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LIST OF ACRONYMS AND ABBREVIATIONS

µg/L	micrograms per liter
AEDB-R	Army Environmental Data Base-Restoration
AR	Army Regulation
ARAR	Applicable or Relevant and Appropriate Requirement
Army	United States Department of the Army
bgs	below ground surface
CDI	Chronic daily intake
CEA	Classification Exception Area
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CFR	Code of Federal Regulations
COC	Contaminant of Concern
COPC	Constituent of Potential Concern
DSERTS	Defense Site Environmental Restoration Tracking System
FS	Feasibility Study
ft	feet
ft/day	feet per day
ft/ft	feet per foot
GIS	Geographic Information System
GRA	General Response Action
GWQS	Groundwater Quality Standards
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
IAG	Inter-Agency Agreement
ICM	Industrial Corrosion Management
INRMP	Integrated Natural Resources Management Plan
IRP	Installation Restoration Program
LOC	Level of Concern
LTGM	Long-Term Groundwater Monitoring
LTMP	Long-Term Monitoring Plan
LUC	Land Use Control
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MGD	million gallons per day
msl	mean sea level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NJ	New Jersey
NJAC	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection
NPL	National Priorities List
O&M	Operation and Maintenance
PAERAB	Picatinny Arsenal Environmental Restoration Advisory Board
Pondview	Pondview Estates, Inc.
PQL	Practical Quantitation Limit
RAO	Remedial Action Objective
RD	Remedial Design
RfD	Reference Dose
RI	Remedial Investigation
RME	Reasonable Maximum Exposure
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SCL	Site Cleanup Level
SDWA	Safe Drinking Water Act
TAPP	Technical Assistance for Public Participation
TBC	To Be Considered
TCE	Trichloroethene
USC	United States Code
USAEHA	U.S. Army Environmental Hygiene Agency
USEPA	U.S. Environmental Protection Agency
USGS	United States Geological Survey
VOC	Volatile Organic Compound
WRA	Well Restriction Area

1.0 PART 1: DECLARATION

1.1 SITE NAME AND LOCATION

Picatinny Arsenal is formally designated as U.S. Department of the Army (Army) Installation Management Agency Northeast Regional Garrison Office. It is located in North Central New Jersey (NJ) in Morris County near the city of Dover. The facility was included on the National Priorities List (NPL) in March of 1990 and assigned a Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) number of NJ3210020704.

This Record of Decision (ROD) specifically addresses groundwater contamination at Area C. The term Area C groundwater is inclusive of all groundwater at the southern boundary of Picatinny Arsenal. The Army maintains a comprehensive database of sites that are being addressed within its Installation Restoration Program (IRP) called Army Environmental Data Base-Restoration (AEDB-R). Area C groundwater is designated in the AEDB-R as PICA-206. The soil, sediment, and surface water in Area C as well as all environmental media in the remaining areas in Picatinny Arsenal are being addressed as separate actions.

1.2 STATEMENT OF BASIS AND PURPOSE

This ROD presents the selected groundwater response action for Area C located in Picatinny Arsenal in Rockaway Township, NJ. The remedial action is selected in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, and to the greatest extent possible, the National Oil and Hazardous Substances Pollution Contingency Plan (also referred to as the National Contingency Plan, or NCP). The information supporting the decisions on the selected remedial action is contained in the administrative record file for the site. These decisions have been made by the Army and the U.S. Environmental Protection Agency (USEPA). Comments received from the New Jersey Department of Environmental Protection (NJDEP) were evaluated and considered in selecting the final response action. NJDEP concurs with the selected response action. The remedial action for Area C groundwater is being undertaken to protect human health from contaminant concentrations in excess of site cleanup levels.

1.3 ASSESSMENT OF THE SITE

The response action selected in this ROD is necessary to protect public health and welfare or the environment from actual or threatened releases of hazardous substances into the environment.

1.4 DESCRIPTION OF THE SELECTED RESPONSE ACTION

The remediation of Area C groundwater is part of a comprehensive environmental investigation and remediation process currently being performed at Picatinny Arsenal. The remaining sites in Picatinny Arsenal are being considered separately, and remedies for these areas are presented in separate documents.

The Area C Groundwater Feasibility Study (FS) identified arsenic and lead as the contaminants of concern (COCs) targeted for remediation in Area C groundwater (Shaw, 2005). The remedial alternative selected to protect human health for Area C groundwater consists of the following components:

- Land use controls (LUCs) to ensure protectiveness, including land use and access restrictions, public education, and emergency provisions throughout the entire duration of the response action.
- Use of the existing Classification Exception Area (CEA)/Well Restriction Area (WRA). The CEA mandates that any proposed groundwater use within the well restriction area will require review and approval to implement modifications that would be protective of any impacts from identified contaminants for the duration of the CEA.
- Implementation of long-term groundwater monitoring (LTGM) to ensure the effectiveness of the response action.
- Performance of 5-year reviews in accordance with CERCLA and the NCP.

- Development of a remediation exit strategy to determine when monitoring efforts should be reevaluated or discontinued.

The objective of the actions described in this ROD is to ensure site conditions are protective of human health and the environment. The response actions will accomplish the objective. No materials have been identified in Area C that meet the criteria of principal threats. The remedial action will be considered complete upon agreement with USEPA Region 2 and Picatinny Arsenal. Upon agreement that remediation is complete, long-term monitoring will be discontinued per an agreed-upon exit strategy and documented in the next 5-year review. LUCs will be continued and 5-year reviews will be performed for Area C until contaminant levels are shown to allow unrestricted use and exposure.

1.5 STATUTORY DETERMINATIONS

The selected remedies are protective of human health and the environment, comply with Federal and State laws and regulations that are applicable or relevant and appropriate to the remedial actions, and are cost effective.

The selected response action is expected to reduce the site contaminant concentrations because decreases in the concentrations observed to date are anticipated to continue over time. The Selected Response Action was evaluated along with other treatment technologies in the technology screening section of Area C Groundwater FS (Shaw, 2005). The Selected Response Action for Area C groundwater is expected to be capable of meeting the remediation goals within a reasonable timeframe and more cost-effectively than the technologies that utilize active treatment.

Because these remedies will result in hazardous substances remaining on site for a period of time above levels that allow for unlimited use and unrestricted exposure, 5-year reviews will be conducted in compliance with CERCLA and the NCP to ensure that the response action is and will be protective of human health and the environment.

1.6 RECORD OF DECISION DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary (Section 2.0) of this ROD. Additional information can be found in the Administrative Record for this site.

Criterion	Section	Page Number
Chemicals of Concern and Their Respective Concentrations	2.6.5.1	2-10
Cleanup Levels Established for Chemicals of Concern and the Basis for These Levels	2.8.1.1	2-15
Current and Reasonably Anticipated Future Land Use Assumptions and Current and Potential Future Beneficial Uses of Groundwater Used in Baseline Risk Assessment and ROD	2.7	2-11
Baseline Risk Represented by the Chemicals of Concern	2.8.1.4	2-16
How Source Materials Constituting Principal Threats will be Addressed	2.12	2-27
Selected Response Action: Description, Estimated Capital, Annual Operation and Maintenance (O&M) and Total Present Worth Costs, Discount Rate, and the Number of Years Over Which the Response Action Cost Estimates are Projected	2.13	2-27
Key Factors Leading to Selection of Selected Response Action	2.14	2-30

1.7 AUTHORIZING SIGNATURE

John P. Stack
Lieutenant Colonel, U.S. Army
Garrison Commander

2 July 09
Date

for Walter E. Mugdan, Director
Emergency and Remedial Response Division
United States Environmental Protection Agency, Region 2

September 1, 2009
Date

2.0 PART 2: DECISION SUMMARY

2.1 SITE NAME, LOCATION, AND DESCRIPTION

Picatinny Arsenal, located in Morris County, NJ, near the city of Dover, is listed on USEPA's Superfund NPL. The CERCLIS identification number is NJ3210020704. The Army is the lead agency for the remedial actions at Area C of Picatinny Arsenal, and USEPA Region 2 is the support agency with oversight responsibilities. Plans and activities are also being coordinated with the appropriate NJ State agencies, including the NJDEP. The funding for this action will be provided from the Environmental Restoration Army account.

Picatinny Arsenal is located approximately 4 miles north of the City of Dover in Morris County, NJ. The location of Picatinny Arsenal is presented on **Figure 1**. Some of the nearby populous areas are Morristown, Morris Plains, Parsippany, Troy Hills, Randolph Township, and Sparta Township. The Picatinny Arsenal land area consists of 6,491 acres of improved and unimproved land. Picatinny Arsenal is situated in an elongated classic U-shaped glacial valley, trending northeast-southwest between Green Pond Mountain and Copperas Mountain on the northwest and an unnamed hill on the southeast. Most of the buildings and other facilities at Picatinny Arsenal are located on the narrow valley floor or on the slopes along the southeast side.

This ROD describes the preferred response action to reduce human health risks associated with elevated concentrations of arsenic and lead that are present in groundwater at Area C. Area C is approximately 126 acres in size and is located in the southwestern portion of Picatinny Arsenal, near the southern boundary. The area is bounded by Green Pond Brook and Area B to the northwest, Route 15 to the southwest, and the steep hillside running adjacent to Parker Road to the east. **Figure 1** illustrates the location of Area C within Picatinny Arsenal and the location of the five sites within Area C. The five sites in Area C include Site 19 (Pyrotechnic Demonstration Area), Defense Site Environmental Restoration Tracking System (DSERTS) site PICA-020; Site 25 (Sanitary Landfill), DSERTS site PICA-067; Site 26 (Dredge Pile), DSERTS site PICA-068; Site 163 (Baseball Fields), DSERTS site PICA-092; and Site 180 (Waste Burial Area), DSERTS site PICA-093. Groundwater at these sites is considered part of the Area C operable unit for purposes of this ROD. The decision to group groundwater from all Area C sites was made with the consultation of the regulatory community. Area C groundwater once included Site 23, the Post Farm Landfill, which is located on the southeast ridge of Picatinny Arsenal. Site 23 was removed from the Area C designation, and groundwater at Site 23 was addressed as part of the response action for Site 23 (IT, 2001); a final ROD for Site 23 was signed by the Army and USEPA in December 2004 (Shaw, 2004a).

The remedial actions presented in this ROD were selected by the Army, in partnership with USEPA Region 2 in accordance with CERCLA, as amended by the SARA, and to the greatest extent possible, the NCP. NJDEP concurs with the selected remedies. The remedial action is funded by the Army and was selected in accordance with Army Regulation (AR) 200-1, Environmental Protection and Enhancement, as applicable.

2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.2.1 Area C Background

There was concern about groundwater contamination in Area C due to historic activities that have been conducted within the area, such as land filling (Site 25), dumping (Site 180), and testing (Site 19). Further, because the southern boundary is the point where some Picatinny Arsenal groundwater flows off post, the Army wanted to ensure that human health and the environment would be protected from unacceptable risk. The Army as the lead agency has investigated these concerns and worked with the USEPA and NJDEP to ensure the investigation was complete.

2.2.2 Previous Investigations

Numerous environmental investigations and extensive groundwater monitoring have been conducted within Area C and along the southern boundary of the facility to evaluate whether past activities may have affected the groundwater in the area. **Table 1** lists these investigations.

Figure 1 Picatinny Arsenal Location Map, Remedial Investigation Concept Plan Areas, and Area C Site Plan

Table 1: Previous Area C Groundwater Investigations

Investigation/Study	Year	Type of Investigation
USAEHA/ICM Groundwater Sampling	1981-84	Groundwater sampling
ICM Soil Investigation	1984	Soil sampling
USGS Geophysical Survey	1986	Seismic refraction, electric-resistivity, and electromagnetic-conductivity surveys
Dames and Moore Site Investigation	1988	Surface soil, sediment, and groundwater sampling
Southern Boundary Investigation	1989	Groundwater sampling
USGS Green Pond Brook Surface Water and Sediment Investigation	1990	Surface water and sediment sampling
USGS Groundwater Investigation	1991	Groundwater flow model
Geophysical Survey for Southern Boundary	1991	Seismic Refraction
USGS Groundwater Investigation	1993	Groundwater flow model
Dames and Moore Phase I Remedial Investigation	1998	Soil, sediment, surface water, groundwater sampling, risk assessment
Shaw Area C Groundwater Data Report	2002	Groundwater investigation, contamination delineation
Shaw Area C Groundwater FS	2005	Remedial alternatives analysis for groundwater
Southern Boundary Groundwater Monitoring	Ongoing	Periodic groundwater chemical and water level monitoring along southern boundary

The majority of investigations of groundwater resources at Picatinny Arsenal have been conducted within the last 20 years. The locations of groundwater samples collected during these various studies are depicted on **Figure 2**. It should be noted that several wells outside of Area C and Picatinny Arsenal are also included in the Area C groundwater assessment to establish the upgradient and downgradient delineation for the groundwater contamination at Area C.

