson, R.A. & Bhattacharyya, G.K. (1996) Statistics: Principles and Methods, 3rd ed. United States: John Wiley and Sons, Inc., p. 666

[3] Where $k = t17_{,0.05}(1+1/n-1)$^0.5

[4] Where UTL = $x + k(s)$

Notes:

µg/L = Micrograms Per Liter
EBP = East Burn Pads
EDA = Explosives Disposal Area
FTA = Fire Training Area
FTP = Fire Training Pit
G = Government Well
ID = Identification
JAW = JAYCOR Well
MW/M = Monitoring Well
ND = Nondetect(s)
RL = Reporting Limit
SA = Sump well
UTL = Upper Tolerance Limit
WBP = West Burn Pads Area

Concentrations in **bold** typeface indicate detected values.

Nondetect values represent one-fifth the RL.

▨ Shaded cells indicate exceedance of the UTL.

TABLE M-2
BACKGROUND 95% UPPER TOLERANCE LIMIT CALCULATIONS AND COMPARISON FOR ARSENIC
EXPLOSIVES DISPOSAL AREA GROUNDWATER
REMEDIAL ALTERNATIVES ANALYSIS

FIELD ID	Clean MW	Contaminated MW
	Arsenic (mg/L)	
FTA-99-1		< 2.0
FTA-99-2	**3.4**	
JAW-58		< 2.0
JAW-59		< 2.0
JAW-60		**3.3**
JAW-61		< 2.0
JAW-62	< 2.0	
JAW-63	< 2.0	
JAW-80		< 2.0
M-01	< 2.0	
SA-99-1		**58**
FTP-MW1		< 2.0
FTP-MW2		< 2.0
FTP-MW3		< 2.0
FTP-MW4	< 2.0	
FTP-MW5		< 2.0
FTP-MW6	< 2.0	
FTP-MW7		< 2.0
FTP-MW8	< 2.0	
EBP-MW2	**16.8**	
EBP-MW3		**2.5**
EDA-01	< 2.0	
EDA-02		< 2.0
EDA-03		< 2.0
EDA-04		< 2.0
G-29	< 2.0	
JAW-04	< 2.0	
JAW-05	< 2.0	
JAW-06		< 2.0
JAW-07	**4.0**	
JAW-64	< 2.0	
JAW-614		**2.5**
G-30		**2.5**
JAW-23		**23**
JAW-24		**99.8**
JAW-25		< 2.0
JAW-68		< 2.0
WBP-99-1		**6.1**
WBP-99-2		< 2.0
WBP-99-3		< 2.0
WBP-99-4		< 2.0
WBP-99-5		**5.8**
WBP-99-6		< 2.0
WBP-99-7	**2.9**	
WBP-MW1	2.0	
WBP-MW2	2.0	
WBP-MW3	**40.3**	

Sample Size (*n*)	18
Average without ND	13.48
Average with ND	5.19
Standard Deviation without ND	16.08
Standard Deviation with ND	9.42
UTL [1]	40.3

[1] UTL = maximum detected value

Notes:
µg/L = Micrograms Per Liter
EBP = East Burn Pads
EDA = Explosives Disposal Area
FTA = Fire Training Area
FTP = Fire Training Pit
G = Government Well
ID = Identification
JAW = JAYCOR Well
MW/M = Monitoring Well
ND = Nondetect(s)
RL = Reporting Limit
SA = Sump well
UTL = Upper Tolerance Limit
WBP = West Burn Pads Area

Concentrations in **bold** typeface indicate detected values.
Nondetect values represent one-fifth the RL.
▨ Shaded cells indicate exceedance of the UTL.

TABLE M-3
BACKGROUND 95% UPPER TOLERANCE LIMIT CALCULATIONS AND COMPARISON FOR CADMIUM
EXPLOSIVES DISPOSAL AREA GROUNDWATER
REMEDIAL ALTERNATIVES ANALYSIS

FIELD ID	**Clean MW**	**Contaminated MW**
	Cadmium (mg/L)	
FTA-99-1		< 1.0
FTA-99-2	< 1.0	
JAW-58		< 1.0
JAW-59		< 1.0
JAW-60		< 1.0
JAW-61		< 1.0
JAW-62	< 1.0	
JAW-63	< 1.0	
JAW-80		< 1.0
M-01	< 1.0	
SA-99-1		< 1.0
FTP-MW1		< 1.0
FTP-MW2		< 1.0
FTP-MW3		< 1.0
FTP-MW6	**0.11**	
FTP-MW5		**0.16**
FTP-MW4	**0.11**	
FTP-MW7		**0.06**
FTP-MW8	< 1.0	
EBP-MW2	< 1.0	
EBP-MW3		< 1.0
EDA-01	< 1.0	
EDA-02		< 1.0
EDA-03		< 1.0
EDA-04		< 1.0
G-29	< 1.0	
JAW-04	< 1.0	
JAW-05	< 1.0	
JAW-06		< 1.0
JAW-07	< 1.0	
JAW-64	< 1.0	
JAW-614		< 1.0
G-30		< 1.0
JAW-23		**5.1**
JAW-24		< 1.0
JAW-25		< 1.0
JAW-68		< 1.0
WBP-99-1		< 1.0
WBP-99-2		< 1.0
WBP-99-3		< 1.0
WBP-99-4		< 1.0
WBP-99-5		< 1.0
WBP-99-6		< 1.0
WBP-99-7	< 1.0	
WBP-MW1	< 1.0	
WBP-MW2	< 1.0	
WBP-MW3	**0.9**	

Sample Size (*n*)	18
Average without ND	0.37
Average with ND	0.90
Standard Deviation without ND	0.46
Standard Deviation with ND	0.29
UTL [1]	0.9

[1] UTL = maximum detected value

Notes:

µg/L = Micrograms Per Liter
EBP = East Burn Pads
EDA = Explosives Disposal Area
FTA = Fire Training Area
FTP = Fire Training Pit
G = Government Well
ID = Identification
JAW = JAYCOR Well
MW/M = Monitoring Well
ND = Nondetect(s)
RL = Reporting Limit
SA = Sump well
UTL = Upper Tolerance Limit
WBP = West Burn Pads Area

Concentrations in **bold** typeface indicate detected values.
Nondetect values represent one-fifth the RL.
▨ Shaded cells indicate exceedance of the UTL.

TABLE M-4
BACKGROUND 95% UPPER TOLERANCE LIMIT CALCULATIONS AND COMPARISON FOR CHROMIUM
EXPLOSIVES DISPOSAL AREA GROUNDWATER
REMEDIAL ALTERNATIVES ANALYSIS

FIELD ID	Clean MW	Contaminated MW
	Chromium (mg/L)	
FTA-99-1		**1.7**
FTA-99-2	< 2.0	
JAW-58		< 2.0
JAW-59		**1**
JAW-60		< 2.0
JAW-61		< 2.0
JAW-62	< 2.0	
JAW-63	< 2.0	
JAW-80		< 2.0
M-01	**0.75**	
SA-99-1		**0.78**
FTP-MW1		< 2.0
FTP-MW2		< 2.0
FTP-MW3		< 2.0
FTP-MW4	< 2.0	
FTP-MW5		< 2.0
FTP-MW6	< 2.0	
FTP-MW7		< 2.0
FTP-MW8	< 2.0	
EBP-MW2	**14.9**	
EBP-MW3		**0.76**
EDA-01	< 2.0	
EDA-02		< 2.0
EDA-03		< 2.0
EDA-04		< 2.0
G-29	< 2.0	
JAW-04	< 2.0	
JAW-05	< 2.0	
JAW-06		**6.7**
JAW-07	< 2.0	
JAW-64	< 2.0	
JAW-614		< 2.0
G-30		< 2.0
JAW-23		**42.3**
JAW-24		< 2.0
JAW-25		< 2.0
JAW-68		< 2.0
WBP-99-1		**7.8**
WBP-99-2		**1.4**
WBP-99-3		< 2.0
WBP-99-4		< 2.0
WBP-99-5		< 2.0
WBP-99-6		< 2.0
WBP-99-7	< 2.0	
WBP-MW1	< 2.0	
WBP-MW2	< 2.0	
WBP-MW3	**68.6**	

Sample Size (*n*)	18
Average without ND	7.83
Average with ND	2.69
Standard Deviation without ND	10.01
Standard Deviation with ND	3.16
UTL [1]	14.9

[1] UTL = maximum detected value

Notes:

µg/L = Micrograms Per Liter
EBP = East Burn Pads
EDA = Explosives Disposal Area
FTA = Fire Training Area
FTP = Fire Training Pit
G = Government Well
ID = Identification
JAW = JAYCOR Well
MW/M = Monitoring Well
ND = Nondetect(s)
RL = Reporting Limit
SA = Sump well
UTL = Upper Tolerance Limit
WBP = West Burn Pads Area

Concentrations in **bold** typeface indicate detected values.
Nondetect values represent one-fifth the RL.
▨ Shaded cells indicate exceedance of the UTL.

TABLE M-5
BACKGROUND 95% UPPER TOLERANCE LIMIT CALCULATIONS AND COMPARISON FOR LEAD
EXPLOSIVES DISPOSAL AREA GROUNDWATER
REMEDIAL ALTERNATIVES ANALYSIS

FIELD ID	Clean MW	Contaminated MW
	Lead (mg/L)	
FTA-99-1		< 2.0
FTA-99-2	< 2.0	
JAW-58		< 2.0
JAW-59		< 2.0
JAW-60		< 2.0
JAW-61		< 2.0
JAW-62	< 2.0	
JAW-63	< 2.0	
JAW-80		< 2.0
M-01	< 2.0	
SA-99-1		< 2.0
FTP-MW1		< 2.0
FTP-MW2		< 2.0
FTP-MW3		< 2.0
FTP-MW4	< 2.0	
FTP-MW5		< 2.0
FTP-MW6	< 2.0	
FTP-MW7		< 2.0
FTP-MW8	< 2.0	
EBP-MW2	< 2.0	
EBP-MW3		< 2.0
EDA-01	< 2.0	
EDA-02		< 2.0
EDA-03		< 2.0
EDA-04		< 2.0
G-29	< 2.0	
JAW-04	< 2.0	
JAW-05	< 2.0	
JAW-06		< 2.0
▨	< 2.0	
JAW-64	< 2.0	
JAW-614		< 2.0
G-30		< 2.0
JAW-23		**27**
JAW-24		< 2.0
JAW-25		< 2.0
JAW-68		< 2.0
WBP-99-1		< 2.0
WBP-99-2		< 2.0
WBP-99-3		< 2.0
WBP-99-4		< 2.0
WBP-99-5		< 2.0
WBP-99-6		< 2.0
WBP-99-7	< 2.0	
WBP-MW1	< 2.0	
WBP-MW2	< 2.0	
WBP-MW3	**35.5**	

Sample Size (*n*)	18
Average without ND	35.50
Average with ND	3.86
Standard Deviation without ND	NA
Standard Deviation with ND	7.90
UTL [1]	35.5

[1] UTL = maximum detected value

Notes:

µg/L = Micrograms Per Liter
EBP = East Burn Pads
EDA = Explosives Disposal Area
FTA = Fire Training Area
FTP = Fire Training Pit
G = Government Well
ID = Identification
JAW = JAYCOR Well
MW/M = Monitoring Well
ND = Nondetect(s)
RL = Reporting Limit
SA = Sump well
UTL = Upper Tolerance Limit
WBP = West Burn Pads Area

Concentrations in **bold** typeface indicate detected values.
Nondetect values represent one-fifth the RL.
▨ Shaded cells indicate exceedance of the UTL.

