Per the Federal Facility Agreement for Iowa Army Ammunition Plant, Article X.B.1, the attached document is the final version of the submitted document.

VOLUME 1 OF 2

HydroGeoLogic INC.

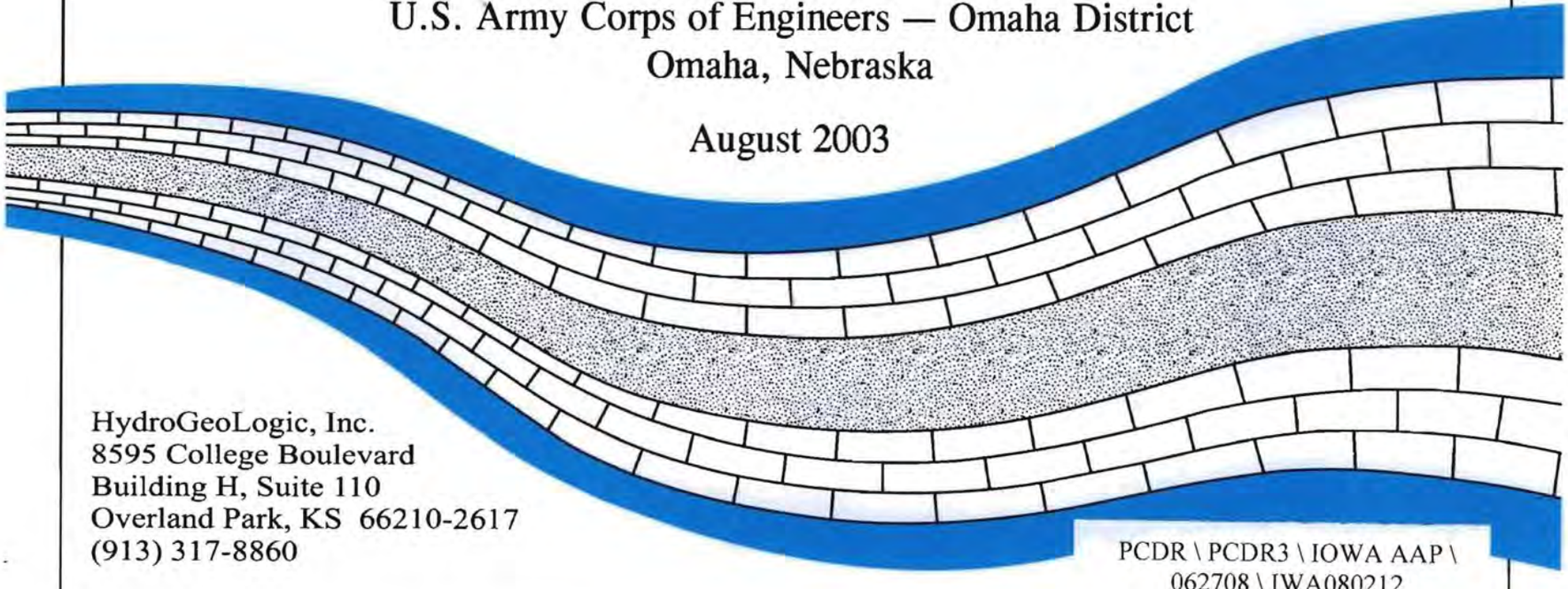
DRAFT FINAL

2002
GROUNDWATER MONITORING REPORT

IOWA ARMY AMMUNITION PLANT
MIDDLETOWN, IOWA

Prepared for
U.S. Army Corps of Engineers — Omaha District
Omaha, Nebraska

August 2003



HydroGeoLogic, Inc.
8595 College Boulevard
Building H, Suite 110
Overland Park, KS 66210-2617
(913) 317-8860

PCDR \ PCDR3 \ IOWA AAP \
062708 \ IWA080212

DRAFT

2002 GROUNDWATER MONITORING REPORT IOWA ARMY AMMUNITION PLANT, MIDDLETOWN, IOWA

Prepared for

U.S. Army Corps of Engineers
Omaha District

Contract No. DACA41-02-D-0004
Delivery Order No. DK02

March 2003

3

DRAFT

2002 GROUNDWATER MONITORING REPORT
IOWA ARMY AMMUNITION PLANT
MIDDLETOWN, IOWA

Prepared for

U.S. Army Corps of Engineers
Omaha District

Prepared by

HydroGeoLogic, Inc.
8595 College Boulevard, Suite 110
Overland Park, KS 66210

March 2003

TABLE OF CONTENTS

TABLE OF CONTENTS

PAGE

TABLE OF CONTENTS

PAGE

TABLE OF CONTENTS

PAGE

TABLE OF CONTENTS

APPENDICES

LIST OF TABLES

LIST OF TABLES

LIST OF FIGURES

LIST OF FIGURES

LIST OF FIGURES

LIST OF ACRONYMS AND ABBREVIATIONS

1,1,1-TCA	1,1,1-trichloroethane
1,1,2-TCA	1,1,2-trichloroethane
1,1-DCA	1,1-dichloroethane
1,1-DCE	1,1-dichloroethene
1,2-DCA	1,2-dichloroethane
1,3,5-TNB	1,3,5-trinitrobenzene
1,3-DNB	1,3-dinitrobenzene
2,4,6-TNT	2,4,6-trinitrotoluene
2,4-DNT	2,4-dinitrotoluene
2,6-DNT	2,6-dinitrotoluene
2-Am-DNT	2-amino-4,6-dinitrotoluene
4-Am-DNT	4-amino-2,6-dinitrotoluene
AO	American Ordnance
bgs	below ground surface
°C	degrees Celsius
CAMU	Corrective Action Management Unit
CCB	continuing calibration blank
CCC	calibration check compound
CCV	continuing calibration verification
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
cis-1,2-DCE	cis-1,2-dichloroethene
CLP	Contract Laboratory Program
COC	chain-of-custody
%D	percent difference
DERP	Defense Environmental Restoration Program
DI	deionized
DO	dissolved oxygen
DoD	Department of Defense
E & E	Ecology and Environment, Inc.
EPA	U.S. Environmental Protection Agency
ER,A	Environmental Restoration, Army
eV	electron volt
°F	degrees Fahrenheit
FS	Feasibility Study
Freon 12	dichlorodifluoromethane

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

Freon 113	1,1,2-trichloro-1,2,2-trifluoroethane
FUSRAP	Formerly Utilized Sites Remedial Action Program
GAC	granular activated carbon
GOCO	government-owned, contractor-operated
GPS	Global Positioning System
HALs	Health Advisory Levels
HGL	HydroGeoLogic, Inc.
HMX	cyclotetramethylenetetranitramine
HSWA	Hazardous and Solid Waste Amendments
HRS	Hazard Ranking System
IAAAP	Iowa Army Ammunition Plant
IAG	Interagency Agreement
ICV	initial calibration verification
IDA	Inert Disposal Area
IDW	investigation derived waste
IGS	Iowa Geologic Survey
LCS	laboratory control sample
LLNL	Lawrence Livermore National Laboratory
LTM	long-term monitoring
MCL	Maximum Contaminant Level
MHC	Mason and Hanger Corporation
µg/L	Micrograms per Liter
MIBK	methyl isobutyl ketone
MNX	hexahydro-1-nitroso-3,5-dinitro-1,3,5-triazine
MS/MSD	matrix spike/matrix spike duplicate
MSL	mean sea level
mV	millivolts
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
ORP	oxidation reduction potential
OSWER	Office of Solid Waste and Emergency Response
OUs	Operable Units
PA	Preliminary Assessment
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

pCi/L	picoCuries per liter
PCE	tetrachloroethene
PID	Photoionization detector
PRGs	Preliminary Remediation Goals
ppb	part per billion
PP	Proposed Plan
PPE	personal protective equipment
PQL	practical quantitation limit
QAPP	Quality Control Project Plan
QA/QC	Quality Assurance/Quality Control
RA	Risk Assessment
RCRA	Resource Conservation and Recovery Act
RD/RA	Remedial Design/Remedial Action
RDX	cyclotrimethylenetrinitramine
RI	Remedial Investigation
RLs	Risk Levels
ROD	Record of Decision
RPD	relative percent difference
RSD	relative standard deviation
SI	Site Investigation
SDGs	sample delivery groups
SOPs	standard operating procedures
SPCC	system performance check compound
SVOCs	semivolatile organic compounds
TCE	trichloroethylene
TKN	total Kjeldahl nitrogen
TOC	top of casing or total organic carbon
TOX	total organic halides
UCL	upper control limit
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
UST	underground storage tank
VOCs	volatile organic compounds

17

DRAFT FINAL

2002 GROUNDWATER MONITORING REPORT
IOWA ARMY AMMUNITION PLANT
MIDDLETOWN, IOWA

Prepared for

U.S. Army Corps of Engineers
Omaha District

Prepared by

HydroGeoLogic, Inc.
8595 College Boulevard, Suite 110
Overland Park, KS 66210

August 2003

Executive Summary

EXECUTIVE SUMMARY

This document presents the results of the 2002 groundwater monitoring events at the Iowa Army Ammunition Plant (Iowa AAP), in Middletown, Iowa. Work for this assignment was completed for the U.S. Army Corps of Engineers (USACE) - Omaha District in accordance with the requirements of Delivery Order No. DK02 of Contract No. DACA41-02-D-0004. The primary purpose of groundwater monitoring at Iowa AAP is to monitor releases of contaminants into groundwater and surface water, identify potential migration pathways, monitor remedial actions, and identify potential natural attenuation (NA) processes that may be occurring in groundwater.

Iowa AAP is a government-owned, contractor-operated (GOCO) facility. The current operating contractor is American Ordnance (AO), under the command of the U.S. Army Joint Munitions Command. Production of munitions began in 1941 and the facility remains in operation. Iowa AAP occupies 19,015 acres in the town of Middletown in Des Moines County, Iowa, and is bordered by U.S. Highway 34 to the north, upland agricultural farms to the east and west, and the Skunk River Valley to the south. Surface topography is characterized by flat to gently rolling uplands dissected by entrenched streams and rivers. Approximately one-third of the Iowa AAP property is occupied by active or formerly active production or storage facilities. The remaining land at Iowa AAP is either woodlands or is leased for agricultural usage. Monitoring wells at Iowa AAP are completed into one of the following three zones: shallow till, intermediate till, basal till/glacial outwash/bedrock.

During the 2002 groundwater monitoring events, samples were collected at 21 sites at Iowa AAP. This effort included collection of groundwater samples at 190 selected monitoring wells, and collection of surface water samples at 22 locations. In addition, water levels were obtained from 274 selected monitoring well and piezometer locations to evaluate groundwater flow at each site. Laboratory analyses were selected on a site-by-site basis, but generally included one or more of the following analytical suites: explosives, metals, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), uranium, and radionuclides. At selected sites, groundwater samples also were analyzed for natural attenuation parameters.

A comparison of the 2001 and 2002 water level data shows that water levels have declined at the majority of the sites. Generally, the decreases were less than 2 feet. Groundwater flow directions interpreted from the 2002 water level data are similar to those observed in 2001.

Based on interpretation of the 2002 analytical data, several observations were noted. In general, explosive contaminant concentrations were similar to those detected during previous monitoring events. The extent of the RDX plumes at Line 1 and Line 1 Impoundment; Line 2; Line 3; Line 5A/5B; Line 800/Pink Water Lagoon; East Burn Pads, Demolition Area and Deactivation Furnace; West Burn Pads area; and North Burn Pads area generally remained consistent with those observed during 2001. At Line 800/Pink Water Lagoon, the most

heavily explosives-contaminated site, bedrock monitoring wells continue to be nondetect for explosives analytes. Changes in explosives concentrations were observed at selected well locations. RDX was detected at a concentration in exceedence of a PRG in one bedrock well (JAW-18) at Line 3A. Previous RDX concentrations in this well were below the 2 μg/L Health Advisory Level (HAL). In addition, RDX was detected above the PRG in North Burn Pads well JAW-626 where historical RDX concentrations have been below the PRG. At Inert Disposal Area (IDA) well ET-3, explosives were detected at concentrations in exceedence of their PRGs during the Spring 2002 semiannual sampling event; however, none were detected during Fall 2002. It should be noted that a report specific to the RCRA Trench 5 monitoring has been submitted under separate cover.

At Line 9, Freon 113 concentrations remained similar to those detected during 2001. In general, VOC contaminants were detected in wells at the West Burn Pads, Fire Training Area (FTA), and the IDA at concentrations similar to those observed during previous sampling events. The only SVOC detected at a significantly elevated level was pentachlorophenol in IDA well ET-3, which was observed at historically similar levels.

Because the arsenic Maximum Contaminant Level (MCL) was lowered from 50 μg/L to 10 μg/L, this analyte was detected at concentrations above the MCL in one or more wells at several sites. These sites include Line 2, IDA, Plant Boundary and General Area, FTA, and the West Burn Pads area.

Select wells were sampled for perchlorate in Spring 2002. The only perchlorate detection was observed in Line 800/Pink Water Lagoon well 800-MW-18. However, perchlorate was nondetect in this well during the November 2000 sampling for this analyte. It appears that further perchlorate sampling is not warranted at the East Burn Pads, IDA, and the North Burn Pads area.

Evaluation of the natural attenuation parameter results did not yield significantly different conclusions from previous monitoring events. Generally, the data compiled to date has not yielded significant conclusions regarding natural attenuation activity at Iowa AAP. Two significant trends remain evident from previous sampling events: dissolved oxygen and Redox potentials continue to decline.

During Spring 2002, RDX concentrations detected in Brush Creek at four locations adjacent to and downstream of Lines 2 and 3 were three to five times 2001 levels. The cause of this RDX increase is currently unknown. However, rainfall totals during the four days prior to the 2002 event were nearly five times that recorded during the same time period prior to the Spring 2001 sampling event. The Army is planning to implement a comprehensive investigation of the Brush Creek watershed to determine the potential source(s) of the RDX contamination in Brush Creek, and the reasons for RDX concentration fluctuations in the surface water.

Section 1

DRAFT FINAL
2002 GROUNDWATER MONITORING REPORT
IOWA ARMY AMMUNITION PLANT, MIDDLETOWN, IOWA

1.0 INTRODUCTION

This document presents the results of the 2002 groundwater monitoring events at the Iowa Army Ammunition Plant (Iowa AAP), in Middletown, Iowa. These activities included the installation-wide annual monitoring event (spring), Trench 5 semiannual groundwater monitoring events (May and November), Trench 7 Corrective Action Management Unit (CAMU) quarterly monitoring events (May, August, November), and the off-site monitoring event (November). Specific monitoring reports for off-site monitoring and Trench 7 CAMU are presented in Appendices C and E, respectively. A data summary for the Trench 5 May and November 2002 results is included in Appendix D. These appendices include sampling activities and data results for the Spring 2002 event and the other sampling events conducted at those sites throughout the remainder of 2002. Iowa AAP sites are listed in Table 1.1. The location of Iowa AAP and the layout of the Iowa AAP facility are shown on Figures 1.1 and 1.2, respectively.

1.1 PROJECT AUTHORITY

The Iowa AAP facility signed an interagency agreement (IAG) (dated September 20, 1990) with the United States Environmental Protection Agency (USEPA) Region 7. The IAG requires that the monitoring of releases of contaminants into groundwater and surface water be monitored, and that the migration pathways be identified. Groundwater monitoring and other environmental investigations at Iowa AAP are being completed under the Department of Defense's (DoD) Defense Environmental Restoration Program (DERP).

HydroGeoLogic has completed the 2002 groundwater monitoring events at the Iowa AAP. Work for this assignment is being completed for the U.S. Army Corps of Engineers (USACE) – Omaha District in accordance with the requirements of Delivery Order No. DK02 of Contract No. DACA41-02-D-0004.

1.2 GROUNDWATER MONITORING PURPOSE AND SCOPE

The primary purpose of groundwater monitoring at Iowa AAP is to monitor releases of contaminants into groundwater and surface water, identify potential migration pathways, and monitor remedial actions. An additional objective was to identify potential natural attenuation (NA) processes that may be occurring in groundwater on a site-by-site basis.

The scope of work for the Spring 2002 groundwater monitoring event generally consisted of:

- Completing a facility-wide measurement of groundwater levels.

- Sampling groundwater from monitoring wells at 21 sites at Iowa AAP, at the plant boundary, and in general areas. Table 1.1 highlights these 21 sites. Laboratory analyses were selected on a site-by-site basis, but generally included explosives, metals, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), uranium, and radionuclides. At selected sites, groundwater samples also were analyzed for natural attenuation parameters.
- Sampling surface water at several locations on the Iowa AAP property, including those along Long Creek, Brush Creek, Spring Creek, and selected tributaries of these creeks.

1.3 FACILITY DESCRIPTION

Iowa AAP is a government-owned, contractor-operated (GOCO) facility. The current operating contractor is American Ordnance (AO), under the command of the U.S. Army Joint Munitions Command. Production of munitions began in 1941 and the facility remains in operation. Production activities at Iowa AAP currently include loading, assembling, and packaging of munitions, including projectiles, mortar rounds, warheads, demolition charges, anti-tank mines and anti-personnel mines. The loading, assembling, and packaging operations use explosive materials and lead-based initiating compounds.

Iowa AAP occupies 19,015 acres in the town of Middletown in Des Moines County, Iowa (Figures 1.1 and 1.2). Iowa AAP is bordered by U.S. Highway 34 to the north, upland agricultural farms to the east and west, and the Skunk River Valley to the south. Surface topography is characterized by flat to gently rolling uplands dissected by entrenched streams and rivers. Approximately one-third of the Iowa AAP property is occupied by active or formerly active production or storage facilities. Sites include surface impoundments, production lines, landfills, disposal areas, burn areas, demolition areas, and a fire training area. The remaining land at Iowa AAP is either woodlands or is leased for agricultural usage. The facility map (Figure 1.2) shows site locations, creeks, and other features of interest.

Wastewater generated at various plant facilities and effluent from wastewater treatment plants are discharged to surface streams under the provisions of a National Pollutant Discharge Elimination System (NPDES) permit. It should be noted that the allowable NPDES discharge limits for explosives generally exceed the remediation criteria used to evaluate the groundwater and surface water analytical results discussed in this report. The production of munitions at the Iowa AAP has resulted in contamination of soil and groundwater, and the discharge of wastewater containing explosives and explosive by-products has caused contamination of surface water. The majority of contamination resulted from placing explosives and waste containing heavy metals directly onto soil and into surface water. Explosive contaminants and heavy metals have migrated through the soil into the groundwater and also over land into surface water. Moderate amounts of VOC contamination in soil and groundwater also have been identified at the facility.

1.4 PREVIOUS INVESTIGATIONS

Pursuant to the Resource Conservation and Recovery Act (RCRA) Hazardous and Solid Waste Amendments (HSWA) of 1984, the USEPA completed an assessment of the facility in 1987 and reported that releases had occurred (Ecology and Environment, Inc. [E & E], 1987). The Iowa AAP was subsequently proposed for the National Priorities List (NPL) and, in August 1990, the facility was placed on the NPL with a Hazard Ranking System (HRS) score of 29.73.

An IAG between the DoD and USEPA Region 7 was signed on September 20, 1990. Under the agreement, Iowa AAP investigations and remediation activities are being completed under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). The agreement allows for RCRA and CERCLA activities at the site to be coordinated. In response to the IAG, in 1992 JAYCOR completed a facility-wide Preliminary Assessment/Site Inspection (PA/SI) of 44 sites with potential contamination that were listed in the IAG. Subsequently, in 1993 JAYCOR completed a facility-wide Remedial Investigation (RI)/Risk Assessment (RA) for approximately 35 of the sites. Two of the sites had ongoing RIs and were not addressed; the remaining seven sites were recommended for no further action. A complete list of previous soil and groundwater contamination investigations at Iowa AAP is provided in the 2003 Installation Action Plan (Iowa AAP, 2003)

The Iowa AAP facility is divided into three operable units (OUs) to facilitate project management. These are:

- Soils OU #1, to address contamination in the soils.
- Groundwater OU #3, to address contamination of groundwater within the Iowa AAP boundaries and (potentially) off-site.
- Facility-wide OU #4, to address closure of the Corrective Action Management Unit (CAMU), institutional controls, previously unaddressed areas of soil contamination, VOC-contaminated media, ecological risks, groundwater monitoring requirements, and any other unacceptable risks that may be identified but not addressed in either OU #1 or OU #3.

OU #2 originally was established for interim soil removal actions, but was subsequently merged into OU #1.

1.5 ENVIRONMENTAL SETTING

The fundamental geologic and hydrogeologic features, along with the prominent surface water bodies, are described in the following sections.

1.5.1 Geology

The Iowa AAP is located in the Dissected Till Plain section of the Central Lowland Province of the Southern Iowa Drift Plain Region. Iowa AAP is reported to be underlain by a sequence

of unconsolidated glacial deposits of Pleistocene age overlying sedimentary bedrock units (IGS 1980). The glacial tills consist primarily of silty clay and clayey silt with thin sand seams and lenses and are assigned to the Kellersville Till Member (Illinoian Age) of the Glasford Formation of southeastern Iowa. The tills extend to depths in excess of 100 feet in portions of the north half of the Iowa AAP, but are thin or absent locally in deeper stream valleys in the south around Mathes Lake, and in the northeast.

The bedrock underlying Iowa AAP consists of a sequence of limestones interbedded with varying thicknesses of shales and sandstones ranging in age from Cambrian to Mississippian. Harris and Parker (1964) report that the uppermost bedrock unit beneath the site is the Mississippian Osage Series of southeastern Iowa, composed predominantly of cherty limestones interbedded with minor amounts of shale. The Osage series is divided into three members (from youngest to oldest): the Warsaw Formation, Keokuk Limestone, and Burlington Limestone. The Warsaw Formation consists primarily of blue-gray calcareous shales; fragmental, fossiliferous, dolomitic limestone; and calcarenites. Regionally, the general slope of the Mississippian Osage Series bedrock is toward the southwest.

1.5.2 Hydrogeology

In Des Moines County, Iowa, there are four principal aquifers: the surficial soils aquifer and the bedrock aquifers of Mississippian, Devonian, and Cambro-Ordovician units (IGS 1980). The shallow surficial soil aquifer at Iowa AAP occupies the upland till plain and is predominantly clay-rich glacial tills that exhibit low hydraulic conductivities and yield only small quantities of groundwater to wells. For the purposes of investigation and interpretation, this report describes the surficial soils aquifer using the following terminology: shallow till (typically containing the water table surface), intermediate till, and basal till. Within the tills, there are reportedly some occurrences of buried-channel sands that are laterally discontinuous across the facility. Depth to the water table surface in the shallow till is generally less than 10 to 15 feet. Shallow groundwater flow typically mimics surface topography. The low permeability of the clay till matrix limits lateral and vertical flow of groundwater. However, lateral and vertical flow may be less restricted (or more pronounced) in the tills that have well-developed fracture networks. Groundwater also discharges to the more deeply incised surface drainages (e.g., creeks) through seeps at the glacial till and bedrock outcrops.

Information on hydrogeological conditions in the bedrock aquifers underlying the deeper till is sparse. Generally, groundwater in the limestones is considered to occur primarily within open bedding planes and/or joints. Therefore, the occurrence and orientation of these features may, in part, control groundwater flow. It is common for much of the groundwater in these bedrock units to be found in the more fractured and weathered upper sequence just under the basal till. Where this is the case, the basal till and the uppermost Mississippian bedrock, defined in previous investigations (Harza 1997) as the uppermost 20 feet of bedrock underlying the till, may comprise a single hydraulic system. Facility-wide groundwater levels suggest that overall flow direction in the bedrock is to the south and east toward the Skunk and Mississippi Rivers, when not intercepted by incised surface drainages.

Water in the Devonian aquifer is reported to be highly mineralized and objectionably hard wherever it has been encountered in the county (IGS 1980). This Devonian aquifer contains high amounts of total dissolved solids, primarily sodium-potassium, chloride, and sulfate. The Cambro-Ordovician aquifer also yields water of poor quality. The water is noticeably hard and exceeds recommended standards for sulfate and dissolved solids. Water temperatures are reported to be higher (averaging 72 degrees Fahrenheit [°F]) than other rock aquifer sources (55 to 60 F).

1.5.3 Surface Water

The major drainage basins, creeks, and surface water bodies at Iowa AAP are shown on Figure 1.2. Little Flint Creek drains a small area in the north portion of the facility. The remainder of the Iowa AAP property is drained by, from west to east, the Skunk River, Long Creek, Brush Creek, and Spring Creek. Brush Creek and Long Creek are tributaries of the Skunk River, which flows to the Mississippi River. Spring Creek is a tributary of the Mississippi River.

1.6 TRANSFER OF SITE FROM ER,A TO FUSRAP

Line 1 and the West Burn Pad sites will be removed from the Long-Term Monitoring (LTM) Program, which is funded by Environmental Restoration, Army (ER,A), and transferred to the Formerly Utilized Sites Remedial Action Program (FUSRAP) in fiscal year 2003. Environmental remediation of soil and groundwater at Line 1 will be programmed, scheduled, and remediated under the FUSRAP program.

The remaining remedial actions at the West Burn Pads sites (in the southern portion) also will be conducted by FUSRAP. For portions of the West Burn Pads sites where remedial actions are complete, a groundwater fate and transport model will be developed, along with up to seven potential remedial technologies. The completion of the Feasibility Study (FS), Proposed Plan (PP), Record of Decision (ROD), and potential Remedial Design (RD)/Remedial Action (RA), and LTM will be completed by FUSRAP.

1.7 GROUNDWATER MONITORING REPORT ORGANIZATION

This groundwater monitoring report is organized as follows:

- **Section 1 – Introduction** summarizes project authority, purpose, and scope; facility description; previous investigations; and environmental setting.
- **Section 2 – Field Activities** summarizes field activities completed, including water level measurements, groundwater sampling, surface water sampling, and investigation derived waste (IDW) disposal.
- **Section 3 – Hydrogeologic Results** presents and interprets water level data, hydraulic gradients, and potentiometric surface maps for each site.

- **Section 4 - Chemical Investigation Results** presents laboratory and field chemical data, data validation, and data review results.
- **Section 5 - Nature and Extent of Contamination** presents and interprets chemical data above Preliminary Remediation Goals (PRGs) for each site.
- **Section 6 - Perchlorate Sampling** presents a discussion of perchlorate sampling and analytical results with comparison to the PRG.
- **Section 7 - Natural Attenuation Parameter Results** presents and interprets field and laboratory natural attenuation parameter data facility wide and for each site.
- **Section 8 - Recommended Monitoring Well Maintenance** presents results of well inspections and provides well maintenance recommendations.
- **Section 9 - References** provides references used to develop this report.

TABLE 1.1
IOWA ARMY AMMUNITION PLANT SITES

Site Designation	Site Name
None	Plant Boundary / General Area
IAAP-1, IAAP-16	Line 1 and Line 1 Impoundment. FUSRAP in FY03.
IAAP-2	Line 2 - Soil
IAAP-2G	Line 2 - Groundwater
IAAP-3	Line 3 - Soil
IAAP-3G	Line 3 - Groundwater
IAAP-4, IAAP-41, IAAP-29	Line 3A, Line 3A Pond, and Line 3A STP - Soil
IAAP-4G	Line 3A - Groundwater
IAAP-5	Lines 4A and 4B
IAAP-6	Lines 5A and 5B
IAAP-7	Line 6
IAAP-8	Line 7
IAAP-9	Line 8
IAAP-10	Line 9 - Soil
IAAP-10G	Line 9 - Groundwater
IAAP-11, IAAP-44	Line 800, Pink Water Lagoon - Soil
IAAP-44G	Line 800, Pink Water Lagoon - Groundwater
IAAP-12	East Burn Pads - Soil
IAAP-12G	East Burn Pads - Groundwater
IAAP-13	Incendiary Disposal Area
IAAP-14	Boxcar Unloading Area
IAAP-15	Old Flyash Waste Pile
IAAP-17	Pesticide Pit
IAAP-18	Possible Demolition Site
IAAP-19	Contaminated Clothing Laundry
IAAP-20	Inert Disposal Area - Soil
IAAP-20G	Inert Disposal Area – Groundwater
IAAP-21, IAAP-23	Demolition Area, Deactivation Furnace
IAAP-22	Unidentified Substance Waste Site
IAAP-24	Contaminated Waste Processor
IAAP-25	Explosive Waste Incinerator
IAAP-26	Sewage Treatment Plant/Sludge Drying Beds
IAAP-27, IAAP-43	Flyash Landfill, Flyash Disposal Area
IAAP-28	Construction Debris Landfill
IAAP-30	Firing Site
IAAP-31	Ammunition Box Chipper Disposal Pit
IAAP-34, IAAP-35, IAAP-32, IAAP-33	West Burn Pads, West Burn Pads Landfill, Burn Cages, Burn Cages Landfill – Soil. FUSRAP in FY03.

TABLE 1.1
IOWA ARMY AMMUNITION PLANT SITES

Site Designation	Site Name
IAAP-32G	West Burn Pads, West Burn Pads Landfill, Burn Cages, Burn Cages Landfill - Groundwater. FUSRAP in FY03.
IAAP-36, IAAP-37	North Burn Pads, North Burn Pads Landfill
IAAP-38	Building 600-86 Septic System
IAAP-39	Fire Training Area - Soil
IAAP-39G	Fire Training Area - Groundwater
IAAP-40	Roundhouse Transformer Storage Yard
IAAP-42	Abandoned Coal Storage Yard
IAAP-45	Former Fuel Station USTs
IAAP-46	Off-Post Groundwater

Note: Shading indicates sites at which groundwater samples were collected.

Filename: X:\KAN004\TO3_IAAP \GWM_2002\LocationMap.cdr
Project: KAN004-003-02-29
Created by: cfarmer 09/12/02
Revised: 03/12/03 ASC
Source: URS

HYDRO GeoLogic INC.

Figure 1.1

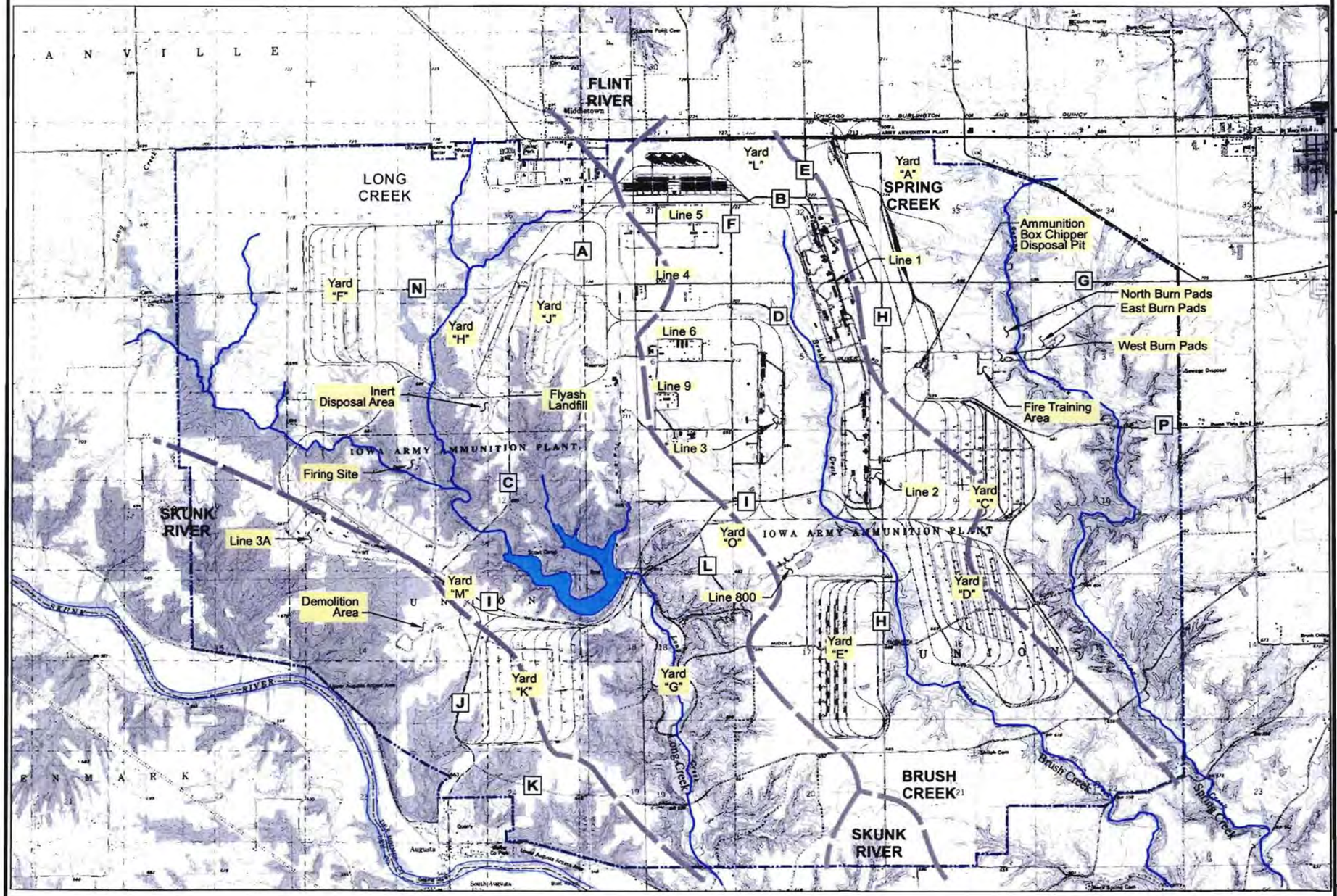
Facility Location Map

HydroGeoLogic, Inc.
2002 Groundwater Monitoring Report
Iowa Army Ammunition Plan, Middletown, Iowa

Figure 1.2

Facility Map
Iowa Army Ammunition Plant

U.S. Army Corps of Engineers
Omaha District



Legend

- A — Road Name
- Plant Property Boundary
- Drainage Basin Boundary
- River/Stream

N

0 2000 4000 6000 8000
SCALE IN FEET

Filename: X:KAN004\TO3_IAAP\MAPS
\GMW_2002\FacilityMap.cdr
Project: KAN004-003-02-29
Created by: cfarmer 09/12/02
Revised: 03/12/03 ASC
Source: URS

HYDRO GeoLogic Inc

Section 2

2.0 FIELD ACTIVITIES

This section summarizes the field activities completed during the Spring 2002 groundwater monitoring event. Known monitoring well/piezometer locations at the facility are shown on Figure 2.1. Field activities included:

- Measuring water levels at 274 selected monitoring well and piezometer locations.
- Measuring water quality parameters during monitoring well purging (e.g., dissolved oxygen [DO], oxidation reduction potential [ORP], pH, temperature, specific conductance, turbidity).
- Collecting and analyzing groundwater samples from 190 selected monitoring wells.
- Collecting and analyzing surface water samples from 22 locations along Long Creek, Brush Creek, Spring Creek, and tributaries of Brush Creek and Spring Creek.
- Collecting and analyzing one sample of the water source used for decontamination for each event.
- Collecting and analyzing one rinsate from the Fultz® sampling pump
- Disposal of IDW (personal protective equipment [PPE] only) at the Inert Disposal Area (IDA). Purge and decontamination waters were containerized at the Line 1 impoundment for treatment per the direction of USACE.
- Documenting all field activities.

All field activities were completed in accordance with the Spring 2002 Groundwater Monitoring Work Plan Addendum (HydroGeoLogic 2002), and the Standard Operating Procedure (SOPs) included in the Final Facility-Wide Work Plan (URS 2002a).

Because of heightened security at the Iowa AAP facility access and egress from the facility was problematic during the Spring 2002 monitoring event. Delays due to more intense scrutiny (i.e. exhaustive vehicle/cargo searches) of contractors working at Iowa AAP resulted in additional expenditures in labor and costs associated with completing the field activities.

2.1 GROUNDWATER LEVEL MEASUREMENT ROUNDS

A facility-wide groundwater level measurement round was completed during the Spring 2002 groundwater monitoring event. The water level data were used to create site-specific groundwater elevation diagrams and to determine horizontal and vertical gradients at each site. All monitoring wells and piezometers were considered for potential water level measurement and those selected were determined using the following criteria:

- The monitoring wells and piezometers must first have been located on a map.
- The monitoring wells or piezometers must have been accessible.
- The monitoring wells or piezometers must have had a surveyed reference point from which to measure the water level (i.e., top of casing [TOC]).

Using these criteria, groundwater levels measurement at 279 locations was proposed in the work plan (HydroGeoLogic 2002). However, five monitoring well and piezometer locations were eliminated from the Spring 2002 round for the following reasons:

- One well (NEP-C) had previously been abandoned.
- Two wells (SL-87, SL-91) could not be located. It should be noted that these two wells could not be located during previous water level measurement rounds.
- The lid of one well (Z1-2) could not be removed to collect the water level. It should be noted that it has not been possible to remove the well lid of Z1-2 during previous water level measurement rounds.
- One well (JAW-13) was dry.

Water levels were measured throughout the installation June 1 and 2, 2001, except for one location inside Line 4A (JAW-605) for which access was arranged at a later date. Water levels in the Inert Disposal Area were measured on May 29, 2002, except for one well (G-5) where maintenance on the security casing lock delayed reading of the water level until June 2, 2002. In addition, a water level measurement from monitoring well G-10 was inadvertently not taken during the water level measurement round, but was obtained before it was sampled on June 13, 2002.

Groundwater level measurements were completed in as short a time period as practical to minimize the effects of water table fluctuations. Water levels were measured from the surveyed reference point found on the top of the well casing, using a Solinist Model 101 electronic water level meter. The water level meter was decontaminated between measurements at each of the monitoring well and piezometer locations with deionized (DI) water. All measurements were recorded in the field logbooks maintained by the sampling teams.

Groundwater levels and occurrences are discussed in Section 3.0 of this report.

2.2 WELL PURGING AND MEASUREMENT OF WATER QUALITY PARAMETERS

The purpose of well purging is to obtain representative, aquifer-quality water from the geologic unit being sampled, while minimizing disturbance to the collected samples. Low-flow techniques were attempted in each well to minimize turbidity and purge water volumes. The goal of low-flow purging is to maintain less than 0.3 feet of drawdown at a pumping rate not to exceed 500 milliliters per minute (mL/min). Groundwater purging procedures included:

- Before sampling, the air quality in the well casing and the breathing zone was monitored with a RAE Systems MiniRae photoionization detector (PID) equipped with a 10.6 electron volt (eV) lamp. Air quality measurements were recorded in the field logbooks. If organic vapors were detected in the well casing, the well was sampled for

VOCs along with the previously planned analytes for that well. No elevated PID readings were observed during Spring 2002 at wells not already scheduled for VOCs analysis.

- The depth to groundwater was measured and the volume of water to be purged was calculated in the event that drawdown exceeded 0.3 feet.
- Eighty-five of the sampled wells were equipped with Well Wizards (dedicated bladder pumps), which were used when purging and sampling. Where no dedicated sampling pumps were available, or they were not functioning, a portable Fultz® sampling pump with virgin disposable tubing was used.
- The depth to groundwater was monitored during purging to determine drawdown.
- Water quality parameters were measured and recorded at all groundwater sampling locations. Specific conductance, pH, temperature, ORP, and DO were measured using the YSI 556 probe fitted with a flow-through cell. Turbidity was measured using a Lamotte 2020 turbidity meter. At specified well locations, ferrous iron was measured by Method 8146, using a HACH DR/820 Colorimeter.
- The field instruments were calibrated to the manufacturers' specifications prior to shipment to the field. Verification of field instrument calibrations (and recalibration, as necessary) were completed daily during the field event. The YSI 556 was calibrated using certified standards and 5 percent sodium sulfite solutions.
- All water quality measurements were recorded on the water sample collection field sheets (included in Appendix A).

Final water quality parameter measurements (i.e., those recorded immediately before sampling) recorded during the Spring 2002 groundwater monitoring event are presented in Section 4.0.

Well purging was completed in accordance with the SOPs included in the Final Facility-Wide Work Plan (URS 2002a). Sample collection field sheets, included in Appendix A, give the detailed purging procedures used at each well.

2.3 SPRING 2002 GROUNDWATER SAMPLING AT MONITORING WELLS

Monitoring well sampling locations, dates sampled, and analytical parameters for the Spring 2002 groundwater monitoring event are presented in Table 2.1. Section 5.0 provides a discussion of the analytical results. Monitoring well locations are shown on the facility-wide well location map (Figure 2.1) and individual site maps in Section 5.0.

The Spring 2002 groundwater sampling event included the following elements:

- Sampling of 190 monitoring wells May 29 through June 30, 2002. Although 195 monitoring well locations were originally intended to be sampled, five wells were dry at the time of sampling. The dry wells were JAW 32 and JAW-33 (Firing Site); JAW-23 (West Burn Pads); G-53 (Boundary Area); and the Pesticide Pit sump.

- 47 samples were collected for cyclotrimethylenetrinitramine (RDX) metabolite analysis at Line 800, Line 2, and Line 3. The majority of these samples were collected at Line 800. The RDX metabolite samples were shipped to Lawrence Livermore National Laboratory (LLNL) for analysis, and were not reported to HydroGeoLogic. It should be noted that the mononitroso- RDX metabolite, hexahydro-1-nitroso-3,5-dinitro-1,3,5-triazine (MNX), also was analyzed for in the samples submitted to the laboratory contracted for the Spring 2002 monitoring event, and those results are included in this report.
- Perchlorate samples were collected from 27 locations at the following sites: East Burn Pads, North Burn Pads Landfill, Inert Disposal Area and Line 800. Perchlorate results are discussed separately in Section 6.0

QC duplicate samples were collected at approximately 6 percent frequency (i.e., 1 per every 15 samples collected). QC matrix spike/matrix spike duplicate (MS/MSD) samples and Quality Assurance (QA) split samples were collected at approximately 4 percent frequency (1 per every 26 samples collected). QA/QC samples are discussed in Section 4.0. QA/QC sample locations are noted in Table 2.1.

The groundwater sampling effort was completed in accordance with the SOPs provided in the Final Facility-Wide Work Plan (URS 2002a) and the Spring 2002 Groundwater Monitoring Work Plan Addendum (HydroGeoLogic, 2002). All groundwater samples were collected into approved sample containers, preserved, and labeled appropriately. Samples (including QC samples) were packed in coolers with wet ice to 4 °C, and shipped to Laucks Testing Laboratory, Inc (Laucks) at 940 South Harney Street, Seattle, Washington via Federal Express for analysis. The QA split samples were packed as described above and shipped to the USACE Environmental Chemistry Branch (420 South 18th Street, Omaha, Nebraska) via Federal Express for analysis.

2.4 SPRING 2002 SURFACE WATER SAMPLING

The Spring 2002 groundwater monitoring event included the collection of 22 surface water samples at Iowa AAP: 12 locations along Brush Creek and its tributaries, 8 locations along Spring Creek and its tributaries, and 2 locations on Long Creek. These locations are situated primarily upgradient, downgradient, and along Line 1, Line 2, Line 800, the Fire Training Area/Explosives Disposal Area, and the Firing Site.

The Long Creek and Spring Creek surface water samples were collected on May 30-31, 2002. Brush Creek surface water samples were collected on June 15, 2002.

The surface water sampling effort was completed in accordance with the SOPs provided in the Final Facility-Wide Work Plan (URS 2002a) and the Spring 2002 Groundwater Monitoring Work Plan Addendum (HydroGeoLogic 2002). Surface water sampling locations, dates sampled, and analytical parameters are presented on Table 2.1. Surface water samples were retrieved using disposable buckets or Teflon® bailers and the sample was transferred to

approved sample containers. Samples were appropriately preserved, labeled, packed in coolers with wet ice to 4 °C, and shipped to Laucks via Federal Express for analysis.

2.5 WATER SOURCE SAMPLING

One water source sample was collected to check for contamination in the water used for decontamination. Culligan of West Burlington provided the DI water used for all decontamination activities. The DI water was bottled by Culligan in pre-cleaned, polycarbonate, 5-gallon containers. Culligan personnel delivered the DI water containers to the site. The water source sample was collected and analyzed for VOCs, semivolatile organic compounds (SVOCs), and explosives. The water source sample results are discussed in Section 4.0.

2.6 RINSATE SAMPLING

One rinsate sample was collected during the Spring 2002 groundwater monitoring event to check for cross contamination from sampling equipment. Source water was run through a decontaminated Fultz® sampling pump attached to a short length of virgin disposable tubing and the rinse water was collected in the appropriate containers. The rinsate sample was analyzed for VOCs, SVOCs, and explosives. The rinsate sample results are discussed in Section 4.0.

2.7 IDW DISPOSAL

IDW generated during the Spring 2002 groundwater monitoring event included purge water, decontamination water, and personal protective equipment (PPE). All purge and decontamination water was containerized and transported to the Line 1 impoundment area, except that accumulated during the sampling of wells in the IDA. At the Line 1 impoundment, the IDW water was discharged into two 450-gallon poly tanks for treatment through a granular activated carbon (GAC) treatment unit. The IDW water from the IDA monitoring wells was discharged into IDA Trench 6 for treatment through a GAC system. The volume of water accumulated for treatment was recorded on waste manifest tracking forms provided to the USACE on-site construction representative. PPE was bagged and disposed in Trench 6. All disposal was coordinated with the USACE on-site construction representative. IDW disposal procedures were completed in accordance with the Spring 2002 Groundwater Monitoring Work Plan Addendum, except that the location for storage of the IDW water prior to its treatment through a GAC system was moved to the Line 1 impoundment area at the direction of USACE (HydroGeoLogic 2002).

TABLE 2.1
SUMMARY OF SAMPLES COLLECTED
SPRING 2002 GROUNDWATER MONITORING EVENT

Site Name, (IAAP Site Designation)/ Well Number	Date Sampled	Analytical Parameters							QC Duplicates[3]	MS/MSD[3]	QA Split[4]	Perchlorate[5]	RDX Metabolite[6]	Notes
		Explosives	Metals	VOCs	SVOCs	Radionuclides	Total Uranium	Natural Attenuation						
Line 1, (IAAP-1) / Line 1 Impoundment, (IAAP-16)														
JAW-39	06/17/02	X	X					X						
JAW-40*	06/18/02	X	X					X						
JAW-43	06/16/02	X	X					X						
JAW-45	06/16/02	X	X					X						
JAW-48	06/11/02	X	X					X						
JAW-50	06/11/02	X	X					X						
JAW-51	06/11/02	X	X					X						
JAW-601*	06/12/02	X	X					X						
JAW-602	06/11/02	X	X					X		X				JAW-602 MS/MSD
JAW-603*	06/12/02	X	X					X						
SL-81	06/05/02	X	X					X						
L1-MW1*	06/12/02	X	X					X						
Line 2, (IAAP-2)														
G-15	06/07/02	X	X					X						
12-A	06/04/02	X	X					X						
12-B	06/04/02	X	X					X						
12-C*	06/05/02	X	X					X						
12-D	06/04/02	X	X					X						
12-E	06/05/02	X	X					X						
12-F*	06/14/02	X	X					X						
12-G	06/05/02	X	X					X						
JAW-70	06/04/02	X	X					X	X		X		X	QC Dup=L2-MW4, QA split=explosives only
JAW-71	06/04/02	X	X					X					X	
JAW-72	06/04/02	X	X					X					X	
JAW-73	06/04/02	X	X					X						
JAW-74	06/05/02	X	X					X						
JAW-75	06/04/02	X	X					X						
L2-MW1*	06/05/02	X	X					X						
L2-MW2	06/04/02	X	X					X						
L2-MW3	06/05/02	X	X					X						
Line 3, (IAAP-3)														
16-A	06/03/02	X	X					X						
16-B	06/03/02	X	X					X						
16-C	06/03/02	X	X					X						

TABLE 2.1
SUMMARY OF SAMPLES COLLECTED
SPRING 2002 GROUNDWATER MONITORING EVENT

Site Name, (IAAP Site Designation)/ Well Number	Date Sampled	Analytical Parameters							QC Duplicates[3]	MS/MSD[3]	QA Split[4]	Perchlorate[5]	RDX Metabolite[6]	Notes
		Explosives	Metals	VOCs	SVOCs	Radionuclides	Total Uranium	Natural Attenuation						
Line 3, (IAAP-3), continued														
16-D	06/03/02	X	X					X						
16-E*	06/03/02	X	X					X						
JAW-53	06/03/02	X	X					X						
JAW-54	06/03/02	X	X					X	X				X	QC Dup=L3-MW1
JAW-55	06/15/02	X	X					X						
JAW-56	06/16/02	X	X					X						
JAW-57	6/0302	X	X					X		X				JAW-57 MS/MSD
JAW-77	06/16/02	X	X					X						
Line 3A, (IAAP-4) / Line 3A Pond, (IAAP-41) / Line 3A STP, (IAAP-29)														
JAW-15	06/15/02	X	X					X						
JAW-16*	06/16/02	X	X					X						
JAW-17	06/05/02	X	X					X						
JAW-18	06/03/02	X	X					X						
JAW-19	06/05/02	X	X					X						
JAW-20	06/15/02	X	X					X						
JAW-21	06/15/02	X	X					X						
JAW-22	06/05/02	X	X					X						
Line 4A and 4B, (IAAP-5)														
JAW-604	06/27/02	X	X	X[2]										
JAW-605	06/05/02	X	X	X[2]										
Line 5A and 5B, (IAAP-6)														
5A-MW1	06/16/02	X	X	X[2]				X			X			QA Split=Explosives/Metals
5A-MW2	06/16/02	X	X	X[2]				X						
5B-MW1	06/16/02	X	X	X[2]				X						
5B-MW2	06/16/02	X	X	X[2]				X						
Line 9, (IAAP-10)														
JAW-29*	06/28/02	X		X[2]	X			X						
JAW-30	06/27/02	X		X[2]	X			X						
JAW-31*	06/27/02	X		X[2]	X			X						
JAW-610	06/26/02	X		X[2]	X			X						
JAW-611	06/26/02	X		X[2]	X			X						
JAW-612	06/27/02	X		X[2]	X			X	X					QC Dup=L9-MW1
Line 800, (IAAP-11) / Pink Water Lagoon, (IAAP-44)														
G-17	06/13/02	X						X				X	X	
G-18	06/30/02	X		X[2]				X	X			X	X	QC Dup=800-MW-27

TABLE 2.1
SUMMARY OF SAMPLES COLLECTED
SPRING 2002 GROUNDWATER MONITORING EVENT

Site Name, (IAAP Site Designation)/ Well Number	Date Sampled	Analytical Parameters							QC Duplicates[3]	MS/MSD[3]	QA Split[4]	Perchlorate[5]	RDX Metabolite[6]	Notes
		Explosives	Metals	VOCs	SVOCs	Radionuclides	Total Uranium	Natural Attenuation						
Line 800, (IAAP-11) / Pink Water Lagoon, (IAAP-44), continued														
G-19	06/30/02	X						X				X	X	
G-20	06/13/02	X		X[2]				X	X			X	X	QC Dup=800-MW-28
G-40*	06/27/02	X		X[2]				X					X	
G-41	06/25/02	X						X					X	
G-42	06/13/02	X						X					X	
G-43	06/26/02	X						X					X	
G-44	06/30/02	X						X		X			X	G-44 MS/MSD
G-45	06/30/02	X		X[2]				X					X	
G-46*	06/30/02	X						X					X	
G-47	06/29/02	X						X					X	
G-48	06/25/02	X						X					X	
G-56	06/14/02	X						X					X	
G-57*	06/29/02	X						X					X	
G-58	06/28/02	X						X				X	X	
JAW-78	06/28/02	X						X					X	
JAW-79	06/27/02	X		X[2]				X					X	
800-MW-1	06/28/02	X						X					X	
800-MW-2*	06/30/02	X		X[2]				X					X	
800-MW-3*	06/15/02	X						X					X	
800-MW-4*	06/14/02	X						X					X	
800-MW-5*	06/30/02	X						X	X		X	X	X	QC Dup=800-MW-29 (Explosives), QA Split=800-MW-5(Explosives)
800-MW-6	06/29/02	X		X[2]				X					X	
800-MW-7	06/30/02	X		X[2]				X					X	
800-MW-8	06/27/02	X						X					X	
800-MW-9	06/14/02	X						X					X	
800-MW-10	06/18/02	X						X					X	
800-MW-11	06/18/02	X						X					X	
800-MW-12	06/27/02	X						X					X	
800-MW-13	06/27/02	X						X					X	
800-MW-14*	06/14/02	X						X					X	
800-MW-15	06/30/02	X						X					X	
800-MW-16*	06/30/02	X						X					X	
800-MW-17	06/29/02	X						X					X	
800-MW-18	06/28/02	X						X				X	X	
800-MW-19	06/18/02	X						X					X	

TABLE 2.1
SUMMARY OF SAMPLES COLLECTED
SPRING 2002 GROUNDWATER MONITORING EVENT

Site Name, (IAAP Site Designation)/ Well Number	Date Sampled	Analytical Parameters							QC Duplicates[3]	MS/MSD[3]	QA Split[4]	Perchlorate[5]	RDX Metabolite[6]	Notes
		Explosives	Metals	VOCs	SVOCs	Radionuclides	Total Uranium	Natural Attenuation						
Line 800, (IAAP-11) / Pink Water Lagoon, (IAAP-44), continued														
800-MW-20*	06/30/02	X						X					X	
800-MW-21	06/28/02	X						X					X	
800-MW-22	06/14/02	X						X					X	
800-MW-23*	06/26/02	X						X					X	
800-MW-24	06/28/02	X						X					X	
800-MW-25	06/28/02	X						X					X	
800-MW-26	06/14/02	X						X					X	
East Burn Pads, (IAAP-12)														
EDA-01	06/10/02	X	X	X[2]	X			X						
EDA-02*	06/26/02	X	X	X[2]	X			X				X		
EDA-03	06/25/02	X	X	X[2]	X			X	X			X		QC Dup=EBP-MW4
EDA-04	06/25/02	X	X	X[2]	X			X	X		X	X		QC Duplicate=EBP-MW-5 (no SVOCs), QA Split=Explosives
G-29	06/10/02	X	X	X[2]	X			X						
JAW-04*	06/28/02	X	X	X[2]	X							X		Insufficient sample volume for NA parameters
JAW-05	06/10/02	X	X	X[2]	X			X				X		
JAW-06	06/25/02	X	X	X[2]	X			X						
JAW-07	06/10/02	X	X	X[2]	X			X						
JAW-64	06/10/02	X	X	X[2]	X			X						
JAW-614	06/25/02	X	X	X[2]	X			X				X		
EBP-MW1*	06/27/02	X	X	X[2]	X			X						Insufficient sample volume for TKN, Sulfide, Alkalinity
EBP-MW2	06/10/02	X	X	X[2]	X			X		X				EBP-MW2 MS/MSD
EBP-MW3	06/10/02	X	X	X[2]	X			X						
Pesticide Pit, (IAAP-17)														
Sump	DRY													Insufficient water for sampling
Inert Disposal Area, (IAAP-20)														
T-4	06/04/02	X	X	X[2]	X									
T-5*	06/03/02	X	X	X[2]	X									
IDA-MW1	05/31/02	X	X	X[2]	X				X			X		QC Dup=IDA-MW3
IDA-MW2*	06/01/02	X	X	X[2]	X									
CAMU-99-1S*	05/31/02	X	X	X[2]	X									
CAMU-99-1D*	05/31/02	X	X	X[2]	X									
CAMU-99-2S	05/29/02	X	X	X[2]	X									
CAMU-99-2D*	05/31/02	X	X	X[2]	X									
CAMU-99-3S*	05/30/02	X	X	X[2]	X									

TABLE 2.1
SUMMARY OF SAMPLES COLLECTED
SPRING 2002 GROUNDWATER MONITORING EVENT

Site Name, (IAAP Site Designation)/ Well Number	Date Sampled	Analytical Parameters							QC Duplicates[3]	MS/MSD[3]	QA Split[4]	Perchlorate[5]	RDX Metabolite[6]	Notes
		Explosives	Metals	VOCs	SVOCs	Radionuclides	Total Uranium	Natural Attenuation						
Demolition Area, (IAAP-21) / Deactivation Furnace, (IAAP-23)														
JAW-01	06/12/02	X	X					X						
JAW-02*	06/13/02	X	X					X						
G-9*	06/13/02	X	X					X						
G-10*	06/13/02	X	X					X						
G-11*	06/13/02	X	X					X						
DA-01	06/12/02	X	X					X						
DA-02	06/12/02	X	X					X						
Firing Site, (IAAP-30)														
JAW-32	DRY													
JAW-33	DRY													
JAW-34	06/28/02	X	X[1]			X	X							
JAW-618	06/27/02	X	X[1]			X	X		X					QC Dup=JAW-100
Ammunition Box Chipper Disposal Pit, (IAAP-31)														
JAW-620	06/13/02	X	X		X									
West Burn Pads, (IAAP-34) / West Burn Pads Landfill, (IAAP-35) / Burn Cages, (IAAP-32) / Burn Cages Landfill, (IAAP-33)														
JAW-23*	DRY													Insufficent water for sampling
JAW-24	06/24/02	X	X	X[2]				X						
JAW-25	06/13/02	X	X	X[2]				X						
JAW-68	06/14/02	X	X	X[2]				X		X				JAW-68 MS/MSD
G-30*	06/15/02	X	X	X[2]				X						
WBP-99-1*	06/11/02	X	X	X[2]				X						
WBP-99-2	06/12/02	X	X	X[2]				X	X		X			QC Dup=WBP-99-8, QA Split=(VOC's, Explosives, and Metals)
WBP-99-3*	06/11/02	X	X	X[2]				X						
WBP-99-4*	06/13/02	X	X	X[2]				X						
WBP-99-5	06/12/02	X	X	X[2]				X						
WBP-99-6*	06/30/02	X	X	X[2]				X						
WBP-99-7*	06/11/02	X	X	X[2]				X						
North Burn Pads, (IAAP-36) / North Burn Pads Landfill, (IAAP-35) / Contaminated Waste Processor, (IAAP-24)														
JAW-11	06/13/02	X	X					X				X		
JAW-12*	06/14/02	X	X					X						
JAW-13	06/14/02	X	X					X						
JAW-14*	06/14/02	X	X					X				X		
JAW-626	06/14/02	X	X					X				X		
JAW-627	06/14/02	X	X					X	X			X		QC Dup=NBPLF-MW2

TABLE 2.1
SUMMARY OF SAMPLES COLLECTED
SPRING 2002 GROUNDWATER MONITORING EVENT

Site Name, (IAAP Site Designation)/ Well Number	Date Sampled	Analytical Parameters							QC Duplicates[3]	MS/MSD[3]	QA Split[4]	Perchlorate[5]	RDX Metabolite[6]	Notes
		Explosives	Metals	VOCs	SVOCs	Radionuclides	Total Uranium	Natural Attenuation						
North Burn Pads, (IAAP-36) / North Burn Pads Landfill, (IAAP-35) / Contaminated Waste Processor, (IAAP-24), continued														
NBPLF-MW1*	06/13/02	X	X					X						
CW-P	06/10/02	X	X					X				X		
Fire Training Area, (IAAP-39)														
JAW-58	06/24/02	X	X	X[2]				X						
JAW-59	06/18/02	X	X	X[2]				X						
JAW-60	06/18/02	X	X	X[2]				X						
JAW-61	06/18/02	X	X	X[2]				X			X			QA Split=VOCs
JAW-62	06/18/02	X	X	X[2]				X						
JAW-63	06/18/02	X	X	X[2]				X						
JAW-80	06/18/02	X	X	X[2]				X						
M-01	06/12/02	X	X	X[2]				X						
SA-99-1	06/18/02	X	X	X[2]				X	X		X			QA Split=(metals)
FTA-99-1	06/17/02	X	X	X[2]				X			X			QA Split=VOCs
FTA-99-2*	06/18/02	X	X	X[2]				X						
Plant Boundary and General Area														
G-1*	06/16/02	X	X											
G-2	06/15/02	X	X											
G-3*	06/17/02	X	X											
G-12	06/24/02	X	X											
G-13	06/17/02	X	X											
G-21	06/17/02	X	X											
G-22*	06/18/02	X	X											
G-23	06/17/02	X	X											
G-24	06/17/02	X	X											
G-25*	06/25/02	X	X											
G-26*	06/25/02	X	X											
G-27	06/18/02	X	X											
G-28	06/11/02	X	X											
G-31	06/24/02	X	X											
G-49	06/15/02	X	X											
G-51	06/25/02	X	X											
G-52	06/05/02	X	X											
G-53*	DRY													
G-54	06/25/02	X	X											
G-55*	06/25/02	X	X											
13-B	06/24/02	X	X											
13-D*	06/16/02	X	X											

TABLE 2.1
SUMMARY OF SAMPLES COLLECTED
SPRING 2002 GROUNDWATER MONITORING EVENT

Site Name, (IAAP Site Designation)/ Well Number	Date Sampled	Analytical Parameters							QC Duplicates[3]	MS/MSD[3]	QA Split[4]	Perchlorate[5]	RDX Metabolite[6]	Notes
		Explosives	Metals	VOCs	SVOCs	Radionuclides	Total Uranium	Natural Attenuation						
Plant Boundary and General Area, continued														
13-E*	06/16/02	X	X											
13-F*	06/25/02	X	X											
JAW-76	06/17/02	X	X											
Surface Water														
Long Creek 1	05/30/02	X	X[1]			X			X					QC Dup=LC3
Long Creek 2	05/30/02	X	X[1]			X								
Brush Creek 1	06/15/02	X	X											
Brush Creek 2	06/15/02	X	X											
Brush Creek 3	06/15/02	X	X											
Brush Creek 4	06/15/02	X	X											
Brush Creek 5	06/15/02	X	X											
Brush Creek 6	06/15/02	X	X											
Brush Creek 7	06/15/02	X	X											
Brush Creek Tributary 1	06/15/02	X	X											
Brush Creek Tributary 2	06/15/02	X	X											
Brush Creek Tributary 3	06/15/02	X	X											
Brush Creek Tributary 4	06/15/02	X	X											
Surface Water, Continued														
Brush Creek Tributary 5	06/15/02	X	X											
Spring Creek 1	05/31/02	X	X	X[2]										
Spring Creek 2	05/31/02	X	X	X[2]										
Spring Creek 3	05/31/02	X	X	X[2]										
Spring Creek 4	05/31/02	X	X	X[2]										
Spring Creek 5	05/31/02	X	X	X[2]										
Spring Creek Tributary 1	05/31/02	X	X	X[2]										
Spring Creek Tributary 2	05/31/02	X	X	X[2]					X	X				QC dup=SCT4; SCT2 MS/MSD
Spring Creek Tributary 3	05/31/02	X	X	X[2]										
Other QC Samples														
Rinsate	06/29/02	X		X[2]	X									
Source	06/25/02	X		X[2]	X									
TOTALS Spring 2002		**214**	**163**	**75**	**32**	**4**	**2**	**159**	**14**	**5**	**8**	**19**	**45**	

Key:

*The well was pumped dry.