Overall, detections of constituents above criteria in groundwater have been either sporadic and isolated at low concentrations (such as for RDX, a compound associated with explosives), potentially related to local background geology (such as the naturally-occurring metals iron, manganese, and aluminum), or not related to site activities occurring at Picatinny (such as sodium and chloride). Leithsville Dolomite, which underlies Area C, contains numerous accessory minerals including arsenopyrite and galena which may be contributing to metals concentrations (including lead and arsenic) in groundwater. **Table 2** presents a summary of constituents that have been detected in southern boundary and Area C groundwater and that have been identified as risk or hazard contributors in the human health risk assessment (HHRA).

Monitoring of southern boundary groundwater was conducted for 12 rounds of sampling from 2002 through 2007. A limited number of exceedances were observed during this period, demonstrating that the majority of contamination observed within Area C groundwater during previous investigations is isolated and of limited extent.

Arsenic and lead, which are thought to be site related, have been detected with a greater frequency and extent at concentrations in excess of levels of concern (LOCs). Lead has been detected in areas along the southern boundary at elevated concentrations; however, continued monitoring has shown that the levels are decreasing. Additionally, the number of sample locations at which lead has been detected above the current LOC of 5 micrograms per liter (µg/L) has decreased over time. Arsenic has been detected in multiple samples in the vicinity of Site 25 at concentrations marginally above

Figure 2 Area C/Southern Boundary Monitoring Well Map

Table 2 Area C Groundwater, Summary of Risk and Hazard Contributors

LOCs; however, the area in which arsenic is present in exceedance of the LOC is relatively limited in extent, and arsenic has only been detected above the LOC in two monitoring wells located along the southern boundary of Area C (SB2-1A and SB2-2) since 2005.

The Army currently monitors 16 wells along the southern boundary of Picatinny Arsenal designated collectively as the southern boundary network of monitoring wells on a semi-annual basis. This sampling will continue until the ROD is signed. After signature of the ROD, the sampling to be completed as part of the remedial action will be finalized in the Remedial Design (RD) and reviewed by the NJDEP and USEPA. The design of the sampling program will factor in the data collection that has been completed by the Army from 2002 until present. The list of compounds to be analyzed in Area C groundwater will be presented in the Long-Term Monitoring Plan (LTMP). Additional information regarding the background of Area C can be found in greater detail in the Administrative Record file for Picatinny Arsenal.

2.2.3 Enforcement Activities

No formalized enforcement activities have occurred at Area C. Picatinny Arsenal is working in cooperation with the USEPA and NJDEP to apply appropriate remedies that will preclude the necessity of formalized enforcement actions, such as Notices of Violation.

2.3 COMMUNITY PARTICIPATION

Area C groundwater has been the topic of presentations to the Picatinny Arsenal Environmental Restoration Advisory Board (PAERAB). The Army briefed the PAERAB on November 29, 2001, on Area C groundwater. PAERAB members have provided comments regarding the proposed remedial alternative. A courtesy copy of the Proposed Plan was given to the PAERAB's co-chair, and a complimentary copy was offered to any PAERAB member who requested it. The final Proposed Plan for Area C Groundwater (Shaw, 2007) was completed and released to the public on September 19, 2007, at the information repositories listed below:

Installation Restoration Program Office
Building 319
Picatinny, NJ 07806

Rockaway Township Library
61 Mount Hope Road
Rockaway Township, NJ 07866

Morris County Library
30 East Hanover Ave
Whippany, NJ 07981

Multiple newspaper notifications were made to inform the public of the start of the Proposed Plan comment period, to solicit comments from the public, and to announce the public meeting. The notification was run in the *New Jersey-Star Ledger* and the *Daily Record* on September 11, 2007. A 30-day public comment period was held from September 20 to October 19, 2007, during which comments from the public were received. A public meeting was held on September 20, 2007, to inform the public about the Selected Response Action for Area C groundwater and to seek public comments. At this meeting, representatives from the Army, NJDEP, USEPA, and the U.S. Army Corps of Engineers were present to answer questions about the site and alternatives under consideration. Written comments were received from Subsurface Solutions on behalf of the PAERAB. Subsurface Solutions is under contract to the Army under the Technical Assistance for Public Participation (TAPP) program. Written comments were also received from the Law Offices of Schwartz, Tobia, Stanziale, Sedita and Campisano on behalf of Pondview Estates, Inc. (Pondview). Pondview is a residential development being constructed across Route 15 from the southern boundary of Picatinny Arsenal. The Army's responses to comments made at the public meeting as well as responses to the written comments are included in the Responsiveness Summary (Section 3.0) of this ROD.

2.4 SCOPE AND ROLE OF RESPONSE ACTION

As outlined in the IRP at Picatinny Arsenal, the overall environmental cleanup goal is to protect human health and the environment. The remediation of Area C groundwater is part of a comprehensive environmental investigation and remediation process currently underway to meet the IRP goals at Picatinny Arsenal.

The selected remedial action for Area C groundwater will be protective of human health and the environment because contaminant concentrations are expected to decrease over time, and an LTMP will be implemented to monitor long-term behavior of the COCs. The LTMP is the tool that will be used when the CERCLA 5-year review is conducted to assess if the response action is operating correctly and is protective of human health and the environment. The CERCLA 5-year review will document the effectiveness of the selected response action and identify any deficiencies of the response action that need to be corrected and any optimization to the monitoring program. The remedial action suggested for Area C groundwater affords protection through the enforcement of LUCs.

It should be noted that Picatinny has many existing LUCs in place. Elements of LUCs in place at Picatinny include: Site Clearance and Soil Management Procedures; Unexploded Ordnance Clearance Procedures; Master Plan Regulations; Picatinny Base Access Restrictions; Picatinny Safety Program; Army Military Construction Program; and a facility-wide CEA. In addition to these LUCs, the Army uses a Geographic Information System (GIS) as a tool to document areas of contamination and restricted land use. The Master Plan will be used to identify and enforce the LUCs. The implementation of LUCs at Picatinny will meet EPA's preference for LUCs being used in layer and/or series to enhance their overall protectiveness. The Army will act to ensure that future land use at Area C is consistent with the LUC objectives.

2.5 DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan for Area C groundwater presents the selected remedial action as the preferred alternative. No significant changes have been made.

2.6 SITE CHARACTERISTICS

2.6.1 Surface and Subsurface Features

The surface and subsurface features of Area C, such as topography, surface water hydrology, geology, and hydrogeology, are described in Sections 2.6.2 through 2.6.4 below.

According to data contained in the Picatinny Arsenal GIS, there are potentially archeologically sensitive areas within the boundaries of Area C. The selected remedial alternative for Area C will not impact the integrity of these areas. Cultural and historic data contained in the Picatinny Arsenal GIS was obtained primarily from *Architectural Assessment of Historic Structures at Picatinny Arsenal, Morris County, NJ* (Panamerican, 1999).

2.6.2 Topography/Surface Water Hydrology

The western half of Area C is flat and is in the floodplain of Green Pond Brook. The eastern half of Area C runs from the floodplains up in elevation to the unnamed southeastern ridge. The topography in Area C does not vary considerably. All of Area C is an essentially flat floodplain, approximately 685 to 695 feet (ft) mean sea level (msl). Topography, roads, and physical features of Area C are displayed on **Figure 2**.

Surface water runoff in the floodplain is controlled by a system of engineered drainage ditches. The drainage ditches carry water into Green Pond Brook. Surface water runoff from the eastern half of Area C flows rapidly down elevation into the western floodplain of Green Pond Brook. No recreational activities are associated with Green Pond Brook or the contributing drainage ditches in this area of the facility.

2.6.3 Geology and Soils

Precambrian Gneiss bedrock comprises the southeastern ridge and slope of Area C where it is overlain by approximately 5 to 130 ft of glacial deposits. The Leithsville Dolomite occurs in the valley region of Area C, where it is overlain by up to 210 ft of glacial deposits near the center of the valley. The

glacial deposits thicken toward the center of the valley and dip along the southwest strike of the valley. Hardyston Quartzite occurs between the Precambrian Gneiss and the Leithsville Dolomite and is estimated to be overlain by approximately 210 ft of glacial deposits. Both the Leithsville Dolomite and Hardyston Quartzite are Cambrian in age and do not crop out in Area C. Three major faults that strike along the valley cut these and other bedrock units at Picatinny. A number of smaller cross faults that cut only the Proterozoic gneiss units in the western part of the valley have also been identified. Bedrock formations dip steeply to the northwest and are overlain by undeformed glacial sediments.

2.6.4 Hydrogeology

A total of 42 monitoring wells are considered to be part of the Area C operable unit, including the 16 wells located along the southern boundary of the facility and Area C, designated as the southern boundary wells. **Figure 2** shows the approximate location of the monitoring wells in Area C.

Four separate aquifers have been identified in Area C. The aquifers consist of an unconfined glacial aquifer, an upper semi-confined glacial aquifer, a lower semi-confined glacial aquifer, and a bedrock aquifer. **Figure 3** is a conceptual illustration of the hydrogeologic framework for Area C. The unconfined aquifer corresponds to the upper unit of sediments. The unconfined aquifer occurs closest to the surface, has a thickness ranging from 3 to 35 ft, has an average horizontal gradient of 0.007, and has an average hydraulic conductivity of 23 feet per day (ft/day) (Dames and Moore, 1998).

The upper semi-confined aquifer corresponds to the intermediate fine-grained unit of sediments and is encountered at depths ranging from 20 to 50 ft below ground surface (bgs). This aquifer is made up predominantly of silt and clay and is a low permeability unit. Since the upper semi-confined glacial aquifer is finer-grained than the overlying and underlying aquifers, it retards downward groundwater flow to the lower semi-confined and bedrock aquifers. Two wells within Area C, LF-2 and SB1-3, are screened within the upper semi-confined aquifer. No hydrogeologic characterization data is available for this aquifer within Area C. However, slug tests were conducted within the upper semi-confined aquifer up valley of Area C at Site 78 (78MW-2). Results of these slug tests indicate a hydraulic conductivity of 4.6 ft/day. The hydraulic gradient was calculated to be 0.002 feet per foot (ft/ft) based upon synoptic water level measurements collected in July 2003 at monitoring wells MW24-4B and LF-2.

The top of the lower semi-confined aquifer is encountered at depths ranging from 35 ft bgs in the northern portion of Area C to 150 ft bgs near the southern portion. The thickness of this aquifer ranges from 0 ft on the southeastern ridge to 163 ft in the center of the valley. As reported in the Phase I Remedial Investigation (RI) report (Dames and Moore, 1998), the average hydraulic gradient in the lower semi-confined aquifer is 0.006 ft/ft and the average hydraulic conductivity is 34 ft/day.

The bedrock aquifer is subdivided into a gneissic bedrock aquifer and a dolomitic bedrock aquifer. The gneissic bedrock aquifer occurs along the southeastern ridge and associated slopes and is encountered at depths ranging from 5 to 70 ft bgs. Along the ridge and associated slopes, the unconfined glacial aquifer directly overlays the bedrock aquifer, and the upper and lower semi-confined glacial aquifers are absent. The dolomitic bedrock aquifer occurs in the valley region and is encountered at depths ranging from 180 to 212 ft bgs.

Groundwater flow within the gneissic aquifer follows the general surface topography in the area, and horizontal groundwater flow is toward the west (off the eastern valley wall) into the valley. Data suggests groundwater flow within the dolomitic aquifer is down valley toward the southwest (Shaw, 2005).

The potentiometric surface of the lower semi-confined aquifer indicates that the direction of horizontal groundwater flow is toward the southwest (down valley), similar to the direction of flow within the dolomitic bedrock aquifer. The potentiometric surface of the upper semi-confined aquifer indicates that the direction of horizontal groundwater flow is away from the valley walls before flowing down the valley. Potentiometric surface of the unconfined aquifer (i.e., the water table) indicates that the direction of horizontal groundwater flow is away from the valley walls before flowing down the valley (similar to the flow in the upper semi-confined aquifer), and ultimately discharging into Green Pond Brook.