TABLE M-6
BACKGROUND 95% UPPER TOLERANCE LIMIT CALCULATIONS AND COMPARISON FOR MERCURY
EXPLOSIVES DISPOSAL AREA GROUNDWATER
REMEDIAL ALTERNATIVES ANALYSIS

FIELD ID	Clean MW	Contaminated MW
	Selenium (mg/L)	
FTA-99-1		< 0.04
FTA-99-2	< 0.04	
JAW-58		< 0.04
JAW-59		< 0.04
JAW-60	< 0.04	< 0.04
JAW-61	< 0.04	< 0.04
JAW-62	< 0.04	
JAW-63	< 0.04	
JAW-80		< 0.04
M-01	< 0.04	
SA-99-1		< 0.04
FTP-MW1		< 0.04
FTP-MW2		< 0.04
FTP-MW3		< 0.04
FTP-MW4	< 0.04	
FTP-MW5		< 0.04
FTP-MW6	< 0.04	
FTP-MW7		< 0.04
FTP-MW8	**0.022**	
EBP-MW2	< 0.04	
EBP-MW3		< 0.04
EDA-01	< 0.04	
EDA-02		< 0.04
EDA-03		**0.048**
EDA-04		**0.027**
G-29	< 0.04	
JAW-04	< 0.04	
JAW-05	< 0.04	
JAW-06		< 0.04
JAW-07	**0.077**	
JAW-64	< 0.04	
JAW-614		**0.2**
G-30		< 0.04
JAW-23		< 0.04
JAW-24		< 0.04
JAW-25		< 0.04
JAW-68		**0.023**
WBP-99-1		< 0.04
WBP-99-2		< 0.04
WBP-99-3		< 0.04
WBP-99-4		< 0.04
WBP-99-5		< 0.04
WBP-99-6		**0.022**
WBP-99-7	< 0.04	
WBP-MW1	< 0.04	
WBP-MW2	< 0.04	
WBP-MW3	**0.059**	

Sample Size (*n*)	18
Average without ND	0.05
Average with ND	0.04
Standard Deviation without ND	0.03
Standard Deviation with ND	0.01
UTL [1]	0.077

[1] UTL = maximum detected value

Notes:

µg/L = Micrograms Per Liter
EBP = East Burn Pads
EDA = Explosives Disposal Area
FTA = Fire Training Area
FTP = Fire Training Pit
G = Government Well
ID = Identification
JAW = JAYCOR Well
MW/M = Monitoring Well
ND = Nondetect(s)
RL = Reporting Limit
SA = Sump well
UTL = Upper Tolerance Limit
WBP = West Burn Pads Area

Concentrations in **bold** typeface indicate detected values.
Nondetect values represent one-fifth the RL.
▨ Shaded cells indicate exceedance of the UTL.

TABLE M-7
BACKGROUND 95% UPPER TOLERANCE LIMIT CALCULATIONS AND COMPARISON FOR SELENIUM
EXPLOSIVES DISPOSAL AREA GROUNDWATER
REMEDIAL ALTERNATIVES ANALYSIS

FIELD ID	Clean MW	Contaminated MW
	Silver (mg/L)	
FTA-99-1		< 2.0
FTA-99-2	< 2.0	
JAW-58		**5.9**
JAW-59		< 2.0
JAW-60		< 2.0
JAW-61		< 2.0
JAW-62	< 2.0	
JAW-63	< 2.0	
JAW-80		< 2.0
M-01	< 2.0	
SA-99-1		**3.7**
FTP-MW1		**0.44**
FTP-MW2		**0.16**
FTP-MW3		**16.2**
FTP-MW4	**1.5**	
FTP-MW5		**0.26**
FTP-MW6	**6.1**	
FTP-MW7		**1**
FTP-MW8	**4.1**	
EBP-MW2	< 2.0	
EBP-MW3		**3.0**
EDA-01	**3.5**	
EDA-02		**5**
EDA-03		< 2.0
EDA-04		< 2.0
G-29	< 2.0	
JAW-04	**9.5**	
JAW-05	< 2.0	
JAW-06		< 2.0
JAW-07	< 2.0	
JAW-64	< 2.0	
JAW-614		< 2.0
G-30		< 2.0
JAW-23		**3.4**
JAW-24		**5.7**
JAW-25		< 2.0
JAW-68		< 2.0
WBP-99-1		< 2.0
WBP-99-2		**2.9**
WBP-99-3		**4.2**
WBP-99-4		< 2.0
WBP-99-5		< 2.0
WBP-99-6		2.0
WBP-99-7	< 2.0	
WBP-MW1	**1.6**	
WBP-MW2	**0.66**	
WBP-MW3	**9**	

Sample Size (*n*)	18
Average without ND	4.50
Average with ND	3.11
Standard Deviation without ND	3.40
Standard Deviation with ND	2.53
UTL [1]	9.5

[1] UTL = maximum detected value

Notes:

µg/L = Micrograms Per Liter
EBP = East Burn Pads
EDA = Explosives Disposal Area
FTA = Fire Training Area
FTP = Fire Training Pit
G = Government Well
ID = Identification
JAW = JAYCOR Well
MW/M = Monitoring Well
ND = Nondetect(s)
RL = Reporting Limit
SA = Sump well
UTL = Upper Tolerance Limit
WBP = West Burn Pads Area

Concentrations in **bold** typeface indicate detected values.
Nondetect values represent one-fifth the RL.
▨ Shaded cells indicate exceedance of the UTL.

TABLE M-8
BACKGROUND 95% UPPER TOLERANCE LIMIT CALCULATIONS AND COMPARISON FOR NITRATE
EXPLOSIVES DISPOSAL AREA GROUNDWATER
REMEDIAL ALTERNATIVES ANALYSIS

FIELD ID	Clean MW	Contaminated MW
	Nitrate (mg/L)	
FTA-99-1		**1600**
FTA-99-2	**130**	
JAW-58		**90**
JAW-59		**180**
JAW-60		**80**
JAW-61		**380**
JAW-62	**310**	
JAW-63	**380**	
JAW-80		**1900**
M-01	**70**	
SA-99-1		< 10.0
FTP-MW1		**360**
FTP-MW2		**160**
FTP-MW3		< 10.0
FTP-MW4	< 10.0	
FTP-MW5		< 10.0
FTP-MW6	**190**	
FTP-MW7		**2000**
FTP-MW8	< 10.0	
EBP-MW1	**500**	
EBP-MW2	< 10	
EBP-MW3		**2800**
EBP-MW4		**100**
EBP-MW5		**770**
EBP-MW6	< 10	
EDA-01	**200**	
EDA-02		**2000**
EDA-03		**1300**
EDA-04		**690**
G-29	**500**	
JAW-04	< 10	
JAW-05	**60**	
JAW-06		< 10
JAW-07	**470**	
JAW-64	**200**	
JAW-614		**1100**
G-30		< 10.0
JAW-23		**9400**
JAW-24		< 10.0
JAW-25		**1900**
JAW-68		< 10.0
WBP-99-1		**12000**
WBP-99-2		**13000**
WBP-99-3		**1000**
WBP-99-4		**8100**
WBP-99-5		**180**
WBP-99-6		< 10.0
WBP-99-7	< 10.0	
WBP-MW1	< 10.0	
WBP-MW2	< 10.0	
WBP-MW3	**210**	

Sample Size (*n*)	20
Average without ND	268.33
Average with ND	191.25
Standard Deviation without ND	160.39
Standard Deviation with ND	178.19
UTL [1]	500

[1] UTL = maximum detected value

Notes:

µg/L = Micrograms Per Liter
EBP = East Burn Pads
EDA = Explosives Disposal Area
FTA = Fire Training Area
FTP = Fire Training Pit
G = Government Well
ID = Identification
JAW = JAYCOR Well
MW/M = Monitoring Well
ND = Nondetect(s)
RL = Reporting Limit
SA = Sump well
UTL = Upper Tolerance Limit
WBP = West Burn Pads Area

Concentrations in **bold** typeface indicate detected values.
Nondetect values represent one-fifth the RL.
▨ Shaded cells indicate exceedance of the UTL.

APPENDIX N

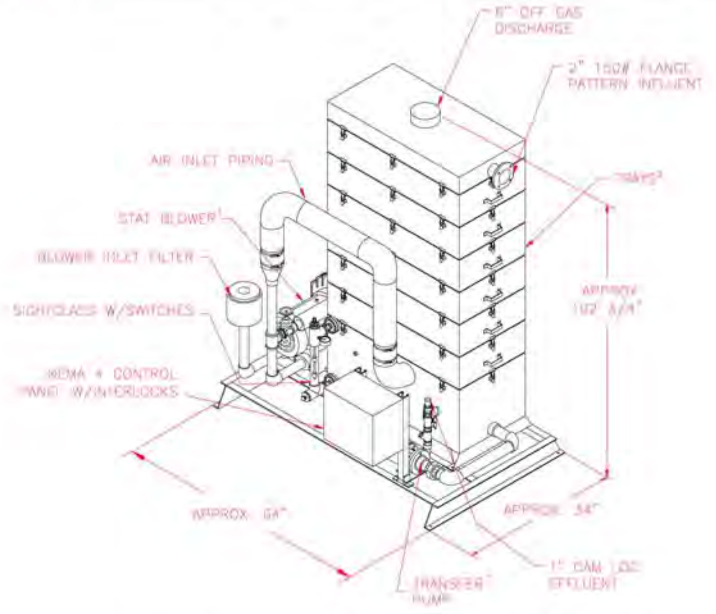
Conceptual Design Information

ALTERNATIVE 3

CARBONAIR

STAT Series Low Profile Air Stripper

STAT 30



Note: Actual dimensions and orientations may vary slightly than shown above.

Vessel Specifications

Influent Flow (gpm):	1 - 35
Air Flow (cfm):	100 - 150
Required Incoming Power:	230V, 1 Phase
Maximum Total Amperage (Amps):	31
Recommended Minimum Generator Performance (kVA[3]):	20

Options

Hose Kits

Air Flow Measurement Kit

Air Temperature Measurement Kit

Water Flow Measurement Kit

Water Temperature Measurement Kit

Service Rated Disconnect

[1] Explosion proof blower motor and pump motor available.
[2] Six trays are standard. Deduct 10" from the overall height for each tray removed.
[3] Generator sizing is estimated. Contact generator supplier for generator selection.