QA and QC samples were collected at a 5 percent rate (i.e., 1 per every 20 samples collected).

[1]Metals analysis included total Uranium.

[2]VOC analysis included Freon 113.

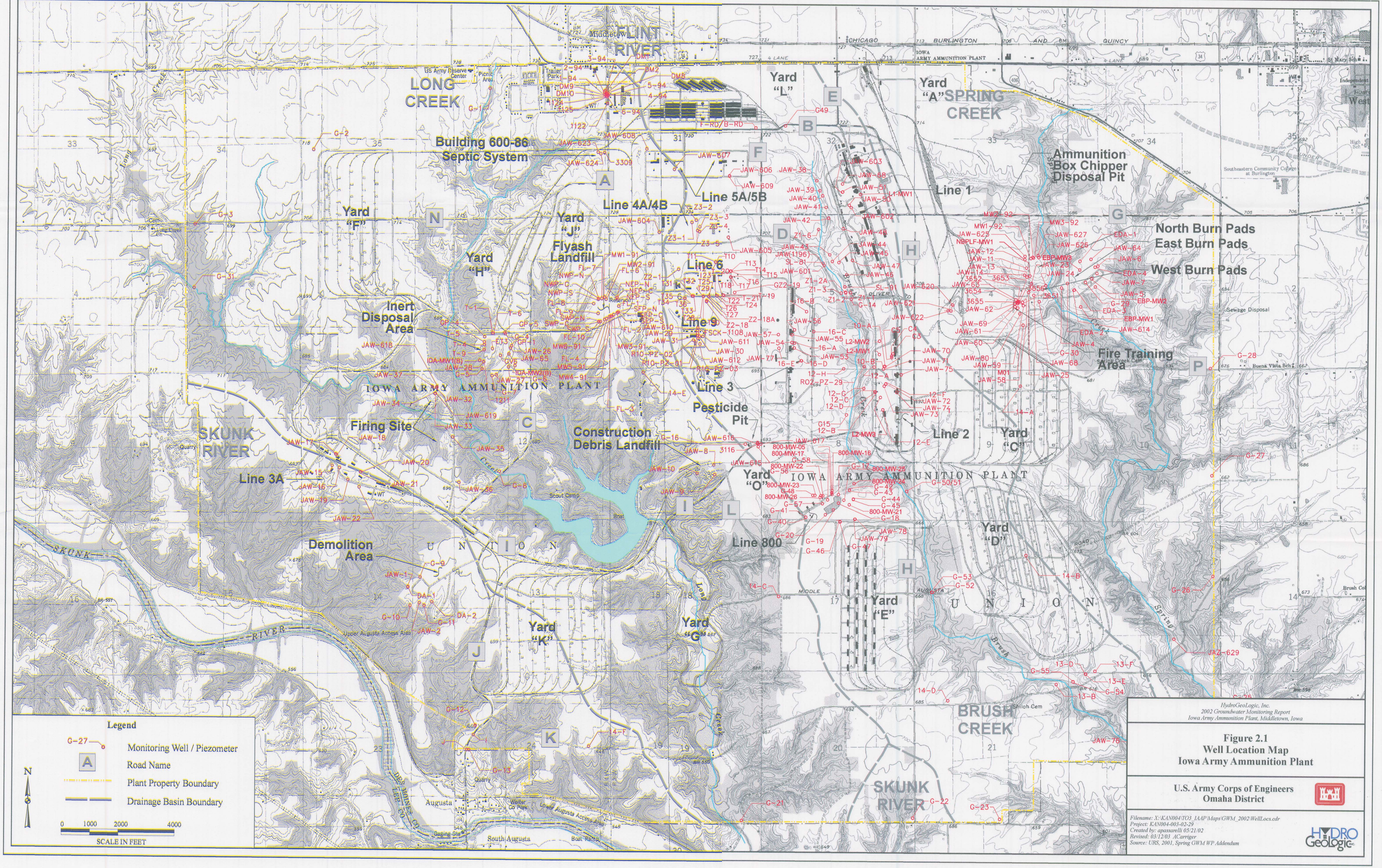
[3]QC Duplicate and MS/MSD samples were analyzed for each well's full suite of parameters, unless otherwise noted.

[4]QA Split samples were collected for explosives (7), VOCs (4), the noted suite of parameters as directed by USACE.

[5]Perchlorate samples were collected as directed by USACE.

[6]RDX Metabolite samples were collected for the Lawrence Livermore National Laboratory.

NS=Not Sampled



HydroGeoLogic, Inc.
2002 Groundwater Monitoring Report
Iowa Army Ammunition Plant, Middletown, Iowa

Figure 2.1
Well Location Map
Iowa Army Ammunition Plant

U.S. Army Corps of Engineers
Omaha District

Filename: X:\KAN004\TO3_IAAP\Maps\GWM_2002\WellLocs.cdr
Project: KAN004-003-02-29
Created by: apassarelli 05/21/02
Revised: 03/12/03 ACarriger
Source: URS, 2001, Spring GWM WP Addendum

HydroGeoLogic, Inc.

3.0 HYDROGEOLOGIC RESULTS

This section presents and interprets the hydrogeologic field data collected during the Spring 2002 groundwater monitoring events. The hydrogeologic data include water level data, estimated hydraulic gradients, interpreted groundwater flow directions, and groundwater potentiometric surface maps for each site.

3.1 SPRING 2002 GROUNDWATER LEVELS

Water level data, available well screen intervals, and screened interval lithologies were obtained during the facility-wide water level measurement round (see Table 3.1).

Groundwater levels were measured at 274 monitoring well and piezometer locations throughout the Iowa AAP facility on June 1 and 2, 2002. Depth to the water table ranged from above the ground surface (artesian) to 19.86 feet below ground surface (bgs). The artesian conditions were observed in four wells, all of which were located adjacent to Brush Creek. Two of those wells (JAW-601 and G-52) are screened in upper bedrock/bedrock. Artesian conditions were also observed in intermediate till well Z1-3, and in well Z1-6, for which the completion interval information is not known. The observance of artesian conditions at these wells is likely related to their placement in a relatively low topographic area adjacent to Brush Creek. At these well locations the land surface elevation is beneath that of the potentiometric surface elevation of the particular water bearing zone into which they are screened. It cannot be ascertained whether the presence of nearby Brush Creek is related to the artesian conditions; however, it is unlikely that the creek is hydraulically connected to the upper bedrock/bedrock aquifer.

Compared to the Spring 2001 groundwater levels, 179 wells had decreased water levels in Spring 2002. Generally, the decreases were less than two feet. The most significant decrease was observed at well 13-F (bedrock well) where the water level dropped 6.08 feet. This well is located along the southern perimeter boundary area. However, significant increases in water levels also were observed in several basal till/upper bedrock wells, with increases ranging up to 10.95 feet. This largest increase was observed in well T-30, which is located in Line 6.

3.2 GROUNDWATER OCCURRENCE AND HYDRAULIC GRADIENTS

The monitoring wells emplaced into the subsurface underlying the Iowa AAP facility are screened at three main depths: the shallow groundwater or water table (typically found in the shallow glacial till); the intermediate groundwater (intermediate glacial till); and the deep groundwater (basal glacial till, glacial outwash, upper bedrock, and bedrock). Table 3.2 describes the hydrogeologic characteristics of each site and presents the range of depths to groundwater, and horizontal and vertical gradients for the shallow till, intermediate till, and basal till/bedrock. Figures 3.1a through 3.18b present groundwater elevations and interpreted groundwater flow directions at each site. Data for each of these general occurrences of groundwater are summarized below.

3.2.1 Shallow Groundwater/Water Table - Shallow Glacial Till

The water table typically occurred in the shallow till at each site. Groundwater flow directions in the shallow till generally mimicked site topography, flowing from the upland areas and terraces toward the creeks and their tributaries. Shallow till exhibits low hydraulic conductivity, which restricts horizontal and vertical flow and yields only small quantities of groundwater to wells. Recharge to the shallow till is slow and is derived from infiltration of precipitation and, to some extent, inflow from surface water sources (e.g., washwater from load lines).

3.2.2 Intermediate Groundwater - Intermediate Glacial Till

Water levels and interpreted potentiometric surfaces of the intermediate till were typically a few feet lower than the overlying shallow till. Groundwater occurrences in the intermediate till also were influenced by the site topography, although to a lesser extent than the shallow till groundwater. Flow directions were usually similar to the overlying shallow till groundwater. Because of the similarities in groundwater flow directions, the shallow and intermediate groundwater occurrences were interpreted to have some hydraulic connection, but the differences in potentiometric surface elevations at most sites indicate that the connection is somewhat limited.

3.2.3 Deep Groundwater - Basal Till/Upper Bedrock

Water levels in wells screened at the base of the surficial soils aquifer (i.e., basal glacial till and glacial outwash) and the upper bedrock were typically tens of feet lower than wells screened in the overlying shallow and intermediate glacial till. In most cases, groundwater in the basal till and upper bedrock had very little hydraulic connection with the overlying shallow and intermediate glacial till. Groundwater flow directions in the basal till and glacial outwash typically followed the slope of the underlying upper bedrock. Groundwater in the upper bedrock was found in the weathered and fractured zones located in the upper 20 feet of this unit. Groundwater in the non-weathered bedrock often was found only in open bedding planes and joints. The disparity in water levels measured from wells screened within the bedrock at most sites indicate that these features typically are not laterally extensive, which limits lateral and vertical groundwater flow.

TABLE 3.1
WATER LEVEL MEASUREMENTS SPRING 2002 GROUNDWATER MONITORING EVENT

	Date Measured Spring 02	Well TOC Elevation[1] (ft. MSL)	Ground Elevation[1] (ft. MSL)	Well Depth (ft. BTOC)	Depth to Water Spring 01 (ft. BTOC)	Depth to Water Spring 02 (ft. BTOC)	Change in Water Level[2] (Spring 01 to Spring 02)	Water Level Elevation Spring 02 (ft. MSL)	Screened Depth (BGS)	Screened Interval	Screened Interval Lithology (USCS)	Well Dia. (in)
Line 1, (IAAP-1) / Line 1 Impoundment, (IAAP-16)												
JAW-38	06/01/02	696.52	693.5	13.1	6.03	6.38	-0.35	690.14	5-10	Shallow till	CLw/SC	2
JAW-39	06/01/02	695.22	692.4	15.2	4.07	4.55	-0.48	690.67	7-12	Shallow till	CLw/SP seams	2
JAW-40	06/01/02	695.84	693.0	23.0	3.55	4.36	-0.81	691.48	10-20	Shallow till	CLw/SP seams	2
JAW-41	06/03/02	694.56	691.7	17.9	4.11	5.12	-1.01	689.44	5-15	Shallow till	MLw/CL	2
JAW-42	06/01/02	689.82	686.9	13.0	4.93	5.19	-0.26	684.63	5-10	Shallow till	CHw/SC	2
JAW-43	06/01/02	697.02	693.9	20.1	3.41	4.20	-0.79	692.82	12-17	Shallow till	SCw/SM	2
JAW-44	06/01/02	698.67	694.9	13.7	4.05	5.42	-1.37	693.25	5-10	Shallow till	ML	2
JAW-45	06/01/02	705.72	703.0	15.7	4.78	6.25	-1.47	699.47	8-13	Shallow till	CL-SC	2
JAW-46	06/01/02	697.11	694.3	12.8	4.40	5.80	-1.40	691.31	5-10	Shallow till	CHw/MH	2
JAW-47	06/01/02	711.57	708.9	20.7	8.26	9.92	-1.66	701.65	13-18	Shallow till	CL-SC	2
JAW-48	06/01/02	704.18	701.5	46.7	7.22	7.04	0.18	697.14	30-44	Intermediate till	CHw/SP seams	2
JAW-50	06/01/02	716.85	714.3	24.5	7.17	9.41	-2.24	707.44	12-22	Shallow till	SMw/ML	2
JAW-51	06/01/02	717.89	714.7	22.2	6.31	6.92	-0.61	710.97	9-19	Shallow till	ML	4
JAW-52	06/01/02	720.16	717.4	22.8	9.88	10.94	-1.06	709.22	10-20	Shallow till	CL	2
JAW-601 (B)	06/01/02	681.41	678.7	69.9	4.34	0.05	4.29	681.36	57-67	Upper bedrock	Weathered Limestone	4
JAW-602 (B)	06/01/02	713.91	711.2	100.2	31.27	24.64	6.63	689.27	87.5-97.5	Up. bed./Glac. outwash	SP&Limestone	4
JAW-603 (B)	06/01/02	717.42	714.8	99.6	36.32	26.00	10.32	691.42	87-97	Upper bedrock	Weathered Limestone	4
SL-81	06/01/02	681.12	679.0	12.9	5.64	5.93	-0.29	675.19	5.5-10.5	Shallow till	NA	2
L1-MW1	06/01/02	719.02	716.5	37.8	11.93	12.68	-0.75	706.34	25-35	Intermediate till	CL-CH	2
Z1-1 (GZ-1)	06/01/02	685.74	682.9	52.8	5.52	5.19	0.33	680.55	40-50	Intermediate till	NA	4
Z1-2 (GZ-2)	06/01/02	673.61	671.2	32.4	NM	NM	NA	NM	20-30	Intermediate till	NA	4
Z1-2A (GZ-2A)	06/01/02	674.06	671.6	12.5	4.09	4.81	-0.72	669.25	5-10	Shallow till	NA	4
Z1-3 (GZ-3)	06/01/02	680.76	678.1	48.7	0.72	0.45	0.27	680.31	36-46	Intermediate till	NA	4
Z1-6 (GZ-6)	06/01/02	689.76	686.8	NA		0.10	-0.10	689.66	39-49	NA	NA	NA
Line 2, (IAAP-2)												
G-15	06/01/02	660.21	655.8	19.5	8.56	9.30	-0.74	650.91	6.5-16.5	Shallow till	SCw/SW	4
12-A	06/01/02	681.25	679.1	22.6	4.81	5.75	-0.94	675.50	10.5-20.5	Shallow till	CLw/ML	2
12-B	06/01/02	691.44	689.2	22.6	5.52	6.12	-0.60	685.32	10.5-20.5	Shallow till	NA	2
12-C	06/01/02	691.66	689.2	52.8	7.79	7.68	0.11	683.98	40.2-50.2	Intermediate till	NA	2
12-D (B)	06/01/02	691.26	689.3	132.0	18.88	18.50	0.38	672.76	110-120	Upper bedrock	Weathered Limestone	2
12-E	06/01/02	690.37	688.5	21.6	7.86	6.90	0.96	683.47	10-20	Shallow till	CL	2
12-F	06/01/02	690.54	688.3	52.8	7.82	7.55	0.27	682.99	40.4-50.4	Intermediate till	CLw/ML	2
12-G	06/01/02	690.00	688.0	22.6	3.45	6.43	-2.98	683.57	10.3-20.3	Shallow till	CLw/SC seams	2
JAW-70	06/01/02	685.22	682.4	37.9	3.16	3.27	-0.11	681.95	7-17	Shallow till	ML-SMw/SP	2
JAW-71	06/01/02	684.61	682.3	19.4	4.96	4.72	0.24	679.89	7-17	Shallow till	CLw/SC	2
JAW-72	06/01/02	691.09	688.1	23.0	3.66	4.00	-0.34	687.09	10-20	Shallow till	SPw/SC	2
JAW-73	06/01/02	692.41	689.7	22.7	4.71	5.48	-0.77	686.93	10-20	Shallow till	CLw/SC	2
JAW-74	06/01/02	693.95	691.4	24.6	8.11	10.16	-2.05	683.79	12-22	Shallow till	CL-SCw/SM	2
JAW-75	06/01/02	691.97	688.8	20.7	3.72	3.70	0.02	688.27	7-17.5	Shallow till	CLw/trace SC	2
L2-MW1	06/01/02	679.57	677.6	37.5	6.54	4.87	1.67	674.70	25-35	Intermediate till	CL-CH	2
L2-MW2	06/01/02	686.68	684.0	20.1	2.89	2.66	0.23	684.02	7.5-17.5	Shallow till	CL-CH	2
L2-MW3	06/01/02	692.32	689.8	27.7	5.67	6.09	-0.42	686.23	15-25	Shallow till	CLw/SC	2
Line 3, (IAAP-3)												
16-A (B)	06/01/02	696.30	694.3	112.6	14.95	13.52	1.43	682.78	99.4-109.4	Upper bedrock	CLw/SP	2
16-B	06/01/02	701.10	699.1	27.3	2.66	3.08	-0.42	698.02	15.1-25.1	Shallow till	CL	2
16-C	06/01/02	697.69	695.7	27.8	3.81	4.15	-0.34	693.54	15.6-25.6	Shallow till	ML	2
16-D	06/01/02	697.66	695.8	27.7	2.70	3.11	-0.41	694.55	15-25	Shallow till	CLw/ML	2
16-E	06/01/02	697.55	695.7	57.7	6.24	5.95	0.29	691.60	45-55	Intermediate till	CL/MLw/SC seams	2
JAW-53	06/01/02	696.11	694.0	20.1	3.74	3.88	-0.14	692.23	8-18	Shallow till	CLw/SC seams	2
JAW-54	06/01/02	698.09	695.8	27.3	3.22	3.50	-0.28	694.59	10-25	Shallow till	ML-SMw/SC	2

TABLE 3.1
WATER LEVEL MEASUREMENTS SPRING 2002 GROUNDWATER MONITORING EVENT

	Date Measured Spring 02	Well TOC Elevation[1] (ft. MSL)	Ground Elevation[1] (ft. MSL)	Well Depth (ft. BTOC)	Depth to Water Spring 01 (ft. BTOC)	Depth to Water Spring 02 (ft. BTOC)	Change in Water Level[2] (Spring 01 to Spring 02)	Water Level Elevation Spring 02 (ft. MSL)	Screened Depth (BGS)	Screened Interval	Screened Interval Lithology (USCS)	Well Dia. (in)
Line 3, (IAAP-3), cont.												
JAW-55	06/01/02	698.69	696.4	27.3	4.25	4.58	-0.33	694.11	10-25	Shallow till	ML-SM	2
JAW-56	06/01/02	701.21	698.9	22.3	2.74	3.15	-0.41	698.06	10-20	Shallow till	CLw/SC seams	2
JAW-57	06/01/02	705.97	703.9	27.1	4.14	5.44	-1.30	700.53	15-25	Shallow till	CH	2
JAW-77	06/01/02	702.76	700.6	22.2	4.32	5.00	-0.68	697.76	10-20	Shallow till	CL-SC	2
Line 3A, (IAAP-4) / Line 3A Pond, (IAAP-41) / Line 3A STP, (IAAP-29)												
JAW-15	06/01/02	712.88	710.7	22.2	3.75	6.09	-2.34	706.79	5-20	Shallow till	CLw/CH	2
JAW-16 (B)	06/01/02	713.07	711.0	60.1	16.38	16.65	-0.27	696.42	43-58	Up. bed./Glac. outwash	SC & Weath. Shale	2
JAW-17	06/01/02	711.83	709.3	17.5	3.85	3.98	-0.13	707.85	5-15	Shallow till	CHw/trace SC	2
JAW-18 (B)	06/01/02	711.74	709.2	53.5	45.10	44.84	0.26	666.90	36-51	Up. bed./Glac. outwash	CHw/SP & Limestone	2
JAW-19	06/01/02	715.77	713.2	17.9	4.29	7.08	-2.79	708.69	5-15	Shallow till	CL-CH	2
JAW-20 (B)	06/01/02	713.82	711.9	60.0	25.04	25.92	-0.88	687.90	43-58	Up. bed./Glac. outwash	SC & Weath. Shale	4
JAW-21	06/01/02	714.66	711.9	22.8	3.84	4.80	-0.96	709.86	5-20	Shallow till	ML-SMw/SC	2
JAW-22	06/01/02	713.57	711.4	22.2	6.86	10.21	-3.35	703.36	5-20	Shallow till	CHw/SC	2
Line 4A and 4B, (IAAP-5)												
JAW-604	06/02/02	721.81	719.4	20.2	2.81	3.41	-0.60	718.40	4.8-14.8	Shallow till	CH	2
JAW-605	06/05/02	719.99	717.8	19.2	3.48	6.51	-3.03	713.48	7-17	Shallow till	CL	2
Z3-1	06/02/02	727.01	724.3	21.8	5.53	7.08	-1.55	719.93	9-19	Shallow till	NA	4
Z3-2	06/02/02	727.39	724.7	10.7	8.53	9.79	-1.26	717.60	3-8	Shallow till	NA	4
Z3-4	06/02/02	725.91	721.7	32.2	NM	11.20	NA	714.71	18-28	Shallow till	NA	4
Z3-5	06/02/02	726.52	722.9	22.1	6.17	11.12	-4.95	715.40	8.5-18.5	Shallow till	NA	4
Line 5A and 5B, (IAAP-6)												
5A-MW1	06/01/02	726.14	723.8	20.0	3.37	3.98	-0.61	722.16	7.5-17	Shallow till	CL-CH	2
5A-MW2	06/01/02	726.83	724.7	20.1	3.84	4.31	-0.47	722.52	7.5-17	Shallow till	CHw/SC	2
5B-MW1	06/01/02	729.65	727.1	20.5	5.40	7.58	-2.18	722.07	7.5-17	Shallow till	CL-CH	2
5B-MW2	06/01/02	729.02	726.7	22.9	3.59	5.90	-2.31	723.12	10-19.5	Shallow till	CL-CHw/SC	2
JAW-606	06/01/02	722.29	720.3	17.0	2.84	5.50	-2.66	716.79	5-15	Shallow till	CL-CH	2
JAW-607	06/01/02	730.11	727.8	17.9	3.03	6.18	-3.15	723.93	6.5-15.5	Shallow till	CL	2
JAW-608	06/01/02	729.84	727.7	21.1	5.11	7.36	-2.25	722.48	9-19	Shallow till	CLw/SC	2
JAW-609 (B)	06/01/02	722.19	720.1	114.1	50.28	36.09	14.19	686.10	102-112	Upper bedrock	Weathered Limestone	4
Line 6, (IAAP-7)												
GZ2-1	06/01/02	725.51	722.2	58.0	12.95	13.60	NA	711.91	44-54	Intermediate till	NA	4
T-10	06/01/02	725.02	722.8	27.9	3.95	5.66	-1.71	719.36	14-24.5	Shallow till	NA	4
T-11	06/01/02	724.46	722.6	76.3	41.65	32.33	9.32	692.13	60-70	Intermediate till	NA	4
T-12 (B)	06/01/02	725.12	723.1	123.1	53.56	47.88	NA	677.24	111-121	Upper bedrock	NA	2
T-16	06/01/02	717.81	715.7	22.5	2.60	4.92	-2.32	712.89	10-20	Shallow till	NA	4
T-17	06/01/02	717.84	715.9	75.6	22.37	18.90	3.47	698.94	60-70	Intermediate till	NA	4
T-18 (B)	06/01/02	717.54	715.6	117.0	38.63	34.85	3.78	682.69	100-115	Upper bedrock	NA	2
T-28	06/01/02	715.77	713.7	23.0	NM	5.54	NA	710.23	10-20	Shallow till	NA	4
T-29	06/01/02	715.79	713.7	77.0	23.10	19.58	3.52	696.21	60-70	Intermediate till	NA	4
T-30 (B)	06/01/02	716.14	713.9	151.2	57.43	46.48	10.95	669.66	139-149	Upper bedrock	NA	2
T-34	06/01/02	715.05	712.8	23.1	5.70	6.52	-0.82	708.53	10-20	Shallow till	NA	4
T-35	06/01/02	716.01	712.6	77.6	23.19	20.05	3.14	695.96	60-70	Intermediate till	NA	4
T-36 (B)	06/01/02	714.95	712.5	161.9	63.75	61.09	2.66	653.86	149.5-159.5	Upper bedrock	NA	2
Line 7, (IAAP-8) There are no wells at this site.												
Line 8, (IAAP-9) There are no wells at this site.												

TABLE 3.1
WATER LEVEL MEASUREMENTS SPRING 2002 GROUNDWATER MONITORING EVENT

	Date Measured Spring 02	Well TOC Elevation[1] (ft. MSL)	Ground Elevation[1] (ft. MSL)	Well Depth (ft. BTOC)	Depth to Water Spring 01 (ft. BTOC)	Depth to Water Spring 02 (ft. BTOC)	Change in Water Level[2] (Spring 01 to Spring 02)	Water Level Elevation Spring 02 (ft. MSL)	Screened Depth (BGS)	Screened Interval	Screened Interval Lithology (USCS)	Well Dia. (in)
Line 9, (IAAP-10)												
JAW-29	06/01/02	713.93	711.2	21.8	3.67	5.41	-1.74	708.52	9-19	Shallow till	ML-SM	2
JAW-30	06/01/02	714.15	711.4	21.8	4.50	6.20	-1.70	707.95	9-19	Shallow till	CL-SCw/SM	2
JAW-31	06/01/02	713.47	711.0	21.5	3.91	5.75	-1.84	707.72	9-19	Shallow till	CLw/SC	2
JAW-610	06/01/02	712.78	710.1	20.6	2.52	3.88	-1.36	708.90	8-18	Shallow till	CLw/SC	2
JAW-611	06/01/02	713.01	710.8	18.7	3.58	4.85	-1.27	708.16	6.5-16.5	Shallow till	CLw/SC	2
JAW-612	06/01/02	709.06	708.0	17.6	3.85	4.70	-0.85	704.36	6.5-16.5	Shallow till	SC	2
R10-PZ-02	06/01/02	706.50	705.4	20.1	1.98	2.55	-0.57	703.95	9-19	Shallow till	CLw/SC	1
Line 800, (IAAP-11) / Pink Water Lagoon, (IAAP-44)												
G-17	06/02/02	684.21	681.2	22.0	5.23	6.17	-0.94	678.04	9-19	Shallow till	CLw/trace SC	4
G-18	06/02/02	682.79	680.1	21.4	3.10	3.85	-0.75	678.94	9-19	Shallow till	CHw/CL-SC	4
G-19	06/02/02	683.40	680.3	22.6	4.33	4.77	-0.44	678.63	9.5-19.5	Shallow till	CHw/SP seams	4
G-20	06/02/02	685.78	683.4	21.1	6.07	7.24	-1.17	678.54	9.5-19.5	Shallow till	CLw/SP seams	4
G-40 (B)	06/02/02	684.08	682.3	85.6	32.45	29.07	3.38	655.01	73.3-83.3	Bedrock	Limestone	4
G-41	06/02/02	684.23	682.5	22.4	2.02	2.19	-0.17	682.04	9.8-19.8	Shallow till	CLw/trace SC	4
G-42 (B)	06/02/02	685.27	683.1	78.6	22.08	21.83	0.25	663.44	66.5-76.5	Upper bedrock	Limestone&Shale	4
G-43	06/02/02	685.60	683.3	44.4	14.95	14.24	0.71	671.36	32.1-42.1	Intermediate till	SPw/SC	4
G-44 (B)	06/02/02	682.02	679.7	80.3	17.72	17.51	0.21	664.51	68-78	Upper bedrock	Shale	4
G-45	06/02/02	681.38	679.7	42.4	6.09	6.41	-0.32	674.97	30-40	Intermediate till	SCw/SP	4
G-46 (B)	06/02/02	680.44	678.4	70.0	8.48	8.95	-0.47	671.49	58-68	Bedrock	Limestone	4
G-47	06/02/02	680.59	678.5	28.1	4.68	5.03	-0.35	675.56	16-26	Intermediate till	CLw/SP	4
G-48	06/02/02	683.11	681.9	31.6	3.34	3.80	-0.46	679.31	20.4-30.4	Intermediate till	SCw/SP	4
G-56	06/02/02	681.90	679.9	30.7	3.99	4.30	-0.31	677.60	18.5-28.5	Intermediate till	SM	4
G-57	06/02/02	682.44	680.3	31.9	3.32	3.99	-0.67	678.45	20-30	Intermediate till	SMw/SP	4
G-58	06/02/02	683.38	680.2	33.5	4.11	5.00	-0.89	678.38	20.1-30.1	Intermediate till	ML-SM	4
JAW-78 (B)	06/02/02	677.71	674.8	68.2	7.22	7.19	0.03	670.52	50-65	Upper bedrock	Limestone&Shale	2
JAW-79	06/02/02	677.74	674.8	38.5	4.98	5.25	-0.27	672.49	25-30	Intermediate till	SCw/SP	2
800-MW-1	06/02/02	684.71	682.6	23.2	5.65	6.09	-0.44	678.62	9.9-19.9	Shallow till	SC	2
800-MW-2 (B)	06/02/02	682.72	680.9	78.4	10.86	10.27	0.59	672.45	66-76	Upper bedrock	Limestone&Shale	2
800-MW-3 (B)	06/02/02	682.63	680.9	81.5	24.03	23.82	0.21	658.81	69-79	Upper bedrock	Fract. Limestone&Shale	2
800-MW-4 (B)	06/02/02	685.92	683.8	76.4	17.83	17.79	0.04	668.13	64-74	Upper bedrock	Limestone&Shale	2
800-MW-5	06/02/02	678.80	677.5	20.7	6.94	2.49	4.45	676.31	7.5-17.5	Shallow till	CLw/trace SC	2
800-MW-6	06/02/02	681.54	679.3	20.6	7.93	5.35	2.58	676.19	7.5-17.5	Shallow till	CL-SC	2
800-MW-7	06/02/02	682.64	681.1	39.8	4.82	5.46	-0.64	677.18	27.5-37.5	Intermediate till	SMwML	2
800-MW-8	06/02/02	685.38	683.3	20.2	4.84	4.83	0.01	680.55	7.5-17.5	Shallow till	CLw/trace SC	2
800-MW-9	06/02/02	685.59	683.9	20.1	7.35	6.82	0.53	678.77	7.5-17.5	Shallow till	CL	2
800-MW-10	06/02/02	681.25	679.2	20.4	3.95	3.87	0.08	677.38	7.5-17.5	Shallow till	CLw/trace SC	2
800-MW-11 (B)	06/02/02	681.33	679.2	78.6	18.87	18.07	0.80	663.26	66.2-76.2	Upper bedrock	Fract. Limestone&Shale	2
800-MW-12	06/02/02	687.37	685.5	20.6	4.52	5.23	-0.71	682.14	7.5-17.5	Shallow till	SM	2
800-MW-13	06/02/02	686.06	684.0	20.6	4.69	5.47	-0.78	680.59	7.5-17.5	Shallow till	SM	2
800-MW-14	06/02/02	685.72	683.6	37.8	6.18	7.13	-0.95	678.59	25-35	Intermediate till	MLw/SM	2
800-MW-15	06/02/02	682.14	680.2	20.7	6.67	7.15	-0.48	674.99	7.5-17.5	Shallow till	CL & SM	2
800-MW-16 (B)	06/02/02	679.59	677.5	73.1	15.76	5.36	10.40	674.23	60.5-70.5	Upper bedrock	Fract. Limestone&Shale	2
800-MW-17	06/02/02	679.55	677.7	36.9	2.50	2.84	-0.34	676.71	24.5-34.5	Intermediate till	CLw/trace SM	2
800-MW-18	06/02/02	681.86	679.5	20.7	4.08	4.20	-0.12	677.66	7.5-17.5	Shallow till	CLw/trace SP	2
800-MW-19 (B)	06/02/02	680.67	678.4	76.8	16.20	15.90	0.30	664.77	64-74	Upper bedrock	Weath. Limestone&Shale	2
800-MW-20	06/02/02	678.81	676.7	20.7	5.63	5.76	-0.13	673.05	7.5-17.5	Shallow till	CL	2
800-MW-21 (B)	06/02/02	682.17	680.1	80.2	19.12	18.88	0.24	663.29	67-77	Upper bedrock	Fract. Limestone&Shale	2
800-MW-22 (B)	06/02/02	682.34	679.6	67.2	5.35	5.62	-0.27	676.72	54-64	Upper bedrock	Limestone	2
800-MW-23 (B)	06/02/02	684.73	682.2	67.0	7.16	8.74	-1.58	675.99	54-64	Upper bedrock	Limestone w/Shale	2
800-MW-24 (B)	06/02/02	680.54	678.0	79.6	16.36	16.12	0.24	664.42	67-77	Upper bedrock	Limestone	2

TABLE 3.1
WATER LEVEL MEASUREMENTS SPRING 2002 GROUNDWATER MONITORING EVENT

	Date Measured Spring 02	Well TOC Elevation[1] (ft. MSL)	Ground Elevation[1] (ft. MSL)	Well Depth (ft. BTOC)	Depth to Water Spring 01 (ft. BTOC)	Depth to Water Spring 02 (ft. BTOC)	Change in Water Level[2] (Spring 01 to Spring 02)	Water Level Elevation Spring 02 (ft. MSL)	Screened Depth (BGS)	Screened Interval	Screened Interval Lithology (USCS)	Well Dia. (in)
Line 800, (IAAP-11) / Pink Water Lagoon, (IAAP-44), cont.												
800-MW-25	06/02/02	681.96	679.9	20.1	2.21	2.45	-0.24	679.51	7.5-17.5	Shallow till	CL-CHw/SC	2
800-MW-26	06/02/02	682.53	679.9	19.9	4.36	4.63	-0.27	677.90	7-17	Shallow till	CL-CHw/SC	2
East Burn Pads, (IAAP-12)												
EDA-01	06/01/02	695.37	692.5	28.7	3.94	5.33	-1.39	690.04	16-25.8	Shallow till	NA	4
EDA-02 (B)	06/01/02	673.22	671.6	29.4	15.29	17.11	-1.82	656.11	12-27	Upper bedrock	Weathered Limestone	4
EDA-03 (B)	06/01/02	676.59	674.3	41.5	17.95	19.05	-1.10	657.54	28-37.6	Upper bedrock	Limestone&Shale	4
EDA-04	06/01/02	685.20	683.4	21.8	4.77	5.72	-0.95	679.48	9.4-18.4	Shallow till	NA	4
G-29	06/01/02	684.33	681.9	20.6	4.21	5.10	-0.89	679.23	8-18	Shallow till	NA	4
JAW-04 (B)	06/01/02	661.00	658.0	26.0	10.42	11.81	-1.39	649.19	13-23	Upper bedrock	Weathered Limestone	4
JAW-05	06/01/02	686.86	684.3	19.6	4.15	4.41	-0.26	682.45	7-17	Shallow till	ML	2
JAW-06	06/01/02	678.04	675.4	28.6	5.08	5.30	-0.22	672.74	16-26	Shallow till	ML-SM	2
JAW-07	06/01/02	689.32	687.0	22.3	4.40	5.81	-1.41	683.51	10-20	Shallow till	CLw/SC&SM	2
JAW-64	06/01/02	686.71	684.1	21.6	3.12	4.15	-1.03	682.56	9-19	Shallow till	CLw/trace SC	2
JAW-614 (B)	06/01/02	675.74	673.5	39.6	17.19	18.32	-1.13	657.42	27-37	Upper bedrock	Limestone&Shale	4
EBP-MW1 (B)	06/01/02	670.89	668.3	57.5	31.19	30.84	0.35	640.05	44.5-54.5	Bedrock	Limestone&Shale	2
EBP-MW2	06/01/02	684.80	682.2	146.4	42.80	43.18	-0.38	641.62	133.5-143.5	Basal till	CH-OH	2
EBP-MW3	06/01/02	690.63	688.0	27.2	4.80	5.12	-0.32	685.51	14.5-24.5	Shallow till	CLw/SC	2
Incendiary Disposal Area, (IAAP-13) There are no wells at this site.												
Boxcar Unloading Area, (IAAP-14) There are no wells at this site.												
Old Flyash Waste Pile, (IAAP-15) There are no wells at this site.												
Pesticide Pit, (IAAP-17)												
Sump	06/01/02	NA	NA	NA	5.77	7.05	-1.28	NA	NA	NA	NA	NA
JAW-615	06/01/02	693.50	691.3	18.7	3.25	4.26	-1.01	689.24	6.5-16.5	Shallow till	CL-SC	2
JAW-616	06/01/02	693.76	691.4	18.8	4.46	4.82	-0.36	688.94	6.5-16.5	Shallow till	CH-SC	2
JAW-617	06/01/02	693.83	691.6	18.8	3.93	4.85	-0.92	688.98	6.5-16.5	Shallow till	CH-SC	2
G-16	06/01/02	696.11	693.5	21.9	5.41	6.58	-1.17	689.53	10-20	Shallow till	CL-SC	4
Possible Demolition Site, (IAAP-18) There are no wells at this site.												
Contaminated Clothing Laundry, (IAAP-19) There are no wells at this site.												
Inert Disposal Area, (IAAP-20)												
IDA-MW1 (B)	05/29/02	696.00	693.6	151.4	43.94	43.97	-0.03	652.03	138-148	Upper bedrock	Limestone	2
IDA-MW2 (B)	05/29/02	703.03	701.4	114.7	49.84	49.31	0.53	653.72	102-112	Bedrock	Limestone	2
CAMU-99-1S[2]	05/29/02	694.17	688.9	32.3	12.73	12.70	0.03	681.47	19.5-29.5	Shallow till	CLw/SP	2
CAMU-99-1D (B)[2]	05/31/02	694.11	689.0	149.7	43.46	43.46	0.00	650.65	137-147	Upper bedrock	Limestone	2
CAMU-99-2S[2]	05/29/02	706.51	701.6	32.5	14.06	12.64	1.42	693.87	20-30	Shallow till	SC-GC	2
CAMU-99-2D (B)[2]	05/29/02	706.67	701.5	160.3	56.45	58.23	-1.78	648.44	147.5-157.5	Upper bedrock	Limesone&Shale	2
CAMU-99-3S[2]	05/29/02	711.40	706.0	32.8	14.99	14.91	0.08	696.49	20-30	Shallow till	SC-GC	2
ET-3	05/29/02	717.27	NA	39.9	NM	26.62	NA	690.65	NA	Intermediate till	ML/CL	2
G-4	05/29/02	707.96	706.0	28.6	6.47	8.01	-1.54	699.95	16-26	Shallow till	CL-SC	4
G-5	06/02/02	692.23	689.1	53.3	38.80	37.97	0.83	654.26	40-50	Intermediate till	SMw/SP	4
G-6R	05/29/02	702.10	NA	30.8	4.04	5.11	-1.07	696.99	20-30	Shallow till	NA	4
G-7	05/29/02	695.36	692.8	44.2	22.26	21.43	0.83	673.93	32-42	Intermediate till	CL-SCw/SP&GP	4
JAW-26	05/29/02	703.43	701.7	24.6	8.25	9.32	-1.07	694.11	12.5-22.5	Shallow till	SC&SM	4
JAW-27 (B)	05/29/02	685.97	684.2	118.3	37.19	37.98	-0.79	647.99	101-116	Upper bedrock/Till	SC/Limestone	2
JAW-28	05/29/02	697.83	695.8	64.6	28.25	27.50	0.75	670.33	47-62	Intermediate till	SCw/SP	2
JAW-65	05/29/02	703.55	702.2	25.9	8.70	5.22	3.48	698.33	19-24	Shallow till	CLw/trace SC	2
T-1	05/29/02	712.40	711.0	37.8	11.30	12.38	-1.08	700.02	25-35	Shallow till	CL	4
T-4	05/29/02	706.56	704.6	42.9	19.38	18.59	0.79	687.97	30-40	Shallow till	CL	4
T-5	05/29/02	709.59	707.4	42.6	20.27	19.35	0.92	690.24	30-40	Shallow till	CL	4
T-6 (B)	05/29/02	712.63	711.2	130.2	59.72	59.81	-0.09	652.82	118.5-128.5	Upper bedrock	Limestone-Shale	2

TABLE 3.1
WATER LEVEL MEASUREMENTS SPRING 2002 GROUNDWATER MONITORING EVENT

	Date Measured Spring 02	Well TOC Elevation[1] (ft. MSL)	Ground Elevation[1] (ft. MSL)	Well Depth (ft. BTOC)	Depth to Water Spring 01 (ft. BTOC)	Depth to Water Spring 02 (ft. BTOC)	Change in Water Level[3] (Spring 01 to Spring 02)	Water Level Elevation Spring 02 (ft. MSL)	Screened Depth (BGS)	Screened Interval	Screened Interval Lithology (USCS)	Well Dia. (in)
Inert Disposal Area, (IAAP-20), cont.												
T-9 (B)	05/29/02	702.88	NA	139.0	50.87	50.64	0.23	652.24	127-137	Upper bedrock	Limestone	2
C95-1	05/29/02	699.77	NA	16.3	7.09	6.52	0.57	693.25	5-15	Shallow till	NA	2
C95-2	05/29/02	693.89	NA	26.0	18.72	17.25	1.47	676.64	18-28	Shallow till	NA	2
C-00-1	05/29/02	684.63	NA	29.1	6.13	6.39	-0.26	678.24	12.5-22.5	Shallow till	CL/MLwSW seams	NA
C-00-2	05/29/02	696.43	NA	22.6	10.15	10.54	-0.39	685.89	19-29	Shallow till	CLw/SM-SC	NA
C-00-3	05/29/02	699.92	NA	42.0	23.71	22.81	0.90	677.11	32-42	Intermediate till	CLw/SM-SW	NA
Demolition Area, (IAAP-21) / Deactivation Furnace, (IAAP-23)												
JAW-01 (B)	06/02/02	676.99	674.5	22.0	8.96	9.57	-0.61	667.42	5-20	Upper bedrock/Till	SM&Limestone	2
JAW-02 (B)	06/02/02	685.04	682.8	29.3	15.85	16.15	-0.30	668.89	12-27	Upper bedrock/Till	SM&Limestone	2
G-9	06/02/02	694.86	692.1	27.2	7.98	7.48	0.50	687.38	16.5-26.5	Shallow till	CH-SC	4
G-10 (B)	06/13/02	685.34	681.9	25.6	16.44	15.44	1.00	669.90	14-24	Upper bedrock	Weathered Limestone	4
G-11 (B)	06/02/02	695.03	691.6	38.2	28.50	28.59	-0.09	666.44	26-36	Upper bedrock	Weathered Limestone	4
DA-01 (B)	06/02/02	675.78	673.5	22.9	7.74	8.26	-0.52	667.52	11-20.6	Upper bedrock	Weathered Limestone	4
DA-02 (B)	06/02/02	680.56	678.3	26.8	8.57	10.02	-1.45	670.54	15-24.5	Upper bedrock	Weathered Limestone	4
Unidentified Substance Waste Site, (IAAP-22) There are no wells at this site.												
Explosives Waste Incinerator, (IAAP-25) There are no wells at this site.												
Sewage Treatment Plant/Sludge Drying Beds, (IAAP-26) There are no wells at this site.												
Flyash Landfill, (IAAP-27) / Flyash Disposal Area, (IAAP-43)												
MW2-91	06/01/02	716.47	714.6	NM	50.04	46.12	3.92	670.35	NA	NA	NA	4
MW4-91	06/01/02	716.39	714.7	NM	51.09	47.30	3.79	669.09	NA	NA	NA	4
FL-4	06/01/02	712.46	710.4	NM	4.40	5.64	-1.24	706.82	NA	Shallow till	NA	4
FL-6	06/01/02	717.04	714.3	NM	3.72	3.97	-0.25	713.07	NA	Shallow till	NA	4
FL-9	06/01/02	714.11	712.4	NM	1.76	2.44	-0.68	711.67	NA	Shallow till	NA	4
FL-10	06/01/02	712.71	710.9	NM	2.90	3.52	-0.62	709.19	NA	Shallow till	NA	4
NEP-E	06/01/02	716.56	714.0	NM	NM	3.95	NA	712.61	NA	NA	NA	NA
NEP-W	06/01/02	716.87	714.2	NM	3.49	3.90	-0.41	712.97	NA	Shallow till	NA	2
NWP-C	06/01/02	717.01	715.5	NM	9.81	6.42	3.39	710.59	NA	NA	NA	2
NWP-N	06/01/02	717.28	715.6	NM	2.82	3.55	-0.73	713.73	NA	Shallow till	NA	2
NWP-S	06/01/02	716.97	715.4	NM	5.69	5.85	-0.16	711.12	NA	Intermediate till	NA	2
SEP-C	06/01/02	717.30	716.0	NM	8.61	8.88	-0.27	708.42	NA	NA	NA	2
SEP-E	06/01/02	716.95	716.0	NM	7.26	8.11	-0.85	708.84	NA	NA	NA	2
SEP-W	06/01/02	717.72	716.3	NM	15.27	15.79	-0.52	701.93	NA	NA	NA	2
Construction Debris Landfill, (IAAP-28)												
JAW-8	06/01/02	697.57	695.4	22.1	5.05	7.21	-2.16	690.36	10-20	Shallow till	MLw/SM	2
JAW-9	06/01/02	697.38	692.0	25.4	5.60	8.95	-3.35	688.43	10-20	Shallow till	MLw/SM	2
JAW-10	06/01/02	688.92	686.9	26.1	16.40	16.61	-0.21	672.31	9-24	Shallow till	SM	2
Firing Site, (IAAP-30)												
JAW-32	06/02/02	690.73	688.5	17.3	DRY	11.14	NA	679.59	5-15	Shallow till	ML-SMw/SP seams	2
JAW-33	06/02/02	684.88	682.4	17.5	DRY	11.77	NA	673.11	5-15	Shallow till	ML-SM	4
JAW-34 (B)	06/02/02	684.74	682.2	35.1	14.48	15.97	-1.49	668.77	19-34	Up. bed./Glac. outwash	SPw/CH&Limestone	4
JAW-35 (B)	06/02/02	642.74	640.0	23.9	8.22	8.83	-0.61	633.91	11-21	Up. bed./Glac. outwash	SPw/CH&Limestone	4
JAW-36	06/02/02	696.80	694.6	22.2	2.76	4.60	-1.84	692.20	10-20	Shallow till	ML-SM	2
JAW-37	06/02/02	684.92	682.8	17.1	NM	6.99	NA	677.93	5-15	Shallow till	SM	2
JAW-618 (B)	06/02/02	692.92	690.5	60.2	46.25	47.79	-1.54	645.13	52-57	Upper bedrock	Weathered Limestone	4
JAW-619 (B)	06/02/02	684.56	682.4	55.4	NM	39.36	NA	645.20	43-53	Upper bedrock	Weathered Limestone	4
G-8	06/02/02	614.36	NA	NM	NM	3.97	NA	610.39	5-15	Shallow till	MLw/trace SP	4