In 1993, the U.S. Geological Survey (USGS) conducted a study to analyze the groundwater flow at Picatinny, using a three-dimensional finite difference groundwater flow model to simulate groundwater flow

Figure 3 Area C/Southern Boundary Conceptual Geologic Block Cross Section

to a hypothetical water-supply well near the southern boundary at Picatinny (USGS, 1993). The flow in the glacial sediments and bedrock was simulated. Results of the USGS groundwater modeling effort indicate that valley-wide groundwater flow in the unconfined aquifer is towards Green Pond Brook, the upper semi-confined aquifer is similar to the unconfined aquifer with a slightly down-valley component, and bedrock groundwater flow has a down-valley component towards the southwest.

Oriented coring of bedrock was conducted in 2001 to determine the overall fabric and three-dimensional orientation of fractures within the granitic gneiss unit in the extreme southern part of Area C (Shaw, 2005). Overall, the gneiss bedrock was highly fractured throughout, with over 130 fractures observed over 70 ft. In general, both steep and shallow fractures were fairly open with evidence of groundwater flow (i.e., recrystallization, discoloration, weathering, and sedimentation on the fracture surfaces). The abundance and interconnected nature of the fractures indicate that the orientation of fractures would have little or no influence on the direction of groundwater flow through this unit. Of the fractures that were measured, northeast trending fracture planes were the most abundant. The dominant set of fractures correspond to the strike of the major faults (Tanners Brook-Green Pond Fault, Berkshire Valley Fault, and Picatinny Fault) that dissect the valley of Picatinny.

There are five well clusters within Area C that provide data about vertical groundwater flow. Two of the well clusters (LF and SB4) have elevation data from all four aquifers. The other three clusters (SB1, SB2, and SB3) have elevation data from three of the four aquifers. The direction of groundwater flow is from higher elevations to lower elevations (i.e., from higher pressure to lower pressure). In the three well clusters with elevation data in both the unconfined and upper semi-confined aquifers (LF, SB1, and SB4), the groundwater is flowing upward (i.e., recharging into the unconfined aquifer). It is reasonable to expect that if there were elevation data for the upper semi-confined aquifer in the other two clusters (SB2 and SB3), that the groundwater would also be flowing upward.

In the four well clusters with elevation data in the bedrock and lower semi-confined aquifers (LF, SB2, SB3, and SB4), groundwater is flowing downward except in cluster SB3. This suggests that groundwater in the lower semi-confined aquifer in the valley floor is flowing downward into the bedrock aquifer, and that at the edge of the valley wall (cluster SB3) the groundwater is flowing upward into the lower semi-confined aquifer (likely due to the high hydraulic pressure of the groundwater within the valley walls, i.e., much higher elevation). In the two well clusters with elevation data in both the upper and lower semi-confined aquifers, the groundwater is flowing downward into the lower semi-confined aquifer.

Based on the upper and lower semi-confined aquifer elevation data in clusters LF and SB4, and the other observations noted above, it appears that groundwater in the upper semi-confined aquifer is discharging upward into the unconfined aquifer above it, and that the groundwater in the unconfined aquifer is ultimately discharging into Green Pond Brook. Groundwater in the lower semi-confined and bedrock aquifers is moving down valley as part of the more regional groundwater flow of the Picatinny Valley.

2.6.5 Nature and Extent of Contamination

This summary of the nature and extent of contamination is based on studies performed by the U.S. Army Environmental Hygiene Agency (USAEHA) and USGS, information provided by the RI, and regular groundwater monitoring performed by the Army since 2001 at the Area C and southern boundary monitoring wells to focus on the nature and extent of contamination present in Area C groundwater. This section focuses on the extent and history of the contamination in Area C groundwater. The potential excess cancer risk and health hazard estimates associated with this contamination are presented in Section 2.8 of this ROD. The Army is conducting separate studies that focus on contamination known or suspected to be present at other sites in Picatinny Arsenal. The administrative record file for the site includes detailed information about individual investigations and sampling results summarized herein.

2.6.5.1 Groundwater

The most comprehensive and recent data sets (1998 Phase I RI and 2001-2007 Area C/Southern Boundary groundwater monitoring) were used to evaluate the groundwater quality. **Figure 2** presents locations of groundwater monitoring wells sampled during the previous investigations. Data sets and additional detail about the previous investigations summarized in **Table 1** and on **Figures 4 and 5** are available in the administrative record.

The Phase I RI Report concluded that there were only limited exceedances of volatile organic compounds (VOCs) and dioxins/furans in groundwater in Area C. Detections of explosive compounds appeared to be related to activities at the Burning Ground (Site 34) and the pyrotechnic area (Site 19). Exceedances of lead and arsenic were widespread throughout the area with no specific identifiable source.

Monitoring of southern boundary groundwater has been conducted for 12 rounds of sampling from 2002 through 2007. A limited number of exceedances have been observed during this period, demonstrating that the majority of contamination observed within Area C groundwater is isolated and of limited extent. In addition, the number of exceedances has decreased over time, indicating a downward trend in the concentrations and suggesting that the contamination is attenuating.

Lead has been detected in areas along the southern boundary; however, continued monitoring has shown that the levels are decreasing. **Figure 4** shows the monitoring wells in Area C and along the southern boundary in which lead has been detected above the LOC (indicated by red coloring) during three discrete time periods – 1993 to 1995, 2001 to 2003, and 2004 to 2008. **Figure 4** illustrates the decreasing number of sample locations over time at which lead has been detected above the current LOC of 5 µg/L.

Arsenic has been detected in multiple samples in the vicinity of Site 25 at concentrations marginally above LOCs; however, the area in which arsenic is present in exceedance of LOCs is relatively limited in extent, and arsenic has only been detected in two southern boundary monitoring wells (SB2-1A and SB2-2) above the LOC of 3.0 µg/L since 2005. **Figure 5** illustrates the monitoring wells in which arsenic has been detected above the LOC (indicated by red coloring) during three discrete time periods – 1993 to 1995, 2001 to 2004, and 2005 to 2008.

Overall, detections of constituents above criteria in groundwater have either been sporadic and isolated at low concentrations (such as for RDX, an explosive compound, VOCs and dioxins/furans), potentially related to local background geology (such as the naturally-occurring metals iron, manganese, and aluminum), or not related to site activities occurring at Picatinny (such as sodium and chloride). Local bedrock geology may also be contributing in part to the arsenic and lead concentrations in the Area C groundwater. The Leithsville Dolomite, which underlies the site, contains arsenic and lead-bearing accessory minerals such as arsenopyrite and galena.

2.7 CURRENT AND POTENTIAL FUTURE LAND USES AND DESIGNATION OF AREA C

The predominant land use throughout Area C is industrial with small areas that are intermittently used for recreational purposes (hunting and softball). Activities conducted in this area of Picatinny Arsenal include:

- Former Pyrotechnic Demonstration Area (Site 19)
- Sanitary Landfill (Site 25)
- Dredge Pile from Green Pond Brook (Site 26)
- Baseball Fields (Site 163)
- Waste Burial Area (Site 180)

According to the Picatinny Arsenal Master Plan (Parsons, 2007), the future land uses within Area C will continue to be for industrial and intermittent recreational activities; however, the potential of a public/private partnership leasing some of the land within Area C for use as an industrial park is a possibility.

Picatinny Arsenal is located over an aquifer with a designated use of Class IIA, current source of drinking water. Although Area C groundwater is currently not used for any purpose, the USEPA policy objective is to return usable groundwater to their beneficial uses wherever practicable, within a timeframe that is reasonable given the particular circumstances of the site. Area C groundwater is included within an NJDEP-approved CEA, described in a letter dated July 29, 2002, from the Army to the NJDEP, for the consolidated and unconsolidated aquifers. The most recent CEA recertification was approved by NJDEP in January 2008. The terminology “unconsolidated aquifers” in the CEA encompasses the unconfined,

Figure 4 – Area C/Southern Boundary Monitoring Wells, Lead in Groundwater 1993-1995, 2001-2003, 2004-2007

Figure 5 – Area C/Southern Boundary Monitoring Wells, Arsenic in Groundwater 1993-1995, 2001-2002, 2003-2007

upper semi-confined, and lower semi-confined aquifers that underlie Area C. The CEA was established for many compounds previously detected within the confines of Picatinny Arsenal. This includes the COCs established for Area C Groundwater (see Section 2.8.1.1). The Picatinny Arsenal CEA mandates that any proposed groundwater use within the CEA will require NJDEP review and approval to ensure that modifications would be protective of any impacts from identified contaminants for the duration of the CEA. The Army will continue to update the CEA and submit biennial recertifications in accordance with NJDEP regulations. Picatinny Arsenal is an active military installation with a potable water system that currently meets all of its needs. The Picatinny Arsenal Master Plan Environmental Assessment indicates that potable water use averages 0.64 million gallons per day (MGD), and is expected to increase to 1.24 MGD through the year 2012. The future projected water demand is well below the average draw of 1.83 MGD allowed by the NJDEP Water Allocation Permit and should not have an adverse impact on the protectiveness of the selected response action. According to the Master Plan, Picatinny Arsenal's existing water supply and treatment facilities are adequate to support future growth.

2.8 SUMMARY OF SITE RISKS

This section presents the results of the Area C human health and ecological risk assessments that were conducted for the Phase I RI. Baseline risk assessments were conducted for Area C groundwater to determine the current and future effects of contaminants on human health. It is reasonably anticipated that there will be no change in the land use at Area C. Correspondingly, it is reasonably anticipated that Area C groundwater will not be used in the future for potable water. However, groundwater within Area C is designated as a current or potential source of drinking water. The USEPA has a policy objective to return groundwater for beneficial use. Accordingly, the risk assessments were designed to evaluate the potential impact to human health should Area C groundwater be used as a source of potable drinking water.

All of the risk assessments summarized below were performed at the request of the USEPA. It should be noted that currently Area C is within a NJDEP-approved CEA. The NJDEP has identified the CEA as a WRA that functions as an institutional control to restrict potable use within the boundaries of the CEA. Therefore, direct residential human exposures to untreated groundwater are unlikely. Additionally, the Army has installed and maintained well head treatment on Picatinny's potable wells. The CEA and well head treatment act as an interim remedial action. It should be noted that the Picatinny potable wells are in the center of the Arsenal, and the well capture zones do not include Area C. A summary of the results of the HHRA are presented in the following sections.

The response action selected in this ROD is necessary to protect human health from actual or threatened releases of hazardous substances into the environment.

2.8.1 Human Health Risk Assessment

To determine whether risk-based remedial action is warranted, USEPA requires a baseline HHRA be conducted for each site. The baseline risk assessment is an evaluation of cancer risks and non-cancer hazards of constituents of potential concern (COPCs) associated with a site if no remedial action was taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. This section summarizes the results of the baseline risk assessment for this site. As part of the baseline HHRA, estimates of exceeded cancer risks and non-cancer health hazards are quantified for potential receptor populations and exposure scenarios.

Currently, USEPA guidelines for excess carcinogenic site risk to an individual, based on the reasonable maximum exposure (RME) for both current and future land use, use a risk range of $1x10^{-6}$ (one in one million) to $1x10^{-4}$ (one in ten thousand) as a target range within which the USEPA strives to manage risks as part of a Superfund Cleanup. Risk levels within this target range generally do not warrant remedial action whereas exceedances of the target range generally do trigger an action.

Potential non-carcinogenic effects are evaluated by comparing the calculated exposure intakes of the COPCs to the chemical-specific reference doses. This ratio of exposure to toxicity is called the hazard quotient (HQ). HQs greater than 1 are indicative of potential adverse health effects. The hazard index (HI) is the sum of all HQs for all COPCs that affect the same target organ, or act through the same mechanism of action within a media or across all media, of a reasonably maximum exposed individual. In general, HIs that are less than 1 are not likely to be associated with non-cancer hazards.

2.8.1.1 Identification of Contaminants of Concern

This section presents a summary of the COC selection that was performed as part of the *Area C Groundwater FS* (Shaw, 2005). A determination of COCs was also performed for the Phase I HHRA (Dames and Moore, 1998) in accordance with the Risk Assessment Guidance for Superfund.