__MINNESOTA: (corp hdqrtrs)__
Carbonair
2731 Nevada Ave. N.
New Hope, MN 55427
PH:800.526.4999
763.544.2154
FAX:763.544.2151
Homepage: www.carbonair.com

__FLORIDA:__
Carbonair
4710 Dignan Street
Jacksonville, FL 32254
PH:800.241.7833
904.387.4465
FAX:904.387.5058

__VIRGINIA:__
Carbonair
4328 West Main St.
Salem, VA 24153
PH:800.204.0324
540.380.5913
FAX:540.380.5920

__TEXAS:__
Carbonair
4889 Hunter Rd. Bldg 1-C
San Marcos, TX 78666
PH:800.893.5937
512.392.0085
FAX:512.392.0066

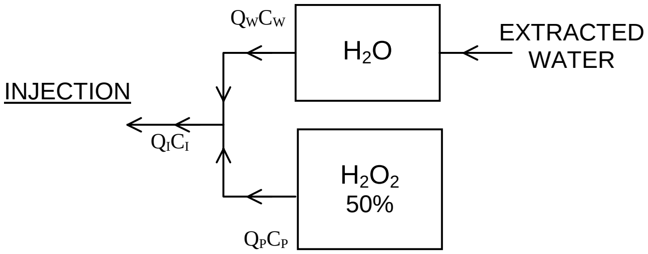
Taken from: ***http://www.carbonair.com/rental%20spec%20sheets/STATs/STAT%2030.pdf***

ALTERNATIVE 4

Goal

Determine H_2O_2 dosage rate (Q_P) required to achieve an injection concentration of 1,000 mg (H_2O_2) per liter.

Assumptions



- Conditions are steady state (no storage).
- $C_I = 1,000$ mg/L (H_2O_2)
- $C_P = 598,000$ mg/L (H_2O_2) (vendor provided)
- $Q_I = 2$ gpm = 7.6 L/min
- $C_W = 0$ mg/L (H_2O_2)
- No H_2O_2 will be created or destroyed prior to injection.

Solution

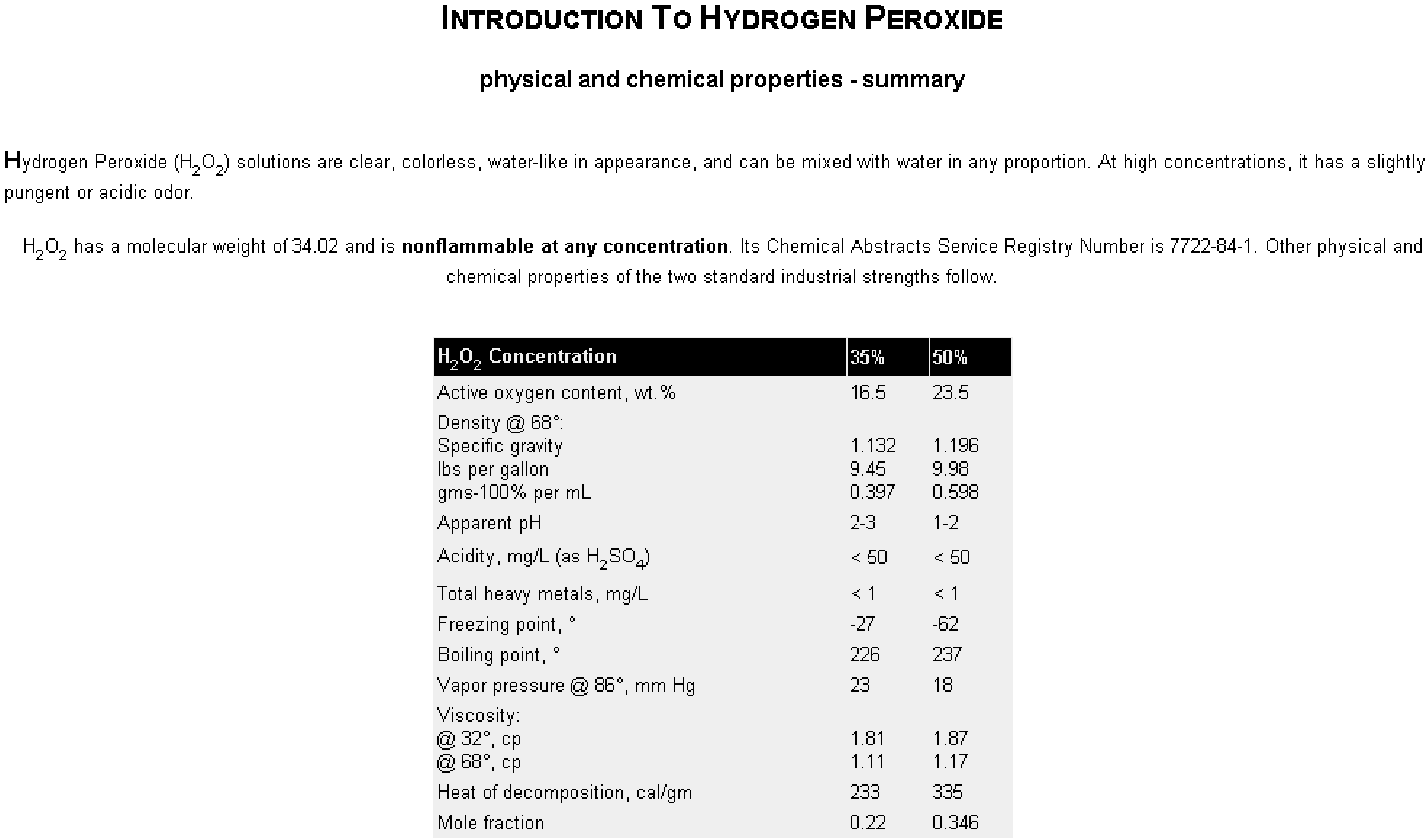
$$Q_IC_I = (Q_WC_W) + (Q_PC_P) \quad \text{(mass balance @ steady state)}$$

$$Q_P = \frac{Q_IC_I}{C_P}$$

$$Q_P = \frac{(7.6\ \text{L/min})(1{,}000\ \text{mg/L}\ (H_2O_2))}{598{,}000\ \text{mg/L}\ (H_2O_2)} = 0.013\ \text{L/min}\ (H_2O_2)$$

$$= \boxed{\textbf{4.9 gal/day}}$$

ALTERNATIVE 4



INTRODUCTION TO HYDROGEN PEROXIDE

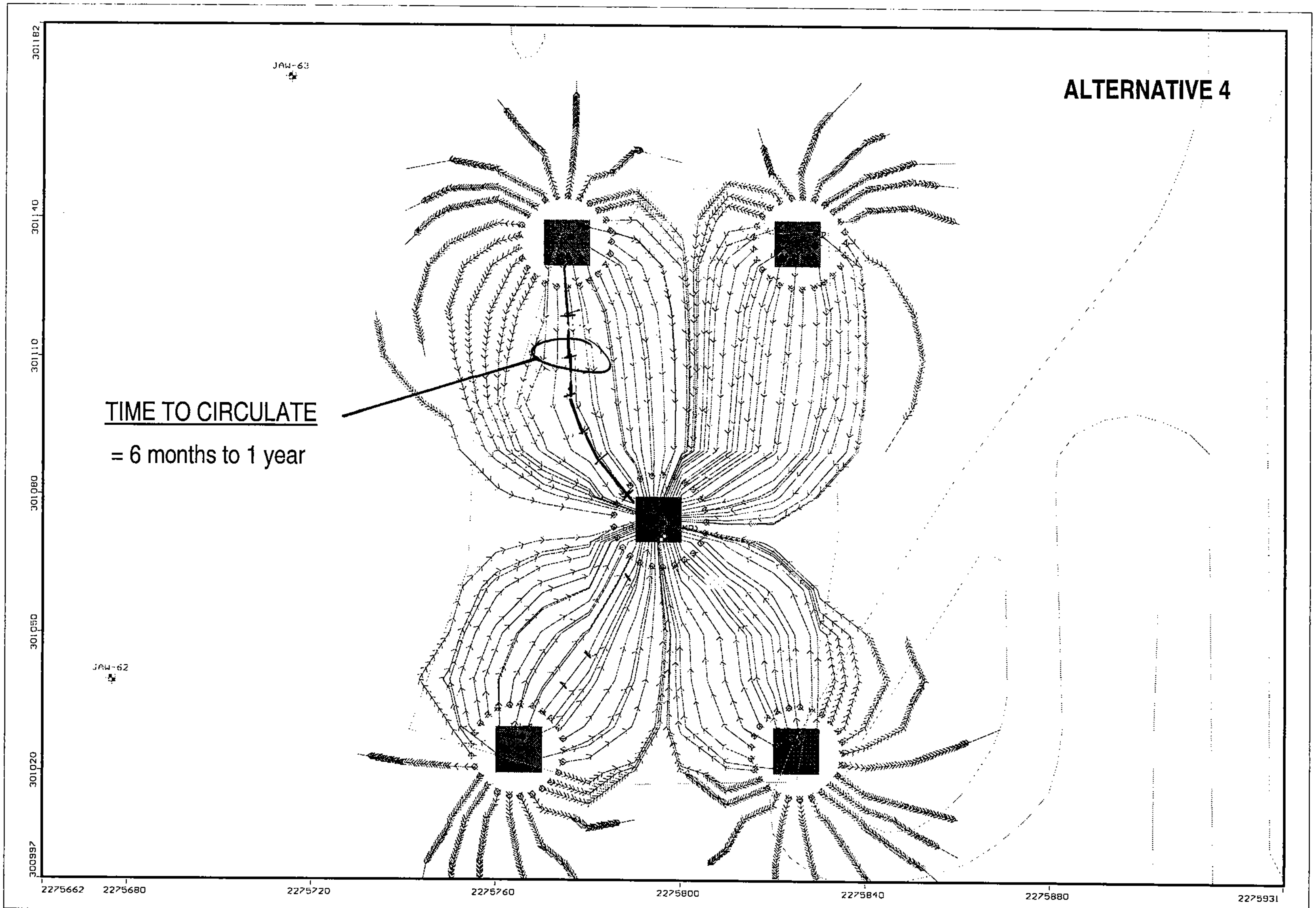
physical and chemical properties - summary

Hydrogen Peroxide (H_2O_2) solutions are clear, colorless, water-like in appearance, and can be mixed with water in any proportion. At high concentrations, it has a slightly pungent or acidic odor.

H_2O_2 has a molecular weight of 34.02 and is **nonflammable at any concentration**. Its Chemical Abstracts Service Registry Number is 7722-84-1. Other physical and chemical properties of the two standard industrial strengths follow.