TABLE 3.1
WATER LEVEL MEASUREMENTS SPRING 2002 GROUNDWATER MONITORING EVENT

	Date Measured Spring 02	Well TOC Elevation[1] (ft. MSL)	Ground Elevation[1] (ft. MSL)	Well Depth (ft. BTOC)	Depth to Water Spring 01 (ft. BTOC)	Depth to Water Spring 02 (ft. BTOC)	Change in Water Level[2] (Spring 01 to Spring 02)	Water Level Elevation Spring 02 (ft. MSL)	Screened Depth (BGS)	Screened Interval	Screened Interval Lithology (USCS)	Well Dia. (in)
Ammunition Box Chipper Disposal Pit, (IAAP-31)												
JAW-620	06/01/02	704.34	702.1	18.8	3.88	5.23	-1.35	699.11	6.5-16.5	Shallow till	CL-SC	2
JAW-621	06/01/02	700.05	697.9	18.7	3.95	4.52	-0.57	695.53	6.5-16.5	Shallow till	CL-SC	2
JAW-622	06/01/02	698.86	697.1	18.3	4.02	3.90	0.12	694.96	6.5-16.5	Shallow till	CL-SC	2
West Burn Pads, (IAAP-34) / West Burn Pads Landfill, (IAAP-35) / Burn Cages, (IAAP-32) / Burn Cages Landfill, (IAAP-33)												
JAW-23 (B)	06/01/02	657.30	654.2	13.1	DRY	9.68	NA	647.62	5-10	Upper bedrock	Weathered Shale	2
JAW-24 (B)	06/01/02	643.14	640.6	13.2	6.19	6.62	-0.43	636.52	5-10	Upper bedrock/Till	SC&Weathered Shale	4
JAW-25	06/01/02	689.91	687.3	21.6	5.41	5.91	-0.50	684.00	9-19	Shallow till	ML-SM	2
JAW-68	06/01/02	679.61	677.1	20.5	4.22	3.84	0.38	675.77	8-18	Shallow till	CLw/trace SC	2
G-30 (B)	06/01/02	654.76	652.0	18.3	10.31	10.27	0.04	644.49	7-17	Upper bedrock	Weathered Limestone	4
WBP-99-1[2]	06/01/02	693.14	690.6	38.2	25.20	26.18	-0.98	666.96	25-35	Shallow till	CL/ML	2
WBP-99-2[2]	06/01/02	680.94	678.3	27.2	19.05	19.86	-0.81	661.08	15-25	Shallow till	CL-SC	2
WBP-99-3[2]	06/01/02	654.43	651.7	20.7	8.04	9.73	-1.69	644.70	8-18	Upper bedrock	Limestone-Shale	2
WBP-99-4 (B)[2]	06/01/02	670.76	668.1	27.3	12.31	13.23	-0.92	657.53	19-24	Upper bedrock	Limestonew/Shale	2
WBP-99-5 (B)[2]	06/01/02	651.85	649.2	22.9	9.43	10.15	-0.72	641.70	10-20	Upper bedrock	Limestone-Shale	2
WBP-99-6 (B)[2]	06/01/02	657.65	654.8	43.1	13.93	13.66	0.27	643.99	30-40	Bedrock	Limestone&Shale	2
WBP-99-7 (B)[2]	06/01/02	654.74	652.1	53.6	8.50	7.43	1.07	647.31	40-50	Upper bedrock	Limestone-Shale	2
North Burn Pads, (IAAP-36) / North Burn Pads Landfill, (IAAP-35) / Contaminated Waste Processor, (IAAP-24)												
JAW-11	06/01/02	691.01	688.6	31.4	4.52	6.33	-1.81	684.68	19-29	Shallow till	MLw/trace SM	2
JAW-12	06/02/02	676.81	674.1	23.7	15.53	19.20	-3.67	657.61	16-21	Shallow till	MLw/SM	2
JAW-13 (B)	06/01/02	669.61	667.2	19.4	14.89	NA	NA	NA	7-17	Upper bedrock/Till	SC&Weath. Limest.	2
JAW-14 (B)	06/01/02	673.97	671.3	30.7	10.41	12.15	-1.74	661.82	18-28	Upper bedrock	Limestone&Shale	2
JAW-626	06/01/02	679.80	677.5	19.8	5.80	7.28	-1.48	672.52	7.5-17.5	Shallow till	CH-SC	2
JAW-627 (B)	06/01/02	683.10	680.6	39.8	31.66	32.05	-0.39	651.05	27.5-37.5	Upper bedrock	Weathered Limestone	4
CW-P	06/01/02	NA	NA	27.1	5.47	5.30	0.17	NA	17-27	NA	NA	NA
NBPLF-MW1 (B)	06/01/02	693.10	690.5	70.6	17.22	17.12	0.10	675.98	58-68	Upper bedrock	Weathered Limestone	2
Building 600-86 Septic System, (IAAP-38)												
JAW-623	06/01/02	726.89	724.7	18.2	5.23	6.63	-1.40	720.26	6-16	Shallow till	ML-SM	2
JAW-624	06/01/02	727.50	725.3	17.7	8.82	8.80	0.02	718.70	5-15.5	Shallow till	CH	2
Fire Training Area, (IAAP-39)												
JAW-58	06/01/02	688.89	685.9	23.0	4.99	6.65	-1.66	682.24	10-20	Shallow till	ML&CLw/trace SC	2
JAW-59 (B)	06/01/02	685.11	682.5	35.6	7.85	9.68	-1.83	675.43	23-33	Upper bedrock/Till	SC&Fract. Limest.	2
JAW-60 (B)	06/01/02	684.21	681.5	36.8	10.94	12.26	-1.32	671.95	24-34	Upper bedrock/Till	SC&Fract. Limest.	2
JAW-61	06/01/02	685.48	683.0	20.5	6.11	7.98	-1.87	677.50	8-18	Shallow till	CLw/SP seams	2
JAW-62	06/01/02	688.41	685.8	21.6	5.43	6.85	-1.42	681.56	9-19	Shallow till	CL-SC	2
JAW-63	06/01/02	691.49	689.0	22.5	5.83	8.04	-2.21	683.45	10-20	Shallow till	SC&SM	2
JAW-80 (B)	06/01/02	675.33	672.7	27.6	5.96	7.21	-1.25	668.12	15-25	Upper bedrock/Till	SM&Limestone	2
M-01	06/01/02	NA	NA	20.4	9.22	9.25	-0.03	NA	8-18	NA	NA	2
SA-99-1 (Sump)[2]	06/01/02	688.91	687.4	29.9	2.61	4.94	-2.33	683.97	18.5-28.5	Shallow-Intermediate till	CL/MLw/SW	6
FTA-99-1[2]	06/01/02	673.31	670.2	19.8	9.17	11.85	-2.68	661.46	6.7-16.7	Shallow till	CLw/SM	2
FTA-99-2 (B)[2]	06/01/02	673.30	670.5	53.0	17.93	17.98	-0.05	655.32	40.3-50.3	Upper bedrock	Shale-Limestone	2
Roundhouse Transformer Storage Yard, (IAAP-40) There are no wells at this site.												
Abandoned Coal Storage Yard (IAAP-42), There are no wells at this site.												
Plant Boundary and General Area												
G-1	06/01/02	719.85	716.0	23.0	4.81	7.69	-2.88	712.16	10-20	Shallow till	CL	4
G-2	06/01/02	718.07	715.2	20.1	3.65	4.07	-0.42	714.00	8-18	Shallow till	CL-CH	4
G-3	06/01/02	688.02	684.1	32.2	11.56	12.51	-0.95	675.51	20.5-30.5	Intermediate till	CL&MLw/trace SP	4
G-12	06/01/02	666.07	663.3	22.4	5.24	5.89	-0.65	660.18	9.5-19.5	Shallow till	CL	4
G-13 (B)	06/01/02	649.39	646.7	31.2	11.47	19.77	-8.30	629.62	18.5-28.5	Upper bedrock	Fractured Limestone	4

TABLE 3.1
WATER LEVEL MEASUREMENTS SPRING 2002 GROUNDWATER MONITORING EVENT

	Date Measured Spring 02	Well TOC Elevation[1] (ft. MSL)	Ground Elevation[1] (ft. MSL)	Well Depth (ft. BTOC)	Depth to Water Spring 01 (ft. BTOC)	Depth to Water Spring 02 (ft. BTOC)	Change in Water Level[3] (Spring 01 to Spring 02)	Water Level Elevation Spring 02 (ft. MSL)	Screened Depth (BGS)	Screened Interval	Screened Interval Lithology (USCS)	Well Dia. (in)
G-21	06/01/02	540.87	538.8	19.1	NM	7.97	NA	532.90	7-17	Shallow till	CHw/SP seams	4
G-22	06/01/02	678.04	675.9	45.2	3.91	3.30	0.61	674.74	32-42	Intermediate till	CLw/SP	4
Plant Boundary and General Area, cont.												
G-23	06/01/02	671.76	669.6	21.0	6.19	7.19	-1.00	664.57	9-19	Shallow till	CL-SC	4
G-24 (B)	06/01/02	602.37	600.1	17.3	10.98	12.96	-1.98	589.41	6-16	Upper bedrock	Fractured Limestone	4
G-25	06/01/02	630.72	628.1	83.6	15.57	15.24	0.33	615.48	71-81	Basal till	CL-CH	4
G-26	06/01/02	659.92	656.4	103.5	42.19	37.83	4.36	622.09	90-100	Basal till	CL-CH	4
G-27	06/01/02	666.18	NA	25.4	2.73	2.74	-0.01	663.44	14-24	Shallow till	SC&SP	4
G-28	06/01/02	678.10	674.7	22.7	7.33	7.45	-0.12	670.65	10-20	Shallow till	CL	4
G-31	06/01/02	669.62	NA	17.6	4.26	7.44	-3.18	662.18	5-15	Shallow till	CLw/SP	4
G-49	06/01/02	720.03	718.1	31.8	2.81	4.76	-1.95	715.27	19.5-29.5	Intermediate till	SMw/SP	4
G-51	06/01/02	648.02	643.9	17.3	4.22	5.31	-1.09	642.71	10.2-15	Shallow till	SM	4
G-52 (B)	06/01/02	636.74	634.7	38.9	-1.44	Artesian	NA	NA	31.7-36.7	Bedrock	Shale&Limestone	4
G-53	06/01/02	637.02	634.8	12.7	5.56	8.41	-2.85	628.61	5-10	Shallow till	SMw/SP	4
G-54 (B)	06/01/02	613.74	611.6	67.5	5.17	6.39	-1.22	607.35	59.2-64.2	Bedrock	Limestone	4
G-55	06/01/02	613.08	611.0	18.0	8.84	8.32	0.52	604.76	10.3-15.3	Shallow till	ML-SM	4
13-B (B)	06/01/02	629.54	627.7	44.8	18.31	19.67	-1.36	609.87	33.6-43.6	Upper bedrock	Fractured Limestone	2
13-D (B)	06/01/02	654.59	652.8	87.5	34.18	33.15	1.03	621.44	74.8-84.8	Bedrock	ML/SW	2
13-E (B)	06/01/02	654.21	652.6	37.3	10.51	10.59	-0.08	643.62	24.5-34.5	Upper bedrock	NA	2
13-F (B)	06/01/02	660.44	658.7	57.9	7.60	13.68	-6.08	646.76	45-55	Upper bedrock	SM-ML	2
JAW-76 (B)	06/01/02	603.41	600.8	80.3	21.92	21.67	0.25	581.74	67-77	Bedrock	Shale&Limestone	2

KEY:

[1]All elevations listed were surveyed using North American Vertical Datum of 1988, with a GPS (except where noted). The achieved survey accuracy is about 1 cm horizontally and 1 to 2 cm vertically (American Survey Consultants).

[2]Elevations listed were surveyed using the National Geodetic Vertical Datum (NGVD) of 1929, and were projected to the North American Vertical Datum (NAVD) of 1988. The margin of error for transformations between NGVD 29 and NAVD 88 is typically 12-18 cm.

[3]A negative symbol associated with the change in water levels between Spring 2001 and Spring 2002 indicates a decreased water level in Spring 2002. The absence of a negative symbol indicates an increased water level in Spring 2002.

(B) = Upper bedrock or bedrock well.

TOC/BTOC = Top of casing/Below top of casing.
ft = feet
MSL = Mean Sea Level.
NM = Not measured.
NA = Data not available.
USCS = Unified Soil Classification System

CL= Lean Clay
SP=Poorly Graded Sand
SM=Silty Sand
MH = Elastic Silt
GC=Clayey Gravel

SC= Clayey Sand
ML=Silt
CH= Fat Clay
SW= Well-Graded Sand
GP= Poorly Graded Gravel

TABLE 3.2
SUMMARY OF GROUNDWATER DEPTHS AND HYDRAULIC GRADIENTS
SPRING 2002 GROUNDWATER MONITORING EVENT

Site Name, (IAAP Site Designation)	Screened Interval	Depth to Groundwater Range (ft. BGS) Spring 2002	Horizontal Hydraulic Gradient Magnitude (feet/foot) Spring 2002	Horizontal Hydraulic Gradient Direction Spring 2002	Other Hydrogeologic Results Spring 2002	
Line 1, (IAAP-1) / Line 1 Impoundment (IAAP-16)	Shallow till	1.10 to 7.72	0.009 to 0.023	West and southwest towards Brush Creek.	**Site Hydrogeology:**	There are three main occurrences of groundwater at Line 1. The groundwater in the shallow till is controlled by the site topography and the flow direction is generally toward Brush Creek along the west side of the site. Groundwater in the intermediate till flows in a more southerly direction than in the shallow till. Groundwater flow in the upper bedrock is parallel to the strike of the bedrock in a south-southeasterly direction.
	Intermediate till	+2.25 to 10.16	0.0070 to 0.0074	South-southwest toward Brush Creek.		
	Basal till	There are no wells screened in the basal till.				
	Glacial outwash	21.94	NA	South-southeast	**Vertical Gradient:**	In the spring, well cluster JAW-51 (shallow till)/ JAW-603 (upper bedrock) exhibited a downward gradient of 0.25 feet/foot.
	Upper bedrock	+2.64 to 23.37	0.0034	South-southeast		
	Bedrock	There are no wells screened in the bedrock.				
Line 2, (IAAP-2)	Shallow till	+0.02 to 7.57	0.054 to 0.0045	West, northwest, and southwest toward Brush Creek.	**Site Hydrogeology:**	The groundwater flow in the shallow till is controlled by the site topography and the flow direction is generally from the upland areas and terraces toward Brush Creek. In the north half of the site groundwater flows to the west-southwest. Groundwater in the south half exhibits a radial flow pattern to the west, northwest, and southwest. The horizontal gradient increases near Brush Creek. Because the general flow direction in the intermediate till is northward, groundwater movement in this water bearing unit is only marginally controlled by the site topography.
	Intermediate till	2.90 to 5.27	0.0033 to 0.0076	North		
	Basal till	There are no wells screened in the basal till.				
	Glacial outwash	NA	NA	NA	**Vertical Gradient:**	The three-well cluster 12-B (shallow till), 12-C (intermediate till), and 12-D (upper bedrock) was used to calculate vertical gradients. The downward gradient between shallow till and intermediate till was 0.052 feet/foot. The downward gradient between shallow till and upper bedrock was 0.12 feet/foot. The downward gradient between intermediate till and upper bedrock was 0.16 feet/foot.
	Upper bedrock	16.90	NA	NA		
	Bedrock	There are no wells screened in the bedrock.				
Line 3, (IAAP-3)	Shallow till	0.86 to 3.34	0.0088 to 0.011	Southeast towards Brush Creek.	**Site Hydrogeology:**	Groundwater in the shallow till is controlled by the site topography and the flow is generally from the upland areas and terraces toward Brush Creek.
	Intermediate till	4.09	NA	NA		
	Basal till	There are no wells screened in the basal till.				
	Glacial outwash	NA	NA	NA		
	Upper bedrock	11.57	NA	NA	**Vertical Gradient:**	In the spring, well cluster 16-D (shallow till) / 16-E (intermediate till) exhibited a downward gradient of 0.095 feet/foot.
	Bedrock	There are no wells screened in the bedrock.				
Line 3A, (IAAP-4) / Line 3A Pond, (IAAP-41) / Line 3A STP, (IAAP-29)	Shallow till	1.48 to 8.01	0.0045 to 0.0125	South and southwest towards Skunk River tributaries.	**Site Hydrogeology:**	Around the well locations at the site, which generally lie in the central and southern portion of the site, groundwater in the shallow till is controlled by the site topography and the flow is south and southwest toward nearby Skunk River tributaries. However, north of the existing wells, the groundwater flow is likely northward toward adjacent Long Creek tributaries. Groundwater flow in the glacial outwash and upper bedrock is along the bedrock interface and is generally toward the northeast.
	Intermediate till	There are no wells screened in the intermediate till.				
	Basal till	There is no basal till unit.				
	Glacial outwash Upper bedrock	14.56 to 42.34	NA	Northeast	**Vertical Gradient:**	In the spring, well cluster JAW-21 (shallow till) / JAW-20 (glacial outwash-upper bedrock) exhibited a downward gradient of 0.58 feet/foot.
	Bedrock	There are no wells screened in the bedrock.				
Line 4A and 4B, (IAAP-5)	Shallow till	1.00 to 7.49	0.0025 to 0.017	Southeast	**Site Hydrogeology:**	Generally, groundwater in the shallow till is controlled by the site topography and the flow is to the southeast toward tributaries of Brush Creek. At the far west end of the site, shallow till groundwater flow is expected to follow the topography southwest toward Long Creek tributaries.
	Intermediate till	There are no wells screened in the intermediate till.				
	Basal till	NA	NA	NA		
	Glacial outwash	NA	NA	NA		
	Upper bedrock	There are no wells screened in the upper bedrock.			**Vertical Gradient:**	The are no well clusters at this site to determine vertical gradients.
	Bedrock	There are no wells screened in the bedrock.				
Line 5A and 5B, (IAAP-6)	Shallow till	1.63 to 5.22	0.0037 to 0.012	Southeast and southwest	**Site Hydrogeology:**	Generally, groundwater flow in the shallow till is controlled by the site topography from uplands to drainage basins) and a north-south flow divide appears to lie beneath the site. The flow direction in the eastern portion of the site is to the southeast toward Brush Creek tributaries. The flow direction in the western portion of the site is toward Long Creek tributaries.
	Intermediate till	There are no wells screened in the intermediate till.				
	Basal till	There are no wells screened in the basal till.				
	Glacial outwash	The is no glacial outwash unit.				
	Upper bedrock	33.96	NA	NA	**Vertical Gradient:**	Well cluster JAW-606 (shallow till) / JAW-609 (upper bedrock) exhibited a downward gradient of 0.32 feet/foot.
	Bedrock	There are no wells screened in the bedrock.				

TABLE 3.2
SUMMARY OF GROUNDWATER DEPTHS AND HYDRAULIC GRADIENTS
SPRING 2002 GROUNDWATER MONITORING EVENT

Site Name, (IAAP Site Designation)	Screened Interval	Depth to Groundwater Range (ft. BGS) Spring 2002	Horizontal Hydraulic Gradient Magnitude (feet/foot) Spring 2002	Horizontal Hydraulic Gradient Direction Spring 2002	Other Hydrogeologic Results Spring 2002	
Line 9, (IAAP-10)	Shallow till	1.24 to 3.59	0.013 to 0.016	Southwest	**Site Hydrogeology:**	Groundwater in the shallow till is controlled by the site topography and the flow is generally to the southwest toward Long Creek tributaries.
	Intermediate till	There are no wells screened in the intermediate till.				
	Basal till	NA	NA	NA		
	Glacial outwash	NA	NA	NA		
	Upper bedrock	There are no wells screened in the upper bedrock.			**Vertical Gradient:**	The are no well clusters at this site to determine vertical gradients.
	Bedrock	There are no wells screened in the bedrock.				
Line 800, (IAAP-11) / Pink Water Lagoon, (IAAP-44)	Shallow till	0.39 to 5.21	0.0096 from the West 0.035 to the North 0.0042 to the East	Southeast and radially away from lagoon, except on the west side.	**Site Hydrogeology:**	There are three main occurrences of groundwater at Line 800. Shallow till groundwater generally flows to the southeast toward Brush Creek and its tributaries. To the north and northeast of the lagoon, horizontal gradients increase and shallow till groundwater is discharged into a tributary of Brush Creek. To the north, east, and south there is a pattern of radial flow away from the lagoon, in response to the greater hydraulic head of the lagoon. To the west, shallow groundwater flow is radially distributed east toward the lagoon, southwest toward Long Creek tributaries, and northeast toward Brush Creek tributaries. The mounding of the water table around the lagoon results in increased recharge to the shallow till. The intermediate till groundwater has a similar flow pattern as the shallow till and is also influenced by the mounding of groundwater around the lagoon creating a similar radial flow pattern away from the lagoon. The upper bedrock and bedrock groundwater seem to be hydraulically-connected. Near the lagoon, groundwater flow in the upper bedrock/bedrock exhibits radial flow to the northeast and southeast. Farther east of the lagoon, groundwater flow is to the west and northwest back toward the lagoon.
	Intermediate till	0.99 to 11.90	0.024 to the North 0.0088 to the East	Southeast and radially away from lagoon.		
	Basal till	There is no basal till unit.				
	Glacial outwash	There is no well-defined glacial outwash unit.			**Vertical Gradient:**	Vertical gradients between the shallow till and the intermediate till were upward at two locations (800-MW-5/800-MW-17 and G-20/800-MW-14) and downward at two locations (800-MW-26/G-56 and G-19/800-MW-7). The two downward gradients were 0.026 and 0.084 feet/foot, while the two upward gradients were 0.026 and 0.039 feet/foot. At 800-MW-5 (shallow till) / 800-MW-17 (intermediate till) the upward vertical gradient appear to have resulted in shallow till groundwater exiting to the surface as a seep. Vertical gradients between the shallow till and the upper bedrock were downward and ranged from an average of 0.15 feet/foot west of the lagoon to an average of 0.79 feet/foot east of the lagoon. Vertical gradients between the intermediate till and the upper bedrock were downward and ranged from an average of 0.10 feet/foot west of the lagoon to an average of 0.38 feet/foot east of the lagoon. Vertical gradients between the shallow till and the bedrock also were downward and ranged from an average of 0.065 feet/foot west of the lagoon to an average of 0.23 feet/foot east of the lagoon. The increased downward vertical gradients from the west to east in the shallow till to bedrock and intermediate till to bedrock is likely due to the greater hydraulic head in the lagoon.
	Upper bedrock	2.88 to 22.09	NA	Southwest		
	Bedrock	6.93 to 27.27	NA	Southwest		
East Burn Pads, (IAAP-12)	Shallow till	1.51 to 3.92	0.010 to 0.030	East and southeast	**Site Hydrogeology:**	Groundwater flow in the shallow till is controlled by the site topography and the flow direction is generally from the upland areas to the east/southeast towards Spring Creek tributaries. At the northwest edge of the site the groundwater flow is expected to follow the site topography to the west toward Spring Creek. Groundwater in the basal till, upper bedrock and bedrock is hydraulically-connected and the flow is to the south, southeast, and southwest.
	Intermediate till	There are no wells screened in the				
	Basal till	40.58	NA	South, southeast, and southwest		
	Glacial outwash	The is no glacial outwash unit.				
	Upper bedrock	8.76 to 16.78	0.022 to 0.035	South, southeast, and southwest		
	Bedrock	28.25	NA	South, southeast, and southwest	**Vertical Gradient:**	The are no well clusters at this site to determine vertical gradients.
Inert Disposal Area, (IAAP-20)	Shallow till	3.32 to 17.20	0.027 to 0.049	Southwest	**Site Hydrogeology:**	There are three main occurrences of groundwater at the IDA. Groundwater flow in the shallow till is controlled by the site topography and the flow direction is to the southwest toward Long Creek tributaries. Groundwater in the intermediate till flows in a similar direction, to the southwest toward Long Creek. Groundwater in the upper bedrock and bedrock seem to be hydraulically connected and the flow is to the south and west.
	Intermediate till	18.73 to 34.74	0.015 to 0.059	Southwest		
	Basal till	There are no wells screened in the basal till.				
	Glacial outwash	The is no glacial outwash unit.				
	Upper bedrock	36.23 to 58.15	0.011 to 0.0067	West	**Vertical Gradient:**	Vertical gradients between shallow till and upper bedrock is downward and averaged 0.33 feet/foot. Well cluster JAW-28 (intermediate till) / IDA-MW-1 (upper bedrock) exhibited a downward gradient of 0.21 feet/foot.
	Bedrock	47.28	NA	West		

TABLE 3.2
SUMMARY OF GROUNDWATER DEPTHS AND HYDRAULIC GRADIENTS
SPRING 2002 GROUNDWATER MONITORING EVENT

Site Name, (IAAP Site Designation)	Screened Interval	Depth to Groundwater Range (ft. BGS) Spring 2002	Horizontal Hydraulic Gradient Magnitude (feet/foot) Spring 2002	Horizontal Hydraulic Gradient Direction Spring 2002	Other Hydrogeologic Results Spring 2002	
Demolition Area, (IAAP-21) / Deactivation Furnace, (IAAP-23)	Shallow till	4.72	NA	NA	**Site Hydrogeology:**	Groundwater at the site is present at the shallow till / upper bedrock interface. The groundwater flows with the dip of the upper bedrock which slopes away from the site to the west and southwest. Groundwater also follows a radial pattern as it flows away from the demolition pits.
	Intermediate till	There is no intermediate till unit.				
	Basal till	There is no basal till unit.				
	Glacial outwash	There is no glacial outwash unit.				
	Upper bedrock	5.98 to 25.16	0.0032 to 0.009	East / Southeast and radially away from site.	**Vertical Gradient:**	The are no well clusters at this site to determine vertical gradients.
	Bedrock	There are no wells screened in the bedrock.				
Firing Site, (IAAP-30)	Shallow till[a]	2.4 to 9.29	.0176	South and East	**Site Hydrogeology:**	Groundwater flow in the shallow till is controlled by the site topography and the flow direction is expected to be from the upland areas towards the west and north branches of Long Creek. Horizontal hydraulic gradients increase around Long Creek and adjacent to the till terraces. Groundwater in the glacial till and upper bedrock flows from the upland areas around the North Test Site to the south toward Long Creek. From the south test site groundwater flows from the uplands toward Long Creek to the north and east
	Intermediate till	There is no intermediate till unit.				
	Basal till	There is no basal till unit.				
	Glacial outwash Upper bedrock[b]	6.09 to 45.37	.00025	Southeast and North/Northeast	**Vertical Gradient:**	In the spring, well cluster JAW-33 (shallow till) / JAW-619 (upper bedrock) exhibited a downward vertical gradient of 0.76 feet/foot.
	Bedrock	There are no wells screened in the bedrock.				
Ammunition Box Chipper Disposal Pit, (IAAP-31)	Shallow till	1.64 to 2.26	0.0034-0.0046	Southwest	**Site Hydrogeology:**	Groundwater in the shallow till is controlled by the site topography and the flow direction is to the southwest toward Brush Creek.
	Intermediate till	There is no intermediate till unit.				
	Basal till	NA	NA	NA		
	Glacial outwash	NA	NA	NA		
	Upper bedrock	There are no wells screened in the upper bedrock.			**Vertical Gradient:**	The are no well clusters at this site to determine vertical gradients.
	Bedrock	There are no wells screened in the bedrock.				
West Burn Pads, (IAAP-34) / West Burn Pads Landfill, (IAAP-35) / Burn Cages, (IAAP-32) / Burn Cages Landfill, (IAAP-33)	Shallow till	1.33 to 23.64	0.045 to 0.111	Radially away from JAW-25 and toward Spring Creek.	**Site Hydrogeology:**	Groundwater in the shallow till is controlled by the site topography and the general flow direction is to the northeast toward Spring Creek and its tributaries. Groundwater in the shallow till also follows a radial pattern away from JAW-25, due to an anomalously high hydraulic head around the well. Groundwater in the upper bedrock and bedrock flows to the northeast and east toward Spring Creek and its tributaries. As shallow till and upper bedrock groundwater approaches Spring Creek, the two units become hydraulically-connected and discharge into the creek and its unnamed tributary to the north.
	Intermediate till	There is no intermediate till unit.				
	Basal till	There is no basal till unit.				
	Glacial outwash	There is no glacial outwash unit.				
	Upper bedrock Bedrock[c]	4.08 to 10.81	0.0109 to 0.0241	East and southeast towards Spring Creek and tributaries.	**Vertical Gradient:**	The are no well clusters at this site to determine vertical gradients.
North Burn Pads, (IAAP-36) / North Burn Pads Landfill, (IAAP-37) / Contaminated Waste Processor, (IAAP-24)	Shallow till	3.92 to 16.49	0.0304	Southeast towards Spring Creek.	**Site Hydrogeology:**	Groundwater flow in the shallow till is controlled by the site topography and the flow direction is to the southeast toward Spring Creek and its tributaries. Groundwater in the upper bedrock flows to the east/southeast toward Spring Creek.
	Intermediate till	There is no intermediate till unit.				
	Basal till	There is no basal till unit.				
	Glacial outwash	There is no glacial outwash unit.				
	Upper bedrock	9.48 to 29.55	0.059 to 0.064	East towards Spring Creek.	**Vertical Gradient:**	The are no well clusters at this site to determine vertical gradients.
	Bedrock	There are no wells screened in the bedrock.				

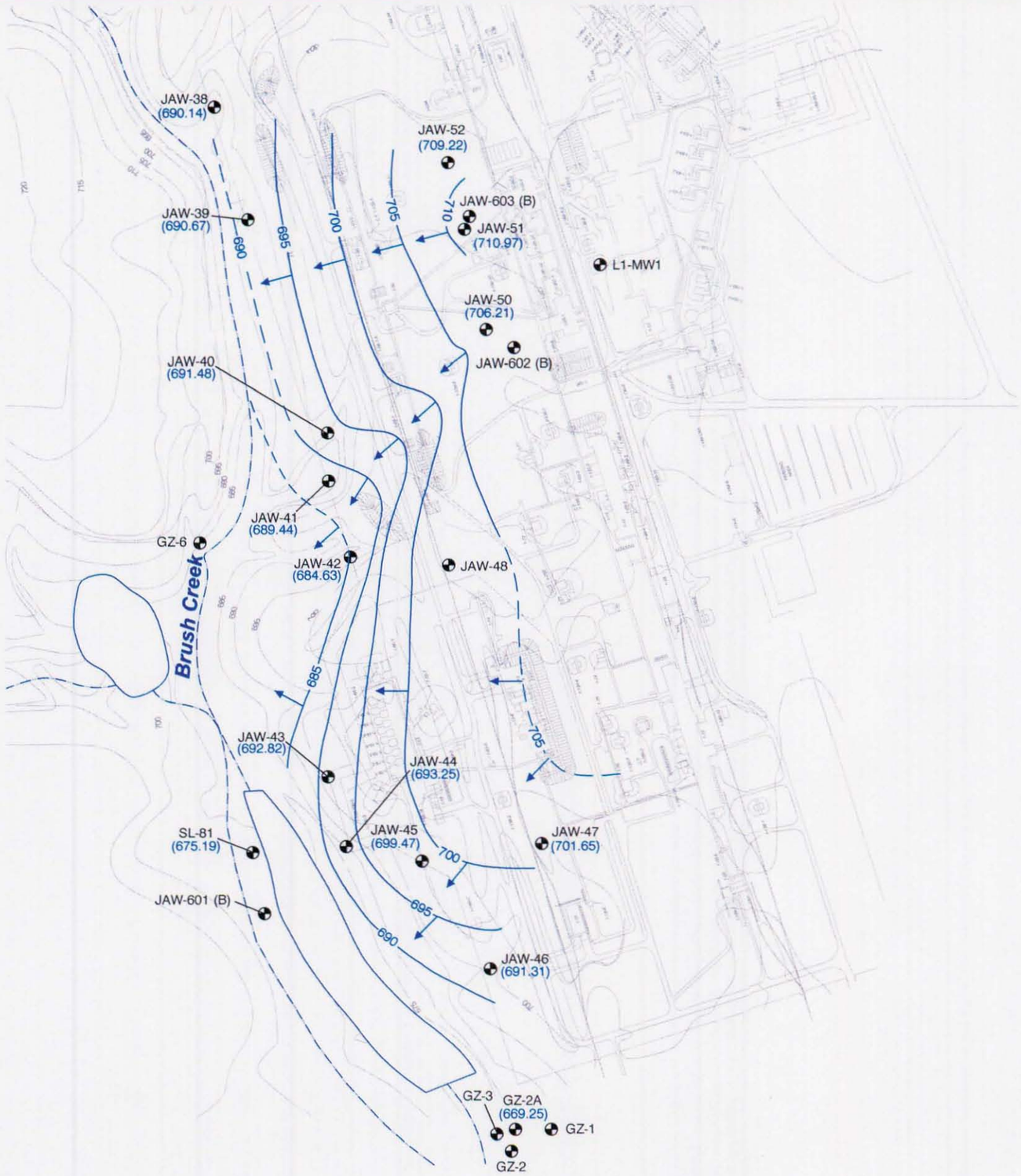
TABLE 3.2
SUMMARY OF GROUNDWATER DEPTHS AND HYDRAULIC GRADIENTS
SPRING 2002 GROUNDWATER MONITORING EVENT

Site Name, (IAAP Site Designation)	Screened Interval	Depth to Groundwater Range (ft. BGS) Spring 2002	Horizontal Hydraulic Gradient Magnitude (feet/foot) Spring 2002	Horizontal Hydraulic Gradient Direction Spring 2002	Other Hydrogeologic Results Spring 2002	
Fire Training Area, (IAAP-39)	Shallow till	3.66 to 8.74	0.0213 to 0.0375	North and South/southeast towards Spring Creek	Site Hydrogeology:	Groundwater flow in the shallow till is controlled by the site topography and the flow direction is from the north to the south / southeast towards Spring Creek tributaries. A shallow till groundwater divide exists to the north of the Sump and JAW-63 . North of the divide shallow till groundwater follows topography towards a tributary of Spring Creek. Groundwater flow in the upper bedrock is planar along the dip of the bedrock and is generally to the southeast.
	Sh.-Int. till	3.43	NA	NA		
	Intermediate till	There is no intermediate till unit.				
	Basal till	There is no basal till unit.				
	Glacial outwash	There is no glacial outwash unit.				
	Upper bedrock	4.55 to 15.18	0.0145 to 0.0488	Southeast	Vertical Gradient:	In the spring, well cluster FTA-99-1 (shallow till) / FTA-99-2 (upper bedrock) exhibited a downward vertical gradient of 0.18 feet/foot.
	Bedrock	There are no wells screened in the bedrock.				
Plant Boundary and General Area	Shallow till	1.2 to 6.22	NA	NA	Site Hydrogeology:	Groundwater in the shallow till is controlled by the topography and the flow direction is generally from the upland areas and terraces to Long, Brush, and Spring Creeks and the Skunk River.
	Intermediate till	1.2 to 8.59	NA	NA		
	Basal till	12.61 to 34.33	NA	NA		
	Glacial outwash	There is no glacial outwash unit.				
	Upper bedrock	8.94 to 17.80	NA	NA		
	Bedrock	+2.02 to 31.40	NA	NA		

KEY:
NA = Not enough data is available.
[a] = Groundwater flow at JAW-36 is likely east to southeast toward Long Creek.

[b] = JAW-34 was not included in the potentiometric interpretation. The more shallow screened interval and groundwater elevation at this location do not coincide with the remaining bedrock wells at this site. The groundwater elevation in this well appears to be significantly influenced by the intermediate till potentiometric surface.

[c] = The two deeper bedrock wells (WBP-99-6 and WBP-99-7) were not included in the potentiometric interpretation. The groundwater elevations in these two wells are not representative of the shallow bedrock potentiometric surface.



HydroGeoLogic, Inc.
2002 Groundwater Monitoring Report
Iowa Army Ammunition Plant, Middletown, Iowa

Figure 3.1 a
Groundwater Elevations
Spring 2002
Shallow Till Wells
Line 1 and Line 1 Impoundment

U.S. Army Corps of Engineers
Omaha District

Legend

- Monitoring Well
- (B) Bedrock Well
- (678.59) Groundwater Elevation (Feet Above Mean Sea Level)
- Groundwater Potentiometric Surface (Contour Interval = 5 feet)
- Inferred Contour
- Groundwater Flow Direction

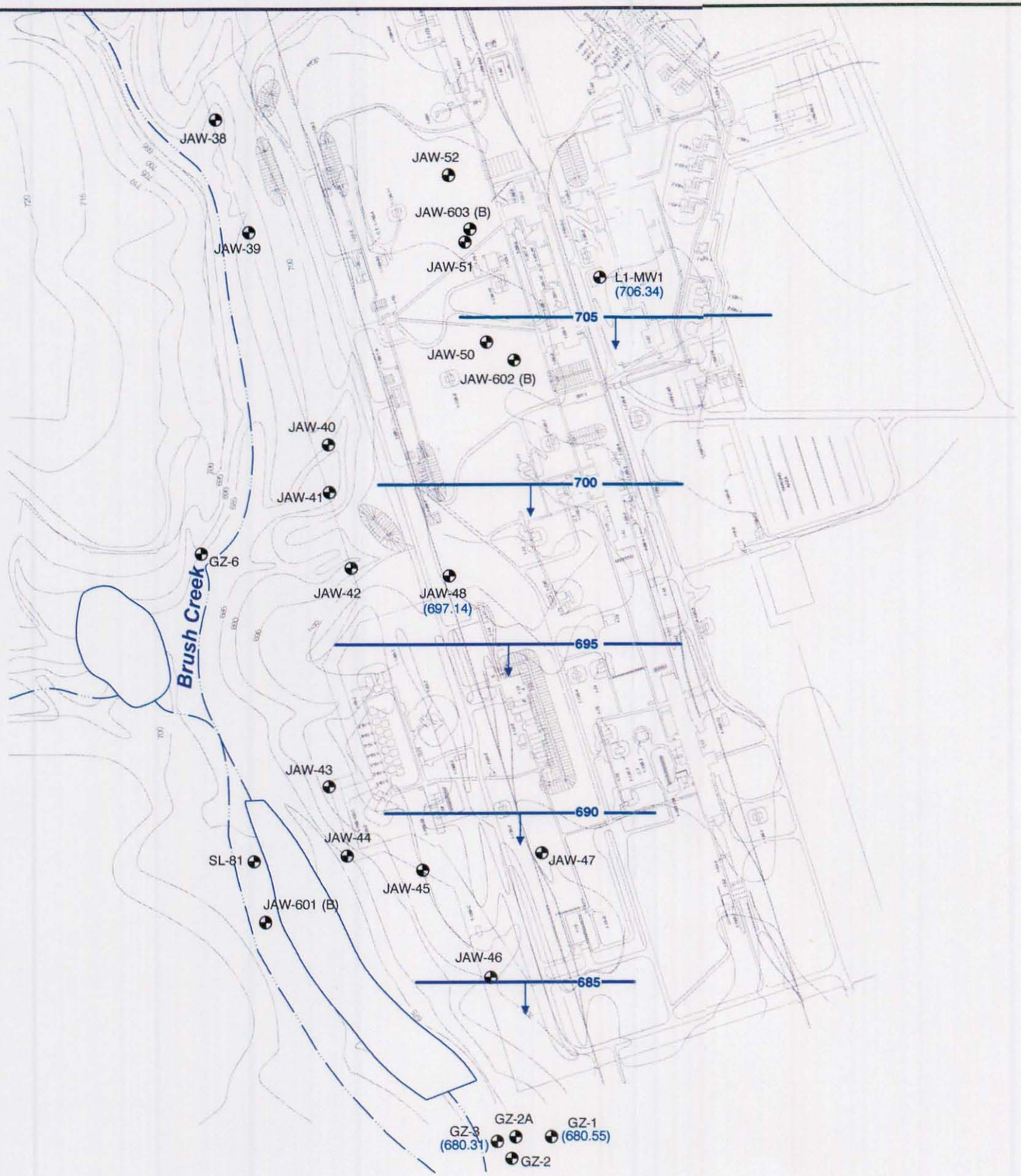
N

0 250 500 1000

SCALE IN FEET

Filename: X:\KAN004\TO3_IAAP\Maps\GWM_2002\GWE_Shallow_Line1.dwg
Project: KAN004-003-02-29
Created by: acarriger 09/17/02
Revised: 03/11/03 tbraswell
Map Source: URS

HYDRO GeoLogic INC.



HydroGeoLogic, Inc.
2002 Groundwater Monitoring Report
Iowa Army Ammunition Plant, Middletown, Iowa

Figure 3.1 b
Groundwater Elevations
Spring 2002
Intermediate Till Wells,
Line 1 and Line 1 Impoundments

U.S. Army Corps of Engineers
Omaha District

Legend

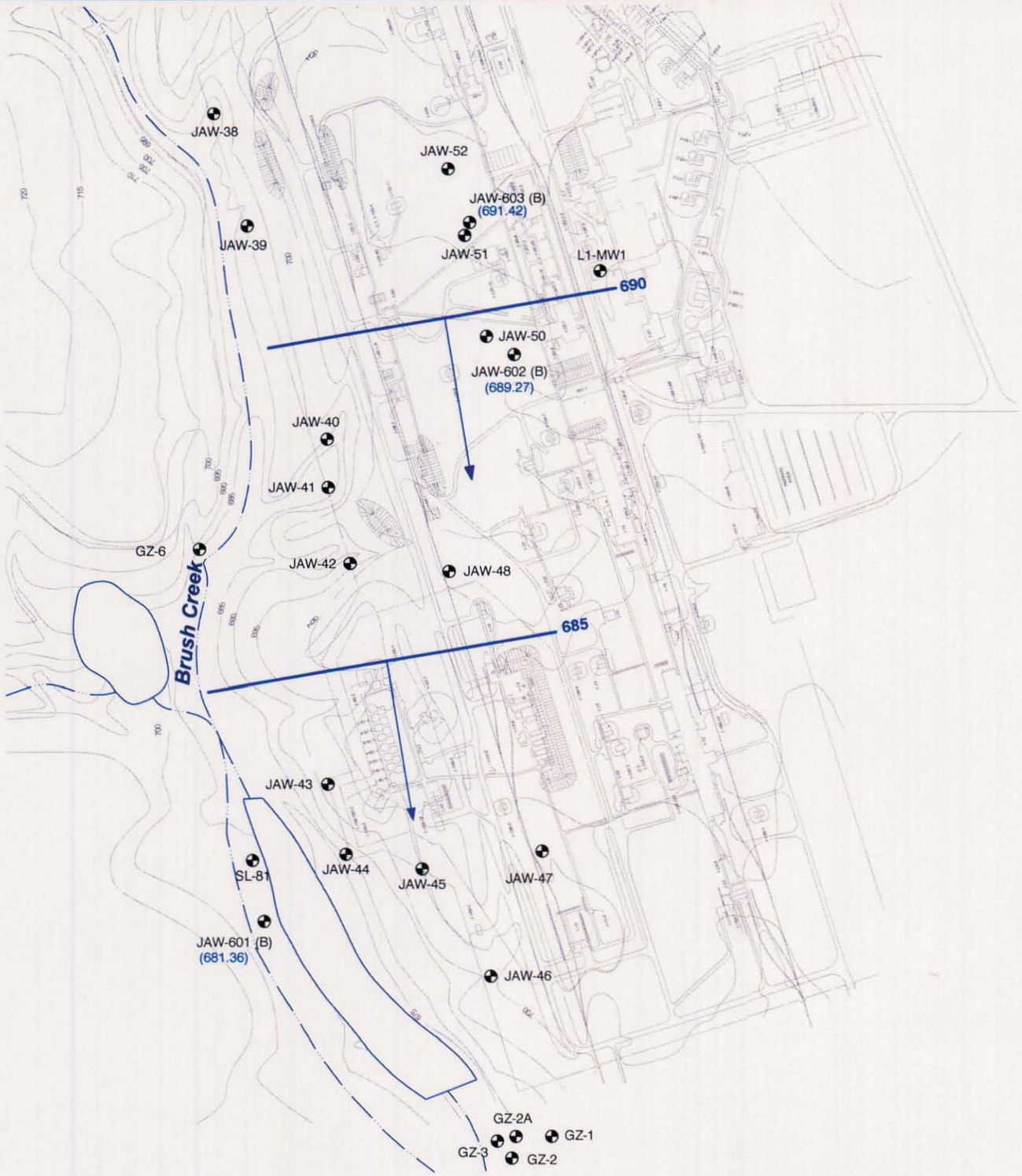
◓	Monitoring Well
(B)	Bedrock Well
(680.55)	Groundwater Elevation (Feet Above Mean Sea Level)
———	Groundwater Potentiometric Surface (Contour Interval = 5 feet)
→	Groundwater Flow Direction

N

0 250 500 1000
SCALE IN FEET

Filename: X:\KAN004\TO3_IAAP\Maps\GWM_2002\GWE_INTERMEDIATE_LINE1.dwg
Project: KAN004-003-02-29
Created by: 9/13/02 WFG
Revised: 03/11/03 tbraswell
Map Source: URS 2001

HYDRO GeoLogic INC.



HydroGeoLogic, Inc.
2002 Groundwater Monitoring Report
Iowa Army Ammunition Plant, Middletown, Iowa

Figure 3.1 c
Groundwater Elevations
Spring 2002
Upper Bedrock Wells
Line 1 and Line 1 Impoundment

U.S. Army Corps of Engineers
Omaha District

Legend

- Monitoring Well
- (B) Bedrock Well
- (678.59) Groundwater Elevation (Feet Above Mean Sea Level)
- Groundwater Potentiometric Surface (Contour Interval = 5 feet)
- Groundwater Flow Direction

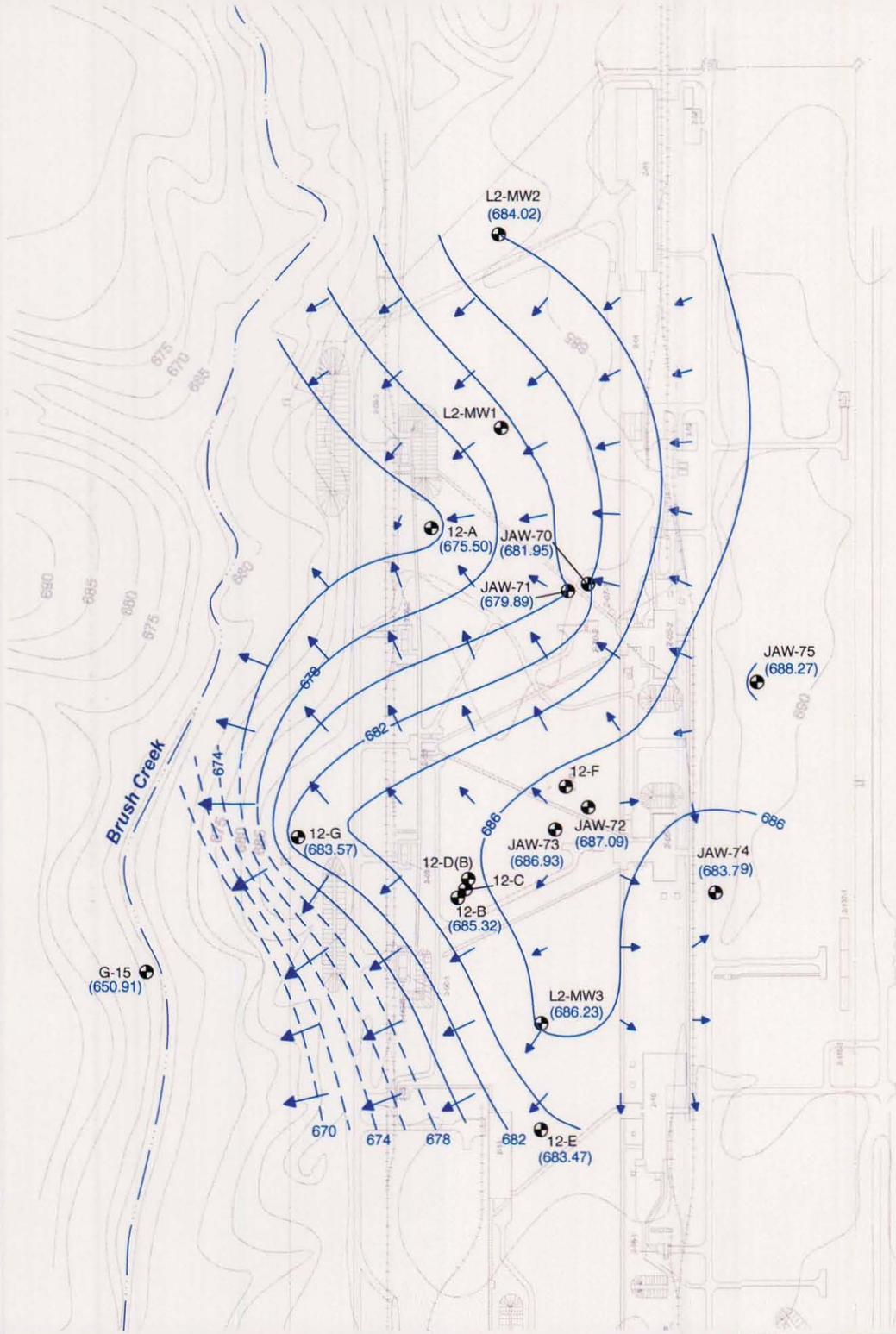
N

0 250 500 1000

SCALE IN FEET

Filename: X:\KAN004\TO3_IAAP\Maps\GWM_2002\GWE_Upperbed_Line1.dwg
Project: KAN004-003-02-29
Created by: apassarelli 09/17/02
Revised: 03/11/04 tbraswell
Map Source: URS

HYDRO GeoLogic INC.



HydroGeoLogic, Inc.
2002 Groundwater Monitoring Report
Iowa Army Ammunition Plant, Middletown, Iowa

Figure 3.2 a
Groundwater Elevations
Spring 2002
Shallow Till Wells
Line 2

U.S. Army Corps of Engineers
Omaha District

Legend

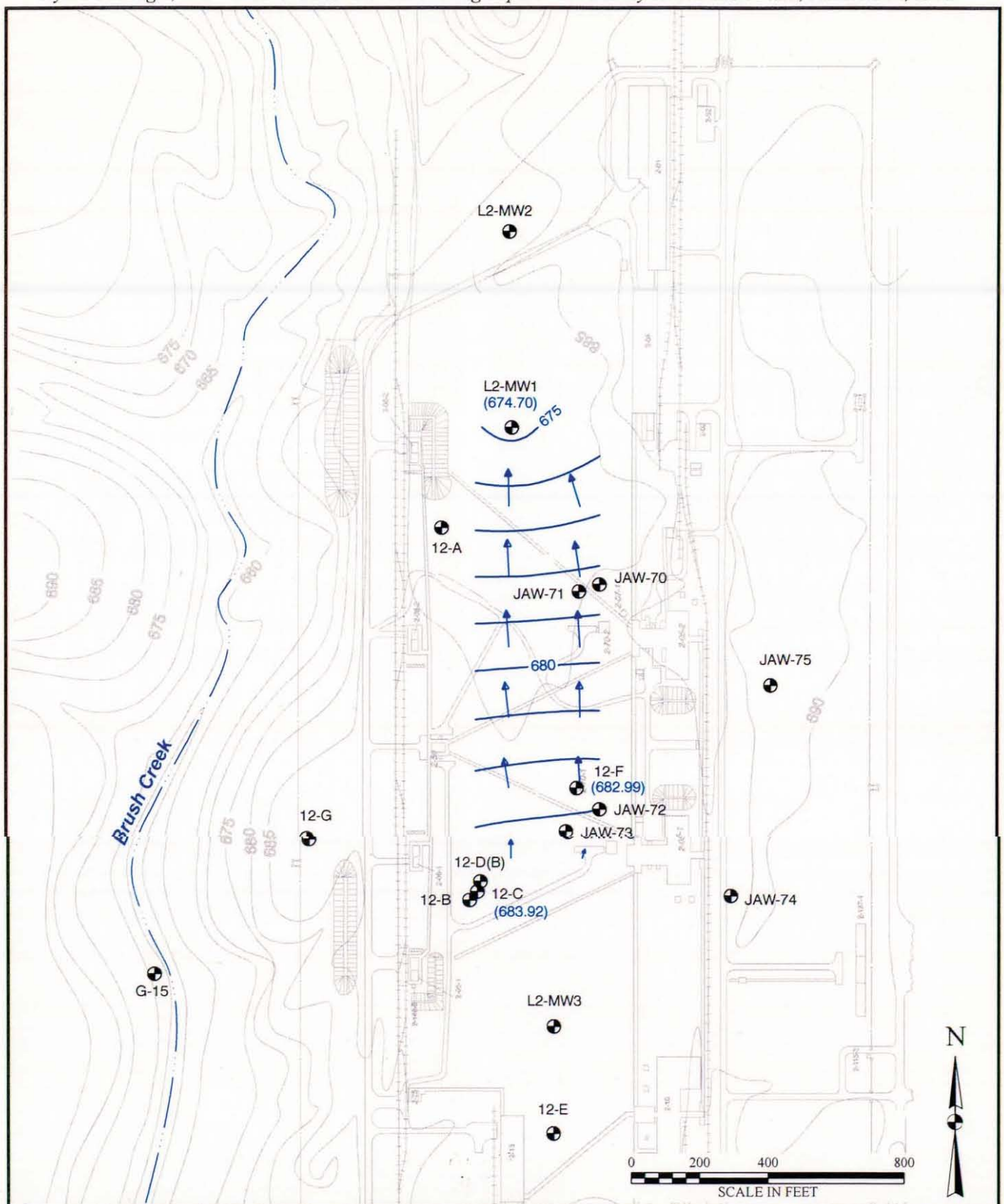
- Monitoring Well
- (B) Bedrock Well
- (686.93) Groundwater Elevation (Feet Above Mean Sea Level)
- Groundwater Potentiometric Surface (Contour Interval = 2 feet)
- Inferred Contours
- Groundwater Flow Vector

N

0 200 400 800
SCALE IN FEET

Filename: X:\KAN004\TO3_IAAP\Maps\GWM_2002\GWE_SHALLOW_LINE2.dwg
Project: KAN004-003-02-29
Created by: acarriger 09/17/02
Revised: 03/11/03 tbraswell
Map Source: URS

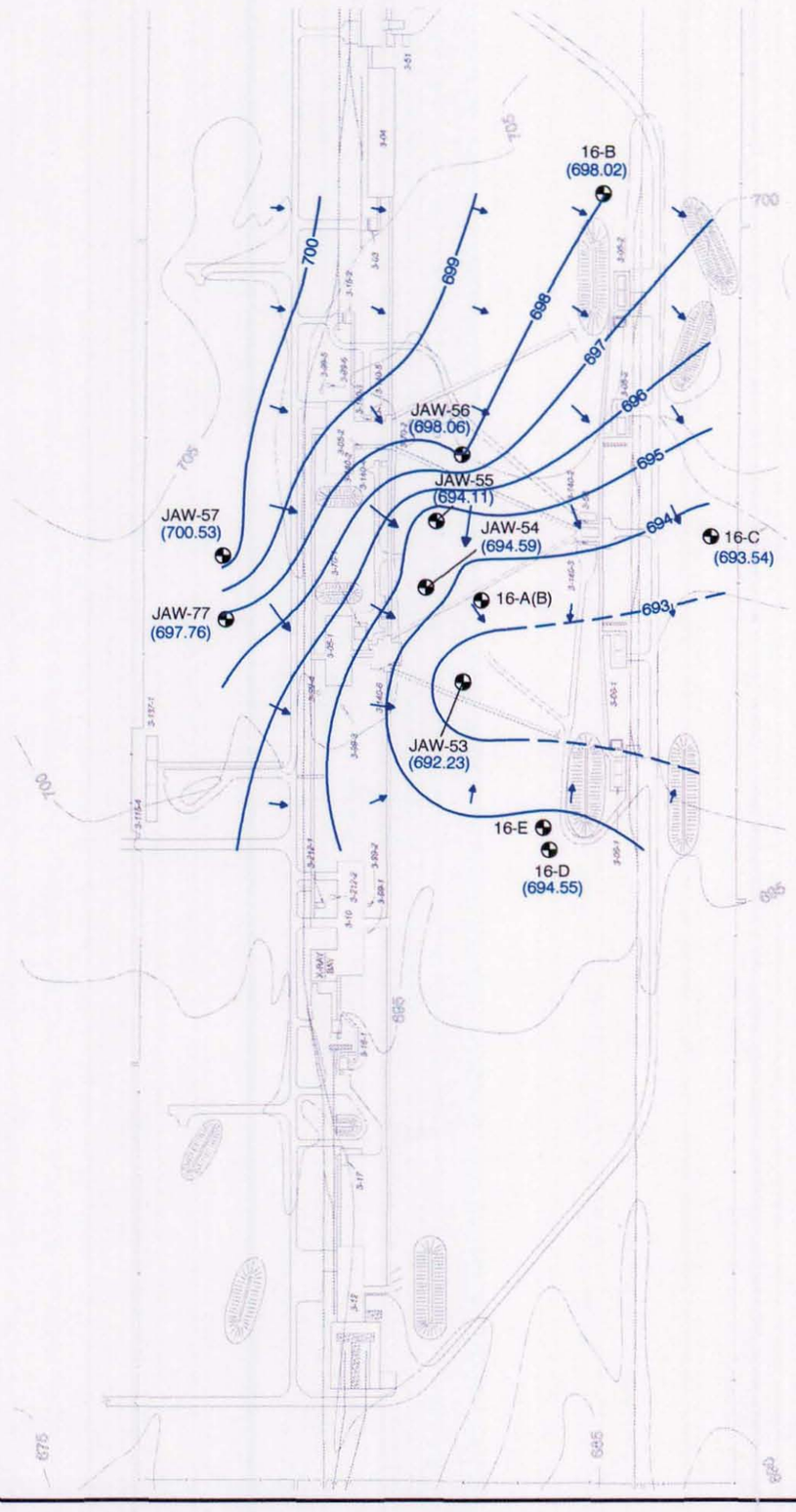
HYDRO GeoLogic INC.