COCs were identified for Area C groundwater based on exceedance of groundwater standards, risk and hazard contributors in the HHRA, and contaminant distribution indicative of a contaminant plume. Inorganic contaminants exhibiting random distribution or that likely were attributable to background conditions or site geology were removed from COC consideration. Organic contaminants that were sporadically detected and not confirmed in adjacent or subsequent samples were also eliminated via this criterion. For two metals, arsenic and lead, concentrations were detected at levels greater than promulgated groundwater comparison criteria, were not sporadic, and were confirmed at multiple locations during multiple rounds of sampling. Arsenic was a significant driver of unacceptable risk and hazard in both aquifers and all exposure scenarios. While the baseline HHRA did not include the performance of a lead uptake model, lead has exhibited persistent detections above promulgated groundwater criteria. Thus, arsenic and lead were considered COCs, as shown in **Table 3**.

Groundwater cleanup levels were identified only for contaminants considered COCs. Site Cleanup Levels (SCLs) were selected from the lowest potential chemical-specific Applicable or Relevant and Appropriate Requirement (ARAR) in existence for each COC. The following SCLs were identified for Area C groundwater based on NJ Practical Quantitation Limits (PQLs) (arsenic) and NJ Groundwater Criteria (lead).

Table 3: Area C Groundwater Site Cleanup Levels

COC	Cleanup Levels (µg/L)	Source
Arsenic	3	NJ Practical Quantitation Limit NJAC 7:9C-1.5 through 1.9 and Table 1
Lead	5	NJ Groundwater Criteria NJAC 7:9C-1.5 through 1.9 and Table 1

2.8.1.2 Exposure Assessment

The Phase I HHRA examined several hypothetical exposure pathways based on potential future use of site groundwater. It should be noted that exposure to Area C groundwater is not applicable under current use conditions, as Picatinny maintains its own potable water supply and distribution network to serve its entire population, including Area C. As stated above, it is reasonably anticipated that there will be no change in the land use at Area C. However, based on established methodologies set in place as part of a negotiation with the USEPA, the risk assessment evaluated the site for land use scenarios in which groundwater use was assumed. The potential receptors and pathways assessed in the HHRA for exposure to contaminated groundwater included:

- Future ingestion of groundwater used as drinking water by Picatinny Arsenal workers.
- Future ingestion of groundwater used as drinking water by combined adult/child residents.
- Future ingestion of groundwater used as drinking water by child residents.
- Future inhalation of VOCs in groundwater while showering by combined adult/child residents.
- Future inhalation of VOCs in groundwater while showering by child residents.

- Future dermal absorption of chemicals in groundwater while showering by combined adult/child residents.
- Future dermal absorption of chemicals in groundwater while showering by child residents.

Children are considered separately because they are a sensitive subpopulation with a higher ingestion/ inhalation rate relative to body weight.

2.8.1.3 Toxicity Assessment

The potential toxicity of chemicals to humans was presented and the chemical-specific toxicity criteria were compiled for each COPC within the Phase I risk assessment. The toxicity criteria used in the quantitative assessment were obtained from USEPA's Integrated Risk Information System, the Health Effects Assessment Summary Tables, and the National Center for Environmental Assessment.

2.8.1.4 Risk Characterization

For carcinogens, risks are generally expressed as the incremental probability of an individual's developing cancer over a lifetime as a result of exposure to the carcinogen. Excess lifetime cancer risk is calculated from the following equation:

$$Risk = CDI \times SF$$

where: risk = a unitless probability (e.g., 2×10^{-5}) of an individual's developing cancer
CDI = chronic daily intake averaged over 70 years (mg/kg-day)
SF = slope factor, expressed as $(mg/kg\text{-}day)^{-1}$

These risks are probabilities that usually are expressed in scientific notation (e.g., $1x10^{-6}$). An excess lifetime cancer risk of $1x10^{-6}$ indicates that an individual experiencing the RME estimate has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as an "excess lifetime cancer risk" because it would be in addition to the risks of cancer individuals face from other causes such as smoking or exposure to too much sun. USEPA identifies cancer risks of 10^{-6} to 10^{-4} as a target range within which USEPA strives to manage risks for site-related exposures for Superfund sites.

The potential for non-carcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g., lifetime) with a reference dose (RfD) derived for a similar exposure period. A RfD represents a level that an individual may be exposed to that is not expected to cause any deleterious effect. The ratio of exposure to toxicity is called an HQ. An HQ<1 indicates that a receptor's dose of a single contaminant is less than the RfD, and that toxic noncarcinogenic effects from that chemical are unlikely. The HI is generated by adding the HQs for all chemicals of concern that affect the same target organ (e.g., liver) or that act through the same mechanism of action within a medium or across all media to which a given individual may reasonably be exposed. An HI<1 indicates that, based on the sum of all HQ's from different contaminants and exposure routes, toxic noncarcinogenic effects from all contaminants are unlikely. An HI>1 indicates that site-related exposures may present a risk to human health. The HQ is calculated as follows:

$$\text{Non-cancer HQ} = CDI/RfD$$

where: CDI = Chronic daily intake
RfD = reference dose

CDI and RfD are expressed in the same units and represent the same exposure period (i.e., chronic, subchronic, or short-term).

The results of the Phase I HHRA identified a cancer risk above the USEPA's target risk range of $1x10^{-6}$ to $1x10^{-4}$ for the future child resident scenario ($2x10^{-4}$) and combined adult/child resident scenario ($6x10^{-4}$). Risk equal to the upper bound of the target range of $1x10^{-4}$ was identified for the future Picatinny worker and the combined adult/child resident exposed to groundwater. Unacceptable human

health risks are only associated with Area C groundwater exposure via the ingestion pathway. The noncancer HI for all three receptor populations exceeded the target HI of 1 with values of 5, 10, and 30, respectively, for the worker, adult/child, and child exposure scenarios. HHRA COCs identified in the Phase I HHRA for the Area C surficial aquifer included chloroform, trichloroethene (TCE), arsenic, beryllium, iron, manganese, heptachlor epoxide, OCDD, and 2,3,7,8-TCDD. HHRA COCs identified in the semi-confined aquifer included carbon tetrachloride, arsenic, beryllium, iron, and manganese. Results of the HHRA for exposure to Area C groundwater are summarized in **Tables 4, 5, 6, 7, 8, and 9**.

The target risk range was exceeded for Area C groundwater as calculated in the Phase I RI Report, with a total of 19 constituents considered risk or hazard contributors. However, seven of the risk/hazard contributors (carbon tetrachloride, chloroform, 1,4-dichlorobenzene, heptachlor epoxide, 3-nitrotoluene, barium, and copper) were not selected as COPCs because they were not detected above LOCs. The 12 contributors that were detected one or more times above the LOCs and thus selected as COPCs are three VOCs (chlorobenzene, dichloroethene, TCE), two dioxins (OCDD and 2,3,7,8-TCDD), and seven metals (aluminum, arsenic, beryllium, chromium, iron, manganese, and vanadium). However, an evaluation of the distribution of risk contributors between Area C groundwater samples and samples collected from monitoring wells along the southern boundary reveals that of the 12 risk contributors detected above LOCs, only the seven metals have been detected above LOCs at the southern boundary. (Refer to Section 2.8.1.1 for a discussion of final COCs.)

Table 4: Area C Groundwater Risk Characterization Summary – Carcinogens

Scenario Timeframe: Future

Receptor Population: Picatinny Arsenal Workers

Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Constituent	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Surficial Aquifer Use	Chloroform	1.0×10^{-8}	NA	NA	1.0×10^{-8}
			TCE	2.0×10^{-8}	NA	NA	2.0×10^{-8}
			1,4-DCB	2.0×10^{-7}	NA	NA	2.0×10^{-7}
			Arsenic	4.0×10^{-5}	NA	NA	4.0×10^{-5}
			Beryllium	2.0×10^{-5}	NA	NA	2.0×10^{-5}
			Heptachlor epoxide	1.0×10^{-7}	NA	NA	1.0×10^{-7}
			2,4,7,8-TCDD	8.0×10^{-5}	NA	NA	8.0×10^{-5}
			OCDD	4.0×10^{-7}	NA	NA	4.0×10^{-7}
						TOTAL RISK	**1.0×10^{-4}**
Groundwater	Groundwater	Semiconfined Aquifer Use	Carbon Tetrachloride	3.0×10^{-7}	NA	NA	3.0×10^{-7}
			Arsenic	2.0×10^{-5}	NA	NA	2.0×10^{-5}
			Beryllium	1.0×10^{-5}	NA	NA	1.0×10^{-5}
						TOTAL RISK	**3.0×10^{-5}**

Table 5: Area C Groundwater Risk Characterization Summary – Carcinogens

Scenario Timeframe: Future

Receptor Population: Residents

Receptor Age: Adult/Child

Medium	Exposure Medium	Exposure Point	Constituent	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Surficial Aquifer Use	Chloroform	5.0×10^{-8}	1.0×10^{-6}	2.0×10^{-12}	1.0×10^{-6}
			TCE	1.0×10^{-7}	9.0×10^{-8}	1.0×10^{-11}	1.9×10^{-7}
			1,4-DCB	6.0×10^{-7}	NA	6.0×10^{-11}	6.0×10^{-7}
			Arsenic	2.0×10^{-4}	NA	1.0×10^{-10}	2.0×10^{-4}
			Beryllium	8.0×10^{-5}	NA	2.0×10^{-9}	8.0×10^{-5}
			Heptachlor epoxide	4.0×10^{-7}	7.0×10^{-7}	3.0×10^{-10}	1.1×10^{-6}
			2,4,7,8-TCDD	3.0×10^{-4}	NA	4.0×10^{-6}	3.0×10^{-4}
			OCDD	2.0×10^{-6}	NA	NA	2.0×10^{-6}
						TOTAL RISK	**6.0×10^{-4}**
Groundwater	Groundwater	Semiconfined Aquifer Use	Carbon Tetrachloride	1.0×10^{-6}	8.0×10^{-7}	6.0×10^{-11}	1.8×10^{-6}
			Arsenic	9.0×10^{-5}	NA	6.0×10^{-11}	9.0×10^{-5}
			Beryllium	4.0×10^{-5}	NA	1.0×10^{-9}	4.0×10^{-5}
						TOTAL RISK	**1.0×10^{-4}**

Table 6: Area C Groundwater Risk Characterization Summary - Carcinogens

Scenario Timeframe: Future

Receptor Population: Residents

Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Constituent	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Surficial Aquifer Use	Chloroform	2.0×10^{-8}	4.0×10^{-7}	4.0×10^{-13}	4.2×10^{-7}
			TCE	4.0×10^{-8}	4.0×10^{-8}	2.0×10^{-12}	8.0×10^{-8}
			1,4-DCB	2.0×10^{-7}	NA	1.0×10^{-11}	2.0×10^{-7}
			Arsenic	6.0×10^{-5}	NA	4.0×10^{-11}	6.0×10^{-5}
			Beryllium	3.0×10^{-5}	NA	8.0×10^{-10}	3.0×10^{-5}
			Heptachlor epoxide	2.0×10^{-7}	3.0×10^{-7}	4.0×10^{-11}	5.0×10^{-7}
			2,4,7,8-TCDD	1.0×10^{-4}	NA	7.0×10^{-7}	1.0×10^{-4}
			OCDD	7.0×10^{-7}	NA	NA	7.0×10^{-7}
						TOTAL RISK	**2.0×10^{-4}**
Groundwater	Groundwater	Semiconfined Aquifer Use	Carbon Tetrachloride	4.0×10^{-7}	3.0×10^{-7}	1.0×10^{-11}	7.0×10^{-7}
			Arsenic	3.0×10^{-5}	NA	2.0×10^{-11}	3.0×10^{-5}
			Beryllium	2.0×10^{-5}	NA	4.0×10^{-10}	2.0×10^{-5}
						TOTAL RISK	**5.0×10^{-5}**