H_2O_2 Concentration	35%	50%
Active oxygen content, wt.%	16.5	23.5
Density @ 68°:		
Specific gravity	1.132	1.196
lbs per gallon	9.45	9.98
gms-100% per mL	0.397	0.598
Apparent pH	2-3	1-2
Acidity, mg/L (as H_2SO_4)	< 50	< 50
Total heavy metals, mg/L	< 1	< 1
Freezing point, °	-27	-62
Boiling point, °	226	237
Vapor pressure @ 86°, mm Hg	23	18
Viscosity:		
@ 32°, cp	1.81	1.87
@ 68°, cp	1.11	1.17
Heat of decomposition, cal/gm	233	335
Mole fraction	0.22	0.346

Taken from ***http://www.h2o2.com/intro/properties/summary.html***



URS Corporation
Project: IAAAP FTP Modeling
Description: FTP–ISCO 2 GPM Extraction
Modeller: 30 d tick marks for 5 yr
27 Feb 04

Visual MODFLOW v.3.1.0, (C) 1995–2002
Waterloo Hydrogeologic, Inc.
NC: 354 NR: 244 NL: 7
Current Layer: 1

HRC Design Software for Plume Area/Grid Treatment

US Version 3.1

Regenesis Technical Support: USA (949) 366-8000, www.regenesis.com

Site Name: IAAAP FTP (East plume), Initial Application
Location: Middleton, Iowa
Consultant: URS

Site Conceptual Model/Extent of Plume Requiring Remediation					
Width of plume (intersecting gw flow direction)	155	ft			
Length of plume (parallel to gw flow direction)	230	ft	=	35,650	sq. ft.
Depth to contaminated zone	20	ft			
Thickness of contaminated saturated zone	10	ft			
Nominal aquifer soil (gravel, sand, silty sand, silt, clay)	clay				
Total porosity	0.3		Eff. porosity:	0.3	
Hydraulic conductivity	0.06	ft/day	=	2.1E-05	cm/sec
Hydraulic gradient	0.078	ft/ft			
Seepage velocity	5.7	ft/yr	=	0.016	ft/day,
Treatment Zone Pore Volume	106,950	ft^3	=	800,093	gallons

	Contaminant		Stoich. (wt/wt)
Dissolved Phase Electron Donor Demand	Conc (mg/L)	Mass (lb)	contam/H_2
Tetrachloroethene (PCE)	0.04	0.2	20.7
Trichloroethene (TCE)	0.00	0.0	21.9
cis-1,2-dichloroethene (DCE)	0.00	0.0	24.2
Vinyl Chloride (VC)	0.00	0.0	31.2
Carbon tetrachloride	0.00	0.0	19.2
Chloroform	0.00	0.0	19.9
1,1,1-Trichloroethane (TCA)	2.10	14.0	22.2
1,1-Dichlorochloroethane (DCA)	0.72	4.8	24.7
Hexavalent Chromium	0.00	0.0	17.3
RDX	0.00	0.0	20.0
User added, also add stoichiometric demand	0.00	0.0	0.0

Sorbed Phase Electron Donor Demand					
Soil bulk density	1.5	g/cm^3	=	94	lb/cf
Fraction of organic carbon: foc	0.0007	range: 0.0001 to 0.01			

(Values are estimated using Soil Conc=foc*Koc*Cgw)	Koc	Contaminant		Stoich. (wt/wt)
(Adjust Koc as nec. to provide realistic estimates)	(L/kg)	Conc (mg/kg)	Mass (lb)	contam/H_2
Tetrachloroethene (PCE)	263	0.01	0.2	20.7
Trichloroethene (TCE)	107	0.00	0.0	21.9
cis-1,2-dichloroethene (DCE)	80	0.00	0.0	24.2
Vinyl Chloride (VC)	2.5	0.00	0.0	31.2
Carbon tetrachloride	110	0.00	0.0	19.2
Chloroform	34	0.00	0.0	19.9
1,1,1-Trichloroethane (TCA)	183	0.27	9.0	22.2
1,1-Dichlorochloroethane (DCA)	183	0.09	3.1	24.7
RDX	108	0.00	0.0	20.0
User added, also add stoichiometric demand	0	0.00	0.0	0.0

	Electron Acceptor		Stoich. (wt/wt)
Competing Electron Acceptors	Conc (mg/L)	Mass (lb)	elec acceptor/H_2
Oxygen	7.71	51	8.0
Nitrate	0.09	1	12.4
Est. Mn reduction demand (potential amt of Mn2+ formed)	1.00	7	27.5
Est. Fe reduction demand (potential amt of Fe2+ formed)	0.01	0	55.9
Estimated sulfate reduction demand	35.00	233	12.0

Microbial Demand Factor	3	Recommend 1-4x
Safety Factor	3	Recommend 1-4x

Injection Point Spacing and Dose:				
Injection spacing within rows (ft)	10.0	# points per row:	16	
Injection spacing between rows (ft)	20.0	# of rows:	12	
Advective travel time bet. rows (days)	1282	Total # of points:	192	
		Minimum req. HRC dose per foot (lb/ft)	4.0	<-Minumum Dose Override

HRC Design Software for Plume Area/Grid Treatment

US Version 3.1

Regenesis Technical Support: USA (949) 366-8000, www.regenesis.com

Site Name: IAAAP FTP (East plume), Initial Application
Location: Middleton, Iowa
Consultant: URS

Project Summary				
Number of HRC delivery points (adjust as nec. for site)			192	
HRC Dose in lb/foot (adjust as nec. for site)			4.0	<-Minumum Dose Override
Corresponding amount of HRC per point (lb)			40	
Number of 30 lb HRC Buckets per injection point			1.3	
Total Number of 30 lb Buckets			256	
Total Amt of HRC (lb)			7,680	
HRC Cost		$	5.50	List Price has been adjusted
Total Material Cost		**$**	**42,240**	
Shipping and Tax Estimates in US Dollars				
Sales Tax	rate: 7%	$	-	
Total Matl. Cost		$	42,240	
Shipping of HRC (call for amount)		$	-	
Total Regenesis Material Cost		**$**	**42,240**	

HRC Installation Cost Est. (responsibility of customer to contract work)		
Footage for each inj. point = uncontaminated + HRC inj. interval (ft)		30
Total length for direct push for project (ft)		5,760
Estimated daily installation rate (ft per day: 500 for push, 200 for drilling)		400
Estimated points per day (10 to 20 is typical for direct push)		13.3
Required number of days		15
Mob/demob cost for injection subcontractor	$	-
Daily rate for inj. Sub. ($1-2K for push $3-4K for drill rig)	$	-
Total injection subcontrator cost for application	$	-
Total Install Cost (not inc. consultant, lab, etc.)	**$**	**42,240**

Other Project Costs		
Design and regulatory issues	$	-
Groundwater monitoring and rpt	$	-
Other	$	-
Other	$	-
Other	$	-
Other	$	-
Other	$	-
Other	$	-
Total Project Cost	**$**	**42,240**

HRC Design Software for Plume Area/Grid Treatment

US Version 3.1

Regenesis Technical Support: USA (949) 366-8000, www.regenesis.com

Site Name: IAAAP FTP (South plume), Initial Application
Location: Middleton, Iowa
Consultant: URS

Site Conceptual Model/Extent of Plume Requiring Remediation

Width of plume (intersecting gw flow direction)	100	ft			
Length of plume (parallel to gw flow direction)	260	ft	=	26,000	sq. ft.
Depth to contaminated zone	15	ft			
Thickness of contaminated saturated zone	10	ft			
Nominal aquifer soil (gravel, sand, silty sand, silt, clay)	clay				
Total porosity	0.3		Eff. porosity:	0.3	
Hydraulic conductivity	0.11	ft/day	=	3.9E-05	cm/sec
Hydraulic gradient	0.03	ft/ft			
Seepage velocity	4.0	ft/yr	=	0.011	ft/day,
Treatment Zone Pore Volume	78,000	ft^3	=	583,518	gallons

	Contaminant		Stoich. (wt/wt)
Dissolved Phase Electron Donor Demand	Conc (mg/L)	Mass (lb)	contam/H_2
Tetrachloroethene (PCE)	0.08	0.4	20.7
Trichloroethene (TCE)	0.12	0.6	21.9
cis-1,2-dichloroethene (DCE)	0.02	0.1	24.2
Vinyl Chloride (VC)	0.00	0.0	31.2
Carbon tetrachloride	0.00	0.0	19.2
Chloroform	0.00	0.0	19.9
1,1,1-Trichloroethane (TCA)	0.27	1.3	22.2
1,1-Dichlorochloroethane (DCA)	0.00	0.0	24.7
Hexavalent Chromium	0.00	0.0	17.3
RDX	0.00	0.0	20.0
User added, also add stoichiometric demand	0.00	0.0	0.0

Sorbed Phase Electron Donor Demand

Soil bulk density	1.5	g/cm^3	=	94	lb/cf
Fraction of organic carbon: foc	0.0007	range: 0.0001 to 0.01			

(Values are estimated using Soil Conc=foc*Koc*Cgw)	Koc	Contaminant		Stoich. (wt/wt)
(Adjust Koc as nec. to provide realistic estimates)	(L/kg)	Conc (mg/kg)	Mass (lb)	contam/H_2
Tetrachloroethene (PCE)	263	0.01	0.3	20.7
Trichloroethene (TCE)	107	0.01	0.2	21.9
cis-1,2-dichloroethene (DCE)	80	0.00	0.0	24.2
Vinyl Chloride (VC)	2.5	0.00	0.0	31.2
Carbon tetrachloride	110	0.00	0.0	19.2
Chloroform	34	0.00	0.0	19.9
1,1,1-Trichloroethane (TCA)	183	0.03	0.8	22.2
1,1-Dichlorochloroethane (DCA)	183	0.00	0.0	24.7
RDX	108	0.00	0.0	20.0
User added, also add stoichiometric demand	0	0.00	0.0	0.0

	Electron Acceptor		Stoich. (wt/wt)
Competing Electron Acceptors	Conc (mg/L)	Mass (lb)	elec acceptor/H_2
Oxygen	0.23	1	8.0
Nitrate	0.08	0	12.4
Est. Mn reduction demand (potential amt of Mn2+ formed)	1.00	5	27.5
Est. Fe reduction demand (potential amt of Fe2+ formed)	0.02	0	55.9
Estimated sulfate reduction demand	39.00	190	12.0

Microbial Demand Factor	3	Recommend 1-4x
Safety Factor	3	Recommend 1-4x

Injection Point Spacing and Dose:

Injection spacing within rows (ft)	10.0	# points per row:	10	
Injection spacing between rows (ft)	20.0	# of rows:	13	
Advective travel time bet. rows (days)	1818	Total # of points:	130	
		Minimum req. HRC dose per foot (lb/ft)	4.0	<-Minumum Dose Override

HRC Design Software for Plume Area/Grid Treatment

US Version 3.1

Regenesis Technical Support: USA (949) 366-8000, www.regenesis.com

Site Name: IAAAP FTP (South plume), Initial Application
Location: Middleton, Iowa
Consultant: URS

Project Summary				
Number of HRC delivery points (adjust as nec. for site)			130	
HRC Dose in lb/foot (adjust as nec. for site)			4.0	<-Minumum Dose Override
Corresponding amount of HRC per point (lb)			40	
Number of 30 lb HRC Buckets per injection point			1.3	
Total Number of 30 lb Buckets			174	
Total Amt of HRC (lb)			5,220	
HRC Cost		$	5.50	List Price has been adjusted
Total Material Cost		**$**	**28,710**	
Shipping and Tax Estimates in US Dollars				
Sales Tax	rate: 7%	$	-	
Total Matl. Cost		$	28,710	
Shipping of HRC (call for amount)		$	-	
Total Regenesis Material Cost		**$**	**28,710**	

HRC Installation Cost Est. (responsibility of customer to contract work)			**Other Project Costs**		
Footage for each inj. point = uncontaminated + HRC inj. interval (ft)		25	Design and regulatory issues	$	-
Total length for direct push for project (ft)		3,250	Groundwater monitoring and rpt	$	-
Estimated daily installation rate (ft per day: 500 for push, 200 for drilling)		400	Other	$	-
Estimated points per day (10 to 20 is typical for direct push)		16.0	Other	$	-
Required number of days		9	Other	$	-
Mob/demob cost for injection subcontractor	$	-	Other	$	-
Daily rate for inj. Sub. ($1-2K for push $3-4K for drill rig)	$	-	Other	$	-
Total injection subcontrator cost for application	$	-	Other	$	-
Total Install Cost (not inc. consultant, lab, etc.)	**$**	**28,710**	**Total Project Cost**	**$**	**28,710**