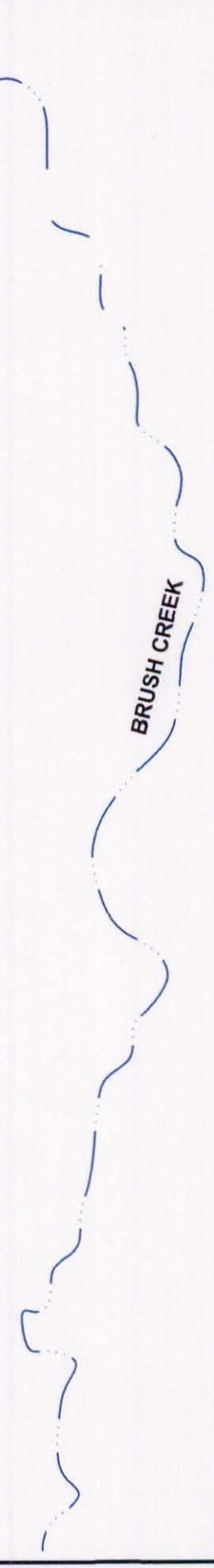


Filename: X:\KAN004\TO_IAAP\MAPS\GWM_2002\GWM_Intermediate_Line2.dwg
Project: KAN004-003-02-29
Created by: apassarelli 09/09/02
Revised by: 03/11/03 tbraswell
Source: URS

Legend
- Monitoring Well
- (B) Bedrock Well
- (679.23) Groundwater Elevation (Feet Above Mean Sea Level)
- Groundwater Potentiometric Surface Contours (Contour Interval = 1 foot)
- Groundwater Flow Vector

Figure 3.2 b
Groundwater Elevations
Spring 2002
Intermediate Till Wells
Line 2





HydroGeoLogic, Inc.
2002 Groundwater Monitoring Report
Iowa Army Ammunition Plant, Middletown, Iowa

Figure 3.3
Groundwater Elevations
Spring 2002
Shallow Till Wells
Line 3

U.S. Army Corps of Engineers
Omaha District

Legend

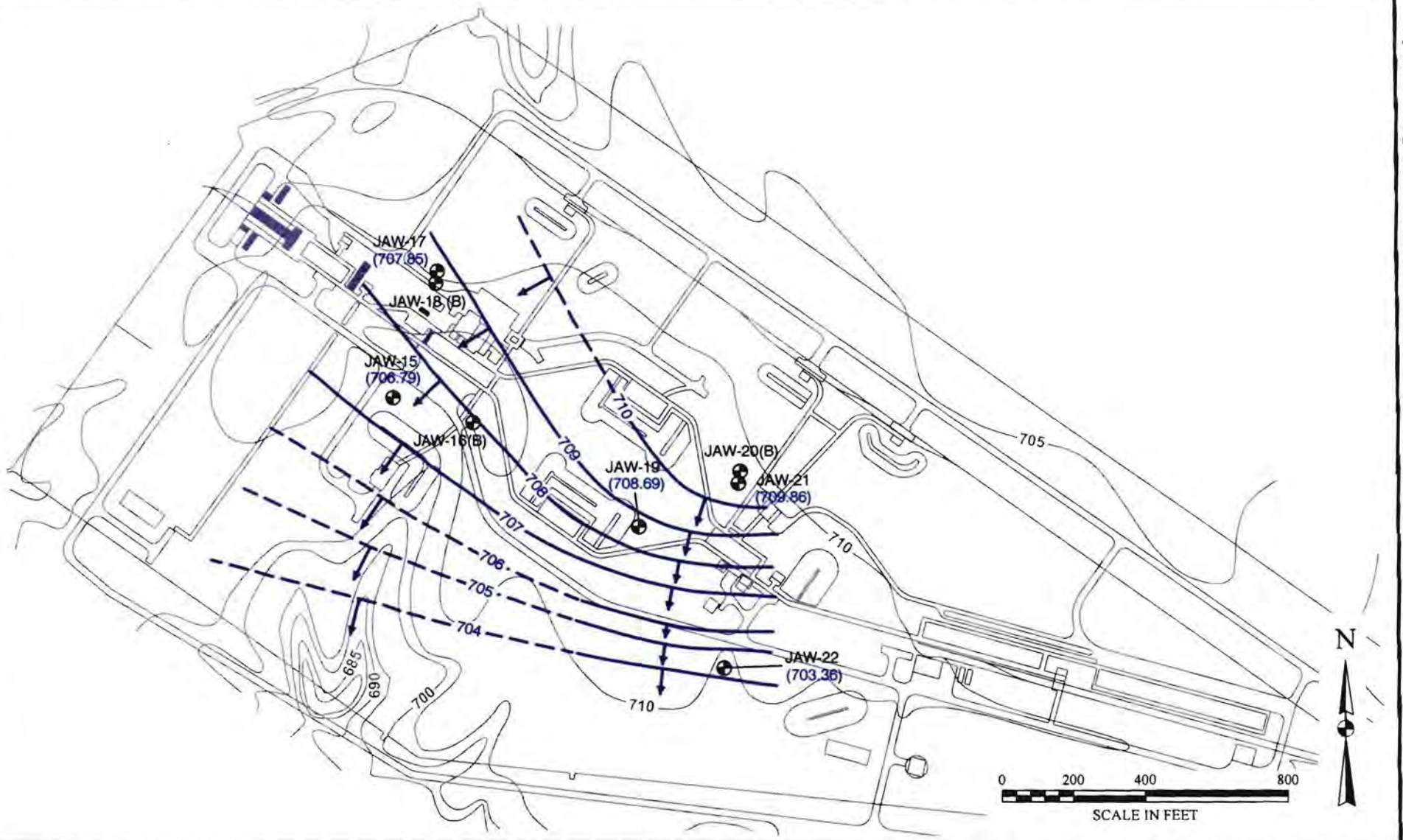
- Monitoring Well
- (B) Bedrock Well
- (694.55) Groundwater Elevation (Feet Above Mean Sea Level)
- Groundwater Potentiometric Surface (Contour Interval = 1 foot)
- Inferred Contour
- Groundwater Flow Direction

N

0 200 400 800
SCALE IN FEET

Filename: X:\KAN004\TO3_IAAP\Maps\GWM_2002\GWE_Shallow_Line3.dwg
Project: KAN004-003-02-29
Created by: acarriger 09/23/02
Revised: 03/11/03/ tbraswell
Map Source: URS

HYDRO GeoLogic INC.



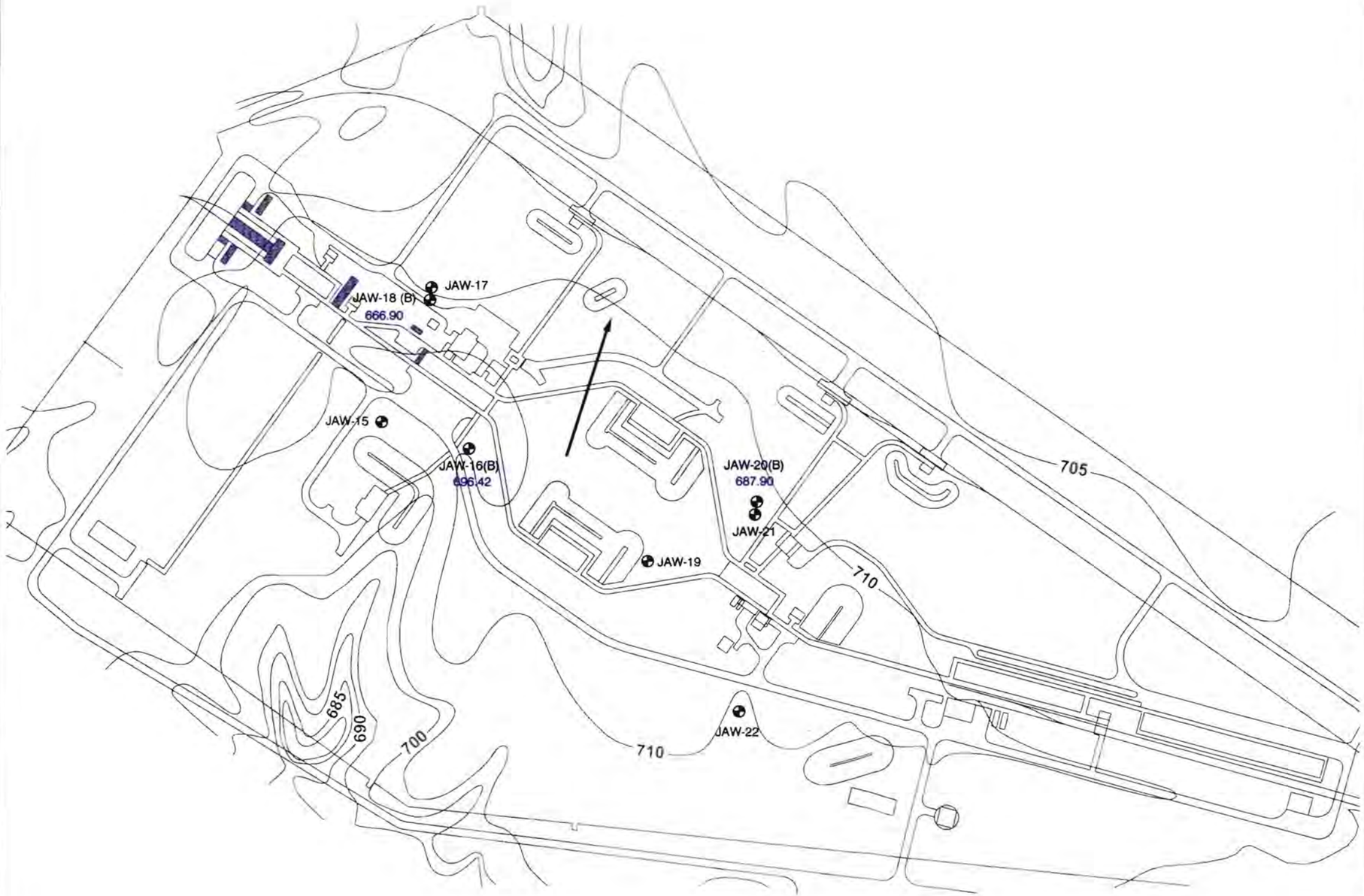
Filename: X:\KAN004\TO3_IAAP\Maps\GWM_2002\GWE_Shallow_Line3A.dwg
Project: KAN004-003-02-29
Created by: acarriger 09/03/02
Revised: 03/11/03 tbraswell
Source: URS

HYDRO GeoLogic

Legend

- Monitoring Well
- (B) Bedrock Well
- (708.69) Groundwater Elevation (Feet Above Mean Sea Level)
- Groundwater Potentiometric Surface (Contour Interval = 1 foot)
- Inferred Contour
- Groundwater Flow Direction

Figure 3.4 a
Groundwater Elevations
Spring 2002
Shallow Till Wells
Line 3A, Line 3A Pond, and Line 3A STP



HydroGeoLogic, Inc.
2002 Groundwater Monitoring Report
Iowa Army Ammunition Plant, Middletown, Iowa

Figure 3.4 b
Groundwater Elevations - Spring 2002
Glacial Outwash/Upper Bedrock Wells
Line 3A, Line 3A Pond
and Line 3A STP

U.S. Army Corps of Engineers
Omaha District

Legend

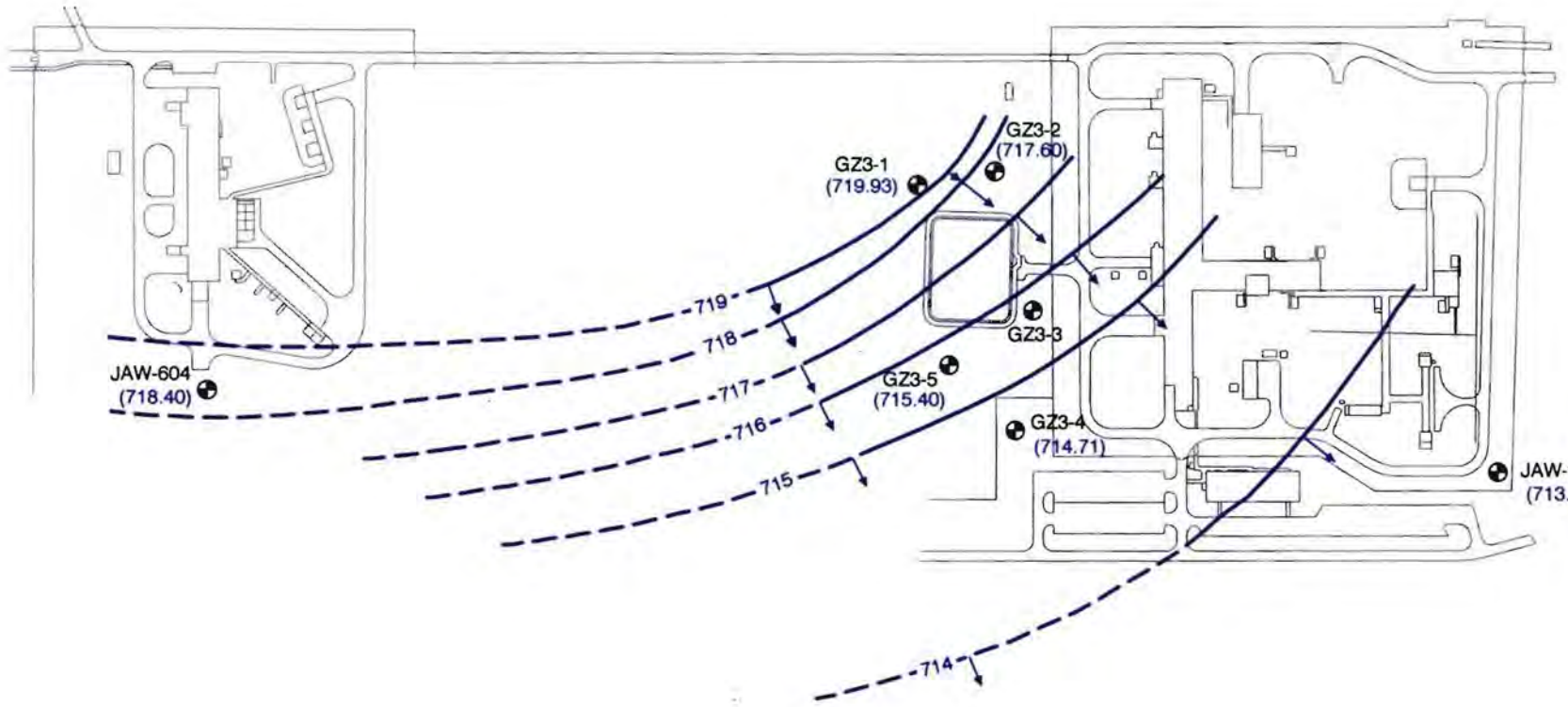
◕	Monitoring Well
(B)	Bedrock Well
(678.59)	Groundwater Elevation (Feet Above Mean Sea Level)
→	Groundwater Flow Direction

N

0 150 300 600
SCALE IN FEET

Filename: X:\KAN004\TO3_IAAP\Maps\GWM_2002\GWE_Glacwash_Line3A.dwg
Project: KAN004-003-02-29
Created by: acarriger 09/17/02
Revised: 03/11/03 tbraswell
Map Source: URS

HYDRO GeoLogic Inc



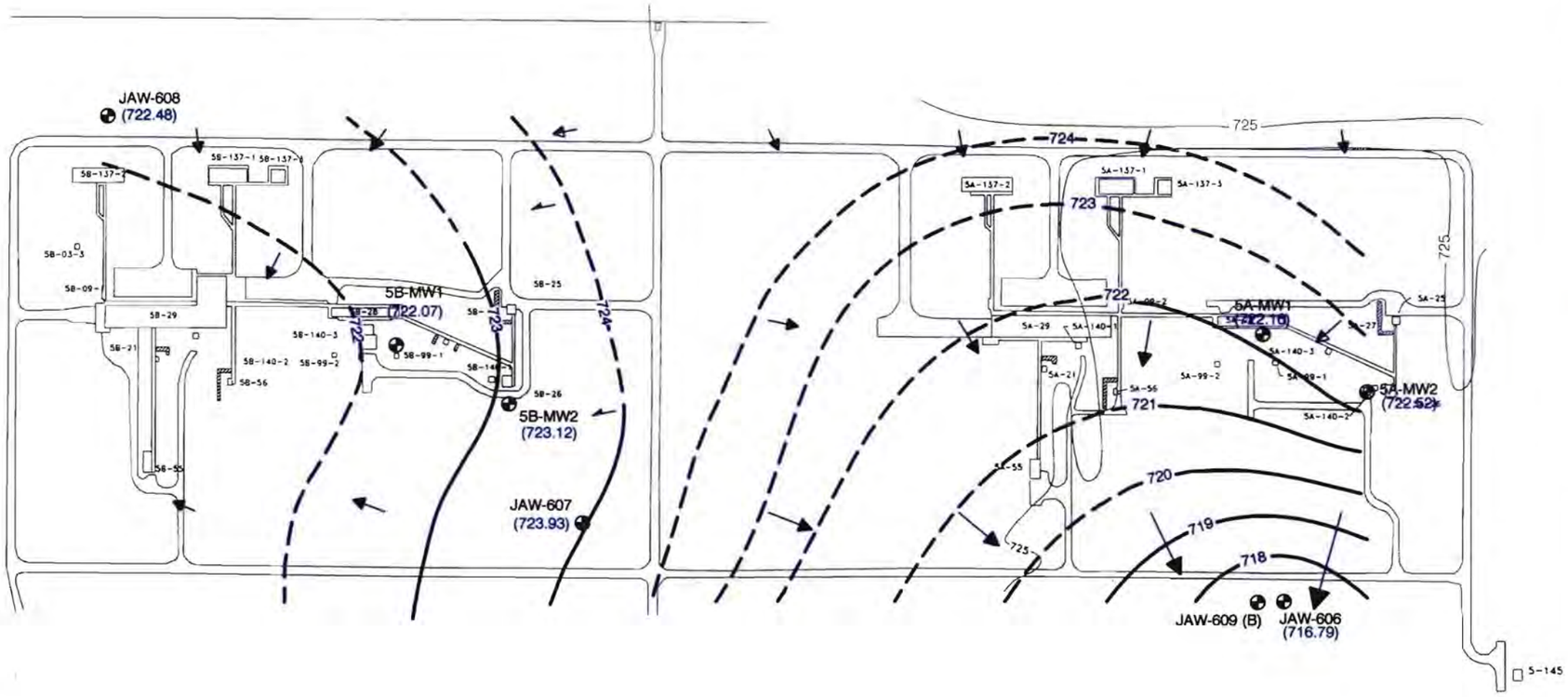
Filename: X:\KAN004\TO3_IAAP\Maps\GWM_2002\GWE_Shallow_Line4.dwg
Project: KAN004-003-02-29
Created by: acarriger 09/19/02
Revised: 03/11/03 tbraswell
Source: URS

HYDRO GeoLogic

Legend

- Monitoring Well
- (718.40) Groundwater Elevation (Feet Above Mean Sea Level)
- Groundwater Potentiometric Surface (Contour Interval = 1 foot)
- Inferred Contour
- Groundwater Flow Direction

Figure 3.5
Groundwater Elevations
Spring 2002
Shallow Till Wells
Line 4A and 4B



HydroGeoLogic, Inc.
2002 Groundwater Monitoring Report
Iowa Army Ammunition Plant, Middletown, Iowa

Figure 3.6
Groundwater Elevations
Spring 2002
Shallow Till Wells
Line 5A and 5B

U.S. Army Corps of Engineers
Omaha District

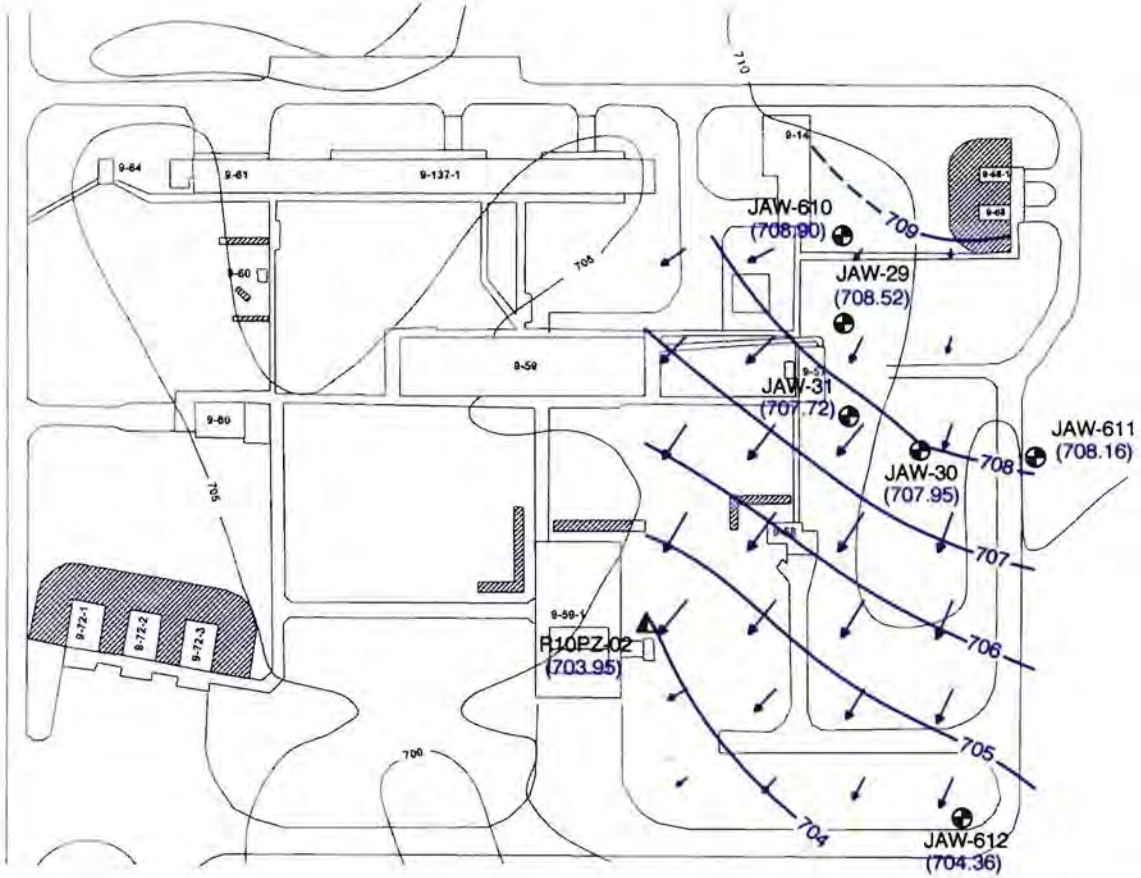
Legend

- Monitoring Well
- (B) Bedrock Well
- (723.93) Groundwater Elevation (Feet Above Mean Sea Level)
- Groundwater Potentiometric Surface (Contour Interval = 1 foot)
- Inferred Contour
- Groundwater Flow Direction

N

0 150 300 600
SCALE IN FEET

Filename: X:\KAN004\TO3_IAAP\Maps\GWM_2002\GWE_SHALLOW_LINE5.dwg
Project: KAN004-003-02-29
Created by: 09/20/02 WFG
Revised: 03/11/03 tbraswell
Map Source: URS 2001



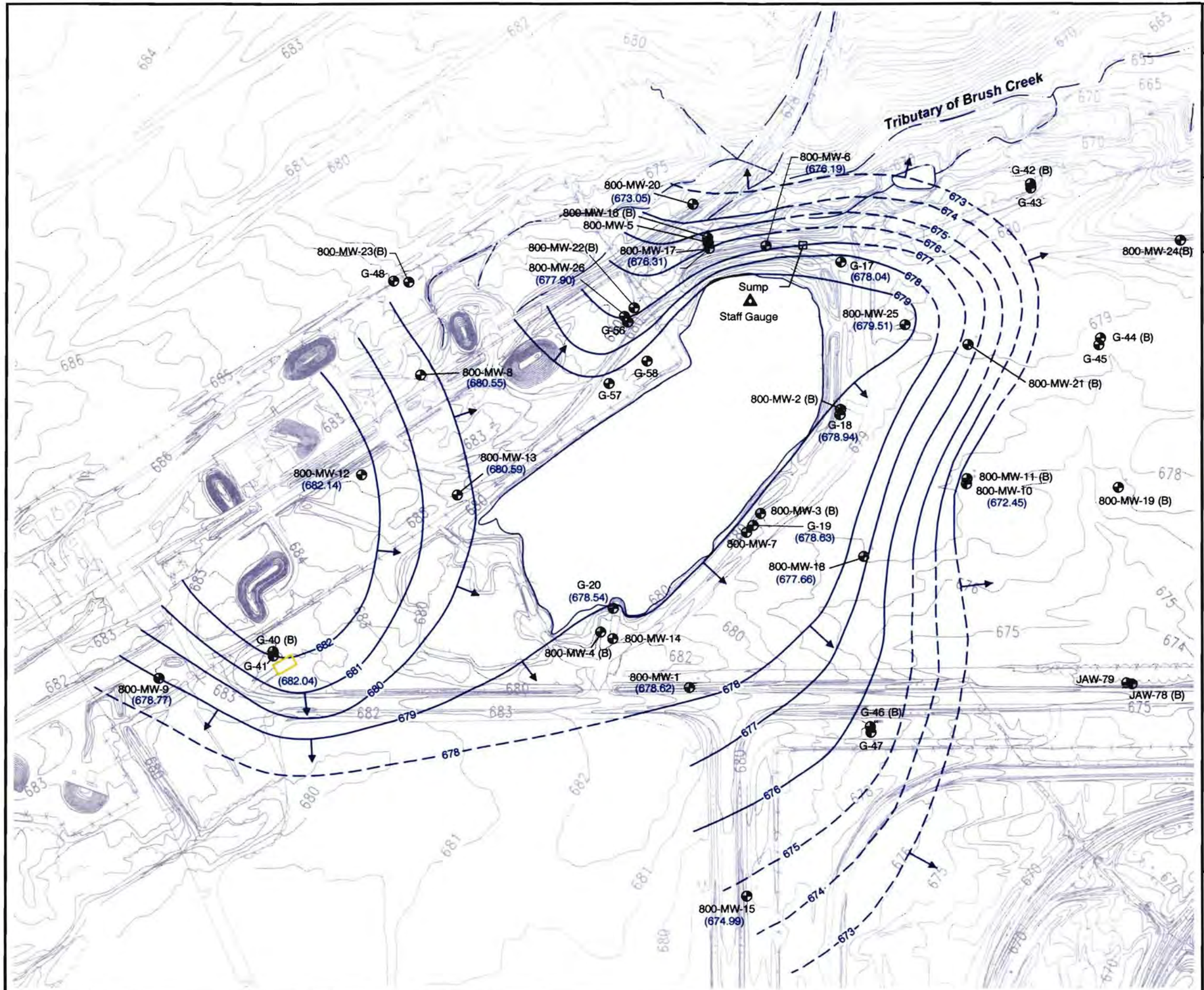
Filename: X:\KAN004\TO3_IAAP\Maps\GWM_2002\GWE_Shallow_Line9.dwg
Project: KAN004-003-02-29
Created by: apassarelli 09/06/02
Revised: 03/11/03 tbraswell
Source: URS

HYDRO GeoLogic Inc

Legend

- Monitoring Well
- Piezometer
- Groundwater Flow Vector
- (679.23) Groundwater Elevation (Feet Above Mean Sea Level)
- Groundwater Potentiometric Surface (Contour Interval = 1 foot)
- Inferred Contour

Figure 3.7
Groundwater Elevations - Spring 2002
Shallow Till Wells
Line 9



HydroGeoLogic, Inc.
2002 Groundwater Monitoring Report
Iowa Army Ammunition Plant, Middletown, Iowa

Figure 3.8 a
Groundwater Elevations
Spring 2002
Shallow Till Wells
Line 800/Pink Water Lagoon

U.S. Army Corps of Engineers
Omaha District

Legend

- Monitoring Well
- (B) Bedrock Well
- Sump Location
- Former Structure/Feature
- (678.59) Groundwater Elevation (Feet Above Mean Sea Level)
- Groundwater Potentiometric Surface (Contour Interval = 1 foot)
- Inferred Contour
- Groundwater Flow Direction

N

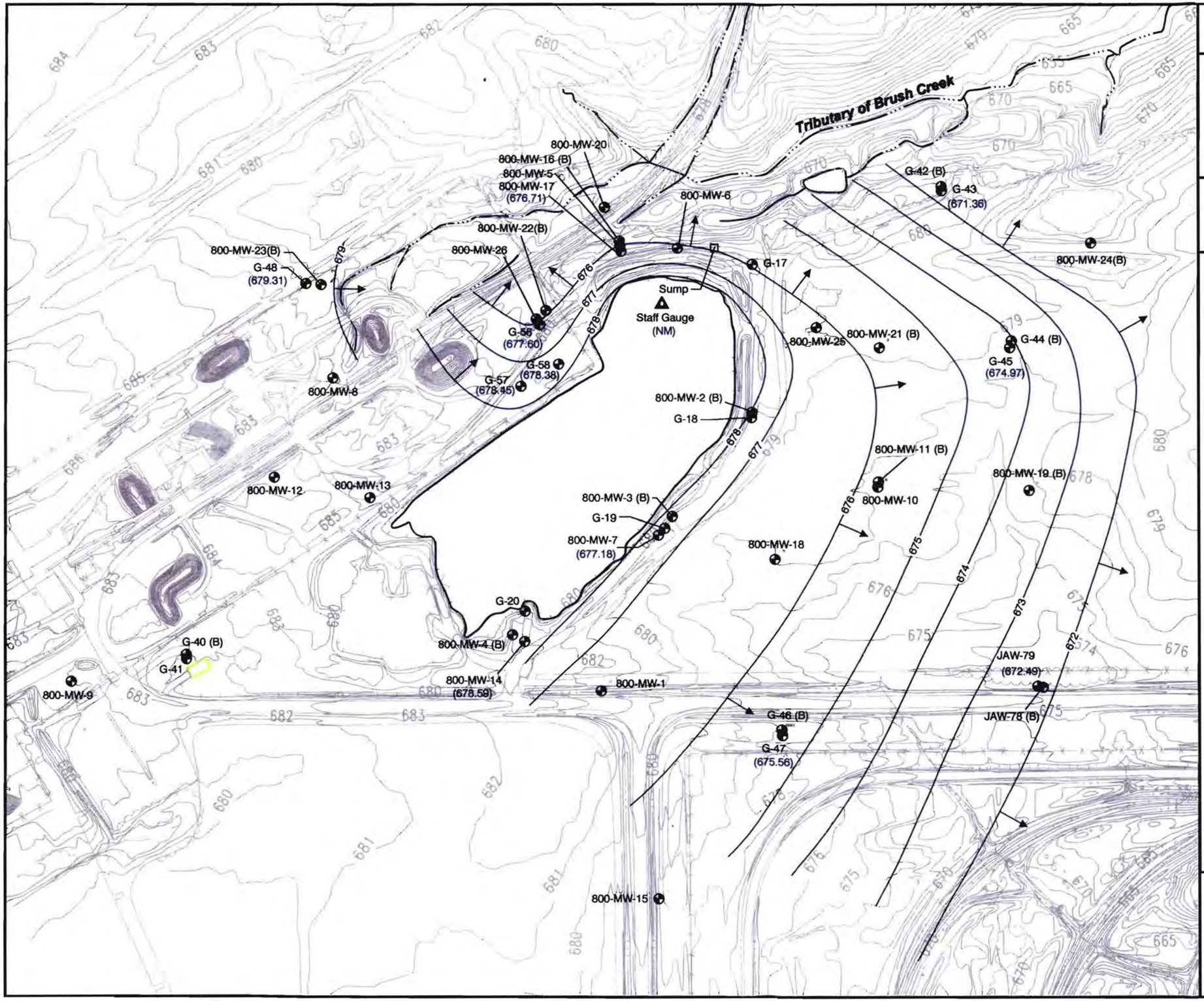
0 100 200 400
SCALE IN FEET

Filename: X:\KAN004\TO3_IAAP\Maps\GWM_2002\GWE_Shallow_Line800.dwg
Project: KAN004-003-02-29
Created by: apassarelli 09/11/02
Revised: 03/11/03 tbraswell
Map Source: URS

HYDRO GeoLogic Inc.

Figure 3.8 b
Groundwater Elevations
Spring 2002
Intermediate Till Wells
Line 800/Pink Water Lagoon

U.S. Army Corps of Engineers
Omaha District



Legend

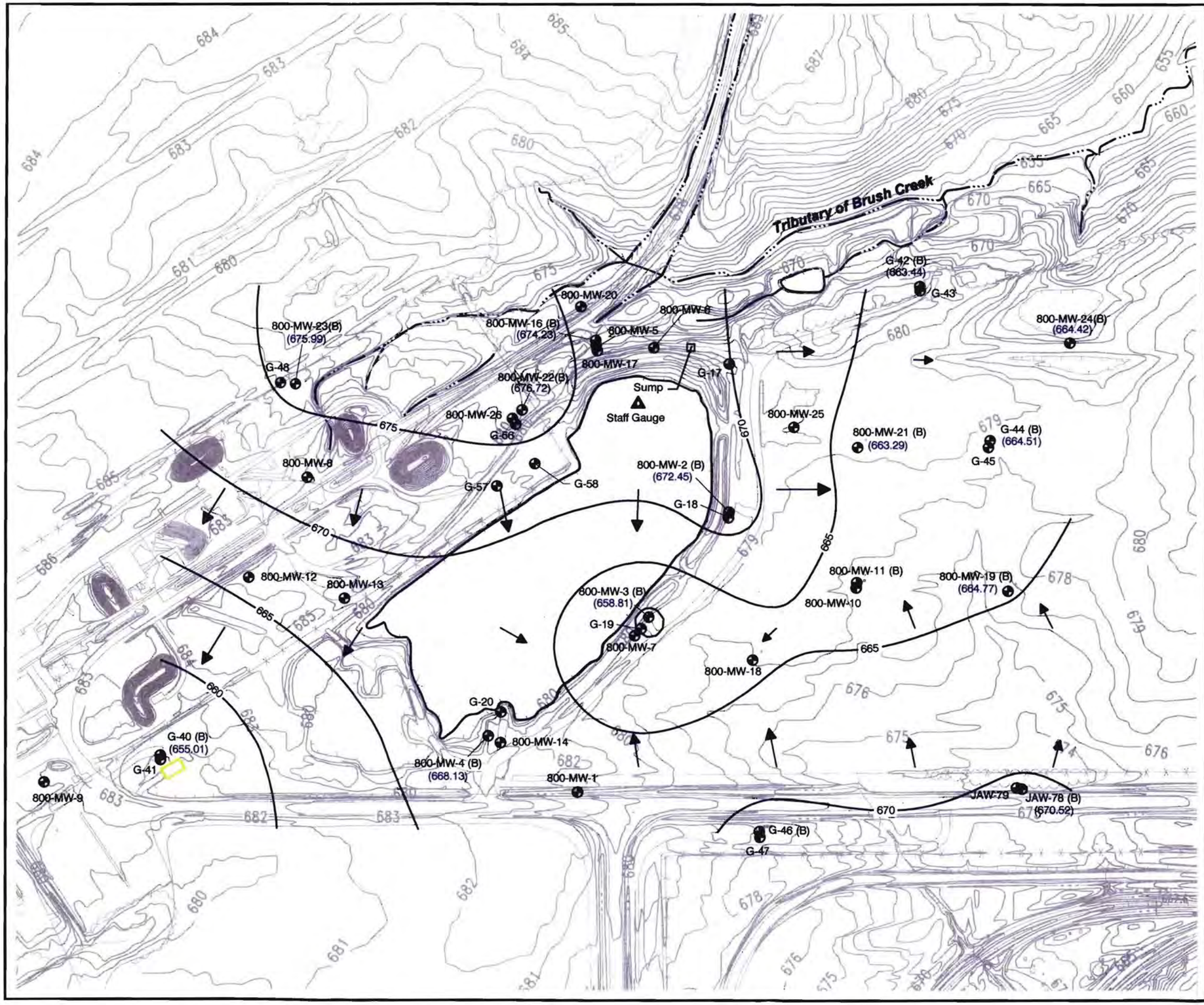
- Monitoring Well
- (B) Bedrock Well
- Sump Location
- Former Structure/Feature
- (678.59) Groundwater Elevation (Feet Above Mean Sea Level)
- Groundwater Potentiometric Surface (Contour Interval = 1 foot)
- Groundwater Flow Direction

N

0 100 200 400
SCALE IN FEET

Filename: X:\KAN004\TO3_IAAP\Maps\GWM_2002\GWE_Intermediate_Line800.dwg
Project: KAN004-003-02-29
Created by: apassarelli 09/12/02
Revised: 03/11/03 tbraswell
Map Source: URS

HydroGeoLogic, Inc.



HydroGeoLogic, Inc.
2002 Groundwater Monitoring Report
Iowa Army Ammunition Plant, Middletown, Iowa

Figure 3.8 c
Groundwater Elevations
Spring 2002
Upper Bedrock and Bedrock Wells
Line 800/Pink Water Lagoon

U.S. Army Corps of Engineers
Omaha District

Legend

- Monitoring Well
- (B) Bedrock Well
- Sump Location
- Former Structure/Feature
- (663.44) Groundwater Elevation (Feet Above Mean Sea Level)
- Groundwater Potentiometric Surface (Contour Interval = 5 feet)
- Groundwater Flow Vector

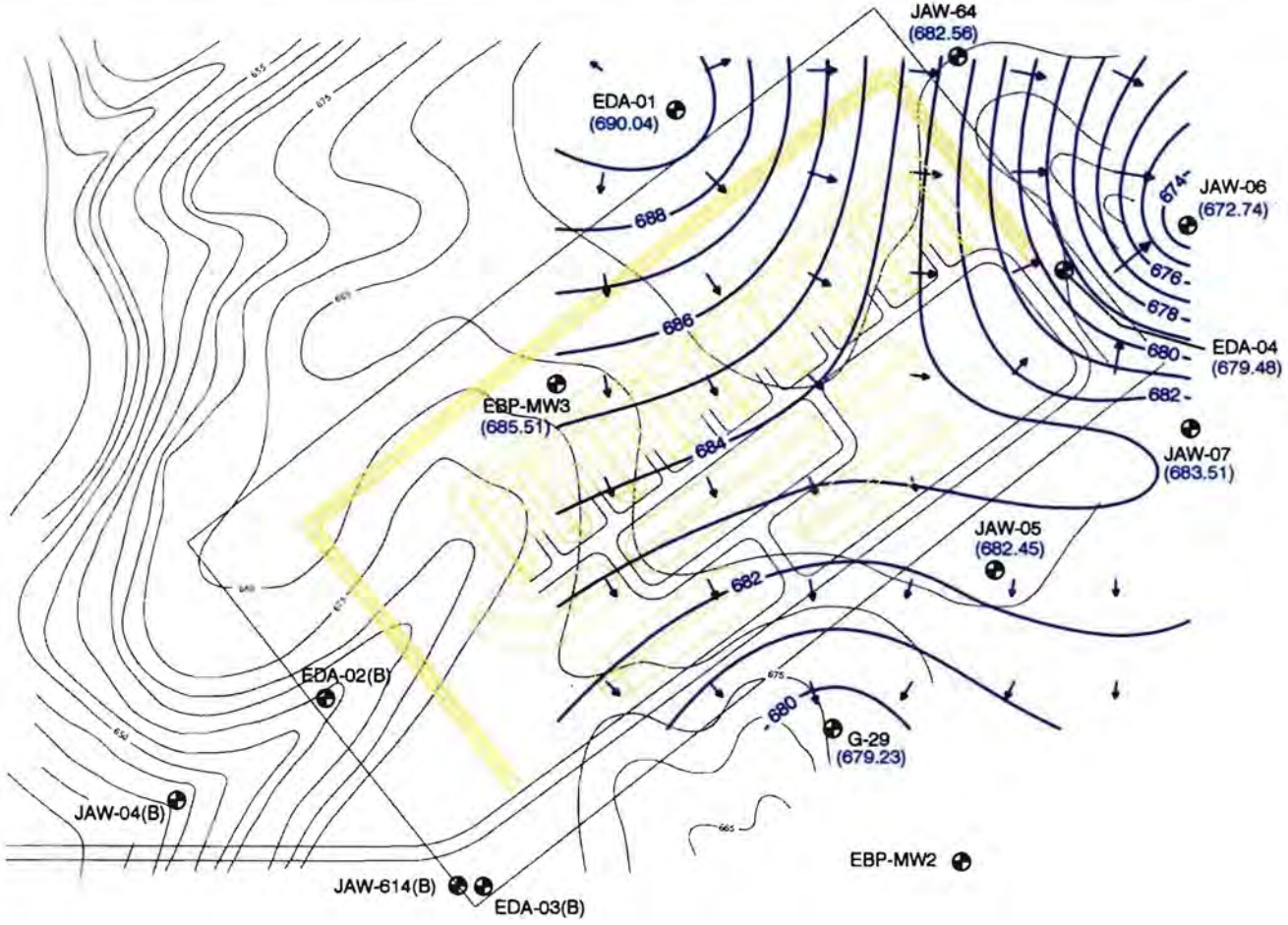
N

0 100 200 400

SCALE IN FEET

Filename: X:\KAN004\TO3_IAAP\Maps\GWM_2002\GWE_Upperbed_Line800.dwg
Project: KAN004-003-02-29
Created by: acarriger 09/23/02
Revised: 03/11/03 tbraswell
Map Source: URS

HYDRO GeoLogic



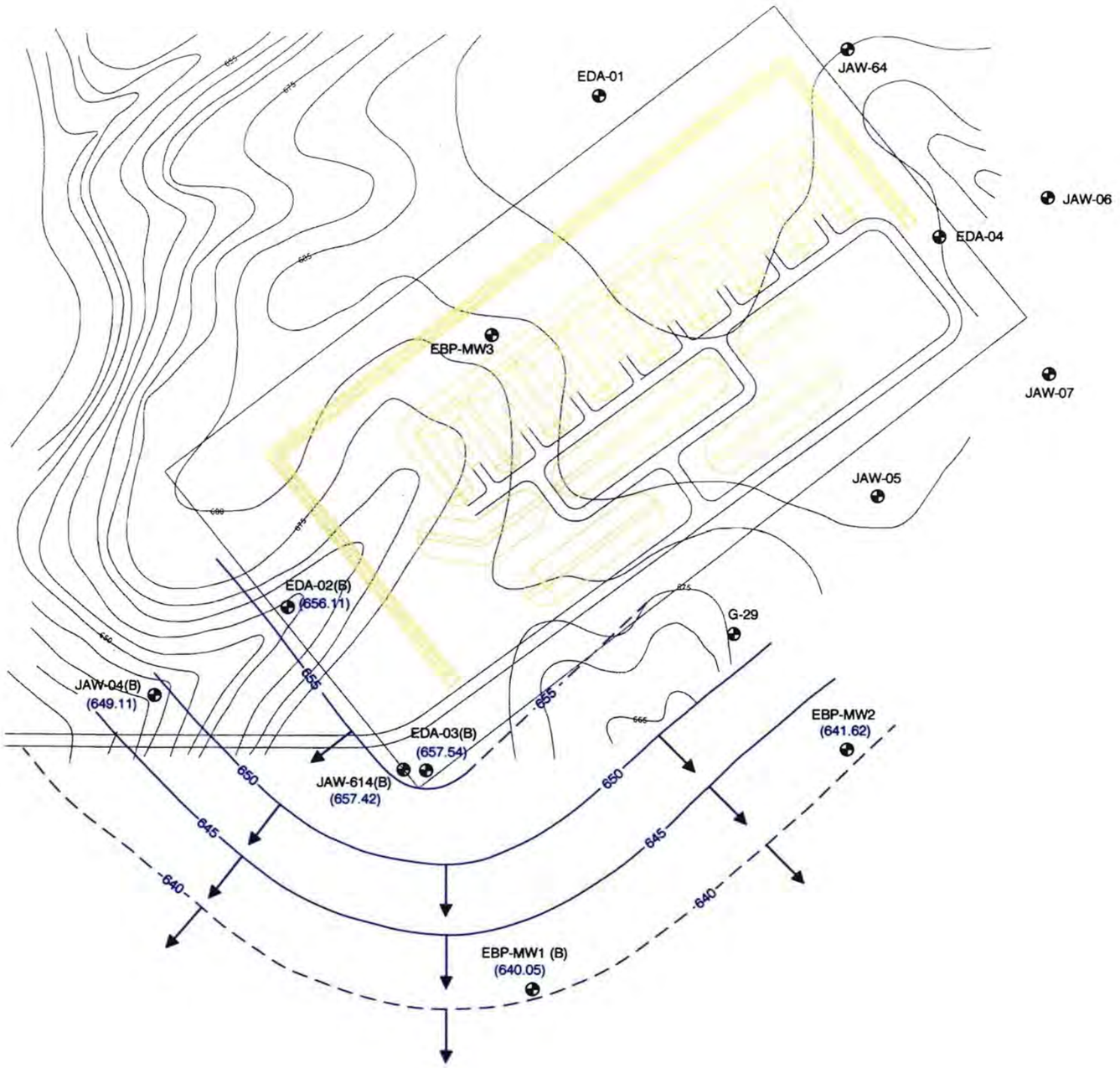
Filename: X:\KAN004\TO3_IAAP\Maps\GWM_2002\GWE_Shallow_Eastburn.dwg
Project: KAN004-003-02-29
Created by: apassarelli 09/05/02
Revised: 03/11/03 tbraswell
Source: URS

HYDRO GeoLogic

Legend

- Monitoring Well
- (B) Bedrock Well
- (679.23) Groundwater Elevation (Feet Above Mean Sea Level)
- Groundwater Potentiometric Surface (Contour Interval = 1 foot)
- Former Structure/Feature
- Groundwater Flow Vector

Figure 3.9 a
Groundwater Elevations - Spring 2002
Shallow Till Wells
East Burn Pads



HydroGeoLogic, Inc.
2002 Groundwater Monitoring Report
Iowa Army Ammunition Plant, Middletown, Iowa

Figure 3.9 b
Groundwater Elevations
Spring 2002
Basil Till, Upper Bedrock, and Bedrock Wells, East Burn Pads

U.S. Army Corps of Engineers
Omaha District

Legend

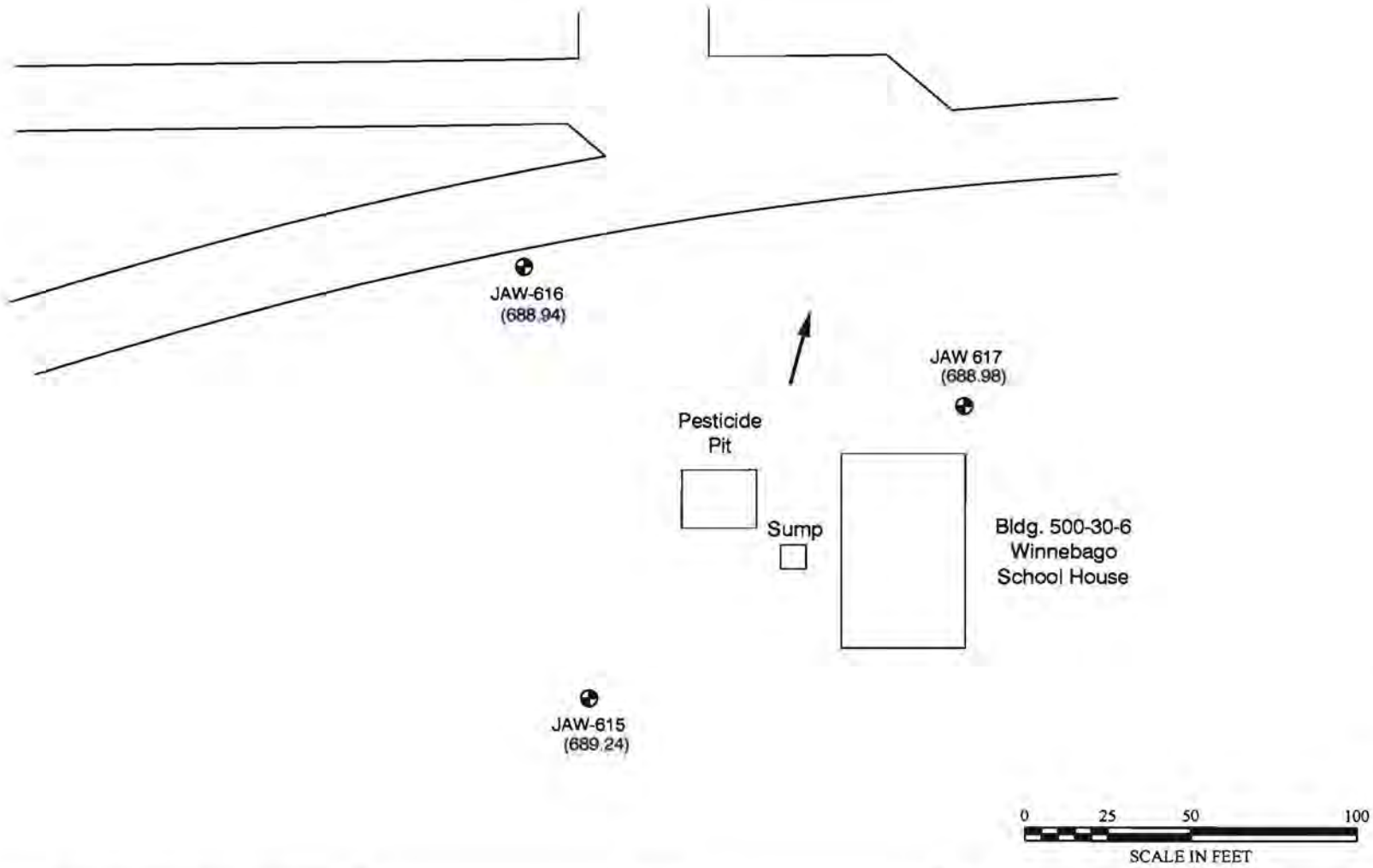
- Monitoring Well
- (B) Bedrock Well
- Former Structure/Feature
- (678.59) Groundwater Elevation (Feet Above Mean Sea Level)
- Groundwater Potentiometric Surface (Contour Interval = 5 feet)
- Inferred Contour
- Groundwater Flow Direction

N

0 125 250 500
SCALE IN FEET

Filename: X:\KAN004\TO3_IAAP\Maps\GWM_2002\GWE_Upperbed_Eastburn.dwg
Project: KAN004-003-02-29
Created by: acarriger 09/19/02
Revised: 03/11/03 tbraswell
Map Source: URS

HYDRO GeoLogic Inc.



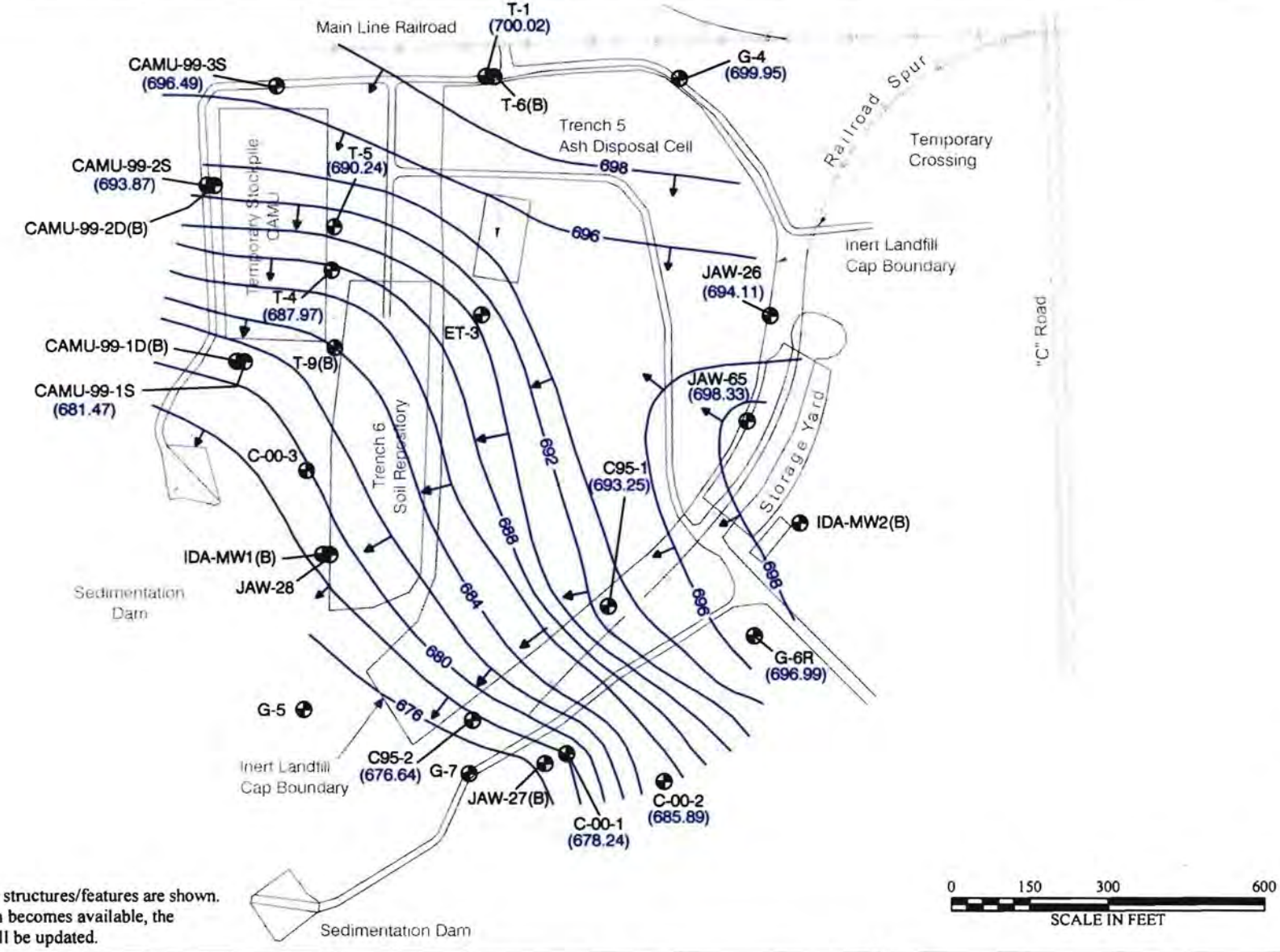
Filename: X:\KAN004\TO3_IAAP\Maps\GWM_2002\GWE_Shallow_Pestpit.dwg
Project: KAN004-003-02-29
Created by: acarriger 09/18/02
Revised: 03/11/03 tbraswell
Source: URS

HYDRO GeoLogic

Legend

- Monitoring Well
- (B) Bedrock Well
- (670.92) Groundwater Elevation (Feet Above Mean Sea Level)
- Groundwater Flow Direction

Figure 3.10
Groundwater Elevations
Spring 2002
Shallow Till Wells
Pesticide Pit



Note: Not all current structures/features are shown. As information becomes available, the illustration will be updated.