Table 7: Area C Groundwater Risk Characterization Summary – Non-Carcinogens

Scenario Timeframe: Future

Receptor Population: Picatinny Arsenal Workers

Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Constituent	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Surficial Aquifer Use	1,2-Dichloroethene	5×10^{-3}	NA	NA	5×10^{-3}
			Chlorobenzene	8×10^{-4}	NA	NA	8×10^{-4}
			Chloroform	5×10^{-4}	NA	NA	5×10^{-4}
			TCE	1×10^{-3}	NA	NA	1×10^{-3}
			3-Nitrotoluene	2×10^{-3}	NA	NA	2×10^{-3}
			Aluminium	9×10^{-2}	NA	NA	9×10^{-2}
			Arsenic	2×10^{-1}	NA	NA	2×10^{-1}
			Barium	2×10^{-2}	NA	NA	2×10^{-2}
			Beryllium	2×10^{-3}	NA	NA	2×10^{-3}
			Chromium	1×10^{-4}	NA	NA	1×10^{-4}
			Copper	6×10^{-3}	NA	NA	6×10^{-3}
			Iron	4×10^{0}	NA	NA	4×10^{0}
			Manganese	8×10^{-1}	NA	NA	8×10^{-1}
			Vanadium	3×10^{-2}	NA	NA	3×10^{-2}
			Heptachlor epoxide	2×10^{-3}	NA	NA	2×10^{-3}
						TOTAL RISK	**5×10^{0}**
Groundwater	Groundwater	Semiconfined Aquifer Use	Carbon Tetrachloride	9×10^{-3}	NA	NA	9×10^{-3}
			Arsenic	1×10^{-1}	NA	NA	1×10^{-1}
			Barium	7×10^{-2}	NA	NA	7×10^{-2}
			Beryllium	1×10^{-3}	NA	NA	1×10^{-3}
			Iron	2×10^{-1}	NA	NA	2×10^{-1}
			Manganese	5×10^{-1}	NA	NA	5×10^{-1}
						TOTAL RISK	**9×10^{-1}**

Table 8: Area C Groundwater Risk Characterization Summary – Non-Carcinogens

Scenario Timeframe: Future

Receptor Population: Residents

Receptor Age: Adult/Child

Medium	Exposure Medium	Exposure Point	Constituent	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Surficial Aquifer Use	1,2-Dichloroethene	2×10^{-2}	NA	2×10^{-7}	2×10^{-2}
			Chlorobenzene	3×10^{-3}	2×10^{-2}	4×10^{-7}	2×10^{-2}
			Chloroform	2×10^{-3}	NA	9×10^{-8}	2×10^{-3}
			TCE	4×10^{-3}	NA	5×10^{-7}	4×10^{-3}
			1,4-Dichlorobenzene	NA	4×10^{-4}	NA	4×10^{-4}
			3-Nitrotoluene	6×10^{-3}	NA	2×10^{-7}	6×10^{-3}
			Aluminium	3×10^{-1}	NA	1×10^{-6}	3×10^{-1}
			Arsenic	8×10^{-1}	NA	6×10^{-7}	8×10^{-1}
			Barium	8×10^{-2}	NA	3×10^{-7}	8×10^{-2}
			Beryllium	8×10^{-3}	NA	2×10^{-7}	8×10^{-3}
			Chromium	4×10^{-4}	NA	7×10^{-9}	4×10^{-4}
			Copper	2×10^{-2}	NA	2×10^{-8}	2×10^{-2}
			Iron	$1 \times 10^{+1}$	NA	3×10^{-5}	1×10^{-1}
			Manganese	3×10^{0}	NA	2×10^{-5}	3×10^{0}
			Vanadium	9×10^{-2}	NA	3×10^{-6}	9×10^{-2}
			Heptachlor Epoxide	9×10^{-3}	NA	5×10^{-6}	9×10^{-3}
						TOTAL RISK	**$1 \times 10^{+1}$**
Groundwater	Groundwater	Semiconfined Aquifer Use	Carbon Tetrachloride	3×10^{-2}	NA	1×10^{-6}	3×10^{-2}
			Arsenic	5×10^{-1}	NA	3×10^{-7}	5×10^{-1}
			Barium	3×10^{-1}	NA	1×10^{-6}	3×10^{-1}
			Beryllium	4×10^{-3}	NA	1×10^{-7}	4×10^{-3}
			Iron	8×10^{-1}	NA	1×10^{-6}	8×10^{-1}
			Manganese	2×10^{0}	NA	1×10^{-5}	2×10^{0}
						TOTAL RISK	**4×10^{0}**

Table 9: Area C Groundwater Risk Characterization Summary – Non-Carcinogens

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Constituent	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Surficial Aquifer Use	1,2-Dichloroethene	3×10^{-2}	NA	1×10^{-7}	3×10^{-2}
			Chlorobenzene	5×10^{-3}	3×10^{-2}	3×10^{-7}	3×10^{-2}
			Chloroform	3×10^{-3}	NA	8×10^{-8}	3×10^{-3}
			TCE	7×10^{-3}	NA	4×10^{-7}	7×10^{-3}
			1,4-Dichlorobenzene	NA	9×10^{-4}	NA	9×10^{-4}
			3-Nitrotoluene	1×10^{-2}	NA	2×10^{-7}	1×10^{-2}
			Aluminium	6×10^{-1}	NA	2×10^{-6}	6×10^{-1}
			Arsenic	2×10^{0}	NA	1×10^{-6}	2×10^{0}
			Barium	1×10^{-1}	NA	6×10^{-7}	1×10^{-1}
			Beryllium	2×10^{-2}	NA	4×10^{-7}	2×10^{-2}
			Chromium	8×10^{-4}	NA	1×10^{-8}	8×10^{-4}
			Copper	4×10^{-2}	NA	4×10^{-8}	4×10^{-2}
			Iron	$2 \times 10^{+1}$	NA	4×10^{-5}	$2 \times 10^{+1}$
			Manganese	5×10^{0}	NA	3×10^{-5}	5×10^{0}
			Vanadium	2×10^{-1}	NA	5×10^{-6}	2×10^{-1}
			Heptachlor Epoxide	2×10^{-2}	NA	4×10^{-6}	2×10^{-2}
						TOTAL RISK	**$3 \times 10^{+1}$**
Groundwater	Groundwater	Semiconfined Aquifer Use	Carbon Tetrachloride	6×10^{-2}	NA	1×10^{-6}	6×10^{-2}
			Arsenic	8×10^{-1}	NA	5×10^{-7}	8×10^{-1}
			Barium	5×10^{-1}	NA	2×10^{-6}	5×10^{-1}
			Beryllium	8×10^{-3}	NA	2×10^{-7}	8×10^{-3}
			Iron	1×10^{0}	NA	3×10^{-6}	1×10^{0}
			Manganese	3×10^{0}	NA	2×10^{-5}	3×10^{0}
						TOTAL RISK	**5×10^{0}**

2.8.2 Ecological Risk Assessment

The scope of this ROD is limited to the evaluation of alternatives for remediation of Area C groundwater and does not address other media (i.e., soil, surface water, or sediment). Area C groundwater from the unconfined aquifer ultimately discharges into Green Pond Brook. As both human health and ecological risks associated with water in Green Pond Brook are addressed separately in the Green Pond Brook ROD (Shaw, 2004b), ecological risk was not evaluated for Area C groundwater.

2.9 REMEDIAL ACTION OBJECTIVES

Remedial Action Objectives (RAOs) for Area C Groundwater have been developed pursuant to exceedances of chemical specific ARARs (New Jersey Groundwater Criteria/PQLs) and unacceptable

risk identified for reasonably anticipated future use. Such objectives are developed based on criteria outlined in Section 121 of CERCLA and Section 300.430 (e)(2) of the NCP.

The RAOs for Area C groundwater have been developed in such a way that attainment of these goals will result in the protection of human health. RAOs for Area C groundwater are specific to groundwater contamination identified within Area C and along the southern boundary of Picatinny Arsenal. The RAOs for Area C groundwater are:

- Prevent human consumption of, and contact with contaminated Area C groundwater.
- Protect uncontaminated groundwater for designated uses.
- Attain SCLs in Area C groundwater

As an additional safeguard, the RAO to minimize human exposure to Area C groundwater will be met by the Picatinny Arsenal CEA until such time that attainment of the SCLs and aquifer restoration are achieved. Picatinny has many existing LUCs in place to prevent a change in land use and the ingestion of groundwater at Area C. The Master Plan will be used to identify and enforce the LUCs. The existing LUCs at Picatinny such as the CEA and Master Plan meet EPA's preference for LUCs being used in layer and/or series to enhance their overall protectiveness. The risks identified in the previous section will be mitigated by attainment of these RAOs, as the only unacceptable human health risk is due to ingestion of the Area C groundwater. By preventing consumption of the groundwater, the human ingestion risk is mitigated. LTGM will be performed in accordance with the LTMP until the SCLs are attained. The list of compounds to be analyzed in the LTM program will be specified in the LTMP. The LTMP will develop this list to be consistent with previous monitoring programs and will contain compounds other than COCs (arsenic and lead).

2.10 DESCRIPTION OF ALTERNATIVES

Area C has undergone an RI/FS in accordance with the CERCLA process. The RI phase is the mechanism for collecting data to characterize the site and assess potential risk. The Phase I RI HHRA identified unacceptable risk to potential receptors. The results of the HHRA identified a cancer risk above the USEPA's target risk range of $1x10^{-6}$ to $1x10^{-4}$ for the future child resident scenario ($2x10^{-4}$) and combined adult/child resident scenario ($6x10^{-4}$). Risk equal to the upper bound of the target range of $1x10^{-4}$ was identified for the future Picatinny worker and the combined adult/child resident exposed to groundwater. The noncancer HI for all three receptor populations exceeded the target HI of 1, with values of 5, 10, and 30, respectively, for the worker, adult/child, and child exposure scenarios. The legal drivers for performance of a remedial action at this site are risk in excess of 10^{-4}, hazard in excess of 1, and exceedances of groundwater ARARs (NJDEP Groundwater Quality Criteria/PQLs). The RI phase is followed by the FS phase, which involves the development, screening, and detailed evaluation of remedial alternatives.

Six general response actions (GRAs) for Area C groundwater were identified and included in the FS: No Action, LUCs, LTGM, ex-situ restoration, in-situ passive restoration, and in-situ active restoration. Numerous remedial technologies including active treatment technologies were identified for each GRA and process options of each remedial technology were screened based on effectiveness, implementability, and cost. This information is provided in detail in the *Final Area C Groundwater FS* (Shaw, 2005). Based on these screening criteria, all GRAs, with the exception of No Action, LUCs, and monitoring, were eliminated from further consideration due to the low detected concentrations and wide dispersion of SCL exceedances. The remedial technologies that passed the initial screening were combined to form the two remedial action alternatives listed in **Table 10**. The Army's preferred alternative for Area C Groundwater is LUCs with LTGM.

Table 10: Area C Groundwater Remedial Alternatives

Number	Alternative
GW-1	No Action
GW-2	Land Use Controls and Long-Term Groundwater Monitoring

2.10.1 Alternative 1: No Action for Area C Groundwater

CERCLA and the NCP require that a No Action alternative be evaluated at every site to establish a baseline for the comparison of other remedial alternatives. Under this alternative, no remedial action would take place. Five-Year reviews in accordance with CERCLA and the NCP would be performed. These reviews are required by CERCLA regulations whenever a selected remedial action results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use of the property and unrestricted exposure. The purpose of the 5-year review is to ensure human health and the environment are being protected.

2.10.2 Area C Groundwater Alternative 2: LUCs and Long-Term Groundwater Monitoring

Alternative GW-2 provides adequate protection of human health through LUCs, primarily through groundwater use restrictions. Direct contact of groundwater to human receptors is restricted under current land uses and LUCs.

Property access restrictions such as site security and restrictions on future site activities are already in place for Area C and the Southern Boundary. Enforcement of these restrictions will ensure the protection of human health. Some restrictions are already in place at Picatinny by virtue of it being an active military installation. However, in the event that Picatinny would be closed and declared excess property, the land-use restrictions would be legally recorded (e.g., in zoning ordinances, property deeds, etc.) and incorporated into the provisions for the new land use. A change in land use would include the re-evaluation of cleanup requirements and notification to USEPA and NJDEP. Although the Army may transfer these procedural responsibilities to another party by contract, property transfer agreement, or through other means, the Army shall retain ultimate responsibility for remedy integrity.

LUCs will be required since contamination will remain at the site above levels that would allow for unrestricted use. LUCs are administrative measures put in place to restrict human activity in order to preclude undesirable land use. In the case of Area C, LUCs would be established to preclude activities that could lead to unacceptable human exposure to environmental contaminants. The specific provisions and requirements of the LUC portion of this response action necessary to ensure land use remains safe and appropriate for the level of protection afforded by the remedial action will be detailed as part of the RD after the ROD is signed.