APPENDIXO Remedial Alternative Cost Estimates

List of Tables

Cost Worksheets

TABLE O-1
COMPARISON OF TOTAL COST OF REMEDIAL ALTERNATIVES
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

Site: FTP Groundwater
Location: IAAAP Middletown, Iowa
Phase: RAA (-30% to +50%)

Base Year: 2004
Date: 5/17/2004

Description	**Alternative 1** **No Action**	**Alternative 2** **MNA**	**Alternative 3** **Focused Extraction/MNA**	**Alternative 4** **ISCO/MNA**	**Alternative 5** **Enhanced Degradation/MNA**
Total Project Duration (Years)	55	55	20	20	20
Capital Cost	$0	$114,000	$208,000	$225,000	$504,000
Total O&M Cost	$0	$1,849,000	$1,037,000	$822,000	$822,000
Total Periodic Cost	$0	$113,000	$49,000	$105,000	$305,000
Total Cost of Alternative	$0	$2,075,000	$1,295,000	$1,152,000	$1,631,000
Total Present Value of Alternative	**$0**	**$711,000**	**$882,000**	**$773,000**	**$1,228,000**

TABLE O-2
COST ESTIMATE SUMMARY - ALTERNATIVE 2
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

MONITORED NATURAL ATTENUATION

Site: FTP Groundwater
Location: IAAAP Middletown, Iowa
Phase: RAA (-30% to +50%)
Base Year: 2004
Date: 5/17/2004

Description: No active remediation systems used. Intall 10 new monitoring wells. Annual groundwater sampling at 19 wells in Years 1 to 10. Annual groundwater sampling at 9 wells in Years 11 to 55. Institutional and engineering controls to mitigate risks. Capital costs in Year 0; O&M costs in Years 1 to 55; periodic costs in Years 5,10,15,20,25,30,35,40,45,50, and 55.

CAPITAL COSTS:

Description	Qty	Unit	Unit Cost	Cost	Notes
Mobilization/Demobilization					
Submittals/Implementation Plans	1	LS	$8,000	$8,000	FSP, QAPP, SSHP
Subtotal				**$8,000**	
Monitoring, Sampling, Testing, Analysis					
MW Installation, Development	10	EA	$3,521	$35,209	See cost worksheet
GW Sampling, Analysis - Initial	1	LS	$23,817	$23,817	See cost worksheet
Surveying	1	LS	$1,200	$1,200	9 MWs
Subtotal				**$60,225**	
Subtotal 1				**$68,225**	
Contingency	25%			$17,056	10% scope + 15% bid
Subtotal 2				**$85,281**	
Project Management	10%			$8,528	
Remedial Design	20%			$17,056	
Construction Management	15%			$12,792	
Subtotal				**$25,584**	
Institutional Controls	1	LS	$3,000	$3,000	Implementation plan
TOTAL CAPITAL COST:				**$113,866**	

ANNUAL O&M COSTS (YEARS 1-10):

Description	Qty	Unit	Unit Cost	Cost	Notes
Site Monitoring					
GW Sampling, Analysis	19	EA	$1,254	$23,817	See cost worksheet
Data Management	1	LS	$2,000	$2,000	
Reporting	1	LS	$8,000	$8,000	Annual reporting
Subtotal				**$33,817**	
Contingency	25%			$8,454	10% scope + 15% bid
Subtotal				**$42,271**	
Project Management	10%			$4,227	
Technical Support	15%			$6,341	
Subtotal				**$10,568**	
TOTAL ANNUAL O&M COST (YEARS 1-10):				**$52,838**	

TABLE O-2
COST ESTIMATE SUMMARY - ALTERNATIVE 2
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

MONITORED NATURAL ATTENUATION

ANNUAL O&M COSTS (YEARS 11-55):

Description	Qty	Unit	Unit Cost	Cost	Notes
Site Monitoring					
GW Sampling, Analysis	9	EA	$1,254	$11,282	See cost worksheet per well cost
Data Management	1	LS	$1,500	$1,500	
Reporting	1	LS	$6,000	$6,000	Annual reporting
Subtotal				**$18,782**	
Contingency	25%			$4,695	10% scope + 15% bid
Subtotal				**$23,477**	
Project Management	10%			$2,348	
Technical Support	15%			$3,522	
Subtotal				**$5,869**	
TOTAL ANNUAL O&M COST (YEARS 11-55):				**$29,346**	

PERIODIC COSTS:

Description	Year	Qty	Unit	Unit Cost	Cost	Notes
Five-Year Review Report	5 to 55	1	EA	$8,000	$8,000	
MW Maintenance	5 to 55	1	EA	$1,500	$1,500	Repair damage, redevelop
Subtotal					**$9,500**	
MW Abandonment	55	25	EA	$300	$7,500	25 MWs
Remedial Action Report	55	1	EA	$10,000	$10,000	
Subtotal					**$17,500**	

PRESENT VALUE ANALYSIS:

Cost Type	Year	Total Cost	Total Cost Per Year	Discount Factor (7%)	Present Value	Notes
Capital Cost	0	$113,866	$113,866	1.000	$113,866	
O&M Cost	1-10	$528,383	$52,838	7.024	$371,114	
O&M Cost	11-55	$1,320,575	$29,346	6.916	$202,968	
Periodic Cost	5	$9,500	$9,500	0.713	$6,773	
Periodic Cost	10	$9,500	$9,500	0.508	$4,829	
Periodic Cost	15	$9,500	$9,500	0.362	$3,443	
Periodic Cost	20	$9,500	$9,500	0.258	$2,455	
Periodic Cost	25	$9,500	$9,500	0.184	$1,750	
Periodic Cost	30	$9,500	$9,500	0.131	$1,248	
Periodic Cost	35	$9,500	$9,500	0.094	$890	
Periodic Cost	40	$9,500	$9,500	0.067	$634	
Periodic Cost	45	$9,500	$9,500	0.048	$452	
Periodic Cost	50	$9,500	$9,500	0.034	$323	
Periodic Cost	55	$17,500	$17,500	0.024	$424	
		$2,075,324			**$711,170**	
TOTAL PRESENT VALUE OF ALTERNATIVE:					**$711,000**	

TABLE O-3
COST ESTIMATE SUMMARY - ALTERNATIVE 3
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

FOCUSED EXTRACTION/MNA

Site: FTP Groundwater
Location: IAAAP Middletown, Iowa
Phase: RAA (-30% to +50%)
Base Year: 2004
Date: 5/17/2004

Description: Intall 10 new monitoring wells. Install a submersible pump in SA-99-1 to remove and treat contaminated groundwater for Years 1 to 5. Annual groundwater sampling at 19 wells in Years 1 to 10. Annual groundwater sampling at 9 wells in Years 11 to 20. Institutional and engineering controls to mitigate risks. Capital costs in Year 0; O&M costs in Years 1 to 20; periodic costs in Years 5,10,15, and 20.

CAPITAL COSTS:

Description	Qty	Unit	Unit Cost	Cost	Notes
Mobilization/Demobilization					
Submittals/Implementation Plans	1	LS	$10,000	$10,000	FSP, QAPP, SSHP
Subtotal				**$10,000**	
Monitoring, Sampling, Testing, Analysis					
MW Installation, Development	10	EA	$3,521	$35,209	See cost worksheet
GW Sampling, Analysis - Initial	19	EA	$1,254	$23,817	See cost worksheet
Photo Ionization Detector	1	LS	$4,000	$4,000	For off-gas monitoing
Surveying	1	LS	$1,300	$1,300	10 MWs
Subtotal				**$64,325**	
Extraction System Installation					
Submersible Pump Install	1	EA	$2,500	$2,500	4-in diameter pneumatic
Equilization Tank	1	EA	$300	$300	300-gal poly
Air Stripper	1	EA	$7,700	$7,700	3 tray, 210 cfm
Air Compressor	1	EA	$250	$250	5-hp, 30-gal
Electric Heater	1	EA	$150	$150	
Pumps/Piping/Controls/Electrical	1	LS	$13,791	$13,791	See cost worksheet
Steel Building	1	EA	$10,000	$10,000	15-ft x 15-ft with slab
Subtotal				**$34,691**	
Subtotal 1				**$109,016**	
Contingency	30%			$32,705	15% scope + 15% bid
Subtotal 2				**$141,721**	
Project Management	10%			$14,172	
Remedial Design	20%			$28,344	
Construction Management	15%			$21,258	
Subtotal				**$63,774**	
Institutional Controls	1	LS	$3,000	$3,000	Implementation plan
TOTAL CAPITAL COST:				**$208,495**	

TABLE O-3
COST ESTIMATE SUMMARY - ALTERNATIVE 3
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

FOCUSED EXTRACTION/MNA

ANNUAL O&M COSTS (YEARS 1-5):

Description	Qty	Unit	Unit Cost	Cost	Notes
Site Monitoring					
GW Sampling, Analysis	19	EA	$1,254	$23,817	
Data Management	1	EA	$2,000	$2,000	
Reporting	1	EA	$8,000	$8,000	Annual reporting
Subtotal				**$33,817**	
Treatment System Monitoring, Maintenance					
O&M Labor	12	MO	$1,000	$12,000	3 day/wk, includes sampling
Equipment/Repair	1	LS	$1,000	$1,000	
Power Usage	12	MO	$500	$6,000	Process, $0.07/Kwh
Water Sampling, Analysis	4	QTR	$400	$1,600	1 sample for VOCs, explosives, metals, incl shipping
Data Management	4	QTR	$750	$3,000	
Reporting	4	QTR	$1,000	$4,000	
Subtotal				**$27,600**	
Subtotal 1				**$61,417**	
Contingency	25%			$15,354	10% scope + 15% bid
Subtotal 2				**$76,771**	
Project Management	10%			$7,677	
Technical Support	15%			$11,516	
Subtotal				**$19,193**	
TOTAL ANNUAL O&M COST (YEARS 1-5):				**$95,963**	

ANNUAL O&M COSTS (YEARS 6-10):

Description	Qty	Unit	Unit Cost	Cost	Notes
Site Monitoring					
GW Sampling, Analysis	19	EA	$1,254	$23,817	See cost worksheet per well cost
Data Management	1	LS	$2,000	$2,000	
Reporting	1	LS	$8,000	$8,000	Annual reporting
Subtotal				**$33,817**	
Contingency	25%			$8,454	10% scope + 15% bid
Subtotal				**$42,271**	
Project Management	10%			$4,227	
Technical Support	15%			$6,341	
Subtotal				**$10,568**	
TOTAL ANNUAL O&M COST (YEARS 6-10):				**$52,838**	

TABLE O-3
COST ESTIMATE SUMMARY - ALTERNATIVE 3
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

FOCUSED EXTRACTION/MNA

ANNUAL O&M COSTS (YEARS 11-20):

Description	Qty	Unit	Unit Cost	Cost	Notes
Site Monitoring					
GW Sampling, Analysis	9	EA	$1,254	$11,282	See cost worksheet per well cost
Data Management	1	LS	$1,500	$1,500	
Reporting	1	LS	$6,000	$6,000	Annual reporting
Subtotal				**$18,782**	
Contingency	25%			$4,695	10% scope + 15% bid
Subtotal				**$23,477**	
Project Management	10%			$2,348	
Technical Support	15%			$3,522	
Subtotal				**$5,869**	
TOTAL ANNUAL O&M COST (YEARS 11-20):				**$29,346**	