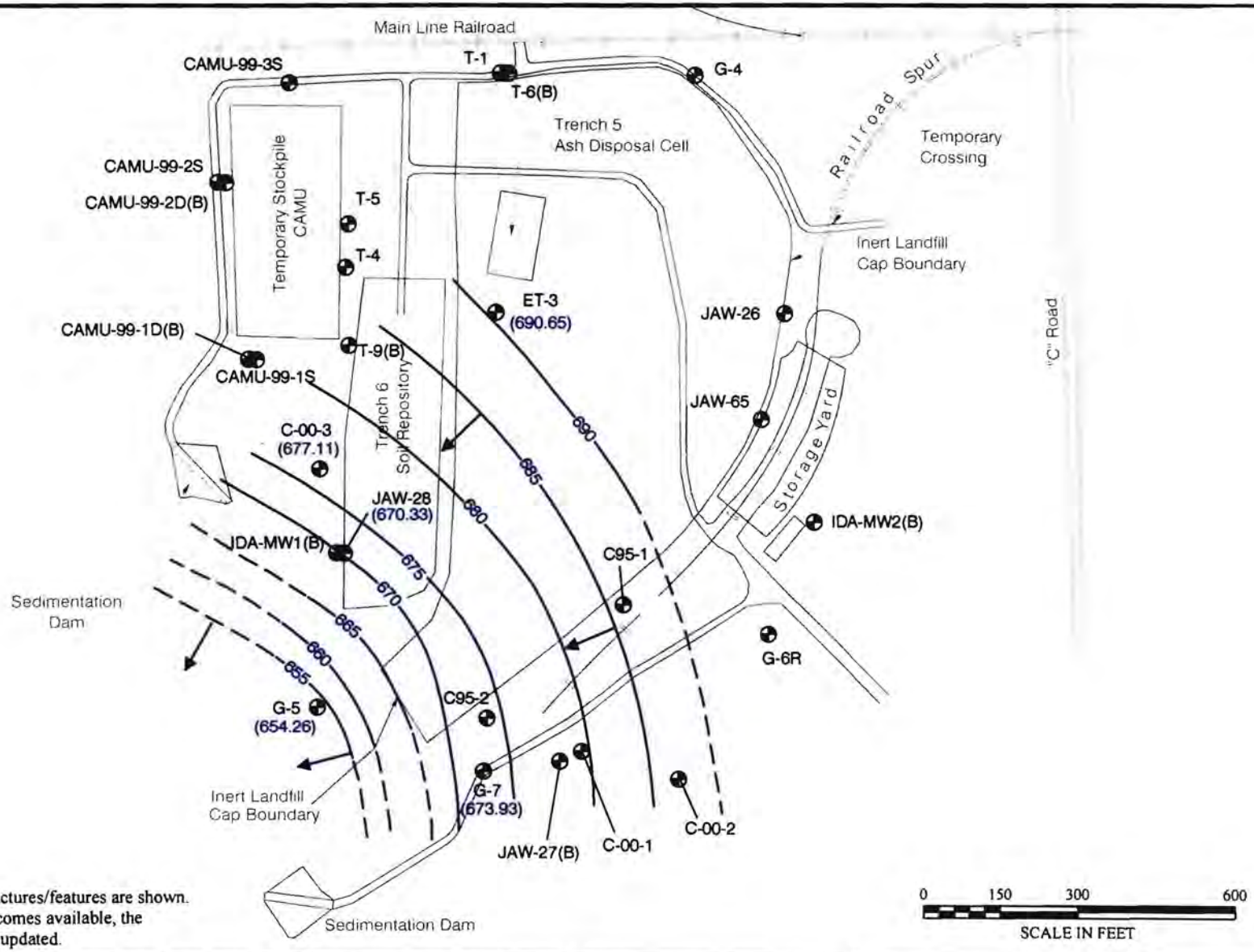
Filename: X:\KAN004\TO3_IAAP\Maps\GWM_2002\GWE_Shallow_Inert.dwg
Project: KAN004-003-02-29
Created by: apassarelli 09/12/02
Revised: 01/11/03 tbraswell
Source: URS

HYDRO GeoLogic Inc

Legend

- Monitoring Well
- (B) Bedrock Well
- (690.65) Groundwater Elevation (Feet Above Mean Sea Level)
- Groundwater Potentiometric Surface (Contour Interval = 2 feet)
- Groundwater Flow Vector

Figure 3.11 a
Groundwater Elevations - Spring 2002
Shallow Till Wells
Inert Disposal Area



Note: Not all current structures/features are shown. As information becomes available, the illustration will be updated.

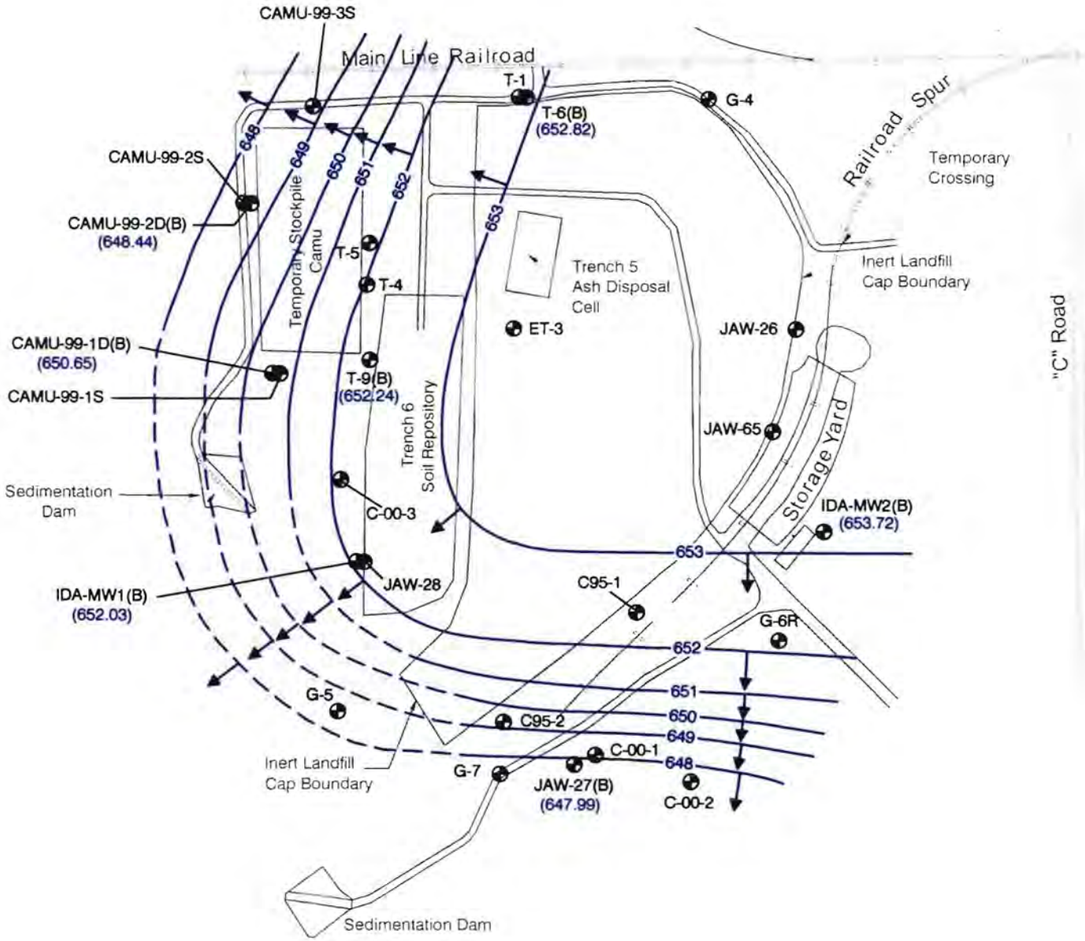
Filename: X:\KAN004\TO3_IAAP\Maps\GWM_2002\GWE_Intermediate Inert.dwg
Project: KAN004-003-02-29
Created by: apassarelli 09/03/02
Revised: 03/12/03 ACarriger
Source: URS

HYDRO GeoLogic

Legend

- Monitoring Well
- (B) Bedrock Well
- (670.92) Groundwater Elevation (Feet Above Mean Sea Level)
- Groundwater Potentiometric Surface (Contour Interval = 5 feet)
- Inferred Contour
- Groundwater Flow Direction

Figure 3.11 b
Groundwater Elevations
Spring 2002
Intermediate Till Wells
Inert Disposal Area



HydroGeoLogic, Inc.
2002 Groundwater Monitoring Report
Iowa Army Ammunition Plant, Middletown, Iowa

Figure 3.11 c
Groundwater Elevations
Spring 2002
Upper Bedrock and Bedrock Wells
Inert Disposal Area

U.S. Army Corps of Engineers
Omaha District

Legend

⊕	Monitoring Well
(B)	Bedrock Well
(654.12)	Groundwater Elevation (Feet Above Mean Sea Level)
———	Groundwater Potentiometric Surface (Contour Interval = 1 foot)
– – –	Dashes Indicate Inferred Contours
⟶	Groundwater Flow Direction

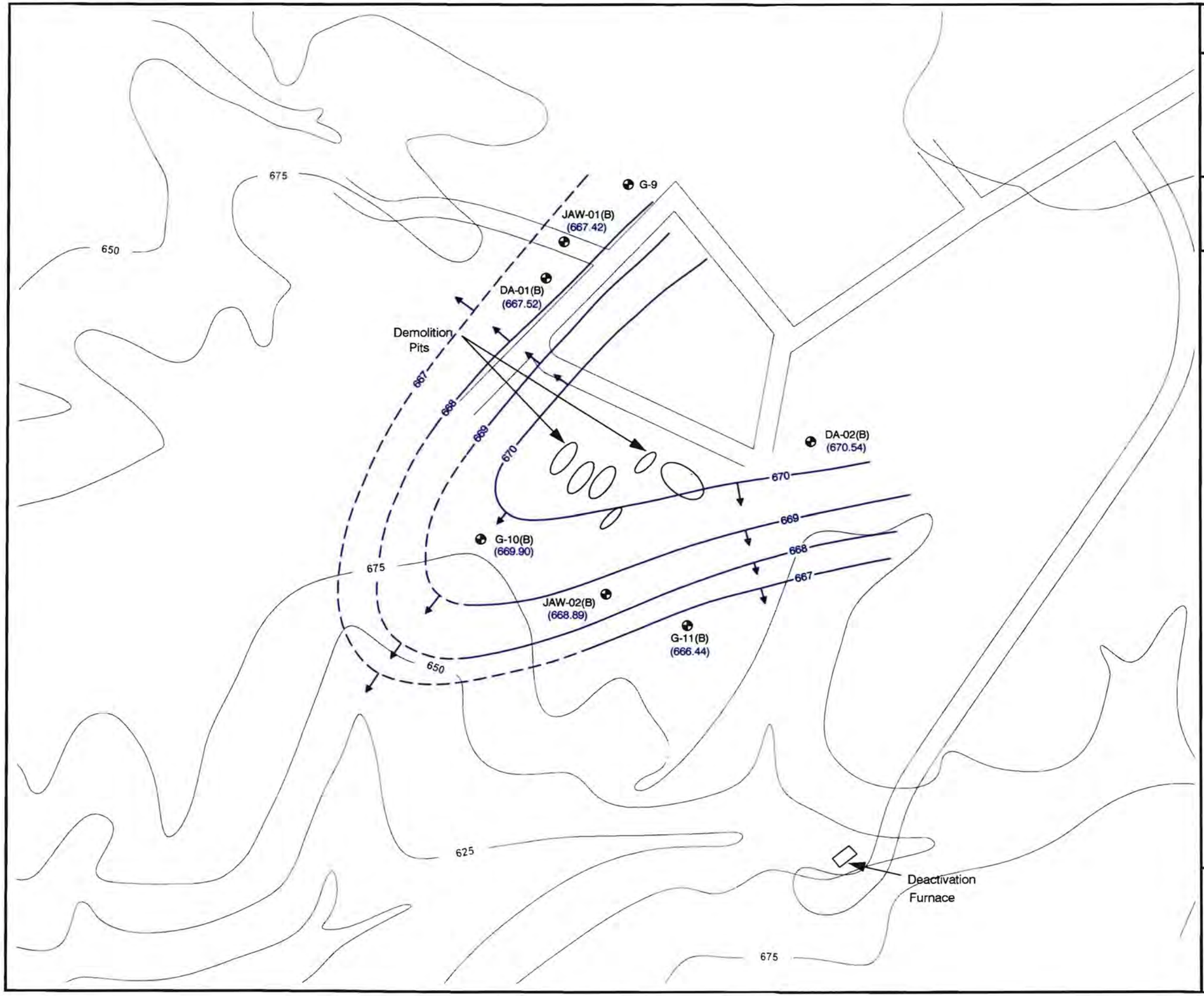
Note: Not all current structures/features are shown. As information becomes available, the illustration will be updated.

N

0 150 300 600
SCALE IN FEET

Filename: X:\KAN004\TO3_IAAP\Maps\GWM_2002\GWE_Upperbed_Inert.dwg
Project: KAN004-003-02-29
Created by: acarriger 09/26/02
Revised: 03/17/03 ACarriger
Map Source: URS

HYDRO GeoLogic INC



HydroGeoLogic, Inc.
2002 Groundwater Monitoring Report
Iowa Army Ammunition Plant, Middletown, Iowa

Figure 3.12
Groundwater Elevations - Spring 2002
Upper Bedrock Wells
Demolition Area
and Deactivation Furnace

U.S. Army Corps of Engineers
Omaha District

Legend

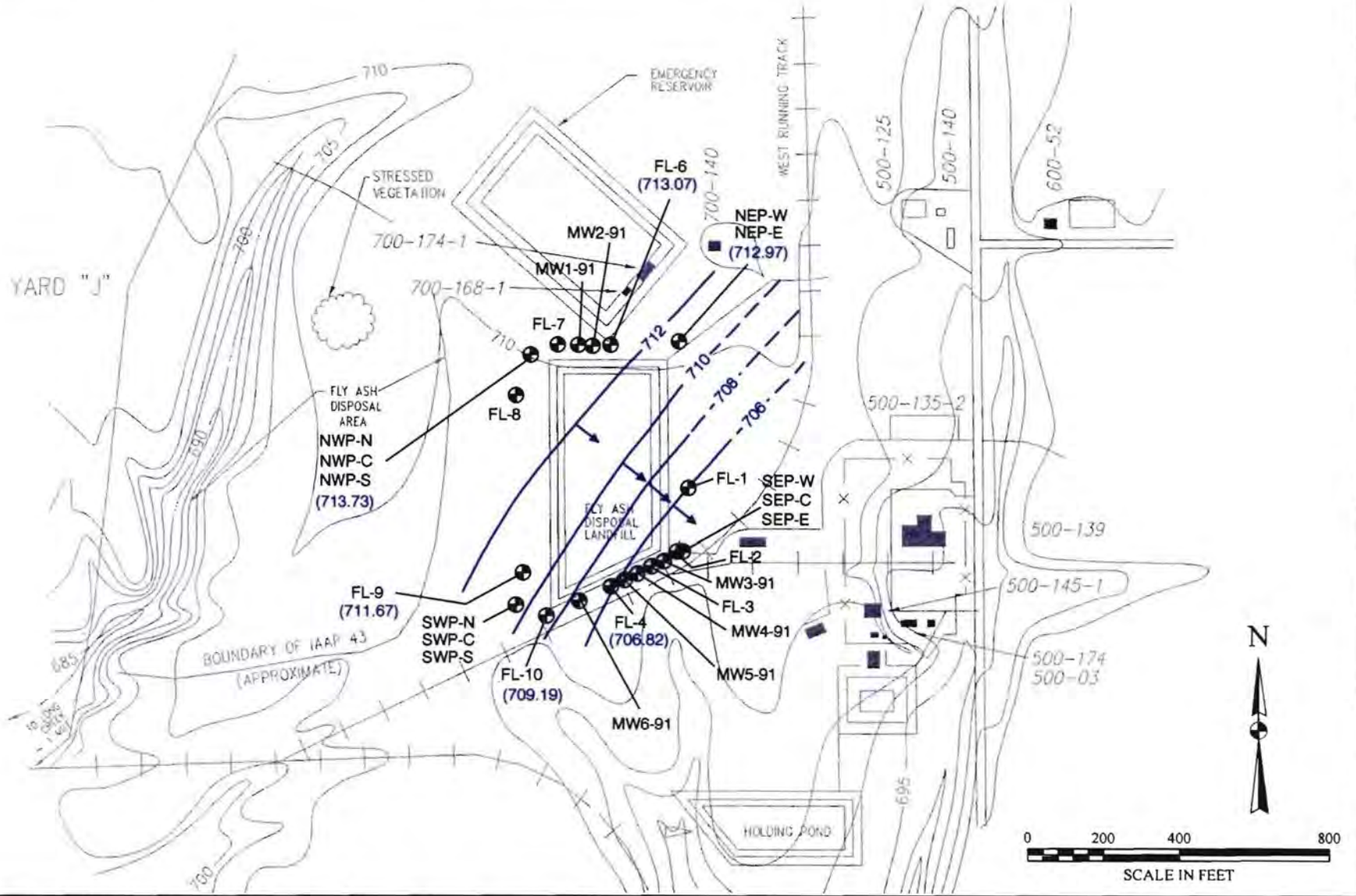
⊕	Monitoring Well
(B)	Bedrock Well
(678.59)	Groundwater Elevation (Feet Above Mean Sea Level)
———	Groundwater Potentiometric Surface (Contour Interval = 1 foot)
- - -	Inferred Contour
→	Groundwater Flow Direction

N

0 100 200 400
SCALE IN FEET

Filename: X:\KAN004\TO3_IAAP\Maps\GWM_2002\GWE_Bedrock_Demo.dwg
Project: KAN004-003-02-29
Created by: acarriger 09/19/02
Revised: 03/11/03 tbraswell
Map Source: URS

HYDRO GeoLogic INC.

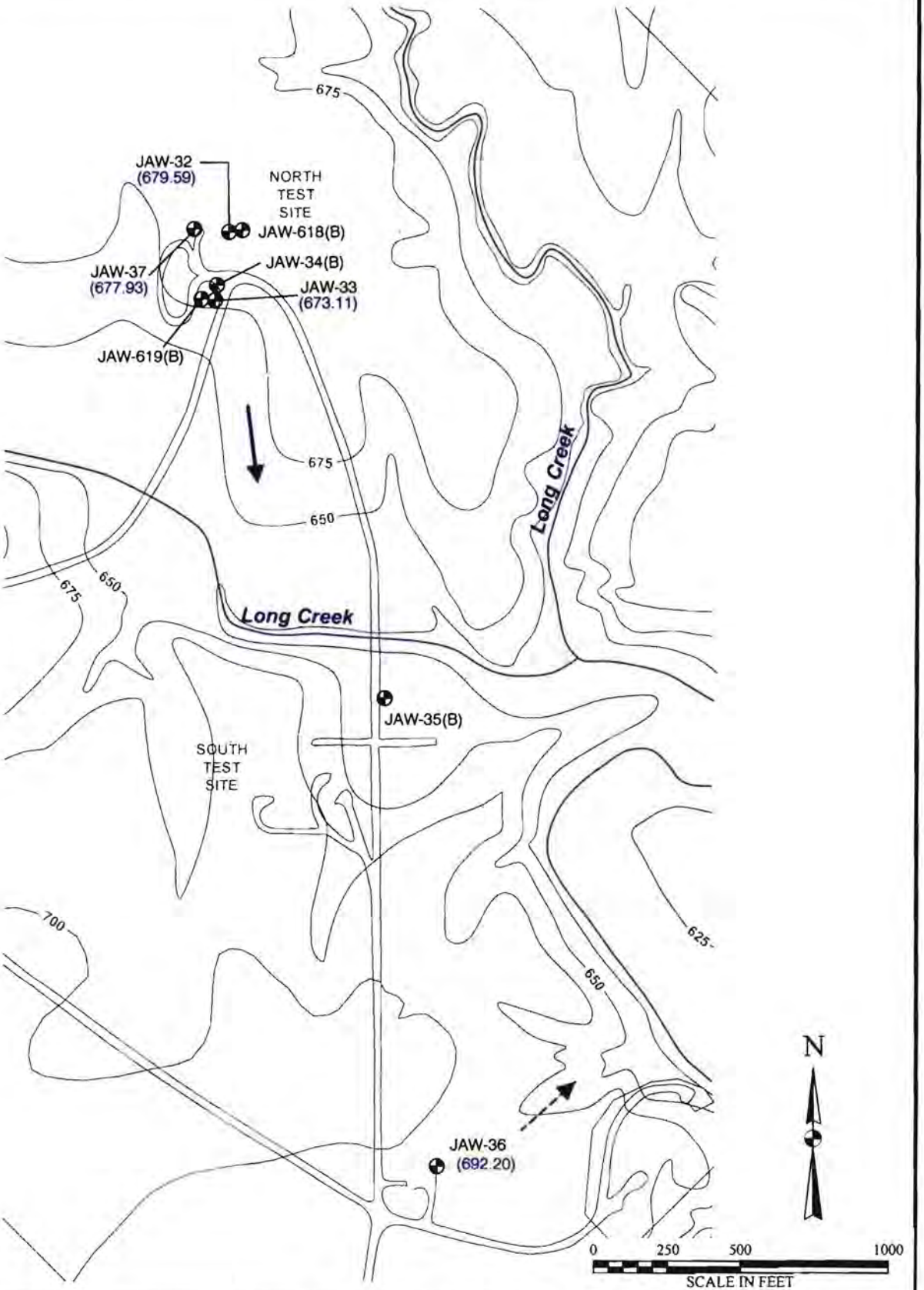


Filename: X:\KAN004\TO3_IAAP\Maps\GWM_2002\GWE_Shallow_Flyash.dwg
Project: KAN004-003-02-29
Created by: acarriger 09/20/02
Revised: 03/12/03 ACarriger
Source: URS

Legend

- Monitoring Well
- (709.19) Groundwater Elevation (Feet Above Mean Sea Level)
- Groundwater Potentiometric Surface (Contour Interval = 2 feet)
- Inferred Contour
- Groundwater Flow Direction

Figure 3.13
Groundwater Elevations
Spring 2002
Shallow Till Wells
Flyash Landfill, Flyash Disposal Area



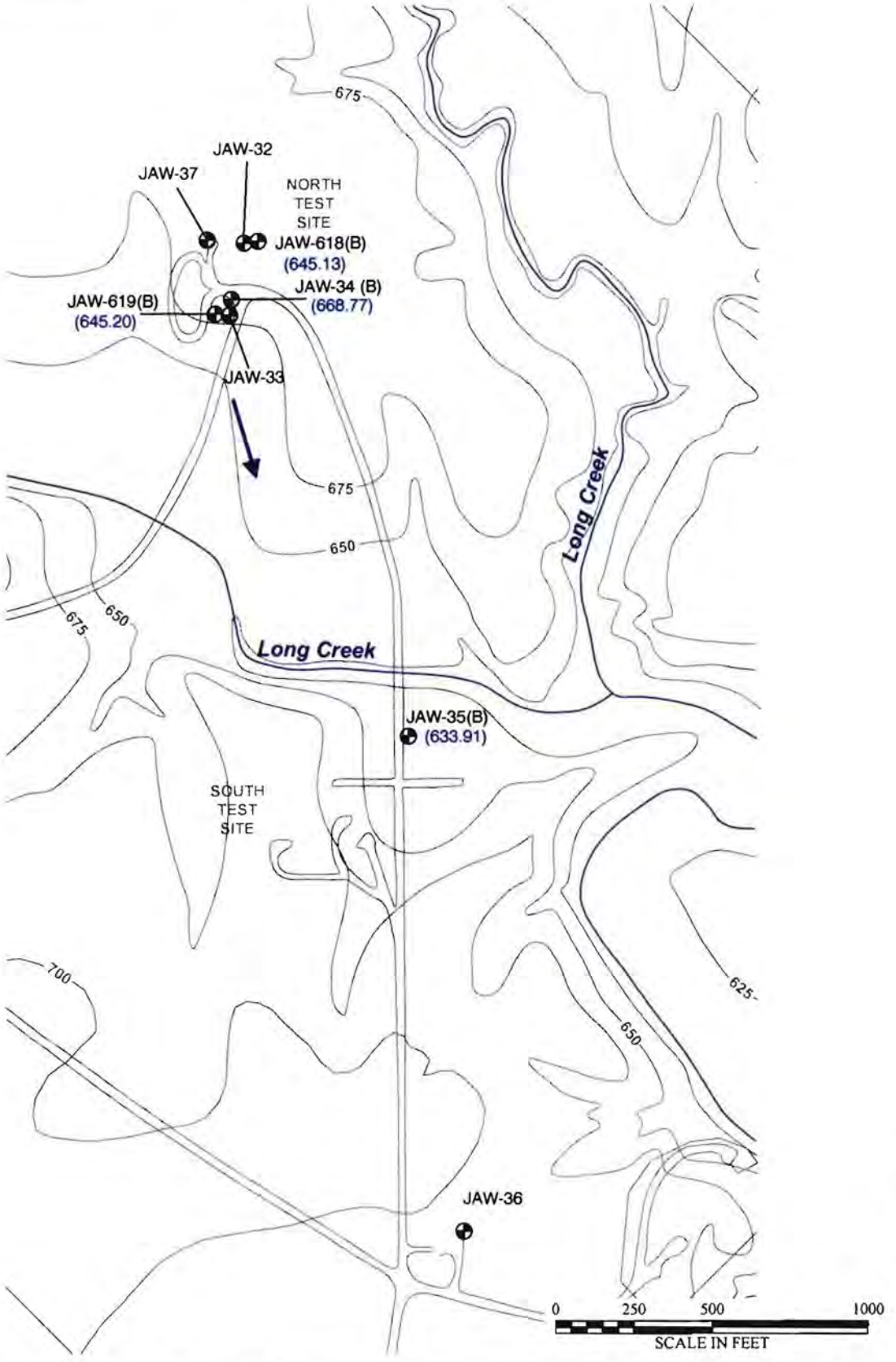
Filename: X:\KAN004\TO_IAAP\MAPS\GWM_2002\GWE_SHALLOW_FIRINGSITE.dwg
Created by: apassarelli 08/28/02
Revised by: 03/12/03 ACarriger
Project: KAN004-003-02-29
Source: URS

HYDRO GeoLogic

Legend

- Monitoring Well
- (B) Bedrock Well
- (673.11) Groundwater Elevation (Feet Above Mean Sea Level)
- Groundwater Flow Direction
- Inferred Groundwater Flow Direction

Figure 3.14 a
Groundwater Elevations
Spring 2002
Shallow Till Wells
Firing Site



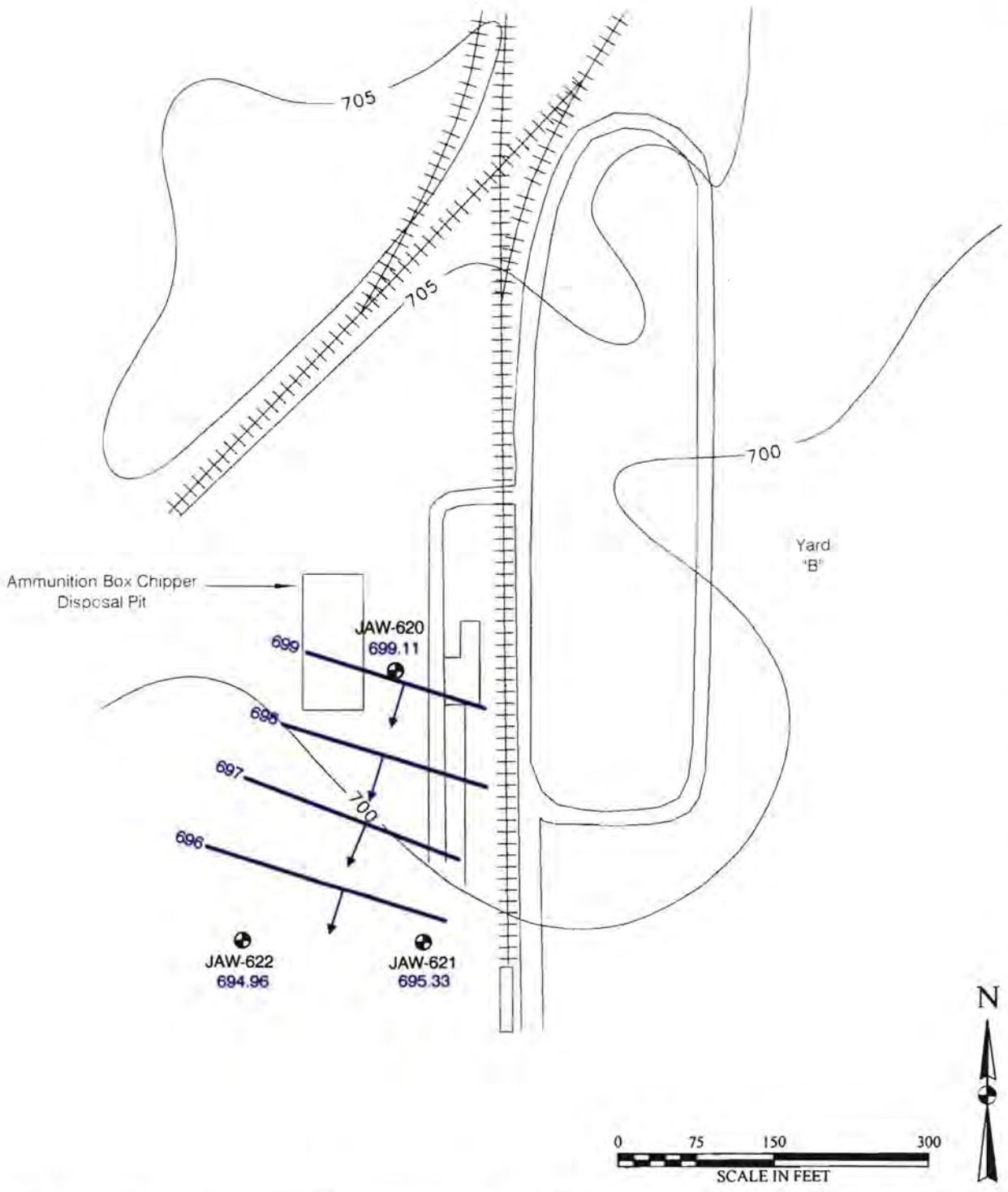
Filename: X\KAN004\TO_IAAP\MAPS\GWM_2002\GWE_Glacial_Outwash_Upper_Bed.dwg
Created by: apassarelli 09/12/02
Revised by: 03/11/03 tbraswell
Project: KAN004-003-02-29
Source: URS

HYDRO GeoLogic

Legend

- Monitoring Wells
- (B) Bedrock Well
- (633.91) Groundwater Elevation (Feet Above Mean Sea Level)
- Groundwater Flow Direction

Figure 3.14 b
Groundwater Elevations
Spring 2002
Glacial Outwash and Upper Bedrock Wells, Firing Site

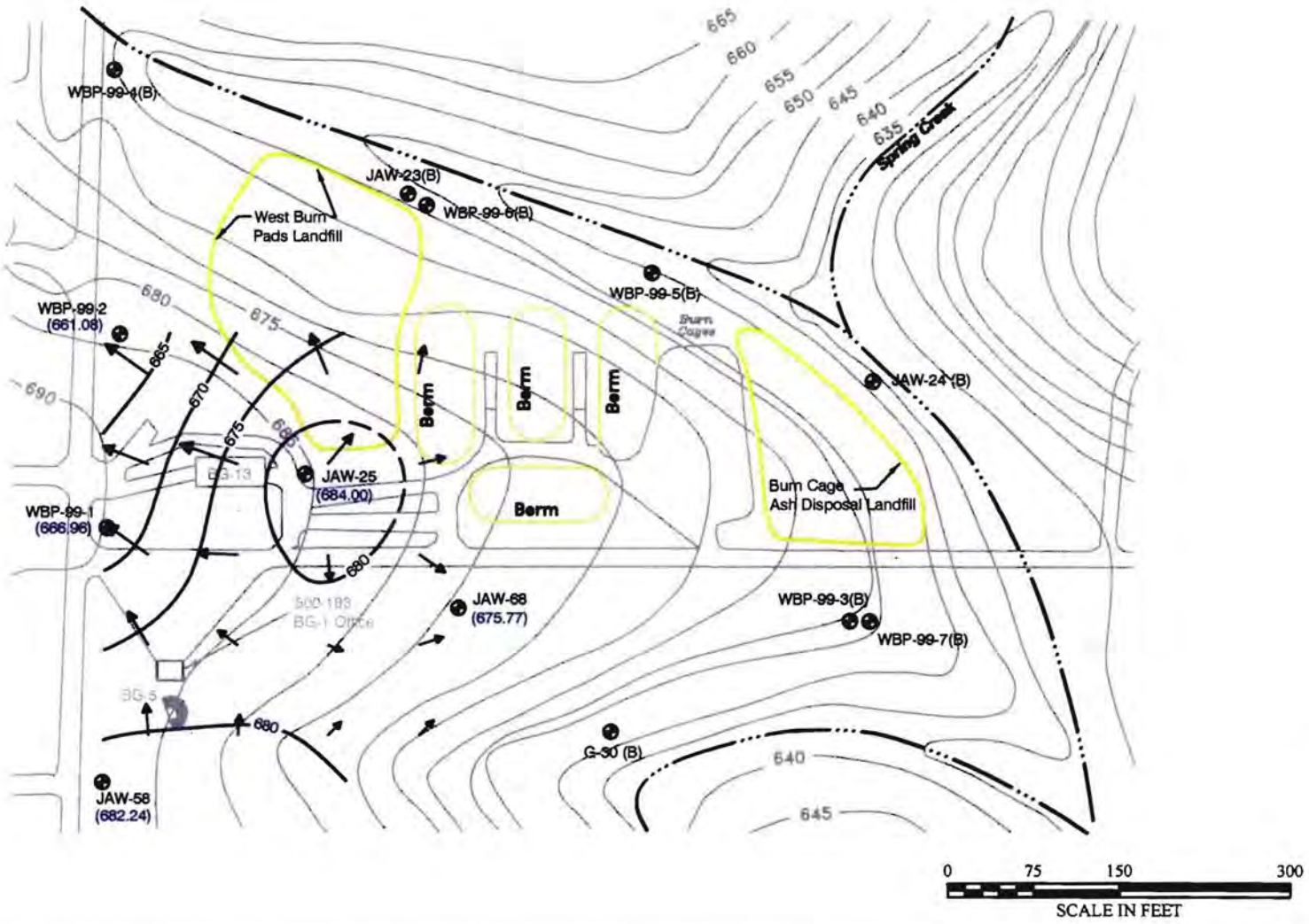


Filename: X:\KAN004\TO_IAAP\MAPS\GWM_2002\GWE_Shallow_Ammopit.dwg
Created by: ACarriger 09/19/02
Revised by: 03/11/03 tbraswell
Project: KAN004-003-02-29
Source: URS

Legend

- Monitoring Well
- (B) Bedrock Well
- (699.11) Groundwater Elevation (Feet Above Mean Sea Level)
- Groundwater Potentiometric Surface (Contour Interval = 1 foot)
- Groundwater Flow Direction

Figure 3.15
Groundwater Elevations
Spring 2002
Shallow Till Wells
Ammunition Box
Chipper Disposal Pit



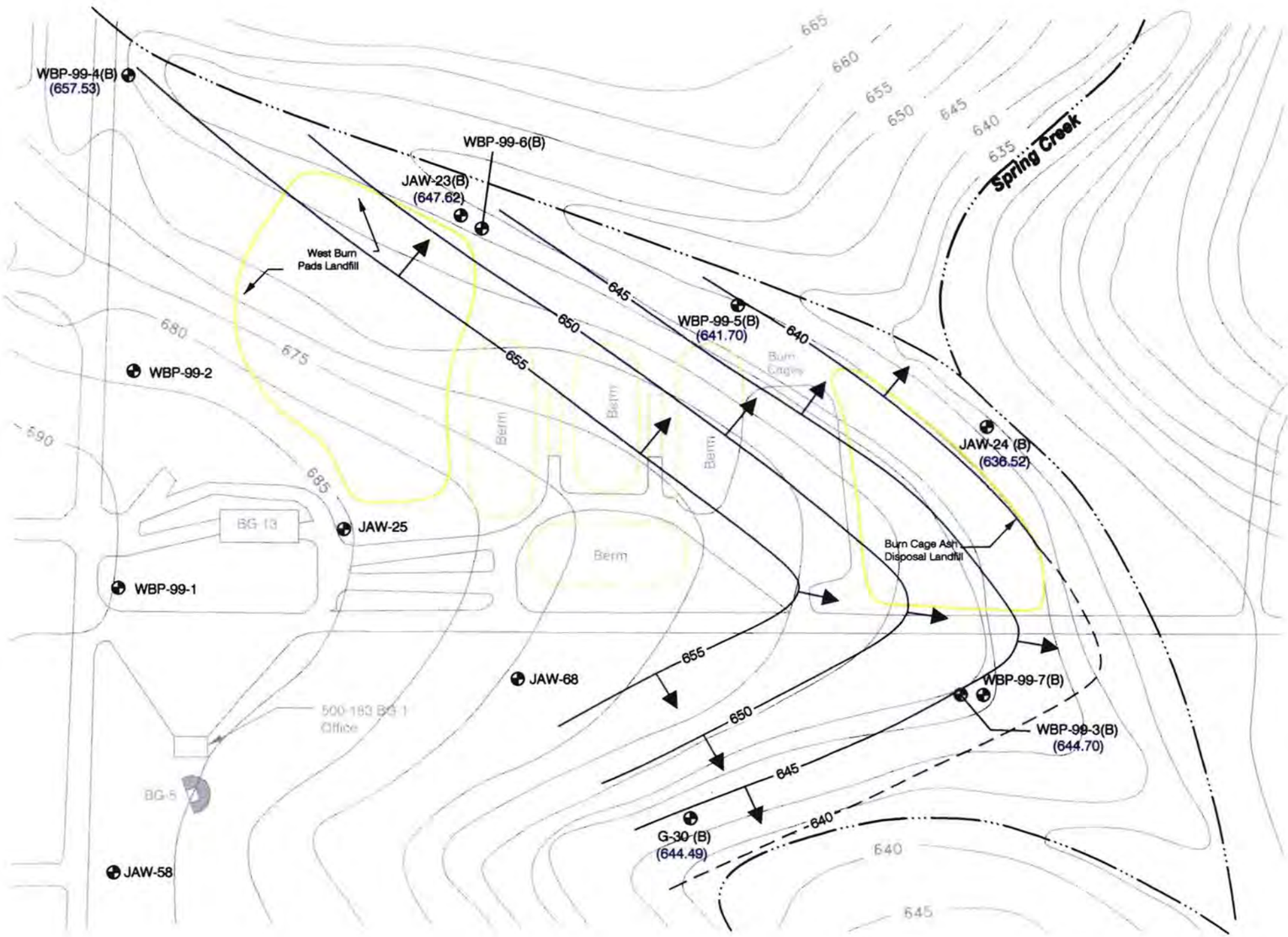
Filename: X:\KAN004\TO3_IAAP\Maps\GWM_2002\GWE_Shallow_Westburn.dwg
Project: KAN004-003-02-29
Created by: apassarelli 09/12/02
Revised: 03/11/03 tbraswell
Source: URS

HydroGeoLogic

Legend

- Monitoring Well
- (B) Bedrock Well
- (675.77) Groundwater Elevation (Feet Above Mean Sea Level)
- Groundwater Potentiometric Surface (Contour Interval = 5 feet)
- Inferred Contour
- Former Structure/Feature
- Groundwater Flow Vector

Figure 3.16 a
Groundwater Elevations - Spring 2002
Shallow Till Wells
West Burn Pads, West Burn Pads Landfill, Burn Cages and Burn Cages Landfill



HydroGeoLogic, Inc.
2002 Groundwater Monitoring Report
Iowa Army Ammunition Plant, Middletown, Iowa

Figure 3.16 b
Groundwater Elevations - Spring 2002
Upper Bedrock Wells
West Burn Pads, West Burn Pads Landfill, Burn Cages and Burn Cages Landfill

U.S. Army Corps of Engineers
Omaha District

Legend

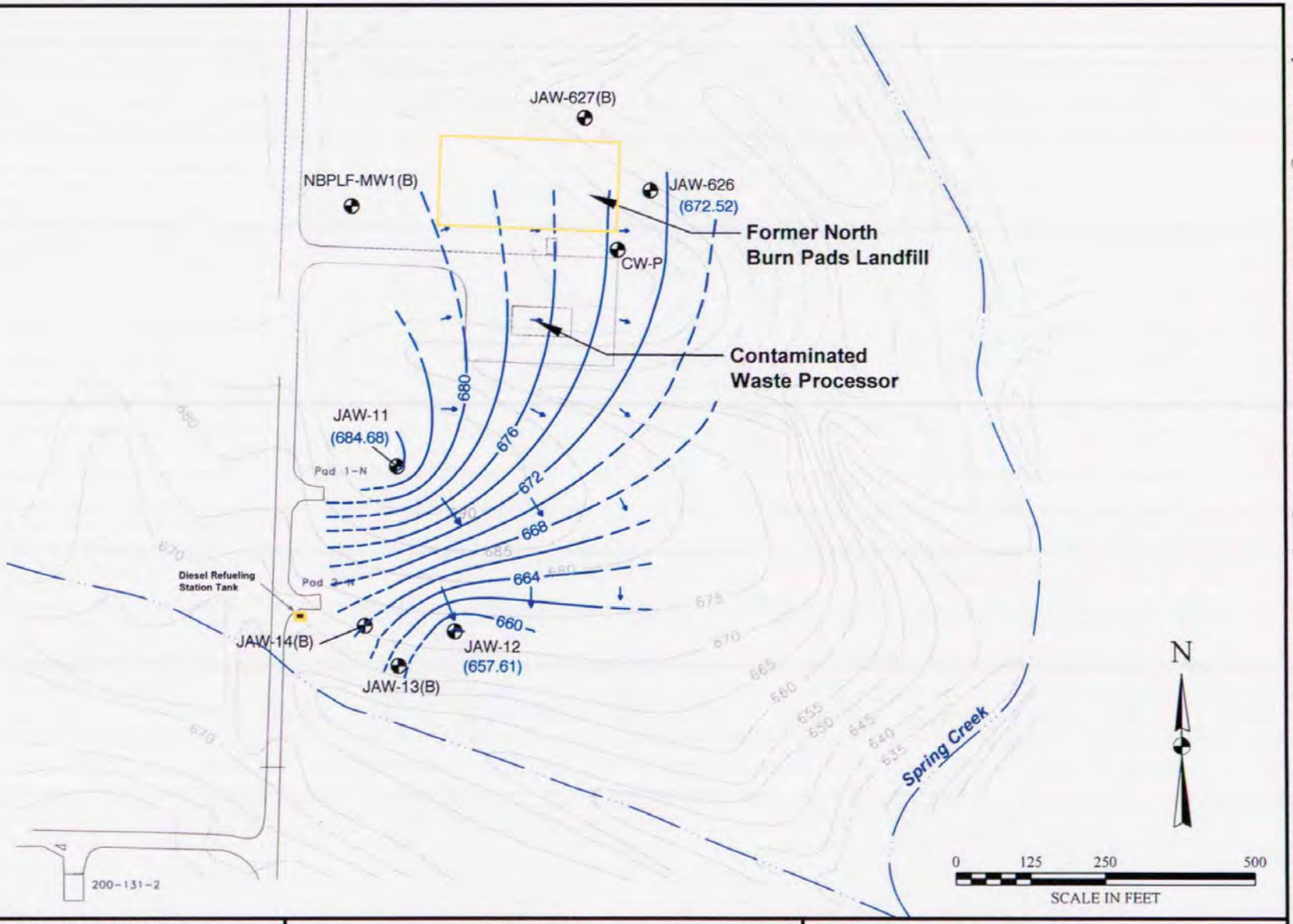
- Monitoring Well
- (B) Bedrock Well
- Former Structure/Feature
- (708.16) Groundwater Elevation (Feet Above Mean Sea Level)
- Groundwater Potentiometric Surface (Contour Interval = 5 feet)
- Inferred Contour
- Groundwater Flow Direction
- Topographic Contour

N

0 50 100 200
SCALE IN FEET

Filename: X:\KAN004\TO3_IAAP\Maps\GWM_2002\GWE_Upperbed_Westburn.dwg
Project: KAN004-003-02-29
Created by: apassarelli 09/12/02
Revised: 03/11/03 tbraswell
Map Source: URS

HydroGeoLogic



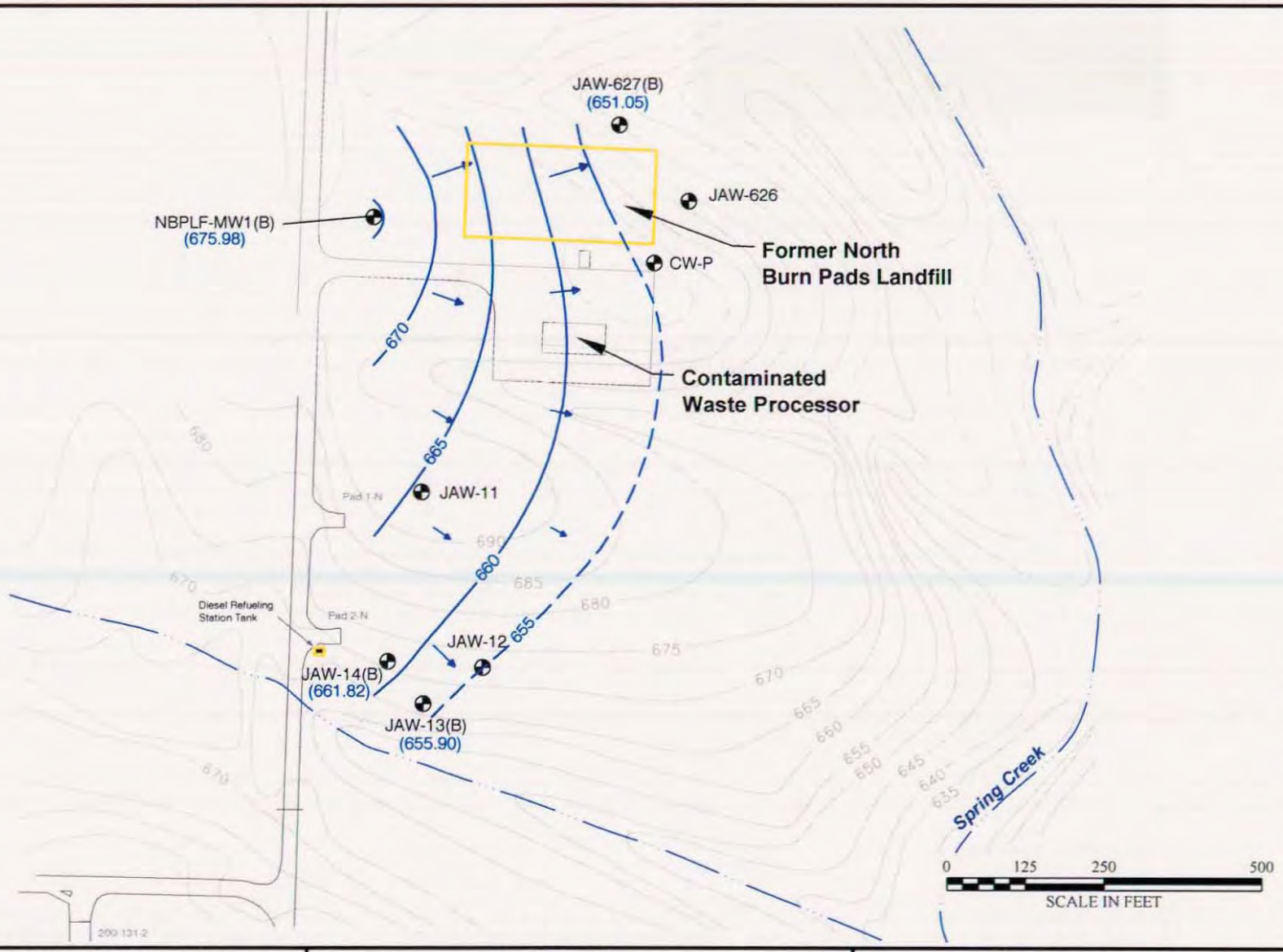
Filename: X:\KAN004\TO3_IAAP\Maps\GWM_2002\GWE_Shallow_Northburn.dwg
Project: KAN004-003-02-29
Created by: apassarelli 09/12/02
Revised: 03/11/03 tbraswell
Source: URS

HYDRO GeoLogic

Legend

- Monitoring Well
- (B) Bedrock Well
- (657.61) Groundwater Elevation (Feet Above Mean Sea Level)
- Groundwater Potentiometric Surface (Contour Interval = 2 feet)
- Inferred Contour
- Former Structure/Feature
- Groundwater Flow Vector

Figure 3.17 a
Groundwater Elevations - Spring 2002
Shallow Till Wells
North Burn Pads, North Burn Pads Landfill, and Contaminated Waste Processor



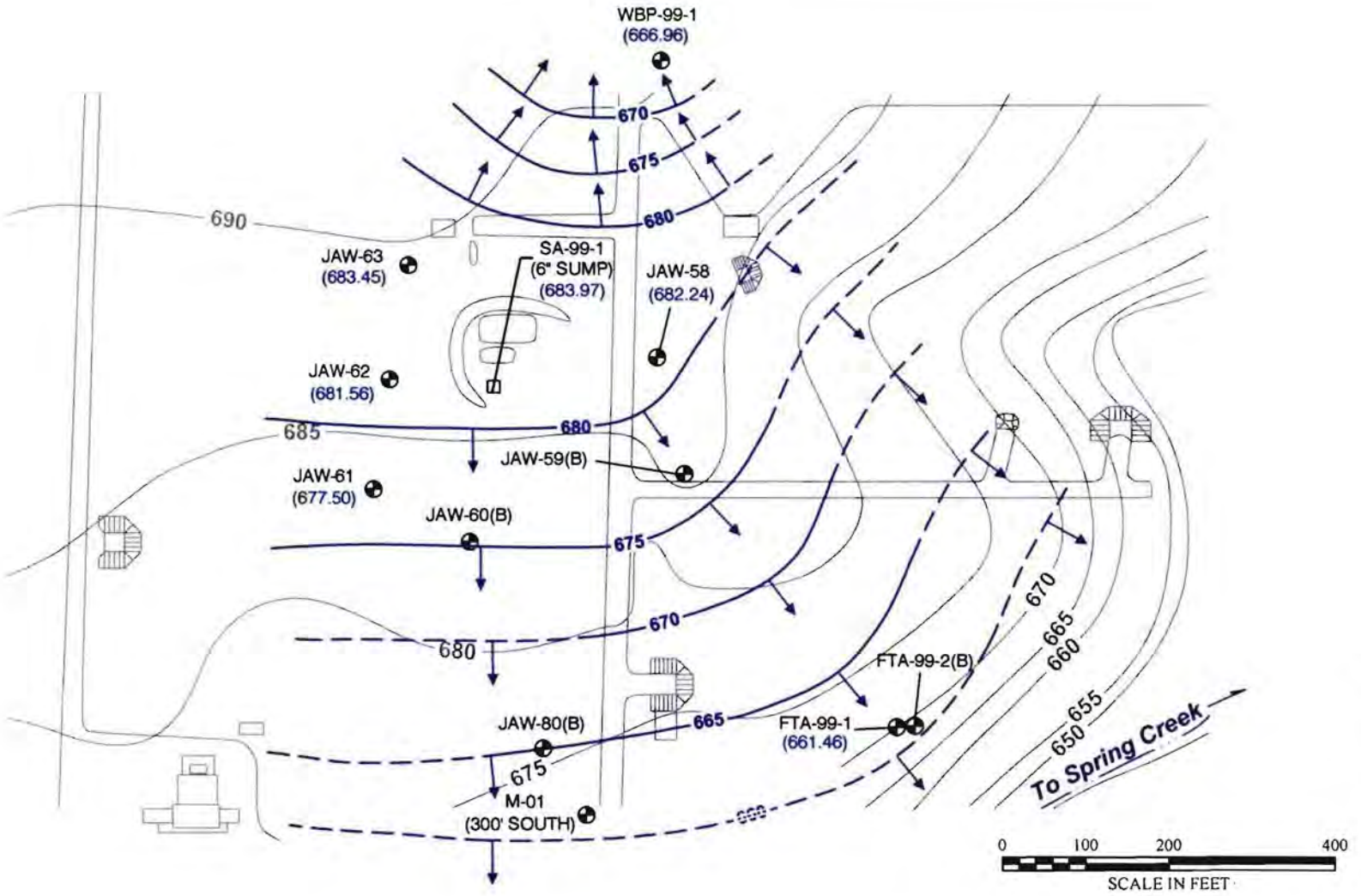
Filename: X:\KAN004\TO3_IAAP\Maps\GWM_2002\GWE_Upperbed_Northburn.dwg
Project: KAN004-003-02-29
Created by: apassarelli 09/12/02
Revised: 03/12/03 ACarriger
Source: URS

HYDRO GeoLogic Inc

Legend

- Monitoring Well
- (B) Bedrock Well
- (655.91) Groundwater Elevation (Feet Above Mean Sea Level)
- Groundwater Potentiometric Surface (Contour Interval = 5 feet)
- Inferred Contour
- Former Structure/Feature
- Groundwater Flow Vector

Figure 3.17 b
Groundwater Elevations - Spring 2002
Upper Bedrock Wells
North Burn Pads, North Burn Pads Landfill, and Contaminated Waste Processor



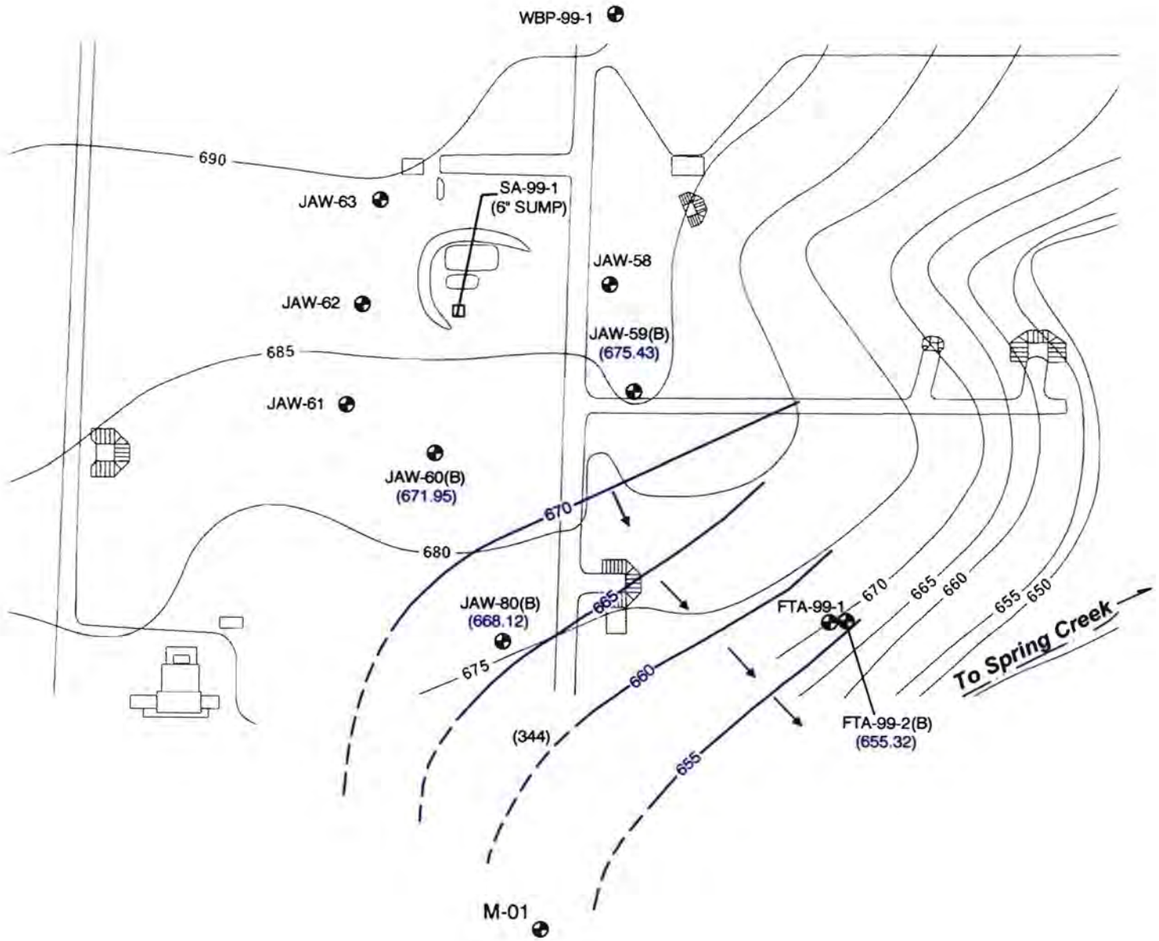
Filename: X:\KAN004\TO3_IAAP\Maps\GWM_2002\GWE_Shallow_Firetrain.dwg
Project: KAN004-003-02-29
Created by: apassarelli 09/12/02
Revised: 03/11/03 tbraswell
Source: URS

HYDRO GeoLogic

Legend

- Monitoring Well
- (B) Bedrock Well
- (683.45) Groundwater Elevation (Feet Above Mean Sea Level)
- Potentiometric Groundwater Surface Contours (Contour Interval = 5 feet)
- Inferred Contour
- Sump Location
- Groundwater Flow Direction

Figure 3.18 a
Groundwater Elevations - Spring 2002
Shallow Till Wells
Fire Training Area



HydroGeoLogic, Inc.
2002 Groundwater Monitoring Report
Iowa Army Ammunition Plant, Middletown, Iowa

Figure 3.18 b
Groundwater Elevations
Spring 2002
Upper Bedrock Wells
Fire Training Area

U.S. Army Corps of Engineers
Omaha District

Legend

- Monitoring Well
- (B) Bedrock Well
- Sump Location
- (668.12) Groundwater Elevation (Feet Above Mean Sea Level)
- Groundwater Potentiometric Surface (Contour Interval = 5 feet)
- Inferred Contour
- Groundwater Flow Direction

N

0 100 200 400
SCALE IN FEET

Filename: X:\KAN004\TO3_IAAP\Maps\GWM_2002\GWE_Upperbed_Firetrain.dwg
Project: KAN004-003-02-29
Created by: acarriger 09/24/02
Revised: 03/11/03 tbraswell
Map Source: URS

HYDRO GeoLogic Inc.