The Army is responsible for implementing, maintaining, reporting on, and enforcing the LUCs. LUCs will be maintained until the concentrations of hazardous substances in the groundwater are at such levels to allow for unrestricted use and exposure. For cost-estimating purposes, it was assumed that LUCs would be maintained for 30 years. The actual duration may be longer or shorter than 30 years. Cessation of LUCs will be determined through the use of the exit strategy by the Army in consultation with USEPA and NJDEP. An LUC RD will be prepared as the land use component of the RD. Within 90 days of ROD signature, the Army will prepare and submit to the USEPA for review and approval an LUC RD that shall contain implementation and maintenance actions, including periodic inspections. The following LUC objectives will be met through LUCs:

- Prevent access or use of the groundwater until cleanup levels are met.
- Maintain the integrity of any current or future remedial monitoring system, such as monitoring wells.
- Maintain the existing CEA.

- Prohibit excavation without safeguards in all areas below the water table where groundwater contaminants exceed SCLs.

The LUC objective to eliminate pathways posing unacceptable risk will be met through maintaining LUCs, and LTGM will ensure the protection of human health and the environment. Industrial land use and intermittent recreational land use (i.e., hunting, softball) are acceptable. This response action prohibits any land use that could result in exposure to groundwater.

The Army will act to ensure that pathways with unacceptable risk are eliminated until such time as site conditions are protective for unrestricted use. The LUC objectives will be met through LUCs as part of the remedial action. LUCs will be continued and 5-year reviews will be performed for Area C and Southern Boundary groundwater until contaminant levels are shown to allow unrestricted use. When the concentrations of COCs fall below the SCLs, groundwater monitoring will be terminated in accordance with an approved exit strategy and documented in the next 5-year review.

The Army will use LUCs in layers to enhance the overall protectiveness of the response action. Layering refers to the use of more than one LUC at the same time to create a redundancy in the protection of human health. In the case of Area C groundwater, the base Master Plan and the NJDEP CEA are examples of layered LUCs.

Groundwater monitoring will be conducted in accordance with an LTMP, which will present sampling frequencies and the analytical parameter list. For cost-estimating purposes, it was assumed that groundwater monitoring would be conducted for 30 years. The actual duration may be longer or shorter. Groundwater sampling will be discontinued in accordance with an exit strategy to be presented in the LTMP. The decision to stop groundwater monitoring will be made in consultation with the USEPA and NJDEP.

2.11 COMPARATIVE ANALYSIS OF ALTERNATIVES

The Army and USEPA selected the preferred alternatives by evaluating each of the alternatives against the nine criteria established by USEPA in Section 300.430(e) of the NCP. The evaluation included a comparison of the advantages and disadvantages of each of the alternatives. The detailed comparative analysis of all the alternatives is provided in the FS for Area C Groundwater (Shaw, 2005). A summary of this comparison is provided in the following sections, organized by type of criteria.

2.11.1 Threshold Criteria (must be met)

2.11.1.1 Overall Protection of Human Health and the Environment

This criterion addresses whether each alternative provides adequate protection of human health and the environment by eliminating, reducing, or controlling exposure to human or environmental receptors.

Alternative GW-1 does not include any additional remedial activity to reduce potential risks to human health and the environment. However, the existing access restrictions and current land use designation help prevent human exposure. Alternative GW-2 provides adequate protection of human health and the environment through LUCs, primarily through groundwater use restrictions. Direct contact of groundwater to human receptors is restricted under current land uses and LUCs.

2.11.1.2 Compliance with Applicable or Relevant and Appropriate Requirements

This criterion addresses if a response action would meet all of the ARARs related to the hazardous substances at the site and the circumstances of their release. ARARs are Federal and State environmental laws and promulgated regulations identified for the cleanup.

Since no remedial activities are associated with Alternative GW-1, ARARs would not be met by the no action alternative. No active treatment is associated with Alternative GW-2; however, chemical-specific ARARs for groundwater are expected to be met over the long term. Compliance with the action-specific and location-specific ARARs will be required for activities related to the sampling.

2.11.2 Primary Balancing Criteria (identifies major trade-offs among alternatives)

2.11.2.1 Long-Term Effectiveness and Permanence

This criterion addresses the remaining risk and the ability to protect human health and the environment over time, once cleanup levels have been met.

Alternative GW-1 provides no long-term effectiveness or permanence. Alternative GW-2 provides adequate long-term effectiveness because the magnitude of the residual risk is expected to decline with declining concentrations of contaminants. The long-term effectiveness and permanence of Alternative GW-2 would be afforded through enforcement of LUCs, particularly the groundwater use restrictions. The long-term effectiveness of this alternative is potentially limited by the lack of off-post LUCs; however, Picatinny will take steps to protect off-post groundwater quality if it is found that contaminants are threatening to migrate off-post. Southern boundary wells will be monitored for an increase in contaminant levels that would be indicative of change. These steps will be defined in the LTMP for Area C, which will be developed during the RD after the ROD is signed.

2.11.2.2 Short-Term Effectiveness

This criterion addresses impacts to the community and site workers during cleanup, including the amount of time it takes to complete the action.

Implementation of Alternative GW-1 or Alternative GW-2 does not pose any additional risks to the community, the workers, or the environment, since there are no active remedial actions associated with either alternative.

2.11.2.3 Reduction of Toxicity, Mobility, or Volume through Treatment

This criterion addresses the anticipated performance of treatment systems that permanently and significantly reduce toxicity, mobility, or volume of hazardous substances as a principal threat at the site. As previously noted, the statutory preference for treatment is not applicable because no principal threat wastes (reference Section 2.12) have been identified at the site.

Neither Alternative GW-1 nor Alternative GW-2 employs any treatment that would reduce the toxicity, mobility, or volume of COCs in the groundwater; therefore, both alternatives do not meet this criterion. However, the continued decline in COC concentrations observed to date is expected.

2.11.2.4 Implementability

This criterion addresses the technical and administrative feasibility of an alternative, including the availability of materials and services required for cleanup.

There are no implementability concerns posed by either alternative.

2.11.2.5 Cost

This criterion compares the differences in cost, including capital and operation and maintenance (O&M) costs. Present worth costs were calculated with a discount rate of 7 percent. Although a time period of 30 years was used for developing a cost estimate, LUCs will be exercised by the Army until such time as the site is determined to be safe for unrestricted use.

There are no costs associated with Alternative GW-1. The only implementation costs for Alternative GW-2 are associated with the long-term monitoring program. The total present worth cost for Alternative GW-2 is approximately $857K, including $16K in capital costs and $841K in O&M during the assumed 30-year timeframe of groundwater monitoring and implementation of LUCs.

2.11.3 Modifying Criteria

2.11.3.1 State Acceptance

This criterion evaluates whether the State agrees with, opposes, or has no comment on the preferred alternative. This criterion is evaluated formally when comments on the Proposed Plan are reviewed.

State acceptance was evaluated formally after the public comment period on the Proposed Plan (Shaw, 2007). The Proposed Plan and this ROD were prepared in partnership with USEPA and NJDEP representatives. Although NJDEP has not provided any formal letter approving the Proposed Plan for Area C groundwater, NJDEP provided an implicit acceptance based on their approval of the FS for Area C Groundwater, various meeting minutes and the Inter-Agency Agreement (IAG) schedules. Generally, the NJDEP accepts Alternative 2 (Land Use Controls and Long-Term Groundwater Monitoring).

2.11.3.2 Community Acceptance

This criterion addresses the issues and concerns the public may have regarding each of the alternatives. This criterion is evaluated formally when comments on the Proposed Plan are reviewed.

A final Proposed Plan for Area C groundwater was completed and released to the public on September 19, 2007, at the information repositories listed in Section 2.3. The notice of availability of these documents was published on September 11, 2007, in the *New Jersey-Star Ledger* and the *Daily Record*. A public meeting was held on September 20, 2007, to inform the public about the Selected Response action for Area C groundwater and to seek public comments. A public comment period was held from September 20 to October 19, 2007, during which comments from the public were received. Written comments were received from Subsurface Solutions on behalf of the PAERAB. Subsurface Solutions is under contract to the Army under the TAPP program. Written comments were also received from the Law Offices of Schwartz, Tobia, Stanziale, Sedita and Campisano on behalf of Pondview. Pondview is a residential development being constructed across Route 15 from the southern boundary of Picatinny Arsenal. The Army's responses to comments made at the public meeting and received during the public comment period are included in the Responsiveness Summary (Section 3.0) of this ROD. A community relations program has been established and is maintained for Picatinny Arsenal.

Community acceptance was evaluated formally after the public comment period on the Proposed Plan. Community acceptance is addressed in the Responsiveness Summary (Section 3.0) of this ROD.

2.12 PRINCIPAL THREAT WASTE

The NCP establishes an expectation that USEPA will use treatment to address the principal threats posed by a site wherever practicable (NCP §300.430[a)][1][iii][A]). Identifying principal threat wastes combines concepts of both hazard and risk. In general, principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur. Conversely, non-principal wastes are those source materials that generally can be reliably contained and that would present only a low risk in the event of exposure. There is no fixed threshold level of toxicity or risk that is used to define principal threats. However, a general rule of thumb is to consider as a principal threat those source materials with toxicity and mobility characteristics that combine to pose a potential risk several orders of magnitude greater than the risk level that is acceptable for the current or reasonably anticipated future land use, given realistic exposure scenarios.

No principal threat wastes have been identified in Area C groundwater. As concluded in the Phase I RI risk assessment (Dames and Moore, 1998), none of the contaminants meet the criteria of principal threat waste. In addition, groundwater itself is not a principal threat because it is considered a non-source material.

2.13 SELECTED RESPONSE ACTION

The Selected Response Action for Area C groundwater is **Alternative 2: Land Use Controls and Long-Term Groundwater Monitoring**. This decision is based on the administrative record for the site. This section provides a detailed description of the Selected Response Action.

2.13.1 Summary of the Rationale for the Selected Response Action

The response action for Area C groundwater was chosen by the RI/FS process. The primary factors in the selection of Alternative 2 for Area C groundwater were based on comparison to chemical-specific ARARs. There is currently no use of groundwater in Area C and the reasonably anticipated future land use also does not include use of Area C groundwater. Furthermore, it is not anticipated that contaminants found in Area C groundwater will migrate off post. If contaminants found in Area C

groundwater are detected in off-post monitoring wells at concentrations above trigger levels, the potential need for a more aggressive remedial action will be evaluated.

The selected response action meets the threshold criteria and provides the best overall balance of tradeoffs in terms of the five balancing criteria:

- Long-term effectiveness and permanence.
- Reduction of toxicity, mobility, and volume.
- Short-term effectiveness.
- Implementability.
- Cost.

The selected response action addresses State and community concerns through LUCs to ensure protectiveness.

The Army expects the selected response action to satisfy the following statutory requirements of CERCLA § 121(b): 1) be protective of human health and the environment; 2) comply with ARARs; 3) be cost effective; and, 4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

2.13.2 Description of the Selected Response Action

2.13.2.1 Area C Groundwater

The major LUC components of the selected response action (Alternative 2) include:

- Maintain LUCs to preclude activities that could lead to unacceptable human exposure to environmental contaminants. LUCs will be enforced throughout the area depicted on **Figure 6**. The following LUC objectives will be met through LUCs:
  - Prevent access or use of the groundwater on post until cleanup levels are met.
  - Maintain the integrity of any current or future remedial monitoring system such as monitoring wells.
  - Maintain the current CEA. Because achievement of the SCLs may require an extended period of time for completion, the groundwater will be out of compliance with groundwater standards for that time period. The CEA allows for the exemption of compliance with NJDEP regulations for the amount of time required for remediation.
  - Prohibit excavation without safeguards in all areas below the water table in the plume footprint.
- Prepare an LUC RD as the land use component of the RD. Within 90 days of ROD signature, the Army will prepare and submit to the USEPA for review and approval an LUC RD that shall contain implementation and maintenance actions, including periodic inspections and long term groundwater monitoring.
- Prepare an LTMP to assess the effectiveness and protectiveness of the response action and to monitor the long-term behavior of the COCs.
- Conduct 5-year reviews in accordance with CERCLA 121 (c) and the NCP to ensure that the response action is and will be protective of human health and the environment. Reports detailing the findings of the reviews would also be generated. When the concentrations of COCs fall below the remedial goals, the groundwater monitoring program will be discontinued upon an agreed-upon exit strategy and documented in the next 5-year review.

2.13.3 Summary of the Estimated Response Action Costs

The total project estimated present worth cost, if approved, is $856,805 for Area C groundwater, which will be paid by the Army. The costs associated with the preferred alternative for Area C groundwater are outlined in **Table 11**.