PERIODIC COSTS:

Description	Year	Qty	Unit	Unit Cost	Cost	Notes
Five-Year Review Report	5,10,15	1	EA	$8,000	$8,000	
Well Maintenance	5,10,15	1	EA	$1,500	$1,500	Repair damage, redevelop
Subtotal					**$9,500**	
Dismantle Treatment System	20	1	EA	$2,500	$2,500	
Well Abandonment	20	26	EA	$300	$7,800	25 MWs, and 1 EW
Remedial Action Report	20	1	EA	$10,000	$10,000	
Subtotal					**$20,300**	

PRESENT VALUE ANALYSIS:

Cost Type	Year	Total Cost	Total Cost Per Year	Discount Factor (7%)	Present Value	Notes
Capital Cost	0	$208,495	$208,495	1.000	$208,495	
O&M Cost	1-5	$479,817	$95,963	4.100	$393,469	
O&M Cost	6-10	$264,192	$52,838	2.923	$154,467	
O&M Cost	11-20	$293,461	$29,346	3.570	$104,778	
Periodic Cost	5	$9,500	$9,500	0.713	$6,773	
Periodic Cost	10	$9,500	$9,500	0.508	$4,829	
Periodic Cost	15	$9,500	$9,500	0.362	$3,443	
Periodic Cost	20	$20,300	$20,300	0.258	$5,246	
		$1,294,765			**$881,501**	
TOTAL PRESENT VALUE OF ALTERNATIVE:					**$882,000**	

TABLE O-4
COST ESTIMATE SUMMARY - ALTERNATIVE 4
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

ISCO/MNA

Site: FTP Groundwater
Location: IAAAP Middletown, Iowa
Phase: RAA (-30% to +50%)
Base Year: 2004
Date: 5/17/2004

Description: Install 1 extraction well and 4 injection wells to circulate H_2O_2 throughout the sump area groundwater for one year. Intall 10 new monitoring wells. Annual groundwater sampling at 19 wells in Years 1 to 10. Annual groundwater sampling at 9 wells in Years 10 to 20. Institutional and engineering controls to mitigate risks. Capital costs in Year 0; O&M costs in Years 1 to 20; periodic costs in Years 1,5,10,15, and 20.

CAPITAL COSTS:

Description	Qty	Unit	Unit Cost	Cost	Notes
Mobilization/Demobilization					
Submittals/Implementation Plans	1	LS	$10,000	$10,000	FSP, QAPP, SSHP
Subtotal				**$10,000**	
Monitoring, Sampling, Testing, Analysis					
MW Installation, Development	10	EA	$3,521	$35,209	See cost worksheet
GW Sampling, Analysis - Initial	19	EA	$1,254	$23,817	See cost worksheet
Surveying	1	LS	$1,300	$1,300	10 MWs
Subtotal				**$60,325**	
ISCO Treatment System					
Submersible Pump Install	1	EA	$2,500	$2,500	4-in diameter pneumatic
Equilization Tank	1	EA	$300	$300	300-gal poly for extracted water collection
Injection Wells	4	EA	$3,920	$15,682	See cost worksheet
Air Compressor	1	EA	$250	$250	5-hp, 30-gal
Pumps/Piping/Controls/Electrical	1	LS	$12,679	$12,679	See cost worksheet
Trailer	1	EA	$5,000	$5,000	
Subtotal				**$36,411**	
Subtotal 1				**$106,736**	
Contingency	30%			$32,021	15% scope + 15% bid
Subtotal 2				**$138,757**	
Project Management	10%			$13,876	
Pre-Design Investigation	15%			$20,814	Pump test, bench and field scale treatability testing
Remedial Design	20%			$27,751	
Construction Management	15%			$20,814	
Subtotal				**$83,254**	
Institutional Controls	1	LS	$3,000	$3,000	Implementation plan
TOTAL CAPITAL COST:				**$225,011**	

ANNUAL O&M COSTS (YEARS 1-10):

Description	Qty	Unit	Unit Cost	Cost	Notes
Site Monitoring					
GW Sampling, Analysis	19	EA	$1,254	$23,817	See cost worksheet per well cost
Data Management	1	LS	$2,000	$2,000	
Reporting	1	LS	$8,000	$8,000	Annual reporting
Subtotal				**$33,817**	
Contingency	25%			$8,454	10% scope + 15% bid
Subtotal				**$42,271**	
Project Management	10%			$4,227	
Technical Support	15%			$6,341	
Subtotal				**$10,568**	
TOTAL ANNUAL O&M COST (YEARS 1-10):				**$52,838**	

TABLE O-4
COST ESTIMATE SUMMARY - ALTERNATIVE 4
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

ISCO/MNA

ANNUAL O&M COSTS (YEARS 11-20):

Description	Qty	Unit	Unit Cost	Cost	Notes
Site Monitoring					
GW Sampling, Analysis	9	EA	$1,254	$11,282	See cost worksheet per well cost
Data Management	1	LS	$1,500	$1,500	
Reporting	1	LS	$6,000	$6,000	Annual reporting
Subtotal				**$18,782**	
Contingency	25%			$4,695	10% scope + 15% bid
Subtotal				**$23,477**	
Project Management	10%			$2,348	
Technical Support	15%			$3,522	
Subtotal				**$5,869**	
TOTAL ANNUAL O&M COST (YEARS 11-20):				**$29,346**	

PERIODIC COSTS:

Description	Year	Qty	Unit	Unit Cost	Cost	Notes
Treatment System Monitoring, Maintenance						
O&M Labor	1	12	MO	$1,000	$12,000	3 day/wk, includes sampling
Equipment/Repair	1	1	LS	$1,000	$1,000	
Power Usage	1	12	MO	$500	$6,000	Process, $0.07/Kwh
Hydrogen Peroxide	1	1	LS	$25,869	$25,869	50% solution, 32-500lb drums/yr
Hydrogen Peroxide Shipping	1	16000	LB	$0.1	$1,600	32-500lb drums
Water Sampling, Analysis	1	4	QTR	$400	$1,600	1 sample for VOCs, explosives, metals, incl shipping
Data Management	1	4	QTR	$750	$3,000	
Reporting	1	4	QTR	$1,000	$4,000	
Subtotal					**$55,069**	
Five-Year Review Report	5,10,15	1	EA	$8,000	$8,000	
Well Maintenance	5,10,15	1	EA	$1,500	$1,500	Repair damage, redevelop
Subtotal					**$9,500**	
Dismantle Treatment System	20	1	EA	$2,500	$2,500	
Well Abandonment	20	30	EA	$300	$9,000	25 MWs, 4 IWs, 1 EW,
Remedial Action Report	20	1	EA	$10,000	$10,000	
Subtotal					**$21,500**	

PRESENT VALUE ANALYSIS:

Cost Type	Year	Total Cost	Total Cost Per Year	Discount Factor (7%)	Present Value	Notes
Capital Cost	0	$225,011	$225,011	1.000	$225,011	
O&M Cost	1-10	$528,383	$52,838	7.024	$371,114	
O&M Cost	11-20	$293,461	$29,346	3.570	$104,778	
Periodic Cost	1	$55,069	$55,069	0.935	$51,466	
Periodic Cost	5	$9,500	$9,500	0.713	$6,773	
Periodic Cost	10	$9,500	$9,500	0.508	$4,829	
Periodic Cost	15	$9,500	$9,500	0.362	$3,443	
Periodic Cost	20	$21,500	$21,500	0.258	$5,556	
		$1,151,924			**$772,972**	
TOTAL PRESENT VALUE OF ALTERNATIVE:					**$773,000**	

TABLE O-5
COST ESTIMATE SUMMARY - ALTERNATIVE 5
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

ENHANCED DEGRADATION/MNA

Site: FTP Groundwater
Location: IAAAP Middletown, Iowa
Phase: RAA (-30% to +50%)
Base Year: 2004
Date: 5/17/2004

Description: Install 1 extraction well and 4 injection wells to circulate H_2O_2 throughout the sump area groundwater for one year. Use direct push to inject HRC^{TM} into CVOC plume outside the sump area. HRC^{TM} re-applied once. Intall 10 new monitoring wells. Annual groundwater sampling at 19 wells in Years 1 to 10. Annual groundwater sampling at 9 wells in Years 10 to 20. Institutional and engineering controls to mitigate risks. Capital costs in Year 0; O&M costs in Years 1 to 20; periodic costs in Years 1,2,5,10,15, and 20.

CAPITAL COSTS:

Description	Qty	Unit	Unit Cost	Cost	Notes
Mobilization/Demobilization					
Submittals/Implementation Plans	1	LS	$10,000	$10,000	FSP, QAPP, SSHP
Subtotal				**$10,000**	
Monitoring, Sampling, Testing, Analysis					
MW Installation, Development	10	EA	$3,521	$35,209	See cost worksheet
GW Sampling, Analysis - Initial	19	EA	$1,254	$23,817	See cost worksheet
Surveying	1	LS	$1,300	$1,300	10 MWs
Subtotal				**$60,325**	
ISCO Treatment System					
Submersible Pump Install	1	EA	$2,500	$2,500	4-in diameter pneumatic
Equilization Tank	1	EA	$300	$300	300-gal poly for extracted water collection
Injection Wells	4	EA	$3,920	$15,682	See cost worksheet
Air Compressor	1	EA	$250	$250	5-hp, 30-gal
Pumps/Piping/Controls/Electrical	1	LS	$12,679	$12,679	See cost worksheet
Trailer	1	EA	$5,000	$5,000	
Subtotal				**$36,411**	
HRC Injection	1	LS	$162,787	**$162,787**	See cost worksheet
Subtotal 1				**$269,523**	
Contingency	30%			$80,857	15% scope + 15% bid
Subtotal 2				**$350,380**	
Project Management	8%			$28,030	
Pre-Design Investigation	10%			$35,038	Pump test, bench and field scale treatability testing
Remedial Design	15%			$52,557	
Construction Management	10%			$35,038	
Subtotal				**$150,663**	
Institutional	1	LS	$3,000	$3,000	Implementation plan
TOTAL CAPITAL COST:				**$504,043**	

ANNUAL O&M COSTS (YEARS 1-10):

Description	Qty	Unit	Unit Cost	Cost	Notes
Site Monitoring					
GW Sampling, Analysis	19	EA	$1,254	$23,817	See cost worksheet per well cost
Data Management	1	LS	$2,000	$2,000	
Reporting	1	LS	$8,000	$8,000	Annual reporting
Subtotal				**$33,817**	
Contingency	25%			$8,454	10% scope + 15% bid
Subtotal				**$42,271**	
Project Management	10%			$4,227	
Technical Support	15%			$6,341	
Subtotal				**$10,568**	
TOTAL ANNUAL O&M COST (YEARS 1-10):				**$52,838**	

TABLE O-5
COST ESTIMATE SUMMARY - ALTERNATIVE 5
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

ENHANCED DEGRADATION/MNA

ANNUAL O&M COSTS (YEARS 11-20):