Section 4

4.0 CHEMICAL INVESTIGATION RESULTS

This section presents laboratory and field chemical data, data validation, and data review results for the Spring 2002 groundwater monitoring event at Iowa AAP.

4.1 SUMMARY OF ANALYTICAL RESULTS

Groundwater and surface water samples were submitted to Laucks for analysis of explosive compounds, VOCs, SVOCs, metals, radionuclides, total uranium, and natural attenuation parameters. Laucks subsequently submitted the radionuclide and total uranium samples to EnviroTest Laboratories of Casper, Wyoming, for analysis. When EnviroTest Laboratories closed, three radionuclide samples were later returned to Laucks and subsequently submitted to Severn-Trent Laboratories of Richland, Washington. Tables 4.1 through 4.23 summarize the detected analytical results for the groundwater and surface water samples collected during the Spring 2002 sampling event. A summary of all analytical results for groundwater and surface water samples collected at Iowa AAP is presented in Appendix B.

Perchlorate and RDX metabolite samples were collected during the Spring 2002 sampling event. Perchlorate samples were collected as part of a follow-up investigation to an independent EPA study conducted in 2000 and 2001, and were submitted for analysis to Laucks. The perchlorate results are discussed in Section 6.0. RDX metabolite samples were collected for an independent research study and analyzed by Lawrence Livermore Laboratory. The RDX metabolite results were not reported to HydroGeoLogic, and are not discussed in this report. However, the RDX metabolite MNX is included in the explosives analytical suite for the samples submitted to Laucks, and those results are discussed in this report.

4.1.1 Volatile Organic Compounds Detected in Groundwater

The primary VOCs detected in groundwater samples collected at Iowa AAP included 1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113) and acetone. Additional VOCs detected included: benzene, 2-butanone, chloroethane, chloroform, 1,1-dichloroethane (1,1-DCA), 1,1-dichloroethene (1,1-DCE), 1,2-dichloroethane (1,2-DCA), cis-1,2-dichloroethene (cis-1,2-DCE), trans-1,2-dichloroethene (trans-1,2-DCE), ethylbenzene, dichlorodifluoromethane (Freon-12), 2-hexanone, 4-isopropyltoluene, methyl isobutyl ketone (MIBK), methylene chloride, tetrachloroethene (PCE), toluene, 1,1,1-trichloroethane (1,1,1-TCA), 1,1,2-trichloroethane (1,1,2-TCA), trichloroethylene (TCE), vinyl chloride, and xylene.

4.1.2 Semivolatile Organic Compounds Detected in Groundwater

The primary SVOC detected in groundwater samples collected at Iowa AAP was bis(2-ethylhexyl)phthalate. Bis(2-ethylhexyl)phthalate is a common laboratory contaminant and is not considered a site-related contaminant at Iowa AAP. Additional SVOCs detected included benzoic acid, 2,4-dichlorophenol, 4-methylphenol, pentachlorophenol, phenol, and 2,4,5-trichlorophenol.

4.1.3 Explosive Compounds Detected in Groundwater

The primary explosive compounds detected in groundwater samples collected at Iowa AAP included RDX and cyclotetramethylenetetranitramine (HMX). Additional explosive compounds detected included MNX, 1,3,5-trinitrobenzene (1,3,5-TNB), 1,3-dinitrobenzene (1,3-DNB), 2,4,6-trinitrotoluene (2,4,6-TNT), 2,4-dinitrotoluene (2,4-DNT), 2,6-dinitrotoluene (2,6-DNT), 2-amino-4,6-dinitrotoluene (2-Am-DNT), and 4-amino-2,6-dinitrotoluene (4-Am-DNT).

4.1.4 Metals Detected in Groundwater Samples

The primary metal analytes detected in groundwater samples collected at Iowa AAP included arsenic, barium, chromium, and lead. Other detected metals included cadmium, copper, manganese, mercury, nickel, selenium, silver, and vanadium.

4.2 DATA QUALITY REVIEW/VALIDATION PROCESS

The analytical data generated by the laboratory was checked for accuracy, precision, representativeness, comparability, and completeness. The data validation process for this project consisted of data generation, reduction, and two levels of review.

4.2.1 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 (Quality Control Project Plan [QAPP]) in the Iowa AAP Facility-Wide Work Plan (URS 2002a) identifies the laboratory reduction and validation processes.

4.2.2 HydroGeoLogic Data Review

The second level of chemical data review was completed by HydroGeoLogic. All of the analytical data were subjected to this review. The data review was completed following the procedures described below utilizing QA/QC criteria specified in the Iowa AAP Final Facility-Wide Work Plan, Section 4 - QAPP (URS 2002a), USEPA Contract Laboratory Program (CLP) National Functional Guidelines for Inorganic Data Review, February 1994, and USEPA CLP National Functional Guidelines for Organic Data Review, October 1999. The QC parameters included in the review of the laboratory analytical data packages included the following:

- Completeness of data 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 blank spike and blank spike duplicate samples

- Surrogate spike recovery in samples
- Results of matrix spike and matrix spike duplicate samples
- Field duplicate samples

4.2.3 HydroGeoLogic Data Validation

HydroGeoLogic completed full data validation on ten percent of the analytical data as defined in the project QAPP. The full validation of 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
- Run log review
- Sample result recalculation using the raw data
- Instrument tune
- Internal standards

Perchlorate analytical data did not receive a full validation on ten percent of the data. Instead, perchlorate results were subjected to a data review as outlined in Section 4.2.2. Internal laboratory control limits were used for the data review because perchlorate samples were added to the work plan after the QAPP had been developed and approved.

4.3 HYDROGEOLOGIC REVIEW/VALIDATION RESULTS

The data review process was implemented to assess the quality of data resulting from the field sampling program. The process determined whether the data meet 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 was based on the laboratory data summary reports and raw data. In some cases the laboratory reported data with qualifiers not listed in the National Functional Guidelines. The following table shows those laboratory qualifiers changed to make qualification conform to the National Functional Guidelines.

Data Qualifiers		
Reason for Qualification	**Laboratory Qualifier**	**HydroGeoLogic Qualifier**
Detections below RL (metals only)	**B***	**J**
Columns differ by > 25%	**P**	**J**
Serial dilution > 10% difference (metals only)	**E**	**J**
Detected result reported above calibrated range (organics only)	**E**	**J**

* See Section 4.3.1.4 for discussion of **B** qualifiers applied by the laboratory to organic results.
Note: In some cases these **J** qualifiers are superseded when there is a QC issue associated with the J-qualified result.

Table 4.29 summarizes all data that were qualified because results from the two analytical columns differed by more than 25%.

4.3.1 Laboratory Sample Delivery Groups

The following subsections summarize the review and validation of the analytical data for Laucks Laboratory sample delivery groups (SDGs). The SDGs were:

Sample Delivery Groups				
HYD01	HYD05	HYD09	HYD13	HYD17
HYD02	HYD06	HYD10	HYD14	IDA01
HYD03	HYD07	HYD11	HYD15	TRE01
HYD04	HYD08	HYD12	HYD16	TRE02

4.3.1.1 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.

4.3.1.2 Laboratory Case Narrative

Problems identified by the laboratory in the case narratives for each SDG are discussed below.

SDG IDA01

The laboratory case narrative for IDA01 indicated that some samples were received at temperatures below the control limits of 4° C $\pm$ 2° C. None of the samples were frozen, so no corrective action was required. One volatile sample vial for TB052902 contained air bubbles of less than one-quarter inch in size. The other sample vial in the pair was used for analysis. The method blank for volatile analyses on 6/4/02 contained methylene chloride and acetone. All sample results associated with this method blank were flagged **B** by the laboratory. The SVOC initial calibration exceeded 40% relative standard deviation (RSD) for

hexachlorocyclopentadiene. The average % RSD for all compounds was less than 15% and all system performance check compounds (SPCCs) and calibration check compounds (CCCs) were in control. The calibration met the QAPP criteria and was accepted. The serial dilution for barium did not meet the original determination to within 10%. The associated results were flagged **E** by the laboratory.

SDG TRE01

The laboratory case narrative for TRE01 indicated that some samples were received at temperatures below the control limits of 4° C ± 2° C. None of the samples were frozen, so no corrective action was required. Several volatile sample vials contained air bubbles of less than one-quarter inch in size. The other sample vials in each pair were used for analysis. The SVOC initial calibration exceeded 40% RSD for hexachlorocyclopentadiene. The average % RSD for all compounds was less than 15% and all SPCCs and CCCs were in control. The calibration met the QAPP criteria and was accepted. The SVOC continuing calibration standard analyzed on 6/13/02 exceed 40% difference (D) for benzoic acid. The minimum response factor was met and all SPCC and CCC compound were in control; therefore, no corrective action was required. HMX exceeded 15% D for some continuing calibration verifications (CCVs) on the confirmation column for explosives analyses. The average % D was less than 15% and HMX was in control for all analyses on the primary (quantitation) column. No corrective action was required. The matrix spike (MS) recovery for uranium for sample C-00-2 exceeded the upper control limit (UCL). A post-digestion spike was performed and the recovery also exceeded the UCL. The associated results were flagged **N** by the laboratory. The recovery in the blank spike sample for uranium exceeded the UCL. Uranium was not detected above the practical quantitation limit (PQL) in the associated samples; therefore, no corrective action was required.

SDG HYD01

The laboratory case narrative for HYD01 indicated that some samples were received at temperatures below the control limits of 4° C ± 2° C. None of the samples were frozen, so no corrective action was required. Some volatile sample vials contained air bubbles of less than one-quarter inch in size. The method blank for volatile analyses on 6/5/02 contained acetone. All sample results associated with this method blank were flagged **B** by the laboratory. The VOC CCV standard on 6/5/02 exceeded 40% D for 2-butanone. The average %D for all compounds was less than 15% and all SPCCs and CCCs were in control. The calibration met the QAPP criteria and was accepted. The SVOC initial calibration exceeded 40% RSD for hexachlorocyclopentadiene. The average % RSD for all compounds was less than 15% and all SPCCs and CCCs were in control. The SVOC continuing calibration standard analyzed on 6/13/02 exceeded 40% D for benzoic acid. The minimum response factor was met and all SPCC and CCC compound were in control; therefore, no corrective action was required. One SVOC surrogate compound, 2-fluorophenol, yielded a recovery below the lower control limit for sample IDA-MW2. All other surrogates were in control. No corrective action was required. HMX exceeded 15% D for some CCVs on the confirmation column for explosives analyses. The average % D was less than 15% and HMX

was in control for all analyses on the primary (quantitation) column. No corrective action was required. The serial dilution for barium did not meet the original determination to within 10%. The associated results were flagged **E** by the laboratory. One CCV standard exceeded the UCL for chloride, ortho-phosphate, and sulfate on 6/4/02. Only QC samples were associated with this standard. The relative percent difference (RPD) of recoveries in the matrix spike/matrix spike duplicate (MS/MSD) analyses for total Kjeldahl nitrogen (TKN) exceeded the UCL. The percent recoveries were within control limits.

SDG HYD02

The laboratory case narrative for HYD02 indicated that HMX exceeded 15% D for some CCVs on the confirmation column for explosives analyses. The average % D was less than 15% and HMX was in control for all analyses on the primary (quantitation) column. No corrective action was required. The serial dilution for barium did not meet the original determination to within 10%. The associated results were flagged **E** by the laboratory. The holding time for ortho-phosphate analysis was exceeded for sample Jaw-70. The initial calibration verification (ICV) standard for ortho-phosphate on 6/5/02 was out of control. All samples were reanalyzed on 6/7/02 to confirm the original results. One CCV standard exceeded the UCL for ortho-phosphate on 6/4/02. Ortho-phosphate was not detected above the PQL in the associated samples; therefore, no corrective action was required. The matrix spike recovery and MS/MSD RPD for ortho-phosphate were out of control on 6/5/02. The RPD of recoveries in the MS/MSD analyses for TKN exceeded the UCL on 6/14/02. The percent recoveries were within control limits.

SDG HYD03

The laboratory case narrative for HYD03 indicated that some samples were received at temperatures below the control limits of 4° C $\pm$ 2° C. None of the samples were frozen, so no corrective action was required. The SVOC continuing calibration standard exceeded 40% difference (D) for benzoic acid. The minimum response factor was met and all SPCC and CCC compound were in control; therefore, no corrective action was required. HMX or tetryl exceeded 15% D for some CCVs on the confirmation column for explosives analyses. The average % D was less than 15% and the analytes were in control for all analyses on the primary (quantitation) column. No corrective action was required. The serial dilution for barium did not meet the original determination to within 10%. The associated results were flagged **E** by the laboratory. Due to a spiking error, MS/MSD analyses for TKN exhibited low recoveries. No corrective action was taken.

SDG HYD04

The laboratory case narrative for HYD04 indicated that some samples were received at temperatures below the control limits of 4° C $\pm$ 2° C. None of the samples were frozen, so no corrective action was required. One of the volatile sample vials for TB061002 contained air bubbles of less than one-quarter inch in size. The other vial in the pair was analyzed. The VOC CCV standard on 6/12/02 exceeded 40% D for bromoform and the CCV on 6/17/02

exceeded 40% D for 2-butanone and bromoform. The average % D for all compounds was less than 15% and all SPCCs and CCCs were in control. The calibration met the QAPP criteria and was accepted. The SVOC CCV standard analyzed on 6/20/02 exceeded 40% D for benzoic acid. The minimum response factor was met and all SPCC and CCC compounds were in control; therefore, no corrective action was required. HMX exceeded 15% D for some CCVs on the confirmation column for explosives analyses. The average % D was less than 15% and HMX was in control for all analyses on the primary (quantitation) column. No corrective action was required. The serial dilution for barium did not meet the original determination to within 10%. The associated results were flagged **E** by the laboratory. The final continuing calibration blank (CCB) for nitrate/nitrite analyses contained 0.5 µg/L nitrate/nitrite. The associated sample was reanalyzed. The preparation blank for nitrate/nitrite on 6/27/02 contained 0.1 micrograms per liter (µg/L) nitrate/nitrite. The associated sample did not contain nitrate/nitrite. The MS/MSD recoveries and RPD for sulfate were out of control on 6/14/02. The RPD for the MS/MSD analyses of ammonia on 6/12/02 and 6/28/02 and for nitrate/nitrite on 6/27/02 were out of control. All MS/MSD recoveries were within control limits for these analyses.

SDG HYD05

The laboratory case narrative for HYD05 indicated that the VOC method blanks on 6/19/02 and 6/20/02 contained Freon 113. All associated samples were flagged **B** by the laboratory. The CCV standard on 6/17/02 exceeded 40% D for 2-hexanone and bromoform, and the CCVs on 6/19/02 and 6/20/02 exceeded 40% D for bromoform. The average % D for all compounds was less than 20% and all SPCCs and CCCs were in control. The calibration met the QAPP criteria and was accepted. Samples 800-MW-28 and G-20 exhibited excessive foaming and required dilution. HMX exceeded 15% D for some CCVs on the confirmation column for explosives analyses. The average % D was less than 15% and HMX was in control for all analyses on the primary (quantitation) column. No corrective action was required. The explosives analysis of sample M-01 exhibited high surrogate recovery due to matrix interference. No target analytes were found in this sample. One CCV standard exceeded the UCL for selenium on 6/24/02. Selenium was not detected in the associated samples. Due to operator error, one CCB for metals analysis was omitted. A preparation blank was analyzed immediately following where the CCB should have been. This preparation blank was free from contaminants and was accepted in the place of a CCB. The laboratory control sample (LCS) recovery of selenium was out of control. The LCS was reanalyzed with similar results; however the MS selenium recovery was in control. Nitrate/nitrite was detected in the preparation blank on 6/27/02. In the associated samples, nitrate/nitrite either exceeded 20 times the concentration found in the blank or was not detected. The MS/MSD recoveries and RPD for sulfate were out of control on 6/14/02. The RPD for the MS/MSD analyses of ammonia on 6/28/02 and for nitrate/nitrite on 7/01/02 were out of control. All MS/MSD recoveries were within control limits for these analyses. The recovery of nitrate/nitrite in the MS on 6/27/02 was out of control.

SDG HYD06

The laboratory case narrative for HYD06 indicated that some samples were received at temperatures below the control limits of 4° C ± 2° C. None of the samples were frozen, so no corrective action was required. One total organic carbon (TOC) sample vial for JAW-13 was broken when it arrived at the laboratory. The other vial in the sample pair was analyzed HMX exceeded 15% D for the ICV and some CCVs on the confirmation column for explosives analyses. The average % D was less than 15% and HMX was in control for all analyses on the primary (quantitation) column. No corrective action was required. Samples JAW-15, JAW-20, JAW-21, and JAW-55 were received at the laboratory after the 48-hour holding time for ortho-phosphate had expired. The samples were analyzed immediately upon receipt. Two CCV analyses on 6/26/02 exhibited selenium recoveries above the UCL. The associated samples did not contain selenium above the PQL, so no corrective action was taken. The serial dilution for barium did not meet the original determination to within 10%. The associated results were flagged **E** by the laboratory.

SDG HYD07

The laboratory case narrative for HYD07 indicated that some samples were received at temperatures below the control limits of 4° C ± 2° C. None of the samples were frozen, so no corrective action was required. The method blank for volatile analyses on 6/19/02 contained Freon 113. All sample results associated with this method blank were flagged **B** by the laboratory. The VOC CCV standard on 6/19/02 exceeded 40% D for bromoform. The average % D for all compounds was less than 20% and all SPCCs and CCCs were in control. The calibration met the QAPP criteria and was accepted. HMX and tetryl exceeded 15% D for the ICV and some CCVs on the confirmation column for explosives analyses. The average % D was less than 15% and HMX and tetryl were in control for all analyses on the primary (quantitation) column. No corrective action was required. Sample G-30 was received at the laboratory after the 48-hour holding time for ortho-phosphate had expired. The sample was analyzed immediately upon receipt. Low internal standard area was exhibited for the LCS analysis of metals, which resulted in high recoveries. The matrix spike was within control limits. The serial dilution for barium did not meet the original determination to within 10%. The associated results were flagged **E** by the laboratory. Some CCV analyses exhibited selenium recoveries above the UCL. The associated samples did not contain selenium above the PQL, so no corrective action was taken.

SDG HYD08

The laboratory case narrative for HYD08 indicated that some samples were received at temperatures below the control limits of 4° C ± 2° C. None of the samples were frozen, so no corrective action was required. The method blank for volatile analyses on 6/20/02 contained Freon 113. All sample results associated with this method blank were flagged **B** by the laboratory. The VOC CCV standards on 6/20/02 and 6/21/02 exceeded 40% D for bromoform. The average % D for all compounds was less than 20% and all SPCCs and CCCs were in control. HMX exceeded 15% D for the ICV and some CCVs on the

confirmation column for explosives analyses. The average % D was less than 15% and HMX was in control for all analyses on the primary (quantitation) column. The serial dilution for barium did not meet the original determination to within 10%. The associated results were flagged **E** by the laboratory. Some CCV analyses exhibited selenium recoveries above the UCL. The associated samples did not contain selenium above the PQL, so no corrective action was taken. The MSD recovery for ammonia on 6/28/02 was out of control. All other QC results were in control. The MS recovery and RPD for ammonia on 6/28/02 was out of control. All other QC results were in control. The recovery of sulfide in the blank spike on 6/21/02 exceeded the UCL. None of the associated samples contained sulfide above the PQL, therefore no corrective action was taken.

SDG HYD09

The laboratory case narrative for HYD09 indicated that one volatile sample vial for sample TB061902 contained air bubbles of less than one-quarter inch in size. The other vial in the sample pair was analyzed. The method blank for volatile analyses on 6/21/02 contained acetone. All sample results associated with this method blank were flagged **B** by the laboratory. The VOC CCV standards on 6/21/02 and 6/24/02 exceeded 40% D for bromoform. The average % D for all compounds was less than 20% and all SPCCs and CCCs were in control. HMX exceeded 15% D for the ICV and some CCVs on the confirmation column for explosives analyses. Tetryl exceeded 15% D for some CCVs on the confirmation column for explosives analyses. The average % D for the ICV and all ICVs were less than 15% and HMX and Tetryl were in control for all analyses on the primary (quantitation) column. The serial dilution for barium did not meet the original determination to within 10%. The associated results were flagged **E** by the laboratory. Due to an integration error, the MS recovery and RPD for chloride were out of control. The MSD recovery and all other QC results were in control.

SDG HYD10

The laboratory case narrative for HYD10 indicated that sample ET-3 required dilution for perchlorate analysis, due to high levels of matrix interferences. The blank spike recovery was out of control. The recoveries of MS/MSD analyses were in control.

SDG HYD11

The laboratory case narrative for HYD11 indicated that some samples were received at temperatures below the control limits of 4° C $\pm$ 2° C. None of the samples were frozen, so no corrective action was required. The method blanks for volatile analyses on 7/01/02 and 7/03/02 contained acetone. All sample results associated with these method blanks were flagged **B** by the laboratory. The VOC CCV standards on 6/27/02, 6/28/02, and 7/01/02 exceeded 40% D for bromoform. The VOC CCV standard on 7/03/02 exceeded 40% D for bromoform and 2-hexanone. The average % D for all compounds was less than 20% and all SPCCs and CCCs were in control. Some analytes exceeded 15% D for the ICV and some CCVs on the confirmation column for explosives analyses. The average % Ds for the analyses

were all less than 15%. The explosives compound 2,6-DNT was out of control for the final CCV on the primary (quantitation) column, however the average % D was less than 15%. The surrogate recovery in sample JAW-610 exceeded the UCL. No analytes were detected in the sample. Cadmium in the interference check standard (solution A) was detected above the PQL. Cadmium was not detected above the PQL in the associated samples. The serial dilution for barium did not meet the original determination to within 10%. The associated results were flagged **E** by the laboratory. Both MS/MSD RPDs for ammonia on 7/05/02 were out of control. All other QC results, including the MS/MSD recoveries, were in control.

SDG HYD12

The laboratory case narrative for HYD12 indicated that both volatile sample vials for TB062702 contained air bubbles of less than one-quarter inch in size. The VOC CCV standard on 7/01/02 exceeded 40% D for bromoform. The VOC CCV standard on 7/03/02 exceeded 40% D for bromoform and 2-hexanone. The VOC CCV standard on 7/08/02 exceeded 40% D for bromoform and 2-butanone. The average % D for all compounds in these CCVs were less than 20% and all SPCCs and CCCs were in control. The method blanks for volatile analyses on 7/01/02, 7/03/02, and 7/8/02 contained acetone. All sample results associated with these method blanks were flagged **B** by the laboratory. The explosives compound 2,6-DNT was out of control for one CCV on the confirmation column, however the average % D was less than 15%. Due to an autosampler problem, MNX recovery in one CCV on the confirmation column was extremely low. All associated samples were subsequently reanalyzed to confirm MNX results from the primary column. The surrogate recovery in sample EBP-MW1 exceeded the UCL. No analytes were detected in the sample. Some CCV analyses exhibited cadmium and selenium recoveries above the UCL. The associated samples did not contain cadmium or selenium above the PQL, so no corrective action was taken. Cadmium in the interference check standard (solution A) was detected above the PQL. The associated samples did not contain cadmium or selenium above the PQL, so no corrective action was taken. On 7/10/02, the final CCV for nitrate/nitrite analyses exhibited a recovery below the lower control limit. Only QC samples were associated with this CCV, so no corrective action was taken. The nitrate/nitrite MS/MSD RPD was out of control. The recoveries were in control.

SDG HYD13

The laboratory case narrative for HYD13 indicated that some samples were received at temperatures below the control limits of 4° C $\pm$ 2° C. None of the samples were frozen, so no corrective action was required.

SDG HYD14

The laboratory case narrative for HYD14 indicated that some samples were received at temperatures below the control limits of 4° C $\pm$ 2° C. None of the samples were frozen, so no corrective action was required. Some volatile sample vials contained air bubbles of less than one-quarter inch in size. The method blank for volatile analyses on 7/10/02 contained methylene chloride. All sample results associated with this method blank were flagged **B** by

the laboratory. Four explosives CCV standards exhibited % D values that exceed 15%. The average % D for each CCV was less than 15%. Samples 800-MW-29 and 800-MW-72 exhibited high surrogate recoveries for explosives analyses, due to matrix interferences. Samples 800-MW-6, 800-MW-17, 800-MW-27, 800-MW-18, and G-57 arrived at the laboratory after the 48-hour holding time for ortho-phosphate had expired. Additionally, the ortho-phosphate holding time for samples 800-MW-2, G-18, 800-MW-5, 800-MW-7, and G-4 expired before the samples could be analyzed. The first CCV analysis for chloride on 6/29/02 exceeded the UCL. The associated samples did not contain chloride above the PQL. The MS/MSD RPD for ammonia was out of control on 7/11/02. The MS/MSD recoveries were in control.

SDG HYD16

The laboratory case narrative for HYD16 indicated that some samples were received at temperatures below the control limits of 4° C $\pm$ 2° C. None of the samples were frozen, so no corrective action was required. The method blank for volatile analyses on 7/10/02 contained methylene chloride. All sample results associated with this method blank were flagged **B** by the laboratory. The CCV standard for SVOC analyses on 7/09/02 exceeded 40% D for benzoic acid and 2,2'-oxybis(1-chloropropene). The minimum response factor was met and all SPCC and CCC compound were in control, therefore no corrective action was required. The explosives compound 2,6-DNT was out of control for one CCV on the confirmation column; however, the average % D was less than 15%. Due to an autosampler problem, MNX recovery in one CCV on the confirmation column was extremely low. All associated samples were subsequently reanalyzed to confirm MNX results from the primary column. Some CCV analyses exhibited cadmium and selenium recoveries above the UCL. The associated samples did not contain cadmium or selenium above the PQL, so no corrective action was taken. Cadmium in the interference check standard (solution A) was detected above the PQL. Sample G-47 arrived at the laboratory after the 48-hour holding time for ortho-phosphate had expired. The RPD for MS/MSD analyses of ammonia on 7/11/02 was out of control. The MS/MSD recoveries were in control.

SDG HYD17

The laboratory case narrative for HYD17 indicated that some samples were received below the control limits of 4° C $\pm$ 2° C. None of the samples were frozen, so no corrective action was required. The recovery of uranium in the LCS was out of control; however, the MS recovery was in control.

4.3.1.3 Holding Times and Sample Preservation

Review of the sample collection and analyses dates involved comparing the COCs, the chemical results summary forms, and the raw data forms for accuracy, consistency, and compliance with holding times. All samples were extracted and analyzed within the required holding time criteria with the exception of ortho-phosphate. Some ortho-phosphate samples were extracted one to two days outside the method recommended extraction criteria.

Additionally, four explosives samples were identified as having heavy matrix interference effects during the data review process. At HydroGeoLogic's request, the laboratory re-analyzed the original sample extracts outside of holding times. The initial analysis of these samples occurred within holding times. Data qualifications based on outlying holding time criteria are presented in Table 4.24.

4.3.1.4 Blank Samples

Blank samples were analyzed to determine whether any contamination was introduced into the samples during laboratory activities. Results for nine analytes were qualified in one or more samples due to blank contamination. Data qualifications based on the blank contamination are presented in Table 4.25.

The method blank analyzed on 7/10/02 contained 0.66 μg/L methylene chloride contamination. The methylene chloride peak area count in this blank was 8451. One of the associated samples, WBP-99-6, contained 0.69 μg/L methylene chloride contamination in the raw chromatogram, with a peak area count of 9141. The similarity in peak area counts between the method blank and the field sample indicate that the methylene chloride contamination in the field sample is attributable to laboratory contamination. Sample WBP-99-6 was analyzed at a dilution factor of 10,000 due to the presence of a significant amount of Freon 113. Due to the large dilution factor, the final methylene chloride result was reported as 6,900 μg/L by the laboratory, with **J** and **B** qualifiers. The **J** qualifier indicated that the result was below the dilution-adjusted reporting limit of 30,000 μg/L. The **B** qualifier indicated that the compound was also present in the blank. The methylene chloride result for WBP-99-6 was qualified **U** by the HydroGeoLogic chemist during the data review process, in accordance with CLP National Functional Guidelines for Organic Data Review.

A sample of source water to be used for field decontamination procedures was collected and analyzed for VOCs, SVOCs, and explosives during the Spring 2002 sampling event. Acetone and three trihalomethanes were detected in the water source sample; however, no qualifications of data were required based on the contamination. Acetone is a common laboratory contaminant and trihalomethanes are by-products of the potable water disinfection processes. All explosives and SVOCs were reported as non-detects in the source sample; therefore, no qualifications were required based these results on source blank contamination.

One rinsate sample was collected and analyzed for VOCs, SVOCs, and explosives during the Spring 2002 sampling event. Acetone and three trihalomethanes were detected in the rinsate samples; however, no qualifications were required based on the contamination. The rinsate samples were reported as not detected for all explosives and SVOCs; therefore, no qualifications were required based on rinsate contamination.

4.3.1.5 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 either within evaluation

criteria or did not require the qualification of any results, with the exceptions noted in the table at the end of this section.

For SVOC analyses, USEPA CLP National Functional Guidelines for Organic Data Review state that two or more surrogates of the same fraction must be outside criteria or one surrogate must exhibit a recovery value of less than 10% to require qualification. In sample IDA-MW2, the 2-fluorophenol recovery was 8%. No acid fraction compounds were detected; therefore, all acid fraction results were qualified **R** and should be considered rejected.

Samples 800-MW-5Dup, G-18Dup, and their respective parent samples exhibited high levels of target analytes and matrix interferences. During the data review process, significant differences were noted between the results from the primary (C18) column and the confirmation column (CN). Poor peak shape, an indicator of possible matrix interference, was noted on the raw chromatograms. At HydroGeoLogic's request, the laboratory reanalyzed the sample extracts outside of holding times. Reanalysis resulted in better resolution of target compounds. Results from the reanalysis were qualified **J/UJ**, because they exceeded holding times, but are considered valid for the purposes of this report.

SDG #	Site ID	Method	Field ID	Analyte	Qualification
HYD01	Inert Disposal Area	8270	IDA-MW2	SVOC acid-fraction compounds	**R**
HYD14	Line 800	8330	800-MW-05Dup	All explosive compounds	**J/UJ**
HYD14	Line 800	8330	G-18Dup	All explosive compounds	**J/UJ**

4.3.1.6 Laboratory Control Samples

Laboratory control samples (LCS) 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 arsenic (HYD07), barium (HYD07), chromium (HYD07), perchlorate (HYD10), selenium (HYD05 and HYD07), and SVOC compounds (HYD03). Data qualifications based on outlying LCS recoveries are presented in Table 4.26.

4.3.1.7 Field Duplicate Analysis

Field duplicate sample pairs were established to determine both field and laboratory precision. Thirteen groundwater field duplicate sample pairs and two surface water field duplicate sample pair were collected and submitted to the laboratory for analysis. The field duplicate sample pairs are presented in the table below:

Field Duplicate Sample Pairs Spring 2002			
Site ID	**Original Sample ID**	**Duplicate Sample ID (Laboratory)**	**Duplicate Sample ID (Report)**
Line 2	JAW-70	L2-MW4	JAW-70Dup
Line 3	JAW-54	L3-MW1	JAW-54Dup
Line 9	JAW-612	L9-MW1	JAW-612Dup
Line 800	G-18	800-MW-27	G-18Dup
Line 800	G-20	800-MW-28	G-20Dup
Line 800	800-MW-5	800-MW-29	800-MW-5Dup
East Burn Pad	EDA-03	EBP-MW4	EDA-03Dup
East Burn Pad	EDA-04	EBP-MW-5	EDA-04Dup
Inert Disposal Area	IDA-MW1	IDA-MW3	IDA-MW1Dup
Firing Site	JAW-618	JAW-100	JAW-618Dup
West Burn Pad	WBP-99-2	WBP-99-8	WBP-99-2Dup
North Burn Pad LF	JAW-627	NBPLF-MW2	JAW-627Dup
Long Creek	LC1	LC3	LC1Dup
Spring Creek	SCT2	SCT4	SCT2Dup
Trench 5 (IDA)	C95-1	C95-3	C95-1Dup

Field duplicate sample pair results were within evaluation criteria (25 percent) for all duplicate sample pairs with the exceptions and data qualifications presented in the table below. Analytical results for the field duplicate sample pairs are presented in Table 4.27.

Duplicate Sample Pairs Outside Evaluation Criteria Spring 2002			
Site ID	**Field ID**	**Analyte**	**Qualification**
Line 2	JAW-70	4-Amino-2,6-dinitrotoluene	**J**
Line 3	JAW-54	HMX	**J**
		RDX	**J**
		Alkalinity	**J**
		Carbon Dioxide	**J**
Line 9	JAW-612	Ammonia	**J/UJ**
Line 800	800-MW-05	1,3-Dinitrobenzene	**J**
West Burn Pad	WBP-99-02	HMX	**J**
		RDX	**J**
		Sulfide	**J**
		1,1,1-Trichloroethane	**J**

4.3.1.8 Quality Assurance Analysis

Quality assurance split samples were collected to determine laboratory accuracy and precision. Eight groundwater samples were collected and submitted to a secondary laboratory (USACE Environmental Chemistry Branch) for analysis and comparison. The QA split samples are listed in the table below:

Quality Assurance Sample Pairs Spring 2002		
Site ID	**Original Sample ID**	**QA Split Sample ID**
Line 2	JAW-70	JAW-70
Line 800	800-MW-5	800-MW-5
East Burn Pad	EDA-04	EDA-04
West Burn Pad	WBP-99-2	WBP-99-2
Fire Training Area	SA-99-1	SA-99-1
Fire Training Area	JAW-61	JAW-61
Fire Training Area	FTA-99-1	FTA-99-1
Line 5A and 5B	5A-MW1	5A-MW1

The USACE places the quality assurance sample evaluations into three categories: major discrepancy, minor discrepancy, or data agreed. Major discrepancies for groundwater are defined as RPDs greater than five times the QA split sample result. Minor discrepancies for groundwater are defined as normalized relative amounts that are less than or equal to five times the split sample result and greater than or equal to two times the split sample result. Data results categorized as agreed are defined as normalized relative amounts of less than two times the split sample result. Table 4.27 presents the data comparison of the original samples and the quality assurance samples.

4.3.1.9 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. Eight groundwater samples and three surface water samples were collected and submitted to the laboratory to be spiked and analyzed with their respective SDGs.

Matrix Spike/Matrix Spike Duplicate Samples Spring 2002	
Site ID	**Original Sample ID**
Line 1	JAW-602
Line 3	JAW-57
Line 800	G-44
East Burn Pad	EBP-MW2
Inert Disposal Area	CAMU-99-1S

Matrix Spike/Matrix Spike Duplicate Samples Spring 2002	
Site ID	**Original Sample ID**
Spring Creek	SCT2
West Burn Pads	JAW-68
Plant Boundary and General Area	G-27

Table 4.28 identifies the MS/MSD samples with outlying recoveries.

The CLP guidelines indicate that organic data should not be qualified based on MS/MSD results alone. Because sample surrogate recoveries and associated LCS recoveries were within criteria, no qualification of VOCs or explosives data was required based on outlying MS/MSD recoveries. The recoveries of four SVOCs in either the MS or MSD analyses of sample EBP-MW2 exceeded the QAPP control limits. In the judgment of the HydroGeoLogic reviewer, the multiple discrepancies observed in the MS/MSD analyses for EBP-MW2 warranted J qualification of the results for these four compounds in the parent sample: 1,4-dichlorobenzene, 4-nitrophenol, pentachlorophenol, and 1,2,4-trichlorobenzene.

Data qualifications based on outlying MS/MSD recoveries are presented in the table below:

SDG #	Site ID	Field ID	Analyte	Qualification
HYD04	East Burn Pad	EBP-MW-2	1,2,4-Trichlorobenzene	**UJ**
			1,4-Dichlorobenzene	**UJ**
			4-Nitrophenol	**UJ**
			Pentachlorophenol	**UJ**

4.3.1.10 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, 99% of the indicators reviewed for accuracy (LCS, MS/MSD and surrogate spike recoveries) were within evaluation criteria. Ninety-nine percent of the indicators reviewed for precision (MS/MSD and/or field duplicate RPDs) were within evaluation criteria.

The overall accuracy and precision of the groundwater and surface water data collected and reported during the Spring 2002 sampling event were determined to be satisfactory.

Representativeness

Representativeness expresses the degree 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 at Iowa AAP. Representativeness was assessed using the 15 field duplicate sample pairs collected at Iowa AAP. Field duplicate sample pairs were within evaluation criteria; therefore, it was concluded that representativeness of the data set 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 site 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 Iowa AAP Facility-Wide Work Plan (URS, 2002a) and the Spring 2002 Groundwater Monitoring Work Plan Addendum (HydroGeoLogic, 2002). It was concluded that results from the Spring 2002 monitoring event are comparable to previous sampling results from monitoring conducted at Iowa AAP.

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 Iowa AAP Facility-Wide Work Plan (URS, 2002a). For Spring 2002, 99.9% of the Iowa AAP groundwater analytical data was considered to be complete after data review and validation.

4.4 FIELD WATER QUALITY PARAMETERS

Field water quality parameter measurements included ORP/redox, dissolved oxygen, pH, conductivity, temperature, turbidity, and ferrous iron (Fe^{2+}). All field parameters were recorded on the sample collection field sheets (included in Appendix A). Field water quality parameter measurements for the Spring 2002 sampling events are presented in Table 4.30.

TABLE 4.1
SUMMARY OF CHEMICALS DETECTED AT LINE 1
SPRING 2002 GROUNDWATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID DATE COLLECTED		JAW-39 Jun 17, 2002			JAW-40 Jun 18, 2002			JAW-43 Jun 16, 2002			JAW-45 Jun 16, 2002			JAW-48 Jun 11, 2002			JAW-50 Jun 11, 2002			JAW-51 Jun 11, 2002		
	PRG	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
EXPLOSIVES (µg/L)																						
HMX	400 (b)	<	0.77	U	<	0.82	U	<	0.47	U	<	1.1	U	<	0.81	U	1.3	0.44		<	0.91	U
MNX	NA	<	0.96	U	<	1	U	<	0.58	U	<	1.3	U	<	1	U	<	0.55	U	<	1.1	U
RDX	2 (b)	<	0.77	U	<	0.82	U	<	0.47	U	<	1.1	U	<	0.81	U	(16)	0.44		<	0.91	U
METALS (µg/L)																						
Arsenic	10 (a)	<	10	U	<	10	U	<	10	U	<	10	U	(15)	10		<	10	U	<	10	U
Barium	2000 (a)	81	200	J	129	200	J	120	200	J	57.8	200	J	507	200	J	191	200	J	62.4	200	J
Chromium	100 (a)	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Lead	15 (a)	<	10	UJ	<	10	U	<	10	UJ	<	10	UJ	<	10	U	<	10	U	<	10	U
Selenium	50 (a)	<	10	UJ	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U	8.2	10	J
NA PARAMETER (µg/L)																						
Alkalinity	NE	160000	8000		380000	8000		300000	8000		250000	8000		430000	8000		390000	8000		240000	8000	
Ammonia	NE	<	10	U	<	10	U	30	10		<	10	U	3700	10		<	10	U	<	10	U
Carbon Dioxide	NE	70400	C		167200	C		132000	C		110000	C		189200	C		171600	C		105600	C	
Chloride	NE	7000	1000		2000	1000		4000	1000		2000	1000		1000	1000		6000	1000		1000	1000	
Nitrate + Nitrite as N	NE	<	10	U	70	10		20	10		840	10		<	10	U	<	10	U	<	10	U
Sulfate	NE	25000	10000		11000	1000		12000	1000		28000	10000		<	1000	U	39000	10000		28000	10000	
Sulfide	NE	<	1000	U	10000	1000		<	1000	U	<	1000	U	16000	1000		9000	1000		16000	1000	
Total Kjeldahl Nitrogen	NE	<	300	U	<	300	U	400	300		<	300	U	4900	300		<	300	U	<	300	U
Total Organic Carbon	NE	<	1000	U	<	1000	U	1500	1000		<	1000	U	13000	1000		1000	1000		<	1000	U

Key:

RL = Reporting Limit
Qual = Qualifier
J = Estimated
R = Rejected
F = presence of interference

UJ = Estimated Nondetect
U = Nondetect
( ) = Above PRG
µg/L = microgram per liter
C = Calculated value equivalent to the alkalinity RL X 0.44

(PRG): Preliminary Remediation Goal:
(a) Maximum Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region IX PRGs
(d) 10^{-6} Risk Level
NA = Not Available
NE = Not Evaluated

TABLE 4.1
SUMMARY OF CHEMICALS DETECTED AT LINE 1
SPRING 2002 GROUNDWATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID		JAW-601			JAW-602			JAW-603			L1-MW1			SL-81		
DATE COLLECTED		Jun 12, 2002			Jun 11, 2002			Jun 12, 2002			Jun 12, 2002			Jun 05, 2002		
	PRG	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
EXPLOSIVES (µg/L)																
HMX	400 (b)	<	0.34	U	<	0.99	U	<	0.42	U	<	0.96	U	18	0.73	
MNX	NA	<	0.42	U	<	1.2	U	<	0.52	U	<	1.2	U	4.1	0.91	
RDX	2 (b)	<	0.34	U	<	0.99	U	<	0.42	U	<	0.96	U	(120)	7.3	
METALS (µg/L)																
Arsenic	10 (a)	<	10	U	8.1	10	J	<	10	U	<	10	U	<	10	U
Barium	2000 (a)	485	200		317	200	J	92.5	200	J	122	200	J	287	200	J
Chromium	100 (a)	<	10	U	<	10	U	0.79	10	J	9.4	10	J	<	10	U
Lead	15 (a)	<	10	UJ	<	10	U	<	10	UJ	3.4	10	J	<	10	U
Selenium	50 (a)	<	10	UJ	<	10	U	<	10	UJ	<	10	UJ	<	10	U
NA PARAMETER (µg/L)																
Alkalinity	NE	460000	8000		380000	8000		410000	8000		390000	8000		290000	8000	
Ammonia	NE	1500	10		2300	10		130	10		150	10		40	10	
Carbon Dioxide	NE	202400	C		167200	C		180400	C		171600	C		127600	C	
Chloride	NE	1000	1000		1000	1000		6000	1000		2000	1000		6000	5000	
Nitrate + Nitrite as N	NE	<	10	U	<	10	U	360	10		140	10		650	10	
Sulfate	NE	<	1000	U	2000	1000		48000	10000		36000	10000		30000	10000	
Sulfide	NE	8000	1000		2000	1000		9000	1000		2000	1000		23000	1000	
Total Kjeldahl Nitrogen	NE	2300	300		2500	300		1200	300		500	300		<	300	U
Total Organic Carbon	NE	2500	1000		3300	1000		1700	1000		1200	1000		2500	1000	

Key:

RL = Reporting Limit
Qual = Qualifier
J = Estimated
R = Rejected
F = presence of interference

UJ = Estimated Nondetect
U = Nondetect
( ) = Above PRG
µg/L = microgram per liter
C = Calculated value equivalent to the alkalinity RL X 0.44

(PRG): Preliminary Remediation Goal:
(a) Maximum Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region IX PRGs
(d) 10^{-6} Risk Level
NA = Not Available
NE = Not Evaluated

TABLE 4.2
SUMMARY OF CHEMICALS DETECTED AT LINE 2
SPRING 2002 GROUNDWATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID / DATE COLLECTED		12-A Jun 04, 2002			12-B Jun 04, 2002			12-C Jun 05, 2002			12-D Jun 04, 2002			12-E Jun 05, 2002			12-F Jun 14, 2002			12-G Jun 05, 2002		
	PRG	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
EXPLOSIVES (µg/L)																						
1,3,5-Trinitrobenzene	1100 (c)	<	0.55	U	<	0.91	U	<	0.65	U	<	0.58	U	<	0.53	U	<	0.53	U	<	1.6	U
1,3-Dinitrobenzene	1 (b)	<	0.55	U	<	0.91	U	<	0.65	U	<	0.58	U	<	0.53	U	<	0.53	U	<	1.6	U
2,4-Dinitrotoluene	5 (d)	<	0.55	U	<	0.91	U	<	0.65	U	<	0.58	U	<	0.53	U	<	0.53	U	<	1.6	U
2-Amino-4,6-dinitrotoluene	NA	<	0.55	U	<	0.91	U	<	0.65	U	<	0.58	U	<	0.53	U	<	0.53	U	<	1.6	U
4-Amino-2,6-dinitrotoluene	NA	<	0.55	U	<	0.91	U	<	0.65	U	<	0.58	U	<	0.53	U	<	0.53	U	<	1.6	U
HMX	400 (b)	<	0.55	U	<	0.91	U	<	0.65	U	<	0.58	U	<	0.53	U	<	0.53	U	<	1.6	U
MNX	NA	<	0.68	U	0.6	1.1	J	<	0.81	U	<	0.73	U	<	0.66	U	<	0.66	U	<	1.9	U
RDX	2 (b)	0.62	0.55	J	(3)	0.91	J	<	0.65	U	<	0.58	U	<	0.53	U	<	0.53	U	<	1.6	U
METALS (µg/L)																						
Arsenic	10 (a)	<	10	U	<	10	U	(43.7)	10		<	10	U	<	10	U	(14.1)	10		<	10	U
Barium	2000 (a)	42.2	200	J	107	200	J	416	200	J	213	200	J	83.6	200	J	600	200	J	103	200	J
Chromium	100 (a)	0.88	10	J	<	10	U	0.88	10	J	11.6	10		<	10	U	1.8	10	J	2.5	10	J
Selenium	50 (a)	<	10	U	7.3	10	J	<	10	U	<	10	U	2.9	10	J	<	10	U	<	10	U
NA PARAMETER (µg/L)																						
Alkalinity	NE	240000	8000		200000	8000		480000	8000		450000	8000		280000	8000		560000	8000		320000	8000	
Ammonia	NE	<	10	U	<	10	U	4000	50		2600	20		<	10	U	4500	10		<	10	U
Carbon Dioxide	NE	105600	C		88000	C		211200	C		198000	C		123200	C		246400	C		140800	C	
Chloride	NE	1000	1000		1000	1000		<	1000	U	1000	1000		1000	1000		1000	1000		3000	1000	
Nitrate + Nitrite as N	NE	860	10		720	10		<	10	U	40	10		490	10		<	10	U	360	10	
Sulfate	NE	28000	10000		42000	10000		2000	1000		2000	1000		19000	1000		14000	1000		69000	10000	
Sulfide	NE	23000	1000		22000	1000		24000	1000		23000	1000		26000	1000		<	1000	U	22000	1000	
Total Kjeldahl Nitrogen	NE	<	300	U	300	300		7400	1200	J	3000	300		<	300	U	6700	300		<	300	U
Total Organic Carbon	NE	<	1000	U	<	1000	U	6800	1000		3200	1000		<	1000	U	8200	1000		1000	1000	

Key:
RL = Reporting Limit
Qual = Qualifier
J = Estimated
R = Rejected
P = presence of interference
UJ = Estimated Nondetect
U = Nondetect
( ) = Above PRG
µg/L = microgram per liter
C = Calculated value equivalent as the alkalinity TL X 0.44
(PRG): Preliminary Remediation Goal
(a) Maximum Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region IX PRGs
(d) 10^{-6} Risk Level
NA = Not Available
NE = Not Evaluated

TABLE 4.2
SUMMARY OF CHEMICALS DETECTED AT LINE 2
SPRING 2002 GROUNDWATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID		G-15			JAW-70			JAW-70Dup			JAW-71			JAW-72			JAW-73			JAW-74		
DATE COLLECTED		Jun 17, 2002			Jun 04, 2002			Jun 04, 2002			Jun 04, 2002			Jun 04, 2002			Jun 04, 2002			Jun 05, 2002		
	PRG	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
EXPLOSIVES (µg/L)																						
1,3,5-Trinitrobenzene	1100 (c)	<	1.1	U	<	0.49	U	<	1.2	U	<	1.5	U	0.53	0.53	J	<	1.3	U	<	0.39	U
1,3-Dinitrobenzene	1 (b)	<	1.1	U	<	0.49	U	<	1.2	U	<	1.5	U	0.32	0.53	J	<	1.3	U	<	0.39	U
2,4-Dinitrotoluene	5 (d)	<	1.1	U	<	0.49	U	<	1.2	U	<	1.5	U	3.2	0.53		<	1.3	U	<	0.39	U
2-Amino-4,6-dinitrotoluene	NA	1.8	1.1	J	53	25	J	42	1.2	J	<	1.5	U	58	27	J	<	1.3	U	<	0.39	U
4-Amino-2,6-dinitrotoluene	NA	2.3	1.1		29	0.49	J	22	1.2	J	<	1.5	U	34	0.53	J	<	1.3	U	<	0.39	U
HMX	400 (b)	300	23	J	(440)	25	J	(420)	12	J	12	1.5	J	290	27	J	8.6	1.3		<	0.39	U
MNX	NA	25	1.4		6	0.62	J	5.3	1.5	J	1.3	1.9	J	16	0.66	J	2.2	1.6		<	0.49	U
RDX	2 (b)	(430)	23		(600)	25		(610)	12		(9.8)	1.5		(2300)	27		(33)	1.3		<	0.39	U
METALS (µg/L)																						
Arsenic	10 (a)	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U	4.9	10	J	<	10	U
Barium	2000 (a)	87.2	200	J	81.7	200	J	81.8	200	J	79.8	200	J	69.6	200	J	102	200	J	125	200	J
Chromium	100 (a)	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Selenium	50 (a)	2	10	J	<	10	U	<	10	U	<	10	U	<	10	U	3.7	10	J	6.8	10	J
NA PARAMETER (µg/L)																						
Alkalinity	NE	140000	8000		270000	8000		270000	8000		270000	8000		240000	8000		220000	8000		160000	8000	
Ammonia	NE	60	10		<	10	U	20	10		<	10	U	40	10		<	10	U	<	10	U
Carbon Dioxide	NE	61600	C		118800	C		118800	C		118800	C		105600	C		96800	C		70400	C	
Chloride	NE	29000	10000		2000	1000		2000	1000		2000	1000		3000	1000		49000	10000		54000	10000	
Nitrate + Nitrite as N	NE	150	10		210	10		230	10		30	10		780	10		310	10		560	10	
Sulfate	NE	20000	10000		15000	1000		15000	1000		40000	10000		29000	10000		150000	10000		25000	10000	
Sulfide	NE	<	1000	U	24000	1000		24000	1000		23000	1000		24000	1000		26000	1000		26000	1000	
Total Kjeldahl Nitrogen	NE	<	300	U	<	300	U	<	300	U	<	300	U	500	300		<	300	U	<	300	U
Total Organic Carbon	NE	2600	1000		1300	1000		1400	1000		1200	1000		1400	1000		<	1000	U	<	1000	U

Key:
RL = Reporting Limit
Qual = Qualifier
J = Estimated
R = Rejected
F = presence of interference

UJ = Estimated Nondetect
U = Nondetect
( ) = Above PRG
µg/L = microgram per liter
C = Calculated value equivalent to the alkalinity TL X 0.44

(PRG): Preliminary Remediation Goal;
(a) Maximum Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region IX PRGs
(d) 10^{-6} Risk Level
NA = Not Available
NE = Not Evaluated

TABLE 4.2
SUMMARY OF CHEMICALS DETECTED AT LINE 2
SPRING 2002 GROUNDWATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID DATE COLLECTED	PRG	JAW-75 Jun 04, 2002			L2-MW1 Jun 05, 2002			L2-MW2 Jun 04, 2002			L2-MW3 Jun 05, 2002		
		Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
EXPLOSIVES (µg/L)													
1,3,5-Trinitrobenzene	1100 (c)	<	1.1	U	<	1.2	U	<	0.64	U	<	0.87	U
1,3-Dinitrobenzene	1 (b)	<	1.1	U	<	1.2	U	<	0.64	U	<	0.87	U
2,4-Dinitrotoluene	5 (d)	<	1.1	U	<	1.2	U	<	0.64	U	<	0.87	U
2-Amino-4,6-dinitrotoluene	NA	<	1.1	U	<	1.2	U	<	0.64	U	<	0.87	U
4-Amino-2,6-dinitrotoluene	NA	<	1.1	U	<	1.2	U	<	0.64	U	<	0.87	U
HMX	400 (b)	<	1.1	U	<	1.2	U	<	0.64	U	<	0.87	U
MNX	NA	<	1.3	U	<	1.5	U	<	0.79	U	<	1.1	U
RDX	2 (b)	<	1.1	U	<	1.2	U	<	0.64	U	<	0.87	U
METALS (µg/L)													
Arsenic	10 (a)	<	10	U	<	10	U	<	10	U	<	10	U
Barium	2000 (a)	79.5	200	J	309	200	J	213	200	J	95	200	J
Chromium	100 (a)	<	10	U	<	10	U	<	10	U	<	10	U
Selenium	50 (a)	<	10	U	<	10	U	<	10	U	<	10	U
NA PARAMETER (µg/L)													
Alkalinity	NE	220000	8000		410000	8000		330000	8000		190000	8000	
Ammonia	NE	10	10		4600	50		<	10	U	10	10	
Carbon Dioxide	NE	96800	C		180400	C		145200	C		83600	C	
Chloride	NE	16000	10000		2000	1000		190000	20000		2000	1000	
Nitrate + Nitrite as N	NE	140	10		190	10		60	10		40	10	
Sulfate	NE	52000	10000		92000	10000		23000	10000		28000	10000	
Sulfide	NE	20000	1000		24000	1000		23000	1000		24000	1000	
Total Kjeldahl Nitrogen	NE	<	300	U	5900	300		<	300	U	<	300	U
Total Organic Carbon	NE	<	1000	U	6300	1000		<	1000	U	<	1000	U

Key:

RL = Reporting Limit
Qual = Qualifier
J = Estimated
R = Rejected
F = presence of interference

UJ = Estimated Nondetect
U = Nondetect
( ) = Above PRG
µg/L = microgram per liter
C = Calculated value equivalent to the alkalinity TL X 0.44

(PRG): Preliminary Remediation Goal.
(a) Maximun Consuminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region IX PRGs
(d) 10^{-4} Risk Level
NA = Not Available
NE = Not Evaluated