Figure 6 Area of Applicability for Land Use Controls

Table 11: Summary of Estimated Lifetime Costs of the Selected Response Action

	Area C Groundwater
CAPITAL COST (TOTAL)	**$16,100**
LUCs and Planning	$14,000
Subtotal Capital Costs	***$14,000***
Scope Contingency (15 percent)	$2,100
O&M COSTS (TOTAL)	**$840,705**
Long-Term Groundwater Monitoring (Subtotal)	**$658,844**
GW Sampling, Analysis & Reporting (Year 0 – 2)	$267,189
GW Sampling, Analysis & Reporting (Year 3 – 29)	$386,802
Closure Sampling, Analysis & Reporting (Year 30)	$4,853
Well Maintenance & Abandonment (Subtotal)	**$39,837**
Annual Well Maintenance (30 years)	$24,818
Periodic Well Replacement (every 5 years)	$10,789
Future Well Abandonment (28 wells)	$4,230
5-Year Reviews (Subtotal)	**$32,367**
5-Year Review Reports (30 years)	$32,367
Subtotal O&M Cost	***$731,048***
Scope Contingency (15 percent)	$109,657
TOTAL PRESENT WORTH COST	**$856,805**

The costing information in this section is based on the best available information regarding the anticipated scope of the remedial alternative. Details on the cost items are presented in the *Final Area C Groundwater FS* (Shaw, 2005). Changes in the cost elements are likely to occur as a result of new information and data collected during the long-term monitoring phase and the 5-year review(s). Major changes may be documented in the form of a memorandum in the Administrative Record file, an Explanation of Significant Differences, or a ROD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to –30 of the actual project cost.

Although a time period of 30 years was selected for developing the cost estimate, LUCs will be exercised by the Army until such time as the site is determined to be safe for unrestricted use. The lifetime O&M cost was calculated with a 7% discount rate.

2.13.4 Expected Outcomes of the Selected Response Action

The RAOs for Area C groundwater would be achieved through implementation of the selected response action. The estimated outcome would also include compliance with ARARs. However, as contaminants will remain in the aquifer, uncontrolled use of groundwater at the site is not permitted until compliance with ARARs is met.

Enforcement of LUCs will ensure the protection of human health. Some restrictions are already in place at Picatinny Arsenal by virtue of it being an active military installation. However, in the event that Picatinny Arsenal would be closed and declared excess property, the land use restrictions would be legally recorded (e.g., in zoning ordinances, property deeds, etc.) and incorporated into the provisions for the new land use. A change in land use would include the re-evaluation of cleanup requirements and a notification requirement to USEPA and NJDEP.

2.14 STATUTORY DETERMINATIONS

The selected remedies satisfy the statutory requirements of CERCLA §121 and the NCP, as described below.

2.14.1 Protection of Human Health and the Environment

The preferred alternative for Area C groundwater provides adequate protection of human health through maintenance of LUCs, primarily through groundwater restrictions such as access restriction and a CEA.

2.14.2 Compliance with Applicable or Relevant and Appropriate Requirements

The preferred alternative for Area C groundwater is expected to comply with the SCLs presented in **Table 3**. The SCLs were established in accordance with the chemical-specific ARARs listed in **Table 12**.

Location-specific ARARs presented in **Table 13** will be satisfied because none of the wetlands or stream encroachment areas will be affected by the LUCs or the long-term monitoring of the groundwater. Clearing or drilling activities will avoid wetland areas and habitat utilized by endangered or threatened species. The CEA will prevent the installation of potable wells within the CEA.

Action-specific ARARs presented in **Table 14** will be met by obtaining appropriate permits for the installation and abandonment of the monitoring wells. Permit equivalents will be obtained for drilling actions within wetland, floodplain or stream encroachment areas. Sampling will comply with the State action-specific ARARs.

2.14.3 Cost Effectiveness

In the lead agency's judgment, the Selected Response Action is cost-effective and represents a reasonable value in the money to be spent. In making this determination, the following definition was used: *"A remedy shall be cost-effective if its costs are proportional to its overall effectiveness." (NCP §300.430(f)(1)(ii)(D))*. This was accomplished by evaluating the "overall effectiveness" of those alternatives that satisfied the threshold criteria (i.e., were both protective of human health and the environment and ARAR-compliant). Overall effectiveness was evaluated by assessing the five balancing criteria in combination (long-term effectiveness and permanence; reduction in toxicity, mobility and volume through treatment; short-term effectiveness; regulatory acceptance; and community acceptance). Overall effectiveness was then compared to costs to determine cost-effectiveness. The relationship of the overall effectiveness of this remedial alternative was determined to be proportional to its costs and hence this alternative represents a reasonable value for the money to be spent.

The estimated present worth cost of the Selected Response Action for Area C groundwater is approximately **$857,000**. This cost estimate was based upon periodic inspections, LTGM, and 5-year reviews for up to 30 years.

The Army believes that the Selected Response Action is cost effective and the additional cost compared to Alternative 1 (No Action) provides a significant increase in protection to human health and the environment.

2.14.4 Utilization of Permanent Solutions and Alternative Treatment Technologies (or Resource Recovery Technologies) to the Maximum Extent Practicable

The Army has determined that the Selected Response Action for Area C groundwater represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner at the site. The Army has determined that the Selected Response Action for Area C groundwater provides the best balance of trade-offs in terms of the five balancing criteria, while also considering the statutory preference for treatment as a principal element and bias against off-site treatment and disposal and considering regulatory and community acceptance.

The Selected Response Action for Area C groundwater does not employ any treatment to eliminate contaminants present at the site. However, the continued decline in COC concentrations in

Table 12: Chemical-Specific ARARs for Area C Groundwater

Authority	Law/Regulation	Requirement(s)
Federal	Safe Drinking Water Act (SDWA) – Maximum Contaminant Levels (MCLs), 40 CFR 141.60-141.62	MCLs have been promulgated and regulate contaminants in public drinking water.
	SDWA – Maximum Contaminant Level Goals (MCLGs), 40 CFR 141.50 through 141.51	Promulgated health-based criteria for drinking water sources.
	USEPA Office of Drinking Water Health Advisories	Non-promulgated estimates of risk due to consumption of contaminated drinking water/ groundwater
State	SDWA – State MCLs, NJAC 7:10-5.0 through 5.4	MCLs have been promulgated by the State and regulate contaminants in public drinking water.
	GWQS, NJAC 7:9C-1.5 through 1.9 and Table 1	Groundwater quality standards have been promulgated and regulate concentrations of contaminants in groundwater.

Table 13: Location-Specific ARARs for Area C Groundwater

Characteristic	Requirement(s)	Impacted Areas
Wetlands Executive Order 11990 section 7(c) and 40 CFR 6, Appendix A section 4 (j)	Whenever possible, Federal agency actions must avoid or minimize adverse impacts on wetlands and act to preserve and enhance their natural and beneficial values. Agencies should particularly avoid new construction in wetland areas unless there are no practicable alternatives. Federal agencies shall incorporate wetlands protection consideration into planning, regulating, and decision-making processes.	According to the Picatinny GIS, there are wetland areas within Area C.
Clean Water Act Section 402 33 CFR 320.4 and pertinent substantive provisions of NJAC 7:7A (the Freshwater Wetlands Protection Act, P.L.1987)	To the extent possible, action must be taken to avoid degradation or destruction of wetlands. Discharges for which there are practicable alternatives with less adverse impacts or those that would cause or contribute to significant degradation are prohibited. If adverse impacts are unavoidable, action must be taken to enhance, restore, or create alternative wetlands.	According to the Picatinny GIS, there are wetland areas within Area C.
Natural Resources Integrated Natural Resource Management Plan (INRMP) Interagency agreement with the United States Army Environmental Center, as required by: - Sikes Act (16 U.S.C. 670a et seq) - Army Regulation 200-3 - Department of Defense Instruction 4715.3	The purpose of the INRMP is to ensure that natural resources conservation measures and Army mission activities are integrated and are consistent with federal stewardship requirements. Stated goals of the INRMP include minimizing habitat fragmentation and protecting unique or sensitive habitat; and protecting native species, rare and ecologically important species, and genetic diversity.	Clearing and/or drilling activities which could affect the multipurpose uses of natural resources at Picatinny.
Endangered Species (Rare, Threatened, or Endangered Species) Indiana Bat, Bog Turtle, Bobcat (NJ), Alleghany Woodrat (NJ), Northern Goshawk (NJ), Red-Shouldered Hawk (NJ), Timber Rattlesnake (NJ), Barred Owl (NJ), Red-headed Woodpecker (NJ), and Long-Tailed Salamander (NJ) Presence of those species listed in the following acts and regulations: - Endangered Species Act (16 U.S.C. 1531 *et seq*) - Fish and Wildlife Coordination Act (16 U.S.C. 661 *et seq*) - 40 CFR 6.302 (h) - 50 CFR 402 - 33 U.S.C. 1344 - 40 CFR 230.10(b) - RSN 37-430 to –438 - NJAC 7:25-4 as being rare, threatened, or endangered species.	Whenever possible, federal agency actions must avoid or minimize adverse impacts on rare, threatened, or endangered species and act to preserve and enhance their natural and beneficial values. Agencies should particularly avoid new construction in those areas containing these species unless there are no practicable alternatives. Federal agencies shall incorporate rare, threatened, or endangered species protection consideration into planning, regulating, and decision-making processes.	Clearing or drilling activities could impact habitat typical of species that are addressed within the Picatinny Arsenal Integrated Natural Resource Management Plan (Picatinny, 2001).

Table 13: Location-Specific ARARs for Area C Groundwater (Continued)

Characteristic	Requirement(s)	Impacted Areas
Fish and Wildlife Coordination Act U.S.C. 661-663	Must consider the effects of water-related projects on fish and wildlife resources. Must take action to prevent, mitigate, or compensate for project-related damages or loss to fish and wildlife resources. Federal agencies should consult with the appropriate federal agency and state personnel to develop protective measures for affected fish and wildlife.	Protection of aquatic resources emptying into Green Pond Brook

Table 14: Action-Specific ARARs for Area C Groundwater

Action	Law/Regulation	Requirement(s)
Generation of Hazardous Waste RCRA methods for identification and evaluation of solid and hazardous wastes - 40 CFR 262.11 - NJAC 7:26G-6.1 (incorporated by reference)	Specific requirements for identifying hazardous wastes.	Generation of purge water, drill cuttings and other waste generated during monitoring activity that may be characterized as hazardous waste.
Installation Of Wells NJDEP Field Sampling Procedures Manual, August 2005	State guidance and general industry procedures for installation of extraction wells/monitoring wells are identified.	Guidelines for installation for monitoring wells.
Technical Requirements for Site Remediation NJAC 7:26E-6.1(b)2,4	Specifies that remediation must comply with all applicable remediation standards in effect at the time and that remedial action must not cause an uncontrolled or unpermitted discharge or transfer of contaminants to another media.	"Comply with all applicable remediation standards in effect at the time the remedial action workplan is approved by the Department." The second part of this citation is not an ARAR since ARARs are frozen at the time of the ROD.
NJAC 7:26E-6.1(e)	Requires ICs whenever a restricted/limited use response action is used at a site.	Relevant and appropriate for on-site remedial activities.
USEPA OSWER Publication 9345.3-03FS, January 1992. Guide to Management of Investigation-Derived Wastes	Investigation-derived wastes generated from remedial activities (e.g., drilling muds, purged water, etc.) are required to be properly stored, managed and disposed. Guidance given in the publication includes waste material containment, collection, labeling, etc.	TBC – for wastes generated during well installation and/or groundwater monitoring.

Table 14: Action-Specific ARARs for Area C Groundwater (Continued)

Action	Law/Regulation	Requirement(s)
Stream/Wetland Encroachment 33 CFR 320.4 Flood Hazard Area Control (NJAC 7:13-1.1 et seq.) Freshwater Wetland Protection Act Rules (NJAC 7:7A-5.4 and 7:7A-4.3) All the regulations require equivalency permits and correlate with location specific requirements.	Equivalency permit required for the following activities: - Development or disturbances in floodplain and wetland area - Stream encroachment - Soil erosion and sediment control Requires minimum disturbance to freshwater wetlands, transition areas, and State open waters; and requires mitigation for disturbances of wetlands and open waters as a result of cleanup activities. Specifies location restrictions and protection of natural resources, public water supply intakes, threatened or endangered species habitat, historic places, vernal habitat; time period restrictions for waters with fishery resources; and applicability of stormwater management rules.	Applicable to the substantive requirements of the permit program for remediation activities.
Packaging, Labeling and Storage RCRA Hazardous Waste Generation 40 CFR 262, Subparts C. NJAC 7:26G-6	Specifies requirements for hazardous waste packaging, labeling, manifesting, record keeping and storage.	Potentially applicable to on-site requirements related to the off-site transportation of hazardous waste (off-site requirements are legally applicable but are not ARAR as they apply outside of the CERCLA process). Potentially applicable to in situ treatment alternatives that may generate hazardous waste.

groundwater is expected over time based on current trends. The Selected Response Action for Area C groundwater satisfies the criteria for long-term effectiveness because the magnitude of the residual risk is expected to decline with declining concentrations of contaminants. In addition, further reduction of risks could be accomplished through proper enforcement of LUCs. The Selected Response Action for Area C groundwater does not present any short-term risks to the community, the workers, or the environment since there are no active remedial actions. There are no implementability issues that set the Selected Response action for Area C groundwater apart from any of the other alternatives evaluated.