Description	Qty	Unit	Unit Cost	Cost	Notes
Site Monitoring					
GW Sampling, Analysis	9	EA	$1,254	$11,282	See cost worksheet per well cost
Data Management	1	LS	$1,500	$1,500	
Reporting	1	LS	$6,000	$6,000	Annual reporting
Subtotal				**$18,782**	
Contingency	25%			$4,695	10% scope + 15% bid
Subtotal				**$23,477**	
Project Management	10%			$2,348	
Technical Support	15%			$3,522	
Subtotal				**$5,869**	
TOTAL ANNUAL O&M COST (YEARS 11-20):				**$29,346**	

PERIODIC COSTS:

Description	Year	Qty	Unit	Unit Cost	Cost	Notes
Treatment System Monitoring, Maintenance						
O&M Labor	1	12	MO	$1,000	$12,000	3 day/wk, includes sampling
Equipment/Repair	1	1	LS	$1,000	$1,000	
Power Usage	1	12	MO	$500	$6,000	Process, $0.07/Kwh
Hydrogen Peroxide	1	1	LS	$25,869	$25,869	50% solution, 32 500-lb drums/Year
Hydrogen Peroxide Shipping	1	16000	LB	$0.1	$1,600	32 500-lb drums
Water Sampling, Analysis	1	4	QTR	$400	$1,600	1 sample for VOCs, explosives, metals, incl shipping
Data Management	1	4	QTR	$750	$3,000	
Reporting	1	4	QTR	$1,000	$4,000	
HRC Performance Sampling	1	3	EA	$6,268	$18,803	Qrtly, 5 wells (excl annual)
Subtotal					**$73,872**	
HRC Performance Sampling	2	3	EA	$6,268	$18,803	Qrtly, 5 wells (excl annual)
HRC Re-Injection	2	1	EA	$162,787	$162,787	See cost worksheet
Subtotal					**$181,589**	
Five-Year Review Report	5,10,15	1	EA	$8,000	$8,000	
Well Maintenance	5,10,15	1	EA	$1,500	$1,500	Repair damage, redevelop
Subtotal					**$9,500**	
Dismantle Treatment System	20	1	EA	$2,500	$2,500	
Well Abandonment	20	30	EA	$300	$9,000	25 MWs, 4 IWs, 1 EW,
Remedial Action Report	20	1	EA	$10,000	$10,000	
Subtotal					**$21,500**	

TABLE O-5
COST ESTIMATE SUMMARY - ALTERNATIVE 5
FIRE TRAINING PIT GROUNDWATER REMEDIAL ALTERNATIVES ANALYSIS

ENHANCED DEGRADATION/MNA

PRESENT VALUE ANALYSIS:

Cost Type	Year	Total Cost	Total Cost Per Year	Discount Factor (7%)	Present Value	Notes
Capital Cost	0	$504,043	$504,043	1.000	$504,043	
O&M Cost	1-10	$528,383	$52,838	7.024	$371,114	
O&M Cost	11-20	$293,461	$29,346	3.570	$104,778	
Periodic Cost	1	$73,872	$73,872	0.935	$69,039	
Periodic Cost	2	$181,589	$181,589	0.873	$158,607	
Periodic Cost	5	$9,500	$9,500	0.713	$6,773	
Periodic Cost	10	$9,500	$9,500	0.508	$4,829	
Periodic Cost	15	$9,500	$9,500	0.362	$3,443	
Periodic Cost	20	$21,500	$21,500	0.258	$5,556	
		$1,631,348			**$1,228,184**	

TOTAL PRESENT VALUE OF ALTERNATIVE: **$1,228,000**

Capital Cost Sub-Element

COST WORKSHEET

MONITORING WELL INSTALLATION AND DEVELOPMENT

Site: FTP Groundwater
Location: IAAAP Middletown, Iowa
Phase: RAA (-30% to +50%)
Base Year: 2004

Prepared By: DRH
Date: 5/17/2004

Checked By: JMR
Date: 5/17/2004

Work Statement:

Install (5 days), develop (2 days), and slug test (2 days) additional LTM monitoring wells. Assume 10 shallow (25-foot) wells. Install includes drilling with 4.25-inch HSAs, continuous soil sampling, install of 2-inch Schedule 40 PVC blank and factory-slotted screen, and aboveground completions.

Cost Analysis:

DESCRIPTION	QTY	UNIT	LABOR	EQUIP	MTRL	UNIT TOTAL	TOTAL	NOTES
Labor								
Field Preparation	4	HR	43	-	-	43	172	$43/hr tech
Digging Permits	4	HR	43	-	-	43	172	$43/hr tech
Drilling Oversight	100	HR	113	-	-	113	11300	$70/hr geo+$43/hr tech (incl travel time)
SUBTOTAL							$11,644	
Supplies, Rental, and Travel								
PPE/Decon/Misc Suppiles	1	EA	-	-	150	150	150	
Hermit Transducer and Logger	2	DAY	-	100	-	100	200	Slug testing
Horiba U-10	2	DAY	-	21	-	21	42	Development
Submersible Pump	2	DAY	-	63	-	63	126	
Polyethylene Tubing	100	LF	-	-	0.25	0.25	25	
Water Level Probe	9	DAY	-	40	-	40	360	
Minirae PID	9	DAY	-	35	-	35	315	
Per Diem (2-man crew)	9	DAY	-	-	-	170	1530	($30+$55) x 2
Mileage	1150	MI	-	-	-	0.36	414	800 mi mob/demob+50 mi/day x 9 days
SUBTOTAL							$3,162	
G&A Markup						5.0%	158	
SUBTOTAL							$3,320	
Subcontract								
Drillers Mob/Demob	1	LS	-	-	-	500	500	
Drillers Per Diem (3-man crew)	3	DAY	-	-	-	150	450	
Install Temp Decon Pads	1	EA	-	-	-	200	200	
Overburden Drilling (2-in SS)	250	LF	-	-	-	18	4500	4.25-in HSA
2-in PVC Sched 40 Riser	170	LF	-	-	-	8.7	1479	10-ft sections
2-in PVC Sched 40 Fact-Slot Scrn	100	LF	-	-	-	12.25	1225	10-ft sections
Filter Pack Sand	120	LF	-	-	-	9	1080	Colorado silica
Bentonite Seal	10	EA	-	-	-	33.5	335	0.375-in chips
Annular Seal	110	LF	-	-	-	5	550	Bentonite grout
Completions/Protective Cover	9	EA	-	-	-	250	2250	
55-gal Drums, Filled and Staged	20	EA	-	-	-	65	1300	Includes drums
Off-site IDW Transport	1	LS	-	-	-	495	495	Subcontract disposal service
Off-site IDW Disposal	20	EA	-	-	-	45	900	Subcontract disposal service
SUBTOTAL							$15,264	
Prime Contractor Overhead						15.0%	2290	Applies to subcontract only
SUBTOTAL							$32,518	
Prime Contractor Profit						10.0%	2691	Applies to labor and subcontract only
TOTAL COST							**$35,209**	
						OR	**$3,521**	Per monitoring well

Source of Cost Data:

Previous experience with drilling in 2003. RSMeans 2004, Environmental Remediation Cost Data, 10th Annual Edition.

Cost Adjustment Checklist:

FACTOR:	NOTES:
☑ H&S Productivity (labor and equipment only)	Level D
☑ Escalation to Base Year	Current year (2004) is base year
☑ Area Cost Factor	0.86 based on area code (RS Means data only)
☑ Subcontractor Overhead and Profit	Included in cost
☑ Prime Contractor Overhead and Profit	Includes 15% overhead and 10% profit

Capital Cost Sub-Element # COST WORKSHEET

FOCUSED EXTRACTION - TREATMENT SYSTEM PUMPS/PIPING/CONTROLS/ELECTRICAL

Site: FTP Groundwater
Location: IAAAP Middletown, Iowa
Phase: RAA (-30% to +50%)
Base Year: 2004

Prepared By: DRH
Date: 5/17/2004

Checked By: JMR
Date: 5/17/2004

Work Statement:

Subcontractors supply and install pipes, meters, electrical, and controls hookup.

Cost Analysis:

DESCRIPTION	QTY	UNIT	LABOR	EQUIP	MTRL	UNIT TOTAL	TOTAL	NOTES
Exterior Pipe Install								
Mob/Demob	1	LS	-	-	-	250	250	
Trenching	1	DAY	100	300	-	400	400	Chain trencher
0.75-in Poly	50	LF	-	-	-	1.2	60	Air to submersible pump
1-in PVC	50	LF	-	-	-	2	100	Influent
2-in PVC	80	LF	-	-	-	2.6	208	Effluent
SUBTOTAL							$1,018	
Process Pumps Install								
Transfer, 0.5-hp, 10-gpm	2	EA	-	-	-	2500	5000	
SUBTOTAL							$5,000	
Interior Process Pipe Install								
1-in PVC	20	LF	-	-	-	8.7	174	Includes fittings
2-in PVC	20	LF	-	-	-	7.6	152	Includes fittings
4-in PVC	30	LF	-	-	-	10.8	324	Off-gas
SUBTOTAL							$650	
Interior Process Pipe Install								
1-in Ball Valve	1	EA	12	-	34	46	46	
2-in Ball Valve	2	EA	81	-	16	97	194	
4-in Ball Valve	2	EA	262	-	25	287	574	
1-in Check Valve	1	EA	40	-	12	52	52	
2-in Check Valve	2	EA	93	-	16	109	218	
1-in Flow Meter	1	EA	-	-	-	100	100	
2-in Flow Meter	2	EA	-	-	-	200	400	
Pressure Gauge	3	EA	-	-	-	25	75	
Temp Gauge	3	EA	-	-	-	25	75	
SUBTOTAL							$1,734	
Electrical Hookup	1	LS	-	-	-	2500	2500	Includes controls, process, building
SUBTOTAL							$2,500	
SUBTOTAL							$10,902	
Prime Contractor Overhead						15.0%	1635	Applies to all
SUBTOTAL							$12,537	
Prime Contractor Profit						10.0%	1254	
TOTAL COST							**$13,791**	

Source of Cost Data:

RSMeans 2004. Environmental Remediation Cost Data, 10th Annual Edition.

Cost Adjustment Checklist:

FACTOR:	NOTES:
☑ H&S Productivity (labor and equipment only)	Level D
☑ Escalation to Base Year	Current year (2004) is base year
☑ Area Cost Factor	0.86 based on area code (RS Means data only)
☑ Subcontractor Overhead and Profit	Included in cost
☑ Prime Contractor Overhead and Profit	Includes 15% overhead and 10% profit

Cost Sub-Element

COST WORKSHEET

GROUNDWATER SAMPLING AND ANALYSIS

Site: FTP Groundwater
Location: IAAAP Middletown, Iowa
Phase: RAA (-30% to +50%)
Base Year: 2004

Prepared By: DRH
Date: 5/17/2004

Checked By: JMR
Date: 5/17/2004

Work Statement:

Groundwater sampling cost per event (19 wells total). Assume 2.5 hours per well by a 2-person team (47.5 hours total). VOCs, explosives, metals, and natural attenuation parameters analyzed in the laboratory.