TABLE 4.3
SUMMARY OF CHEMICALS DETECTED AT LINE 3
SPRING 2002 GROUNDWATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID		16-A			16-B			16-C			16-D			16-E			JAW-53			JAW-54		
DATE COLLECTED		Jun 03, 2002			Jun 03, 2002			Jun 03, 2002			Jun 03, 2002			Jun 03, 2002			Jun 03, 2002			Jun 03, 2002		
	PRG	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
EXPLOSIVES (µg/L)																						
1,3,5-Trinitrobenzene	1100 (c)	<	1.4	U	<	0.94	U	<	0.42	U	<	0.51	U	<	0.43	U	<	0.57	U	7.6	0.56	
2,4-Dinitrotoluene	5 (d)	<	1.4	U	<	0.94	U	<	0.42	U	<	0.51	U	<	0.43	U	<	0.57	U	1.3	0.56	
2-Amino-4,6-dinitrotoluene	NA	<	1.4	U	<	0.94	U	<	0.42	U	<	0.51	U	<	0.43	U	<	0.57	U	67	0.56	J
4-Amino-2,6-dinitrotoluene	NA	<	1.4	U	<	0.94	U	<	0.42	U	<	0.51	U	<	0.43	U	<	0.57	U	22	0.56	J
HMX	400 (b)	<	1.4	U	<	0.94	U	<	0.42	U	<	0.51	U	<	0.43	U	<	0.57	U	120	11	J
MNX	NA	<	1.8	U	<	1.2	U	<	0.52	U	<	0.63	U	<	0.53	U	<	0.71	U	8	0.7	J
RDX	2 (b)	<	1.4	U	<	0.94	U	<	0.42	U	<	0.51	U	<	0.43	U	<	0.57	U	(380)	11	J
METALS (µg/L)																						
Barium	2000 (a)	361	200	J	101	200	J	145	200	J	114	200	J	266	200	J	101	200	J	80.9	200	J
Chromium	100 (a)	2.3	10	J	<	10	U	1.4	10	J	<	10	U	1.7	10	J	<	10	U	<	10	U
Lead	15 (a)	<	10	U	<	10	U	<	10	U	<	10	U	2.8	10	J	<	10	U	<	10	U
Selenium	50 (a)	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U	2.8	10	J
NA PARAMETER (µg/L)																						
Alkalinity	NE	490000	8000		300000	8000		230000	8000		240000	8000		480000	8000		250000	8000		110000	8000	J
Ammonia	NE	1700	10		<	10	U	<	10	U	<	10	U	360	10		10	10		20	10	
Carbon Dioxide	NE	215600	C		132000	C		101200	C		105600	C		211200	C		110000	C		48400	C	J
Chloride	NE	1000	1000		2000	1000		1000	1000		2000	1000		1000	1000		<	1000	U	8000	1000	
Nitrate + Nitrite as N	NE (a)	<	10	U	310	10		150	10		40	10		20	10		<	10	U	460	10	
Sulfate	NE	1000	1000		22000	10000		8000	1000		30000	10000		20000	10000		1000	1000		30000	10000	
Sulfide	NE	22000	1000		24000	1000		24000	1000		23000	1000		23000	1000		24000	1000		25000	1000	
Total Kjeldahl Nitrogen	NE	3200	300		400	300		600	300		700	300		400	300		600	300		500	300	
Total Organic Carbon	NE	4000	1000		<	1000	U	<	1000	U	<	1000	U	<	1000	U	<	1000	U	<	1000	U

Key:
RL = Reporting Limit
Qual = Qualifier
J = Estimated
R = Rejected
F = presence of interference

UJ = Estimated Nondetect
U = Nondetect
( ) = Above PRG
µg/L = microgram per liter
C = Calculated value equivalent to the alkalinity RL X 0.44

(PRG): Preliminary Remediation Goal:
(a) Maximum Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region IX PRGs
(d) 10^{-6} Risk Level
NA = Not Available
NE = Not Evaluated

TABLE 4.3
SUMMARY OF CHEMICALS DETECTED AT LINE 3
SPRING 2002 GROUNDWATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID		JAW-54Dup			JAW-55			JAW-56			JAW-57			JAW-77		
DATE COLLECTED		Jun 03, 2002			Jun 15, 2002			Jun 16, 2002			Jun 03, 2002			Jun 16, 2002		
	PRG	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
EXPLOSIVES (µg/L)																
1,3,5-Trinitrobenzene	1100 (c)	7.7	0.84		<	0.62	U	<	0.51	U	<	1.2	U	<	0.91	U
2,4-Dinitrotoluene	5 (d)	1.2	0.84		<	0.62	U	<	0.51	U	<	1.2	U	<	0.91	U
2-Amino-4,6-dinitrotoluene	NA	66	0.84	J	<	0.62	U	<	0.51	U	<	1.2	U	<	0.91	U
4-Amino-2,6-dinitrotoulene	NA	22	0.84	J	<	0.62	U	<	0.51	U	<	1.2	U	<	0.91	U
HMX	400 (b)	160	0.84	J	3	0.62	J	<	0.51	U	<	1.2	U	<	0.91	U
MNX	NA	8.1	1.1	J	<	0.78	U	<	0.63	U	<	1.5	U	<	1.1	U
RDX	2 (b)	(520)	8.4	J	<	0.62	U	<	0.51	U	<	1.2	U	<	0.91	U
METALS (µg/L)																
Barium	2000 (a)	74.9	200	J	144	200	J	64.6	200	J	56.2	200	J	53.4	200	J
Chromium	100 (a)	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Lead	15 (a)	<	10	U	<	10	U	<	10	UJ	<	10	U	<	10	UJ
Selenium	50 (a)	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
NA PARAMETER (µg/L)																
Alkalinity	NE	170000	8000	J	300000	8000		150000	8000		120000	8000		140000	8000	
Ammonia	NE	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Carbon Dioxide	NE	74800	C	J	132000	C		66000	C		52800	C		61600	C	
Chloride	NE	8000	1000		2000	1000		<	1000	U	4000	1000		7000	1000	
Nitrate + Nitrite as N	NE	470	10		80	10		<	10	U	2300	50		290	10	
Sulfate	NE	29000	10000		24000	10000		63000	10000		36000	10000		29000	10000	
Sulfide	NE	22000	1000		<	1000	U	<	1000	U	23000	1000		<	1000	U
Total Kjeldahl Nitrogen	NE	500	300		<	300	U	<	300	U	400	300		<	300	U
Total Organic Carbon	NE	<	1000	U	1200	1000		<	1000	U	<	1000	U	<	1000	U

Key:
RL = Reporting Limit
Qual = Qualifier
J = Estimated
R = Rejected
F = presence of interference

UJ = Estimated Nondetect
U = Nondetect
( ) = Above PRG
µg/L = microgram per liter
C = Calculated value equivalent to the alkalinity RL X 0.44

(PRG): Preliminary Remediation Goal:
(a) Maximum Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region IX PRGs
(d) 10^{-6} Risk Level
NA = Not Available
NE = Not Evaluated

TABLE 4.4
SUMMARY OF CHEMICALS DETECTED AT LINE 3A
SPRING 2002 GROUNDWATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID		JAW-15			JAW-16			JAW-17			JAW-18			JAW-19			JAW-20			JAW-21		
DATE COLLECTED		Jun 15, 2002			Jun 16, 2002			Jun 05, 2002			Jun 05, 2002			Jun 05, 2002			Jun 15, 2002			Jun 15, 2002		
	PRG	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
EXPLOSIVES (µg/L)																						
HMX	400 (b)	3.7	0.64	J	<	0.87	U	5.3	0.86	J	2	0.94		<	0.94	U	<	0.64	U	1.8	0.52	J
MNX	NA	<	0.79	U	<	1.1	U	1.3	1.1	J	<	1.2	U	<	1.2	U	<	0.79	U	0.37	0.65	J
RDX	2 (b)	(9.6)	0.64		<	0.87	U	(14)	0.86		(5.8)	0.94		<	0.94	U	1.8	0.64		(12)	0.52	
METALS (µg/L)																						
Barium	2000 (a)	119	200	J	372	200	J	98.2	200	J	201	200	J	111	200	J	345	200	J	75.1	200	J
Chromium	100 (a)	<	10	U	4.7	10	J	<	10	U	0.72	10	J	<	10	U	<	10	U	<	10	U
Lead	15 (a)	<	10	UJ	1.6	10	J	<	10	U	<	10	U	<	10	U	<	10	UJ	<	10	UJ
Selenium	50 (a)	5.9	10	J	2.3	10	J	<	10	U	<	10	U	3.2	10	J	2.6	10	J	5.8	10	J
NA PARAMETER (µg/L)																						
Alkalinity	NE	290000	8000		400000	8000		250000	8000		320000	8000		310000	8000		360000	8000		180000	8000	
Ammonia	NE	220	10		<	10	U	20	10		<	10	U	<	10	U	<	10	U	<	50	U
Carbon Dioxide	NE	127600	C		176000	C		110000	C		140800	C		136400	C		158400	C		79200	C	
Chloride	NE	2000	1000		<	1000	U	9000	1000		6000	1000		1000	1000		2000	1000		<	1000	U
Nitrate + Nitrite as N	NE	280	10		<	10	U	170	10		420	10		70	10		2300	50		980	10	
Sulfate	NE	72000	10000		5000	1000		81000	10000		56000	10000		33000	10000		9000	1000		32000	10000	
Sulfide	NE	<	1000	U	<	1000	U	24000	1000		23000	1000		23000	1000		<	1000	U	<	1000	U
Total Kjeldahl Nitrogen	NE	400	300		<	300	U	<	300	U	<	300	U	<	300	U	<	300	U	<	300	U
Total Organic Carbon	NE	2000	1000		<	1000	U	1000	1000		<	1000	U	1000	1000		<	1000	U	<	1000	U

Key:

RL = Reporting Limit
Qual = Qualifier
J = Estimated
R = Rejected
P = presence of interference

UJ = Estimated Nondetect
U = Nondetect
( ) = Above PRG
µg/L = microgram per liter
C = Calculated value equivalent to the alkalinity RL X 0.44

(PRG): Preliminary Remediation Goal:
(a) Maximum Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region IX PRGs
(d) 10^{-6} Risk Level
NA = Not Available
NE = Not Evaluated

TABLE 4.4
SUMMARY OF CHEMICALS DETECTED AT LINE 3A
SPRING 2002 GROUNDWATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID / DATE COLLECTED	PRG	JAW-22 Jun 05, 2002 Result	RL	Qual
EXPLOSIVES (µg/L)				
HMX	400 (b)	<	0.99	U
MNX	NA	<	1.2	U
RDX	2 (b)	(3.7)	0.99	
METALS (µg/L)				
Barium	2000 (a)	154	200	J
Chromium	100 (a)	<	10	U
Lead	15 (a)	<	10	U
Selenium	50 (a)	3.3	10	J
NA PARAMETER (µg/L)				
Alkalinity	NE	360000	8000	
Ammonia	NE	<	10	U
Carbon Dioxide	NE	158400	C	
Chloride	NE	7000	1000	
Nitrate + Nitrite as N	NE	430	10	
Sulfate	NE	88000	10000	
Sulfide	NE	24000	1000	
Total Kjeldahl Nitrogen	NE	<	300	U
Total Organic Carbon	NE	1200	1000	

Key:

RL = Reporting Limit
Qual = Qualifier
J = Estimated
R = Rejected
F = presence of interference
UJ = Estimated Nondetect
U = Nondetect
( ) = Above PRG
µg/L = microgram per liter
C = Calculated value equivalent to the alkalinity RL X 0.44
(PRG): Preliminary Remediation Goal;
(a) Maximum Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region IX PRGs
(d) 10^{-6} Risk Level
NA = Not Available
NE = Not Evaluated

TABLE 4.5
SUMMARY OF CHEMICALS DETECTED AT LINE 4A AND 4B
SPRING 2002 GROUNDWATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID DATE COLLECTED	PRG	JAW-604 Jun 27, 2002 Result	RL	Qual	JAW-605 Jun 05, 2002 Result	RL	Qual
METALS (µg/L) Barium	2000 (a)	80.7	200	J	123	200	J
VOLATILE ORGANC COMPOUNDS (µg/L) Freon113	59000 (c)	18	3		<	3	U

Key:

RL= Reporting Limit
Qual = Qualifier
J = Estimated
R = Rejected
F = presence of interference

UJ = Estimated Nondetect
U = Nondetect
( ) = Above PRG
µg/L = microgram per liter

(PRG): Preliminary Remediation Goal:
(a) Maximum Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region IX PRGs
(d) 10^{-6} Risk Level
NA = Not Available
NE = Not Evaluated

TABLE 4.6
SUMMARY OF CHEMICALS DETECTED AT LINE 5A AND 5B
SPRING 2002 GROUNDWATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID DATE COLLECTED		5A-MW1 Jun 16, 2002			5A-MW2 Jun 16, 2002			5B-MW1 Jun 16, 2002			5B-MW2 Jun 16, 2002		
	PRG	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
EXPLOSIVES (µg/L)													
1,3,5-Trinitrobenzene	1100 (c)	<	0.71	U	0.98	1	J	<	0.27	U	<	0.27	U
2,4,6-Trinitrotoluene	2 (b)	(6.9)	0.71		(6.3)	1		<	0.27	U	<	0.27	U
2-Amino-4,6-dinitrotoluene	NA	8.5	0.71	J	30	1	J	<	0.27	U	<	0.27	U
4-Amino-2,6-dinitrotoluene	NA	19	0.71	J	65	1	J	<	0.27	U	<	0.27	U
HMX	400 (b)	4.3	0.71	J	7.6	1	J	24	0.27	J	0.84	0.27	J
MNX	NA	0.46	0.89	J	3.1	1.2	J	0.89	0.34		<	0.34	U
RDX	2 (b)	(4.2)	0.71	J	(15)	1		(42)	2.7		0.77	0.27	
METALS (µg/L)													
Barium	2000 (a)	244	200	J	113	200	J	137	200	J	90.3	200	J
Selenium	50 (a)	<	10	UJ	<	10	UJ	2.8	10	J	<	10	UJ
NA PARAMETER (µg/L)													
Alkalinity	NE	280000	8000		150000	8000		280000	8000		180000	8000	
Ammonia	NE	30	10		20	10		<	10	U	<	10	U
Carbon Dioxide	NE	123200	C		66000	C		123200	C		79200	C	
Chloride	NE	<	1000	U	2000	1000		2000	1000		4000	1000	
Nitrate + Nitrite as N	NE	70	10		310	10		510	10		150	10	
Sulfate	NE	28000	10000		40000	10000		24000	10000		28000	10000	
Total Organic Carbon	NE	1400	1000		1200	1000		1000	1000		1400	1000	

Key:

RL = Reporting Limit
Qual = Qualifier
J = Estimated
R = Rejected
F = presence of interference
UJ = Estimated Nondetect
U = Nondetect
( ) = Above PRG
µg/L = microgram per liter
C = Calculated value equivalent to the alkilinity RL X 0.44
(PRG): Preliminary Remediation Goal.
(a) Maximun Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region IX PRGs
(d) 10^{-6} Risk Level
NA = Not Available
NE = Not Evaluated

TABLE 4.7
SUMMARY OF CHEMICALS DETECTED AT LINE 9
SPRING 2002 GROUNDWATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID		JAW-29			JAW-30			JAW-31			JAW-610			JAW-611			JAW-612			JAW-612Dup		
DATE COLLECTED		Jun 28, 2002			Jun 27, 2002			Jun 27, 2002			Jun 26, 2002			Jun 26, 2002			Jun 27, 2002			Jun 27, 2002		
	PRG	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
EXPLOSIVES (µg/L)																						
RDX	2 (b)	<	0.56	U	<	0.7	U	<	0.62	U	<	0.87	U	1.1	0.56		<	1	U	<	0.81	U
NA PARAMETER (µg/L)																						
Alkalinity	NE	190000	8000		280000	8000		260000	8000		250000	8000		270000	8000		230000	8000		230000	8000	
Ammonia	NE	<	10	U	<	10	U	<	10	U	<	10	U	20	10		<	10	UJ	50	10	J
Carbon Dioxide	NE	83600	C		123200	C		114400	C		110000	C		118800	C		101200	C		101200	C	
Chloride	NE	5000	1000		4000	1000		11000	10000		7000	1000		12000	10000		13000	10000		13000	10000	
Nitrate + Nitrite as N	NE	110	10		50	10		<	10	U	4000	50		1600	10		1200	10		1100	10	
Sulfate	NE	53000	10000		68000	10000		65000	10000		41000	10000		53000	10000		35000	10000		33000	10000	
Total Organic Carbon	NE	<	1000	U	<	1000	U	10000	1000		1000	1000		1000	1000		<	1000	U	<	1000	U
SEMIVOLATILE ORGANIC COMPOUNDS (µg/L)																						
4-Methylphenol	180 (c)	<	5	U	<	5	U	4	5	J	<	5	U	<	5	U	<	5	U	<	5	U
Benzoic acid	150000 (c)	<	9	U	<	10	U	23	10		<	10	U	<	10	U	<	10	U	<	10	U
Bis(2-ethylhexyl) phthalate	6 (a)	<	5	U	<	5	U	<	5	U	2	5	J	<	5	U	<	5	U	<	5	U
Pentachlorophenol	1 (a)	<	5	U	<	5	U	1	5	J	<	5	U	<	5	U	<	5	U	<	5	U
Phenol	4000 (b)	<	5	U	<	5	U	2	5	J	<	5	U	<	5	U	<	5	U	<	5	U
VOLATILE ORGANIC COMPOUNDS (µg/L)																						
1,1-Dichloroethene	7 (a)	<	1500	U	<	1500	U	<	6000	U	<	30	U	<	600	U	(51)	150	J	<	300	U
Freon113	59000 (c)	(83000)	1500		(64000)	1500		(230000)	6000		1000	30		24000	600		17000	300		15000	600	

Key:

RL = Reporting Limit
Qual = Qualifier
J = Estimated
R = Rejected
F = presence of interference

UJ = Estimated Nondetect
U = Nondetect
( ) = Above PRG
µg/L = microgram per liter
C = Calculated value equivalent to alkalinity RL X 0.44

(PRG): Preliminary Remediation Goal:
(a) Maximum Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region IX PRGs
(d) 10^{-6} Risk Level
NA = Not Available
NE = Not Evaluated

TABLE 4.8
SUMMARY OF CHEMICALS DETECTED AT LINE 800 / PINK WATER LAGOON
SPRING 2002 GROUNDWATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID DATE COLLECTED		800-MW-01 Jun 28, 2002			800-MW-02 Jun 30, 2002			800-MW-03 Jun 15, 2002			800-MW-04 Jun 14, 2002			800-MW-05 Jun 30, 2002			800-MW-05Dup Jun 30, 2002			800-MW-06 Jun 29, 2002		
	PRG	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
EXPLOSIVES (µg/L)																						
1,3,5-Trinitrobenzene	1100 (c)	<	0.58	U	<	0.75	U	<	0.94	U	<	0.6	U	85	42	J	100	58	J	<	0.61	U
1,3-Dinitrobenzene	1 (b)	<	0.58	U	<	0.75	U	<	0.94	U	<	0.6	U	(47)	42	J	<	58	UJ	<	0.61	U
2,4,6-Trinitrotoluene	2 (b)	<	0.58	U	<	0.75	U	<	0.94	U	<	0.6	U	(32000)	420	J	(30000)	580	J	(2.7)	0.61	
2,4-Dinitrotoluene	5 (d)	<	0.58	U	<	0.75	U	<	0.94	U	<	0.6	U	(180)	42	J	(190)	58	J	<	0.61	U
2,6-Dinitrotoluene	5 (d)	<	0.58	U	<	0.75	U	<	0.94	U	<	0.6	U	<	42	UJ	<	58	UJ	4.9	0.61	
2-Amino-4,6-dinitrotoluene	NA	<	0.58	U	<	0.75	U	<	0.94	U	<	0.6	U	7100	420	J	5600	58	J	<	0.61	U
4-Amino-2,6-dinitrotoluene	NA	<	0.58	U	<	0.75	U	<	0.94	U	<	0.6	U	2100	42	J	2300	58	J	5.7	0.61	J
4-Nitrotoluene	NA	<	0.58	U	<	0.75	U	<	0.94	U	<	0.6	U	72	42	J	88	58	J	<	0.61	U
HMX	400 (b)	<	0.58	U	<	0.75	U	<	0.94	U	<	0.6	U	360	42	J	(410)	58	J	140	61	J
MNX	NA	0.49	0.58	J	<	0.75	U	<	1.2	U	<	0.75	U	<	42	UJ	<	58	UJ	12	0.61	
RDX	2 (b)	(16)	0.58		<	0.75	U	<	0.94	U	<	0.6	U	(2700)	42	J	(2900)	58	J	(1100)	61	J
NA PARAMETERS (µg/L)																						
Alkalinity	NE	280000	8000		440000	8000		480000	8000		450000	8000		1200000	8000					270000	8000	
Ammonia	NE	10	10		220	10		120	10	J	70	10		150000	1000					70	10	
Carbon Dioxide	NE	123200	C		193600	C		211200	C		198000	C		528000	C					118800	C	
Chloride	NE	9000	1000		1000	1000		1000	1000		10000	10000		10000	5000					4000	1000	
Nitrate + Nitrite as N	NE	21000	200		150	10		30	10		20	10		62000	1000					590	10	
Ortho-Phosphate	NE	<	1000	U	<	1000	UJ	<	1000	U	<	1000	U	<	1000	UJ				<	1000	UJ
Sulfate	NE	27000	10000		26000	10000		11000	1000		56000	10000		46000	10000					41000	10000	
Sulfide	NE	<	1000	U	<	1000	U	<	1000	U	1000	1000		<	1000	U				<	1000	U
Total Kjeldahl Nitrogen	NE	<	300	U	400	300		300	300		1900	300		120000	3000					<	300	U
Total Organic Carbon	NE	1200	1000		1500	1000		1400	1000		1000	1000		43000	8000					3700	1000	
PERCHLORATE (µg/L)																						
Perchlorate	18 (c)													<	20	U						
VOLATILE ORGANIC COMPOUNDS (µg/L)																						
Freon113	59000 (c)				<	3	U													2	3	J

Key:
RL = Reporting Limit
Qual = Qualifier
J = Estimated
R = Rejected
E = Value exceeds linear range
F = presence of interference
UJ = Estimated Nondetect
U = Nondetect
( ) = Above PRG
µg/L = microgram per liter
C = Calculated value equivalent to alkalinity RL X 0.44
(PRG): Preliminary Remediation Goal:
(a) Maximun Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region IX PRGs
(d) 10^{-4} Risk Level
NA = Not Available
NE = Not Evaluated

121

TABLE 4.8
SUMMARY OF CHEMICALS DETECTED AT LINE 800 / PINK WATER LAGOON
SPRING 2002 GROUNDWATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID DATE COLLECTED		800-MW-07 Jun 30, 2002			800-MW-08 Jun 27, 2002			800-MW-09 Jun 14, 2002			800-MW-10 Jun 18, 2002			800-MW-11 Jun 18, 2002			800-MW-12 Jun 27, 2002			800-MW-13 Jun 27, 2002		
	PRG	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
EXPLOSIVES (µg/L)																						
1,3,5-Trinitrobenzene	1100 (c)	<	0.47	U	<	0.25	U	<	0.4	U	<	1.6	U	<	0.42	U	<	0.75	U	<	0.7	U
1,3-Dinitrobenzene	1 (b)	<	0.47	U	<	0.25	U	<	0.4	U	<	1.6	U	<	0.42	U	<	0.75	U	<	0.7	U
2,4,6-Trinitrotoluene	2 (b)	<	0.47	U	<	0.25	U	<	0.4	U	<	1.6	U	<	0.42	U	<	0.75	U	<	0.7	U
2,4-Dinitrotoluene	5 (d)	<	0.47	U	<	0.25	U	<	0.4	U	<	1.6	U	<	0.42	U	<	0.75	U	<	0.7	U
2,6-Dinitrotoluene	5 (d)	<	0.47	U	<	0.25	U	<	0.4	U	<	1.6	U	<	0.42	U	<	0.75	U	<	0.7	U
2-Amino-4,6-dinitrotoluene	NA	<	0.47	U	<	0.25	U	<	0.4	U	<	1.6	U	<	0.42	U	<	0.75	U	<	0.7	U
4-Amino-2,6-dinitrotoluene	NA	<	0.47	U	<	0.25	U	<	0.4	U	<	1.6	U	<	0.42	U	<	0.75	U	<	0.7	U
4-Nitrotoluene	NA	<	0.47	U	<	0.25	U	<	0.4	U	<	1.6	U	<	0.42	U	<	0.75	U	<	0.7	U
HMX	400 (b)	<	0.47	U	1	0.25	J	<	0.4	U	<	1.6	U	<	0.42	U	<	0.75	U	<	0.7	U
MNX	NA	<	0.47	U	<	0.25	U	<	0.5	U	<	2	U	<	0.52	U	<	0.75	U	<	0.7	U
RDX	2 (b)	<	0.47	U	1.4	0.25		<	0.4	U	<	1.6	U	<	0.42	U	<	0.75	U	<	0.7	U
NA PARAMETERS (µg/L)																						
Alkalinity	NE	190000	8000		200000	8000		190000	8000		240000	8000		440000	8000		240000	8000		260000	8000	
Ammonia	NE	600	10		<	10	U	<	10	U	<	10	UJ	320	10		<	10	U	<	10	U
Carbon Dioxide	NE	83600	C		88000	C		83600	C		105600	C		193600	C		105600	C		114400	C	
Chloride	NE	3000	1000		7000	1000		15000	10000		19000	10000		<	1000	U	2000	1000		1000	1000	
Nitrate + Nitrite as N	NE	20	10		300	10		<	10	U	2300	50		<	10	U	4600	50		2300	20	
Ortho-Phosphate	NE	<	1000	UJ	<	1000	U	<	1000	U	<	1000	U	<	1000	U	<	1000	U	<	1000	U
Sulfate	NE	60000	10000		22000	10000		35000	10000		31000	10000		3000	1000		26000	10000		36000	10000	
Sulfide	NE	<	1000	U	<	1000	U	<	1000	U	8000	1000		10000	1000		<	1000	U	<	1000	U
Total Kjeldahl Nitrogen	NE	1000	300		<	300	U	<	300	U	<	300	U	500	300		<	300	U	<	300	U
Total Organic Carbon	NE	1600	1000		<	1000	U	1200	1000		2800	1000		1200	1000		<	1000	U	<	1000	U
PERCHLORATE (µg/L)																						
Perchlorate	18 (c)																					
VOLATILE ORGANIC COMPOUNDS (µg/L)																						
Freon113	59000 (c)	<	3	U																		

Key:
RL = Reporting Limit
Qual = Qualifier
J = Estimated
R = Rejected
F = presence of interference

UJ = Estimated Nondetect
U = Nondetect
( ) = Above PRG
µg/L = microgram per liter
C = Calculated value equivalent to alkalinity RL X 0.44

(PRG): Preliminary Remediation Goal;
(a) Maximun Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region IX PRGs
(d) 10^{-4} Risk Level
NA = Not Available
NE = Not Evaluated

TABLE 4.8
SUMMARY OF CHEMICALS DETECTED AT LINE 800 / PINK WATER LAGOON
SPRING 2002 GROUNDWATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID / DATE COLLECTED	PRG	800-MW-14 Jun 14, 2002			800-MW-15 Jun 30, 2002			800-MW-16 Jun 30, 2002			800-MW-17 Jun 29, 2002			800-MW-18 Jun 28, 2002			800-MW-19 Jun 18, 2002		
		Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
EXPLOSIVES (µg/L)																			
1,3,5-Trinitrobenzene	1100 (c)	<	0.43	U	<	0.68	U	<	0.64	U	<	0.73	U	<	0.23	U	<	0.86	U
1,3-Dinitrobenzene	1 (b)	<	0.43	U	<	0.68	U	<	0.64	U	<	0.73	U	<	0.23	U	<	0.86	U
2,4,6-Trinitrotoluene	2 (b)	<	0.43	U	<	0.68	U	<	0.64	U	1.8	0.73	J	<	0.23	U	<	0.86	U
2,4-Dinitrotoluene	5 (d)	<	0.43	U	<	0.68	U	<	0.64	U	<	0.73	U	<	0.23	U	<	0.86	U
2,6-Dinitrotoluene	5 (d)	<	0.43	U	<	0.68	U	<	0.64	U	<	0.73	U	<	0.23	U	<	0.86	U
2-Amino-4,6-dinitrotoluene	NA	<	0.43	U	<	0.68	U	<	0.64	U	<	0.73	U	<	0.23	U	<	0.86	U
4-Amino-2,6-dinitrotoluene	NA	<	0.43	U	<	0.68	U	<	0.64	U	<	0.73	U	<	0.23	U	<	0.86	U
4-Nitrotoluene	NA	<	0.43	U	<	0.68	U	<	0.64	U	<	0.73	U	<	0.23	U	<	0.86	U
HMX	400 (b)	<	0.43	U	<	0.68	U	<	0.64	U	<	0.73	U	<	0.23	U	<	0.86	U
MNX	NA	0.56	0.53	J	<	0.68	U	<	0.64	U	<	0.73	U	<	0.23	U	<	1.1	U
RDX	2 (b)	(5.9)	0.43		<	0.68	U	<	0.64	U	<	0.73	U	0.38	0.23		<	0.86	U
NA PARAMETERS (µg/L)																			
Alkalinity	NE	400000	8000		190000	8000		400000	8000		370000	8000		280000	8000		440000	8000	
Ammonia	NE	10	10		<	10	U	20	10	UJ	560	10		<	10	U	320	10	
Carbon Dioxide	NE	176000	C		83600	C		176000	C		162800	C		123200	C		193600	C	
Chloride	NE	1000	1000		5000	1000		6000	1000		4000	1000		6000	1000		<	1000	U
Nitrate + Nitrite as N	NE	13000	100		4500	50		40	10		20	10		890	10		<	10	U
Ortho-Phosphate	NE	<	1000	U	<	1000	U	<	1000	U	<	1000	UJ	<	1000	UJ	<	1000	U
Sulfate	NE	11000	1000		29000	10000		40000	10000		12000	1000		36000	10000		<	1000	U
Sulfide	NE	<	1000	U	<	1000	U	<	1000	U	<	1000	U	<	1000	U	3000	1000	
Total Kjeldahl Nitrogen	NE	<	300	U	<	300	U	400	300		1000	300		<	300	U	500	300	
Total Organic Carbon	NE	<	1000	U	1300	1000		1800	1000		1500	1000		1500	1000		1200	1000	
PERCHLORATE (µg/L)																			
Perchlorate	18 (c)													(28)	4				
VOLATILE ORGANIC COMPOUNDS (µg/L)																			
Freon113	59000 (c)																		

Key:
RL= Reporting Limit
Qual= Qualifier
J=Estimated
R=Rejected
F=presence of interference

UJ=Estimated Nondetect
U=Nondetect
( ) =Above PRG
µg/L= microgram per liter

C=Calculated value equivalent to alkalinity RL X 0.44

(PRG): Preliminary Remediation Goal;
(a) Maximun Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region IX PRGs
(d) 10^{-4} Risk Level
NA= Not Available
NE= Not Evaluated

TABLE 4.8
SUMMARY OF CHEMICALS DETECTED AT LINE 800 / PINK WATER LAGOON
SPRING 2002 GROUNDWATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID / DATE COLLECTED	PRG	800-MW-20 Jun 30, 2002			800-MW-21 Jun 28, 2002			800-MW-22 Jun 14, 2002			800-MW-23 Jun 26, 2002			800-MW-24 Jun 28, 2002			800-MW-25 Jun 28, 2002			800-MW-26 Jun 14, 2002		
		Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
EXPLOSIVES (µg/L)																							
1,3,5-Trinitrobenzene	1100 (c)	<	1	U	<	1.4	U	<	0.34	U	<	1	U	<	0.99	U	<	0.87	U	<	0.27	U
1,3-Dinitrobenzene	1 (b)	<	1	U	<	1.4	U	<	0.34	U	<	1	U	<	0.99	U	<	0.87	U	<	0.27	U
2,4,6-Trinitrotoluene	2 (b)	<	1	U	<	1.4	U	<	0.34	U	<	1	U	<	0.99	U	<	0.87	U	<	0.27	U
2,4-Dinitrotoluene	5 (d)	<	1	U	<	1.4	U	<	0.34	U	<	1	U	<	0.99	U	<	0.87	U	<	0.27	U
2,6-Dinitrotoluene	5 (d)	<	1	U	<	1.4	U	<	0.34	U	<	1	U	<	0.99	U	<	0.87	U	0.61	0.27	J
2-Amino-4,6-dinitrotoluene	NA	<	1	U	<	1.4	U	<	0.34	U	<	1	U	<	0.99	U	<	0.87	U	0.63	0.27	J
4-Amino-2,6-dinitrotoluene	NA	<	1	U	<	1.4	U	<	0.34	U	<	1	U	<	0.99	U	<	0.87	U	1.9	0.27	J
4-Nitrotoluene	NA	<	1	U	<	1.4	U	<	0.34	U	<	1	U	<	0.99	U	<	0.87	U	<	0.27	U
HMX	400 (b)	<	1	U	<	1.4	U	<	0.34	U	<	1	U	<	0.99	U	26	0.87		17	0.27	J
MNX	NA	<	1	U	<	1.4	U	<	0.42	U	<	1	U	<	0.99	U	50	0.87		2.4	0.34	
RDX	2 (b)	<	1	U	<	1.4	U	<	0.34	U	<	1	U	<	0.99	U	(1600)	87	J	(260)	14	
NA PARAMETERS (µg/L)																							
Alkalinity	NE	190000	8000		460000	8000		450000	8000		430000	8000		430000	8000		350000	8000		270000	8000	
Ammonia	NE	30	10		240	10		140	10		110	10		480	10		<	10	U	30	10	
Carbon Dioxide	NE	83600	C		202400	C		198000	C		189200	C		189200	C		154000	C		118800	C	
Chloride	NE	2000	1000		2000	1000		1000	1000		11000	10000		2000	1000		5000	1000		2000	1000	
Nitrate + Nitrite as N	NE	1400	10		80	10		<	10	U	30	10		<	10	U	250	10		2300	50	
Ortho-Phosphate	NE	<	1000	U	<	1000	U	<	1000	U	<	1000	U	<	1000	U	<	1000	U	<	1000	U
Sulfate	NE	35000	10000		30000	10000		32000	10000		42000	10000		2000	1000		43000	10000		34000	10000	
Sulfide	NE	<	1000	U	<	1000	U	<	1000	U	<	1000	U	<	1000	U	<	1000	U	<	1000	U
Total Kjeldahl Nitrogen	NE	<	300	U	400	300		400	300		<	300	U	800	300		400	300		300	300	
Total Organic Carbon	NE	1600	1000		1400	1000		<	1000	U	<	1000	U	1900	1000		2000	1000		1500	1000	
PERCHLORATE (µg/L)																							
Perchlorate	18 (c)																						
VOLATILE ORGANIC COMPOUNDS (µg/L)																							
Freon113	59000 (c)																						

Key:
RL= Reporting Limit
Qual= Qualifier
J=Estimated
R=Rejected
F=presence of interference

UJ=Estimated Nondetect
U=Nondetect
( ) = Above PRG
µg/L= microgram per liter
C=Calculated value equivalent to alkalinity RL X 0.44

(PRG): Preliminary Remediation Goal;
(a) Maximun Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region IX PRGs
(d) 10^{-4} Risk Level
NA= Not Available
NE= Not Evaluated

TABLE 4.8
SUMMARY OF CHEMICALS DETECTED AT LINE 800 / PINK WATER LAGOON
SPRING 2002 GROUNDWATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID / DATE COLLECTED	PRG	G-17 Jun 13, 2002			G-18 Jun 30, 2002			G-18Dup Jun 30, 2002			G-19 Jun 30, 2002			G-20 Jun 13, 2002			G-20Dup Jun 13, 2002			G-40 Jun 27, 2002		
		Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
EXPLOSIVES (µg/L)																						
1,3,5-Trinitrobenzene	1100 (c)	<	0.69	U	170	20	J	200	29	J	5	0.71		(1600)	29		(1600)	22		<	0.47	U
1,3-Dinitrobenzene	1 (b)	<	0.69	U	(16)	20	J	(24)	29	J	(5)	0.71		(29)	29	J	(28)	22		<	0.47	U
2,4,6-Trinitrotoluene	2 (b)	<	0.69	U	(1300)	20	J	(1400)	29	J	(250)	36		(50)	29	J	(47)	22		<	0.47	U
2,4-Dinitrotoluene	5 (d)	<	0.69	U	(30)	20	J	(42)	29	J	(12)	0.71		(97)	29	J	(91)	22	J	<	0.47	U
2,6-Dinitrotoluene	5 (d)	<	0.69	U	<	20	UJ	<	29	UJ	<	0.71	U	(170)	29		(150)	22		<	0.47	U
2-Amino-4,6-dinitrotoluene	NA	<	0.69	U	58	20	J	59	29	J	79	0.71		41	29	J	38	22	J	<	0.47	U
4-Amino-2,6-dinitrotoluene	NA	<	0.69	U	69	20	J	68	29	J	54	0.71	J	21	29	J	20	22	J	<	0.47	U
4-Nitrotoluene	NA	<	0.69	U	<	20	UJ	<	29	UJ	<	0.71	U	<	29	U	<	22	U	<	0.47	U
HMX	400 (b)	<	0.69	U	(940)	20	J	(1000)	29	J	(480)	36		(1800)	29	J	(1600)	22	J	<	0.47	U
MNX	NA	1.1	0.86		<	20	UJ	<	29	UJ	<	0.71	U	<	36	U	<	28	U	<	0.47	U
RDX	2 (b)	(16)	0.69		(5400)	78	J	(4700)	88	J	(1400)	36		(14000)	290		(14000)	220		<	0.47	U
NA PARAMETERS (µg/L)																						
Alkalinity	NE	170000	8000		92000	8000		92000	8000		350000	8000		260000	8000		260000	8000		470000	8000	
Ammonia	NE	<	10	U	50	10		30	10		<	10	U	300	10		380	10		50	10	
Carbon Dioxide	NE	74800	C		40480	C		40480	C		154000	C		114400	C		114400	C		206800	C	
Chloride	NE	2000	1000		3000	1000		3000	1000		3000	1000		11000	10000		12000	10000		2000	1000	
Nitrate + Nitrite as N	NE	<	10	U	11000	100		11000	100		2100	20		96000	1000		89000	1000		320	10	
Ortho-Phosphate	NE	<	1000	U	<	1000	UJ	<	1000	UJ	<	1000	U	<	1000	U	<	1000	U	<	1000	U
Sulfate	NE	26000	10000		48000	10000		48000	10000		9000	1000		61000	10000		61000	10000		30000	10000	
Sulfide	NE	3000	1000		<	1000	U	<	1000	U	<	1000	U	<	1000	U	<	1000	U	<	1000	U
Total Kjeldahl Nitrogen	NE	<	300	U	<	300	U	900	300		700	300		<	300	U	<	300	U	500	300	
Total Organic Carbon	NE	2100	1000		6900	1000		7000	1000		3700	1000		7200	1000		6800	1000		<	1000	U
PERCHLORATE (µg/L)																						
Perchlorate	18 (c)	<	4	UJ	<	4	U				<	4	U	<	4	UJ						
VOLATILE ORGANIC COMPOUNDS (µg/L)																						
Freon113	59000 (c)													3900	150		3700	150				

Key:

RL= Reporting Limit
Qual= Qualifier
J=Estimated
R=Rejected
F=presence of interference

UJ=Estimated Nondetect
U=Nondetect
( ) = Above PRG
µg/L= microgram per liter
C=Calculated value equivalent to alkalinity RL X 0.44

(PRG): Preliminary Remediation Goal;
(a) Maximun Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region IX PRGs
(d) 10^{-6} Risk Level
NA= Not Available
NE= Not Evaluated

TABLE 4.8
SUMMARY OF CHEMICALS DETECTED AT LINE 800 / PINK WATER LAGOON
SPRING 2002 GROUNDWATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID		G-41			G-42			G-43			G-44			G-45			G-46			G-47		
DATE COLLECTED		Jun 26, 2002			Jun 13, 2002			Jun 26, 2002			Jun 30, 2002			Jun 30, 2002			Jun 30, 2002			Jun 29, 2002		
	PRG	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
EXPLOSIVES (µg/L)																						
1,3,5-Trinitrobenzene	1100 (c)	<	1.1	U	<	0.79	U	<	0.79	U	<	0.55	U	<	0.78	U	<	0.66	U	<	0.88	U
1,3-Dinitrobenzene	1 (b)	<	1.1	U	<	0.79	U	<	0.79	U	<	0.55	U	<	0.78	U	<	0.66	U	<	0.88	U
2,4,6-Trinitrotoluene	2 (b)	<	1.1	U	<	0.79	U	<	0.79	U	<	0.55	U	<	0.78	U	<	0.66	U	<	0.88	U
2,4-Dinitrotoluene	5 (d)	<	1.1	U	<	0.79	U	<	0.79	U	<	0.55	U	<	0.78	U	<	0.66	U	<	0.88	U
2,6-Dinitrotoluene	5 (d)	<	1.1	U	<	0.79	U	<	0.79	U	<	0.55	U	<	0.78	U	<	0.66	U	<	0.88	U
2-Amino-4,6-dinitrotoluene	NA	<	1.1	U	<	0.79	U	<	0.79	U	<	0.55	U	<	0.78	U	<	0.66	U	<	0.88	U
4-Amino-2,6-dinitrotoluene	NA	<	1.1	U	<	0.79	U	<	0.79	U	<	0.55	U	<	0.78	U	<	0.66	U	<	0.88	U
4-Nitrotoluene	NA	<	1.1	U	<	0.79	U	<	0.79	U	<	0.55	U	<	0.78	U	<	0.66	U	<	0.88	U
HMX	400 (b)	<	1.1	U	<	0.79	U	<	0.79	U	<	0.55	U	<	0.78	U	<	0.66	U	<	0.88	U
MNX	NA	<	1.1	U	<	0.99	U	<	0.79	U	<	0.55	U	<	0.78	U	<	0.66	U	<	0.88	U
RDX	2 (b)	<	1.1	U	<	0.79	U	<	0.79	U	<	0.55	U	<	0.78	U	<	0.66	U	<	0.88	U
NA PARAMETERS (µg/L)																						
Alkalinity	NE	240000	8000		430000	8000		300000	8000		300000	8000		260000	8000		490000	8000		220000	8000	
Ammonia	NE	220	10		270	10		190	10		430	10		110	10		60	10		<	10	U
Carbon Dioxide	NE	105600	C		189200	C		132000	C		132000	C		114400	C		215600	C		96800	C	
Chloride	NE	15000	10000		<	1000	U	3000	1000		2000	1000		17000	10000		1000	1000		48000	10000	
Nitrate + Nitrite as N	NE	<	10	U	<	10	U	120	10		450	10		<	10	U	150	10		3300	50	
Ortho-Phosphate	NE	<	1000	U	<	1000	U	<	1000	U	<	1000	UJ	<	1000	U	<	1000	U	<	1000	UJ
Sulfate	NE	39000	10000		9000	1000		7000	1000		11000	1000		28000	10000		60000	10000		30000	10000	
Sulfide	NE	<	1000	U	<	1000		<	1000	U	<	1000	U	<	1000	U	<	1000	U	<	1000	U
Total Kjeldahl Nitrogen	NE	1000	300		<	300	U	<	300	U	600	300		<	300	U	1000	300		<	300	U
Total Organic Carbon	NE	3200	1000		1700	1000		<	1000	U	1700	1000		2200	1000		1700	1000		<	1000	U
PERCHLORATE (µg/L)																						
Perchlorate	18 (c)																					
VOLATILE ORGANIC COMPOUNDS (µg/L)																						
Freon113	59000 (c)													6	3							

Key:
RL= Reporting Limit
Qual= Qualifier
J=Estimated
R=Rejected
F=presence of interference

UJ=Estimated Nondetect
U=Nondetect
( ) =Above PRG
µg/L= microgram per liter
C=Calculated value equivalent to alkalinity RL X 0.44

(PRG): Preliminary Remediation Goal:
(a) Maximun Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region IX PRGs
(d) 10^{-6} Risk Level
NA= Not Available
NE= Not Evaluated

TABLE 4.8
SUMMARY OF CHEMICALS DETECTED AT LINE 800 / PINK WATER LAGOON
SPRING 2002 GROUNDWATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID / DATE COLLECTED	PRG	G-48 Jun 25, 2002			G-56 Jun 14, 2002			G-57 Jun 29, 2002			G-58 Jun 28, 2002			JAW-78 Jun 28, 2002			JAW-79 Jun 27, 2002		
		Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
EXPLOSIVES (µg/L)																			
1,3,5-Trinitrobenzene	1100 (c)	<	0.39	U	<	0.48	U	<	0.64	U	<	0.53	U	<	1.2	U	<	0.7	U
1,3-Dinitrobenzene	1 (b)	<	0.39	U	<	0.48	U	<	0.64	U	(1.5)	0.53		<	1.2	U	<	0.7	U
2,4,6-Trinitrotoluene	2 (b)	<	0.39	U	<	0.48	U	<	0.64	U	<	0.53	U	<	1.2	U	<	0.7	U
2,4-Dinitrotoluene	5 (d)	<	0.39	U	<	0.48	U	<	0.64	U	<	0.53	U	<	1.2	U	<	0.7	U
2,6-Dinitrotoluene	5 (d)	<	0.39	U	<	0.48	U	0.47	0.64	J	(9.4)	0.53		<	1.2	U	<	0.7	U
2-Amino-4,6-dinitrotoluene	NA	<	0.39	U	<	0.48	U	<	0.64	U	<	0.53	U	<	1.2	U	<	0.7	U
4-Amino-2,6-dinitrotoluene	NA	<	0.39	U	<	0.48	U	0.75	0.64		<	0.53	U	<	1.2	U	<	0.7	U
4-Nitrotoluene	NA	<	0.39	U	<	0.48	U	<	0.64	U	<	0.53	U	<	1.2	U	<	0.7	U
HMX	400 (b)	<	0.39	U	4.6	0.48	J	21	0.64		250	13		<	1.2	U	<	0.7	U
MNX	NA	<	0.39	U	1.3	0.6	J	6.6	0.64		12	0.53		<	1.2	U	<	0.7	U
RDX	2 (b)	<	0.39	U	(77)	4.8		(710)	32		(2000)	130		<	1.2	U	<	0.7	U
NA PARAMETERS (µg/L)																			
Alkalinity	NE	380000	8000		330000	8000		210000	8000		300000	8000		460000	8000		380000	8000	
Ammonia	NE	<	10	U	160	10		<	10	U	230	10		200	10		350	10	
Carbon Dioxide	NE	167200	C		145200	C		92400	C		132000	C		202400	C		167200	C	
Chloride	NE	<	1000	U	2000	1000		23000	10000		9000	1000		<	1000	U	<	1000	U
Nitrate + Nitrite as N	NE	80	10		550	10		43000	10		23000	200		<	10	U	<	10	U
Ortho-Phosphate	NE	<	1000	U	<	1000	U	<	1000	UJ	<	1000	U	<	1000	U	<	1000	U
Sulfate	NE	22000	10000		30000	10000		32000	10000		40000	10000		11000	1000		6000	1000	
Sulfide	NE	<	1000	U	<	1000	U	<	1000	U	<	1000	U	<	1000	U	<	1000	U
Total Kjeldahl Nitrogen	NE	<	300	U	400	300		<	300	U	<	300	U	400	300		600	300	
Total Organic Carbon	NE	<	1000	U	1400	1000		2700	1000		3500	1000		1500	1000		1300	1000	
PERCHLORATE (µg/L)	NE																		
Perchlorate	18 (c)										<	4	U						
VOLATILE ORGANIC COMPOUNDS (µg/L)																			
Freon113	59000 (c)																<	3	U

Key:
RL = Reporting Limit
Qual = Qualifier
J = Estimated
R = Rejected
F = presence of interference
UJ = Estimated Nondetect
U = Nondetect
( ) = Above PRG
µg/L = microgram per liter
C = Calculated value equivalent to alkalinity RL X 0.44
(PRG): Preliminary Remediation Goal;
(a) Maximun Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region IX PRGs
(d) 10^{-4} Risk Level
NA = Not Available
NE = Not Evaluated

TABLE 4.9
SUMMARY OF CHEMICALS DETECTED AT EAST BURN PADS
SPRING 2002 GROUNDWATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID / DATE COLLECTED		EBP-MW1 Jun 27, 2002			EBP-MW2 Jun 10, 2002			EBP-MW3 Jun 10, 2002			EDA-01 Jun 10, 2002			EDA-02 Jun 26, 2002			EDA-03 Jun 25, 2002			EDA-03Dup Jun 25, 2002		
	PRG	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
EXPLOSIVES (µg/L)																							
HMX	400 (b)	<	1.4	U	<	0.39	U	16	1.1	J	<	0.42	U	14	0.36	J	7.2	0.48	J	8	0.65	J
MNX	NA	<	1.4	U	<	0.49	U	<	1.4	U	<	0.52	U	2.7	0.36		<	0.48	U	<	0.65	U
RDX	2 (b)	<	1.4	U	<	0.39	U	(29)	1.1		<	0.42	U	(70)	3.6		(6.7)	0.48		(7.3)	0.65	
METALS (µg/L)																							
Arsenic	10 (a)	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Barium	2000 (a)	122	200	J	310	200	J	43.8	200	J	59.8	200	J	113	200	J	102	200	J	96.3	200	J
Chromium	100 (a)	<	10	U	5	10	J	1.8	10	J	<	10	U	<	10	U	0.91	10	J	0.52	10	J
Selenium	50 (a)	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U	2.5	10	J	<	10	U
NA PARAMETERS (µg/L)																							
Alkalinity	NE				410000	8000		200000	8000		340000	8000		410000	8000		290000	8000		290000	8000	
Ammonia	NE				3800	10		10	10		<	10	U	<	10	U	<	10	U	<	10	U
Carbon Dioxide	NE				180400	C		88000	C		149600	C		180400	C		127600	C		127600	C	
Chloride	NE				9000	1000		1000	1000		<	1000	U	4000	1000		4000	1000		4000	1000	
Nitrate + Nitrite as N	NE				<	10	U	1100	10		320	10		1500	10		980	10		990	10	
Sulfate	NE				4000	1000		20000	10000		53000	10000		40000	10000		38000	10000		39000	10000	
Sulfide	NE				28000	1000		38000	1000		29000	1000		<	1000	U	<	1000	U	<	1000	U
Total Kjeldahl Nitrogen	NE				3600	300		<	300	U	<	300	U	<	300	U	<	300	U	<	300	U
Total Organic Carbon	NE	<	1000	U	3000	1000		<	1000	U	<	1000	U	1000	1000		<	1000	U	<	1000	U
VOLATILE ORGANIC COMPOUNDS (µg/L)																							
Trichloroethylene	5 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Freon113	59000 (c)	<	3	U	<	3	U	<	3	U	<	3	U	9	3		<	3	U	<	3	U

Key:
RL = Reporting Limit
Qual = Qualifier
J = Estimated
R = Rejected
F = presence of interference

UJ = Estimated Nondetect
U = Nondetect
( ) = Above PRG
µg/L = microgram per liter

(PRG): Preliminary Remediation Goal;
(a) Maximun Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region IX PRGs
(d) 10^{-4} Risk Level
NA = Not Available
NE = Not Evaluated

C = Calculated value equivalent to alkalinity RL X 0.44

TABLE 4.9
SUMMARY OF CHEMICALS DETECTED AT EAST BURN PADS
SPRING 2002 GROUND WATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID DATE COLLECTED	PRG	EDA-04 Jun 25, 2002			EDA-04Dup Jun 25, 2002			G-29 Jun 10, 2002			JAW-04 Jun 28, 2002			JAW-05 Jun 10, 2002		
		Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
EXPLOSIVES (µg/L)																
HMX	400 (b)	140	0.74	J	120	0.44	J	<	0.83	U	<	0.99	U	<	0.35	U
MNX	NA	0.95	0.74	J	0.84	0.44		<	1	U	<	0.99	U	<	0.44	U
RDX	2 (b)	(5.8)	0.74		(5.2)	0.44		<	0.83	U	<	0.99	U	<	0.35	U
METALS (µg/L)																
Arsenic	10 (a)	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Barium	2000 (a)	64.8	200	J	61.7	200	J	58.1	200	J	105	200	J	79.5	200	J
Chromium	100 (a)	0.61	10	J	<	10	U	1.6	10	J	<	10	U	<	10	U
Selenium	50 (a)	<	10	U	2	10	J	<	10	U	4.2	10	J	<	10	U
NA PARAMETERS (µg/L)																
Alkalinity	NE	430000	8000		440000	8000		84000	8000					240000	8000	
Ammonia	NE	<	10	U	<	10	U	30	10					<	10	U
Carbon Dioxide	NE	189200	C		193600	C		36960	C					105600	C	
Chloride	NE	3000	1000		3000	1000		1000	1000					1000	1000	
Nitrate + Nitrite as N	NE	2400	20		2400	20		1800	10					<	10	U
Sulfate	NE	53000	10000		52000	10000		22000	10000					31000	10000	
Sulfide	NE	<	1000	U	<	1000	U	35000	1000					36000	1000	
Total Kjeldahl Nitrogen	NE	<	300	U	<	300	U	<	300	U				<	300	U
Total Organic Carbon	NE	1700	1000		1700	1000		2300	1000					<	1000	U
VOLATILE ORGANIC COMPOUNDS (µg/L)																
Trichloroethylene	5 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Freon113	59000 (c)	<	3	U	<	3	U	<	3	U	13	3		<	3	U

Key:
RL= Reporting Limit
Qual= Qualifier
J=Estimated
R=Rejected
F=presence of interference
UJ=Estimated Nondetect
U=Nondetect
( ) =Above PRG
µg/L= microgram per liter
(PRG): Preliminary Remediation Goal:
(a) Maximun Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region IX PRGs
(d) 10^{-6} Risk Level
NA= Not Available
NE= Not Evaluated
C=Calculated value equivalent to alkalinity RL X 0.44

TABLE 4.9
SUMMARY OF CHEMICALS DETECTED AT EAST BURN PADS
SPRING 2002 GROUNDWATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID / DATE COLLECTED		JAW-06 Jun 25, 2002			JAW-07 Jun 10, 2002			JAW-614 Jun 25, 2002			JAW-64 Jun 10, 2002		
	PRG	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
EXPLOSIVES (µg/L)													
HMX	400 (b)	32	0.35	J	<	0.73	U	7.5	0.96	J	<	1.1	U
MNX	NA	<	0.35	U	<	0.91	U	<	0.96	U	<	1.4	U
RDX	2 (b)	<	0.35	U	<	0.73	U	(6.6)	0.96		<	1.1	U
METALS (µg/L)													
Arsenic	10 (a)	6.5	10	J	<	10	U	<	10	U	<	10	U
Barium	2000 (a)	144	200	J	62.9	200	J	119	200	J	67.4	200	J
Chromium	100 (a)	1.1	10	J	<	10	U	<	10	U	<	10	U
Selenium	50 (a)	<	10	U	<	10	U	2	10	J	<	10	U
NA PARAMETERS (µg/L)													
Alkalinity	NE	370000	8000		240000	8000		290000	8000		240000	8000	
Ammonia	NE	160	10		20	10		<	10	U	<	10	U
Carbon Dioxide	NE	162800	C		105600	C		127600	C		105600	C	
Chloride	NE	2000	1000		1000	1000		4000	1000		<	1000	U
Nitrate + Nitrite as N	NE	<	10	U	<	10	U	860	10		550	10	
Sulfate	NE	48000	10000		17000	1000		35000	10000		35000	10000	
Sulfide	NE	<	1000	U	22000	1000		<	1000	U	16000	1000	
Total Kjeldahl Nitrogen	NE	600	300		1600	300		<	300	U	<	300	U
Total Organic Carbon	NE	1500	1000		1400	1000		<	1000	U	<	1000	U
VOLATILE ORGANIC COMPOUNDS (µg/L)													
Trichloroethylene	5 (a)	4	3		<	3	U	<	3	U	<	3	U
Freon113	59000 (c)	<	3	U	<	3	U	<	3	U	<	3	U

Key:
RL= Reporting Limit
Qual= Qualifier
J=Estimated
R=Rejected
F=presence of interference
UJ=Estimated Nondetect
U=Nondetect
( ) =Above PRG
µg/L= microgram per liter
C=Calculated value equivalent to alkalinity RL X 0.44
(PRG): Preliminary Remediation Goal;
(a) Maximun Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region IX PRGs
(d) 10^{-4} Risk Level
NA= Not Available
NE= Not Evaluated