NJDEP and USEPA representatives concur with the Army's conclusion that active remediation was not warranted for groundwater in Area C.

2.14.5 Preference for Treatment as a Principal Element

The Selected Response Action for Area C groundwater uses long-term monitoring to address the remaining mobilized contamination. The Selected Response action provides an optimal implementation timeframe commensurate with an effective use of funding; therefore, it is much more cost-effective than the technologies that utilize active treatment.

2.14.6 5-Year Review Requirements

Five-Year reviews will be conducted in compliance with CERCLA and the NCP, and in accordance with the IAG, to ensure that the response action is and will be protective of human health and the environment.

3.0 PART 3: RESPONSIVENESS SUMMARY

The final component of the ROD is the Responsiveness Summary. The purpose of the Responsiveness Summary is to provide a summary of the stakeholders' comments, concerns, and questions about the Selected Response action for Area C groundwater and the Army's responses to these concerns.

Some community concern has been expressed because groundwater treatment will rely on passive attenuation rather than active treatment. The Army, USEPA, and NJDEP have considered all comments and concerns, summarized below, in selecting the final cleanup methods for Area C groundwater at Picatinny Arsenal.

3.1 PUBLIC ISSUES AND LEAD AGENCY RESPONSES

As of the date of this ROD, the Army endorses the preferred alternative for Area C groundwater of LUCs and LTGM. The USEPA and the NJDEP support the Army's plan.

Comments received during the public meeting are summarized below in Section 3.1.1. Written comments received during the Area C groundwater public comment period on the Proposed Plan are summarized in Section 3.1.2. Written comments were received from Subsurface Solutions on behalf of the PAERAB. Subsurface Solutions is under contract to the Army under the TAPP program. Written comments were also received from the Law Offices of Schwartz, Tobia, Stanziale, Sedita and Campisano on behalf of Pondview. Pondview is a residential development being constructed across Route 15 from the southern boundary of Picatinny Arsenal. The comments are categorized by source.

3.1.1 Summary of Comments Received during the Public Meeting on the Proposed Plan and Agency Responses

The following summarize the Army responses to the comments received during the public meeting on September 20, 2007.

Comment from Lieutenant Colonel John P. Stack, Commander, Picatinny Garrison

Comment 1: What caused the levels of contaminants to decrease over time?

Response: The reduction in contaminant concentrations could be the result of a number of things such as natural attenuation, the flushing out of the contaminants from the aquifer or their adsorption to the soil particles. These processes happen naturally.

Comment from Mr. Michael Glaab, Picatinny Restoration Advisory Board

Comment 2: Could you be more specific?

Response: As groundwater moves through an area, there is dispersion and dilution. There can be a change in the oxidation state where it becomes part of the soil matrix. In some cases, the arsenic levels we are seeing now are very similar to what we might consider background.

3.1.2 Summary of Comments Received during the Public Comment Period and Agency Responses

The following comments were received from Subsurface Solutions LLC on behalf of the PAERAB. These comments were received through a letter dated October 20, 2007, to the Environmental Affairs Office of Picatinny Arsenal.

Critical Location

Comment 1: Area C is in a critical location as it is contained in the southernmost portion of Picatinny Arsenal. Regional groundwater flow at the Arsenal is to the south toward the Southern Boundary Area. As such, the quality of the groundwater exiting the Arsenal is of utmost importance. Residential development proposed outside the Arsenal boundaries in the vicinity of the Southern Boundary Area has been in dispute for a number of years – a major source of contention has been the feasibility of producing an adequate potable water supply that is free from the threat of contamination. Given the existing and potential population that may rely on groundwater downgradient of the Arsenal, Area C should have a monitoring plan that is frequently scrutinized and revised according to analytes that appear in the groundwater. The provision for a 5-year review of the response action may not be sufficiently protective and a contingency plan should be included in the RD so that more immediate measures can be enacted depending on the type and concentration of contaminants that may be detected in the future.

Response: A detailed LTMP will be developed during the RD. The LTMP will initially include all potential parameters identified as COPCs (i.e., risk or hazard contributors in the HHRA identified in Table 3 of the Proposed Plan) and all COCs. Sampling results will be evaluated at the conclusion of each sampling event and compared to previous data to determine constituent concentration trends and to determine if the analytical program needs to be amended. Specific components of the LTMP will be specified in the RD following approval of the ROD. A contingency plan will be developed to define trigger mechanisms for the modification of the monitoring program to address any deficiencies.

Duration of Monitoring

Comment 2: The PAERAB has commented in the past on the duration of projected remedies. Costs calculated for comparison of various remedial alternatives rely on a 30-year time period. In the past, the PAERAB has noted that engineering covers/caps can require maintenance over a much longer time span – essentially until contaminants are rendered harmless or inert or, in the case of persistent compounds that do not readily degrade, forever. The critical location of Area C and its location at the furthest downgradient extent of the Arsenal will likely necessitate a monitoring plan far longer than 30 years. Therefore, it is respectfully recommended that the duration of monitoring be extended to the length of time required for the environmental contaminants of concern to be degraded sufficiently to assure compliance with the applicable standards. In addition, the frequency of sampling should be frequent enough to assure the timely detection of possible contaminant migration from the Arsenal.

Response: In order to meet the remedial action objective of protection of human health and the environment, the response action will be continued until contaminant levels are shown to allow unrestricted use of the groundwater, as noted in the Proposed Plan. Cessation of monitoring will be allowed only after the tenants of the exit strategy are met. The details of the exit strategy will be finalized in the RD phase. It should be noted that all remedial technologies except LUCs and LTM were screened out prior to the development of detailed cost estimates. Therefore, changing the number of years used in the cost estimate will have no effect on the selection of the preferred alternative.

Sampling Parameters

Comment 3: The recent detection of analytes heretofore previously undetected in several monitoring wells is reason to periodically analyze a comprehensive list of compounds in selected wells. It is respectfully recommended that this list conservatively include all significant

environmental contaminants which have been detected at Picatinny Arsenal that can be expected to eventually be naturally transported by the environment beyond the Arsenal's boundaries via normal surface water and/or groundwater flow. While it is beyond the scope of the Proposed Plan to detail the specifics of a monitoring program, the PAERAB would like the opportunity to provide input when the RD is prepared.

Response: The LTMP will initially include all potential parameters identified as COPCs (i.e., risk or hazard contributors in the HHRA identified in Table 3 of the Proposed Plan) and all COCs. Additional compounds may be included based on recent groundwater results. PAERAB will be given the opportunity to comment on the LTMP during the RD.

Natural Attenuation versus Contaminant Removal/Reduction

Comment 4: There is an inherent difficulty in assessing and accurately quantifying the true long-term cost of permitting significant levels of environmental contaminants to remain in the soil and/or waters of contaminated sites until those contaminants are degraded naturally by the environment.

Therefore, it is incumbent on this author to note, on behalf of the community members of the PAERAB, that community members have repeatedly expressed a preference for those environmental remediation measures which actively and directly remediate sites contaminated with significant levels of contaminants by either expeditiously removing those contaminants from the premises of Picatinny Arsenal to disposal sites elsewhere or by implementing remediation actions which will effectively reduce those contaminants to their acceptable applicable levels in a timely manner.

To assure the health and safety of the individuals working and/or living at Picatinny Arsenal, to assure the health and safety of the citizenry of the communities adjacent to the Arsenal, and to assure that the Arsenal can continue and perhaps expand its national security mission of serving our nation as a vital multi-use military research and logistics facility that can also serve our nation's defense as a munitions production facility, it is respectfully suggested that such remediation alternatives as "hot spot" contaminant removal and the timely reduction of contaminants be given preference to monitored natural attenuation alternatives.

Response: The choice to pursue a more aggressive remediation alternative must be made in accordance with the CERCLA process. The evaluation process includes a preference for treatment. However, the evaluation process requires that cost reasonableness and technical implementability be factors in the response action selection. For Area C Groundwater, more active remedial alternatives were not cost effective due to the low detected contaminant concentrations, widely dispersed and sporadic nature of the detected contamination, and the distribution of contaminants in multiple aquifers.

The following comments were received from the Law Offices of Schwartz, Tobia, Stanziale, Sedita & Campisano on behalf of Pondview. These comments were received through a letter dated October 19, 2007, to the Environmental Affairs Office of Picatinny Arsenal.

Comment 1: Contrary to the Army's statement in the Proposed Plan (at the bottom of Page 18), there are significant questions as to whether the preferred alternative satisfies the statutory requirements of CERCLA §121(b) that the remedy provide long-term effectiveness and permanence. By the Army's own admission (at Page 17), the long-term effectiveness of the proposed alternative is limited by the lack of off-post LUCs. The Army's Proposed Plan states that "Picatinny will take steps to protect off-post groundwater quality if the [long-term groundwater monitoring] results indicate contaminants are migrating off-post." However, the Proposed Plan provides no further specific information as to the steps that would be

taken. Lacking further specific information to address this contingency, the Proposed Plan is incomplete and thus deficient.

Response: A response action selection under CERLA utilizes nine selection criteria. Two of these criteria are threshold criteria that must be met by the selected alternative. The threshold criteria are overall protection of human health and the environment and compliance with ARARs. The preferred alternative meets these threshold criteria. Long-term effectiveness and permanence is a primary balancing criterion. Primary balancing criteria identify major trade-offs between the remedial alternatives that are being evaluated. The preferred response action meets statutory requirements as discussed in the *Area C Groundwater FS.* The *Area C Groundwater FS* was approved by both the USEPA and NJDEP.

The Army is committed to correcting any deficiencies in the response action should they arise. Trigger levels for the re-evaluation of the effectiveness of the remedial alternative will be presented in the LTMP, which will be developed during the RD. The trigger levels will indicate if a more aggressive remedial alternative should be considered. In the event deficiencies in the response action are identified, the need for action will be evaluated at that time. Without knowing the nature of a hypothetical deficiency in the response action or potential technological advances, the reaction to that deficiency is unknown.

Comment 2: In Table 5 of the Proposed Plan (Page 13), the Army describes the various groundwater technologies considered and screened as potential remedial alternatives for Area C. Among those options screened was the option of hydraulic barriers with hydraulic control through water injection. As the Army is aware, NJDEP is requiring that a hydraulic barrier be installed on Pondview's property to address the NJDEP's stated belief that a threat exists of groundwater contamination from Picatinny reaching Pondview's proposed potable supply well that would serve its development project. We request that the Army explain why the Proposed Plan dismisses a hydraulic barrier alternative as "cost prohibitive" when NJDEP is requiring Pondview to install the very same wellhead protection measure at its own property located more than 0.5 miles from Picatinny's southern boundary.

Response: The Army cannot speak for NJDEP on their decision and requirement. The explanation for the elimination of a hydraulic barrier remedial alternative from the Area C Groundwater technology selection is discussed in the *Area C Groundwater FS.* The choice to pursue a more aggressive remediation alternative must be made in accordance with the CERCLA process. It is the responsibility of the Army to ensure that funding for CERCLA cleanup is expended appropriately and efficiently. Using funds to perform additional remediation not warranted by the degree of contamination within Area C would be a waste of taxpayer's dollars.

Comment 3: Given the selected remedy's deficiencies, including but not limited to the failure to fully satisfy the statutory requirements of CERCLA § 121(b) as set forth above, Pondview urges that the Army's Proposed Plan for Area C Groundwater be rejected.

Response: As noted above in the Response to Comment 1, the preferred response action does meet the statutory requirements of CERCLA § 121(b). The selected response action meets the threshold criteria and provides the best overall balance of tradeoffs in terms of the five balancing criteria.

4.0 REFERENCES

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