Cost Analysis:

DESCRIPTION	QTY	UNIT	LABOR	EQUIP	MTRL	UNIT TOTAL	TOTAL	NOTES
Labor								
Technician	57.5	HR	43	-	-	43	2473	includes travel time
Geo/Chem/Eng	57.5	HR	70	-	-	70	4025	includes travel time
SUBTOTAL							$6,498	
Supplies, Rental, and Travel								
PPE/Decon/Misc Suppiles	1	EA	-	-	150	150	150	
Horiba U-10	5	DAY	-	21	-	21	105	
Peristaltic Pump	5	DAY	-	63	-	63	315	
Polyethylene Tubing	450	LF	-	-	0.25	0.25	113	
Water Level Probe	5	DAY	-	8	-	8	40	
Minirae PID	5	DAY	-	35	-	35	175	
Per Diem (2-man crew)	5	DAY	-	-	-	170	850	($30+$55) x 2
Package and Ship	5	EA	-	-	-	90	450	
Mileage	1050	MI	-	-	-	0.36	378	800 mi mob/demob+50 mi/day x 5 days
SUBTOTAL							$2,576	
G&A Markup						5.0%	129	
SUBTOTAL							$2,704	
Subcontract								
Lab Analysis								
VOCs	21	EA	-	-	-	140	2940	Includes 10% duplicates
Explosives	21	EA	-	-	-	145	3045	Includes 10% duplicates
Metals	21	EA	-	-	-	70	1470	Includes 10% duplicates
Natural Attenuation Parameters	21	EA	-	-	-	177	3717	Includes 10% duplicates
SUBTOTAL							$11,172	
Prime Contractor Overhead						15.0%	1676	applies to subcontract only
SUBTOTAL							$22,050	
Prime Contractor Profit						10.0%	1767	applies to labor and subcontract only
TOTAL COST							**$23,817**	
						OR	**$1,254**	per monitoring well

Source of Cost Data:

Previous experience with drilling in 2003. RSMeans 2004, Environmental Remediation Cost Data, 10th Annual Edition.

Cost Adjustment Checklist:

FACTOR:	NOTES:
☑ H&S Productivity (labor and equipment only)	Level D
☑ Escalation to Base Year	Current year (2004) is base year
☑ Area Cost Factor	0.86 based on area code (RS Means data only)
☑ Subcontractor Overhead and Profit	Included in cost
☑ Prime Contractor Overhead and Profit	Includes 15% overhead and 10% profit

Capital Cost Sub-Element

COST WORKSHEET

ISCO - TREATMENT SYSTEM PUMPS/PIPING/CONTROLS/ELECTRICAL

Site: FTP Groundwater
Location: IAAAP Middletown, Iowa
Phase: RAA (-30% to +50%)
Base Year: 2004

Prepared By: DRH
Date: 5/17/2004

Checked By: JMR
Date: 5/17/2004

Work Statement:

Subcontractors supply and install pipes, meters, electrical, and controls hookup.

Cost Analysis:

DESCRIPTION	QTY	UNIT	LABOR	EQUIP	MTRL	UNIT TOTAL	TOTAL	NOTES
Exterior Pipe Install								
Mob/Demob	1	LS	-	-	-	250	250	
0.75-in Poly	50	LF	-	-	-	1.2	60	Air to submersible pump
1-in SS SCH 40	220	LF	-	-	-	11.7	2574	To injection wells
SUBTOTAL							$2,884	
Process Equipment								
Injection Pump	1	EA	-	-	-	1287	1287	Adjustable, 0 to 20 gpm, 200 psi
Feed Tank, Regulator, Injector	1	EA	-	-	-	2368	2368	Peroxide mixture/controls
SUBTOTAL							$3,655	
Interior Process Pipe Install	1							
1-in SS SCH 40	20	LF	-	-	-	11.7	234	Includes fittings
1-in Flow Meter	5	EA	-	-	-	100	500	
Pressure Gauge	5	EA	-	-	-	25	125	
Temp Gauge	5	EA	-	-	-	25	125	
SUBTOTAL							$984	
Electrical Hookup	1	LS	-	-	-	2500	2500	Includes controls, process, trailer
SUBTOTAL							$2,500	
SUBTOTAL							$10,023	
Prime Contractor Overhead						15.0%	1503	Applies to all
SUBTOTAL							$11,526	
Prime Contractor Profit						10.0%	1153	
TOTAL COST							**$12,679**	

Source of Cost Data:

RSMeans 2004. Environmental Remediation Cost Data, 10th Annual Edition.

Cost Adjustment Checklist:

FACTOR:	NOTES:
☑ H&S Productivity (labor and equipment only)	Level D
☑ Escalation to Base Year	Current year (2004) is base year
☑ Area Cost Factor	0.86 based on area code (RS Means data only)
☑ Subcontractor Overhead and Profit	Included in cost
☑ Prime Contractor Overhead and Profit	Includes 15% overhead and 10% profit

Capital Cost Sub-Element

COST WORKSHEET

INJECTION WELL INSTALLATION AND DEVELOPMENT

Site: FTP Groundwater
Location: IAAAP Middletown, Iowa
Phase: RAA (-30% to +50%)
Base Year: 2004

Prepared By: DRH
Date: 5/17/2004

Checked By: JMR
Date: 5/17/2004

Work Statement:

Install (2 days) and develop (1 day) ISCO injection wells. Assume 4 shallow (15-foot) wells. Install includes drilling with 4.25-inch HSAs, continuous soil sampling, install of 2-inch stainless steel blank and factory-slotted screen, and below ground completions.

Cost Analysis:

DESCRIPTION	QTY	UNIT	LABOR	EQUIP	MTRL	UNIT TOTAL	TOTAL	NOTES
Labor								
Field Preparation	4	HR	43	-	-	43	172	$43/hr tech
Digging Permits	4	HR	43	-	-	43	172	$43/hr tech
Drilling Oversight	40	HR	113	-	-	113	4520	$70/hr geo+$43/hr tech (incl travel time)
SUBTOTAL							$4,864	
Supplies, Rental, and Travel								
PPE/Decon/Misc Suppiles	1	EA	-	-	150	150	150	
Hermit Transducer and Logger	1	DAY	-	100	-	100	100	Slug testing
Horiba U-10	1	DAY	-	21	-	21	21	Development
Submersible Pump	1	DAY	-	63	-	63	63	
Polyethylene Tubing	100	LF	-	-	0.25	0.25	25	
Water Level Probe	3	DAY	-	40	-	40	120	
Minirae PID	3	DAY	-	35	-	35	105	
Per Diem (2-man crew)	3	DAY	-	-	-	170	510	($30+$55) x 2
Mileage	950	MI	-	-	-	0.36	342	800 mi mob/demob+50 mi/day x 3 days
SUBTOTAL							$1,436	
G&A Markup						5.0%	72	
SUBTOTAL							$1,508	
Subcontract								
Drillers Mob/Demob	1	LS	-	-	-	500	500	
Drillers Per Diem (3-man crew)	1	DAY	-	-	-	150	150	
Install Temp Decon Pads	1	EA	-	-	-	200	200	
Overburden Drilling (2-inch SS)	60	LF	-	-	-	18	1080	4.25-in HSA
2-in SS Riser	40	LF	-	-	-	21.9	876	10-ft sections
2-in SS Screen	20	LF	-	-	-	18.6	372	5-ft sections
Filter Pack Sand	28	LF	-	-	-	9	252	Colorado silica
Bentonite Seal	4	EA	-	-	-	33.5	134	0.375-in chips
Annular Seal	24	LF	-	-	-	5	120	Bentonite grout
Completions/Protective Cover	4	EA	-	-	-	500	2000	24-in diameter CMP vault with lid
55-gal Drums, Filled and Staged	8	EA	-	-	-	65	520	Includes drums
Off-site IDW Transport	1	LS	-	-	-	495	495	Subcontract disposal service
Off-site IDW Disposal	8	EA	-	-	-	45	360	Subcontract disposal service
SUBTOTAL							$7,059	
Prime Contractor Overhead						15.0%	1059	Applies to subcontract only
SUBTOTAL							$14,490	
Prime Contractor Profit						10.0%	1192	Applies to labor and subcontract only
TOTAL COST							**$15,682**	
						OR	**$3,920**	Per injection well

Source of Cost Data:

Previous experience with drilling in 2003. RSMeans 2004, Environmental Remediation Cost Data, 10th Annual Edition.

Cost Adjustment Checklist:

FACTOR:	NOTES:
☑ H&S Productivity (labor and equipment only)	Level D
☑ Escalation to Base Year	Current year (2004) is base year
☑ Area Cost Factor	0.86 based on area code (RS Means data only)
☑ Subcontractor Overhead and Profit	Included in cost
☑ Prime Contractor Overhead and Profit	Includes 15% overhead and 10% profit

Capital Cost Sub-Element
HRC INJECTION

COST WORKSHEET

Site: FTP Groundwater
Location: IAAAP Middletown, Iowa
Phase: RAA (-30% to +50%)
Base Year: 2004

Prepared By: DRH
Date: 5/17/2004

Checked By: JMR
Date: 5/17/2004

Work Statement:

Inject HRC^{TM} into the contaminant plume using direct push injection. Treatment zone covers areas east and south od SA-99-1. Estimated 12 days to complete using two rigs.

Cost Analysis:

DESCRIPTION	QTY	UNIT	LABOR	EQUIP	MTRL	UNIT TOTAL	TOTAL	NOTES
Labor								
Field Preparation	8	HR	43	-	-	43	344	$43/hr tech
Digging Permits	8	HR	43	-	-	43	344	$43/hr tech
Drilling Oversight	130	HR	140	-	-	140	18200	$70/hr geo/eng x 2 (incl travel time)
SUBTOTAL							$18,888	
Supplies, Rental, and Travel								
HRC Product	12900	LB	-	-	5.5	5.5	70950	see HRC^{TM} design sheets (App. N)
HRC Tax	1	LS	-	-	-	6.50%	4612	6.50%
HRC Shipping	12900	LB	-	-	0.1	0.1	1290	
PPE/H&S Setups	1	LS	-	250	-	250	250	
Minirae PID	12	DAY	-	70	-	70	840	x 2
Oversight Per Diem (2-man crew)	12	DAY	-	-	-	170	2040	($30+$55) x 2
Mileage	1400	MI	-	-	-	0.36	504	800 mi mob/demob+50 mi/day x 12 days
SUBTOTAL							$80,486	
G&A Markup						5.0%	4024	
SUBTOTAL							$84,510	
Subcontract								
Direct Push Mob/Demob	2	LS	-	-	-	1000	2000	2 rigs and 2 crews
Direct Push	11	DAY	-	-	-	4000	44000	$2000/day/rig
SUBTOTAL							$46,000	
Prime Contractor Overhead						15.0%	6900	applies to subcontract only
SUBTOTAL							$156,298	
Prime Contractor Profit						10.0%	6489	applies to labor and subcontract only
TOTAL COST							**$162,787**	

Source of Cost Data:

Regenesis HRC Grid Design Versino 3.1 and cost information from Regenesis sales rep.

Cost Adjustment Checklist:

FACTOR:	NOTES:
☑ H&S Productivity (labor and equipment only)	Level D
☑ Escalation to Base Year	Current year (2004) is base year
☑ Area Cost Factor	0.86 based on area code (RS Means data only)
☑ Subcontractor Overhead and Profit	Included in cost
☑ Prime Contractor Overhead and Profit	Includes 15% overhead and 10% profit