TABLE 4.10
SUMMARY OF CHEMICALS DETECTED AT PESTICIDE PIT
SPRING 2002 GROUNDWATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID DATE COLLECTED	SUMP June, 2002		
	Result	RL	Qual
	DRY		

Key:
RL= Reporting Limit
Qual= Qualifier

TABLE 4.11
SUMMARY OF CHEMICALS DETECTED AT INERT DISPOSAL AREA
SPRING 2002 GROUNDWATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID DATE COLLECTED		C-00-1 Jun 01, 2002			C-00-2 Jun 02, 2002			C-00-3 May 31, 2002			C95-1 May 31, 2002			C95-1Dup May 31, 2002			C95-2 Jun 01, 2002			CAMU-99-1D May 31, 2002		
	PRG	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
EXPLOSIVES (µg/L)																						
2,4,6-Trinitrotoluene	2 (b)	<	0.83	U	<	0.53	U	<	0.51	U	(4.7)	0.61		(5.3)	0.82	J	<	0.6	U	<	0.84	U
2,4-Dinitrotoluene	5 (d)	<	0.83	U	<	0.53	U	<	0.51	U	<	0.61	U	<	0.82	U	<	0.6	U	<	0.84	U
2,6-Dinitrotoluene	5 (d)	<	0.83	U	<	0.53	U	<	0.51	U	2.2	0.61	J	3.7	0.82		<	0.6	U	<	0.84	U
2-Amino-4,6-dinitrotoluene	NA	<	0.83	U	<	0.53	U	<	0.51	U	10	0.61	J	11	0.82	J	<	0.6	U	<	0.84	U
4-Amino-2,6-dinitrotoluene	NA	<	0.83	U	<	0.53	U	<	0.51	U	9.1	0.61	J	10	0.82	J	<	0.6	U	<	0.84	U
Nitrobenzene	3.4 (c)	<	0.83	U	<	0.53	U	<	0.51	U	<	0.61	U	<	0.82	U	<	0.6	U	<	0.84	U
RDX	2 (b)	<	0.83	U	<	0.53	U	<	0.51	U	(5.9)	0.61	J	(5.3)	0.82	J	<	0.6	U	<	0.84	U
METALS (µg/L)																						
Arsenic	10 (a)	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Barium	2000 (a)	167	200	J	146	200	J	524	200		172	200	J	143	200	J	143	200	J	236	200	J
Chromium	100 (a)	1.1	10	J	0.83	10	J	<	10	U	<	10	U	<	10	U	1.9	10	J	<	10	U
Copper	1400 (c)	0.6	25	J	<	25	UJ	1.7	25	J	<	25	U	<	25	U	<	25	UJ			
Lead	15 (a)	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Manganese	880 (c)	90.7	15		<	15	U	76.2	15		3.9	15	J	3.1	15	J	13.7	15	J			
Nickel	100 (b)	2	40	J	<	40	U	<	40	U	2	40	J	<	40	U	<	40	U			
Selenium	50 (a)	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Silver	100 (b)	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Uranium	20 (b)	5.9	100	J	3.3	100	J	4.8	100	J	8.4	100	J	7.8	100	J	1.1	100	J			
Vanadium	260 (c)	1.9	50	J	<	50	U	0.8	50	J	<	50	U	<	50	U	1.9	50	J			
PERCHLORATE (µg/L)																						
Perchlorate	18 (c)	<	4	UJ				<	4	UJ	<	4	UJ				<	4	UJ			
OTHER PARAMETERS (µg/L)																						
Total Organic Carbon	NE	1800	1000		<	1000	U	<	1000	U												
Total Organic Halides	NE	70	50		<	50	U	<	50	U												
SEMIVOLATILE ORGANIC COMPOUNDS (µg/L)																						
2,4,5-Trichlorophenol	3600 (c)	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U
2,4,6-Trichlorophenol	6.1 (c)	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U
2,4-Dichlorophenol	110 (c)	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U
2,4-Dimethylphenol	730 (c)	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U
2,4-Dinitrophenol	73 (c)	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
2,4-Dinitrotoluene	5 (d)	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U
2,6-Dinitrotoluene	5 (d)	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U
2-Chlorophenol	30 (c)	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U
2-Methylphenol	1800 (c)	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U
2-Nitrophenol	NA	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U
4,6-Dinitro-2-methylphenol	NA	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U
4-Chloro-3-methylphenol	NA	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U
4-Methylphenol	180 (c)	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U
4-Nitrophenol	290 (c)	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U
Benzoic acid	150000 (c)	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Bis(2-ethylhexyl) phthalate	6 (a)	<	5	U	2	5	J	<	5	U	<	5	U	<	5	U	<	5	U	4	5	J
Nitrobenzene	3.4 (c)	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U
Pentachlorophenol	1 (a)	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U
Phenol	4000 (b)	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U

TABLE 4.11
SUMMARY OF CHEMICALS DETECTED AT INERT DISPOSAL AREA
SPRING 2002 GROUNDWATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID DATE COLLECTED		C-00-1 Jun 01, 2002			C-00-2 Jun 02, 2002			C-00-3 May 31, 2002			C95-1 May 31, 2002			C95-1Dup May 31, 2002			C95-2 Jun 01, 2002			CAMU-99-1D May 31, 2002		
	PRG	Result	RL	Qual	Result	RL	Qual	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)	19	3		<	3	U	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
1,1-Dichloroethane	810 (c)	3	3		<	3	U	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
1,1-Dichloroethene	7 (a)	(99)	3		<	3	U	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
1,2-Dichloroethane	5 (a)	(12)	3		<	3	U	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
2-butanone	1900 (c)	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U	4	10	J
4-isopropyltoluene	NA	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U			
Acetone	610 (c)	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Benzene	5 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloroethane	4.6 (c)	<	3	U	<	3	U	<	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	<	3	U	<	3	U
Freon113	59000 (c)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Toluene	1000 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Trichloroethylene	5 (a)	(18)	3		<	3	U	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Vinyl Chloride	2 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Xylenes	10000 (b)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
RADIONUCLIDES (pCi/L)																						
Gross Alpha	15 (a)	4.1 ± 1.5	2.1		2.9 ± 1.6	2.4		3.9 ± 1.8	2.6		<	3.4	U	4.0 ± 2.1	3.2		3.1 ± 1.5	2.1				
Gross Beta	50 (a)	3.4 ± 1.4	2.2		3.2 ± 1.4	2.2		3.5±1.5	3.5		<	3.3	U	<	2.9	U	2.7± 1.3	2.1				
Lead 212	NA	4.2 ± 3.4	3.1		<	3	U	<	3.4	U	<	3.1	U	<	3	U	<	3	U			
Potassium - 40	NA	<	17	U	93.9 ± 43.2	16.4		49.5 ± 45.0	18		53.8 ± 42.2	17.1		30.4 ± 44.2	17		44.7±43.5	17.2				
Uranium - 235	NA	<	0.2	U	<	0.3	U	<	0.2	U	<	0.4	U	<	0.3	U	0.2 ± 0.2	0.2				

Key:
RL = Reporting Limit
Qual = Qualifier
J = Estimated
R = Rejected
F = presence of interference

UJ = Estimated Nondetect
U = Nondetect
( ) = Above PRG
µg/L = microgram per liter
pCi/L = picoCuries per liter

(PRG): Preliminary Remediation Goal:
(a) Maximun Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region IX PRGs
(d) 10^{-4} Risk Level
NA = Not Available
NE = Not Evaluated

TABLE 4.11
SUMMARY OF CHEMICALS DETECTED AT INERT DISPOSAL AREA
SPRING 2002 GROUNDWATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID DATE COLLECTED	PRG	CAMU-99-1S May 30, 2002			CAMU-99-2D May 31, 2002			CAMU-99-2S May 29, 2002			CAMU-99-3S May 30, 2002			ET-3 May 30, 2002			G-04 May 30, 2002			G-05 Jun 02, 2002		
		Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
EXPLOSIVES (µg/L)																						
2,4,6-Trinitrotoluene	2 (b)	<	0.99	U	<	0.51	U	<	0.78	U	<	1	U	<	0.71	U				<	1.2	U
2,4-Dinitrotoluene	5 (d)	<	0.99	U	<	0.51	U	<	0.78	U	<	1	U	(10)	0.71	J				<	1.2	U
2,6-Dinitrotoluene	5 (d)	<	0.99	U	<	0.51	U	<	0.78	U	<	1	U	(24)	0.71	J				<	1.2	U
2-Amino-4,6-dinitrotoluene	NA	<	0.99	U	<	0.51	U	<	0.78	U	<	1	U	<	0.71	U				<	1.2	U
4-Amino-2,6-dinitrotoluene	NA	<	0.99	U	<	0.51	U	<	0.78	U	<	1	U	<	0.71	U				<	1.2	U
Nitrobenzene	3.4 (c)	<	0.99	U	<	0.51	U	<	0.78	U	<	1	U	(13)	0.71	J				<	1.2	U
RDX	2 (b)	<	0.99	U	<	0.51	U	<	0.78	U	<	1	U	(4.5)	0.71	J				<	1.2	U
METALS (µg/L)																						
Arsenic	10 (a)	<	10	U	<	10	U	<	10	U	<	10	U	(15.6)	10		<	10	U	<	10	U
Barium	2000 (a)	71.4	200	J	243	200	J	64.1	200	J	110	200	J	554	200		176	200	J	252	200	
Chromium	100 (a)	3	10	J	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Copper	1400 (c)													7	25	J	0.97	25	J	<	25	UJ
Lead	15 (a)	4.1	10	J	3	10	J	2.7	10	J	3	10	J	<	10	U	<	10	U	<	10	U
Manganese	880 (c)													851	15		12.3	15	J	353	15	
Nickel	100 (b)													24.6	40	J	3	40	J	2.8	40	J
Selenium	50 (a)	<	10	U	<	10	U	<	10	U	5.9	10	J	<	10	U	<	10	U	<	10	U
Silver	100 (b)	<	10	U	0.41	10	J	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Uranium	20 (b)													1.3	100	J	1.9	100	J	8.5	100	J
Vanadium	260 (c)													3.7	50	J	1.6	50	J	<	50	U
PERCHLORATE (µg/L)																						
Perchlorate	18 (c)													<	20	U						
OTHER PARAMETERS (µg/L)																						
Total Organic Carbon	NE																1300	1000				
Total Organic Halides	NE																<	50	U			
SEMIVOLATILE ORGANIC COMPOUNDS (µg/L)																						
2,4,5-Trichlorophenol	3600 (c)	<	5	U	<	5	U	<	5	U	<	5	U	3	5	J	<	5	U	<	5	U
2,4,6-Trichlorophenol	6.1 (c)	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U
2,4-Dichlorophenol	110 (c)	<	5	U	<	5	U	<	5	U	<	5	U	3	5	J	<	5	U	<	5	U
2,4-Dimethylphenol	730 (c)	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U
2,4-Dinitrophenol	73 (c)	<	9	U	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
2,4-Dinitrotoluene	5 (d)	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U
2,6-Dinitrotoluene	5 (d)	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U
2-Chlorophenol	30 (c)	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U
2-Methylphenol	1800 (c)	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U
2-Nitrophenol	NA	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U
4,6-Dinitro-2-methylphenol	NA	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U
4-Chloro-3-methylphenol	NA	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U
4-Methylphenol	180 (c)	<	5	U	<	5	U	<	5	U	<	5	U	12	5		<	5	U	<	5	U
4-Nitrophenol	290 (c)	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U
Benzoic acid	150000 (c)	<	9	U	<	10	U	<	10	U	<	10	U	38	10		<	10	U	<	10	U
Bis(2-ethylhexyl) phthalate	6 (a)	<	5	U	(9)	5		<	5	U	<	5	U	<	5	U	<	5	U	<	5	U
Nitrobenzene	3.4 (c)	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U
Pentachlorophenol	1 (a)	<	5	U	<	5	U	<	5	U	<	5	U	(1600)	480		<	5	U	<	5	U
Phenol	4000 (b)	<	5	U	<	5	U	<	5	U	<	5	U	23	5		<	5	U	<	5	U

TABLE 4.11
SUMMARY OF CHEMICALS DETECTED AT INERT DISPOSAL AREA
SPRING 2002 GROUNDWATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID DATE COLLECTED	PRG	CAMU-99-1S May 30, 2002			CAMU-99-2D May 31, 2002			CAMU-99-2S May 29, 2002			CAMU-99-3S May 30, 2002			ET-3 May 30, 2002			G-04 May 30, 2002			G-05 Jun 02, 2002		
		Result	RL	Qual	Result	RL	Qual	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				<	3	U
1,1-Dichloroethane	810 (c)	<	3	U	<	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				<	3	U
1,2-Dichloroethane	5 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U				<	3	U
2-butanone	1900 (c)	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U				<	10	U
4-isopropyltoluene	NA													2	3	J				<	3	U
Acetone	610 (c)	<	10	U	<	10	U	<	10	U	<	10	U	25	10					<	10	U
Benzene	5 (a)	<	3	U	<	3	U	<	3	U	<	3	U	2	3	J				<	3	U
Chloroethane	4.6 (c)	<	3	U	<	3	U	<	3	U	<	3	U	2	3	J				<	3	U
cis-1,2-Dichloroethene	70 (a)	<	3	U	<	3	U	<	3	U	<	3	U	2	3	J				<	3	U
Freon113	59000 (c)	<	3	U	<	3	U	<	3	U	1	3	J	<	3	U				<	3	U
Toluene	1000 (a)	<	3	U	<	3	U	<	3	U	<	3	U	1	3	J				<	3	U
Trichloroethylene	5 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U				<	3	U
Vinyl Chloride	2 (a)	<	3	U	<	3	U	<	3	U	<	3	U	(3)	3	J				<	3	U
Xylenes	10000 (b)	<	3	U	<	3	U	<	3	U	<	3	U	2	3	J				<	3	U

Key:
RL= Reporting Limit
Qual= Qualifier
J=Estimated
R=Rejected
F=presence of interference
UJ=Estimated Nondetect
U=Nondetect
µg/L= microgram per liter
( ) =Above PRG
(PRG): Preliminary Remediation Goal;
(a) Maximun Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region IX PRGs
(d) 10^{-6} Risk Level
NA= Not Available
NE= Not Evaluated

TABLE 4.11
SUMMARY OF CHEMICALS DETECTED AT INERT DISPOSAL AREA
SPRING 2002 GROUNDWATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID		G-07			G-6R			IDA-MW1			IDA-MW1Dup			IDA-MW2			JAW-26			JAW-27		
DATE COLLECTED		Jun 01, 2002			May 29, 2002			May 31, 2002			May 31, 2002			Jun 01, 2002			May 31, 2002			Jun 01, 2002		
	PRG	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
EXPLOSIVES (µg/L)																						
2,4,6-Trinitrotoluene	2 (b)							<	0.91	U	<	0.81	U	<	1	U	<	0.73	U			
2,4-Dinitrotoluene	5 (d)							<	0.91	U	<	0.81	U	<	1	U	<	0.73	U			
2,6-Dinitrotoluene	5 (d)							<	0.91	U	<	0.81	U	<	1	U	<	0.73	U			
2-Amino-4,6-dinitrotoluene	NA							<	0.91	U	<	0.81	U	<	1	U	<	0.73	U			
4-Amino-2,6-dinitrotoluene	NA							<	0.91	U	<	0.81	U	<	1	U	<	0.73	U			
Nitrobenzene	3.4 (c)							<	0.91	U	<	0.81	U	<	1	U	<	0.73	U			
RDX	2 (b)							<	0.91	U	<	0.81	U	<	1	U	<	0.73	U			
METALS (µg/L)																						
Arsenic	10 (a)				<	10	U	6.5	10	J	5.8	10	J	<	10	U	<	10	U			
Barium	2000 (a)				110	200	J	310	200	J	294	200	J	61	200	J	171	200	J			
Chromium	100 (a)				<	10	U	3	10	J	4.5	10	J	0.82	10	J	<	10	U			
Copper	1400 (c)				0.79	25	J										0.86	25	J			
Lead	15 (a)				<	10	U	<	10	U	<	10	U	<	10	U	<	10	U			
Manganese	880 (c)				84.9	15											217	15				
Nickel	100 (b)				<	40	U										5	40	J			
Selenium	50 (a)				<	10	U	<	10	U	<	10	U	<	10	U	<	10	U			
Silver	100 (b)				<	10	U	<	10	U	<	10	U	<	10	U	<	10	U			
Uranium	20 (b)				3.5	100	J										2.6	100	J			
Vanadium	260 (c)				1.4	50	J										0.66	50	J			
PERCHLORATE (µg/L)																						
Perchlorate	18 (c)							<	4	UJ												
OTHER PARAMETERS (µg/L)																						
Total Organic Carbon	NE	1400	1000																	12000	1000	
Total Organic Halides	NE	<	50	U																<	50	U
SEMIVOLATILE ORGANIC COMPOUNDS (µg/L)																						
2,4,5-Trichlorophenol	3600 (c)							<	5	U	<	5	U		5	R						
2,4,6-Trichlorophenol	6.1 (c)							<	5	U	<	5	U		5	R						
2,4-Dichlorophenol	110 (c)							<	5	U	<	5	U		5	R						
2,4-Dimethylphenol	730 (c)							<	5	U	<	5	U		5	R						
2,4-Dinitrophenol	73 (c)							<	10	U	<	10	U		10	R						
2,4-Dinitrotoluene	5 (d)							<	5	U	<	5	U	<	5	U						
2,6-Dinitrotoluene	5 (d)							<	5	U	<	5	U	<	5	U						
2-Chlorophenol	30 (c)							<	5	U	<	5	U		5	R						
2-Methylphenol	1800 (c)							<	5	U	<	5	U		5	R						
2-Nitrophenol	NA							<	5	U	<	5	U		5	R						
4,6-Dinitro-2-methylphenol	NA							<	5	U	<	5	U		5	R						
4-Chloro-3-methylphenol	NA							<	5	U	<	5	U		5	R						
4-Methylphenol	180 (c)							<	5	U	<	5	U		5	R						
4-Nitrophenol	290 (c)							<	5	U	<	5	U		5	R						
Benzoic acid	150000 (c)							<	10	U	<	10	U		10	R						
Bis(2-ethylhexyl) phthalate	6 (a)							<	5	U	<	5	U	<	5	U						
Nitrobenzene	3.4 (c)							<	5	U	<	5	U	<	5	U						
Pentachlorophenol	1 (a)							<	5	U	<	5	U		5	R						
Phenol	4000 (b)							<	5	U	<	5	U		5	R						

TABLE 4.11
SUMMARY OF CHEMICALS DETECTED AT INERT DISPOSAL AREA
SPRING 2002 GROUNDWATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID DATE COLLECTED		G-07 Jun 01, 2002			G-6R May 29, 2002			IDA-MW1 May 31, 2002			IDA-MW1Dup May 31, 2002			IDA-MW2 Jun 01, 2002			JAW-26 May 31, 2002			JAW-27 Jun 01, 2002		
	PRG	Result	RL	Qual	Result	RL	Qual	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						
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						
2-butanone	1900 (c)							<	10	U	<	10	U	<	10	U						
Acetone	610 (c)							<	10	U	<	10	U	<	10	U						
Benzene	5 (a)							<	3	U	<	3	U	<	3	U						
Chloroethane	4.6 (c)							<	3	U	<	3	U	<	3	U						
cis-1,2-Dichloroethene	70 (a)							<	3	U	<	3	U	<	3	U						
Freon113	59000 (c)							<	3	U	<	3	U	<	3	U						
Toluene	1000 (a)							<	3	U	<	3	U	<	3	U						
Trichloroethylene	5 (a)							<	3	U	<	3	U	<	3	U						
Vinyl Chloride	2 (a)							<	3	U	<	3	U	<	3	U						
Xylenes	10000 (b)							<	3	U	<	3	U	<	3	U						

Key:
RL= Reporting Limit
Qual= Qualifier
J=Estimated
R=Rejected
F=presence of interference
UJ=Estimated Nondetect
U=Nondetect
() =Above PRG
µg/L= microgram per liter
pCi/L= picoCuries per liter
(PRG):
(a) Maximun
(b) Health Advisory Level (HAL)
(c) Region IX PRGs
(d) 10^{-4} Risk Level
NA= Not Available
NE= Not Evaluated

TABLE 4.11
SUMMARY OF CHEMICALS DETECTED AT INERT DISPOSAL AREA
SPRING 2002 GROUNDWATER MONITORING REPORT - IOWA ARMY AMMUNITION PLANT

FIELD ID DATE COLLECTED		JAW-28 May 30, 2002			JAW-65 May 31, 2002			T-1 May 30, 2002			T-4 Jun 04, 2002			T-5 Jun 03, 2002			T-6 May 30, 2002		
	PRG	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
EXPLOSIVES (µg/L)																			
2,4,6-Trinitrotoluene	2 (b)	<	0.51	U	<	0.97	U				<	0.52	U	<	1.4	U			
2,4-Dinitrotoluene	5 (d)	<	0.51	U	<	0.97	U				<	0.52	U	<	1.4	U			
2,6-Dinitrotoluene	5 (d)	<	0.51	U	<	0.97	U				<	0.52	U	<	1.4	U			
2-Amino-4,6-dinitrotoluene	NA	<	0.51	U	<	0.97	U				<	0.52	U	<	1.4	U			
4-Amino-2,6-dinitrotoluene	NA	<	0.51	U	<	0.97	U				<	0.52	U	<	1.4	U			
Nitrobenzene	3.4 (c)	<	0.51	U	<	0.97	U				<	0.52	U	<	1.4	U			
RDX	2 (b)	<	0.51	U	<	0.97	U				<	0.52	U	<	1.4	U			
METALS (µg/L)																			
Arsenic	10 (a)	<	10	U	<	10	U	<	10	U	4.9	10	J	<	10	U			
Barium	2000 (a)	306	200		107	200	J	95.4	200	J	295	200	J	123	200	J			
Chromium	100 (a)	<	10	U	3.2	10	J	<	10	U	1.4	10	J	<	10	U			
Copper	1400 (c)	<	25	U	<	25	UJ	<	25	U									
Lead	15 (a)	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U			
Manganese	880 (c)	97.3	15		27.8	15		4.2	15	J									
Nickel	100 (b)	1.5	40	J	8.7	40	J	<	40	U									
Selenium	50 (a)	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U			
Silver	100 (b)	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U			
Uranium	20 (b)	4.3	100	J	2	100	J	1.9	100	J									
Vanadium	260 (c)	0.91	50	J	1	50	J	0.83	50	J									
PERCHLORATE (µg/L)																			
Perchlorate	18 (c)	<	4	UJ	<	4	UJ												
OTHER PARAMETERS (µg/L)																			
Total Organic Carbon	NE							<	1000	U							1600	1000	
Total Organic Halides	NE							<	50	U							<	50	U
SEMIVOLATILE ORGANIC COMPOUNDS (µg/L)																			
2,4,5-Trichlorophenol	3600 (c)	<	5	U							<	5	UJ	<	5	U			
2,4,6-Trichlorophenol	6.1 (c)	<	5	U							<	5	UJ	<	5	U			
2,4-Dichlorophenol	110 (c)	<	5	U							<	5	UJ	<	5	U			
2,4-Dimethylphenol	730 (c)	<	5	U							<	5	UJ	<	5	U			
2,4-Dinitrophenol	73 (c)	<	11	U							<	9	UJ	<	10	U			
2,4-Dinitrotoluene	5 (d)	<	5	U							<	5	UJ	<	5	U			
2,6-Dinitrotoluene	5 (d)	<	5	U							<	5	UJ	<	5	U			
2-Chlorophenol	30 (c)	<	5	U							<	5	UJ	<	5	U			
2-Methylphenol	1800 (c)	<	5	U							<	5	UJ	<	5	U			
2-Nitrophenol	NA	<	5	U							<	5	UJ	<	5	U			
4,6-Dinitro-2-methylphenol	NA	<	5	U							<	5	UJ	<	5	U			
4-Chloro-3-methylphenol	NA	<	5	U							<	5	UJ	<	5	U			
4-Methylphenol	180 (c)	<	5	U							<	5	UJ	<	5	U			
4-Nitrophenol	290 (c)	<	5	U							<	5	UJ	<	5	U			
Benzoic acid	150000 (c)	<	11	U							<	9	UJ	<	10	U			
Bis(2-ethylhexyl) phthalate	6 (a)	<	5	U							<	5	UJ	<	5	U			
Nitrobenzene	3.4 (c)	<	5	U							<	5	UJ	<	5	U			
Pentachlorophenol	1 (a)	<	5	U							<	5	UJ	<	5	U			
Phenol	4000 (b)	<	5	U							<	5	UJ	<	5	U			

TABLE 4.11
SUMMARY OF CHEMICALS DETECTED AT INERT DISPOSAL AREA
SPRING 2002 GROUNDWATER MONITORING REPORT - IOWA ARMY AMMUNITION PLANT

FIELD ID DATE COLLECTED		JAW-28 May 30, 2002			JAW-65 May 31, 2002			T-1 May 30, 2002			T-4 Jun 04, 2002			T-5 Jun 03, 2002			T-6 May 30, 2002		
	PRG	Result	RL	Qual	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			
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			
2-butanone	1900 (c)	<	10	U							<	10	U	<	10	U			
4-isopropyltoluene	NA	<	3	U															
Acetone	610 (c)	<	10	U							<	10	U	<	10	U			
Benzene	5 (a)	<	3	U							<	3	U	<	3	U			
Chloroethane	4.6 (c)	<	3	U							<	3	U	<	3	U			
cis-1,2-Dichloroethene	70 (a)	<	3	U							<	3	U	<	3	U			
Freon113	59000 (c)	<	3	U							<	3	U	<	3	U			
Toluene	1000 (a)	<	3	U							<	3	U	<	3	U			
Trichloroethylene	5 (a)	<	3	U							<	3	U	<	3	U			
Vinyl Chloride	2 (a)	<	3	U							<	3	U	<	3	U			
Xylenes	10000 (b)	<	3	U							<	3	U	<	3	U			

Key:

RL= Reporting Limit
Qual= Qualifier
J=Estimated
R=Rejected
F=presence of interference
UJ=Estimated Nondetect
U=Nondetect
( ) =Above PRG
µg/L= microgram per liter
pCi/L= picoCuries per liter
(PRG): Preliminary Remediation Goal;
(a) Maximun Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region IX PRGs
(d) 10^{-4} Risk Level
NA= Not Available
NE= Not Evaluated

TABLE 4.11
SUMMARY OF CHEMICALS DETECTED AT INERT DISPOSAL AREA
SPRING 2002 GROUNDWATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID DATE COLLECTED	PRG	T-9 May 30, 2002 Result	RL	Qual
OTHER PARAMETERS (mg/L)				
Total Organic Halides	NA	<	50	U
Total Organic Carbon	NA	7200	1000	

Key:

RL= Reporting Limit
Qual= Qualifier
J=Estimated
R=Rejected
F=presence of interference
UJ=Estimated Nondetect
U=Nondetect
( ) =Above PRG
µg/L= microgram per liter

(PRG): Preliminary Remediation Goal;
(a) Maximun Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region IX PRGs
(d) 10^{-4} Risk Level
NA= Not Available
NE= Not Evaluated

TABLE 4.12
SUMMARY OF CHEMICALS DETECTED AT DEMOLITION AREA AND DEACTIVATION FURNACE
SPRING 2002 GROUNDWATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID		DA-01			DA-02			G-09			G-10			G-11			JAW-01			JAW-02		
DATE COLLECTED		Jun 12, 2002			Jun 12, 2002			Jun 13, 2002			Jun 13, 2002			Jun 13, 2002			Jun 12, 2002			Jun 13, 2002		
	PRG	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
EXPLOSIVES (µg/L)																						
HMX	400 (b)	<	0.7	U	1.6	0.53	J	<	0.99	U	<	1.3	U	<	1.2	U	<	1	U	<	0.32	U
MNX	NA	<	0.87	U	0.56	0.66	J	<	1.2	U	<	1.6	U	<	1.5	U	<	1.3	U	0.31	0.41	J
RDX	2 (b)	(5.2)	0.7		(11)	0.53		1.4	0.99	J	(5.1)	1.3		(2.6)	1.2	J	(6.2)	1		(2.5)	0.32	
METALS (µg/L)																						
Barium	2000 (a)	82.2	200	J	68	200	J	158	200	J	72.4	200	J	87.7	200	J	96.2	200	J	139	200	J
Selenium	50 (a)	1.6	10	J	<	10	UJ	3.6	10	J	<	10	U	<	10	UJ	1.7	10	J	<	10	UJ
NA PARAMETER (µg/L)																						
Alkalinity	NE	440000	8000		810000	8000		340000	8000		370000	8000		230000	8000		500000	8000		580000	8000	
Ammonia	NE	60	10		50	10		<	10	U	<	10	U	70	10		<	10	U	<	10	U
Carbon Dioxide	NE	193600	C		356400	C		149600	C		162800	C		101200	C		220000	C		255200	C	
Chloride	NE	15000	10000		7000	1000		4000	1000		8000	1000		1000	1000		11000	10000		3000	1000	
Nitrate + Nitrite as N	NE	290	10		1000	10		1800	10		1800	10		<	10	U	840	10		580	10	
Sulfate	NE	51000	10000		20000	10000		57000	10000		30000	10000		35000	10000		55000	10000		86000	10000	J
Sulfide	NE	15000	1000		5000	1000		<	1000	U	<	1000	U	<	1000	U	10000	1000		<	1000	U
Total Kjeldahl Nitrogen	NE	<	300	U	800	300		<	300	U	<	300	U	400	300		<	300	U	400	300	
Total Organic Carbon	NE	1400	1000		4400	1000		1200	1000		3100	1000		2400	1000		1600	1000		2000	1000	

Key:
RL = Reporting Limit
Qual = Qualifier
J = Estimated
R = Rejected
F = presence of interference

UJ = Estimated Nondetect
U = Nondetect
( ) = Above PRG
µg/L = microgram per liter

(PRG): Preliminary Remediation Goal:
(a) Maximun Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region IX PRGs
(d) 10^{-4} Risk Level
NA = Not Available
NE = Not Evaluated

C = Calculated value equivalent to alkalinity RL X 0.44

TABLE 4.13
SUMMARY OF CHEMICALS DETECTED AT FIRING SITE
SPRING 2002 GROUNDWATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID DATE COLLECTED		JAW-34 Jun 28, 2002			JAW-618 Jun 27, 2002			JAW-618Dup Jun 27, 2002			JAW-32 June, 2002			JAW-33 June, 2002		
	PRG	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
METALS (µg/L)																
Barium	2000 (a)	<	200	U	240	200		235	200			DRY			DRY	
Uranium	20 (b)	(21.5)	2.0		1.7	2.0	J	2	2.0							
RADIONUCLIDES (pCi/L)																
Actinium-228	NA	<	40	U	8.03 ± 4.19	40	J	<	40	U						
Gross alpha	15 (a)	9.7 ± 2.9	3.8		3.4 ± 1.9	2.9		<	3.3	U						
Gross Beta	50 (a)	6.1 ± 2.6	4.1		<	3.7	U	<	3.3	U						
Lead-214	NA	12.7 ± 6.7	50	J	<	50	U	<	50	U						
Uranium-235	NA	0.63 ± 0.28	1.0	J	<	1.0	U	<	1.0	U						

Key:
RL= Reporting Limit
Qual= Qualifier
J=Estimated
R=Rejected
E=Value exceeds linear range
F=presence of interference

UJ=Estimated Nondetect
U=Nondetect
( ) =Above PRG
µg/L= microgram per liter
pCi/L= picoCuries per liter

(PRG): Preliminary Remediation Goal:
(a) Maximun Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region IX PRGs
(d) 10-4 Risk Level
NA= Not Available
NE= Not Evaluated

TABLE 4.14
SUMMARY OF CHEMICALS DETECTED AT THE AMMUNITION BOX CHIPPER DISPOSAL PIT
SPRING 2002 GROUNDWATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID DATE COLLECTED		JAW-620 Jun 13, 2002		
	PRG	Result	RL	Qual
METALS (µg/L)				
Barium	2000 (a)	74.2	200	J
Selenium	50 (a)	4.9	10	J

Key:

RL= Reporting Limit
Qual= Qualifier
J=Estimated
R=Rejected
F=presence of interference
UJ=Estimated Nondetect
U=Nondetect
µg/L= microgram per liter
( ) =Above PRG
(PRG): Preliminary Remediation Goal;
(a) Maximun Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region IX PRGs
(d) 10^{-4} Risk Level
NA= Not Available
NE= Not Evaluated

TABLE 4.15
SUMMARY OF CHEMICALS DETECTED AT WEST BURN PADS, WEST BURN PADS LANDFILL, BURN CAGES, AND BURN CAGES LANDFILL
SPRING 2002 GROUNDWATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID / DATE COLLECTED		G-30 Jun 15, 2002			JAW-24 Jun 24, 2002			JAW-25 Jun 13, 2002			JAW-68 Jun 14, 2002			WBP-99-01 Jun 11, 2002			WBP-99-02 Jun 12, 2002			WBP-99-02Dup Jun 12, 2002		
	PRG	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
EXPLOSIVES (µg/L)																							
2,4,6-Trinitrotoluene	2 (b)	<	0.39	U	<	0.58	U	<	0.38	U	<	0.47	U	<	0.66	U	<	0.57	U	<	0.48	U
2,4-Dinitrotoluene	5 (d)	<	0.39	U	<	0.58	U	<	0.38	U	<	0.47	U	<	0.66	U	<	0.57	U	<	0.48	U
2-Amino-4,6-dinitrotoluene	NA	<	0.39	U	<	0.58	U	<	0.38	U	<	0.47	U	<	0.66	U	<	0.57	U	<	0.48	U
4-Amino-2,6-dinitrotoluene	NA	<	0.39	U	<	0.58	U	<	0.38	U	<	0.47	U	<	0.66	U	<	0.57	U	0.36	0.48	J
4-Nitrotoluene	61 (c)	<	0.39	U	<	0.58	U	<	0.38	U	<	0.47	U	<	0.66	U	<	0.57	U	<	0.48	U
HMX	400 (b)	1.4	0.39	J	54	0.58		140	5.7	J	32	0.47	J	<	0.66	U	41	0.57	J	3.8	0.48	J
MNX	NA	<	0.49	U	0.56	0.58	J	3.4	0.47		<	0.58	U	<	0.83	U	5.5	0.71		0.97	0.6	
RDX	2 (b)	(3.4)	0.39		(5)	0.58		(98)	5.7		0.48	0.47	J	(5.8)	0.66	J	(74)	5.7	J	(30)	0.48	J
METALS (µg/L)																							
Arsenic	10 (a)	<	10	U	(28.8)	10		<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Barium	2000 (a)	44.5	200	J	714	200	J	30.9	200	J	55.7	200	J	44.2	200	J	46	200	J	48.7	200	J
Chromium	100 (a)	<	10	U	<	10	U	<	10	U	<	10	U	2.4	10	J	<	10	U	2.2	10	J
Lead	15 (a)	<	10	UJ	<	10	U	<	10	U	<	10	UJ	<	10	U	<	10	UJ	<	10	UJ
Selenium	50 (a)	<	10	UJ	<	10	U	2.4	10	J	<	10	UJ	<	10	U	<	10	UJ	<	10	UJ
Silver	100 (b)	<	10	U	<	10	U	<	10	U	<	10	U	<	10	UJ	<	10	U	<	10	U
NA PARAMETERS (µg/L)																							
Alkalinity	NE	340000	8000		400000	8000		110000	8000		180000	8000		240000	8000		280000	8000		290000	8000	
Ammonia	NE	20	10		690	10		<	10	U	<	10	U	30	10		<	10	U	20	10	
Carbon Dioxide	NE	149600	C		176000	C		48400	C		79200	C		105600	C		123200	C		127600	C	
Chloride	NE	4000	1000		12000	10000		50000	10000		110000	20000		61000	20000		47000	10000		48000	10000	
Nitrate + Nitrite as N	NE	440	10		<	10	U	5300	100		<	10	U	1200	10		13000	100		13000	100	
Sulfate	NE	34000	10000		81000	10000		250000	20000		63000	10000		330000	20000		170000	10000		180000	10000	
Sulfide	NE	<	1000	U	3000	1000		<	1000	U	<	1000	U	7000	1000		2000	1000	J	16000	1000	J
Total Kjeldahl Nitrogen	NE	<	300	U	1000	300		<	300	U	<	300	U	<	300	U	<	300	U	<	300	U
Total Organic Carbon	NE	1000	1000		5500	1000		2300	1000		1400	1000		1000	1000		1200	1000		1100	1000	
VOLATILE ORGANIC COMPOUNDS (µg/L)																							
1,1,1-Trichloroethane	200 (a)	<	3	U	<	150	U	<	3	U	<	3	U	<	3	U	56	3	J	40	3	J
1,1-Dichloroethene	7 (a)	<	3	U	<	150	U	<	3	U	<	3	U	<	3	U	(41)	3		(40)	3	
Acetone	610 (c)	<	10	U	<	500	U	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Chloroform	80 (a)	<	3	U	<	150	U	4	3		<	3	U	<	3	U	3	3	J	2	3	J
cis-1,2-Dichloroethene	70 (a)	<	3	U	<	150	U	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Dichlorodifluoromethane (Freon12)	1000 (a)	<	3	U	220	150		<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Trichlorotrifluoroethane (Freon113)	59000 (c)	<	3	U	16000	600		<	3	U	<	3	U	<	3	U	19000	600		20000	600	
o-Xylene	NA	<	3	U	<	150	U	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Toluene	1000 (a)	<	3	U	<	150	U	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Trichloroethylene	5 (a)	<	3	U	<	150	U	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U

Key:

RL= Reporting Limit
Qual= Qualifier
J=Estimated
R=Rejected
E=Value exceeds linear range
F=presence of interference

UJ=Estimated Nondetect
U=Nondetect
( ) =Above PRG
µg/L= microgram per liter
C=Calculated value equivalent to alkalinity RL X 0.44

(PRG): Preliminary Remediation Goal;
(a) Maximun Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region IX PRGs
(d) 10^{-4} Risk Level
NA= Not Available
NE= Not Evaluated

TABLE 4.15
SUMMARY OF CHEMICALS DETECTED AT WEST BURN PADS, WEST BURN PADS LANDFILL, BURN CAGES, AND BURN CAGES LANDFILL
SPRING 2002 GROUNDWATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID / DATE COLLECTED		WBP-99-03 Jun 11, 2002			WBP-99-4 Jun 13, 2002			WBP-99-5 Jun 12, 2002			WBP-99-6 Jun 30, 2002			WBP-99-7 Jun 11, 2002		
	PRG	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
EXPLOSIVES (µg/L)																
2,4,6-Trinitrotoluene	2 (b)	1.7	0.36		<	1.2	U	<	0.91	U	<	0.23	U	<	0.79	U
2,4-Dinitrotoluene	5 (d)	<	0.36	U	<	1.2	U	<	0.91	U	1.6	0.23	J	<	0.79	U
2-Amino-4,6-dinitrotoluene	NA	3.8	0.36	J	<	1.2	U	<	0.91	U	1.4	0.23	J	<	0.79	U
4-Amino-2,6-dinitrotoluene	NA	4.2	0.36	J	<	1.2	U	<	0.91	U	<	0.23	U	<	0.79	U
4-Nitrotoluene	61 (c)	<	0.36	U	<	1.2	U	<	0.91	U	0.67	0.23	J	<	0.79	U
HMX	400 (b)	180	36	J	3.4	1.2	J	6	0.91	J	<	0.23	U	<	0.79	U
MNX	NA	44	45	J	<	1.5	U	1.1	1.1		<	0.23	U	<	0.99	U
RDX	2 (b)	(1400)	36		(3.4)	1.2	J	(32)	0.91		0.2	0.23	J	<	0.79	U
METALS (µg/L)																
Arsenic	10 (a)	<	10	U	<	10	U	(20.9)	10		<	10	U	<	10	U
Barium	2000 (a)	216	200	J	48.8	200	J	(2020)	200		65.5	200	J	126	200	J
Chromium	100 (a)	0.84	10	J	<	10	U	<	10	U	<	10	U	<	10	U
Lead	15 (a)	2.8	10	J	<	10	UJ	2.5	10	J	<	10	U	<	10	U
Selenium	50 (a)	<	10	U	2.9	10	J	<	10	UJ	<	10	UJ	<	10	U
Silver	100 (b)	<	10	UJ	<	10	U	<	10	U	<	10	U	0.85	10	J
NA PARAMETERS (µg/L)																
Alkalinity	NE	360000	8000		350000	8000		590000	8000		310000	8000		370000	8000	
Ammonia	NE	30	10		10	10		1700	10		400	10		70	10	
Carbon Dioxide	NE	158400	C		154000	C		259600	C		136400	C		162800	C	
Chloride	NE	33000	10000		53000	10000		62000	10000		22000	10000		3000	1000	
Nitrate + Nitrite as N	NE	860	10		7700	50		<	10	U	<	10	U	<	10	U
Sulfate	NE	46000	10000		240000	20000		36000	10000		59000	10000		17000	1000	
Sulfide	NE	2000	1000		<	1000	U	6000	1000		<	1000	U	21000	1000	
Total Kjeldahl Nitrogen	NE	<	300	U	<	300	U	3400	300		700	300		<	300	U
Total Organic Carbon	NE	2200	1000		1300	1000		5000	1000		1800	1000		<	1000	U
VOLATILE ORGANIC COMPOUNDS (µg/L)																
1,1,1-Trichloroethane	200 (a)	<	3	U	3	3	J	<	3	U	<	30000	U	<	3	U
1,1-Dichloroethene	7 (a)	<	3	U	<	3	U	<	3	U	<	30000	U	<	3	U
Acetone	610 (c)	20	10		<	10	U	<	10	U	<	100000	U	<	10	U
Chloroform	80 (a)	<	3	U	<	3	U	<	3	U	<	30000	U	<	3	U
cis-1,2-Dichloroethene	70 (a)	3	3	J	<	3	U	5	3		<	30000	U	<	3	U
Dichlorodifluoromethane (Freon12)	1000 (a)	<	3	U	<	3	U	<	3	U	<	30000	U	<	3	U
Trichlorotrifluoroethane (Freon113)	59000 (c)	860	60		9100	300		(73000)	1500		(210000)	30000		<	3	U
o-Xylene	NA	<	3	U	<	3	U	3	3	J	<	30000	U	<	3	U
Toluene	1000 (a)	<	3	U	<	3	U	1	3	J	<	30000	U	<	3	U
Trichloroethylene	5 (a)	1	3	J	<	3	U	(12)	3		<	30000	U	<	3	U

Key:
RL= Reporting Limit
Qual= Qualifier
J=Estimated
R=Rejected
F=presence of interference

UJ=Estimated Nondetect
U=Nondetect
( ) =Above PRG
µg/L= microgram per liter
C=Calculated value equivalent to alkalinity RL X 0.44

(PRG): Preliminary Remediation Goal;
(a) Maximun Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region IX PRGs
(d) 10^{-4} Risk Level
NA= Not Available
NE= Not Evaluated

TABLE 4.16
SUMMARY OF CHEMICALS DETECTED AT NORTH BURN PADS, NORTH BURN PADS LANDFILL, AND CONTAMINATED WASTE PROCESSOR
SPRING 2002 GROUNDWATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID		CW-P			JAW-11			JAW-12			JAW-13			JAW-14			JAW-626		
DATE COLLECTED		Jun 10, 2002			Jun 13, 2002			Jun 14, 2002			Jun 14, 2002			Jun 14, 2002			Jun 14, 2002		
	PRG	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
EXPLOSIVES (µg/L)																			
1,3,5-Trinitrobenzene	1100 (c)	1.4	0.44	J	<	0.56	U	<	0.74	U	<	0.83	U	<	0.39	U	<	0.6	U
2-Amino-4,6-dinitrotoluene	NA	1.3	0.44	J	<	0.56	U	<	0.74	U	<	0.83	U	<	0.39	U	<	0.6	U
4-Amino-2,6-dinitrotoluene	NA	1	0.44	J	<	0.56	U	<	0.74	U	<	0.83	U	<	0.39	U	1.1	0.6	J
HMX	400 (b)	<	0.44	U	<	0.56	U	<	0.74	U	<	0.83	U	<	0.39	U	6.6	0.6	J
RDX	2 (b)	<	0.44	U	<	0.56	U	<	0.74	U	<	0.83	U	1.3	0.39		(3.6)	0.6	
METALS (µg/L)																			
Barium	2000 (a)	417	200	J	70.3	200	J	23.4	200	J	86.2	200	J	184	200	J	177	200	J
Chromium	100 (a)	<	10	U	<	10	U	<	10	U	1.7	10	J	0.62	10	J	<	10	U
Lead	15 (a)	<	10	U	<	10	UJ	<	10	U	<	10	UJ	1.7	10	J	<	10	UJ
Selenium	50 (a)	<	10	U	<	10	UJ	<	10	UJ	1.6	10	J	1.8	10	J	<	10	U
NA PARAMETERS (µg/L)																			
Alkalinity	NE	530000	8000		220000	8000		76000	8000		180000	8000		330000	8000		350000	8000	
Ammonia	NE	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Carbon Dioxide	NE	233200	C		96800	C		33440	C		79200	C		145200	C		154200	C	
Chloride	NE	160000	20000		36000	10000		<	1000	U	24000	10000		13000	10000		18000	10000	
Nitrate + Nitrite as N	NE	<	10	U	460	10		<	10	U	610	10		<	10	U	10	10	
Ortho-Phosphate	NE	<	1000	U	<	1000	U	3000	1000		<	1000	U	<	1000	U	<	1000	U
Sulfate	NE	9000	1000		31000	10000		13000	1000		40000	10000		28000	10000		18000	1000	
Sulfide	NA	2000	1000		<	1000	U	<	1000	U	<	1000	U	<	1000	U	<	1000	U
Total Kjeldahl Nitrogen	NE	<	300	U	<	300	U	<	300	U	<	300	U	3100	300		300	300	
Total Organic Carbon	NA	3400	1000		<	1000	U	<	1000	U	<	1000	U	1700	1000		2800	1000	

Key:
RL= Reporting Limit
Qual= Qualifier
J=Estimated
R=Rejected
F=presence of interference
µg/L= microgram per liter

UJ=Estimated Nondetect
U=Nondetect
C=Calculated value equivalent to alkalinity RL X 0.44
( ) =Above PRG

(PRG): Preliminary Remediation Goal;
(a) Maximun Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region IX PRGs
(d) 10^{-4} Risk Level
NA= Not Available
NE= Not Evaluated

TABLE 4.16
SUMMARY OF CHEMICALS DETECTED AT NORTH BURN PADS, NORTH BURN PADS LANDFILL, AND CONTAMINATED WASTE PROCESSOR
SPRING 2002 GROUNDWATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID DATE COLLECTED	PRG	JAW-627 Jun 14, 2002			JAW-627Dup Jun 14, 2002			NBPLF-MW1 Jun 13, 2002		
		Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
EXPLOSIVES (µg/L)										
1,3,5-Trinitrobenzene	1100 (c)	<	0.39	U	<	1.2	U	<	0.43	U
2-Amino-4,6-dinitrotoluene	NA	<	0.39	U	<	1.2	U	<	0.43	U
4-Amino-2,6-dinitrotoluene	NA	<	0.39	U	<	1.2	U	<	0.43	U
HMX	400 (b)	<	0.39	U	<	1.2	U	<	0.43	U
RDX	2 (b)	(3.5)	0.39		(4.3)	1.2		<	0.43	U
METALS (µg/L)										
Barium	2000 (a)	189	200	J	168	200	J	160	200	J
Chromium	100 (a)	5.6	10	J	5	10	J	0.77	10	J
Lead	15 (a)	<	10	UJ	<	10	UJ	<	10	U
Selenium	50 (a)	<	10	U	<	10	U	<	10	U
NA PARAMETERS (µg/L)										
Alkalinity	NE	270000	8000		270000	8000		410000	8000	
Ammonia	NE	<	10	U	<	10	U	120	10	
Carbon Dioxide	NE	118800	C		118800	C		180400	C	
Chloride	NE	56000	10000		55000	10000		<	1000	U
Nitrate + Nitrite as N	NE	1000	10		1000	10		<	10	U
Ortho-Phosphate	NE	<	1000	U	<	1000	U	<	1000	U
Sulfate	NE	34000	10000		36000	10000		19000	1000	
Sulfide	NE	<	1000	U	<	1000	U	<	1000	U
Total Kjeldahl Nitrogen	NE	<	300	U	<	300	U	<	300	U
Total Organic Carbon	NE	<	1000	U	<	1000	U	1800	1000	

Key:
RL= Reporting Limit
Qual= Qualifier
J=Estimated
R=Rejected
E=Value exceeds linear range
F=presence of interference
µg/L= microgram per liter

UJ=Estimated Nondetect
U=Nondetect
C=Calculated value equivalent to alkalinity RL X 0.44
( ) =Above PRG

(PRG): Preliminary Remediation Goal;
(a) Maximun Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region IX PRGs
(d) 10^{-4} Risk Level
NA= Not Available
NE= Not Evaluated

TABLE 4.17
SUMMARY OF CHEMICALS DETECTED AT THE FIRE TRAINING AREA
SPRING 2002 GROUNDWATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID		FTA-99-1			FTA-99-2			JAW-58			JAW-59			JAW-60			JAW-61			JAW-62		
DATE COLLECTED		Jun 17, 2002			Jun 18, 2002			Jun 24, 2002			Jun 18, 2002			Jun 18, 2002			Jun 18, 2002			Jun 18, 2002		
	PRG	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
EXPLOSIVES (µg/L)																						
1,3,5-Trinitrobenzene	1100 (c)	<	1.3	U	<	0.44	U	<	0.46	U	<	0.51	U	<	1.1	U	<	0.31	U	<	1	U
2,4-Dinitrotoluene	5 (d)	<	1.3	U	<	0.44	U	<	0.46	U	<	0.51	U	<	1.1	U	<	0.31	U	<	1	U
2-Amino-4,6-dinitrotoluene	NA	<	1.3	U	<	0.44	U	<	0.46	U	<	0.51	U	<	1.1	U	<	0.31	U	<	1	U
4-Amino-2,6-dinitrotoluene	NA	<	1.3	U	<	0.44	U	<	0.46	U	<	0.51	U	<	1.1	U	<	0.31	U	<	1	U
HMX	400 (b)	3.7	1.3	J	<	0.44	U	<	0.46	U	<	0.51	U	<	1.1	U	<	0.31	U	<	1	U
RDX	2 (b)	(9)	1.3		<	0.44	U	0.55	0.46	J	1.7	0.51		<	1.1	U	<	0.31	U	<	1	U
METALS (µg/L)																						
Arsenic	10 (a)	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Barium	2000 (a)	134	200	J	47.5	200	J	93.3	200	J	141	200	J	191	200	J	73.6	200	J	72.6	200	J
Cadmium	5 (a)	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U	<	5	U
Chromium	100 (a)	<	10	U	1.3	10	J	1.2	10	J	<	10	U	<	10	U	<	10	U	<	10	U
Lead	15 (a)	<	10	U	<	10	U	<	10	U	<	10	UJ	<	10	U	<	10	U	<	10	U
Mercury	2 (b)	<	0.2	U	<	0.2	U	<	0.2	U	0.024	0.2	J	<	0.2	U	<	0.2	U	<	0.2	U
Selenium	50 (a)	<	10	UJ	<	10	U	<	10	U	<	10	U	<	10	U	<	10	UJ	<	10	UJ
NA PARAMETERS (µg/L)																						
Alkalinity	NE	300000	8000		420000	8000		280000	8000		320000	8000		380000	8000		170000	8000		130000	8000	
Ammonia	NE	30	10		220	10		<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Carbon Dioxide	NE	132000	C		184800	C		123200	C		140800	C		167200	C		74800	C		57200	C	
Chloride	NE	8000	1000		2000	1000		3000	1000		12000	10000		21000	10000		4000	1000		12000	10000	
Nitrate + Nitrite as N	NE	1400	10		70	10		90	10		140	10		140	10		50	10		90	10	
Ortho-Phosphate	NE	<	1000	U	<	1000	U	<	1000	U	<	1000	U	<	1000	U	<	1000	U	33000	10000	
Sulfate	NE	44000	10000		58000	10000		44000	10000		59000	10000		34000	10000		41000	10000		34000	10000	
Sulfide	NE	<	1000	U	8000	1000		9000	1000		8000	1000		9000	1000		<	1000	U	<	1000	U
Total Kjeldahl Nitrogen	NE	<	300	U	<	300	U	<	300	U	<	300	U	300	300		<	300	U	<	300	U
Total Organic Carbon	NE	1000	1000		<	1000	U	1600	1000		1600	1000		1600	1000		<	1000	U	<	1000	U

TABLE 4.17
SUMMARY OF CHEMICALS DETECTED AT THE FIRE TRAINING AREA
SPRING 2002 GROUNDWATER MONITORING EVENT - IOWA ARMY AMMUNITION PLANT

FIELD ID		FTA-99-1			FTA-99-2			JAW-58			JAW-59			JAW-60			JAW-61			JAW-62		
DATE COLLECTED		Jun 17, 2002			Jun 18, 2002			Jun 24, 2002			Jun 18, 2002			Jun 18, 2002			Jun 18, 2002			Jun 18, 2002		
	PRG	Result	RL	Qual	Result	RL	Qual	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)	110	3		<	3	U	180	3		140	3		94	3		140	3		<	3	U
1,1,2-Trichloroethane	5 (a)	<	3	U	<	3	U	1	3	J	1	3	J	4	3		<	3	U	<	3	U
1,1-Dichloroethane	810 (c)	11	3		<	3	U	4	3		3	3		110	3		20	3		<	3	U
1,1-Dichloroethene	7 (a)	(120)	3		<	3	U	(170)	3		(190)	3		(440)	15		(120)	3		<	3	U
1,2-Dichloroethane	5 (a)	4	3		<	3	U	<	3	U	1	3	J	(29)	3		2	3	J	<	3	U
2-butanone	1900 (c)	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
2-Hexanone		<	10	U	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U	<	10	U
Acetone	610 (c)	<	10	U	<	10	U	<	10	U	<	10	U	<	3	U	<	10	U	<	10	U
Benzene	5 (a)	<	3	U	<	3	U	<	3	U	<	3	U	(13)	3		<	3	U	<	3	U
Chloroethane	4.6 (c)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Chloroform	80 (a)	2	3	J	<	3	U	<	3	U	<	3	U	4	3		2	3	J	<	3	U
cis-1,2-Dichloroethene	70 (a)	10	3		<	3	U	<	3	U	2	3	J	(100)	3		6	3		<	3	U
Ethylbenzene	700 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Freon113	59000 (c)	<	4	U	<	3	U	<	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	<	10	U	<	10	U
Methylene chloride	5 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
o-Xylene		<	3	U	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Tetrachloroethene	5 (a)	1	3	J	<	3	U	3	3		(8)	3		<	3	U	(50)	3		<	3	U
Toluene	1000 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
trans-1,2-Dichloroethene	100 (a)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U
Trichloroethylene	5 (a)	(8)	3		<	3	U	<	3	U	1	3	J	(76)	3		(63)	3		<	3	U
Vinyl Chloride	2 (a)	<	3	U	<	3	U	<	3	U	<	3	U	(3)	3		<	3	U	<	3	U
Xylenes	10000 (b)	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U	<	3	U

Key:

RL = Reporting Limit
Qual = Qualifier
J = Estimated
R = Rejected
F = presence of interference

UJ = Estimated Nondetect
U = Nondetect
( ) = Above PRG
µg/L = microgram per liter
C = Calculated value equivalent to alkalinity RL X 0.44

(PRG): Preliminary Remediation Goal;
(a) Maximun Contaminant Level (MCL)
(b) Health Advisory Level (HAL)
(c) Region IX PRGs
(d) 10^{-4} Risk Level
NA = Not Available
NE = Not Evaluated